



Enhancing agrobiodiversity in smallholder agroforestry systems in Madagascar

Producer organisation: Analamanga Regional Branch of the National Platform for Women, Sustainable Development and Food Security (ARFDDSA Analamanga)



Agrobiodiversity Case Study 3: Madagascar

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Cover photo: An agrobiodiverse landscape in the Antanetibe Mahazaza area of Madagascar © Edena Andrianaivolala

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Acronyms

ARFDDSA	Analamanga Regional Branch of the National Platform for Women, Sustainable
	Development and Food Security (Antenne Régionale Analamanga de la Plateforme
	Nationale Femmes, Développement Durable et Sécurité Alimentaire)
FFPO	Forest and farm producer organisation
FIFAMANOR	Norwegian Malagasy Farming (Fiompiana Fambolena Malagasy Norveziana)
FOFIFA	National Centre for Applied Research on Rural Development (Centre National de la
	Recherche Appliquée au Développement Rural)
PNFDDSA	National Platform for Women, Sustainable Development and Food Security
	(Plateforme Nationale Femmes, Développement Durable et Sécurité Alimentaire)

Summary

The National Platform for Women, Sustainable Development and Food Security (Plateforme Nationale Femmes, Développement Durable et Sécurité Alimentaire or PNFDDSA) brings together 'committed women, pillars of the nation' in Madagascar. It is represented in the Analamanga region by the Analamanga Regional Branch of the National Platform for Women, Sustainable Development and Food Security (Antenne Régionale Analamanga de la Plateforme Nationale Femmes, Développement Durable et Sécurité Alimentaire or ARFDDSA).

In its founding documents, the platform does not make any specific reference to agrobiodiversity. Nevertheless, each member is obliged to raise awareness of and implement sustainable development and food security strategies – which in practice involve diversified agroforestry and climate-smart agriculture using agroecological approaches.

This case study was conducted in the Antanetibe Mahazaza area of Ambohidratrimo district in the Analamanga region, located 40km outside the capital city of Antananarivo. Observations and data collected from 20 farmer households who are members of ARFDDSA (men and women in equal numbers) revealed that a typical household consists of five members, with a farm comprising on average of 0.45 hectares of rainfed crops on upland hills and 0.3 hectares of lowland rice fields. Farms are diversified, planting on average nine different types of crop and three different types of livestock alongside several fruit or cash crops. There is a dominance of annual crops, driven by market demand from the neighbouring urban centre. In total, the 20 ARFDDSA members interviewed grow more than 34 types of crops: 24 agricultural and 10 fruit crops (composed of 80 varieties) and keep 13 types of livestock. Despite this agrobiodiversity, the natural vegetation is severely reduced and is under heavy pressure from annual agricultural cycles.

In interviewing the farmers, a number of trends were revealed. Firstly, there had been a progressive integration of agroforestry in recent years under the guidance of ARFDDSA, with an increase in the number of trees planted and the widespread adoption of organic fertilisation using leaf compost techniques. This has been accompanied by a significant reduction in the use of chemical inputs and the progressive adoption of biological pest control methods.

ARFDDSA had helped to animate this community dynamic favourable to agrobiodiversity through a number of approaches. Firstly, ARFDDSA implemented a clear and determined direction to promote to its members agroecology, agroforestry, climate-resilient agriculture and organic agriculture in a context of profit-seeking agricultural entrepreneurship. It also relied on local structures and mechanisms for the transfer of farmer-to-farmer knowledge – such as the use of farmer leaders to train their local farmer organisations – and through the regular use of reference sites and demonstration plots.

This push towards a more agroecological approach has been achieved by providing regular local support during the innovation phases, such as the adoption of new crops or planting techniques. ARFDDSA has also developed exchange and consultation networks, such as fairs and various meetings of sustainable development actors and value chains. Through these networks, ARFDDSA has been able to mobilise development partners and work with the relevant authorities.

Access to remunerative and regular markets is key to maintaining agrobiodiversity in rural agricultural landscapes. ARFDDSA does not directly market products for its members, but can play a key role in market research to improve the market prospects for tree-based products, the development of which will further expand the uptake of agroforestry and other agroecological techniques among its members. This can be further enhanced by strong advocacy for access to land.

1 Introduction to ARFDDSA and its land use

1.1 ARFDDSA's vision

The forest and farm producer organisation (FFPO) described in this case study is the Analamanga Regional Branch of the National Platform for Women, Sustainable Development and Food Security (Antenne Régionale Analamanga de la Plateforme Nationale Femmes, Développement Durable et Sécurité Alimentaire or ARFDDSA Analamanga). ARFDDSA Analamanga is one of many regional branches of the broader association the National Platform for Women, Sustainable Development and Food (and Nutritional) Security (Plateforme Nationale Femmes, Développement Durable et Sécurité Alimentaire or PNFDDSA) which covers the whole of Malagasy territory.¹

The creation of the national platform in 2013 formed part of the Indian Ocean Commission's (IOC) national gender policy and strategy. The vision was to contribute to gender equality by strengthening the role of women in economic and social development in the Indian Ocean region. At the level of the national platform, the vision is translated into the slogan 'Committed women, pillar of the nation'.

After establishment, PNFDDSA then formulated its objective to promote the role and contribution of women in sustainable development and food security at national and international levels. In its statutes, PNFDDSA aims to:

- Mobilise women in the promotion of sustainable development and actions towards food security, especially in rural areas
- Develop and implement projects on gender promotion, sustainable development and food security
- Make Madagascar the granary of the Indian Ocean
- Strengthen and promote value chains
- Develop agricultural and rural entrepreneurship, and
- Create national leadership on sustainable development and food security actions.

The founding documents do not contain any specific articles on the promotion of agrobiodiversity. However, each branch of the association has an obligation to raise awareness of and implement sustainable development and food security strategies – and these strategies invariably include strong components to do with environmental sustainability and climate change resilience, both of which are served by maintaining agrobiodiversity within the association and its members' land.²

1.2 Foundation

PNFDDSA was launched on the margins of the Indian Ocean Commission Regional Conference on Food Security in March 2013 in the city of Mahajanga, Madagascar. The platform started with about 40 members (IOC 2013).

The statutes and rules of procedure of the association were only established and registered in August 2016, marking the formalisation of the association. In its organisation, the association is represented in the regions by regional branches. These branches are managed and operate autonomously but are considered part of the overall national structure. ARFDDSA Analamanga represents the association in the Analamanga region.

1.3 Location

ARFDDSA Analamanga is delimited by the administrative territory of the Analamanga region. For this specific case study, farmer members were visited in the rural commune of Antanetibe Mahazaza in Ambohidratrimo district. Antanetibe is located about 40km from the city of Antananarivo, the capital of Madagascar and its largest consumer centre.

