

Successful smallholder management of agrobiodiversity in Northern Tanzania

Producer organisation: Mtandao wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha (MVIWAARUSHA)



Agrobiodiversity Case Study 5: Tanzania

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Acronyms

FAO	Food and Agriculture Organization of the United Nations
FFF	Forest and Farm Facility
FFPO	Forest and farm producer organisation
MVIWAARUSHA	Mtandao wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha (Network of Groups of Farmers and Breeders of Arusha)

Summary

This case study describes the work of the forest and farm producer organisation (FFPO) Mtandao wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha (MVIWAARUSHA).¹ The FFPO represents almost 12,500 smallholder farmers organised into 446 local groups, including 46 ward-level networks and six district-level networks in Northern Tanzania. Land use in the region is divided into two major categories: agricultural land specified for growing food and cash crops; and conservation areas (especially by the Ngorongoro Conservation Authority Area or NCAA, which is a totally protected area).

This case study looks in detail at Karatu and Monduli districts. Karatu and Monduli are enormously rich in agrobiodiversity because of the natural variation and productivity of tropical savanna and forest systems. MVIWAARUSHA works to promote agroecological productivity in the region and has taken part in the preservation of agrobiodiversity in both agricultural and forest landscapes.

MVIWAARUSHA organises and supports its members in policy advocacy, agroecological productivity, the development of financial services and marketing, and promotes the effective mobilisation and management of the networks' resources. MVIWAARUSHA envisions a strong rights-based and socioeconomically network of empowered farmers and pastoralists achieving sustainable livelihoods from agriculture and animal crops.

The smallholder farmer's development success through MVIWAARUSHA is rooted in its members' solidarity. Most are involved in agriculture and rearing livestock, with a focus on the rehabilitation and restoration of degraded natural resources, protecting intact natural vegetation, and enriching agroforestry systems with trees on farms. Retained trees and woodlots within the homesteads of smallholder farmers offer fruit, lumber, poles, firewood, windbreaks, shade, livestock fodder and soil erosion control. The men and women smallholder farmers interviewed for this case study plant, sell and consume more than 20 commercial crops and 10 types of livestock (including bees) and extract a much wider range of less common vegetables, fruit and medicinal plants for regular use from the patchwork of forests and farms.

Knowledge management is key to maintaining that agrobiodiversity. MVIWAARUSHA draws heavily on its members' Indigenous knowledge of plant and animal cultivation – augmented by outside knowledge – and fosters this knowledge through projects, partnerships and practical farmer field school-type exchanges that enhance collective understanding of cultural behaviour and ecological sustainability.

MVIWAARUSHA has expanded its members' knowledge and experience in several key ways, by:

- Strengthening local groups and networks that encourage peer-to-peer learning and participation in market shows
- Attracting external support and knowledge from projects
- Developing professional staff capability and trainers-of-trainers in topics such as entrepreneurship, agroforestry, tree nurseries and tree planting, community seed banks, poultry rearing, and the use of livestock waste to make biogas
- Enhancing local communication through radio, television and social media, and
- Helping local groups to develop microcredit facilities and larger finance groups offering members community savings and loans schemes.

Smallholder farming families play an important role in producing food for households and market demand in Tanzania. Tapping into community-centred Indigenous knowledge of agriculture, animal domestication and ecological sustainability provides a high level of agrobiodiversity protection compared with more industrial agricultural models. The MVIWAARUSHA leadership and committees serve to extend local community farmers' networks to help spread an agroforestry vision that integrates crops, trees, livestock, manure and compost, rainwater harvesting, enterprise development and finance. It also promotes the transfer of intergenerational knowledge. Most knowledge about plant and animal cultivation and management is transmitted from grandparents, parents and neighbours to their children.

¹ Translated from the Swahili, 'mtandao wa vikundi vya wakulima na wafugaji mkoa wa Arusha' means 'network of groups of farmers and breeders of Arusha'.

Seed production – especially local climate-resistant varieties of crops and medicinal plants as well as local and exotic trees – has also been crucial to agrobiodiversity conservation. In addition to normal practices of acquiring seed (for example, through self-multiplication, bartering or purchasing commercially), MVIWAARUSHA has developed five community seed banks and a host of local tree nurseries that together help farmers to maintain control over and access to a wide diversity of crop varieties. MVIWAARUSHA promotes the role of both men and women in such ventures, working towards sustainable social, economic and ecological improvement.

Enterprise development that supports agrobiodiversity is being built through MVIWAARUSHA's trainings in entrepreneurship. It is backed by access to finance through microcredit facilities and larger community savings and loans schemes that are now almost ubiquitous across its local groups and networks. Market research and support for processing and packaging is emerging in key areas such as the production of sunflower oil, pigeon peas, honey and potentially coffee and other crops. These products are developed from agroforestry systems that maintain agroecological functions to be climate resilient. The organisation unites people with a diverse understanding of Indigenous resources and combines their efforts and talents in successful business development. As members, smallholder farmers have more financial security, for example through access to finance to help support their families and businesses. External knowledge (for example, about seed and livestock availability or market access) is spread easily throughout the organisation.

Tanzania has a rich biocultural heritage and MVIWAARUSHA is actively building on traditional agroforestry practices while also introducing innovations to strengthen agroforestry production. For example, it promotes the use of livestock waste to make biogas and slurry, the establishment of community seed banks, the development of diversified processing, packaging and marketing of different products, and establishing savings and loans schemes to fund its members' necessary investments. Yet it is perhaps the organisational solidarity within farmer groups and networks that offers the greatest source of innovation in conserving agrobiodiversity that will best sustain its members in the future.

For future agroforestry sustainability, we recommend that MVIWAARUSHA:

- Identifies its most active members as trainers (those who very quickly learn from the successes of others and put this learning into practice).
- Provides more ongoing and practical hands-on teaching/education. Members find farmer field school-type approaches more useful than theoretical training.
- Promotes the greater use of agroecological approaches using drought resistant crops, cover-crop farming and agroforestry (for soil improvement and moisture retention).
- Protects natural vegetation patches in and around farms, including trees.
- Protects water catchment areas to ensure a sustainable supply of water for irrigation.
- Continues market research to access international markets for organically grown crops.
- Continues to support its members to attend agricultural markets, shows and seed fairs.
- Supports the integration of poultry huts (chicken huts) and other zero-grazing livestock to support food security and to ensure an ongoing supply of livestock manure.

1 Introduction to MVIWAARUSHA and its land-use impacts

1.1 MVIWAARUSHA's vision and mission

The organisation presented here is Mtandao wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha (MVIWAARUSHA). A member-based farmers' organisation, MVIWAARUSHA is a network of smallholder farmer and pastoralists groups in the Arusha region. Its head office is located in Njiro, Arusha town, Tanzania. The lands farmed by its members are located in the central zone of Karatu district, in the low zone of Monduli district, and in the high zone adjacent to the protected Ngorongoro Conservation Authority Area (NCAA).

MVIWAARUSHA aims to unite smallholder farmers to have a common voice to advocate for their economic, social, cultural and political interests while also addressing various gender concerns, so as to advance women's interests as well. Agrobiodiversity is seen by the organisation as central to food and livelihood security (Khush 1996). MVIWAARUSHA's vision is to balance care for human rights alongside achieving sustainability and quality in production, while creating:

A strong, rights-based network of socioeconomically empowered farmers and pastoralists achieving sustainable livelihoods.

MVIWAARUSHA also aims to become a knowledge hub for gathering and sharing information via its farmer networks in relation to high-quality production of agricultural crops and livestock, and the protection of domesticated and wild plants within the landscape around. Its mission is to:

Attain collective voices and actions, sustainable high-agroforestry productivity, reliable markets and financial sustainability.

Within that mission, MVIWAARUSHA has five strategic goals:

- Strengthening its network of farmers and pastoralists in the Arusha region
- Improving its lobbying and advocacy skills and actions
- Building the agroecological capacities of its farmer and pastoralist members
- Developing and effectively managing programmes, financial services and marketing interventions, and
- Effectively mobilising and managing the network's resources.

