Innovations for agroforestry uptake in Madagascar: the role of FITAFA

Agroforestry case study 4. Madagascar

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Forest and Farm Facility

Acknowledgements

This case study was commissioned using a template prepared by the International Institute for Environment and Development (IIED) for the Forest and Farm Facility (FFF), a co-management partnership between the Food and Agriculture Organization of the United Nations (FAO), the International Union for Conservation of Nature (IUCN), IIED and AgriCord. The FFF is supported by the governments of Finland, Germany, Norway, the Netherlands, Sweden, the United Kingdom, the United States of America, the European Union and IKEA.

FFF surveys of knowledge needs in areas of land and natural resources from 41 forest and farm producer organisations (FFPOs) in six countries carried out in 2018 identified two top priority research needs: climate resilience information and options; and diversified climate-smart agroforestry options. By 2022 the FFF programme had assembled case studies and guidance on the first of these priorities, climate resilience, spread in a peer-to-peer learning event in Vietnam (see www.iied.org/20311iied and www.iied.org/21211g). In 2023 further work was commissioned resulting in guidance on how FFPOs can advance agrobiodiversity for climate resilience, with another peer-to-peer learning event in Nepal (see www.iied.org/22251iied and www.iied.org/22451g). Agroforestry systems are the central land use system that allows integration of trees, crops and livestock to advance agrobiodiversity and climate resilience. Now in 2025, the FFF is focusing on the second identified priority knowledge need: how to increase adoption of diversified climate-smart agroforestry. The coproduction process used by FFF draws insights from across the world of the most innovative FFPOs that have encouraged the adoption of agroforestry systems – which are then blended with an academic review of agroforestry adoption – to provide FFPOs with the latest thinking and best practice in promoting agroforestry. This case study is part of that process.

The author would like to thank to Duncan Macqueen of IIED for initiating and supporting this study; Andry Rakoto Harivony and Herizo Rakotoniaina of FAO, for their guidance on site selection under the Forest and Farm Facility (FFF) programme; Mahefa Heriantenaina, president of the Confederation of Malagasy Farmers (FEKRITAMA), for his enthusiastic collaboration; Miandritiana Arisoa Rafidimalala, executive director of FEKRITAMA, for his support in organising field trips and surveys; José Pierre Didinina, president of the Union of Farmer Organisations of Atsinanana (FITAFA), for his invaluable collaboration; the presidents, board and members of FITAFA for their active cooperation throughout; Bernardin Josito Rasolonjatovo, FEKRITAMA technician and facilitator, for his continuous support; and to the 23 surveyed farmers (10 women and 13 men) from six communes in the Vatomandry district for their essential contribution to this study.

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Citation: Raharison T.S. (2025) Innovations for agroforestry uptake in Madagascar – the role of FITAFA. FEKRITAMA and IIED, London, UK.

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Abbreviations

CASEF	Agricultural Growth and Land Security Programme (Croissance Agricole et de Sécurisation Foncière)
FEKRITAMA	Confederation of Malagasy Farmers (Fivondronamben' ny Tantsaha Malagasy)
FFF	Forest and Farm Facility
FFPOs	Forest and farm producer organisations
FITAFA	Union of Farmer Organisations of Atsinanana (Fikambanan'ny Fikambanan'ny Tantsaha Faritra Atsinanana)
FRDA	Regional Agricultural Development Fund (Fonds Régionaux de Développement Agricole)
NGOs	Nongovernmental organisations
VSLA	Village savings and loan associations

Summary

This case study documents the agroforestry practices implemented in Madagascar by the Union of Farmer Organisations of Atsinanana (FITAFA – Fikambanan'ny Fikambanan'ny Tantsaha Faritra Atsinanana) and promoted by the Confederation of Malagasy Farmers (FEKRITAMA – Fivondronamben' ny Tantsaha Malagasy) with support from the Forest and Farm Facility (FFF). The case study analyses innovations, perceived benefits, constraints and perspectives to strengthen the adoption of agroforestry systems.

The smallholder cooperative FITAFA is regional forest and farm producer organisation (FFPO). FITAFA was established in 2001 and now has 350 household members. It is located in the Atsinanana region of Madagascar, spread across three districts: Vatomandry, Antanambao Manampotsy and Mahanoro. The area has a humid tropical climate and vegetation, abundant annual rainfall and an average temperature of between 24°C and 27°C. Farms are generally inherited and privately owned and average farm sizes for male farmers are 6.5 hectares and for female farmers 4.1 hectares. FITAFA is a member of the apex-level farmers' organisation FEKRITAMA, established in 1988, that groups 12 federations and 23 regional FFPOs comprising 42,000 member households throughout Madagascar.

At its foundation, FITAFA members faced significant challenges of natural resource degradation within the traditional slash-and-burn agriculture system used for rainfed rice, with increasing climate variability and more frequent droughts. In response, many have installed agroforestry systems.

FITAFA's agroforestry system is based on a shade-grown cash crop or home garden model built around cash crops (such as cinnamon, clove, coffee and lychee) combined with diverse other tree species. They also practice beekeeping and fish farming in ponds. Initially, FITAFA agroforestry systems can begin with only 2–4 tree species but can then evolve into complex systems with more than 50 species. It is characterised by different spatial strata including:

- Emergent timber or fruit tree species such as eucalyptus (*Eucalytpus citriodora*) and endemic species such as manasavelona (*Rhodolaena leroyana*)
- Upper-canopy timber or fruit trees such as lychee (*Litchi chinensis*) and avocado (*Persea americana*)
- A wide range of middle-canopy fruit and spice trees such as cinnamon (*Cinnamomum verum*) and lemon (*Citrus limon*)
- Dwarf trees and shrubs such as black pepper (*Piper nigrum*) and peppers (*Capsicum annuum*)
- Shade tolerant crops, including cash crops such as vanilla (*Vanilla planifolia*) and coffee (*Coffea robusta*)
- Basic crops including rice (*Oryza sativa*) and maize (Zea mays)
- Root crops such as cassava (*Manihot esculenta*) and sweet potato (*Ipomoea batatas*)
- Vine crops such as oviala (*Dioscorea sp.*) and granadilla (*Passiflora edulis*)
- Livestock including zebus, pigs, poultry, bees and fish and
- Nitrogen-fixing fodder hedges such as glyricidia (*Gliricidia sepium*) and grasses such as ahipisaka (*Stenotaphrum dimidiatum*).

Farmer members who have implemented the agroforestry system have benefited from structured technical support (training, nurseries, demonstration plots) provided by FEKRITAMA and FITAFA, with special attention given to women and young farmers. For these farmers, the perceived benefits of agroforestry systems are numerous:

- **Nutritional:** Improved diet and diversification of products
- **Economic:** Diversified sources of income, circular economy at the farm level
- **Ecological:** Soil restoration, climate resilience and reduction of bushfires and
- **Social:** Creation of rural jobs, valorisation of women's work and strengthening of social ties.

Farmers also mention, however, a number of constraints that hinder their adoption of agroforestry systems:

- Limited access to rewarding markets for producers
- Effects of climate change (droughts, season shifts)

- Difficulties of maintaining agroforestry systems, especially for single women (divorced or widowed)
- Low representation of women and youth in technical training
- Limited access to seeds and seedlings and
- Limited access to financing and necessary equipment.

To overcome these constraints, FEKRITAMA has been supporting farming activities and integrating sustainable practices with its regional FFPOs such as FITAFA for over 15 years through a series of programmes and projects. Together they have developed key innovations that include the promotion of more than 40 community nurseries and the training of farmer facilitators. Training and technical coaching have been given, as well as exchange visits conducted, covering topics such as climate-smart agriculture, forest landscape restoration, the use of mulch and organic fertilisers, terracing and soil-conservation techniques, helpful crop associations that work for all species involved and water management. They have also assisted with the supply of inputs (such as seeds, seedlings and fertilisers), support for improving land tenure situations, and access to services including financial support, mostly through projects to offset high agroforestry start-up costs and to strengthen rural entrepreneurship.

FEKRITAMA has also helped FITAFA find solutions in a number of areas, including marketing of new agroforestry products by strengthening the negotiating skills of farmer leaders and by putting them in touch with potential buyers (such as Phael Flor Export for cinnamon[1] and AgriExport), as well as by increasing participation in national or regional agricultural fairs. Future opportunities that could further enhance impact include improving market structuring and credit access, public–private partnerships and organic certifications.

Recommendations by FITAFA members suggest that strengthening local support, developing tailored financial services, supporting access to fair markets and integrating women and youth more into training programmes are important priorities.

[1] See also FEKRIMATA (2025) for details on cultivating cinnamon in agroforestry systems.

1. Introduction to FEKRITAMA and FITAFA

1.1 The FEKRITAMA confederation and it's vision

The Confederation of Malagasy Farmers (FEKRITAMA – Fivondronamben' ny Tantsaha Malagasy) is an umbrella organisation grouping 12 federations and 23 regional forest and farm producer organisations (FFPOs) throughout Madagascar. Apolitical in nature, it is based on Christian values while promoting religious tolerance, cultural non-discrimination and anti-racism in line with democratic principles.

FEKRITAMA encourages its member organisations to operate with respect for human rights, social justice and fairness, thereby contributing to sustainable improvements in the social, economic and health conditions of farming families.