Very characteristic of the Malagasy highlands, the landscape is dominated by extensively cultivated hills, interspersed with rice-growing valleys and lowlands. Rice cultivation dominates the agricultural landscape as rice is the Malagasy staple food. In the central highlands, in addition to swampy areas,

¹ Nutritional security is an integral part of the platform's objective and is inseparable from food security.

² Interview with the national president of PNFDDSA.

rice terraces have also been developed since the pre-colonial period. The climate is described as 'tropical highland', with a rainy and hot summer period (October to February) progressively replaced by a cool and dry season (April to August).

In previous generations, the original forest that covered the area was cleared. However, after the disappearance of the forests, the land was left fallow. More recently, driven by demographic pressure, this land is gradually being reclaimed for agriculture. Currently in the study area, almost all the arable land is cultivated. The uncultivated parts, observed only in the dry season, are generally plots left fallow for a short time to be taken up in the following seasons. A few eucalyptus and pine trees and woodlots occupy occasional hilltops.

The natural biodiversity is poor and degrading due to the high agricultural pressure. Agricultural production in the area is being hindered by soil degradation and a loss of fertility due to erosion and intense cropping, and agricultural inputs cannot compensate for the levels of nutrient extraction.



This landscape is representative of the study area: a vast cultivated hill and lowland rice fields © Edena Andrianaivolala

1.4 Membership

ARFDDSA Analamanga is active in five zones and this regional branch has 30 farmer leaders, each representing groups of about 10 farmers who are members of grassroots farmer organisations in their localities. In the study area, a typical farm has just under 0.5 hectares of upland hillside known as tanety³ and nearly 0.3 hectares of lowland rice fields.

ARFDDSA Analamanga promotes women's participation and leadership in farm management and entrepreneurship. Women farmer leaders receive capacity building from the regional branch of the association and subsequently mobilise and train their members. They also act as the organisational and communication link between the local farmers and the national platform. They generally host a demonstration or reference site in their locality.

Technical training topics that have been identified and delivered by ARFDDSA Analamanga to the farmer leaders include:

³ 'Tanety' refers to hillsides in general, including the whole transect outside the lowlands.

- The challenge of climate change
- Agroforestry: annual crops grown in association with perennial trees (usually fruit or other useful trees)
- Nursery stock production and tree-growing techniques
- Composting techniques and the use of organic fertiliser
- Organic farming without the use of chemical inputs and with biological control of pests and diseases, and
- Agroecological techniques: crop rotation, cover crops, soil moisture management.

The demonstration or reference sites are cultivation areas developed using exemplary climate-smart agroecological and agroforestry techniques. They serve as a training and awareness-raising demonstration tool for farmers who come to visit them. ARFDDSA trains the farmer leaders and supports them to establish these demonstration sites on their farms. The objective is to make good agroecological/agroforestry practices observable locally, and contextualised to local conditions. The integration of agriculture with livestock is a common practice and is also reinforced with the widespread adoption of organic manure. Practical training in composting has been provided to farmers. At the community level, ARFDDSA also builds the capacity of farmer leaders in advocacy to negotiate the allocation of communal land for reforestation/afforestation/tree cultivation.

In the Antanetibe Mahazaza landscape, farmers plant several different crops on their land (polyculture). At a minimum, a typical farmer would grow five types of crops during a season. Crops are diversified in part to meet the diversified nutritional needs of the farmers but also because diversification makes the farm more resilient to various hazards, including climate change events, invasions of specific pest or diseases, and economic downturns (crop markets in particular).

The main subsistence crop that farmers plant is rice. However, as the area is close to Antananarivo (the country's major centre of consumption) the market channels for agricultural products are also highly developed. Relatively high percentages of the volumes of all crops combined are sold, and this is particularly true for some types of livestock (see Table 1).

Production	Category	Number of	Average %
		production units ⁴	volume sold
Annual crops	Cereals	36	17.66%
	Fodder crops	11	9.09%
	Market garden	41	87.89%
	vegetables		
	Tubers	13	29.62%
	Proteins and	56	61.27%
	oilseed		
Perennial crops	Fruit trees	13	40.00%
	Walnut	1	0.00%
Livestock	Cattle for meat	2	95.00%
	Rabbits	1	0.00%
	Dairy cattle	10	89.29%
	Fish farming	2	0.00%
	Pigs	10	99.00%
	Silkworms	1	100.00%
	Poultry	26	62.31%

Table 1. Percentage of production volume sold by category (2022)

How to read the table: for cereals (rice and maize), there are 36 cultivated plots of which 17.66% of the total production volume is marketed.

⁴ A production unit represents either a crop-growing plot or a livestock pen.

1.5 Land-use patterns

In the study area, agricultural pressure is such that the tanety area is cultivated during the rainy season (typically about 0.45 hectares per farmer), except for some few rocky areas which make up about 10% of the tanety surface area. The rice fields in the lowlands are also fully planted at this time (typically about 0.3 hectares per farmer). After the rainy season, the annual crop plots on tanety are left fallow. A large part of the lowland rice fields is then used mainly for market gardening and fodder crops.

Natural ecosystems are maintained within these fallows in the off-season as well as by some small areas of vegetation left on the edges of farm plots (often to delimit land holdings and/or as a living hedge). Some perennials, generally located around the villages, also serve as natural fodder, as soil protection for the cultivated areas, and mainly as sources of material for composting. Examples of plants used for such purposes include sisal, wild sunflower, ambiaty and neem, among many others.



Ambiaty is a plant found in natural vegetation that is left at the edge of plots and used for compost production © Edena Andrianaivolala

During the off-season, annual crops on tanety are followed by a short fallow period, while the lowland rice fields are used partly for off-season rice and partly for market gardening, fodder crops and beans. The average area under off-season rice cultivation is typically 0.2 hectares per household.

All the land in the study area is privately owned and much of it has been inherited (see Table 2). Ownership is traditionally and socially recognised between communities. Only one of the 20 farmers interviewed for this study had a formal land title deed. Land purchases are occasionally made through deeds of sale signed in the presence of witnesses and registered locally in the municipalities. Borrowing or renting of land is also a common practice in the area, accounting for a fifth of all cultivated plots. The trends are similar between the tanety and the lowlands. Natural vegetation, found on the margins of the plots, is accessible to the whole community for 'wild' collection (natural grasses for fodder, or medicinal plants).