MVIWAARUSHA's commitment to agrobiodiversity is found in the third strategic goal. Agrobiodiversity is seen to contribute to agroecological farming that encourages sustainability. Sustainable agriculture necessarily involves tree planting and protecting native trees, both on farms and in adjacent protected areas of natural vegetation, which should minimise the impacts of climate change and contribute to food security (Sadio and Negrero-Gastillo 2003).

MVIWAARUSHA mobilises farmers and livestock keepers into groups within their regional areas of operation, helping its members to:

- Undertake enhanced environmental conservation activities (such as tree planting and protecting natural vegetation and water catchment areas)
- Produce high-quality crops and livestock
- Gain access to financial resources such as those offered by savings and credit cooperative organisations (SACCOs) and finance Circle Management Groups (CMGs)
- Better market their products, and
- Build their skills by providing training on how to process their farming products (crops, livestock and honey).

1.2 Foundation of MVIWA-Arusha

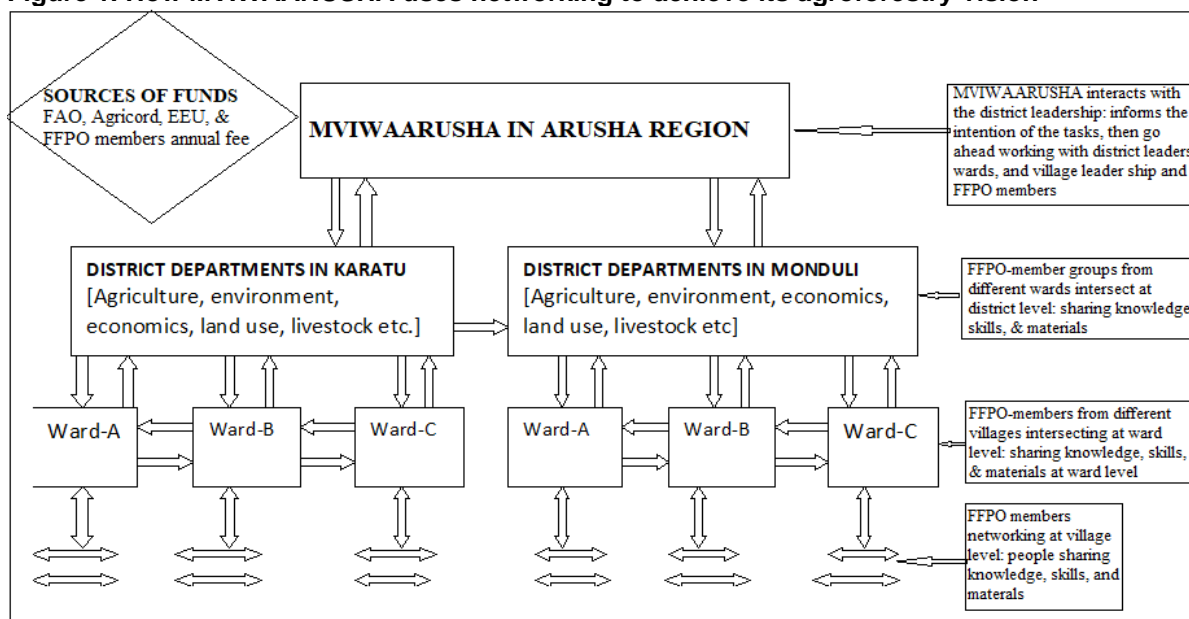
Originally named MVIWAMO, MVIWAARUSHA was established in 2011 as a network of farmers in Monduli district. As the network expanded to include members in Karatu district, Arumeru East and West districts, it was reregistered in 2013 as MVIWAARUSHA with registration number SA 19231. The MVIWAARUSHA management is now well known in Tanzania, with an active social media presence. Operations now cover the Arusha regional level. There are six district networks within that

region, 42 ward networks within those districts, and finally 446 village groups. Local members interact at village level, but then also occasionally interact with members of other villages, or sometimes at ward level in local networks. Different wards members will meet either during trainings, or as they share seeds, knowledge and skills, interact with other members from other wards within the district. Members from the two districts covered by this case study (Karatu and Monduli) with the coordination of MVIWAARUSHA, meet or interact at different levels to share their knowledge, skills and materials (Figure 1).

MVIWAARUSHA receives finance from external and internal sources:

- External sources (including the Food and Agriculture Organization of the United Nations (FAO), Agricorn and the European Union), and
- Internal sources (mainly from annual membership fees of approximately US\$2 per member per year (5,000 Tanzanian shillings) making a total of approximately US\$26,000 (62 million Tanzanian shillings) per year, depending on the increasing number of members.

Figure 1. How MVIWAARUSHA uses networking to achieve its agroforestry vision



1.3 Location

The MVIWAARUSHA groups surveyed for this case study cover the Monduli and Karatu districts of the northern highlands of Tanzania. MVIWAARUSHA is situated within the tropical savanna with a humid-subtropical climate. The area receives relatively sufficient rainfall to support agriculture and livestock production, although climate change is adversely impacting normal crop-growing schedules.

Within this region, MVIWAARUSHA operates in two major classified upland zones. The lower zone has an altitude of $\geq 1000\text{m}$, while the central zone around Karatu has an altitude of $\geq 1,700\text{m}$. The higher zone adjacent to the NCAA has an altitude of $\geq 2000\text{m}$. The lower and central zones are occupied by settlements, agricultural farms and grazing land within a patchwork of natural forest and woodland. These landscapes cross the Manyara National Park on the eastern arm of the Rift Valley.

The farming population lives on the undulating ridges of Karatu and the valley of Mto wa Mbu, which is well supplied with water from the area below Lake Manyara National Park. The areas are tropical savanna, with grassland patches, bush lands, thickets and tropical forest patches beautifying the landscapes. The agricultural systems managed by the Indigenous communities stand out for their high biodiversity and the use of agroecological approaches and traditional knowledge. The people strive for soil and water conservation. They visibly shape a colourful mosaic landscape in contrast to the haciendas which are characterised by large-scale monocultures based on biochemical and technological land-use packages that degrade the soil and water.

1.4 Membership

The MVIWAARUSHA network serves the six district councils of Meru, Arusha, Karatu, Longido, Ngorongoro and Monduli. MVIWAARUSHA works with more than 42 ward-level networks of smallholder farmers, each with its own operating office. The groups comprise of agricultural crop farmers, fisherfolk, small-scale beekeepers and livestock keepers, including pastoralists. The MVIWAARUSHA members possess a varied size of farms ranging from 1.5–5ha of land for cultivation. Most farmers sell around half of their crops with the rest kept for household consumption (subsistence).

MVIWAARUSHA has a varied number of members and groups that have joined since 2013. Its original groups have now substantially increased in membership, although some have decreased. In terms of diversified agricultural and animal crop production, the organisation has gradually developed a sophisticated support system. As of 2023, there 12,500 individual members within 446 local groups (up from 11,100 members in 2021) including 6,436 women, 4,662 men, and 3,107 young people from 341 FFPO groups. Membership increased by 9.3% (1,032 people) and 25.2% (86 groups) between 2021 and 2022, even though there was a drop of 3.7% for men (173 people). Between 2022 and 2023, there was an increase of every type of group except for networking groups at district level (see Table 1).

Table 1. Total MVIWAARUSHA members 2021–2023

Membership	Members			Increase or decrease in number of members			
	2021	2022	2023	2021–2022	%	2022–2023	%
Total members	11,098	12,130	12,498	1,032	9.3	368	3.0
Women members	6,436	7,741	7,996	1,305	20.3	255	3.3
Men members	4,662	4,489	4,502	-173	-3.7	13	0.3
Youth members	3,107	3,396	3,749	289	9.3	353	10.4
Groups	341	427	446	86	25.2	19	4.4
Local networks	32	36	42	4	12.5	6	16.7
District networks	5	6	6	1	20.0	0	0.0

1.5 Patterns of land use

The main official land-use categories occupied by MVIWAARUSHA members include mainly agriculture crop production land, but also some adjacent conservation land. The estimated amount of land used for agricultural crop production is $\geq 80\%$ while the remaining $\leq 20\%$ is natural ecosystems on both private and village-owned land. Each member owns at least 1.5ha for agricultural crop production.