The confederation works to strengthen regional member organisations by:

- Structuring promising value chains for cooperatives, including women and youth farmers, (agriculture, livestock, fishing, rural ecotourism)
- Supporting the development of agricultural production as an economic lever for income improvement
- Defending farmers' interests and rights, and
- Promoting the emergence, development and sustainability of member organisations.

Although agroforestry systems are not explicitly mentioned in FEKRITAMA's founding texts, the principles of agroforestry systems align perfectly with the confederation's strategic objectives. Agroforestry, as a sustainable production model, is consistent with the goal of promoting resilient, environmentally friendly and income-generating agricultural practices.

Present in all 23 regions of Madagascar, FEKRITAMA has about 42,000 members that are farming households. Although the exact distribution between men and women is not precisely documented, the confederation has set itself the target of achieving at least 30% women and 50% young people among its members. This commitment is also reflected in the active integration of structures such as the National Federation of Rural Women in Madagascar (FVTM – Federasiona ny Vehivavy Tantsaha Eto Madagasikara) and the National Federation of Young Farmers (FNJA – Fédération Nationale des Jeunes Agriculteurs). This confederation also monitors gender parity within the framework of Forest and Farm Facility (FFF) activities (FEKRIMATA 2024).

For the purposes of this study, the focus is on the Atsinanana region and more specifically on the Union of Farmer Organisations of Atsinanana (FITAFA – Fikambanan'ny Fikambanan'ny Tantsaha Faritra Atsinanana), a regional forest and farm producer organisation (FFPO) made up of 350 household members (see Table 1).

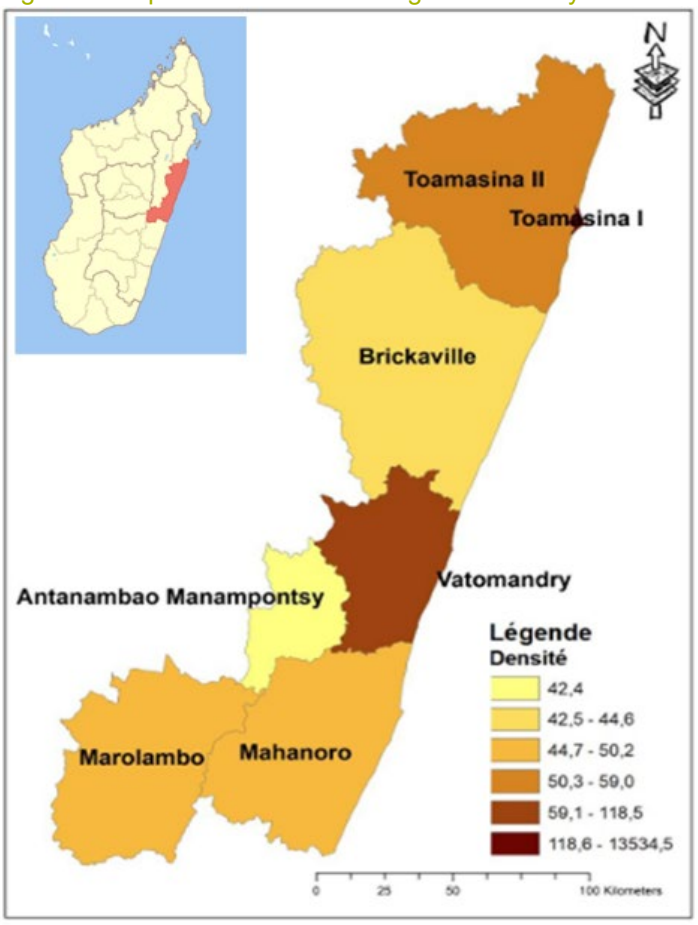
Table 1. Profiles of the FEKRITAMA confederation and FITAFA

FFPO	Year of creation	Number of members	Regions covered
FEKRITAMA	1988	42,000 households	23 regions
FITAFA	2001 (official receipt – 2009)	350 households	Atsinanana region

1.2 Location of FITAFA

For FEKRITAMA, the themes of intervention and agricultural value chains are specific to each territory, depending on local contexts. Under the FFF mechanism, agroforestry support is mainly concentrated in two pilot regions: Atsinanana and Analamanga. This study specifically documents the experience of FITAFA in the Atsinanana region.

Figure 1. Map of the Atsinanana region and study areas



In the Atsinanana region, FEKRITAMA's interventions primarily concern three districts: Vatomandry, Antanambao Manampotsy and Mahanoro. Each presents contrasting demographic characteristics.

The region benefits from a humid tropical climate, with abundant annual rainfall: 2,000–3,500mm, concentrated between November and April, which includes the cyclone season. The so-called dry season, from May to October, is still marked by frequent rainfall. Temperatures remain high throughout the year, with an average of between 24°C and 27°C with relatively small seasonal variations, the hottest months being from January to March.

This climate favours tropical humid forest vegetation, which is currently undergoing severe regression due to increasing anthropogenic pressures. The region's main challenges are the degradation of natural resources (including forests and soils) and climate change and variability.

Source: INSTAT (2022)

The photos in Figure 2 illustrate the impacts of the practice of *tavy*, a slash-and-burn system of agriculture traditionally used for cultivating rainfed rice. This technique has been identified as one of the main causes of forest degradation. According to FEKRITAMA's executive director, the rate of degradation has increased sharply in recent years, with significant consequences for soil degradation, due to more frequent periods of drought.

Figure 2. Resource degradation issues (slash-and-burn practices) © Raharison, T.

Figure 3. Climate change and variability issues © Raharison, T.

The photos in Figure 3 highlight the effects of climate change. Rice is normally transplanted between November and December or in January at the latest (left hand photo). However, due to the delay in the first rains and a marked drought during the usual favourable period, transplanting has extended into February and March. The transplanted rice plants (right-hand photo) are still suffering from a significant water deficit. The direct impact would be a reduction in yield, given the lack of water. In addition, as most of the varieties grown are photoperiodic, their cycle is not very adaptable: they will reach maturity in June, regardless of when they are transplanted. However, with late establishment and limited tillering, these crops will enter their heading phase as early as April or May, further compromising their productivity.

How to tackle these issues will be supplemented by other issues raised by farmers surveyed for this report. From the outset, it is important to mention these issues relating to the environment and environmental management.

1.3 Membership

In the survey for this research, a deliberate choice was made to include FFPO members of FITAFA that include at least 10 households led by men and 10 households led by women. The research team were able to survey 23 producers, including 13 men and 10 women. The characteristics of each household are summarised in Table 2: they are not necessarily representative of all members (due to the limited number of households surveyed and because the participant selection was made by the farmer organisations and not randomly). The information in Table 2 represents the surveyed population and provides insights into the farmers of the area.

Table 2. Characteristics of the farmer households surveyed

Characteristics		Elements of characteristics
Average farm size	Male-headed households	**6.5ha** (max 30ha. min 1.5ha) – cv: 113%
	Female-headed households	**4.1ha** (max 10ha. min 1ha) – cv: 74%
Land tenure	Male-headed households	93.5% owned, 4.7% rented and 1.8% inherited jointly
	Female-headed households	100% owned
Land acquisition	Male-headed households	Inherited: 61% (surface) Land appropriation through development: 10% Purchased: 29%
	Female-headed households	Inherited: 74% (surface) Land appropriation through development: 6% Purchased: 21%
Cropping systems	Male-headed households	Agroforestry systems: 4.1ha Irrigated rice: 1.75 ha Other cropping systems: 0.9ha

	Female-headed households	Agroforestry systems: 2.8ha Irrigated rice: 1.3 ha Other cropping systems: 0
Livestock practices	Male-headed households	Livestock practises: 92.3% Zebus: 15.4% Pigs: 53.9% Poultry: 92.3% Fish: 38.5% Beekeeping: 15.4%
	Female-headed households	Livestock practises: 90% Zebus: 10% Pigs: 30% (20% sold recently) Poultry: 90% Fish: 10% Beekeeping: 0%
Use of animal-traction equipment	Male-headed households	Used by 30.8% (15.4% rented, 7.7% via FFPO)
	Female-headed households	Used by 20% (rented or borrowed from siblings)

KEY: cv – coefficient of variation

Table 2 shows that the average farm size is 5.5 ha, with a significant difference by gender: 6.5ha for male-headed households versus 4.1ha for female-headed ones. Although land availability is not seen as a major constraint in the area, divorced or widowed women face limitations in land access due to unequal inheritance and lack of rights from deceased or separated spouses. In contrast, stable long-term households show more balanced land access.

Men also have more opportunities to expand their farms, especially through land development or purchase. Women, especially when alone, struggle to mobilise the labour required, limiting land development and affecting farm management and yields.

Agroforestry systems are the main farm component, accounting for 4.1ha for men (63% of land) and 2.8ha for women (68% of land). The rest is devoted to rice farming, other crops or left uncultivated. Cash crops such as cinnamon, clove, lychee and coffee dominate and are mainly for sale. Other crops such as bananas are used both for household consumption and sale.

Rice and maize are also widely grown. Often half is for sale, while cassava and sweet potatoes are mainly for household consumption. Specialising in cash crops is seen by FEKRITAMA as a vulnerability, due to market fluctuations, so they also aim for food diversification.