Land acquisition method	Lowlands	Tanety (lower slopes and hillsides)	All settings
Purchased	6.29%	10.69%	16.98%
Borrowed/rented	10.69%	10.06%	20.75%
Inherited	30.82%	31.45%	62.26%
Total	47.80%	52.20%	100.00%

Table 2. Method of land acquisition in the study area (as a percentage of area farmed)

2 Agrobiodiversity in the landscape

2.1 Methodology for data collection

To obtain quantitative data on agrobiodiversity in the area, a survey of 20 farm households (all members of ARFDDSA Analamanga) was organised. This involved:

- Meetings with the farmer leaders and the technical facilitators to identify the 20 households, 10 of which are managed mainly by women and the other 10 by men (management here refers to the organisation of resource allocation)
- Individual surveys that were conducted and accompanied by visits to plots and production units to verify the data
- An inventory of the different crops grown by the farmers according to the landscape units and with information on crop rotation
- Discussions to capture additional data on:
 - o Scale of activity (area of crops, number of livestock, number of cash crops etc)
 - Seed supply and management (species and varieties, sources)
 - \circ $\,$ Production techniques and how knowledge is transferred $\,$
 - Production and its market destinations (quantity, self-sufficiency, trade), and
- Open discussions about farming strategies conducted with both individuals and focus groups.

			Number of production units												
Household code	Family members	Annual crops	Livestock	Perennial crops	Reforestation	Total									
F01	6	10	3	1		14									
F02	2	8	2	1		11									
F03	5	13	4	1		18									
F04	3	9	3	1		13									
F05	1	3				3									
F06	5	8	3			11									
F07	5	6	1	1		8									
F08	5	8	4	1		13									
F09	5	6	3	1		10									
F10	5	6	5	1		12									
M01	4	9	2	1		12									
M02	5	9	3	1		13									
M03	7	12	2			14									
M04	2	9	3	1		13									
M05	2	7	4	1		12									
M06	5	7	4	1	1	13									
M07	1		3			3									
M08	8	10	4	1		15									
M09	2	9	4	1		14									
M10	3	10		1		11									
Total	81	159	57	16	1	233									

Table 3. Summary characteristics of the 20 farms monitored

Notes: M = male-headed household, F = female-headed household. For example, female-headed household F01 is composed of six family members. The farm has 10 plots of different annual crops, three different livestock units and one plot of perennial crops (fruit trees planted around the living area).

It should be noted that the survey period coincided with the peak times of agricultural activities in the area. Farmers were very busy and it was not possible to have uniform groups during the focus group discussions. In the following tables and sections, (M) refers to farms run by men and (F) to farms run

by women. Table 3 details the characteristics of the 20 farms surveyed with an overall summary of agrobiodiversity (details on the species are provided in subsequent tables). With the exception of those farmers who very occasionally only rear livestock, most farmers are cultivating between 3–13 annual crops and 1–5 different types of livestock, plus a wide variety of fruit trees.

In the area, the average household is comprised of five members. The farms are diversified: on average, each has around nine crop plots, three livestock units and a lot of fruit trees or cash crops. Only one farmer has reforested land.

The dominance of annual crops on the farms in the area can be seen in the landscape. The perennial crops are generally fruit trees grown in gardens around the home, as well as a few banana trees on the edge of fields (about 10 trees of various species per household: peach, avocado, banana, guava, orange, medlar, papaya, apple, persimmon, tangerine, mango and/or plum). The only cash crops grown in full plot plantations are coffee and orange trees.

It should be noted that reforestation was seen in only one of the 20 farms monitored. This was a plantation of eucalyptus and pine trees grown for construction purposes and fuel. The other 19 households have devoted all their land entirely to agriculture.



A farming landscape dominated by annual crops, with some fruit trees around housing areas © Edena Andrianaivolala

2.2 Crops and livestock traded by men

Figure 1 provides information on the types of cash crops grown and sold by the male-headed farming households surveyed. Tables 4 and 5 provide information on the percentages of the volume of agricultural and livestock production that are sold commercially.



Figure 1. Cash crops grown and sold by men by number of farmers surveyed

Table 4. Cash crops grown by men far	ners and estimated percentages	sold by farmers that
grow those crops		

Crop categories	Crops	M01 (%)	M02 (%)	M03 (%)	M04 (%)	M05 (%)	M06 (%)	M07 (%)	M08 (%)	M09 (%)	M10 (%)	Total (%)
Cereals	Maize	(/0)	(/0)	(/0)	(/0)	(///	(/0)	(/0)	(/0)	(/0)	75	75
-	Rice				32					50		41
Fruit trees	Fruit trees	50				70			60	80		65
Market garden	Paracress		100		100		100			100		100
	Carrots	96										96
	Cauliflower		98									98
	Courgettes						98				88	91
	Green beans	100	100		98					95	88	96
	Lettuce		99									99
	Onions				100							100
	Leeks		100									100
	Peppers		100									100
	Potato										70	70
	Tomato		100									100
Tubers	Cassava	80										80
Proteins and oils	Peanuts	100	100		95		100			80		95
	Beans	90		25		96	100			95	88	86
	Peas	99				100	100			100		100

Notes: Male-headed household M06 sells 100% of paracress production, 98% of courgette production and 100% of groundnut, bean and pea production. Empty cells indicate either a non-response or that none of the production is sold and therefore for the purposes of this table, each empty cell represents 0%.



Figure 2. Commercial livestock raised and sold by men by number of farmers surveyed

Table 5. Livestock reared by men farmers and estimated percentages sold by those that rear those animals

Туре	Animals	M01 (%)	M02 (%)	M03 (%)	M04 (%)	M05 (%)	M06 (%)	M07 (%)	M08 (%)	M09 (%)	M10 (%)	Average (%)
Dairy	Cows	95	95	95	90	80	80		90			89
Pig	Pigs					100	100	100				100
Poultry	Ducks								60			60
	Fighting cocks							100				100
	Geese				100							100
	Laying hens			95						95		95
	Broiler chickens									100		100
	Local chickens					50		90	80			73

Interpreting these figures, it is clear that there are at least 18 agricultural crops and eight livestock types that are marketed for the 10 male-headed households. But with a wide diversity of fruit trees, the total number of crops may be as high as 28. The percentages of production sold are close to 100% except for rice, maize, potatoes, fruit, beans and poultry. On average, a male-headed household produces 4–5 (4.2 average) crops and 1–2 (1.9 average) types of livestock whose production is intended for sale. For agriculture, market garden produce and dry grains are in first place. In terms of different types of fruit sold, most of the trees in this area were oranges.

2.3 Crops and livestock traded by women

Figure 3 provides information on the types of cash crops grown and sold by the female-headed farming households surveyed. Tables 6 and 7 provide information on the percentages of the volume of agricultural and livestock production that are sold commercially.