The nature of land tenure on planned agricultural land is mainly private ownership but some is also communal land. The associated tenure of natural vegetation is private ownership, communal ownership (mainly controlled by village authorities), and government protected areas such as the NCAA at the border of farms. Privately owned land belongs to individuals or farming households where agriculture and livestock grazing are practiced at different seasons. Free grazing operates across almost all patches of land on which there is no cultivation such as those found at homesteads, stream banks or village authority land. However, during crop-harvesting, livestock grazing takes place on agricultural crop farms. A few cattle and goats (especially expensive stock hybrids) are zero grazed. Communal land is controlled by the village authority or several households. The NCAA national protected area is governed by national protection rules that prohibit any human activities including firewood collection, cultivation and settlements.

2 Agrobiodiversity in the landscape

2.1 Cash crops grown by men

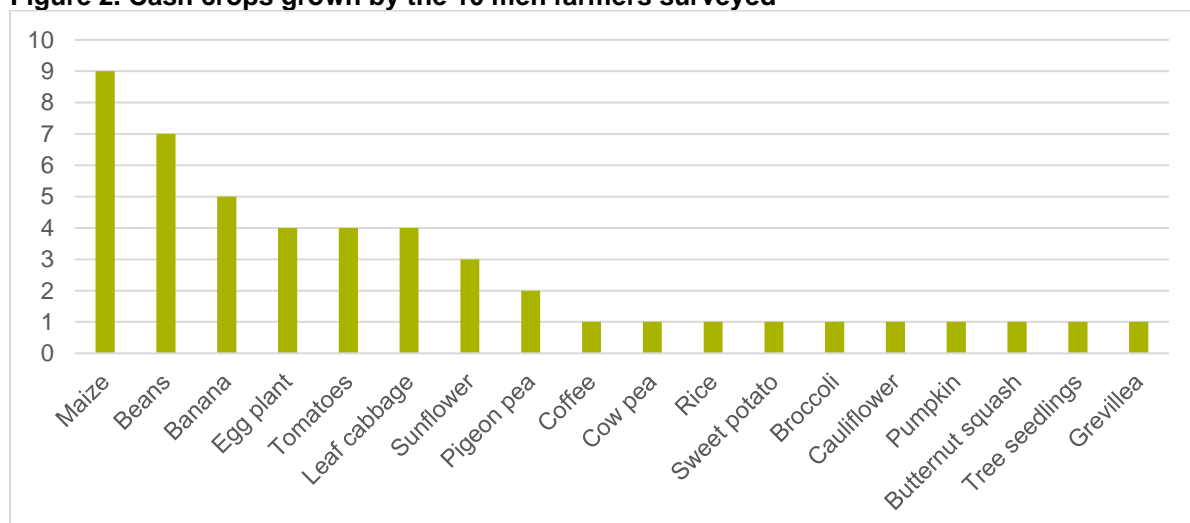
Usually, men possess more land than women and they prefer to produce cash crops, including predominantly maize and beans. Crops that are produced over the longer term (such as Arabica coffee) are cultivated by few men in Karatu on a larger scale, together with short rotation crops that can be sold and consumed at household level (such as vegetables) (see photos below). However, Arabica coffee is not a common crop grown by either Karatu or Monduli farmers. MVIWAARUSHA male members in Karatu produce maize, beans and vegetables to sell to tourist hotels at the border of the NCAA, where they earn good prices. Coffee is sold to a coffee buying organisations in Tanzania and then shipped to the world market.



A coffee plantation of almost 4ha with more than 0.5ha for growing pumpkins and other vegetables for sale © Canisius John Kayombo

Commercial agricultural crops most commonly grown by the 10 men farmers surveyed maize, beans, bananas, tomatoes, eggplants, sunflowers, leaf cabbage and pigeon peas. A few also grow a diversity of additional crops, such as sweet potatoes and broccoli (Figure 2). However, the small sample size is insufficient to determine if these results are indicative of the crops commonly grown in the two districts.

Figure 2. Cash crops grown by the 10 men farmers surveyed



The data were collected from particular farming areas, but it should be noted that there is a big difference between the two regions. For Monduli, in Mto wa Mbu the land is almost always irrigated, allowing for the planting of not only maize but also rice, bananas and sweet potatoes. The number of crops grown by the 10 men farmers surveyed for this case study (Table 2) reveals how diverse the

area is in crop production. However, most of the men farmers we surveyed prefer to grow cash crops on a larger scale, with less retained for household consumption.

Table 2. Cash crops grown by the 10 men farmers surveyed

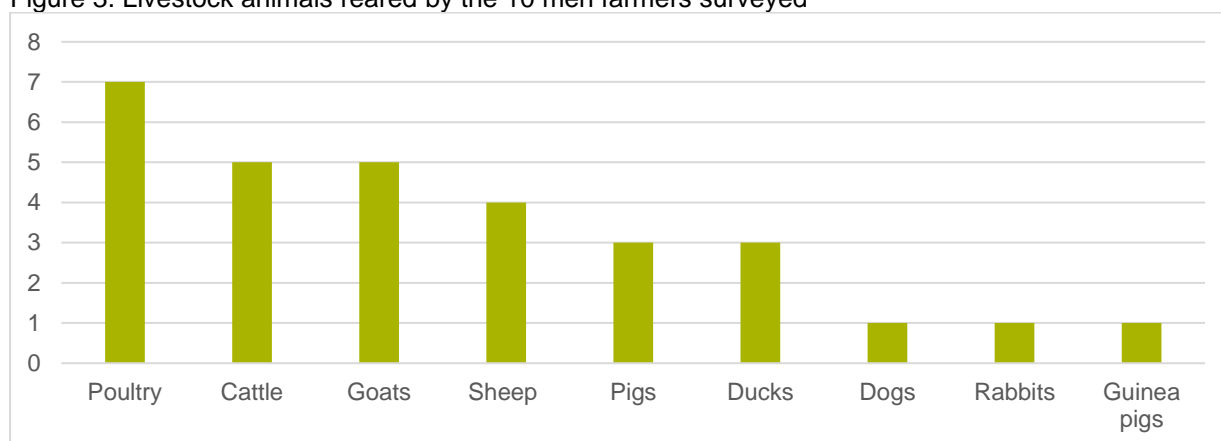
Farmer #	Grains (% for sale)							Tubers	Fruits	Vegetables								Trees		
	Maize	Beans	Sunflower	Pigeon pea	Coffee	Cow pea	Rice			Sweet potatoes	Banana	Broccoli	Sweet pepper	Cauliflower	Eggplant	Watermelon	Pumpkin	Tomatoes	Butternut squash	Leaf cabbage
1	80	85	100	90				50	80											
2	90			99	98	2				99		99			50		80			95
3	70	90	70						10							95		70		
4	95	95	90										95					90		
5	80	50							80											
6	60	50							90			80			90					
7	50	30					40		80			90			90					
8	70	90										95						95		
9	80														95					
10																	90	99		

Many MVIWAARUSHA members raise livestock to sell, such as cows, sheep, goats and pigs. A farmer will not slaughter a cow just for household consumption, but it can be slaughtered for sale with a few kilos retained for his family. Sheep, goats and chickens are, however, slaughtered for household consumption because of their smaller size. These domesticated animals support MVIWA-Arusha's members economic and food security. Figure 3 shows the number of types of livestock reared and sold by the 10 male-headed households surveyed. Poultry is the most popular type of livestock reared locally, followed by cattle, goat, sheep, and ducks.



