COMMUNITY-BASED CLIMATE CHANGE ADAPTATION AND LOCAL FOOD SYSTEMS: HANDBOOK AND CASE STUDIES

E Kruger, T Mathebula, B Maimela, H Hlongwane, N Mbokazi, S Mbhele, A Kotschy and K Kotschy

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Community-based Climate Change Adaptation and Local Food Systems: Handbook and case studies

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- Dissemination and scaling of a decision support framework for climate change adaptation for smallholder farmers in South Africa (**WRC report no. TT 967/1/26**)
- Climate resilience impact measurement for poor rural communities. A MERL (Monitoring, evaluation, reflection and learning) manual for community-based climate change adaptation (CbCCA) (**WRC report no. TT 967/3/26**)
- Community-owned water access: Guidelines and case studies (**WRC report no. TT 967/4/26**)
- Microfinance handbook for smallholder farmers in South Africa: A case study on small businesses (**WRC report no. TT 967/5/26**)
- Multistakeholder platform development manual: Guidelines for successful implementation (**WRC report no. TT 967/6/26**)
- Climate Resilient Agriculture: Practices for smallholder farmers. Farmer Handouts: English (**WRC report no. TT 967/7/26**)
- Climate Resilient Agriculture: Practices for smallholder farmers. Farmer Handouts: isiXhosa (**WRC report no. TT 967/8/26**)
- Climate Resilient Agriculture: Practices for smallholder farmers. Farmer Handouts: isiZulu (**WRC report no. TT 967/9/26**)
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EXECUTIVE SUMMARY

Numerous studies suggest that the transformation of food systems is crucial in the enhancement of food security, livelihood creation, environmental sustainability, and economic transformation. Daunting challenges such as soil degradation, loss of biodiversity, climatic shifts, and food-related diseases require deep structural reforms in food systems. Food system reform requires strategic solutions and strong collaboration between all the actors involved (Global Alliance for the Future of Food, 2021).
In order to identify opportunities for transformation, frameworks for change provide a conceptual structure for challenging existing paradigms and birthing new ideas and solutions. Most food system frameworks have three defining components: external drivers as tools for change, description of the various components of food systems, and outcomes. The Global Alliance (GA) has introduced a "Principles Framework for Food System Transformation," which is composed of seven principles: renewability, resilience, health, equity, diversity, inclusion, and interconnectedness. The GA framework views the food system components in retrospect and helps to identify misalignment, thus providing guidelines for future decision-making. Another framework is the "Sustainable Food Systems Transformative Framework," which is a three-tiered framework of drivers, activities an outcomes. This framework provides a more detailed breakdown of the various food systems' components and thus provides a wider scope of analysis of challenges and opportunities for intervention. This is the main framework that will be adapted and used for this study. The third framework to be used in this study is the "Framework for Researching African Food Systems," adapted from the TRANSMANGO framework, which provides a conceptual overview and the linkages in food systems. This framework is useful in identifying the different levels in which food systems operate and can transform

In a recent food systems profile for South Africa (FAO, European Union, CIRAD and DSI-NRF Centre of Excellence in Food Security (CoE-FS), 2022) a number of levers to drive the transformation of the food system to one that can provide for improved livelihoods, environmental sustainability and a better territorial balance have been outlined. In summary, these levers are:

- **Reduce the relative cost of nutrient-dense food and modify the consumer environment**.
- Increase the range, scale, and coverage of child-centred food system interventions in the built environment.
- **Support the transition towards agroecological food systems.**
- Link land reform with place-based farmer support.
- Reform and enforce food system regulatory policies.
- **Adopt an integrated approach to building an inclusive food system.**
- **Improve inclusive stakeholder participation and enhance engagement and**
- **Adopt a two-pronged place-and issue-based approach to food system governance**

The work and research undertaken by Mahlathini and our development partners have focused primarily on the five levers in bold in the above list. We have worked within the 7 principles outlined by the Global Alliance for the Future of Food ((Global Alliance for the Future of Food, 2021), namely renewability, resilience, health, equity, diversity, inclusion, and interconnectedness.

The approach has been to improve the resilience of smallholder farmers' livelihoods in the face of multiple shocks and stresses. A further focus on the development of local food systems and local marketing strategies alongside microfinance products for the rural poor has been undertaken and woven into the case studies presented in this document.