Table 6. Cash crops grown by women farmers and estimated percentages sold by those growing the crop

Crop	Crops	F01	F02	F03	F04	F05	F06	F07	F08	F09	F10	Average
category		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Cereals	Maize		75	50	75			50				63
	Rice					23		56	99		50	57
Fodder	Fodder	100										100
Fruit trees	Fruit trees				60			70	20	50	60	52
Market garden	Paracress						100		100			100
	Carrots			97								97
	Courgette		90	95			100		98		100	96
	Green beans								100			100
	Onions			95				100				98
	Peas	88	90									89
	Potato	80								67		73
Tubers	Cassava	25				100			50		50	56
	Sweet potato				80							80
Proteins and oils	Peanuts	50	80		60		100		50	67		68
	Beans	17	75		82	83	100	100	100	76	50	78
	Green beans		89	97								93
	Peas							75				75
	Soybeans							100				100



Figure 4. Commercial livestock raised and sold by women by number of farmers surveyed



Type of	Animals	F01	F02	F03	F04	F05	F06	F07	F08	F09	F10	Average
farming		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Cattle	Draught oxen								100	90		95
Dairy	Dairy cows	80		93	95							89
Pig	Pigs	100		90			100	100	100	100	100	99
Silk	Silkworms		100									100
Poultry	Ducks						80					80
	Muscovy ducks				90							90
	Geese			100							100	100
	Broiler chickens										100	100
	Local chickens	90	80	90	50					50	20	63

Interpreting these figures, once again we found that the 10 women farmers were in total growing 18 agricultural crops for sale but this time with nine different types of livestock. Once again, if you factor in the numbers of different fruit trees these figures may be as high as 28 agricultural crops. The percentages of production sold are varied compared to the distribution for men. The rates remain high. On average, a female-headed household produces 5–6 crops and 2–3 types of livestock intended for sale. At the individual level, the women's farms are slightly more diversified in terms of production for sale (they grow more types of different crops for sale than do men).

2.4 Subsistence crops grown by men and women

Tables 8 and 9 provide information on the percentages of subsistence production from agriculture and livestock for male- and female-headed households.

Production	Categories	Crops	M01 (%)	M02 (%)	M03 (%)	M04 (%)	M05 (%)	M06 (%)	M07 (%)	M08 (%)	M09 (%)	M10 (%)
Annual crops	Cereals	Maize			100	100	100			100	100	25
		Rice	100	100	100	68	100	100		100	50	100
	Fodder	Fodder			100	100				100		
	Market gardening	Paracress		0								
		Carrots	4									
		Cauliflower		3								
		Courgette						2				12
		Green beans				2					5	13
		Lettuce		1								
		Onions										100
		Potato			100		100					30
	Tubers	Cassava	20		100	100				100		
		Sweet potato			100							
	Proteins and oils	Peanuts			100	5				100	20	
		Beans	10		88		7			100	10	13
		Peas	1									
		Soybeans	100		100		100			100		
Perennial crops	Fruit trees	Fruit trees	50	100			30			40	20	100
Livestock breeding	Rabbits	Rabbits								100		
	Dairy	Dairy cows	5	5	5	10	20	20		10		
	Fish farming	Freshwater fish	100									
	Poultry	Ducks								40		
		Laying hens		5						5		
		Local chickens	100	100		100	50	100	10	20	100	

Table 8. Percentages of subsistence production for the men farmers surveyed

Notes: The coloured cells represent the range of percentages of crops grown for subsistence purposes: high (green), medium (orange) and low (red)

Interpreting this data, it can be seen that overall the 10 male-headed households produce 18 crop types (excluding fruit trees) and six livestock types for subsistence needs. The values are 14 crop types (excluding free trees) and seven types of livestock for the female-headed farms (see Table 9). At the individual farm level, there is no real difference in the number of crops between male- and female-headed farms.

Overall, there are 22 types of crops and 13 types of livestock inventoried on the 20 farms that made up the survey. For agriculture, consumption and marketing go hand in hand, and the adoption of a crop type almost always serves this dual purpose. The proportions of production sold remain relatively high, which means that farmers have similar approaches as a whole, but more specific needs individually. For livestock, the objectives of commercial sale and subsistence tend to be more clearly differentiated. There are some types of livestock that are only grown for sale.

It can be seen here that plant agrobiodiversity is dominated by annual crops. Perennial crops such as fruit trees have not yet evolved much in terms of surface area and landscape occupation. However, within the farmer organisations, there is a collective awareness of the need to increase the number of trees in farming systems following training and awareness raising by ARFDDSA. The biggest issue at present is the very limited availability of land, given the demographic pressure and vital food needs.



An agroforestry demonstration plot, showing a food crop panted in an orange orchard © Edena Andrianaivolala

Production	Category	Crops	F01 (%)	F02 (%)	F03 (%)	F04 (%)	F05 (%)	F06 (%)	F07 (%)	F08 (%)	F09 (%)	F10 (%)
Annual crops	Cereals	Maize	100	25	50	25			50	100	100	
		Rice	100	100	100	100	77	100	44	1	100	50
	Fodder	Fodder	100		100	100						
	Market gardening	Carrots			3							
		Courgette		10	5					2		
		Onions			5							
		Peas	12	10								
		Potato	20								33	
	Tubers	Cassava	75		100	100		100		50		50
		Sweet potato				20						
	Protein and oilseed	Peanuts	50	20	100	40				50	33	100
		Beans	92	25	100	18	18				24	50
		Green beans		11	3							
		Peas							25			100
Perennial crops	Fruit trees	Fruit trees	100		100	40			30	80	50	40
	Walnut	Walnuts		100								
Livestock breeding	Cattle	Draught oxen									10	
	Dairyman	Dairy cows	20		7	5						
	Fish farming	Freshwater fish								100		
	Pig	Pork			10							
	poultry	Ducks						20				
		Muscovy ducks	_			10						
		Local chickens	10	20	10	50				100	50	80

Table 9. Percentages of subsistence production for the women farmers surveyed

Notes: The coloured cells represent the range of percentages of crops grown for subsistence purposes: high (green), medium (orange) and low (red).

2.5 Wild products harvested by men

Information on wild harvesting was collected during focus group discussions with the farmers. Those unfamiliar with this area of Madagascar might be struck by how little 'wild' or natural forest space there is:

- In the boundaries of plots or around dwellings, and
- In valley heads (at the break in the slopes) where the ground is too steep to be developed as arable plots (these are very rare situations).

There is no clear differentiation between what men and women would want to collect from off-farm areas, but there are differences due to amount of work associated with that extraction – men tend to do tasks requiring more strength. Table 10 shows the main natural species that are collected by men. It is usually men who carry out the majority of the tasks associated with these products.