Livestock reared by one an MVIWAARUSHA member in Karatu © Canisius John Kayombo

Figure 3. Livestock animals reared by the 10 men farmers surveyed



The percentage of livestock that is sold (not consumed) is >75% for most of the men members surveyed (see Table 3). These results are unlikely to be indicative of the real situation, but rather a small snapshot of what is happening within the much larger landscape of MVIWAARUSHA members (more than 12,000). The number of types of animals domesticated seems to reflect the landscape where each member lives and the general patterns of land use and the size of farm. The members with very small amounts of land prefer smaller livestock animals that can be managed more easily within a small range of land and fewer feeding resources. Cattle need a huge amount of fodder, and sheep and goats somewhat less. Some smaller livestock animals can be fed on food waste (such as banana husks) or small bundles of grasses. These animals both provide an income when sold, support food security and health, and provide manure for agricultural crops.

Table 3. Percentages of livestock sold by the 10 men farmers surveyed

Farmer #	Livestock (% for sale)								
	Cattle	Goats	Pigs	Poultry	Sheep	Dogs	Ducks	Rabbits	Guinea pigs
1	100	90	90	90	90	100			
2	100				5				
3	80	100	100	50					
4			85						
5	70	70		70	80				
6				90			50		50
7				90			80	100	
8	50	50		80			80		
9		80			70				
10				70					

2.2 Cash crops grown by women

The 10 women farmers of female-headed households surveyed also grow a variety of crops, although most women possess less land than men. Their crops provide them with money to pay for school fees for their children, to construct houses and to buy seeds when necessary for the next growing season.



(Top left) Women maize farmers from Mto wa Mbu in Monduli district in the field weeding and checking for diseases that attack young maize. (Bottom left) Women at the local market selling their crops © Canisius John Kayombo

Once again, the predominant crops grown by the women farmers surveyed are maize and beans, followed by sweet potato, rice, eggplant, leaf cabbage and tomato (Figure 4). The most marketable and highest-priced crops are preferred by MVIWAARUSHA members, even though mixing with other crops is a priority as it provides some resilience if a particular crop fails. The women also grow grains, tubers, fruits and vegetables and at least more than half of these crops are sold (Table 4).

Figure 4. Cash crops grown by the 10 women farmers surveyed

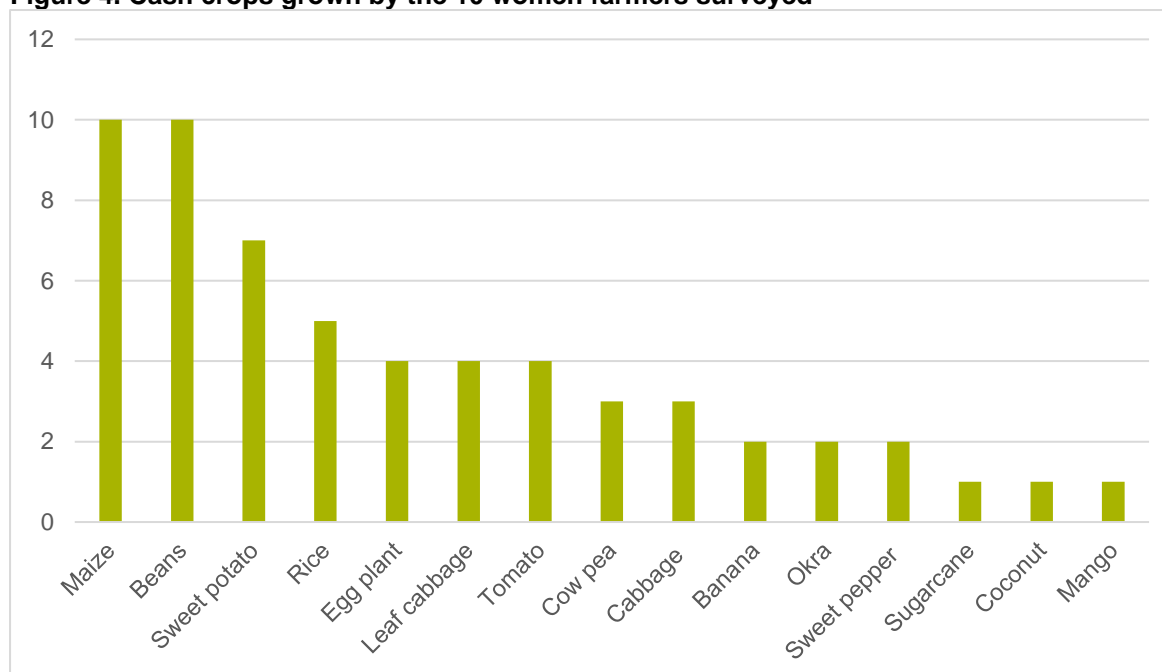


Table 4. Percentages of cash crops sold by the 10 women farmers surveyed

Farmer #	Grains				Tubers	Stems	Fruit			Vegetables						
	Maize	Beans	Rice	Cowpea			Sweet potatoes	Sugarcane	Coconut	Banana	Mango	Leaf cabbage	Eggplant	Tomato	Sweet pepper	Cabbage
1	75	85	90	20	5						98	95	98	5		
2	50	65	80		20						95	95	95	45		
3	60	50	75		45						96	90	95		35	
4	75	75	75	5											5	65
5	50	95	65	15	70	80			75	95	85	85		80	75	
6	40	75			90			50								
7	50	80					10	50								
8	50	75														
9	80	80			90											
10	80	80			80											

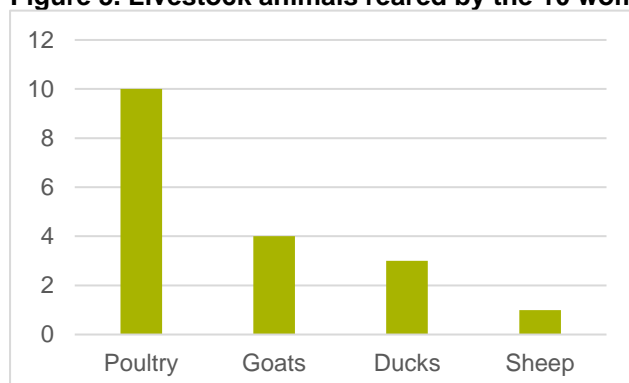
Women members of MVIWAARUSHA are also involved in raising livestock animals but prefer those that can be easily managed close to the farm, including goats, sheet, ducks and poultry. Like the men, most of the animals are sold to earn cash to pay for children’s school fees and the rest is for household consumption.



Livestock reared by MVIWAARUSHAWomen members at Mto wa Mbu in Monduli district © Canisius John Kayombo

The animal most frequently domesticated by the 10 women farmers surveyed were chickens, followed by goats, ducks and sheep (Figure 5). Chickens can be raised more easily than other types of livestock and also provide eggs and manure.

Figure 5. Livestock animals reared by the 10 women farmers surveyed



Poultry and goats serve best for the combined purposes of sale and household consumption. Women seem to prefer rearing sheep in particular for household consumption, with only 10% of the sheep they reared being sold. Table 5 provides a snapshot of the animals domesticated by female-headed households, although such small sample size will not be indicative of the real situation for the full MVIWAARUSHA membership. However, the data are useful to indicate the predominant species domesticated – even if it misses the fact that some women also keep domestic cattle.

Table 5. Percentages of livestock sold by the 10 women farmers surveyed

Farmer #	Livestock (% for sale)			
	Goats	Poultry	Sheep	Ducks
1		85		95
2		90		
3		70	10	20
4	10	80		
5	50	95		
6	80	50		
7	80	50		10
8		50		
9		50		
10		50		

2.3 Subsistence crops grown by men

Most subsistence crops are the same crops that are sold at markets, including those which are mostly for household consumption. Most men concentrate on growing cash crops, but certain amounts are retained for subsistence (Table 6).

In terms of livestock, some of the animals reared by male-headed households are retained for home consumption, although to differing degrees. Larger animals such as cattle are used less for subsistence purposes, while smaller animals such as goats and chickens are used more.

