Enhancing agroforestry uptake in Tanzania: the role of MVIWAMA

Agroforestry case study 6. Tanzania

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Forest and Farm Facility

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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.

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Abbreviations

FFPO	Forest and farm producer organisation
MVIWAMA	Mtandao wa Vikundi vya Wakulima na Wafugaji wa Mkoa wa Manyara (Manyara Region Network of Farmers and Pastoralists Groups)
MVIWATA	Mtandao wa Vikundi vya Wakulima Tanzania (Tanzania Farmers' Association Network)
NGO	Nongovernmental organisation
SACCO	Savings and credit cooperative organisation

Summary

The Tanzanian farmers organisation Mtandao wa Vikundi vya Wakulima na Wafugaji wa Mkoa wa Manyara (MVIWAMA – the Manyara Region Network of Farmers and Pastoralists Groups) is a pioneering agroforestry institution in Tanzania. As a voluntary non-profit, non-political aligned organisation, it aims to connect groups of smallholder producers (crop growers, livestock keepers and fishers/aqua-farmers) to learn, have a collective voice, advocate and influence social and economic rights.

MVIWAMA was founded in September 2006, when it was established as a loose network of farmers. It was registered as a nongovernmental organisation (NGO) as MVIWATA Manyara in June 2011, initially under the national apex-level farmers' organisation Mtandao wa Vikundi vya Wakulima Tanzania (MVIWATA – Tanzania Farmers' Association Network). In December 2020, MVIWAMA changed from being an NGO and was registered under the cooperative societies law. This change marked the end of MVIWAMA's membership of the umbrella farmers' organisation MVIWATA. MVIWAMA now operates as an independent membership organisation.

The MVIWAMA office is located in Babati town in the Manyara region, but its member farmer producers are spread across all five districts of Babati, Hanang, Kiteto, Mbulu and Simanjiro. As of January 2025, data obtained from MVIWAMA's head office for the whole region of Manyara shows that there were 399 local producer groups, organised into 59 local networks at ward level, comprising a total of 9,343 household members including 4,321 men and 5,022 women. For Mbulu district, where this case study took place, there were 108 local producer groups organised into 18 local networks at ward level, comprising a total of 3,376 household members of whom 1,415 were men and 1,961 women. This investigation focused on the Mbulu district only.

Agroforestry systems have been established on approximately 2,727 hectares by village-level farmers producer groups in Mbulu district, including home garden systems, shade-grown cash crop systems, and silvopastoral systems. These systems are made up of a very wide range of species in different components of which the most common are listed here. In total, the case study recorded 27 agriculture food and or cash crop species and 18 timber species making a total of 45 plant species.

- Emergent timber trees include *Croton megalocarpus, Eucalyptus camaldulensis, Grevillea robusta, Melia azedarach and Schinus molle* (among others).
- Upper-canopy fruit trees include *Annona cherimola* (custard apple), *Mangifera indica* (mango tree) and *Persea americana* (avocado).
- Middle-canopy fruit trees include *Citrus limon* (lemon) and *Citrus sinensis* (chungwa), *Eriobotrya japonica* (loquat), and *Morus alba* (mulberry).
- In the lower canopy are fruit trees such as *Cyphomandra betacea* (tree tomato/tamarillo) and *Musa acuminata* (banana) with dwarf trees and shrubs such as *Punica granatum* (pomegranate).
- Beneath the canopy were found some shade-tolerant crops such as *Amaranthus hybridus* (amaranth), *Brassica chinensis* (Chinese cabbage) and *Malva trilobata* (common mallow).
- In the more open fields are basic crops such as *Zea mays* (maize), *Phaseolus vulgaris* (beans), Brassica oleracea (collard greens), *Cajanus cajan* (pigeon peas), *Capsicum frutescens* (tabasco pepper), *Cucurbita pepo* (pumpkin), *Pennisetum glaucum* (pearl millet), *Saccharum officinarum* (sugarcane), *Sorghum bicolor* (sorghum).
- Among these are grown root, tuberous and bulb crops such as *Allium cepa* (onion), *Allium sativum* (garlic), Daucus carota (carrot), *Ipomoea batatas* (sweet potato), *Solanum tuberosum* (potato).
- Although no woody climbing crop is cultivated by the sampled farmers at Mbulu, sometimes a native herbaceous climbing plant of *Coccinia grandiflora* can be seen.

This agroforestry case study reveals many trees that were known to be or have been planted as a source of financial income (cash crops) and that households use for fuelwood and building poles. Only some of these have been integrally used to improve the productivity of agroforestry systems. One species, *Eucalyptus camaldulensis* (and perhaps other eucalyptus species) that is used for timber, building poles and fuelwood was perceived by farmers to have a detrimental effect on soil and other crops because of allelopathic effects (affecting the growth, survival and reproduction of neighbouring plants through the release of secondary compounds). Nevertheless, eucalyptus remains important to

farmers especially in waterlogged sites where crops struggle to grow, and on farm boundaries as a source of timber, fuelwood and building poles, and as boundary markers and windbreaks.

MVIWAMA promotes the economic, environmental and social benefits of agroforestry and provides technical support that encourages village-level farmers' producer groups to get together and adopt agroforestry practices. Seminars, trainings and demonstration plots have promoted the establishment of such groups and practices in Mbulu district. The perceived benefits of agroforestry to members include nutritional benefits, diversified opportunities to gain economic benefit, ecological sustainability benefits, and social benefits as described in the full case study. MVIWAMA also links its members to sources of finance to cover the costs of seeds and tree seedlings. MVIWAMA also provides regular financial support to its farmer members through a group savings and credit cooperative organisation (SACCO) helping them to overcome the costs associated with establishing and maintaining agroforestry systems.

For the future, MVIWAMA has identified expansion plans that require further finance to support its members, including:

- Investing in any enterprise project that would offer profit
- Ensuring that members repay loans with interest to expand the SACCO
- Developing nurseries to collectively sell tree seedlings for profit
- Collecting members fees, and
- Seeking local and international project funds.

MVIWAMA has helped its smallholder farmer members to adopt more diverse agroforestry systems, building on its provision of education on agroforestry and environmental conservation, of seeds and seedlings of relevant fruit and timber species, and on the installation of demonstration plots as learning sites.

1. Introduction to MVIWAMA

1.1 Name and vision of MVIWAMA

The full name of this Tanzanian farmers' organisation is Mtandao wa Vikundi vya Wakulima na Wafugaji wa Mkoa wa Manyara (MVIWAMA – the Manyara Region Network of Farmers and Pastoralists Groups). MVIWAMA's vision is "To see prosperous livelihoods for all farmers, livestock keepers and fisherfolks in Manyara region" (MVIWAMA 2022). MVIWAMA has a regional coordinator and steering committee that is equivalent to a board of directors. Above this is the annual general meeting (AGM) at which all major decisions are made or endorsed. Then for operational work there exist programme officers, each with their own administrative support functions. Below the programme officers are the field staff who work on specific projects. MVIWAMA currently has four field staff who supervise the multiple stakeholders and beneficiaries groups, notably the 399 village-level farmers' producer groups (see Figure 1).