Names	Use
Tanamasoandro (shrub)	Compost
Ambiaty (shrub)	Compost
Fotsy avadika (shrub)	Medicine
Kifafa (wasteland grass)	Roofing material
Neem	Phytosanitary treatment of crops
Sisal	Rope making
Fish	Food

Tahlo 10	Main	enocioe	hetrallor	from	tho	wild	hv	mon
Table IV.	IVIAIII	species	conected	mom	une	wiiu	IJy	men

Apart from fish caught in streams, these are all perennial plants that are often found in the area. Only the owners of the land can exploit these species, except for plants with medical uses. One special case is that of 'kifafa' (wild grass), which grows on poor soils on uncultivated hillsides. This land is usually owned by 'big' landowners who do not want to rent out their land. The community can harvest these resources with the permission of the landowners.

ARFDDSA promotes the use of natural wild vegetation in composting and biological crop protection treatments and in hedgerows. Farmer leaders are trained in these techniques and subsequently train members of their farmer organisations. Organic manure, including composting, has been well promoted in the area. Producers do not only harvest these species from the wild. They also cultivate them around their plots, according to the needs of the farmers.



A row of sisal has been planted as both a plot boundary and to protect against erosion © Edena Andrianaivolala

2.6 Wild products harvested by women

Table 11 shows the main natural plants that are usually harvested by women. Many of these plants have medicinal or culinary uses.

Names	Uses
Beroberoka (ringed herb)	Medicine
Arongana (shrub)	Medicine
Aferotany (annual herb)	Medicine
Dingadingana (shrub)	Medicine
Satriko aza maratra (annual herb)	Medicine
Tsipipihina (annual herb)	Medicine
Anatarika (annual herb)	Food
Anapatsa (annual herb)	Food
Anamadinika (annual herb)	Food

Table 11. Main species collected from the wild by women

Women use these plants in traditional medicine and for traditional foods. ARFDDSA trains its women leaders in the valorisation and good food and nutritional practices using natural plants. Communities can freely harvest medicinal plants for their own use (but not for commercial sale). For most shrubs, it is the plot owners who manage their harvest. However, several of these herbaceous plants do not benefit from specific management because they naturally invade the plots left fallow. They can even be weeds found among the main crops.

2.7 Crop varieties

There is no forest in the study area. Almost 90% of the tanety land is cultivated – and the remainder is rock. Table 12 lists the different crop varieties adopted by the 20 farmers in 2022. There is considerable diversity in the various varieties of rice and peanut. Many of the other crops grown also include several varieties.

Category	Crop	Varieties maintained
Cereals	Maize	IRAT 200, PANNAR 12, other ⁵
	Rice	12-85, Fofifa 160, hybrid, mavo kely, rojo fotsy, samona fotsy, samona mena, tsipolitra, X260, X265
Fruit trees	Avocado	Boribory, lavalava
	Banana	Batavia
	Persimmon	Unspecified
	Tangerine	Unspecified
	Mango	Unspecified
	Medlar	Unspecified
	Orange	Japanese
	Papaya	Unspecified
	Peach	Gasy, petakorona, valdo
	Apple	Unspecified
	Plum	Fon'omby, rakena

 Table 12. Varieties of main crops grown by the 20 farmers surveyed

⁵ Several varieties are designated with Malagasy names. Botanical identification could not be carried out.

Market gardening	Paracress	Petsay be, petsay fotsy, petsay maitso, ramirebaka
	Carrot	Daucus, touchon
	Cauliflower	Unspecified
	Courgette	Maitso, marafotsy, maramaitso, vangafotsy
	Green beans	Fotsy kely, mangarira, sary olona
	Lettuce	Batavia
	Onions	Red creole, zanatany
	Peas	Eat everything, peas
	Leeks	Unspecified
	Pepper	Unspecified
	Potato	Fotsy, manga maso, all coming
	Radish	Radie
	Tomato	Boribory
Protein and oilseed	Peanut	Flower 11, marabe, mavokely, menabe, menakely
	Beans	CAL 98, fotsy kely, kinimba, mara oditra, ranjon'omby, RI5-2, sary olona, taolana
	Bambara	Marakely, donabe
	groundnut	
	Soybeans	Mavo
Tubers	Cassava	Anivorano, madarasy, mangakely
	Sweet potato	Borah, carrot, fotsy, mavokely
Reforestation	Eucalyptus	Robusta
Plantation	Coffee	Arabica

Across all crop types, there are 34 different crops and 80 different varieties that are maintained on farm by the local farmers. There is a very wide variety especially of annual crops:

- For rice, which is the staple food, producers try to keep at least two varieties (one in the main season and one in the irrigated off-season). But within the community, there is a maintenance of a wide range of varieties, with provision for exchanges in the future. It is also, to a lesser extent, to diversify the diet or to meet specific market needs.
- For other commercial crops (market gardening, dry grains), varieties follow market demand. Producers tend to adopt several varieties to spread risk in production and marketing.

Agrobiodiversity has historically been strongly influenced by the farmers perception of market demand for their commercial crops. ARFDDSA had occasionally provided market garden seeds to help increase women's incomes during the COVID-19 pandemic.

In the more recent promotion of agroforestry and arboriculture, ARFDDSA trains nurserymen at the level of the farmer organisation and supports the production of seedlings in nurseries. These include useful tree species such as fruit trees, trees for medicinal use, and auxiliary trees for climate-smart agriculture. At the moment, ARFDDSA is still at the nursery planting stage and the trees are not yet distributed across the landscape. Because of pressures on the land, these trees are planted in the cultivation plots – and so there has to be strong buy-in from the farmers for agroforestry to become more widespread.



Moringa plants produced at one of the local nurseries © Edena Andrianaivolala

3 Knowledge sources for crop and animal cultivation and management

Table 13 provides an overview of access to knowledge about agrobiodiversity (knowledge of how to cultivate or manage crop and livestock production) for the 20 households surveyed. For each production unit (agriculture, forestry, livestock), producers were asked how they acquired the technical and management knowledge specific to the given production activity. In one or two cases, data were not recorded for a production unit, meaning that the total production unit figures vary slightly between this and subsequent tables – but with the overall trends clearly visible for production units where data was known.

Table 13. Sources of knowledge aboutlivestock cultivation and management	Number of production units			
Source of knowledge	Annual crops	Perennial crops	Livestock	All units combined
Buyers	4			4
State extension agents	1			1
Radio broadcasts	1			1
Suppliers	23		6	29
Parents	71	2	23	96
Projects	1			1
Own experiences	18		8	26
Shared by neighbours	40	1	12	53
Total	159	3	49	211

The data show that the most common forms of knowledge transfer is between generations and through local community exchanges (such as sharing learning between neighbours) and self-experimentation. Parents pass on to young people their knowledge of the 'old' types of crops and livestock. These are mainly agricultural subsistence activities that have been practised for generations: the production of rice, maize, tubers, beans, groundnuts, zebus, pigs and chickens.