Table 6. Subsistence crops grown by the 10 men farmers surveyed

Farmer #	Grains			Tubers		Fruit			Vegetables				
	Maize	Beans	Cowpea	Sweet potato	Cassava	Coconut	Mango	Banana	Amaranth	Mnafu	Cabbage	Leaf cabbage	Sunga
1	x	x		x					x	x		x	x
2	x	x	x	x					x	x		x	x
3	x	x		x	x				x	x	x	x	x
4	x	x		x					x	x	x	x	x
5	x	x		x	x				x	x		x	x
6	x	x		x	x	x	x	x	x	x		x	x
7	x	x		x	x			x	x	x		x	x
8	x	x		x				x	x	x		x	x
9	x	x		x				x	x	x		x	x
10	x	x		x				x	x	x		x	x

2.4 Subsistence crops grown by women

All agricultural crops known to be grown by the ten female households (Table 7) are also used as subsistence crops. Vegetables are mostly kept for home consumption, including sunga, amaranth, and cassava. These crops significantly support the livelihoods of the women MVIWAARUSHA members in the landscapes of Karatu and Monduli districts, even though this data offers just a narrow picture of the facts on the ground.

Table 7. Subsistence crops grown by the 10 women farmers surveyed

Farmer #		Grains			Tubers		Vegetables			
		Maize	Beans	Cowpeas	Sweet potato	Cassava	Sunga	Cabbage	Amaranth	Mnafu
1		x	x	x	x					x
2		x	x		x					x
3		x	x		x		x	x		x
4		x	x		x		x	x		x
5		x	x	x	x		x			x
6		x	x		x		x			x
7		x	x		x		x			x
8		x	x		x		x			x
9		x	x		x		x			x
10		x	x		x		x			x

2.5 Wild products harvested by men

A certain number of plants are known to be harvested by men from the wild, including plants used as food (fruits and vegetables), medicine, firewood and timber (Table 8). Fewer plant species are collected from the wild by men than by women. These plants are often found on both private farms (where the remnants of Indigenous trees are left to grow alongside cultivated trees such as the widely planted *Grevillea robusta*, a rapidly growing shelter and timber tree) and on communal or village land. Around the NCAA areas, this is not strictly possible because the land is under total protection rules. Local people also harvest plant materials from village authority land and homestead woodlots.

The only wild fauna known to be collected by male-headed households are fish from Lake Manyara (tilapia and catfish) and from streams (catfish).

Table 8. Wild products harvested by the 10 men farmers surveyed

Botanical name	Swahili/Maasai name	Food	Fibres	Construction	Medicine	Cosmetics	Preserving	Firewood	Bee fodder	Fodder
<i>Albizia gummifera</i>	Mfuruanji							x	x	
<i>Aloe secundiflora</i>	Mshubiri/mlovera		x		x					
<i>Balanites aegyptiaca</i>	Mduguyu	x								
<i>Carissa edulis</i>	Mkarisa				x				x	
<i>Cleome hirta</i>	Mgagani	x								x
<i>Cordia Africana</i>	Mringaringa			x						
<i>Euclea divinorum</i>	Osojo				x	x		x		
<i>Ficus sur</i>	Mkuyu/oreteti	x					x			
<i>Ficus sycomorus</i>	Mkuyu/oreteti	x					x			
<i>Rauvolfia caffra</i>	Msesewe			x	x		x			
<i>Solanum nigrum</i>	Mnafu	x								x
<i>Vangueria madagascariensis</i>	Ergumii/emardanyii	x			x			x	x	
<i>Ximenia caffra</i>	Armai	x								

2.6 Wild products harvested by women

Wild plant crops known to be harvested by female-headed households are collected for numerous uses (Table 9). No wild fauna species were revealed to be harvested by the women surveyed.

Table 9. Wild products harvested by the 10 women farmers surveyed

	Botanical name	Common name	Food	Medicine	Firewood	Cosmetics	Bee fodder	Water catchment protection	Fodder
1	<i>Adansinia digitata</i>	Baobab/mbuyu	x						
2	<i>Albizia gummifera</i>	Mfuruanji			x				
3	<i>Aloe secundiflora</i>	Mshubiri	x						
4	<i>Capsicum frutescens</i>	Pilipili kichaa	x						
5	<i>Carissa edulis</i>	Olamoriaki		x			x		
6	<i>Cleome hirta</i>	Mgagani	x						
7	<i>Cordia Africana</i>	Mringaringa			x				
8	<i>Ehretia cymosa</i>				x		x	x	
9	<i>Euclea divinorum</i>	Osojo				x			
10	<i>Galinsoga parviflora</i>	Olikisiko	x						x
11	<i>Ipomoea aquatica</i>	Kiazi kitamu pori							
12	<i>Solanum nigrum</i>	Mnafu	X				x		
13	<i>Sonchus schweinfurthii</i>	Sunga/mchungu	x						
14	<i>Tamarindus indica</i>	Tamarind/ukwaju							
15	<i>Thespesia garkeana</i>	Matogwa	x						
16	<i>Vangueria madagascariensis</i>	Ergumii	x		x		x		
17	<i>Ximenia caffra</i>	Armai	x				x		

2.7 Crops varieties

MVIWAARUSHA members keep a high number of local varieties of crops that are used for generating financial income and household consumption (subsistence). Some crops are deliberately distinguished and maintained on farms and in the forest. MVIWAARUSHA has made recent efforts to establish community seed banks to maintain these varieties (such as maize, beans and many other crops – see Table 10). Some varieties of tree are not only found in the forest but also occur together with agricultural crops, and are retained during clearing for farming. Some plants grow as weeds (such as *Galinsoga parviflora*) but are also useful as both a vegetable and for livestock fodder.

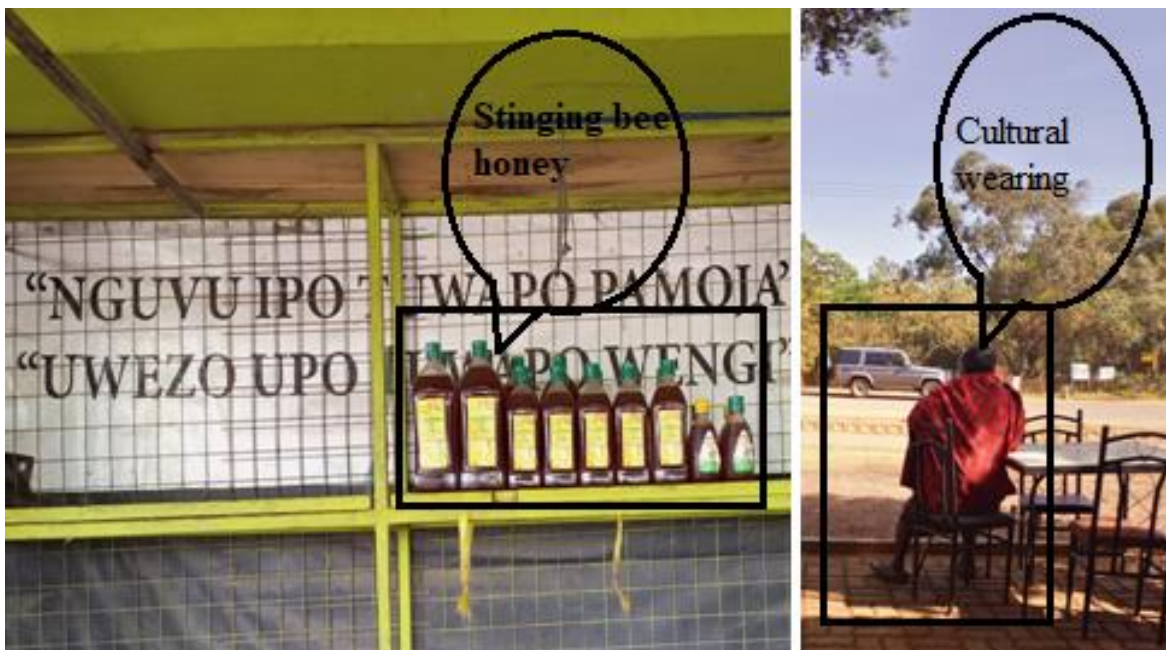
Table 10. Commercial and subsistence plants grown by MVIWAARUSHA members