More than 90% of households also engage in raising livestock, mainly poultry. Pig farming is more common among men (53%) than women (30%), while zebu cattle are raised only by a minority. Fish farming in ponds is developing (38% of men, 10% of women), while beekeeping remains marginal (only 10% among men).

All households use traditional manual tools such as the local spade (*angady*), hoe and machete. The use of animal traction equipment remains limited: 30% of men and 20% of women use it, often by renting the equipment or borrowing it from family members.

2. Description of the agroforestry system

2.1 Type of agroforestry system

The agroforestry systems that have developed in the region are mainly based on a shade-grown cash crops model (see Table 3). Some systems integrate fish farming in ponds and beekeeping as part of animal husbandry, but agro-silvo-pastoralism has not yet been developed. Zebu cattle graze throughout the area and grazing areas were not reported as being problematic during interviews.

Table 3. Types of agroforestry systems developed

FFPO	Regions covered	Types of agroforestry practised
FEKRITAMA	23 regions	Shade-grown cash crop systems (East Coast) Diversified home gardens (Highlands) No agro-silvo-pastoralism systems, but beekeeping is integrated into agroforestry systems. There is also fish farming in ponds in the lowlands, downstream of the agroforestry system.
FITAFA	Atsinanana region	Shade-grown cash crop systems Very limited case of diversified home gardens No agro-silvo-pastoralism systems, but beekeeping is integrated into agroforestry systems. There is also fish farming in ponds in the lowlands, downstream of the agroforestry system.

FEKRITAMA implements agroforestry systems in two primary agroecological zones:

- Shade-grown cash crop systems on the east coast (Atsinanana region, humid tropical climate)
- Diversified home gardens in the central highlands (mainly Analamanga region)

This report focuses specifically on the Atsinanana region and thus on shaded cash-crop agroforestry systems.

2.2 Main species

Generally, shade-grown cash crop agroforestry systems incorporate several species, with a varying number of combinations:

- 2 to 4 species on a plot at the time of installation
- Up to 10 species on average during full development
- Up to 20 species in some complex systems

The species listed below in Table 4 were observed during field visits and mentioned by farmers (see also the illustrative diagrams in appendices 2 and 3).[2] Although other ecosystem functions and services may emerge from the different combinations of tree strata, the explanations presented here are based exclusively on farmers' perceptions and accounts.

Table 4. Main species used in FITAFA's agroforestry systems and their functions

	Agroforestry components	Main species	Functions, services or descriptions mentioned by farmers
1	Emergent timber or fruit trees	Eucalyptus (*Eucalytpus citriodora* and others) Bonara or Bonarambazaha (*Albizia lebbeck*) Nonoka (*Syzygium bernieri,* endemic to Madagascar) Manasavelona (*Rhodolaena leroyana*, endemic to Madagascar) Varongy (*Ocotea Sp.*) Rotra ou Jamblon or Jamelonnier (*Syzygium cumini*) Breadfruit (*Artocarpus altilis*)	These tall trees mainly serve as shade, windbreaks and protection during cyclonic periods. They are not felled so as to preserve biodiversity and the environment. Some are endemic to Madagascar. These trees can also be used for timber in exceptional cases. In the case of jamblon and breadfruit, the trees grow tall, providing protection and shade, but the fruit is also edible. Breadfruit is mainly eaten during the lean season.

[2] In addition, an herbaceous grass plant, ahipisaka (*Stenotaphrum dimidiatum*), is sometimes used as living ground cover. This perennial plant forms a dense mat that is difficult to control once established. Farmers sometimes leave it in their agroforestry system to protect the soil from erosion in heavy rain.

	Agroforestry components	Main species	Functions, services or descriptions mentioned by farmers
2	Upper-canopy timber or fruit trees	Lychee (*Litchi chinensis*) Avocado (*Persea americana*) Mango (*Mangifera indica)* Voatoana or wild frangipani (*Voacanga thouarsii*) Acacias (*Acacia sp.)* Manasavelona (*Streblus dimepate*) Rosewood (*Dalbergia sp.)* Ambora (*Canarium madagascariensis*)	Lychee, avocado and mango fruit trees are grown for sale. Lychee fruit is a major income source for some households, especially those near roads. It is the same case for avocado but with a slightly lower level of marketing. Voatoana is used for medicinal purposes, but farmers often preserve these trees to protect nature.
3	Middle-canopy fruit trees	Banana (*Musa sp.*) Cinnamon (*Cinnamomum verum*) Clove (*Syzygium aromaticum*) Orange (*Citrus sinensis*) Lemon (*Citrus limon*) Mandarin (*Citrus reticulata*) Coffee (*Coffea robusta*) Jackfruit (*Artocarpus heterophyllus)* Soursop (*Annona muricata*) Sugar apple (*Annona squamosa*), Bullock's heart (*Annona reticulata*) Noni (*Morinda citrifolia*) Mangosteen (*Garcinia mangoustana*) Palm (*Arecaceae sp.*) Coconut (*Cocos nucifera*) Raffia palm (*Raphia sp.)* Pistachio nuts (*Pistacia vera*) Pink pepper (*Schinus molle*) Ravenala (*Ravenala madagascariensis*) Grevillia (*Grevillea banksii*) Voapaka (*Voacanga africana*)	Banana is used for initial shading and provides fruit for sale or household consumption. Cinnamon, clove, coffee, citrus and annona species are the main cash crops. They are mainly for sale, but also used for household consumption. Mangosteen is consumed as fruit or used medicinally. This tree can also have a medium canopy. Palm is used for local soap and oil production. Pistachio nuts are used as animal feed (pigs and fish) Ravenala retains water and is used in local construction (walls and roofs).
4	Dwarf trees and shrubs	Pepper (*Capsicum annuum*) Strawberry guava (*Psidium cattleianum*) Pineapple (*Ananas comosus*)	Peppers and strawberry guavas are for local consumption. Pineapple is often used in agroforestry systems as a protective hedge (and to produce fruit at the same time). It tolerates light shade (so it is not used in dense agroforestry systems).
5	Shade-tolerant crops	Vanilla (*Vanilla planifolia*)	Vanilla is a spice derived from tropical liana orchids. It needs to be shaded when planted. This crop is for sale (for exporters)
6	Basic crops	Rice (*Oryza sativa*) Maize (*Zea mays*)	Rainfed rice and maize are rarely used in dense agroforestry system. However, they can be associated with a few shrubs (fruit trees) and managed in agroforestry, but less densely. These crops are partly for household consumption and partly for sale.
7	Root crops	Cassava (*Manihot esculenta*) Sweet potato (*Ipomoea batatas)* Yam (*Dioscorea sp.*) Tavolo (*Tacca leontopetaloides*)	Cassava and sweet potatoes are used in less-dense agroforestry systems, on the edges or with sparser trees. These crops are grown mainly for family consumption and sometimes as livestock feed. Turmeric is mainly a cash crop.

	Agroforestry components	Main species	Functions, services or descriptions mentioned by farmers
		Turmeric (*Curcuma longa*)	
8	Vine crops	Vanilla *(Vanilla planifolia)* Pepper tree (*Piper nigrum*) Oviala *(Dioscorea sp.)* Granadilla *(Passiflora edulis)*	Vanilla is also a type of creeping orchid. Oviala is a tuberous plant, but the emerging part is creeping. Granadilla can be found in some agroforestry systems.
9	Livestock	Common livestock, whether or not integrated into agroforestry systems, include zebus, pigs and poultry Other animals integrated into agroforestry systems include bees and fish	Zebus are sources of manure and are used mainly as direct manure, for composting or mixed with soil in cash-crop pits. Pigs and poultry benefit from shade, but also from eating earthworms in fertile soil under agroforestry. Bees are fully integrated into the agroforestry system. Fish farming in ponds is for landscape management and for making good use of low-lying areas (taking advantage of the improved access to water in the systems).
10	Nitrogen-fixing hedges	Gliricidia (*Gliricidia sepium*) Leucena (*Laucaena glauca*) Jatropha (*Jatropha sp.*)	Leucaena provides both shade and nitrogen fixation. Jatropha is used for hedging but does not fix nitrogen.

3. Motivation, perceived advantages and constraints

3.1 Origin and promotion of agroforestry

The promotion of agroforestry systems in the Atsinanana region stems from multiple origins:

- Training and awareness campaigns by FEKRITAMA and FITAFA, particularly through programmes supported by the FFF
- Farmer-to-farmer exchanges and local knowledge sharing, and
- External interventions from projects, such as projects under the Ministry of Agriculture, Livestock and Fisheries and nongovernmental organisations (NGOs) promoting agroecological practices.

FEKRITAMA has been supporting farming activities and integrating sustainable practices for over 15 years. Training courses were launched in the municipality of Marovoay on topics such as direct seeding mulch-based cropping systems, organic fertilisation and microirrigation. Trainings then extended to include climate-smart agriculture and farmer-to-farmer approaches.