For more recently introduced crops mostly linked to market needs, knowledge is generally imported from elsewhere. Suppliers sell seeds and inputs for agriculture and livestock play an important role in transferring knowledge when farmers adopt a new crop for the first time. Providing production advice and guidance on local market needs is also important for suppliers to run their businesses. The advice may simply be in the form of labels and leaflets on the packaging of the seeds or inputs.

In this area, there are also specific supply-production-sale contracts with clients active in the value chain. They can provide seeds and inputs in advance, which they 'recover' when the production is sold. This is the case, for example, for the company Leucofruit with some producers in the area for the production of green beans and onions. Leucofruit also provides technical advice and works with the producers throughout the production process until the sales are concluded. There are systematically stricter production and quality standards to be respected for this type of contract.

In terms of technical knowledge and production management, ARFDDSA has strengthened the capacity of its farmer leaders in several areas focused on sustainable production and adapted to the context of climate change, such as agroecology, agroforestry, tree nurseries, organic fertilisers, organic farming and soil moisture management.

3.1 Biocultural heritage

The majority of the population of Antananarivo is of Indonesian and Malaysian origin. They have inherited their native food and nutritional cultures and habits based around the consumption of rice, fruits, vegetables and poultry. It is this biocultural heritage that shapes the types of crops grown in this region.

In terms of food self-sufficiency, rice is the main staple food of the Malagasy. The varieties grown are selected on the basis of productivity (yield per unit area), taste and consistency. Producers rotate varieties (through barter or purchase) in order to renew seed performance after a few crop cycles. Maize and tubers (cassava and sweet potato) supplement the family diet. Cereals are also produced for livestock feed (rice, bran and maize). The landscape is developed to essentially meet local food needs either in the rural area itself or the nearby city of Antananarivo.

The particular importance of beans among the others crops is that it is the main accompaniment to rice during meals in rural areas. Beans are also used to pay for external labour (salaries and meals). In addition, the product is relatively easy to store.

Eating poultry on holidays is also a traditional Malagasy habit. The same is true when hosting occasional visitors. Table 14 describes the main end use or destination for the crops grown by the farmers interviewed.

	Number of production units							
Category	Main products	Subsistence food	Livestock feed	Food for workers	Commercial sales	Test plots	Tot al	
Annual crops	Cereals	20	6		10		36	
	Fodder		10		1		11	
	Market gardening	2			39	1	42	
	Tubers	4	7		2		13	
	Protein and oilseed	19	2		35	1	57	
Perennial crops	Fruit trees	3			3		6	
Livestock	Cattle			4	3		7	
	Rabbits	1					1	
	Dairy				10		10	
	Pigs				10		10	
	Silkworms				1		1	
	Poultry	6			20		26	
Total		55	25	4	134	2	220	

Table 14. Destination of products

3.2 Intergenerational knowledge transfer within households

As noted above, the transmission of knowledge from generation to generation is the main way in which knowledge of agrobiodiversity is maintained. Parents are observed by their children when in the fields helping their parents with agricultural activities. The young people grow up and start their own farms by 'imitating' the model of their parents. They are often even 'set up' by their parents, who gradually hand over part of their land and resources to their children.

Changes occur to this generational transfer pattern when there is a new opportunity, brought about by projects or new markets. Farmers then go through a period of 'testing' new crops/techniques before scaling up on their farm if necessary. Currently, with the nutritional advice organised by ARFDDSA, producers are beginning to show an interest in soya production. They are at this testing phase.

Another example would be that of dairy farming, which has developed significantly in the area over the past 10 years. Ten of the 20 households surveyed are involved in dairy farming, with up to seven heads of cattle on one farm. There has been a project to revive the dairy sector in the highlands that has spurred adoption. Fodder cultivation has also developed alongside this.

Farmers are also forced to change in the event of hazards (technical, climatic, commercial, socioeconomic), leading to innovations in farm management. For example, the area used to produce tomatoes. But as a result of diseases that require more and more treatment and the fact that it is a product that rots very quickly, producers have gradually abandoned it.

3.3 Knowledge transfer between neighbours

Copying what neighbours do well is also a predominant form of knowledge transfer. This channel is the second most important source of knowledge influencing the adoption of farming strategies or simply farming techniques. In the study area, farms adopt similar overall strategies to access remunerative markets for agricultural products. There are informal exchanges that sustain these strategies. Strategies and exchanges can also be very technical and organisational. Rural radio and 'word of mouth' works well on a daily basis. As a result, there is an overall community dynamic that collectively sustains the evolution of agrobiodiversity in the landscape.

Consider again the development of dairy farming. This has promoted the growth of fodder crops. At the same time, the rearing of laying hens has also seen a remarkable expansion. This has transformed large areas of land that was previously used for growing cassava into maize crops for animal feed.

ARFDDSA greatly values this important potential for knowledge transfer between neighbours. The platform promotes and prioritises the establishment of demonstration and reference sites with innovators within the communities themselves.

3.4 Organisational knowledge networks

ARFDDSA has organised itself to promote farmers' access to training and to update their knowledge in the areas of agroecology. In recent years, ARFDDSA has focused much of its efforts on the dissemination of climate-sensitive agricultural techniques, many of which involve enhancing agrobiodiversity.

Each grassroots farmer organisation identifies a farmer leader (a woman in the case of ARFDDSA). The role of the farmer leader is to act as facilitator and trainer, linking the platform to the members of their farmer organisations. The farmer leaders receive training and are informed about the work of the national-level organisation. The training then cascades from the farmer leaders to the members of the farmer organisation. In this way, ARFDDSA 'injects' new knowledge by working with the local community dynamics already in place.

ARFDDSA has also mobilised two female technicians to accompany farmers in different zones. In addition, it supports the participation of women farmers' leaders in various events where agricultural

actors meet (such as product fairs and workshops). During these events, these representatives benefit from the exchange of information on existing or new value chains. Once there, they learn more about how to innovate certain aspects of their own operations and can explore new opportunities further.

For example, the women farmer leaders in the study area participated in the most recent International Fair of Agriculture, Livestock and Fishing in September 2022.⁶ The event not only allowed an increase in and diversity of sales by the farmer organisations but also their active participation in a conference on the development of organic agriculture in Madagascar, jointly organised by the Ministry of Agriculture and Livestock (Ministère de l'Agriculture et de l'Elevage or MINAE) and the Malagasy Syndicate of Organic Agriculture (Syndicat Malgache de l'Agriculture Biologique or SYMABIO). The farmer organisations were able to learn about the institutional concepts provided for in Law 2020-003, such as the Territory with Organic Agriculture Vocation (Territoire à Vocation Agriculture Biologique or TVAB) and Participatory Guarantee Systems (Système Participatif de Garantie), which were presented and debated (PNFDDSA 2023).