The MVIWAMA strategic plan (2022) states that MVIWAMA is a voluntary non-profit, non-political aligned organisation intending to connect groups of smallholder producers (crop growers, livestock keepers and fishers/aqua-farmers) to learn, have a collective voice, advocate and influence social and economic rights.

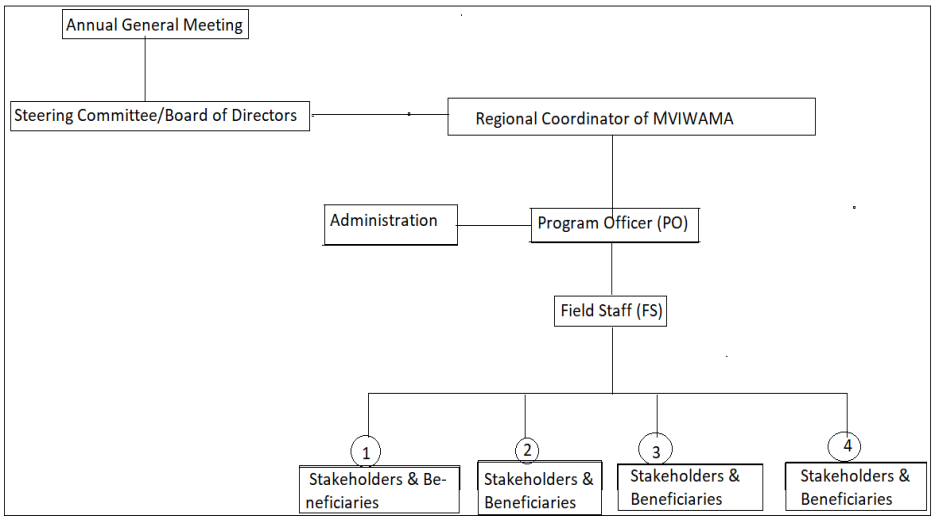

Figure 1. Organogram of MVIWAMA

1.2 Foundation of MVIWAMA

MVIWAMA was founded in September 2006, when it was established as a loose network of farmers (MVIWAMA 2022). It was registered as a nongovernmental organisation (NGO) as MVIWATA Manyara in June 2011, initially under the national apex-level farmers' organisation Mtandao wa Vikundi vya Wakulima Tanzania (MVIWATA – Tanzania Farmers' Association Network). In December 2020, MVIWAMA changed from being an NGO and was registered as a cooperative under the Cooperative Societies Act of 2013. This change marked the end of MVIWAMA's membership of MVIWATA and the start of its operations as an independent cooperative membership organisation.

1.3 Location of MVIWAMA

MVIWAMA has members in all five districts of Manyara region (Babati, Hanang, Kiteto, Mbulu and Simanjiro). The MVIWAMA head office is located in Babati town, while the farmer producer groups are spread across all five districts. This study focuses on Mbulu district (Figure 2).

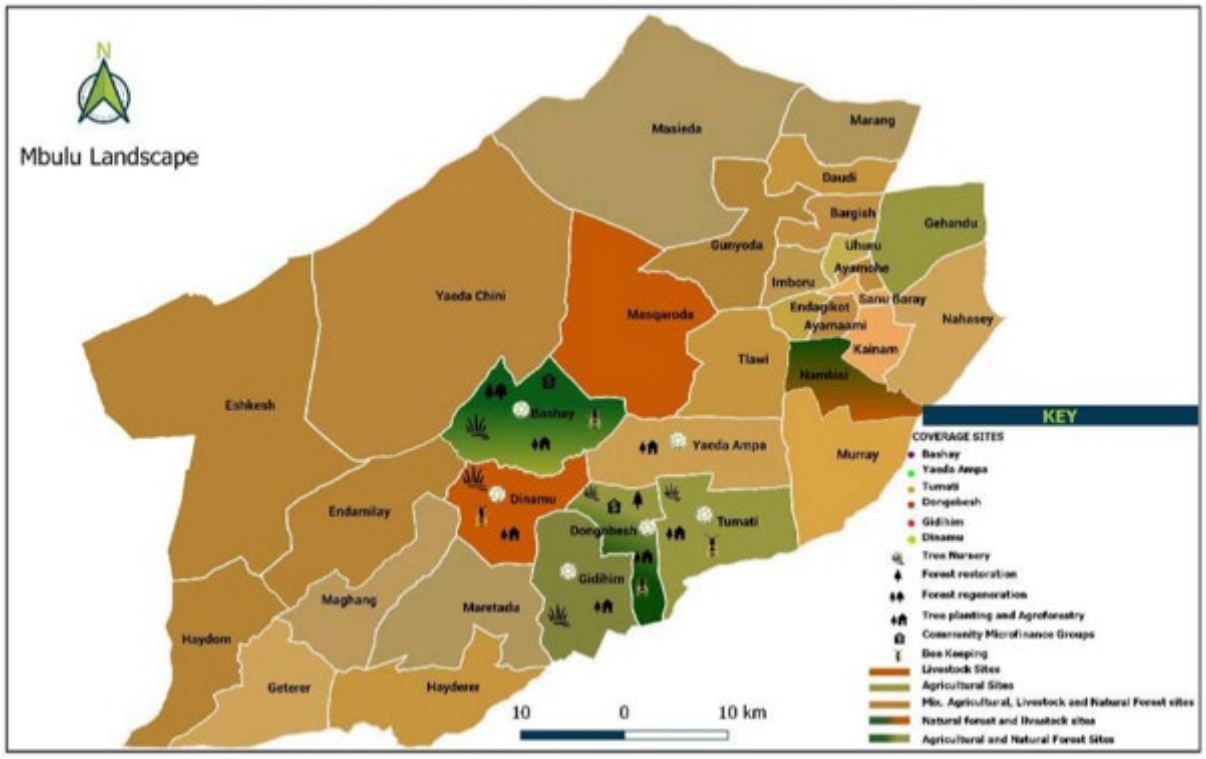

Figure 2. Map of MVIWAMA programme activities in Mbulu district, Tanzania

The vegetation type Mbulu district is tropical savannah. The area is mostly Vachellia woodland, and prominent native tree species include *Euclea divinorum, Maerua angolensis var. heterophylla, Searsia natalensis, Vachellia kirkii, Vachellia lahai* and *Vachellia seyal.* In the wet or riverine areas, prominent tree species include *Croton macrostachyus* and *Rauvolfia caffra.*

1.4 Membership of MVIWAMA

According to MVIWAMA, there has been an overall positive change in the number of individual members by 9.879% (10%) between 2021 and 2025 for the whole region of Manyara (Babati, Hanang, Kiteto, Mbulu and Simanjiro districts). There are now 399 local farmers' producer groups, organised within 59 local networks at ward level with a total of 9,343 individual members including 4,321 men and 5,022 women.