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ABBREVIATIONS AND ACRONYMS

CA	Conservation Agriculture
CbCCA	Community-based climate change adaptation
CRA	Climate resilient agriculture
DARD	Department of Agriculture and Rural Development
EC	Eastern Cape
EU	European Union
FET	Further Education and Training
INR	Institute of Natural Resources
MDF	Mahlathini Development Foundation
SDGs	Sustainable development goals
SKZN	Southern KwaZulu-Natal
TRANSMANGO	EU-funded programme on the future of food and nutrition
UN	United Nations
URP	Umngeni Resilience Programme
VSLA	Village savings and loan association
WWF	World Wildlife Fund

CHAPTER 1: CONTEXTUAL FRAMEWORK

In this handbook, we provide contextualized case studies (both place-and issue-based) as well as recommendations for the transformation of local food systems, based on a framework for the transformation of food systems developed from literature.
The case studies include:

- Local food system analysis for smallholder farmers in the Midlands region of KwaZulu- Natal and
- Improved resilience for smallholder farmers in CbCCA.

Numerous studies suggest that the transformation of food systems is crucial in the enhancement of food security, livelihood creation, environmental sustainability, and economic transformation. In these unprecedented times, a holistic approach is vital in driving systematic shifts in both global and local food systems (United Nations Environment Programme (UNEP), 2016). Daunting challenges such as soil degradation, loss of biodiversity, climatic shifts, and food-related diseases require deep structural reforms in food systems. Because food systems are a major contributing factor in the creation of the existing challenges, they are instrumental in finding solutions. Food system reform requires strategic solutions and strong collaboration between all the actors involved (Global Alliance for the Future of Food, 2021).

According to the Framework for Researching African Food Systems (May, Farmework for researching Afircan Foos Systems, 2021), food system transformation is vital in achieving Sustainable Development Goals (SDGs), especially SDG 2, which is to end hunger by enhancing food security through the promotion of sustainable agricultural practices.

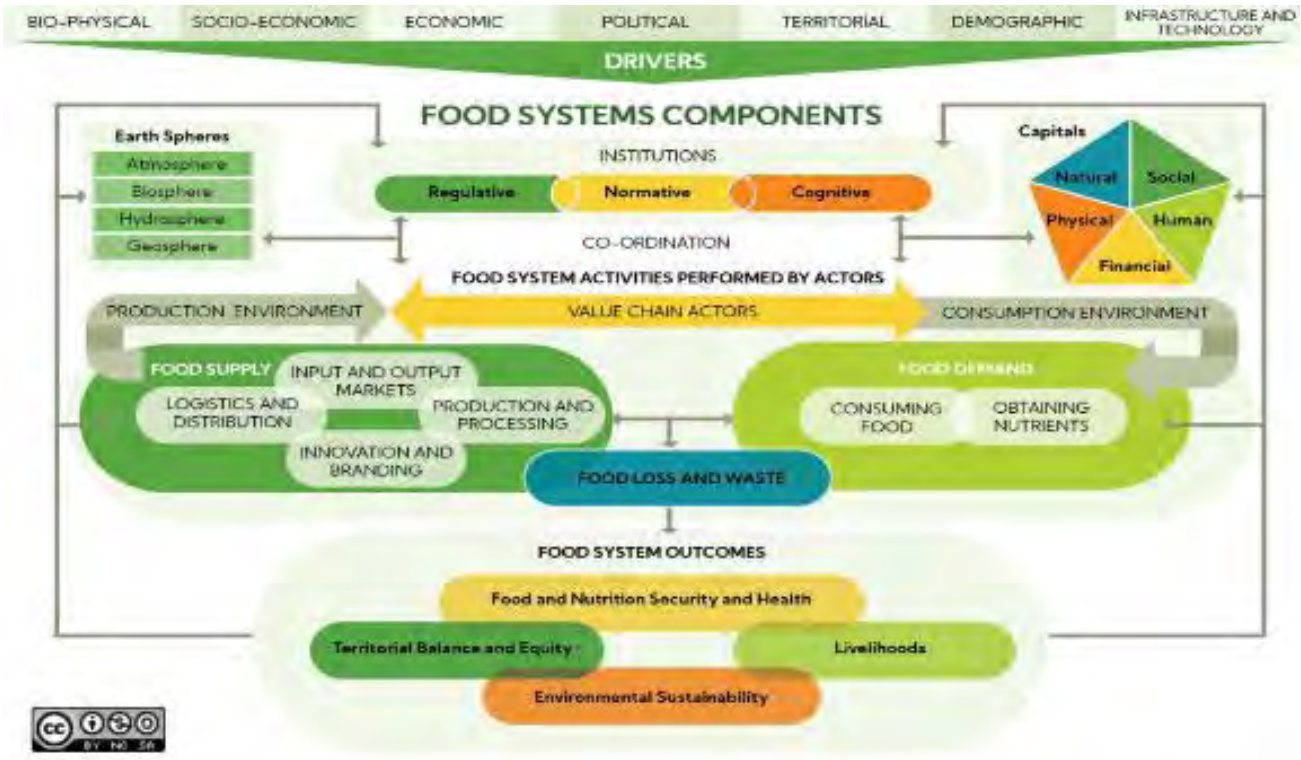

Figure 1: The Food systems framework outlined through FS Net Africa – Prof J. May 2021.