S/N	Botanical name	Common name	Food	Medicine	Bee fodder	Water catchment protection	Boundaries	Ornamental	Timber	Firewood	Beverages
1	<i>Acacia seyal</i>	Mgunga				x					
2	<i>Acacia xanthophloea</i>	Mgunga				x					
3	<i>Adansonia digitata</i>	Mbuyu	x	x	x						
4	<i>Albizia gummifera</i>	Mfuruanji			x				x	x	
5	<i>Aloe secundiflora</i>	Mshubiri		x							
6	<i>Amaranthus hybridus</i>	Mchicha	x								
7	<i>Balanites aegyptiaca</i>	Mduguyu		x	x						
8	<i>Capsicum frutescens</i>	Pilipili kichaa	x	x							
9	<i>Cleome hirta</i>	Mgagani	x								
10	<i>Coffea arabica</i>	Coffee			x					x	x
11	<i>Cordia africana</i>	Mringaringa			x			x	x		
12	<i>Euphorbia nyikae</i>	Mlangali	x				x				
13	<i>Ficus sur</i>	Mkuyu/oreteti	x			x					
14	<i>Ficus sycomorus</i>	Mkuyu/oreteti	x			x					
15	<i>Galinsoga parviflora</i>	Olekisiko	x								
16	<i>Ipomoea batatas</i>	Sweet potato									
17	<i>Ipomoea aquatica</i>	Kiazi kitamu pori									
18	<i>Manihot esculenta</i>	Cassava	x								
19	<i>Prosopis juliflora</i>	Mesquite	x		x					x	
20	<i>Psidium guajava</i>	Mpera	x	x						x	
21	<i>Rauvolfia caffra</i>	Msesewe		x		x		x	x		
22	<i>Solanum nigrum</i>	Mnafu	x								
23	<i>Sonchus schweinfurthii</i>	Mchungu/sunga	x	x							
24	<i>Vangueria madagascariensis</i>	Ergumii/emardanyii	x	x						x	
25	<i>Ximenia caffra</i>	Armai/lamai			x						
26	<i>Zea mays</i>	Maize	x		x						

3 Crop cultivation and rearing livestock: knowledge sources

3.1 Biocultural heritage

Local communities eat both plants found on their farms and in the wild. Most prefer to grow plant materials such as maize, beans and many vegetables without applying artificial fertilisers. Plant materials and livestock manure are generally used to fertilise farms. Some members fertilise poor-performing agricultural crops with wood ash or, in a couple of cases, with slurry from biogas generators recently installed by MVIWA-Arusha. Communities tend to store any seed kept for planting as next year's crops in their kitchens, as smoke from cooking fires helps to preserve the seed. Local foods and medicine are widely used and often preferred to modern medicines, including honey. Honey production is widely understood to sustain vegetation and protect crops from wild animal damage, including elephants in the Karatu region near Ngorogoro. Some natural products including honey have traditionally been processed/packaged and sold, and this practice has now advanced with support from MVIWA-Arusha.



Communities produce and sell natural products such as honey and traditional fabrics made from cotton or other natural fibres © Canisius John Kayombo

Agrobiodiversity is seen as one way of maintaining yields of agricultural crops and livestock. The practice sustains natural vegetation patches as wildlife habitats, which can also encourage on-farm tourism.



A chameleon observed in a vegetation patch near an MVIWAARUSHA member's house © Canisius John Kayombo

3.2 Intergenerational knowledge transfer within households

Most knowledge about plant and animal cultivation and management is transferred from grandparents, parents and neighbours to younger generations from childhood through practice and informal teachings. Over time, knowledge is handed down, either through learning by doing, through media such as television and radio, or by other means including seminars, workshops and short- and long-term education. However, this system is being eroded by the expansion of technology and also because children now spend less time with their parents and more time in school. However, media can also be important in terms of building awareness of new types of seed and animals from outside and how to manage them.



At one of the MVIWAARUSHA member's homesteads, a child practises what her parents do using a small made-hand hoe © Canisius John Kayombo

3.3 Knowledge transfer between neighbours

Farmers often rely on their neighbours and tend to watch and practice what their more successful neighbours do. People seem to learn more easily when they see a neighbour's successes – even more than being educated by technical experts from outside. Sitting in buildings for formal trainings with a lot of theoretical material is largely seen as inappropriate given many farmers cannot read and have no time to take part. Instead, they prefer to put into practice what they learn from their neighbours. For example, many local farmers who cultivate and store traditional crop varieties and pass on this knowledge to other farmers (such as varieties that stand out for taste or are resistant to drought or pests).

In areas where MVIWAARUSHA operates, there have been many changes, especially in tree planting. Public media and even institutions such as schools invite MVIWAARUSHA members to plant trees for them. This increases agrobiodiversity as areas with more trees have minimal soil erosion, better-regulated temperatures and better soil quality, which is seen as an ecologically attractive practice. It also helps to generate new streams of income for members.

3.4 Organisational knowledge networks

As a member-based organisation, the collective knowledge of both nutrition and plant and animal cultivation and management is shared across the membership. MVIWAARUSHA has expanded its members' knowledge and experience in the following key ways.

- **Peer-to-peer learning:** MVIWAARUSHA has encouraged peer-to-peer learning within its local groups and networks, including seed and market fairs where their members can display their products, meet and share ideas with each other. For example, in 2021 representatives of local groups participated in a farming show during the Nane Nane show in Arusha city, where members' products were sold and publicised for their quality.²
- **External support:** MVIWAARUSHA's visibility has attracted external support from organisations such as the Forest and Farm Facility (FFF). For example, few members used biogas plants (an anaerobic digester that turns farm waste or energy crops into fuel) but with training and financial support, their adoption of this system is gradually expanding. New

² In Tanzania, Nane Nane (meaning 'eight eight' in Swahili) is a public holiday. Also known as Farmers' Day, Nane Nane takes place on the 8th of August each year.

knowledge on agroecology, entrepreneurship, marketing, finance, and laws and policies have been introduced to members through a wide range of projects with partners, including FAO and IIED in the FFF, as well as the Belgian agri-agency Trias, the Swedish agri-agency WeEffect, the Belgian organisation Iles de Paix, the Andreas Hermes Akademie and many others.

- **Staff professionalism:** The staff at MVIWAARUSHA's headquarters provide its members with professional services, such as finding new markets for agricultural products such as honey and sunflower oil that are sold right at the MVIWAARUSHA office in Mto wa Mbu. Staff have also been upskilled through external support from FFF and other organisations that provide training through farmer field schools or training-of-trainers approaches.
- **Training programmes:** Many hundreds of members have been trained in topics such as entrepreneurship using the German Bäuerliche Unternehmer Schulungen (BUS – meaning 'farm entrepreneur training') agribusiness training tool, on how to mix annual food crops with trees (agroforestry), raising trees seedlings (nurseries), tree planting, community seed banks, poultry rearing and the use of livestock waste to make biogas. The entrepreneurship trainings are now in their seventh year with initial support from the Andreas Hermes Akademie of the German Farmers' Association. Each local farmers' group have had least one member (usually the leader) trained by MVIWAARUSHA in a variety of topics such climate change impact mitigation and coping strategies. This has helped members to plant a variety of crops including those which are drought resistant and to keep livestock that can offer manure, skins, meat and provide a financial income.
- **Media communications:** External communications have improved hugely. For example, Radio Tap is a radio programme run by Farm Radio International Tanzania that records useful farming information for the Tanzania Broadcasting Corporation (TBC). MVIWAARUSHA members listen to the programmes, discuss what they have learnt and then put it into practice, such as how to manufacture organic manure.
- **Financial services:** MVIWAARUSHA has invested heavily in establishing microcredit facilities or SACCOs for almost all of its members' groups as well microcredit services that allow member groups or individuals to borrow up to three times their combined savings. This has greatly improved access to finance in support of agriculture and livestock business development.