For the Mbulu district where the study was conducted, MVIWAMA covers a total of 26 villages from its local office (see Figure 3). Table 1 shows the increase in number of producer groups, networks, and men and women in Mbulu who are now members of MVIWAMA.

In Mbulu, the MVIWAMA members' total land coverage is 2,727 hectares. However, this is equivalent to only 0.5% of the whole land of Mbulu district – indicating that while membership of MVIWAMA as a whole grew from 8,503 total members in 2021 to 9,343 members in 2025, there is still huge potential for further expansion and outreach in Mbulu.

Table 1. Number of MVIWAMA producer groups, networks and members in Mbulu (2021 and 2025)

	Year	No. of producer groups	No. of local networks	No. of members		
				Men	Women	Total
Mbulu district	2021	96	16	1,335	1,872	3,207
	2025	108	18	1,415	1,961	3,376
Increase (number)		12	2	80	89	169
Percentage increase		12.5%	12.5%	5.9%	4.7%	5.3%

Figure 3. Office of MVIWAMA in Mbulu district, Tanzania

Local smallholder land holdings in Mbulu are known to range from 0.2–4.9ha. Forest and farm producer organisations (FFPOs) were established with the motive of bringing together farmers to give them a collective voice, collective economic empowerment, to find markets for their products, to support smallholder farmer to meet their needs and to improve their livelihoods. Their main products include a variety of agricultural crops, livestock and beekeeping products. Nearly all crops grown by the MVIWAMA members are either for sale or for household (subsistence) consumption, except for those trees which do not provide edible fruit or which provide timber and fuelwood for sale or home use.

2. Agroforestry systems practiced

In order to describe the agroforestry systems used by MVIWAMA members, a survey was conducted with 20 MVIWAMA member households in Mbulu district, including 11 men (55%) and 9 women (45%) (see Appendix 1).

2.1 Types of agroforestry system

The type of agroforestry systems practiced by the Mbulu district FFPOs include home gardens systems, silvopastoral systems, and shade-grown cash crop systems (as a much less frequent system). A typical example of a home garden system is shown in Figure 4. In Mbulu, some of these systems overlap (for example, some home gardens also contained livestock – see Figure 5).

Figure 4. Typical home garden agroforestry system in Mbulu district, Tanzania

Figure 5. Incorporating livestock into agroforestry systems in Mbulu district, Tanzania

2.3 Main agroforestry components and species

Each individual agroforestry system is highly dependent on the farmer involved. Nevertheless, by looking across the sample of 20 farmers it is possible to pick out a number of commonly used species. Tables 2 and 3 list the total identified species planted in the area. The main species include:

- **Emergent timber trees:** *Croton megalocarpus*, *Eucalyptus camaldulensis, Grevillea robusta, Melia azedarach and Schinus molle*.
- **Upper-canopy fruit trees:** *Annona cherimola* (custard apple), *Mangifera indica* (mango tree) and *Persea americana* (avocado).
- **Middle-canopy fruit trees:** *Citrus limon* (lemon), *Citrus sinensis* (chungwa*), Eriobotrya japonica* (loquat) and *Morus alba* (mulberry).
- **Lower-canopy fruit trees:** *Cyphomandra betacea* (tree tomato/tamarillo) and *Musa acuminata* (banana).
- **Dwarf trees and shrubs:** *Punica granatum* (pomegranate).
- **Shade-tolerant crops:** *Amaranthus hybridus* (amaranth), *Brassica chinensis* (Chinese cabbage) and *Malva trilobata* (common mallow).
- **Basic crops:** *Zea mays* (maize), *Phaseolus vulgaris* (beans), *Brassica oleracea* (collard greens), *Cajanus cajan* (pigeon peas), *Capsicum frutescens* (tabasco pepper), *Cucurbita pepo* (pumpkin), *Pennisetum glaucum* (pearl millet), *Saccharum officinarum* (sugarcane) and *Sorghum bicolor* (sorghum).
- **Root, tuberous, and bulb crops:** *Allium cepa* (onion), *Allium sativum* (garlic), *Daucus carota* (carrot), *Ipomoea batatas* (sweet potato) and *Solanum tuberosum* (potato).
- **Vine crops (woody climbers):** No woody climbing crop was recorded at the Mbulu FFPO members' area. However, a native herbaceous climbing plant of *Coccinia grandiflora* from *Cucurbitaceae* (pumpkin) family was observed in two households at Bashay village, along rare remnants of woody plant patches. The herbaceous climbing plant was self-seeded and the farmer decided protect from damage to harvest the ripe fruits for household consumption; no commercial value was recorded. As it is self-seeded, the *Coccinia grandiflora* has not been included in the cultivated crops listed in Table 3.

The field survey identified species that can be classified into two major groups: food crops (Table 2) and non-food timber, fuelwood or ornamental trees (Table 3). There were 27 agriculture food crop species and 18 non-food species making a total of 45 plant species.