To identify opportunities for transformation, frameworks for change provide a conceptual structure for challenging existing paradigms and birthing new ideas and solutions. Frameworks are tools to "understand, analyse and shift systems" and can be applied in multi-contextual ways (Nesheim, Oria, & Yih, 2015). Therefore, a food systems framework is an important tool in assessing and strengthening food systems because it provides an empirical structure for analysing the food system components and identifying gaps and points of intervention (FAO, European Union, CIRAD and DSI-NRF Centre of Excellence in Food Security (CoE-FS), 2022).

A desktop review of various journal articles, research papers, and presentations on food systems has revealed that there are several food system frameworks for transformation. Most have three defining components: external drivers as tools for change, description of the various components of food systems, and outcomes. The Global Alliance (GA) has introduced a Principles Framework for Food System Transformation, which is composed of seven principles: renewability, resilience, health, equity, diversity, inclusion, and interconnectedness. These principles are the outcome of sustainable food systems, which encompass a future of biodiversity, access to healthy food, and resilience to shocks and stresses (Global Alliance for the Future of Food, 2021). The framework works by assessing food system alignment to the aforementioned principles using a set of predetermined criteria. The GA framework views the food system components in retrospect and helps to identify misalignment, thus providing guidelines for future decision-making. Another framework is the Sustainable Food Systems Transformative Framework, which is a three-tiered framework of drivers, activities an outcomes. This framework provides a more detailed breakdown of the various food system components and thus provides a wider scope of analysis of challenges and opportunities for intervention. The framework helps to assess the processes and information pathways in food systems, identify gaps, and find ways to improve food system governance. This is the main framework that will be adapted and used for this study. The third framework to be used is the Framework for Researching African Food Systems, adapted from the TRANSMANGO framework, which provides a conceptual overview and the linkages in food systems. This framework is useful in identifying the different levels in which food systems operate and can transform. It is a detailed framework of the food system drivers and components, and helps with an in-depth analysis of processes, interactions, and feedback loops (Brunori, et al., 2014).

In a recent food systems profile for South Africa (FAO, European Union, CIRAD and DSI-NRF Centre of Excellence in Food Security (CoE-FS), 2022), several levers have been outlined that drive the transformation of the food system to one that can provide for improved livelihoods, environmental sustainability, and a better territorial balance. In summary, these levers are:

- **Reduce the relative cost of nutrient-dense food and modify the consumer environment**.
- Increase the range, scale, and coverage of child-centred food system interventions in the built environment.
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- **Adopt a two-pronged place- and issue-based approach to food system governance.**

The work and research undertaken by MDF and our development partners have focused primarily on the five levers in bold in the above list. We have worked within the seven principles outlined by the Global Alliance for the Future of Food ((Global Alliance for the Future of Food, 2021), namely, renewability, resilience, health, equity, diversity, inclusion, and interconnectedness.

The approach has been to improve the resilience of smallholder farmers' livelihoods in the face of multiple shocks and stresses. A further focus on the development of local food systems and local marketing strategies alongside microfinance products for the rural poor has been undertaken.

1.1 MDF CONTEXTUAL FRAMEWORK

Mahlathini Development Foundation (MDF) has done extensive work in strengthening local food systems in KwaZulu-Natal, Eastern Cape, and Limpopo. The organisation's project focus has been to reduce vulnerability and increase resilience to external shocks such as climate change, economic decline, food insecurity, and political instability, which seem to be particularly detrimental to the poorest of the poor. Further complicating matters is the reality that smallholder farmers do not have access to formal credit, are excluded from the mainstream economy, struggle with high levels of unemployment, and are food insecure. The disproportionate distribution of power between men and women also continues to be a point of major concern, although the tide is slowly turning. There is, therefore, a necessity for interventions that will drastically reduce and possibly eradicate the aforementioned challenges. Our project activities have included the introduction of sustainable agricultural practices, which encompass agroecology and regenerative agriculture principles, to help strengthen the farming systems of smallholder farmers, alongside local marketing and microfinance and microlending options. More recently, an increased focus on soil and water conservation, as well as resource conservation and management, has also been included in the suite of interventions.

To better understand local food systems as well as their challenges and opportunities, the organisation has applied the food systems approach, in which a framework was used to identify the primary external drivers and the interactions between the various components of the food system, as well as the actors involved, the outcomes, and the impacts. The food system framework that we present below is adapted from Sustainable Food Systems Transformative Network, The Global Alliance Network, and the TRANSMANGO Network.