4 Cultivating and managing seed and animal resources

How MVIWAARUSHA members source their seed depends on the purpose of planting, the availability of seed (such as seed kept from the previous harvest), and the prices and availability of external seed sources and what farmers can afford to pay, as many smallholder farmers either cannot save money or seed in drought years. Some members buy seed from commercial farm shops or from fellow MVIWAARUSHA members or neighbours.

From the interviews in this case study, four of the 20 farmers revealed that they buy some seed from farm shops run by agricultural input firms and other privately licensed businesses in Arusha city or from smaller privately licensed shop owners around Karatu town. Almost all of the farmers surveyed buy seed from other MVIWAARUSHA members. Members buy livestock such as goats and cattle either from local auctions or their neighbours.

4.1 Self-provisioning and multiplication of seed

From the interviews for this case study, 10–20% of the seed and animal offspring comes from the farmer's own stocks or from seed multiplication. The rest is sourced from neighbours, farm shops or auctions.

To ensure that diversity is maintained, MVIWAARUSHA is encouraging members to plant or maintain trees that can generate fruits, firewood and livestock fodder at their homestead (as zero grazing is encouraged).³ Farmers have always protected some of the more important Indigenous trees both on and outside of their farms, but are now increasing this practice following MVIWAARUSHA's awareness-raising activities about the impacts and causes of climate change.



Zero grazing practiced by MVIWAARUSHA members © Canisius John Kayombo

4.2 Bartering for and purchasing seed

More than 60% of seed/animal offspring is sourced from informal social networks of neighbouring farmers and MVIWAARUSHA members regularly share information among themselves about available agricultural crops or animal resources. Rather than bartering for and exchanging seeds and livestock, most are sold for cash. The bartering system rarely works, usually because two parties rarely have exactly what each other wants, although it does happen occasionally.

Local seed that is either purchased or bartered for can enhance agrobiodiversity because it helps to maintain or enhance local varieties, whereas seed cannot be multiplied from hybrid varieties as they do not set viable seeds (leading some farmers to exploit wild resources such as charcoal or timber to generate a source of income, which in turn degrades local agrobiodiversity).

4.3 Formal purchasing systems and community seed banks

MVIWAARUSHA has helped to develop local microfinance systems that enable farmers to purchase seeds and livestock. Through different projects, it also offers tree seedlings, piglets, bananas and sweet potatoes.

³ MVIWA-Arusha encourages zero grazing as it allows for the collection of animal waste to be converted into biogas fuel while also reducing damage to vegetation caused by roaming livestock.

A crucial recent set of interventions have led to the establishment of five community seed banks with support from Iles de Paix. Farmer groups have been sensitised to the need to maintain hardy and unusual varieties of a whole range of local crops. Members provide small demonstration pots of seedlings for display at their local community seed banks with a record of their contribution. The community seed banks also maintain larger seed selections of key crops that can be purchased either by members or external buyers. Members can also use seed from the seed bank, provided they replace the same quantity from that year's harvest. If there is insufficient seed in stock, the leader of the community seed bank can direct any buyer to MVIWAARUSHA members who are known to have seed of that variety available for sale.

At present, the commercial activities of the community seed banks are constrained by a law that prohibits local farmers from selling traditional varieties of seed to the open market. However, the community seed bank groups with MVIWAARUSHA and its broader allies (including Shiwakuta, the National Federation of Smallholders Farmers' Associations in Tanzania) are currently lobbying for this law to be changed.



A community seed bank near Karatu, run by MVIWAARUSHA members © Canisius John Kayombo

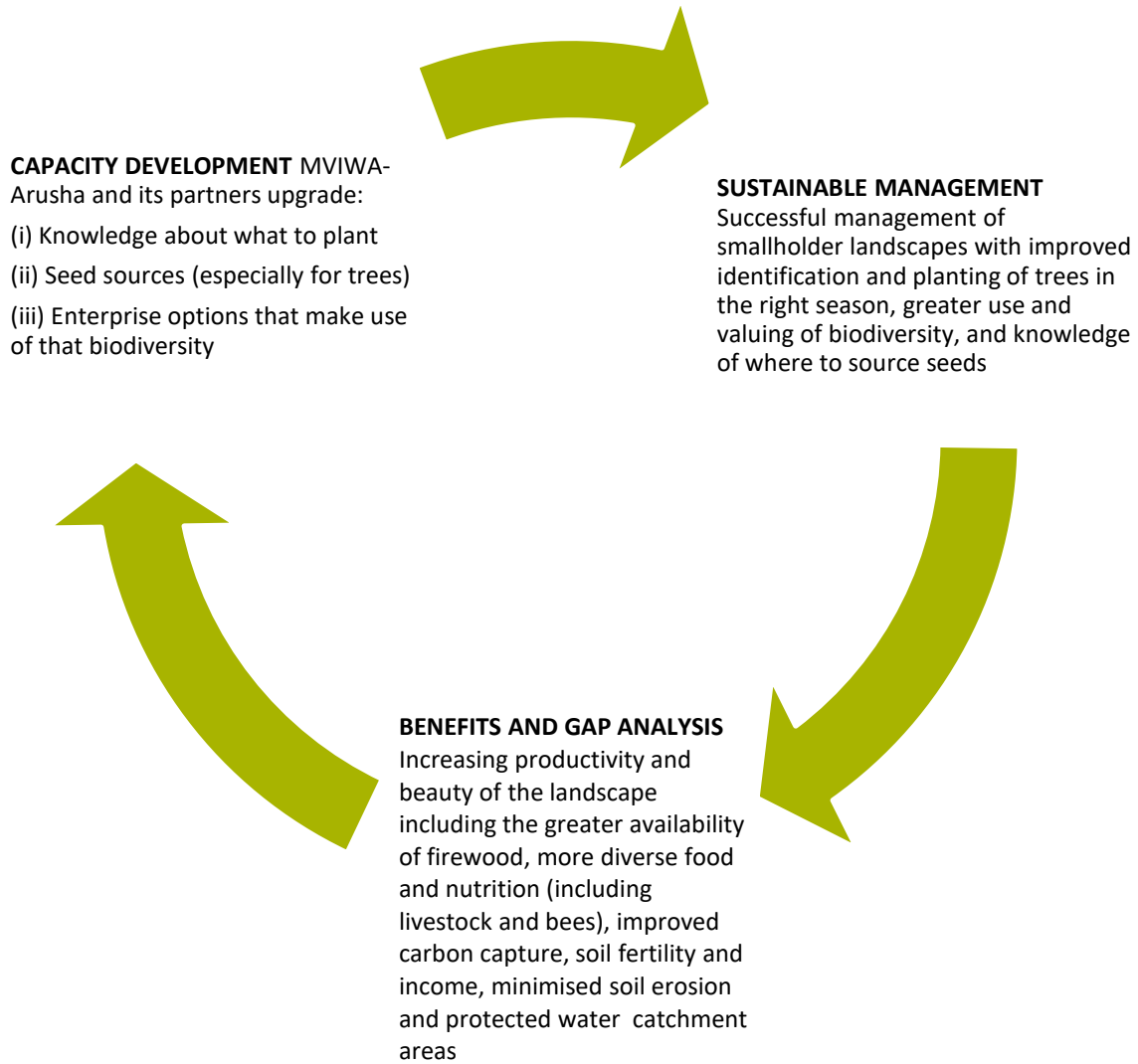
Additionally, and with FFF support, since 2022 MVIWAARUSHA has helped many of its local groups to establish commercial tree nurseries. Nursery bags have been provided alongside technical training that has included training in grafting. Members either sell trees locally at a range of prices (including high-yielding grafted fruit trees) or through MVIWAARUSHA programmes on tree planting and landscape restoration. Several tree seedling varieties are also being sold to individuals and schools including popular options such as: *Grevillea robusta*, *Markhamia lutea*, *Persea americana* (avocado), *Psidium guajava* (guava) and *Sesbania sesban*. Seed sources for trees are collected from local orchards, farms and woodlots or are sometimes bought from external orchards.