Table 2. Agricultural crops grown by the MVIWAMA members surveyed

S/N	Botanical name	Botanical family	English name	Kiswahili name	Growth form	CC	SS
1	*Allium cepa*	Amaryllidaceae	Onion	Kitunguu maji	Herb	1	1
2	*Allium sativa*	Amaryllidaceae	Garlic	Kitunguu swaumu	Herb	1	1
3	*Amaranthus hybridus*	Amaranthaceae	Amaranth	Mchicha	Herb	1	1
4	*Annona cherimola*	Annonaceae	Custard apple	Stafeli/tomoko	Tree	1	1
5	*Brassica chinensis*	Brassicaceae	Chinese cabbage	Chainizi	Herb	1	1
6	*Brassica oleracea*	Brassicaceae	Collard greens	Sukuma wiki	Herb	1	1
7	*Cajanus cajan*	Fabaceae	Pigeon pea	Mbaazi	Shrub	1	1
8	*Capsicum frutescens*	Solanaceae	Tabasco pepper	Pilipili	Herb	1	1
9	*Citrus limon*	Rutaceae	Lemon	Limau	Tree	1	1
10	*Citrus sinensis*	Rutaceae	Chungwa	Chungwa	Tree	1	1
11	*Cucurbita pepo*	Cucurbitaceae	Pumpkin	Boga	Herb	1	1
12	*Cyphondra betacea*	Solanaceae	Tree tomato/tamarillo	Mtinyanya	Tree	1	1
13	*Daucus carota*	Apiaceae	Carrot	Karoti	Herb	1	1
14	*Eriobotrya japonica*	Rosaceae	Loquat	Sangiri/Sambia	Tree	1	1
15	*Helianthus annuus*	Asteraceae	Sunflower	Alizeti	Herb	1	1
16	*Ipomoea batatas*	Convolvulaceae	Sweet potato	Kiazi kitamu	Herb	1	1
17	*Malva trilobata*	Malvaceae	Common mallow	----------	Herb	0	1
18	*Mangifera indica*	Anacardiaceae	Mango tree	Mwembe	Tree	1	1
19	*Morus alba*	Moraceae	White mulberry	Mfurusadi	Tree	0	1
20	*Musa acuminata*	Musaceae	Banana	Mgomba	Herb	1	1
21	*Pennisetum glaucum*	Poaceae	Pearl millet	Uwele	Grass	1	1
22	*Persea americana*	Lauraceae	Avocado	Mparachichi	Tree	1	1
23	*Phaseolus vulgaris*	Poaceae	Beans	Maharage	Herb	1	1
24	*Punica granatum*	Lythraceae	Pomegranate	Mkomamanga	Shrub	1	1
25	*Saccharum officinarum*	Poaceae	Sugarcane	Muwa	Shrub	1	1
26	*Solanum tuberosum*	Solanaceae	Potato	Kiazi ulaya	Herb	1	1
27	*Sorghum bicolor*	Poaceae	Sorghum	Mtama	Grass	1	1

Key: 0 = does not fall under such category; 1 = falls under such category; CC = cash crop; SS = subsistence

The survey revealed trees that were conserved or had been planted (Table 3) as source of financial income (cash crops) and for household use as fuelwood and building poles. Some species are also preferred for agroforestry. Only one species of eucalyptus, *E. camaldulensis,* was felt by farmers to

have a detrimental effect on soil and other crops because of allelopathic effects (affecting the growth, survival and reproduction of neighbouring plants through the release of secondary compounds) (Alebachew et al. 2015). Nevertheless, eucalyptus remains important to farmers especially in waterlogged sites where crops struggle to grow, as a source of timber, fuelwood and building poles, and as boundary markers and windbreaks.

Table 3. Timber and fuelwood trees grown by the MVIWAMA members surveyed

S/N	Botanical name	Botanical family	English name	Kiswahili name	Growth form	CC	HU
1	*Acacia mearnsii*	Fabaceae	Wattle	Muwato	Tree	1**	1**
2	*Albizia gummifera*	Fabaceae	Peacock	Mkenge	Tree	1*	1*
3	*Azadirachta inica*	Meliaceae	Neem tree	Mwarobaini	Tree	1*	1*
5	*Cordia africana*	Boraginaceae	Sudan teak	Mringaringa	Tree	1*	1*
6	*Croton megalocarpus*	Euphorbiaceae	Croton	Msenefu	Tree	1*	1*
7	*Cupressus lusitanica*	Cupressaceae	Cyprus	Msanduku	Tree	1**	1**
8	*Eucalyptus camaldulensis*	Myrtaceae	Gum tree	Mkaratusi	Tree**	1**	1**
9	*Grevillea robusta*	Proteaceae	Grevillea	Mgrevilia	Tree*	1*	1*
10	*Helianthus annuus*	Asteraceae	Sunflower	Alizeti	HERB	1*	1*
11	*Melia azedarach*	Meliaceae	Chinaberry	Mmelia	Tree	1*	0
12	*Pinus patula*	Pinaceae	Pine	Mpaina	Tree	1*	1*
13	*Rauvolfia caffra*	Apocynaceae	Quinine tree	Msesewe	Tree	1*	1*
14	*Schinus molle*	Anacardiaceae	California Pepper	Mpilipili	Tree	1*	1*
15	*Senna siamea*	Fabaceae	Cassia tree	Mjoholo	Tree	1**	1**
16	*Senna spectabilis*	Fabaceae	American cassia	Mhomba	Tree	1**	1**
17	*Terminalia mantaly*	Combretaceae	Umbrella terminalia	Mtimwavuli	Tree	0	1**
18	*Vachellia kirkii*	Fabaceae	Floodplain acacia	Mgunga jamii	Tree	1**	1**

Key: CC = cash crop; HU = home use (fuelwood, building poles, ornamental); 1* = present under this category with preference for agroforestry; 1** = present under this category but harms the sustainability of the agroforestry system

The recorded livestock included cattle, ducks, goats, pigs, poultry and sheep. Poultry were reared by nearly all members, while goats were reared by most but not all, followed by cattle, sheep and pigs. Duck was ranked the least commonly reared (see Table 4 and Figure 6)

Table 4. Livestock species reared by the MVIWAMA members surveyed

Scientific name	English name	Kiswahili name	Rank
Gallus gallus	Poultry	Kuku	1
Capra hircus	Goat	Mbuzi	2
Bos taurus	Cattle	Ng'ombe	3
Ovis aries	Sheep	Kondoo	4
Sus domesticus	Domesticated pig	Nguruwe	5
Anas platyrhyncos	Duck	Bata	6

Key: 1 = most commonly reared; 6 = least commonly reared

Figure 6. Local cattle are kept and sometimes fed on grass or fodder

No nitrogen-fixing plant species or protein-rich fodder hedges were recorded, except the evergreen, thorny shrub *Dovyalis caffra* that was recorded at two households as a home fence. However, nitrogen-fixing plants within some of the farms were recorded such as *Calpurnia aurea* at Elibariki Paulo's farm, in Tumati village, belonging to the Upendo farmers' group. Also, indigenous tree species *Albizia gummifera* and *Vachellia kirkii* were recorded at one member's home in Bashay village. Those trees were also known to be crucially important as be fodder.

Over 75% of the land of the farmers surveyed was classified as some form of agroforestry system, while 25% was noted to belong to other activities such as grazing pasture only, solid tree plantations, or conservation areas.

2.4 Scale of agroforestry farms

The size of the land by individual members ranged from 0.2–4.9ha. The majority of members' land is privately owned (100%). Private ownership of land is the possession of land by a private person or family and has the right to use that land or property (Powell 1998; Benditt 2015). In total in Mbulu district, the area of agroforestry established by farmers belonging to MVIWAMA is estimated to cover 2,727 hectares.

3. Motivation to adopt agroforestry systems

3.1 Origin and promotion of agroforestry

From the literature, it has been highlighted that for farmers there are multiple motivations for practicing agroforestry systems, including sustaining the household economy, supporting environmental sustainability, mitigating and adapting to climate change, and improving landscape stewardship (Schaffer et al. 2024). Many of these reasons also apply to this MVIWAMA context.