Since becoming part of the FFF in 2021, FEKRITAMA has initially provided theoretical training, before stepping up its practical work in the field from 2023 onwards, by training members of the board of directors and regional board members in adapting practices to the realities of the climate and local resources (particularly in Analamanga and Atsinanana). The themes have been extended to the introduction of agro-silvo-pastoral systems, soil conservation, terracing of sloping plots and helpful crop associations, as well as using tools from a Mihari Network project (water management, biopesticides, soil fertility etc).

As part of this effort, around 650 farmers' organisation representatives were trained, including relay farmers as contacts, lead farmers for the demonstration sites, and chairpersons in charge of awareness-raising activities. These efforts were aimed at changing behaviour in relation to farming practices:

- In Analamanga, farmers are still focused on increasing yields and believe that this should always be achieved through the use of chemical products.
- In Atsinanana: Farmers still consider using fires to manage their plots.

In response, FEKRITAMA has developed a comprehensive support package that involves finding alternatives to these practices in a number of areas:

- The supply of inputs (seeds, seedlings, fertilisers etc)
- Providing technical support through training and technical coaching, as well as exchange visits
- Improving marketing by strengthening the negotiating skills of FFPO leaders, by putting them in touch with potential buyers and increasing participation in national or regional agricultural fairs
- Providing technical training in landscape restoration, conservation and use
- Support for improving land tenure situations, and
- Improving access to services, financial support and strengthening rural entrepreneurship.

In the Atsinanana region, the priority is given to cinnamon, cloves and rice, as well as the production of seedlings in nurseries. Emphasis is also placed on developing beekeeping and honey production.

3.2 Nutritional benefits

Some 74% of households surveyed mentioned the nutritional benefits of implementing an agroforestry system, including 77% of male-headed households and 70% of female-headed households (Table 5).

Table 5. Nutritional benefits mentioned by the households surveyed by gender

Male-headed households	Female-headed households
Ensuring better nutrition Diversifying food production Spreading food production over time	Ensuring better nutrition Diversifying food production

According to farmers, agroforestry systems make significant contributions to improved nutrition and nutritional diversification. Fruits, vegetables and tubers are available year-round and enhance household diets. Some women also pointed to the opportunity to include market gardening.

In addition, some farmers emphasised the need to spread production over time, citing breadfruit for example, which plays a key role in food security during the lean season. Food autonomy has improved. Families have reduced their dependence on the market and better manage the lean season thanks to permanent plot production. This dietary diversification also promotes health and wellbeing and reduces food expenses.

3.3 Economic benefits

All farmers (men and women) perceived economic advantages in developing agroforestry systems as shown in Table 6. Farmers unanimously agreed that agroforestry systems help to improve incomes, particularly through the integration of cash crops. Main sources of income include cash crops (cinnamon, clove, coffee, lychee), fruits and vegetables (such as banana, mango, avocado), livestock and aquaculture (such as pigs, poultry, tilapia).

Table 6. Economic benefits mentioned by the households surveyed by gender

Male-headed households	Female-headed households
Improved income Diversified sources of income (in number and over time – production calendar) Promotion of a local circular economy	Improved income Diversified sources of income (in number and over time)

For cinnamon, the market is fairly open (traders, export companies) and FITAFA is constantly looking for more profitable markets. Purchase contracts have been signed with Phael Flor Export. Other markets are being targeted in Antananarivo (the capital). Grassroot groups are targeting local markets that offer better prices for their products, such as 4cm cinnamon sticks produced by the Tantsaha Miray group in Ambalavolo (see Figure 4). Sales of other products (vanilla, pepper and other cash crops) are also being negotiated with AgriExport.

In some areas, particularly those close to main roads, crops such as bananas and cinnamon apples also offer interesting market opportunities. Other products are also mentioned as sources of income, such as citrus fruits (oranges, mandarins, lemons), palms, vanilla, turmeric, as well as various types of custard apple (soursop, noni, bullock's heart) or Chinese lychees, although they are only marketed occasionally due to the scarcity of buyers and the remoteness of the production areas. Women in particular benefit from this economic diversification, often taking charge of short-cycle crops and small livestock. The main limitations cited are the low remuneration from local markets, price volatility and the difficulty of physical access to marketing channels, which curbs the interest of traders and limits the output of production.

Figure 4. Drying cinnamon sticks © Raharison, T.

Farmers also mentioned that they spread production over time in agroforestry systems, allowing for staggering in terms of cash flow, which plays an important role in financial security and in the ability to invest or reinvest in farming and other activities. This staggering of production is a major strength of agroforestry systems, whereas in other regions of Madagascar, production periods occur all at once and weeding periods are longer throughout the year (sometimes in the period when agricultural investment is needed). Table 7 gives some examples of this spread of production over time.

Table 7. Spread of agroforestry production for main cash crops

Crop	Flowering	Harvest	Observations
Cloves	August–October	October–December	Hand-picked when ripe before opening
Cinnamon	Continuous	March–June and September–December	Debarking of secondary branches after 2–3 years of growth
Lychee	August–October	November–December	Harvest concentrated over 4 to 6 weeks for export market
Black pepper	September–November	December–March	Bunches are harvested when ripe and dried in the sun
Vanilla	October–November	May–July	Demanding crop – pollination is by hand
Coffee (arabica/ robusta)	Robusta: September–October Arabica: March–April	Robusta: December–January Arabica: June–August	Robusta coffee is more widespread in hot areas such as Vatomandry.
Banana	Continuous	Continuous	Good complement to agroforestry, continuous production

Some farmers also talked about a circular economy that is highly advantageous at farm, household and regional levels. Firstly, agroforestry-based farms consume very few external inputs, because everything is recycled (including fertility recycling to replenish soil nutrients, which means no need to buy synthetic fertilisers). Products are also developed in synergy. One example is the development of beekeeping, which provides a diversified source of income and develops the agroforestry complexity as melliferous bee species are added within the system. Products from agroforestry systems can also be used as animal feed such as cassava, other tuberous plants, breadfruit and voanjombazaha (peanuts), limiting the need to purchase external animal feed products. Nitrogen-fixing trees such as *Gliricidia sepium* and *Leucaena leucocephala* are often used as fodder in ‘cut and carry’ systems for cattle. As well as being used as a living hedge and to shade crops, the leaves are used as a nitrogen-rich mulch to improve soil fertility.

3.3 Ecological benefits

Some 57% of households surveyed mentioned environmental benefits as shown in Table 8, including 77% of male-headed households and 30% of female-headed households. There was a big difference in the perception of environmental benefits and this was also found to be linked to training/awareness-raising. Training participants are often initially the heads of the grassroots farmers’ organisations and are generally men. They were also those selected by the FFPO for the interviews (although the research team asked to extend participation in the survey to include other members).

Table 8. Ecological benefits mentioned by the households surveyed by gender

Male-headed households	Female-headed households
Environmental protection Increased climate resilience (against cyclones and flooding) Soil protection and improvement Recycling of organic matter (closed cycle) Restoration of the forest landscape and the forest Limiting pressure on the forest and natural trees (production of firewood – cinnamon)	Environmental protection Increased climate resilience Soil protection and improvement Restoration of the forest landscape

The environmental benefits cited are firstly the protection of the environment with the non-use of fires in plot management. The traditional practice of *tavy* or slash-and-burn agriculture is still common, particularly for rainfed rice cultivation. This practice is a major factor in environmental degradation in the region. In addition to limiting fires, (see Figure 5) agroforestry systems also help to make agriculture more sustainable.

According to farmers, agroforestry systems also ensure greater resilience in the face of climate change and variability. These are among the major challenges they face. At the time of the survey, farmers were complaining in particular about the delay in rainfall and the severe drought. The primary roles mentioned are the ability of agroforestry systems to combat wind (with windbreak trees) and the effects of cyclones (which are cyclical in the area). Agroforestry systems also limit water run-off in the plots, with the diversity of trees, shrubs and crops at different levels, including hedges. This limits flooding of lowland areas (important for rice and fish farming) but also manages water availability by building up the water table, helping to maintain arable land.

Figure 5. Comparing a landscape damaged by fire with an agroforestry system landscape © Raharison, T.

Landscape after a recent fire

Landscape with agroforestry systems

With their diversity of species (performing multiple functions), agroforestry systems also help to protect and improve the soil (see Figure 6). The various mulches produced by trees and a wide range of species help to boost soil fertility. There is no longer any need for external fertilisers (closed cycle).

Figure 6. Organic matter regenerated in agroforestry systems © Raharison, T.

Some farmers emphasised that agroforestry systems help to reduce pressure on the forest and natural trees. For example, growing cinnamon enables firewood to be produced from the leftover brash from managed plantations, whether from new plants or from the management of offshoots from existing stumps (see Figure 7).

Figure 7. Firewood produced from leftover cinnamon brash © Raharison, T.

3.4 Social benefits

Some 48% of households surveyed mentioned social benefits, including 54% of male-headed households and 40% of female-headed households, as shown in Table 9.

Table 9. Social benefits mentioned by the households surveyed by gender

Male-headed households	Female-headed households
Rural employment Promotes interaction between farmers Future for young people and children at school Sources of housing and building materials Insurance for farmers	Rural employment (with staggered production) Increased value of increasingly scarce land Improved standard of living Reduced daily hardship for women and increased roles

Among the social benefits, farmers mentioned the development of rural employment. One example is the production of cinnamon sticks, which is fairly continuous throughout the year, with only few months downtime during unfavourable periods (see Figure 8). The same applies to employment generated for the cleaning, harvesting and transport of different crops, given the diversity of species developed. This has also increased the contribution of women and young people to the household economy. In these market-oriented production systems, women and young people make an active contribution to all work within the household, and also at the local level.