MDF FOOD SYSTEMS FRAMEWORK

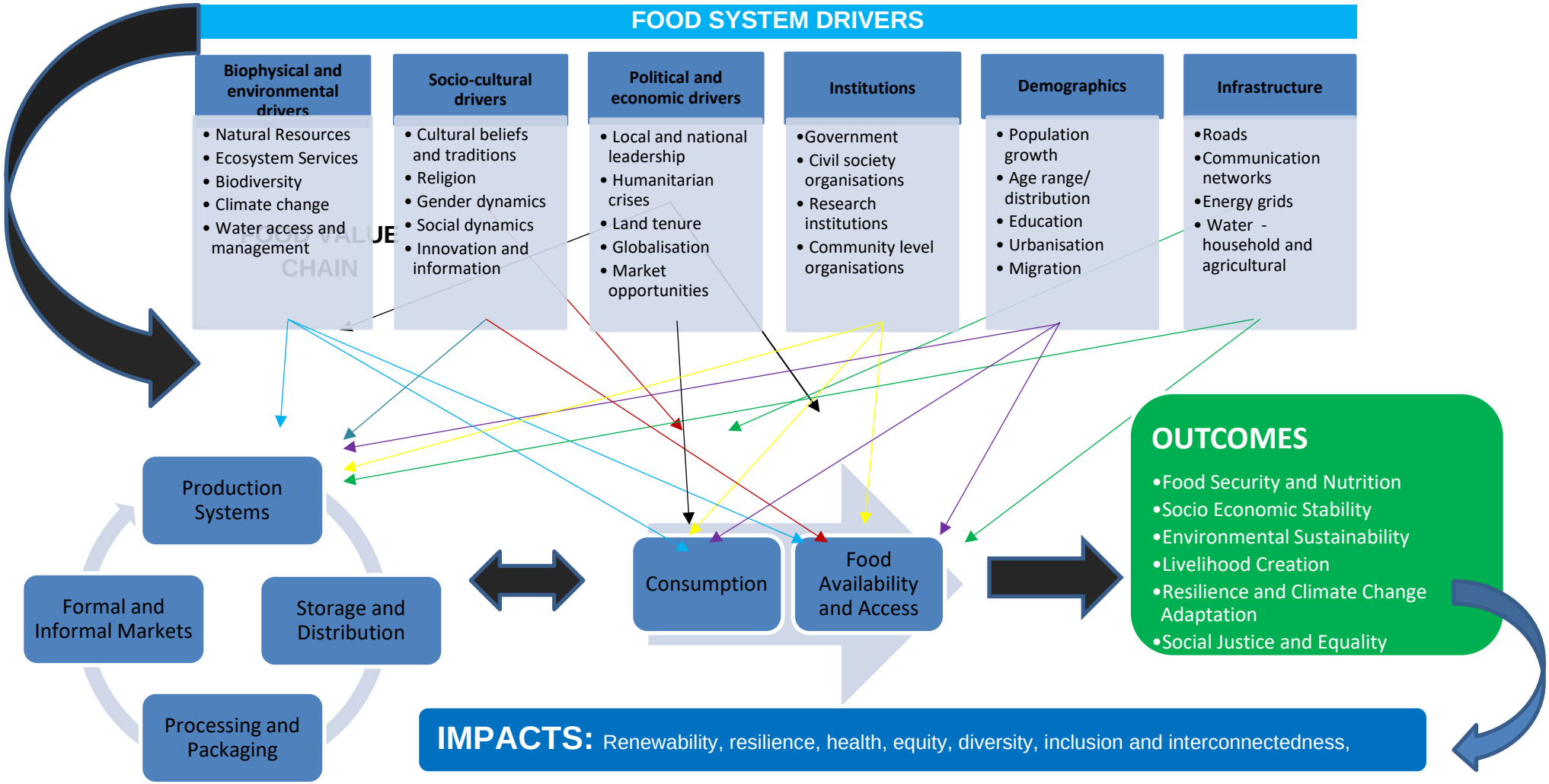

Figure 2: MDF Contextualised Food Systems Framework. (Adapted from the Sustainable Food Systems Network, TRANSMANGO D2.1 Framework and the Global Alliance Food Systems Framework)

The diagram below outlines the main food system stakeholders who have been involved in the food system analysis and transformation interventions led by MDF.