According to the survey results from 20 farmers, the perceived (observed) benefits that caused farmers to establish this agroforestry system included:

- **Nutritional benefits:** Agroforestry was perceived to provide more varied nutrition.
- **Economic benefits:** Agroforestry was perceived to provide an opportunity to increase income through diverse crops, to reduce inputs costs by improving soil fertility, to access markets for products such as fruits, timber and honey, and to improve employment opportunities.
- **Ecological benefits:** Agroforestry systems were perceived to contribute to soil conservation and fertility, better water management, and enhanced resilience to climate change, alongside broader environmental benefits such as biodiversity conservation and carbon sequestration, contributing to global climate change mitigation.

- **Social benefits:** Agroforestry system were perceived to improve food security and foster community collaboration.
- **Technical and financial support:** The local farmer group members are motivated by the support and incentives they have received from MVIWAMA, which provides technical and financial assistance, thus making agroforestry systems both practical and sustainable.

In summary, MVIWAMA's members have benefitted from collective actions to develop agroforestry and market research to help find market for new products at standardised scales and prices. MVIWAMA has also collective empowered its members through access to biogas installations that can make use of livestock manure (see Figure 7) and seeds of different species, as well education and seminars.

Figure 7. Support from MVIWAMA to install a biogas digester at a member's farm

MVIWAMA started to promote agroforestry systems in 2013. The processes used to persuade farmers about the benefits of working collectively as FFPOs to establish agroforestry systems included seminars on the advantages of agroforestry, training on agroforestry practices and the establishment of demonstration plots. These processes are considered in more detail in Section 4.

3.2 Nutritional benefits

Farmers perceive numerous benefits in terms of the number and diversity of food or other useful products that can be used by the household. They have been able to adopt mixed farming methods that offer a diverse range of crops: if one or more crops fail, they can still harvest others. Most have also started zero grazing or 'cut-and-carry' fodder systems that ensure a regular supply of manure for biogas and have improved soil fertility by planting mixed crops such as *Zea mays* (maize), *Phaseolus vulgaris* (beans) and *Helianthus annuus* (sunflower).

For women, they perceive that agroforestry offers a variety of crops that can be marketed and/or used for household consumption. Crops include most vegetables that can be grown within other crops in home gardens and agroforestry systems. Home gardens offer massive resources for home use and reduce time wasted fetching food or watering crops at plots that are further away from the home. Producing biogas has also reduced the need to search for fuelwood. These improvements have helped to reduce the burden on women.

3.3 Economic benefits

Most of the male FFPO members say they have been able to improve sustainable livelihoods by building or modifying their old family houses to a better standard, and being able to buy more livestock (cattle, goats and sheep). Women have been better able to sustain themselves from the additional crops such as honey products and garlic. This was particularly true for some of the women participants (those who are elderly or divorced).

3.4 Ecological benefits

Men perceive agroforestry systems as ecologically friendly, with several benefits:

- Green manure from livestock is used to grow agriculture crops, while mulching is applied on land, thus improving the soil quality.
- Agroforestry offers livestock fodder (such as tree leaves, maize, beans, bananas, carrots, sunflower seeds). The men no longer have to spend time walking a long distance seeking for livestock fodder.
- Agroforestry minimises or controls erosion caused by water runoff and wind. The planted shrubs and short and tall trees act as a wind break, reducing wind that could damage houses and discourage households' comfort, and
- Agroforestry offers crops which can be sold to earn money which can be used to buy livestock and pay school fees for their children.

Women perceive agroforestry as a great help in terms of availability of agricultural crops and of livestock fodder around the home, which enables them to keep livestock (which they less likely to do before). The availability of green manure and mulching at households allows the women to improve the soil and crop yields. Agroforestry systems also control erosion, thus reducing the risks of soil fertility loss. Wind breaks provided by the agroforestry trees help to reduce crop damage and shelter women working at home both during windy and sunny seasons.

Figure 8. Home garden fertilised with livestock manure and plant mulch

3.4 Social benefits

For women, the agroforestry system helps them to solve the nutritional challenges they face. They also spend less time fetching fuelwood: some now use biogas, while others they can now readily collect fuelwood from their home gardens, which are comprised of herbaceous and woody plant species with branches that can be pruned or pollarded for use as fuelwood. It is also easier to feed their cattle themselves from the livestock fodder obtained at or near their household gardens. The agroforestry systems promoted by MVIWAMA insists on the conservation of native plant species while also planting fruit trees to improve livelihoods, thus reducing the distance to walk seeking for fruits. All of these labour-saving characteristics increase the time that women have for social interactions with their families and with the wider community.

For youths, the system helps them to learn quickly because home gardens are exactly where they live. Producing biogas reduces the time and effort required of them for finding fuelwood instead of home studying when back from school. Home gardens also encouraged them to rear livestock for producing biogas and farming manure.

According to MVIWAMA, marginalised groups are also being involved in the agroforestry production system, including older people (those aged 65 or above), those with disabilities, divorced women and widows. They can perform a diverse set of activities within the agroforestry such as gardening from

home, beekeeping, livestock keeping, processing of products (honey and garlic), and keeping fish ponds that help them to earn money and foods for their households. Also, the procurement of seeds, seedlings, organic inputs and market research for products can involve them without any prejudice because of their status. For culturally marginalised people such as the hunter-gatherer Hadzabe tribe, MVIWAMA recruits them as members together with other tribes, while also involving their own groups in MVIWAMA capacity-building courses.

3.5 Disadvantages

Despite the many perceived benefits of agroforestry systems, there are some well-known disadvantages:

- **Complexity and labour to maintain the agroforestry system:** Members of the FFPO who are committed to agroforestry system development find it difficult to get casual labourers at the necessary time. Most activities in agroforestry must be done on time, with certain agricultural crops having to be planted before others. Significant pruning and or pollarding activities are also needed at particular times of the year, alongside the collection of manure and storing livestock fodder. Finding casual labourers to meet these bursts of necessary activity is very difficult and expensive, thus compelling members to search for labourers in neighbouring villages while also incurring costs for transport and providing meals in addition to normal daily wages.
- **Time delay before harvesting commences:** The extended time before harvesting of the tree components commences means that farmers have to have enough money up-front to pay their labourers. In addition, many crops have varying storage requirements that must be met to preserve them properly (for example, some crops have seeds that do not survive drying and freezing during ex-situ conservation). Also, some crops may be ready at time when the money is not available and or crops may become overgrown, thus loosing market quality.

The disadvantages revealed by field survey are either avoided or minimised as follows:

- To manage the shortage of casual labourers, the FFPOs members go to nearby villages and order a given number of labourer hours.
- To manage financial constraints, FFPOs members set aside money from what they sell when harvesting crops so as to have available budget when needed.
- Members can also take out loans from village community banks (VICOBA), a type of SACCO, to help to solve financial problems.
- Livestock such as sheep, cattle and goats can be sold to solve financial shortfalls.
- Members can also take out private loans from fellow MVIWAMA members.