Figure 8. Rural employment provided by the preparation of cinnamon sticks © Raharison, T.

3.5 Disadvantages

Despite the various advantages perceived by rural households and observed in the field, difficulties and constraints were also mentioned during the interviews. All farmers mentioned constraints, to varying degrees and depending on the type of farm and their environment (See Table 10). These constraints are technical or related to access to inputs, financial and/or materials, environment of production, the structuring of FFPOs and markets.

Table 10. Major constraints according to the households surveyed by gender

Constraints	Men (%)	Women (%)
Climatic hazards	100%	100%
Difficulty in organising work and workforce	77%	90%
Non-remunerative markets or less-developed markets	70%	80%
Lack of financial resources	54%	70%
Lack of material resources	31%	30%
Difficulties in accessing seeds and plants	**31%**	20%
Technical constraints (lack of training)	15%	40%
Bushfires	15%%	10%
Free grazing by animals	15%	0%
Social problems and crop theft	8%	0%

Climate change is a major concern. This year, all farmers expressed their worries about the delayed rains and prolonged drought, which severely affected lowland rice farming (a staple food crop) as well as agroforestry systems. Seedlings from nurseries suffered from the drought and several fish ponds dried up.

In addition to these climatic challenges, there are difficulties in weed and brush management in agroforestry systems (see Figure 9). They require regular clearing, typically twice a year (in March-April and in November), demanding more than 50 days labour per hectare each time. These demands pose a significant challenge for women who are alone (widowed or divorced), as they struggle to mobilise labour and/or cover the associated costs. Competition with other seasonal crops, especially lowland rice farming, further increases constraints in terms of time, labour and the prioritisation of farming works.

Figure 9. Labour-intensive regular land-clearance activities © Raharison, T.

Markets are also frequently criticised by farmers as being unprofitable for a large portion of value chains. Currently, cinnamon and cloves are attractive in terms of price but remain dominated by traders. In fact, the traders who sell to exporters buy at very low prices, taking advantage of the difficult access to production. Consequently, there is a desire to explore other market opportunities. FITAFA would like to think about opening up to other markets and this is one of its main concerns, with the search for external markets or with direct export companies.

For many of the crops developed within agroforestry systems, markets are very unstable or difficult to access. Lychees, bananas and coffee require organised efforts to find markets elsewhere, as local prices, especially through traders, offer very low returns. Other value chains (such as avocados, citrus fruits, sugar apples, vanilla, turmeric, soursop) require better market access and remain difficult to develop in villages located far from the main road (the RN11a connecting Antsampanana and Mahanoro). This represents a limitation for commercial diversification efforts.

Financial resources are also among the main concerns cited by a majority of households. This mainly concerns cash flow during periods requiring investment (such as purchasing seedlings or hiring labour during crop cycles). Access to material resources were also frequently mentioned, since some systems, such as transplanting seedlings, require transportation. Constraints related to access to seeds and materials were also reported by a third of the surveyed farmers. Although this is an area addressed by FEKRITAMA, not everyone has access to the seedlings produced within the organisations.

Technical training constraints are also mentioned by 10% of men, but especially by 40% of the interviewed women. This also reflects the difficulty women face in accessing training organisations (where the vast majority of participants are men). Finally, bushfires, free grazing by livestock and crop theft are also cited as challenges, although these were mentioned less frequently

4. Design and installation of the agroforestry system

Design and installation are important phases in the success of agroforestry systems and FEKRITAMA and FITAFA have tried to help members overcome some of the constraints described in the previous section.

4.1 Guidance on agroforestry installation

Agroforestry systems have been practiced for a long time in the Atsinanana region, which has a humid tropical climate. However, farmers still need support in implementing their systems. To support the establishment of agroforestry system, the FEKRITAMA and the regional organisation FITAFA connect farmers with existing mechanisms, initiatives and/or projects. In this context, partnerships have been established with several initiatives:

- The CASEF programme (Agricultural Growth and Land Tenure Security – Croissance Agricole et de Sécurisation Foncière) has developed an approach to improve land-tenure security and market access for farming households, within specific value chains. In the Atsinanana region, the targeted value chains include clove, lychee, pepper, cinnamon, pineapple, passion fruit and turmeric. Some technical training sessions have been provided around cultivating these crops, but the focus is mainly on improving the commercial value chain prospects.
- The PROSPERER programme (Support Programme for the Rural Microenterprise Poles and Regional Economies in Madagascar – Programme de Soutien aux Pôles de micro-Entreprises Rurales et aux Economies Régionales) has also contributed to the development of certain cash crops through an approach focused on structuring value chains and professionalising microenterprises. It has provided both technical and commercial capacity building for cash-crop value chains.
- Other initiatives were mentioned by farmers for technical support and seedling production, such as CARE Madagascar and Catholic Relief Services' Securing and Protecting Investments and Capacities for Environmental Sustainability (SPICES) project.

The link with the FFF that was initiated in 2021 was strengthened in 2023. Within this mechanism, approaches to developing agroforestry systems as systems (beyond value chain reinforcement) have been developed. Support includes theoretical training in Vatomandry on seedling production, system establishment and maintenance. Support strategies are also based on model sites managed by lead farmers. FITAFA and grassroots farmer organisations also play a key role in supporting members by transferring knowledge gained through training.

In the implementation agroforestry systems, two situations arise:

- **Installing agroforestry systems on new land** where a system has not yet been developed (as in Figure 10): In these cases, farmers plant cinnamon or clove trees in combination with banana plants or other annual crops such as cassava. These systems are gradually strengthened with the addition of more crops. Annual crops are complemented by perennial ones such as bananas. After five years, the bananas, which initially served to provide shade, are gradually removed, making way for trees and shrubs.
- **Reinforcement or improvement of existing systems** where new species are introduced into available spaces or are used to replace old plants and/or trees (see Figure 11).

Figure 10. New agroforestry system installation © Raharison, T.

Cloves planted between cassava and banana trees

Cinnamon planted between cassava

Cinnamon grown alongside banana for shade

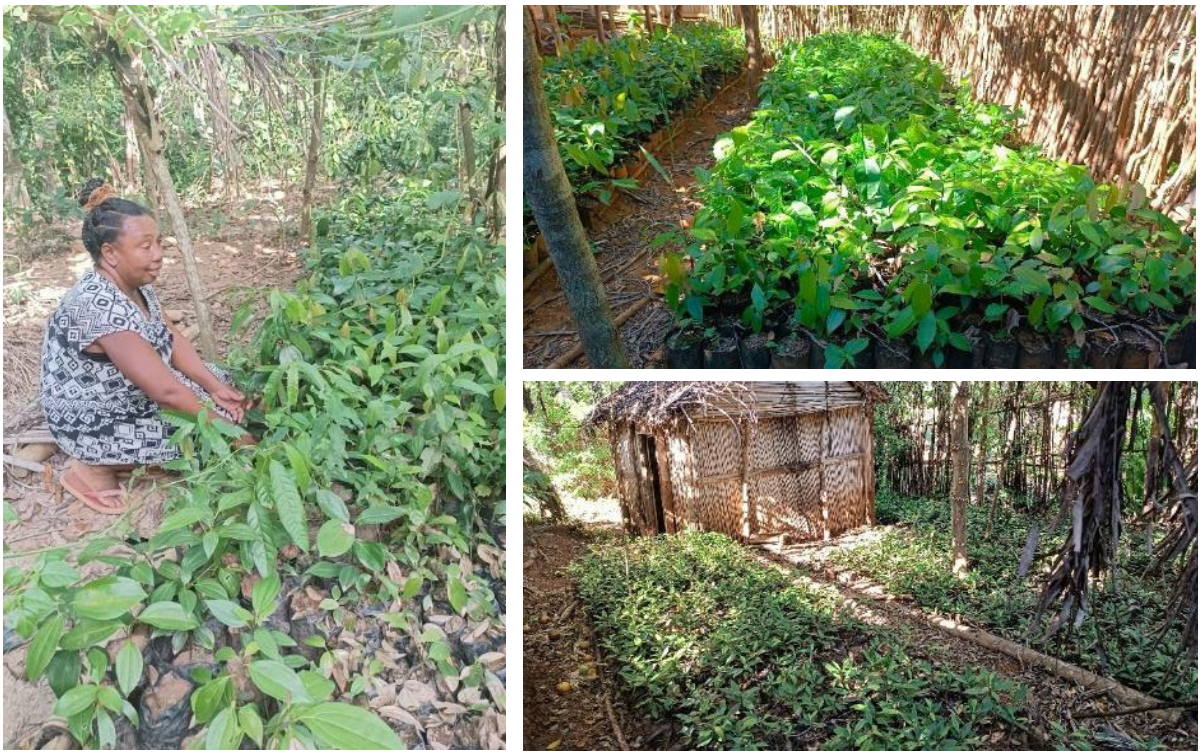
Agoforestry system after five years

Figure 11. Integration of cinnamon into an existing agroforestry system © Raharison, T.