At present, ARFDDSA focuses its intervention on improving farming performance, environmental preservation and adaptation to climate change. The diversification of income sources, the gradual abandonment of the use of chemical inputs, and the gradual adoption of agroforestry (through the integration of fruit and other trees such as orange, avocado and eucalyptus) are currently beginning to restore the landscape of the targeted farms in the study area.



An agroecological showcase site, demonstrating certified organic agroforestry and providing training and exchange support for farmers © Edena Andrianaivolala

⁶ See <u>www.foire-internationale-agriculture-madagascar.com</u>

4 Cultivating and managing seed and animal resources

Table 15 provides information on the sources of seed for each of the production units of the 20 farmers interviewed. The data show that self-provisioning is the most frequent practice (keeping seed from the previous year's crops). Nevertheless, there is also a steady input of seed from research centres and specialist suppliers.

	Number of production units						
Seed source	Annual crops	Perennial crops	Livestock	Total			
Research centre ⁷	21		1	22			
Community (via project) ⁸	4			4			
Specialist supplier9	13		3	16			
EIG-MDB ¹⁰	4		2	6			
Local market	7	2	14	23			
Own stock	108	1	17	126			
Neighbours	1		14	15			
Total	158	3	51	212			

Table 15. Sources of seed per production unit of the 20 farmers surveyed



Samples of different bean seed varieties produced by members © Edena Andrianaivolala

⁷ FOFIFA and FIFAMANOR: state research centre on agricultural production and livestock

⁸ Seed distribution organised at the municipality level

⁹ Suppliers specialising in the sale of seeds and agricultural inputs

¹⁰ Economic Interest Grouping, Malagasy Diary Board

4.1 Self-provisioning and multiplication

As noted above, self-provisioning predominates both agriculture and livestock. Once farmers identify the seeds (or progeny) most suitable to their needs, they then recover the best part of the harvest (production) to store (or renew) them for the next cycle. They carry out a mass selection to do this and will continue to do this until the seeds (or generations of livestock) start to deteriorate. Deterioration is judged by the loss of food or commercial quality and the loss of yield potential.

If the lack of available land does not become a limiting factor, farmers maintain crop diversity and do not settle for a single species or variety per type of crop or livestock production for three main reasons:

- To diversify household diets
- To spread risk within the farm (in the face of various production and commercial hazards), and
- To maintain a diversity of options on the farm, so that they are able quickly adapt to new opportunities (genetic pool).

In promoting organic agriculture, ARFDDSA encourages the self-provisioning/selection of seeds to avoid contamination and loss of traceability. Specific training is given to the farmer leaders on this issue.

4.2 Purchasing livestock from neighbours

The purchase (and very rarely the exchange) of source material between neighbours mainly concerns animal breeding stock. At the time of the survey, this represented 14 cases out of 51. Any purchases are mainly motivated by the seller's decision on whether to part with their stock. Indeed, animals are considered as savings in this region. It is only at times of crisis or urgent financial need that households sell their livestock.

However, the purchase of livestock maintains agrobiodiversity within the landscape. At the small scale of the farm, it helps strengthen the genetic potential. Indeed, the buyer generally seeks to acquire the best animals in transactions. There are also commercial breeding farms in the study area. This is the case for some pig farmers whose sell piglets to be raised by other farmers.

4.3 Formal purchasing systems

ARFDDSA has not established a formal community seed bank in the area. Indeed, farmers are used to getting their supplies from the local market which is close at hand. The local market supplies nearly 20% of the needs of farms. This category mainly concerns vegetable seeds and poultry. More formal types of contracts are also made with producers in the area (five of the 20 producers are involved). One example is a regular buyer who is active in the value chain and who supplies seed to producers under a production buy-back agreement. At present, almost all of the green bean seed and fodder seed grown in the area are included in this scheme. Specialist suppliers (input shops) also offer locally identified seeds and provide some basic advice to producers.

ARFDDSA does not deal directly in seed or negotiate directly with these 'proximity' suppliers-buyers, but builds the capacity of its members, especially the farmer leaders, to study and seize opportunities. It is then up to the farmer leaders to mobilise their members to organise themselves if necessary. On the other hand, ARFDDSA does promote access to information through different channels such as social networks and websites (specifically Evokatra, a specialist farming platform), fairs and exchange visits.

ARFDDSA has also mobilised the specialised National Centre for Applied Research on Rural Development (Centre National de la Recherche Appliquée au Développement Rural or FOFIFA) to train farmer leaders in seed production techniques for rice and dry grains (beans, groundnuts). This strengthens the capacity for local seed multiplication and management within the farms themselves. It is through research done by the organisation Norwegian Malagasy Farming (Fiompiana Fambolena Malagasy Norveziana or FIFAMANOR) that fodder seeds are recommended to improve the productivity of dairy farming.

5 Agrobiodiversity and enterprise strategies

5.1 Cash-crop enterprises

Commercial production remains oriented towards securing food for urban populations. Production is mainly transported to the cities to meet the daily needs of those urban households. This large urban market encourages agricultural diversification in the production areas, as the needs themselves are very diversified. This situation is also beneficial for the farmers themselves, as it contributes also to diverse subsistence needs. Nevertheless, commercial crop planting is also putting much pressure on natural vegetation. With the current trend, natural vegetation is decreasing in terms of both amount and variety from year to year and is almost non-existent in some sites.

ARFDDSA engages producers in making their farms more profitable by gradually attracting them to organic production with higher added value. Awareness raising, cascade training and accompaniment by technical staff have been organised. These transformations are still in their infancy and will take time. However, producers are becoming more and more attentive, especially with regard to market potential. At the same time, the agroecological advice on crop rotation, intercropping, composting and agroforestry, which is popularised by the organisation, also makes it possible, to a lesser extent, to improve the profitability of crop plots.

5.2 Changing modalities of commercial cash crops

Economic returns on resources force farmers to intensify production and pay close attention to the needs of local markets. The ability of the farm to adapt as quickly as possible to a change in the market context encourages the trend towards the development of annual (short cycle) crops. If new opportunities arise, the crop can be changed more quickly.

ARFDDSA is aware of the importance of this commercial and economic dynamic, and is intensifying the promotion of agricultural entrepreneurship among its members. The model it promotes is for peasant farming to be:

- Profitable and income-generating, with control of production and access to profitable markets
- Able to meet the food and nutritional needs of the household
- Sustainably managed, integrating environmental sustainability and resilience to hazards, and
- Inclusive of active and committed women.

The diversification of agricultural and livestock production is materialising at the farm level. This is the combined effect of agroecological, food and especially nutritional advice promoted by ARFDDSA in parallel with the evolution of urban consumption (the farmers' main market).