4. Design and installation of agroforestry systems

4.1 Guidance from MVIWAMA on agroforestry installation

There are several steps required for farmers to join MVIWAMA:

- **Form a group:** Farmers must first organise themselves into groups, and each group must have a minimum of five members.
- **Registration process:** Each group should provide details and register their name using the MVIWAMA registration form, which can be obtained from MVIWAMA offices or local network leaders' representatives.
- **Payment of registration fee:** Farmers are required to pay a registration fee, which includes the cost of a membership card for each member.
- **Payment of annual fees:** To maintain an active membership farmers must pay an annual fee. This ensures they remain eligible for continued services and support from MVIWAMA.
- **Accessing MVIWAMA services:** Once registered and fees are paid farmers can start benefiting from MVIWAMAs' services.

Once farmers belong to a group that is a member of MVIWAMA, they are entitled to support for agroforestry development. The MVIWAMA field staff provide training in the design of the main agroforestry components. MVIWAMA then chooses one of the members' farms to establish a demonstration plot. For example, at Kastuli Paulo's farm, MVIWAMA provide seeds for the various crops to be grown. Other members were then supported to copy and install the same agroforestry system. Also, MVIWAMA organised members to establish woodlots/home gardens around homesteads mixed with herbaceous food crops for food security.

4.2 Seed sources

In this case study site, farmers receive seeds, planting materials (seedlings) and planting advice from MVIWAMA to plant the different components of their agroforestry system. MVIWAMA provides seeds, polythene bags, watering cans and spades, while also arranging seminars and trainings on how to operate the system.

Figure 9. Agroforestry seedlings grown and distributed by MVIWAMA

4.3 Management issues

There have been a number of challenges to adopting agroforestry systems as already noted above. The main management challenges of the agroforestry system among many others include:

- Limited availability of required casual labour (human resource) to perform different activities in establishing agroforestry systems.
- Higher costs of hiring labour when sourced from bordering villages, with transport and meals becoming additional costs to the normal daily wages.
- Delays in planting agroforestry crops during the planting season, as labour shortages can cause farmers to miss monthly targets, and when planting is delayed yields are never guaranteed.
- Inputs delays, sometimes caused when fertilisers arrive late. Because of this, many members are now turning to manure as a source of fertiliser.
- Inadequate buyers (market) and lower prices for more varied harvested crops. When yields are ready there is often a shortage of people to buy them.
- Market selective behaviour, which can work against diverse agroforestry systems. For example, even when buyers such as National Food Reserve Agency (NFRA) offer to pay good prices they still tend to be very selective about they buy. In terms of maize, such buyers prefer only white coloured corns to red, black, yellow or mixed colours that come from locally adapted land races in agroforestry systems.
- Buying delays by companies or institutions that are willing to pay higher prices to the FFPOs, while 'smugglers' or 'traders' (*walanguzi*) tend to buy first, although paying very low prices.

- Lack of indicative prices of agriculture crops set by the government. Some crops such as *Daucus carota* (carrots) and *Allium cepa* (onions) do not have set indicative prices and weights, and buyers come with their own scales and prices.
- Impact of climate change when relying on rainfall. The farmers face a challenge of agricultural crops failure, thus facing hunger and lack of financial income for that particular season or year when prices for basic food stuffs can easily double in price.

To overcome or minimise management these management challenges, MVIWAMA and local FFPO member groups help farmers by:

- Bringing seeds to FFPOs members in collaboration with the agricultural input company Meru Agro, although demand almost always outstrips supply, and
- Seeking sustainable markets for the FFPOs members' products. This has worked well for *Allium cepa* (onions) and *Allium sativum* (garlic) and MVIWAMA is currently exploring markets for additional crops.

5. Aggregation and sale of agroforestry products

5.1 Markets for products

Farmers use various arrangements to market and sell their products. The setting-up of group-based enterprises has enabled the farmers to organise into cooperatives and aggregate their products, to negotiate better prices and access larger markets. As these groups have become established, through value addition, the farmers have also improved product quality. Commercially sold products by forest and farm producers now include honey, beeswax, garlic, carrots and potatoes.

A good example is that of *Allium sativum* (garlic) which is bought from FFPOs members and others. The garlic is processed using a machine, packaged, labelled and sold by the FFPOs to both retail and wholesale buyers. In the case of garlic, the group enterprise now produces garlic oil, paste and powder. The differentiation into different products is increasing profitability. In collaboration with MVIWAMA, the farmers have created market linkages with buyers, processors and different farmer's exhibition events. Another example of products commercially sold by the FFPOs includes honey which is harvested from their hives. It is then processed, packaged, labelled and sold by to both retail and wholesale buyers (see Figures 10 and 11).

Figure 10. Honey being produced by smallholder farmer members of MVIWAMA

Figure 11. Processing Manyara honey and the end product produced by MWIVAMA members

The main end markets of products are local and national markets. The components used for home subsistence are almost vegetables such as *Amaranthus hybridus* (amaranthus), *Cucurbita pepo* (pumpkin), *Malva trilobata* (common mallow, which is only for home consumption), *Phaseolus vulgaris* (beans), *Zea mays* (maize), and any other food crops that are sold but can also be used as subsistence resources.

5.2 Changes over time in enterprise initiatives

The different value chains managed by MVIWAMA have changed over time, especially honey and garlic production. The FFPOs' honey production started with 20 beehives, with several local beehives owned by private individual members at their homes. But now production has expanded hugely with initial purchase of packaging materials done by MVIWAMA.

Similarly, garlic production has changed over time since MVIWAMA started to support its members through seminars and training and also researching markets garlic. Initially, local FFPOs had not had great success. They decided to service an already-existing garlic-processing machine belonging to the Madima group in Bashay village. The machine was supported by MVIWATA until 2017 when there was a parting of ways, and then MVIWAMA took over support to the group. Today, the raw materials (garlic) for feeding this small industry come from the FFPOs members and other individuals and are processed into garlic oil, paste and powder. As an innovation, honey is now being mixed with garlic products and sold at local markets, and at national agricultural shows (such as the annual Nanenane Farmers' Exhibition). MVIWAMA also sells the FFPOs' products from its head office in Babati and sends back the money to the producers.

An individual farmer receives a profit of approximately US$75 (200,000 Tanzanian shillings) per 100kg of garlic. The recorded overall harvests of garlic per annum was 10 tonnes which is 10,000kg. When sold unprocessed, this was known to yield an income of US$30,000 (80,000,000 Tanzanian shillings) with a profit of US$7,515 (20,000,000 Tanzanian shillings), but when processed could yield twice as much profit (Table 5).