4.2 Seed sources

Strengthening the supply of inputs (seeds and seedlings) was identified as one of the priority actions of FEKRITAMA and the regional organisation FITAFA. With support from the FFF, they have improved access to cash-crop seeds, provided training on tree seedling production, and helped establish several nurseries (mainly cinnamon and cloves, but others such as coffee, citrus fruits, peppers are also produced in these nurseries). FEKRITAMA and FITAFA subsequently ensure the multiplication of these nurseries. A nursery-growers' union was also created to facilitate collaboration and interactions.

Figure 12. Locally established nurseries © Raharison, T.



Nurseries are established either collectively (where seedlings distributed free of charge among the grassroots FFPOs) or individually by specialised nursery growers (who sell seedlings as a source of income). In some cases, community nurseries face transportation challenges due to the distance between members' villages. As a result, members have chosen to produce seedlings individually, while maintaining shared exchanges and technical collaboration. Seedling production is not yet widespread across all areas, which explains the previously mentioned constraints and/or difficulties in accessing seeds and seedlings.

4.3 Management issues

Agroforestry support begins primarily through technical training on main targeted products and value chains (such as local poultry farming and the production of corn, cinnamon, honey, young plants in nurseries, cloves and rice). But it also includes support in the management of agroforestry systems (mulching and maintenance) and the management/enhancement of landscapes (see Appendix 3). The benefits of these training sessions are that farmers are expected to transfer the knowledge they have acquired through farmer-to-farmer approaches or peer-based training, which are encouraged by FEKRITAMA and FITAFA.

Support needs are often raised by women, as mentioned earlier, as the representation of women and youth remain limited. FFPO leaders are the primary targets for such capacity-building. Members of FFPO, as well as the president of FITAFA, have also expressed the need for closer technical support. Indeed, theoretical-based training is considered insufficient.

5. Aggregation and sale for agroforestry products

Marketing is also one of the major challenges highlighted by farmers. It is a key priority for FEKRITAMA, which seeks to strengthen the negotiation capacity of regional FFPOs and grassroots FFPOs leaders or connect them with potential buyers.

5.1 Markets for products

As previously mentioned, the most commonly marketed products are mainly spices and fruits, particularly cinnamon, clove, lychee, pepper and coffee. Markets vary significantly depending on the area and the producers.

Marketing is mainly based on traders, who are accessible but offer low prices and most of the profit margins tend to go to these intermediaries. In villages near main roads, sales are sometimes made directly to passing traders. For example, members of the FFPO Tantsaha Miray in Ambalavolo commune sell their products locally or at nearby collection points, such as Anosimanasa or Amboditavolo.

Some producer groups (such as the grassroots FFPO in Andasibe commune in Ambodivoananto, a FITAFA member) organise to pool and transport their products to more distant collection centres (such as Vatomandry, Niarovana Caroline and Tsarasambo). Grouping allows them to share transport costs (sometimes walking up to 25km to reach the main road, then using car transport), with weights and prices prenegotiated for each producer. In some cases, producers rely on a local intermediary, sometimes an FPPO member, to sell products such as lychees in Tamatave to exporters (Free Deal Export) to get better prices. However, some farmers report negative experiences with such group marketing efforts (product losses, poor organisation), which sometimes forces them to sell locally at any price to minimise risks.

5.2 Changes over time

One positive trend observed is that farmers are constantly seeking more profitable markets. For example, the Tantsaha Miray FFPO from Antanandava I in the commune of Ambalavolo, organised itself to identify common outlets and succeeded in selling their 4cm cinnamon sticks at a higher price through a partnership with a trader linked to the exporter Jacarandas Spices & Ingredients.

Moreover, a new market for cinnamon has recently emerged in Antananarivo, following negotiations led by the president of FITAFA with support from FEKRITAMA. Although these initiatives are still recent, they are seen by members as promising and worthy of follow up and consolidation.

5.3 Future plans

Other collaboration prospects are currently being developed within FEKRITAMA and FITAFA. Among them is a potential partnership with the company Phael Flor Export, which specialises in the export of organic products, particularly spices. A sales contract for cinnamon sticks has been secured. This potential collaboration still needs to be strengthened, especially regarding the requirements related to organic certification. Similarly, FFPOs are also being connected with the company AgriExport (vanilla and cloves).

At the same time, FEKRITAMA and FITAFA are considering the creation of a cooperative for the marketing of agricultural products, with an initial focus on cinnamon and the potential to expand to other value chains. This project is still in the planning stage and is part of a medium- to long-term approach. At the national level, the Federation of Cooperatives of Madagascar (FECOMA) had been established, but the structure has not yet functioned effectively due to a lack of funding.

6. Financing agroforestry plots

The cost of agroforestry implementation is a key constraint that was frequently mentioned by the farming households surveyed.

6.1 Start-up and running costs

Start-up costs are often significant, according to farmers. Initially, land clearance for the first implementation of an agroforestry system represents a major expense. Seedling production also requires substantial investment for farmers (pots, labour, watering, nursery maintenance). Transporting seedlings is also a challenge, as nurseries are often located in lowland areas due to water access, or sometimes in other villages when seedling production is done collectively and members are spread out.

Agroforestry implementation (digging holes, planting) requires labour. Plot maintenance is also cited as a major cost by farmers. Women frequently raise concerns about this, as it demands significant physical effort or a large amount of labour (over 50 days of labour per hectare, at least twice a year).

6.2 External finance

Sometimes, the FFPO and its members seek external support, such as the CASEF project for seedling production (pots, nurseries), CARE for the supply of seedlings, and the FFF mechanism for seeds and nursery implementation.

There has also been occasional direct funding or subsidies from the FRDA (Fonds Régionaux de Développement Agricole – Regional Agricultural Development Fund) for material support (such as ploughs, wheelbarrows, seeds and motor pumps). However, farmers sometimes complain about the procedures and paperwork required by this funding institution, which is located in Tamatave, the regional capital, 200km away.

6.3 Internal finance

Community-based finance systems such as village savings and loan associations (VSLA) are being promoted by FEKRITAMA. These systems are not yet developed everywhere, but some cases have been reported among certain members. These systems offer community services to members, such as group purchasing and selling for vulnerable women, shared tree nurseries, and reforestation activities done within the group. A few rare cases are referred there, but this system needs to be developed within FITAFA and to be generalised within FEKRITAMA.

6.4 Future plans

Financing remains relatively underdeveloped and no additional solutions have yet been identified beyond the systems previously mentioned (FRDA, VSLA). For now, neither banks nor microfinance institutions are of interest to members. Aggregation or prefinancing systems through private actors have also been discussed, but this still requires closer collaboration with the private sector, which is only in the early stages of development.

7. Conclusions and recommendations

7.1 Key innovations

Support for seedling production is thought to have been the key innovation that facilitated the adoption of agroforestry systems by members. This dynamic has emerged through training, the development of nurseries and their large-scale deployment, particularly in the Atsinanana region, where up to 40 nurseries have been implemented, often with strong involvement from women (according to the FEKRITAMA representative interviewed for this study).

Today, local nurserymen (and women) ensure the continuity of production. Community-based seedling production initiatives are emerging, although some face logistical challenges, particularly due to the distance between villages.

7.2 Remaining challenges

Climate change and variability, along with environmental degradation, represent major challenges in the area. The development of agroforestry systems is seen as a response to these issues, but implementing it requires enhanced awareness-raising, both by FEKRITAMA and other stakeholders.

One key challenge is access to fair markets. Small-scale producers, who are poorly organised, have limited bargaining power, while economic operators dominate the value chains and set the prices. Often, traders act as the sole intermediaries, leaving producers with no room for negotiation. Initiatives are being taken by FITAFA and grassroots FFPOs to address this and this is one of the basic foundations of farmers' organisations.

The lack of financial and material resources, coupled with the absence of support for financial management, increases producers' vulnerability. In some areas, traders also serve as lenders (providing oil, rice and medicine). But they expect repayment in the form of paying extremely low prices for produce and also have strict quality requirements, which disadvantage farmers. This system traps producers in a cycle of dependence. VSLA systems have been developed to address this problem.

Crop maintenance, particularly land clearing and maintenance, remains a significant constraint, especially for female-headed households that struggle to mobilise labour. Poor maintenance leads to a vicious cycle of declining productivity: the less well-maintained the crops are, the lower the yields and the less capacity farmers have to reinvest in their fields, further deepening discouragement.

Lastly, although the participation of youth and women is encouraged by FEKRITAMA, their involvement in technical training remains limited, often benefiting mainly FFPOs leaders, who tend to be older and male. Proximity-based support remains a top priority, yet it is still insufficient due to the state's disengagement and the lack of local technical staff.

7.3 Policy recommendations

Integrated programmes such as CASEF that focus on land-tenure security, infrastructure improvement, market access, value chain development (particularly for cash crops), as well as technical and material support, are widely perceived by farmers as positive and beneficial.

In contrast, the FRDA is often criticised due to its complex and burdensome procedures, which require frequent travel to the regional capital located 200km away. Furthermore, its interventions are limited to certain value chains, excluding cinnamon, which is nevertheless a flagship product in the region.