As part of its drive to educate its members on the need to maintain on-farm agrobiodiversity, MVIWAARUSHA ensures that it communicates with and advises its members on when trainings and performance surveys are available to participate in. MVIWAARUSHA prepares members to be ready to receive external support from organisations such as Farm Radio International Tanzania. These organisations provide capacity development on for example how to identify types of plant or animals, when best to plant trees to ensure survival, areas to be planted (farms, water catchment areas, homesteads, avenues), the value and benefits of different varieties of tree or crops (such as for food, livestock fodder, nitrogen fixing, firewood), where to source seeds (locally among members or from outside the community), how to obtain seed (using loans, cash, bartering or for free) and other elements of business development from those trees (see Figure 6). For example, Farm Radio International in Tanzania supported two MVIWAARUSHA groups in Karatu district (Eden and Ebeneza groups) by supplying banana transplants. These are now being grown on smallholder farms. This was unexpected as bananas were not previously considered as suitable for growing in this area.

MVIWAARUSHA aims to promote sustainable management of the landscape so that it can meet today's needs with jeopardising the needs of future generations. This will lead to benefits such as improved natural beauty, the availability of energy resources (firewood), food, livestock and bee fodder, improved carbon sequestration, climate regulation, soil quality and economic income, and

minimising soil erosion (see Figure 6). A gap analysis for additional benefits can lead to further capacity development by MVIWAARUSHA.

Figure 6. How MVIWAARUSHA promotes sustainable resource management in Karatu and Monduli



5 Enterprise strategies and agrobiodiversity

5.1 Cash-crop enterprises

The production of commercial crops can enhance agrobiodiversity if carefully planned. Planting crops such as coffee together with Indigenous or local trees and cover crops can enhance agrobiodiversity, for example. On the other hand, expanding monocultures or using shifting cultivation in areas too small to allow for fields to lie fallow, or using chemicals to uplift harvests, will almost always diminish agrobiodiversity on farms. Intensive production can lead to clearing of natural vegetation for crops such as maize and beans – and this can reduce biodiversity and exacerbate climate change because it also removes carbon sinks.

MVIWAARUSHA members are committed to agroforestry, cover-crop farming and zero grazing livestock farming. The most common tree crops in the predominant maize and bean agroforestry systems are species such as banana and *Grevillea robusta* and *Cordia africana* (for timber). Of the 20 respondents, only one farmer was growing Arabica coffee as his main agroforestry crop within which trees such as *Acacia albida*, *Albizia gummifera*, *Cordia africana*, *Croton macrostachyus*, *Vangueria madagascariensis* were identified. MVIWAARUSHA is actively exploring marketing opportunities for a wider variety of agricultural and tree crops by sending representatives to market shows such as Nane Nane in Arusha city to discuss what buyers want. Furthermore, the Kilimo Endelevu show in Karatu in 2020 was positively supported by MVIWA-Arusha. This has helped link smallholder farmers to local markets and other consumers such as tourists who visit the NCAA. MVIWAARUSHA also helps members aggregate crops for sale at farmer markets and shows.

5.2 Changing patterns of cash cropping

Most farmers in MVIWAARUSHA revealed that the quantities of maize and beans they sell has declined in terms of kilos harvested. However, the quality is higher and attracts customers more easily. Because diversification is encouraged, the range of products being sold have changed significantly over time. Now if one crop fails, there are others to replace it.

5.3 MVIWA-Arusha's role in shaping what is sold

MVIWAARUSHA is currently conducting market research for a number of its member's products. As noted above, MVIWAARUSHA also has a very active entrepreneurship programme and has offered training on value addition for a variety of products. For example, it has made particular progress in adding value to products through processing training on sunflower oil and honey production. Farmers have been supported to find suitable materials to package and label their products so they can be sold at the roadside shop owned by MVIWAARUSHA.

New honey associations and nursery seedling associations have also been formed. Through such associations, honey can be aggregated from multiple members and sold to markets under a single branded label. The honey is currently sold within Karatu and Monduli districts, but some external buyers have also made purchases, including wholesale buyers in Arusha City and in other regions. The smallholder farmers who are members of the honey associations believe that in time their honey could also be exported. MVIWAARUSHA is encouraging beekeeping because it helps to expand the volumes of honey that can be traded and is also an ecologically friendly income-generating intervention. It is also planning to offer beehives to other groups starting with Monduli district to enhance production for both local and eventually international markets.

The external networks or contacts managed by MVIWAARUSHA have offered education and tangible materials that have helped expand its members' options as to what they can cultivate and sell. For example, training on tree planting has shaped what trees are being sold and planted commercially. Growing fruit trees such as *Carica papaya* (papaya), *Annona reticulata* (bullock's heart), *Punica granatum* (pomegranate) and *Citrus lemon* (lemon) opens up possible future market opportunities.

MVIWAARUSHA trainings on tree nursery production have also opened up new sales of trees for firewood, timber, fruit, shade, wind breaks, nitrogen fixing and climate regulation. The 20 farmers surveyed for this case study described how MVIWAARUSHA training had led to further demonstrations in schools (primary and secondary schools) with trainers capable of explaining and demonstrating tree planting in Karatu district. This will lead to having more diversified crops for sale.

Environmentally friendly farming systems are also emerging that are shaping the types and scale of crops sold (for example, mixed maize, beans or coffee agroforestry systems with intercropped vegetables, beekeeping and zero-grazed cattle for dairy products).

5.4 Future plans

One of MVIWAARUSHA's future strategy is to prepare a documentary on the cultural knowledge used to produce and preserve crops, and how to protect natural vegetation. This documentary will teach people how to use traditional methods to treat crops such as using wood ash to discourage insects that feed on agricultural crops.

In terms of developing climate-resilient business, MVIWAARUSHA is looking at alternative approaches to cope with the impacts of climate change, such as the use of drought-resistant crops including *Manihot esculenta* (cassava) and local maize seeds, planting trees to regulate climate, applying cover-crop methods, and producing biogas from livestock waste.

MVIWAARUSHA is also contemplating establishing a business unit or trading arm to work alongside its member-based association and act as a product aggregator and value-addition service for its members. This will improve market access to major towns and other higher-value markets.

6 Conclusions and recommendations

6.1 Conclusions

Knowledge exchange, seed management and enterprise development are crucial to maintaining agrobiodiversity. This is made possible through a strong commitment to member-based farmer organisations and networks, sharing local knowledge and resources between members and neighbours, and through partnerships with external organisations including local, national and international media.

MVIWAARUSHA has acted as a critical agent in promoting agroecology and agrobiodiversity to its members and networks. It is working hard to find appropriate types of education for its members that not too theoretical but more practical. The growing diversity of crops being produced by its members is also opening up new markets and ways to generate incomes.

MVIWAARUSHA is also focused on tackling the impacts of climate change, by favouring systems that mix crops with trees and livestock fodder, that make better use of livestock waste for fuel and compost, and which protect water catchment areas and improve water harvesting and irrigation. These systems are complex and take both time and good leadership to develop. However, MVIWAARUSHA is working to put them into practice through its regular knowledge exchanges, seminars and training, and by promoting agrobiodiversity using approaches such as community seed banks to conserve local sources of seed.

6.2 Recommendations

For future agroforestry sustainability, we recommend that MVIWAARUSHA:

- Identifies its most active members as trainers (those who very quickly learn from the successes of others and put this learning into practice).
- Provides more ongoing and practical hands-on teaching/education. Members find farmer field school-type approaches more useful than theoretical training.
- Promotes the greater use of agroecological approaches using drought resistant crops, cover-crop farming and agroforestry (for soil improvement and moisture retention).
- Protects natural vegetation patches in and around farms, including trees.
- Protects water catchment areas to ensure a sustainable supply of water for irrigation.
- Continues market research to access international markets for organically grown crops.
- Continues to support its members to attend agricultural markets, shows and seed fairs.
- Supports the integration of poultry huts (chicken huts) and other zero-grazing livestock to support food security and to ensure an ongoing supply of livestock manure.

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