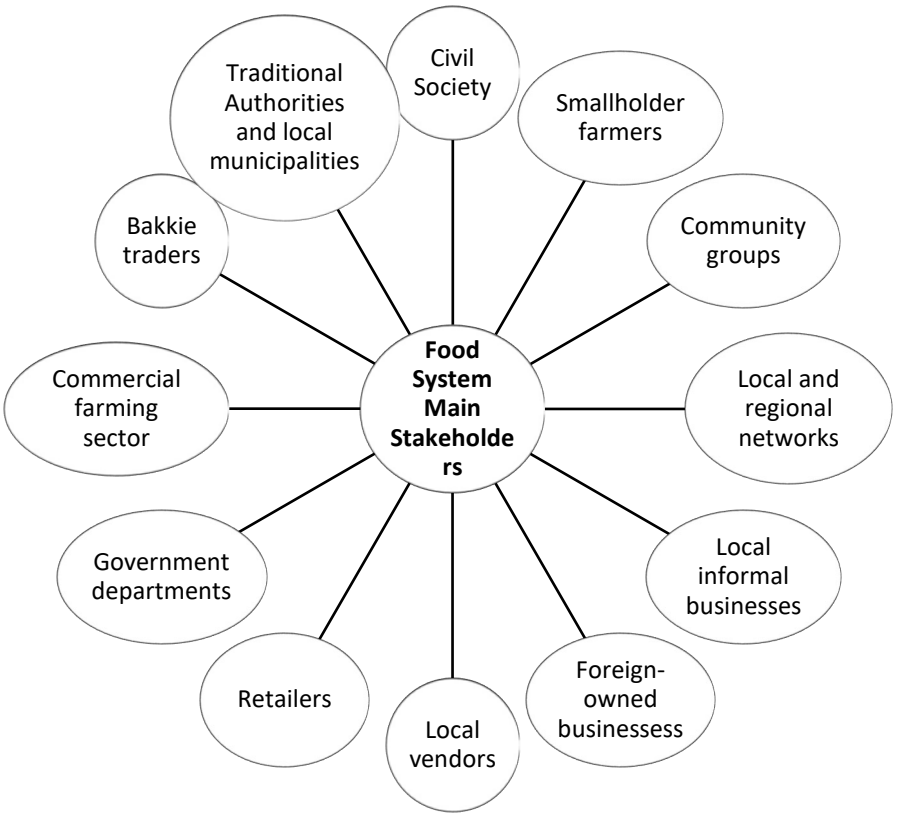

Figure 3: Main food system stakeholders

These stakeholders have been engaged through a range of platforms at local, regional, and national levels, on both conceptual and practical implementation levels.
The three case studies below explore different aspects of food systems for smallholder communities in South Africa.

CHAPTER 2: FOOD SYSTEMS CASE STUDIES

2.1 CASE STUDY: STRENGTHENING LOCAL FOOD SYSTEMS IN THE MIDLANDS OF KWAZULU-NATAL

2.1.1 Introduction: Ozwathini

Ozwathini is a rural communal-tenure community in the Midlands of KwaZulu-Natal under the Leadership of Inkosi N. Z. Mthuli. The area falls under two municipalities: uMshwathi (uMgungundlovu District) and Indwedwe (iLembe District). It is characterised by small farming communities in which various commodities are grown, including maize, beans, potatoes, *amadumbe* (taro), sweet potatoes, sugar cane, and vegetables. Farming activities also include livestock in the form of cattle, goats, pigs, poultry, and rabbits. The age group of participants in the organised farming groups ranges between 40 and 80 years old. The majority are comprised of women.

2.1.1.1 Environmental Factors

This sourveld area is sub-tropical with high rainfall and misty conditions in summer and some frost in winter. Ozwathini is also characterised by deep, well-drained soils with high fertility. Agriculture is primarily rainfed. Most of the households have access to tap water, which is mainly used for household needs and, on occasion, watering of vegetable crops. The area has been severely impacted by climate change, which has led to a perpetual decline in maize yields and income over the years. Heavy rainfalls, soil degradation, and pest outbreaks have also caused crop damage, especially to beans and vegetables, which has also adversely affected income. The farmers grow food for the informal market, namely their neighbours, bakkie traders, and, for a short period, school feeding schemes.

2.1.1.2 Institutional Arrangements

Smallholder farmers are organised in both formal and informal groups. Informal climate resilient agriculture (CRA) learning groups, under the auspices of Mahlathini Development Foundation, have been set up in nine of the villages in the area. These have given rise to the marketing group, savings groups, and the calf-rearing group. Farmers in Ozwathini receive support both from the government and civil society organisations. The diagram below outlines the methodological understanding of the interrelationships of these groups.

Below is a list of the organisations active in the area:

- *Mahlathini Development Foundation* (MDF) started working in the area in 2018 and set up a conservation agriculture (CA) learning group, which has since grown to include climate resilient agriculture, micro finance, livestock, and marketing.
- The *Department of Agriculture and Rural Development (DARD)* has a formal structure called the Mathulini Farmers Association, which was set up by the local extension officer. Research institutions that have done work in the area include the University of KwaZulu-Natal and the Durban University of Technology.
- *uMgibe Farming Organics* is a private company that seeks to collaborate with smallholder farmers in supplying large retailers with organically certified produce.
- The *uMshwathi Local Municipality* is currently running a programme of building market stalls in the small towns of Wartburg, Dalton, and Bhamshela and issuing licenses to farmers so they can sell their produce at these hubs.