However, the strong pressure to plant annual food crops could limit the development of agroforestry and arboriculture in the long term. To prevent this, ARFDDSA has adopted the following main strategies with its farmer organisations:

- Developing organic farming with higher added value (including fruit trees)
- Exploring and acquiring profitable markets for those crops, and
- Strengthening advocacy for the allocation of new agroforestry land to farmers.

5.3 The role of ARFDDSA in shaping what is sold

The role that ARFDDSA plays in helping farmers to diversify their enterprises is that it promotes exchanges and joint learning between farmers. It relies on external networks and social contacts to promote access to information and exchange, including trade. The result is a positive development in cultivated agrobiodiversity, but potentially at the expense of wild biodiversity if fields expand into previously unused land. Such is the land use intensity in this region that that effect is likely to be minimal.

ARFDDSA encourages the gradual structuring of 'value chains' or integration into promising sectors among its grassroots members, while maintaining agricultural diversification. With the support of farmer leaders, each farmer organisation is supported in developing a business plan for their project to promote the production and marketing of a specific product (such as a business plan for the production and marketing of beans or for producing ducks).

In order to minimise the risk of a return to monoculture production (as is the case with the few intensive livestock owners encountered in the area), ARFDDSA organises the farmer organisations into small groups (around 10 members) and each group identifies a different specialisation from the others in the area. This allows for a minimum threshold of organisation of production and sales while providing a concrete margin for diversification at the landscape level.

Capacity building for farmers is also organised regularly on the following topics:

- Sustainable farm management
- Financial management at the household level, and
- Prospecting for markets and other opportunities (such as participation in agricultural fairs, economic events, Evokatra).

ARFDDSA also places particular emphasis on the adoption of agroforestry and organic agriculture as one of the levers of sustainability. ARFDDSA is setting up a programme with the farmer organisations focused on these issues:

- Technical (techno-economic) training of farmer leaders who then train the members of the farmer organisations
- Regular accompaniments in the field by the platform's technicians to ensure the proper implementation of the planned actions and to support the farmer leaders
- Developing and implementing a network of demonstration plots and reference sites
- Intensifying research and negotiating remunerative and regular markets for tree-based products, and
- Policy advocacy on access to land.

There is a growing awareness of the need to adopt these techniques among farmer members. In addition, this has the potential to add value to their products for informed consumers – especially if farmers can use certification or production standards to better position themselves in markets.

ARFDDSA's nutritional advice cascades from its women farmer leaders to women members of the farmer organisations and encourages dietary diversification. This implicitly affects the choice of crop types and varieties in the fields. Examples include the recent introduction of soybean cultivation in the area, rabbit rearing and the return of fish farming, and the increase in self-consumption of dry grains within households.

5.4 Future plans

The short- and medium-term strategy of ARFDDSA is to disseminate and showcase demonstration and reference sites accompanied by training and support for farmer-to-farmer exchanges, notably:

- Demonstrating agroecological techniques (intercropping, crop rotation and improving soil fertility)
- Having reference sites on organic agriculture with auxiliary biodiversity
- Demonstrating agroforestry techniques to increase tree-planting
- Producing diversified crops in farmer organisations' nurseries linked to the above, and

• Ensuring that marketing works and is attractive for newer crops.

Year after year, farmers note that soil fertility is declining and that the systematic use of chemical fertilisers is 'killing' the soil. This observation is a major asset for encouraging the adoption of innovative techniques. It is therefore necessary to provide producers with successful farm management models that not only demonstrate their economic performance but also contribute to the maintenance or even improvement of agrobiodiversity.

In parallel to this, ARFDDSA will strengthen support for the smooth running of projects identified in the farmer organisations. Nutritional advice will continue, as will the dissemination of agroforestry and organic farming techniques that can improve nutrition. ARFDDSA feels that the resilience of farms rests largely on diversifying production and it will continue to mobilise its members to do so, as it has already been successful in the study area.

6 Conclusions and recommendations

6.1 Conclusions

The most important factors that allow the ARFDDSA team to help mobilise knowledge, seed and enterprises towards the maintenance of agrobiodiversity are:

- The proximity of farms to each other, encouraging exchanges between neighbours (formal or informal) which allow a flow of information about agroecological farming
- The transmission of knowledge and capacities from parents (who are responsible for most strategic decisions on the farm) to the next generation, by passing on those new techniques
- Self-supply of seed and the close proximity of suppliers of new seed, which is favourable to the maintenance and renewal of the genetic stock in the landscape, and
- The strong and diversified market demand from Antananarivo, which has a significant influence on farmers' choices and therefore has the greatest impact on the agricultural landscape.

The dynamism and strengthened capacities of farmer leaders facilitates better organisation and communication within the communities. ARFDDSA has been able to use this solid and highly functional community dynamic to initiate the necessary innovations within the farms:

- Adoption of organic fertilisation using manure, composting and the promotion of auxiliary vegetation for compost production
- Significantly reducing the use of chemical inputs to a strict minimum (in parallel with the developments above)
- The integration of fruit trees (such as orange), cash crop trees (such as coffee and ravintsara), or reforestation of others trees (such as neem and tephrosia) on farms, and
- The progressive adoption of biological pest control techniques through the promotion of auxiliary vegetation (such as comfrey, chillis, repellents).

6.2 Recommendations

Decision-making is mostly influenced by economic necessity within family farms. Agrobiodiversity will only be maintained 'naturally' if it maintains or even enhances the profitability of the farming system. The gateway to improving agrobiodiversity is therefore economic growth.

A key strategy is to develop the networks and market access for products with higher added value and that augment biodiversity. For example, certified essential oils from trees and crops, organic fruit, honey production and other new additions need to be developed by structuring the farmer organisations into functional value chains.

There is also a need to strengthen participative reflections on the impacts of farming on the associated natural biodiversity. There are many important ecological services maintained by natural areas of forest or vegetation that are being lost.

In terms of knowledge management, ARFDDSA should deepen its work in order to identify profitable, stable agrobiodiverse reference farms that are already existing and well adapted to the specific conditions of the respective target landscapes. It is often more effective to mobilise communities around existing reference farms to exchange and learn from each other – a kind of farmer field school. Showcase sites and demonstration fields will complement the scheme for more technical learning. ARFDDSA can also continue to develop and better structure farmer-to-farmer exchanges to promote these efficient models that promote agrobiodiversity.

In going forward, ARFDDSA might also support:

- Research and development of high-performance varieties, combined with an organisational approach to knowledge management and community seed management and distribution alongside extension management
- Promoting exchanges and programmes between different value chain actors in tree-based value chains
- Strengthening the structuring of producers to allow a change of scale in terms of quality, volume and regularity of combined products offered to the market while maintaining diversified farms at the base
- Developing outreach tools (including test and demonstration facilities) while keeping costs down
- Advocacy processes for facilitating access to land and promoting the benefits of agroforestry and agroecological approaches.

References

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