This study shows that agroforestry is a key solution for the livelihoods and resilience of farming households and that producer organisations have played an important role in improving uptake, but structural barriers still hinder its expansion.

7.3.1 Opportunities identified

Several opportunities have been identified to strengthen the development of agroforestry systems. First, training and awareness-raising remain essential levers to consolidate progress, ensuring the sustainable management of agroforestry systems in the face of climate challenges and natural resource degradation. These systems indeed allow for better valorisation of local ecosystems.

The development of small-scale local processing units also represents a strategic avenue for increasing value-added and improving farm-gate prices. The use of distillation equipment for processing spices or exploiting cinnamon leaves, which are currently underutilised, is an option to promote.

Moreover, the low use of chemical inputs in the area, reinforced by the agroforestry approach, opens the door to partnerships with companies specialising in certified products. It is therefore relevant to facilitate access to certification processes (organic, Fairtrade), in connection with companies such as Phael Flor Export, in order to reach more profitable markets. National legislation should also offer supportive frameworks to structure these initiatives and facilitate their integration into more rewarding commercial circuits, including Madagascar's Organic Agriculture Law, National Organic Agriculture Strategy (SNABIO – Stratégie Nationale d'Agriculture Biologique), TVAB (Territories for Organic Agriculture – Territoire à Vocation Agriculture Biologique) initiatives and Participatory Guarantee Systems (PGS).

7.4.2 Recommendations and perspectives

The social dimension of transformation processes is often overlooked in favour of purely technical solutions (MacQueen 2021). It is therefore essential to integrate other aspects, including political ones, into support mechanisms. For FEKRITAMA, several actions should be prioritised:

- **Strengthen the technical capacities of farmers** with particular attention paid to women and youth. Exchange visits should be enhanced as they are highly effective tools for raising awareness. It is important to develop field-based support with practical demonstrations.
- **Introduce cover crops** such as arachis that can help reduce weeding constraints by limiting the spread of weeds. It is important to continue developing FFPO capacity to produce agronomically and economically useful plants.
- **Develop financial services adapted to small-scale producers** (for example, by scaling up VSLA systems oriented toward agricultural investments) and moving towards larger financial cooperatives (Núñez del Prado Nieto 2024). These financial cooperatives, in other cases elsewhere, can support investment in the collection, processing and transport of crops to market, which is a particular constraint for FITAFA members in this region.
- **Improve marketing and product aggregation structures** for agroforestry products, by continuing efforts to connect with private actors and making sure farmers sell as a group. It is important to develop FITAFA funds, with enough cash flow to pay farmers for crops before selling them on to markets to recoup costs.

For policymakers and development actors:

- **Facilitate market access** by improving infrastructure and rural roads, as has been initiated in some integrated programmes.
- **Reform agricultural financing mechanisms** such as the FRDA, by simplifying procedures, targeting priority value chains and integrating funding sources focused on local processing units.
- **Strengthen access to local services** by developing hybrid systems that combine support from the private sector, projects/NGOs and FFPOs, while building linkages with research and combining support for both agroforestry systems and value chain development.

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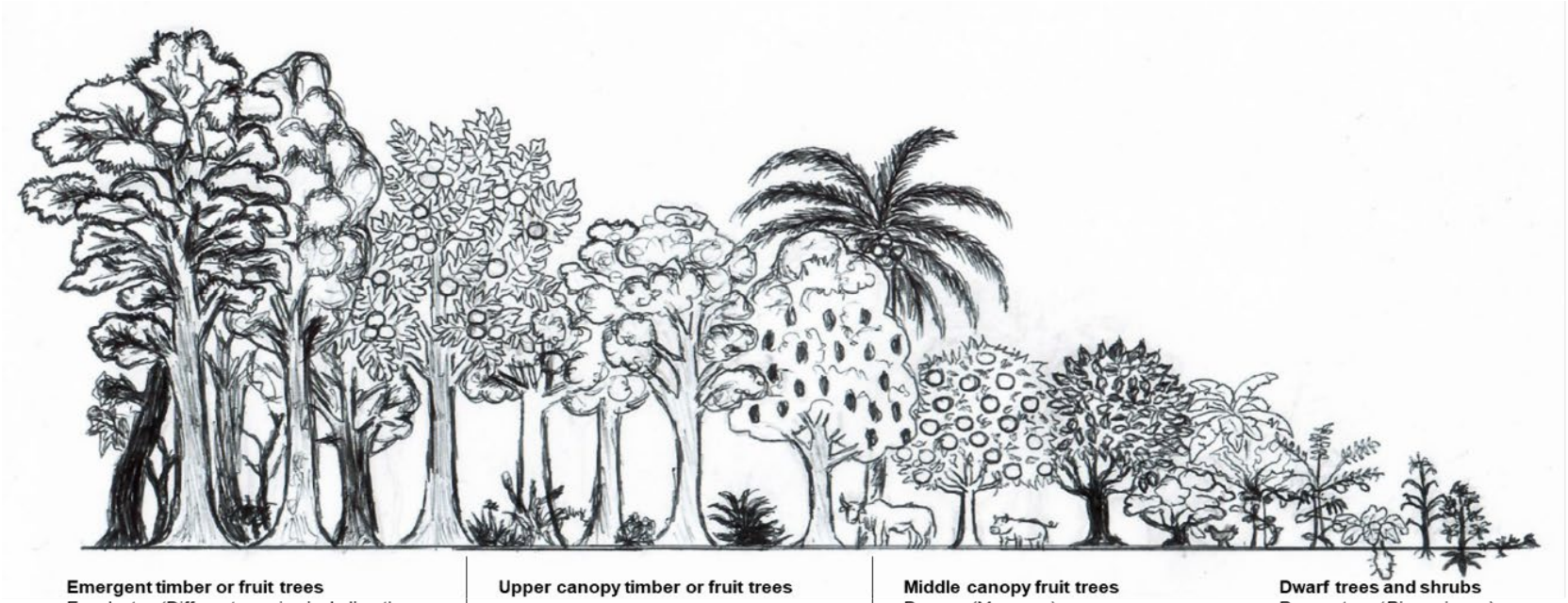
Appendix 1. List of 23 FFPO members surveyed (13 men and 10 women)

Name	Gender	Age	Marital status	Education level	Grassroots FPPO	Hamlet	Fokontany	Commune
FENOMANANA Zafilahy Norbert	M	61	Married	6ème	FEKRITAMA	Andasibe	Andasibe	Ambodivoananto
RAFANOMEZANJANAHARY Soa Vanessa	F	28	Widow	T3	FEKRITAMA	Andasibe	Andasibe	Ambodivoananto
DIDININA José Pierre	M	54	Married	6ème	FEKRITAMA	Andasibe	Andasibe	Ambodivoananto
ZAFISOA Tody Elisabeth Joséphine	F	54	Widow	3ème	FEKRITAMA	Andasibe	Andasibe	Ambodivoananto
MOUSTAPHA Darosy	M	60	Married	3ème	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
MAROVAVY Marie Noeline	F	42	Divorced	T3	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
SAMPILAHY Jonas	M	68	Married	9ème	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
RAVOLOLONIRINA Eugenie	F	65	Widow	T5	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
RAKOTONIRINA Jean de Dieu Darosy	M	35	Married	7ème	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
ZANABAO Arline	F	44	Widow	T3	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
RASAMINIRINA Josette	F	62	Single	T4	TANTSAHA MIRAY	Antanandava I	Antanandava	Ambalavao
RASOANIRINA Jacqueline	F	42	Veuve	3ème	EZAKA	Mahavariana	Anosimanasa	Sahamatevina
RAFANAMBINANTSOA Joseph Odon	M	60	Single	Baccalauréat	MIARADIA	Mahajerena	Nosimpary	Ambotitavolo
SAMPY Julien	M	38	Married	Terminale	MAITSO	Maintinandry	Maintinandry	Maintinandry
SOATODY MARIA	F	34	Divorced	3ème	MAITSO	Maintinandry	Maintinandry	Maintinandry
JACQUES ARSYL Angelin	M	31	Married	Terminale	MAITSO	Maintinandry	Maintinandry	Maintinandry
ZAKA Paulin Arsyl	M	50	Married	3ème	MAITSO	Vohitromby 2	Ampaho	Tsarasambo
RABEARIMANANA Jean Claude	M	47	Married	3ème	TAFA	Ambodivato	Afaho	Amboditavolo
BENASOLO Gérôme	M	60	Married	4ème	TAFA	Antsampanana	Amboditavolo	Amboditavolo
RATSARAMANANA Memelson	M	61	Married	Terminale	TAFA	Antsampanana	Amboditavolo	Amboditavolo
ANDRIANAMBININA Nasolo Jean Norbert	M	37	Married	CEPE	FANDRIAKA	Tamboro	Ambodivoananto	Ambodivoananto
SAMBITIANA Cécile Marcelline	F	62	Widow	T2	FANDRIAKA	Tamboro	Ambodivoananto	Ambodivoananto
PERRETTE Julienne	F	34	Widow	T5	FANDRIAKA	Tamboro	Ambodivoananto	Ambodivoananto