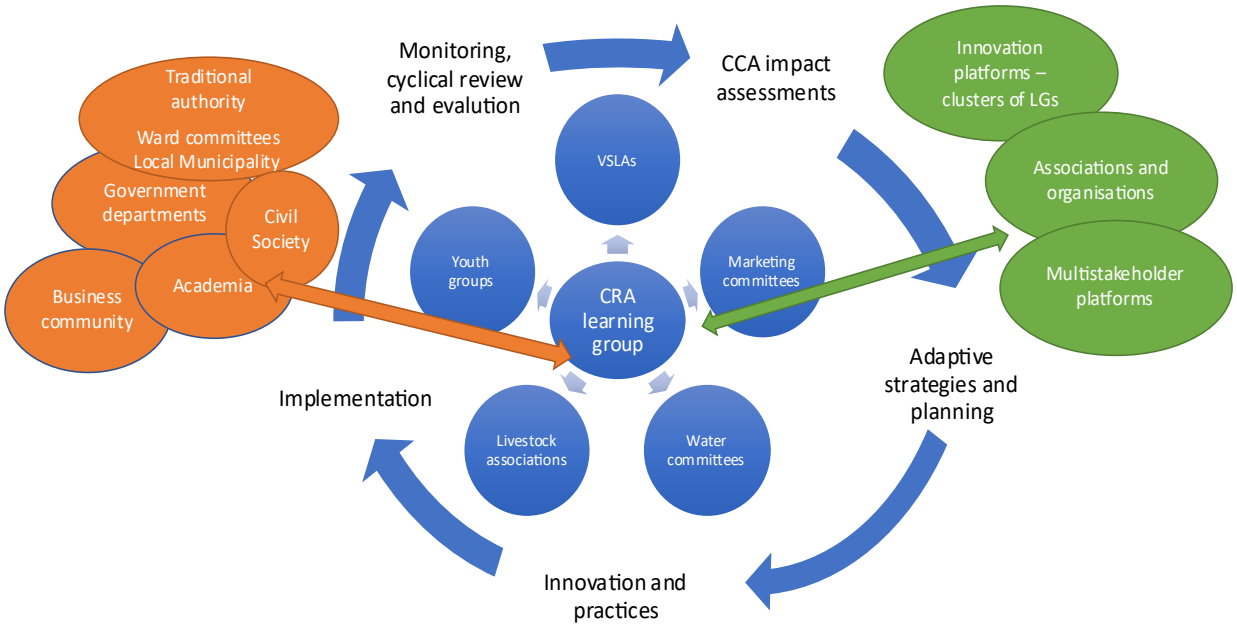

Figure 4: The model for relationship building and development of social agency around the climate resilient agriculture learning groups (MDF, 2022)

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2.1.1.3 Local Infrastructure

It is noteworthy that Ozwathini is reasonably well supported and is strategically placed between two major cities, mainly Durban and Pietermaritzburg. There is one main tar road going to Tongaat that passes through the communities. Most of the villages, apart from Appelsboch, still have gravel roads. Appelsbocsh has a government hospital that also services Swayimane and surrounding communities. Also situated in Appelsbosch is the Coastal FET college. The existence of the hospital and college has opened a platform for vendors to set up selling stalls in the area. The area also has an art gallery, hardware store, clothing store, supermarkets and a tavern that have all attracted economic activity to the area. The local town in Ozwathini is called Bhamshela, which is closer to the communities in Indwedwe. Boxer Supermarket is the main supermarket in the town. There are several foreign-owned shops and scores of local street vendors across the town.

2.1.1.4 Livelihood Activities

Farming is practised primarily for income generation and for household consumption. Aside from farming, the communities also depend on government grants and remittances to support their families. Some have small informal businesses such as spaza shops and others are retired. Within these farming groups are members who also work in ward committees and play a substantial role in addressing social issues pertaining to health and food security.

Farming plays a pivotal part in household food security in the area. Farmers employ various farming activities to support their food security needs. In recent years they have incorporated into their farming systems improved farming practices such as intercropping, crop rotation and minimum soil disturbance to slow down erosion and improve yields. They also apply organic farming practices in their gardens to

help minimise reliance on external inputs and have increased crop diversity in their food gardens to include herbs and new, unfamiliar vegetable types. In terms of livestock, as mentioned above, the farmers farm mainly cattle, goats, and poultry. The cattle are communally grazed; however, the hand-raised calves are provided with artificial milk and later fed maize stover and cover crops such as sunflower, sorghum, millet, black oats, fodder rye, and fodder radish, among others. In terms of poultry, they have layers and broilers as well as Boschvelders, which is a multipurpose breed. Poultry provides a source of protein in the form of meat and eggs, and is also a very useful source of income. Some of the farmers sell inputs such as seeds, seedlings, and herbicides to supplement their household income. Pigs are slaughtered and sold locally; some farmers have brought pork to sell at the market, which often sells out.