Table 5. Financial income from garlic per annum

Garlic sold	Tonnes	Kilos	Price per kilo	Total income	Profit
Unprocessed Garlic	10	10,000	8,000	TZS 80,000,000	TZS 20,000,000
Processed Garlic	10	10,000	10,000	TZS 120,000,000	TZS 40,000,000

During the case study survey, a visit was made to the honey-processing industry of the Muungano group in Bashay village. Even though no processing, packaging or labelling was happening at the time (being out of season), a few previously packaged products were still available for sale, with an expectation of harvesting more honey in February 2025.

The garlic and honey products have provided employment, both to machine operators and farmers, and have improved peoples' financial income. Beekeeping has also expanded because of individuals selling honey to MIVWAMA, and money for agroforestry expansion has also been accrued. Nearly all FFPO members revealed that they keep bees as source of staple food and to provide a source of income to supplement other types of agroforestry products.

As mentioned, MVIWAMA has also supported members by researching markets for products such as onions and garlic. It has succeeded in providing a new honey-processing machine and maintaining/servicing the existing garlic-processing machine, while also selling garlic and honey products from its head office in Babati. Furthermore, through the Food for Progress Programme (FFP), MVIWAMA has constructed a honey-processing machine house (completed early in 2025 – see Figure 12).

In summary, multiple positive changes have occurred over time through the development of agroforestry enterprises. These include improvements and increases in:

- Individual profits
- Number of new members seeking to emulate the observed benefits
- Markets for agroforestry products (such as garlic and honey)
- On-farm employment
- Livestock rearing and livestock fodder (which increases the availability of manure for producing fertiliser and biogas)
- Product processing
- Food security
- Environmental conservation (through planting a variety of perennial plants and protecting damaged remnants of native woodland)
- Use of manure and mulching
- Improved soil quality
- Number of trees planted, and
- Ecosystem services in villages and peri-urban areas (such as better water regulation and carbon storage).

5.3 Future plans

The external social networks or contacts managed by MVIWAMA will continue to affect what is cultivated and sold in the future. MVIWAMA's strategies to further benefit farmers include priority interventions such as:

- Planning for indicative prices on lesser-used crops
- Continuing education, seminars and trainings to members and other people in the area
- Conducting market research for the best prices for crops at local, national and international levels
- Distributing newsletters about the benefits of agroforestry systems
- Investing in new machines with higher processing capacity for garlic. The existing garlic-processing machine works for few hours but then has to be stopped to cool down, which delays production.

- Growing different varieties of garlic (existing garlic products are highly marketable domestically but do not attract buyers from abroad such as China and Japan)
- Conserving the remaining areas of natural vegetation, and
- Considering the potential for ecotourism (such as along the riverside at Tumati village) and in other areas.

6. Financing of agroforestry activities

It has been stated that making full and efficient use of agroforestry systems is both a challenge and an opportunity to the agroforestry scientific community (Alavalapati and Mercer 2005). To help better prepare themselves for this challenge and to seize opportunities, those promoting agroforestry need to understand how best to finance the multidimensional aspects of scientific agroforestry (Dagar and Tewari 2016).

As per the FFPO respondents who took part in this study, members have been financed in various ways to develop their agroforestry plots:

- **Grants and donations:** FFPOs have secured funding from donors such as the Food and Agriculture Organization of the United Nations (FAO) Forest and Farm Facility (FFF) grant to MIVWAMA, or government programmes to support agroforestry and related projects.
- **Partnership and collaborations:** FFPOs such as MVIWAMA collaborate with organisations such as Mkulima Mbunifu (meaning 'creative farmer') and Sustainable Agriculture Tanzania (SAT) to provide capacity building for farmers and to distribute educational materials and information to enhance agroforestry practices.
- **Capacity-building funds:** Using SACCOs, FFPOs save and allocate their own funds to train members in agroforestry practices, ensuring sustainable management and improved productivity of agroforestry systems.

6.1 Start-up and running costs

The main costs involved in setting up and maintaining the agroforestry system have been ranked by respondents' responses in Table 6.

Table 6. Ranking of activities based on costs

Activity	Cost ranking
Labour to clear land	1
Buying tree seedlings	2
Growing tree seedlings	3
Fertiliser	4
Weeding	5
Irrigation	6

Key: 1 = most expensive; 6 = least expensive

6.2 External finance

There has been an external source of funds from a MVIWAMA project through an FFF grant to support its members in covering the costs of seeds and tree seedlings.

6.3 Internal finance

MVIWAMA helps farmer members through a group SACCO scheme to overcome the costs associated with establishing and maintaining agroforestry systems. For example, MVIWAMA has provided loans to local FFPOs, such as the Ufanisi group which has 30 members in Dongobeshi. The group, just like others, was given a revolving fund of 2,000,000 Tanzanian shillings by MVIWAMA to top up the

financial share (savings) of its members which was 1,600,000, making a total of 3,600,000. Each member is allowed to take out an individual loan worth three times the amount of their share capital. Loans must be repaid with 10% interest within three months.

6.4 Future plans

MVIWAMA's future expansion plans will require financing. Plans include supporting its members by investing in any project that will offer profit, making sure that members repay their loans with interest, making sure that local FFPOs collect membership fees, and selling tree seedlings produced by its members at a profit. Membership fees, interest on loans and profits from group sales will then be deposited into each group's bank account, thereby expanding the group's savings.

In addition, the FFPOs with support from MVIWAMA are about to complete the honey-processing premises and office in Bashay village (Figure 12).

Figure 12. Construction of the Muungano group's honey-processing premises, Bashay village, Mbulu

7. Conclusions and recommendations

7.1 Key innovations

MVIWAMA has helped the smallholder farmer members adopt more diverse agroforestry systems by providing education on agroforestry and environmental conservation, establishing demonstration plots, and providing inputs such as seeds and seedlings. MVIWAMA has also provide financial support, such as financing for processing facilities for onion and garlic, fishing ponds and biogas installation. It has also conducted market research.

7.2 Remaining challenges

As a democratic FFPO with a large group of members, challenges have arisen such having a collective understanding of how to implement agroforestry systems. There have also been different speeds of implementation, because of variances in ways of thinking and individual strategies among members. Finance also remains a main challenge due to the high demand for labour for agroforestry. Furthermore, obtaining loans from banks such as NMB Bank and CRDB (two leading Tanzanian commercial banks) is not easy for an individual farmer member and even if it is possible may take a long time to process.

External support should facilitate the availability of finance to cover various emerging costs, facilitate the groups' internal savings through SACCOs, and offer education on loans and budgeting at the individual level.