Appendix 2. Cross-sectional diagram of agroforestry system



Emergent timber or fruit trees
Eucalyptus (Different species including the *Eucalytpus citriodora*)
Bonara ou Bonarambazaha (*Albizia lebbeck*)
Nonoka (*Syzygium bernieri*) endemic to Madagascar
Manasavelona (*Rhodolaena leroyana*) endemic to Madagascar
Varongy (*Ocotea Sp.*)

Rotra ou Jamblon ou Jamelonnier (*Syzygium cumini*)
Breadfruit (*Artocarpus altilis*)

Upper canopy timber or fruit trees

Lychee (*Litchi chinensis*)
Avocado (*Persea americana*)
Mango (*Mangifera indica*)

Voatoana (*Voacanga thouarsii*)
Acacias (*Acacia sp.*)
Manasavelona (*Streblus dimepate*)
Rosewood (*Dalbergia sp.*)
Ambora (*Canarium madagascariensis*)

Livestock
Common livestock, whether or not integrated into agroforestry system
Zebus // Pigs // Pouttry

Other animals integrated into agroforestry system
Bees // Fish

Middle canopy fruit trees
Banana (Musa sp.)
Cinnamon (*Cinnamomum verum*)
Clove (*Syzygium aromaticum*)
Orange (Citrus cinensis), Lemon (*Citrus limon*), Mandarin (*Citrus reticulata*)
Coffee (*Coffea robusta*)
Jackfruit (*Artocarpus heterophyllus*)
Soursop (*Annona muricata*), Sugar apple (*Annona squamosa*), Bullock's heart (*Annona reticulata*), Noni (*Morinda citrifolia*)
Mangosteen (*Garcinia mangoustana*)
Palm (*Arecaceae sp.*), Coconut (*Cocos nucifera*), Raffiia (*Raphia sp.*)
Pistachembazaha (*Pistacia vera*)
Pink pepper (*Scinus molle*)

Ravenala (*Ravenala madagascariensis*)
Grevillia (*Grevillea banksii*)
Voapaka (*Voacanga africana*)

Dwarf trees and shrubs
Pepper tree (*Piper nigrum*)
Pepper (*Capsicum annuum*)
Goyava Chinois (*Psidium cattleianum*)

Shade tolerant crops – including cash crops
Vanilla (*Vanilla planifolia*)
Curcuma (*Curcuma longa*)

Basic crops
Rice (*Oryza sativa*)
Maize (*Zea mays*)

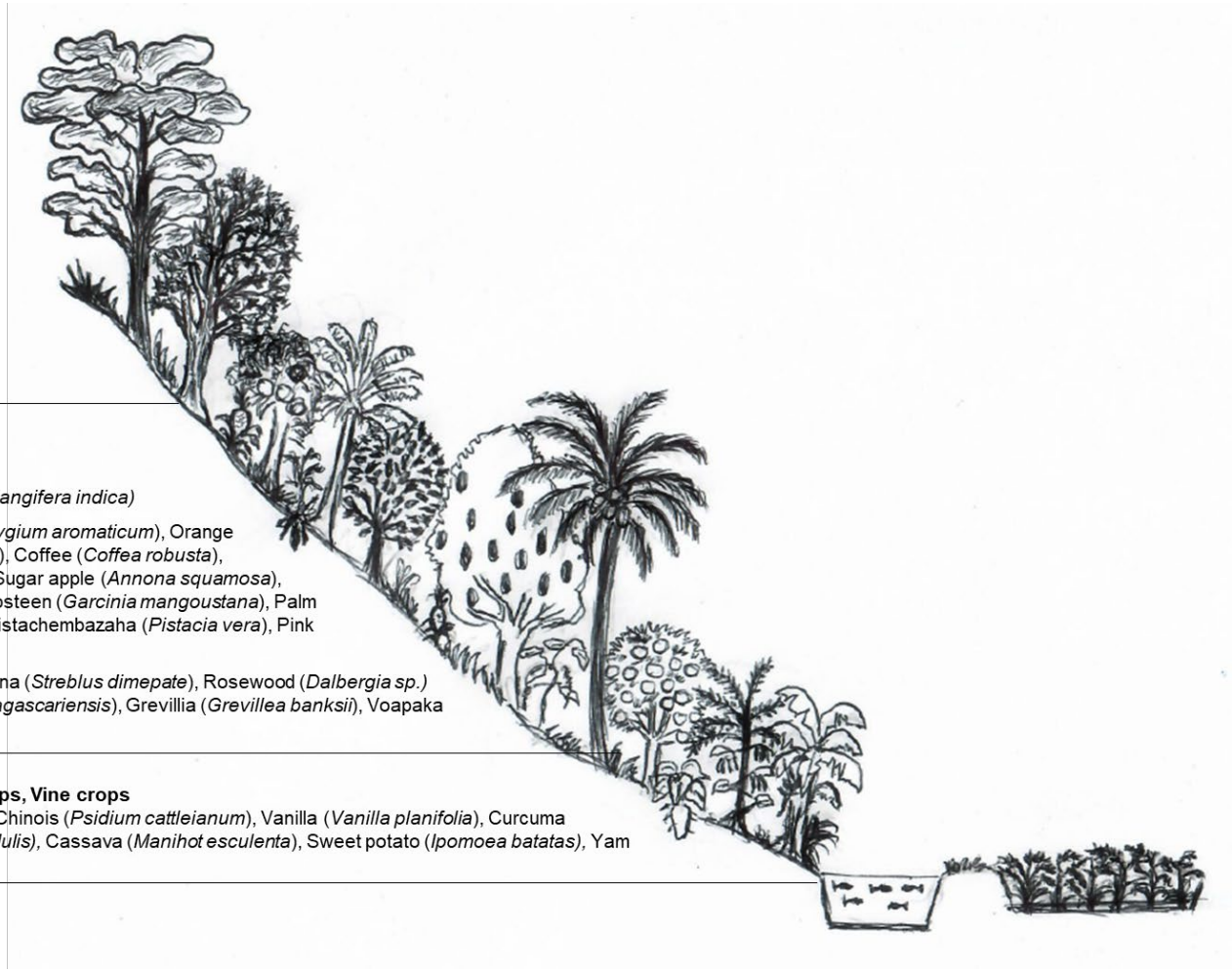
Root crops
Cassava (*Manihot esculenta*)
Sweet potato (*Ipomoea batatas*)
Yam (*Dioscorea sp.*)
Tavolo (*Tacca leontopetaloides*)

Vine crops
Vanilla (*Vanilla planifolia*)
Oviala (*Dioscorea sp.*)
Grenadilla (*Passiflora edulis*)

Nitrogen fixing hedges or simple hedge
Glyricidia (*Gliricidia sepium*)
Leucena (*Laucaena glauca*)
Jatropha (*Jatropha sp.*)

Source: Drawing and design by the author

Appendix 3. Cross-sectional diagram of agroforestry system slope



UPSTREAM OR STEEPLY SLOPING AREAS
Often intended for timber trees
Eucalyptus (différentes espèces intégrant l'*Eucalytpus citriodora*)
Bonara ou Bonarambazaha (*Albizia lebbeck*)
Nonoka (*Syzygium bernieri*) endémique à Madagascar
Manasavelona (*Rhodolaena leroyana*) endémique à Madagascar
Varongy (*Ocotea Sp.*)

MEDIUM OR MODERATELY STEEP SLOPE
Areas planted with cash crops or fruit trees of various kinds
Rotra or Jamblon (*Syzygium cumini*), Breadfruit (*Artocarpus altilis*)
Lychee (*Litchi chinensis*), Avocado (*Persea americana*), Mango (*Mangifera indica)*

Banana (Musa sp.), Cinnamon (*Cinnamomum verum*), Clove (*Syzygium aromaticum*), Orange (Citrus cinensis), Lemon (*Citrus limon*), Mandarin (*Citrus reticulata*), Coffee (*Coffea robusta*), Jackfruit (*Artocarpus heterophyllus),* Soursop (*Annona muricata*), Sugar apple (*Annona squamosa*), Bullock's heart (*Annona reticulata*), Noni (*Morinda citrifolia*), Mangosteen (*Garcinia mangoustana*), Palm (*Arecaceae sp.*), Coconut (*Cocos nucifera*), Raffiia (*Raphia sp.),* Pistachembazaha (*Pistacia vera*), Pink pepper (*Scinus molle*)

Voatoana (*Voacanga thouarsii*), Acacias (*Acacia sp.),* Manasavelona (*Streblus dimepate*), Rosewood (*Dalbergia sp.)* Ambora (*Canarium madagascariensis*), Ravenala (*Ravenala madagascariensis*), Grevillia (*Grevillea banksii*), Voapaka (*Voacanga africana*)

LOWER SLOPE
Growing zones: dwarf trees and shrubs, Basix crops, root crops, Vine crops
Pepper tree (*Piper nigrum*), Pepper (*Capsicum annuum*), Goyava Chinois (*Psidium cattleianum*), Vanilla (*Vanilla planifolia*), Curcuma (*Curcuma longa*), Oviala *(Dioscorea sp.),* Grenadilla *(Passiflora edulis),* Cassava (*Manihot esculenta*), Sweet potato (*Ipomoea batatas),* Yam (*Dioscorea sp.*), Tavolo (*Tacca leontopetaloides*)

LOWLAND : For pond fish farming or rice growing

Source: Drawing and design by the author