2.1.1.5 Market Access

Market access remains a serious constraint for smallholder farmers in the area. One of the glaring realities of the rural farming sector is the exclusion of smallholder farmers from competitive markets. This is largely due to inconsistent yields, poor quality produce, lack of access to relevant knowledge, poor technology development, and inherent risks stemming from a broken past of segregation and economic exclusion. These challenges are further complicated by the ever-increasing threat of climate change. To alleviate some of the effects of climate change on rural livelihoods, several interventions introduced by MDF include conservation agriculture, climate-resilient agriculture, micro-finance management, logistical support, learning platforms, and multistakeholder engagement.

Through the assistance of MDF, farmers from the learning groups set up a monthly market in Bhamshela that has been in operation for more than two years. The market lasts two to three days each month, depending on produce availability and level of demand. Mahlathini also supports two savings groups in the area, which meet monthly. These groups serve as "money banks" and as a source of small credit for business purposes.

2.1.2 Introduction: Swayimane

Swayimane is situated in the heart of uMshwathi Local Municipality, under the leadership of iNkosi Gcumisa. It is made up of many small farming communities, and like Ozwathini, farming activities include field cropping and livestock production, and there are community networks such as savings groups. Communities working with Mahlathini include Mayizekanye, Gobizembe, and Ndlvaveleni. MDF has also started meetings and consultations with the uMbhava community. The majority of the farmers working with MDF are women between the ages of 35 and 85.

2.1.2.1 Environmental Factors

The communities farm on communal land using plots in and around their homesteads as well as separate plots in the wider community, which are either family-owned or leased from their owners. Similar to Ozwathini, Swayimane is also a subtropical area with high rainfall and periodic dry spells. As with most smallholder farmers on the periphery of the agricultural food chain, climate change has dealt a severe blow to the less organised and poorly resourced farmers. The climatic conditions in the Midlands are characterised by localised flooding, heavy hailstorms, temperature fluctuations, and exacerbated pest and disease outbreaks. Field cropping is rainfed due to a lack of water and water infrastructure. Although most of the soils are deep and well-drained with reasonable fertility, years of mechanical ploughing and chemical application have resulted in reduced fertility and poor soil structure in some homesteads. Due to illegal burning of pastures, as well as an incoherent programme for

removing alien invasive plants, most of the local veld has become severely degraded. There has been heavy encroachment of lantana, bug weed, and peanut butter acacia, as well as wattle in some parts of Swayimane, which has adversely affected local water resources and, in some cases, has led to livestock mortalities.

2.1.2.2 Local Livelihoods

Unemployment levels are extremely high in Swayimane, especially among the youth. The area also has a high percentage of “the missing middle”, which are people who do not qualify to receive social grants or pensions but are also unemployed. Farming is the primary source of food and income. The area has a large number of sugar cane farmers who supply the local mill. Others grow SC701 maize and sell it to local traders. Other common commodities in the area include beans, sweet potatoes, avocados, *amadumbe* (taro), and vegetables. There are also a variety of fruit trees, namely peach, mango, banana, and guava. The communities survive on pension and child-support grants, small business activities, and seasonal employment on neighbouring commercial farms. The farmers also keep livestock in the form of cattle, goats, and poultry.

2.1.2.3 Local Infrastructure

After many years under construction, Mayizekanye finally has a roughly five-kilometre-long tar road that ends at the edge of the community. The area is highly underdeveloped in terms of infrastructure, and although most households have running water, the taps often run dry for extended periods. Mayizekanye has a local clinic which also accommodates Gobizembe and Emambediwni communities. There is one informal grocery store in the area and a few spaza shops. In neighbouring Gobizembe, there are also a few spaza shops. The roads are poor and very slippery in wet conditions. Although, like Mayizekanye, there are taps in the homesteads, most are not working. Some community members have addressed this by installing JoJo tanks. A municipal water-delivery vehicle also supplies the homesteads at least once a week. Wartburg is the primary local town where the main supermarket is Spar. Farmers purchase most of their household food items at Spar when they collect their pension and social grant payouts. There are some vendors on the main road and at the taxi rank, but the town is generally busy only on pension days.

2.1.2.4 Institutional Arrangements

MDF started working in Swayimane in 2018, with Mayizekanye being the oldest community, followed by Gobizembe. CA learning groups were established that were involved in the planting of CA trials of maize, legumes, and cover crops. The Ndlaveleni learning group and Gobizembe youth groups were established in 2023. Also, with MDF, the community has been involved in climate resilient agriculture and has diversified their farming systems to include a variety of vegetables and herbs that are essential for food security and nutrition. They have also expanded their farming systems to incorporate livestock in the form of poultry.