7.3 Policy support and barriers

Policy is a set of ideas or plans that is used as a basis for making decisions, especially in politics, economics or business (Ojumu 2022). According to this study, the main policies that have supported members at Mbulu district include:

- **National Agricultural Policy:** The FFPOs members highlighted that this policy recommends growing a variety of crops as sources of financial gain and for household food security. Agroforestry is recommended to improve soil quality. There are also urban agrarian policies which encourage home gardens (homestead gardens). The National Agriculture Policy (United Republic of Tanzania 2013) revolves around the goals of developing an efficient, competitive and profitable agricultural industry that contributes to the improvement of the livelihoods of Tanzanians and the attainment of broad-based economic growth and poverty alleviation.
- **National Forestry Policy:** Agroforestry applied by the FFPOs members is appreciated by the Tanzania National Forest Policy which encourages tree planting and conservation of native trees, especially at catchment water areas. Agroforestry as part of forestry is a practice where agricultural crops and trees are intercropped on one farm land (United Republic of Tanzania 1998a).
- **National Beekeeping Policy:** Agroforestry sustains vegetation which is important as a source of a variety of nectar and pollen for honey bees. For local hives, trees are important for hanging the log beehives. The National Beekeeping Policy Implementation Strategy (United Republic of Tanzania 2021) focusing on the National Beekeeping Policy (United Republic of Tanzania 1998b) among others states that agroforestry is a practice where agricultural crops and trees are intercropped on one farmland, and api-agroforestry is a practice where beekeeping is carried out on the same land so that bees can collect nectar and pollen from the cultivars and natural flora and in return render pollination to flora.
- **National Land Policy:** This policy recommends the maximum utilisation of land through a variety of uses, including intercropping species (such as herbaceous annual and perennial species, and trees of various sizes and use) to minimise land damage. The National Land Policy (United Republic of Tanzania 1995) focuses on the prediction of changes in environmental quality that would result from the proposed action, attempts to weigh environmental effects on a common basis with economic costs and benefits.
- **National Tourism Policy:** In Tanzania there is great tourism potential, based on its wildlife and spectacular landscape and scenery, water bodies and beaches, a diversity of cultures and

numerous archaeological sites (United Republic of Tanzania 1999). Agroforestry systems can protect such terrestrial and aquatic environments and provide opportunities for ecotourism enterprises. An example of a potential ecotourism site in Mbulu district is Tumati village where there is the Rocky River bank with a small waterfall and a pond for irrigating farms downslope. The area is already known to attract tourists.

On the other hand, according to the FFPOs members, the policies that seemed to threaten agroforestry system include:

- **National Trade Policy:** The National Trade Policy (United Republic of Tanzania 2023) supports a diverse of stakeholders, being any person or group of people who have an interest in trade, including the private sector and development partners. However, the policy does not set indicative prices for agricultural produce, nor does it specify quality standards for crops sold in relation to the prices set by the buyers.
- **National Land Policy:** When land uses change from being farmland to settlements (town councils), this may force farmers to legalise their land through leasing (United Republic of Tanzania 1995). However, land leasing costs money which most low-income earners cannot afford.
- **National Transport Policy:** This policy has disregarded building transport infrastructure to enable access to and from fertile areas located at a distance from existing main roads, making it costly to transport crops to market.

7.4 Policy recommendations

The FFPOs proposed what could be changed to make a more enabling environment for the spread of agroforestry systems, including recommendations for government:

- Improve and establish road infrastructure within the agroforestry operating areas
- Formulate indicative pricing for newer agroforestry crops
- Support smallholder farmers (FFPO members and others) in the implementation of agrobiodiversity
- Conduct market research and help producers find markets for their products (this applies to both the government and MVIWAMA), and
- Implement product quality and biosafety standards and checks for agroforestry products, as crops such as vegetables are being sold after they have been sprayed with pesticides.

External support partners are also requested to help drive the adoption and expansion of agroforestry systems:

- Continue creating a conducive environment by offering education, training, seminars and workshops both at local and even international levels.
- Provide funds to support efficient processing, packaging and labelling of products (such as honey, and garlic).
- Explore international markets for organic crops in order to fetch higher prices.
- Establish a mechanism or standard for testing product quality and biosafety checks for agroforestry products to reveal whether the vegetables sold at markets are fit for human consumption or are toxic due to sprayed pesticides.
- Support a new garlic-processing machine at Madima group in Bashay village, where the existing processing machine seems to be of low capacity, even though it is serviced regularly with the support of MVIWAMA.
- Fish ponds established by individual members (such as the one belonging to Emmanuel Daniel) need to be filled with fish, preferably terrapin and not catfish.
- Support the establishment of ecotourism ventures, as tourists have shown an interest in visiting numerous areas in Mbulu such as the waterfalls in Tumati village.

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Appendix 1. Survey participants

The survey participants for this research included 20 members of MVIWAMA groups in Mbulu district.

S/N	Name of respondent	Name of group	Village	Sex		Remarks	PBG	NPBG
				M	F			
1.	Agripina Hipoliti	Muungano	Bashay	0	1	Divorced	0	1
2.	Catherine Akonay	Ufanisi	Dongobeshi	0	1		1	0
3.	Clement H Malleiyek	Ufanisi	Dongobeshi	1	0		1	0
4.	Elibariki Paulo	Upendo	Tumati	1	0		1	0
5.	Emmanuel Daniel	Ufanisi	Bashay	1	0	Old & deaf	0	1
6.	Euphrasia Petro	Muungano	Bashay	0	1		0	1
7.	Felista Paulo	Ufanisi	Endeshi	0	1		0	1
8.	Julius Albert	Mapambano	Gidhim	1	0		0	1
9.	Karist Paulo	Ufanisi	Dongobeshi	1	0		1	0
10.	Kastuli Paulo	Ufanisi	Bashay	1	0		1	0
11.	Lucas Lorry	Ufanisi	Dongobeshi	1	0		0	1
12.	Marcela Desderi Mau	Madima	Bashay	0	1		0	1
13.	Mary James	Muungano	Bashay	0	1	Youth/single	0	1
14.	Neema H Ollo	Nyuki na Mazingira	Bashay	0	1		1	0
15.	Niima Nade	Muungano	Bashay	1	0		0	1
16.	Nikola Yesaya	Ufanisi	Dongobeshi	1	0		0	1
17.	Raphael Cleo	Ufanisi	Bashay	1	0		1	0
18.	Regina Paulo	Tumaini	Tumati	0	1		0	1
19.	Teophil Tluway	Muungano	Bashay	1	0		0	1
20.	Theresia A Laurent	Muungano	Bashay	0	1		0	1
	Total			**11**	**9**		**7**	**13**
	Percentage			**55**	**45**		**35**	**75**

Key: M = male; F = female; PBG = processing biogas; NPBG = not processing biogas