The Institute of Natural Resources (INR) is also involved with Swayimane communities under the Elifans project, which seeks to support food security initiatives focused on women. One of the primary aims of the project is to identify local innovations and support them in partnership with other organisations working in the areas. The INR is also involved in the rehabilitation of springs in Swayimane and is looking into getting involved in the clearing of alien invasive species that threaten the water sources in the area and have encroached on local pastures, drastically reducing their quality.
The University of KwaZulu-Natal is currently running six projects in Swayimane under the Umngeni Resilience Programme (URP) and the Water Research Commission. Although the URP programme

has come to an end, the research continues. Some of the focus areas have included a study on climate-resilient built-infrastructure early-warning systems (including one for lightning, linked to a communication process and weather stations in the area), exploration of commercial production of cannabis, and the use of drone technology to assist smallholder farmers in coping with both biotic and abiotic factors that affect their farming systems. The WRC project aims to develop a database for underutilised crops such as *amadumbe*, sweet potatoes, and Bambara nuts.

Msinsi Farming works in protected areas and is involved in the removal of alien invasive species within these protected areas. They also visit schools and have information sessions on environmental conservation, and mainly work individually, but have recently been involved in proposal writing with the INR.

The SA Canegrowers Association is a commodity organisation that works with small-scale growers and land reform beneficiaries around the Illovo mill. Their primary services are the compilation of business plans, commodity enterprise research, and diversification. It is estimated that small-scale growers supply less than 5% of the sugar cane in the sugar industry. Seed cane growers seek to increase the percentage by giving farmers access to disease-free seed cane. They also help farmers with vegetable projects, as well as with collecting topsoil and subsoil samples.
Jaagbaan is a local agricultural input supplier that has given a few presentations in the community on the various products and services they offer. Their main objective was to make farmers aware of what products are available locally, especially when it comes to animal feed and medicinal products.

2.1.3 MDF interventions to strengthen local food systems in the Midlands

2.1.3.1 Conservation Agriculture (CA)

Conservation agriculture (CA) is an alternative approach to conventional farming that promotes better use of natural resources to improve sustainability and resilience to climate change. The primary principles of CA include minimum soil disturbance, permanent soil cover, and crop diversification. Because farmers still had some level of success with the conventional approach to farming, the introduction of CA was initially met with resistance. And although, as time went on and farmers saw the benefits of not disturbing the soil, and their attitude towards CA began to change, they still question the potential of CA to improve yields compared to conventional farming. Benefits in soil fertility, soil health, reduced erosion, and improved water management have been noted. Planting under CA also played a significant role in reducing input costs, due to the reduced use of synthetic fertilisers and the elimination of ploughing, which removed tractor hire costs.

In the last three years, rainfall has been exceptionally high, which led to crop damage due to black rot, especially among legumes. The alternating high temperatures and high rainfall also led to increased levels of stalk borer infestation, which led farmers to buy even stronger and more expensive chemicals to control it. Farmers in the Midlands also plant maize to sell to local bakkie traders, but due to declining yields, the rising price of inputs, and the ever-present competition with commercial farmers, even this market is under threat. This has caused some to either downscale maize production or cease growing maize altogether and focus on alternatives.
Another significant principle of CA is ensuring that the soil is always covered and incorporating a diversity of crop types either through intercropping, relay cropping or crop rotation. Various cover crops which included legumes, brassicas, grasses and cereals were introduced. These varieties came in mixtures that could be planted in summer and winter to protect and improve soil fertility. Incorporating cover crops worked well for farmers who kept livestock, because they were able to cut and carry in

winter. Some farmers reported that their livestock refused to eat any of the cover crops and so they stopped growing them. There is still a need for more workshops on the uses and benefits of cover crops in the Midlands.

Figure 5: Examples of CA cropping for smallholder farmers in the Midlands showing beans (L), summer cover crops (M), and maize and bean intercropping (R), undertaken by farmers in the CRA learning groups.

The greatest benefit of CA in the Midlands was that farmers realised that it was possible to grow field crops and market them without damaging the soil structure and without over-applying synthetic fertilisers. The reduction in input costs has always been reported as one of the major advantages of CA, especially in this economy. Over the years, some farmers were willing to expand their CA plots, and others requested to do so, which meant they recognised the role CA played in helping them deal with the effects of climate change.

2.1.3.2 Climate Resilient Agriculture

To mitigate the effects of climate change, MDF has collaboratively explored various options that farmers can implement. This was done through a series of climate change workshops that created awareness on how climate change affects food production as well as quality of life, and what scientists foresee in the future should the situation not change. Farmers shared their indigenous practices for protecting their crops and livestock, which included filling bottles with ocean water to drive away hailstorms, banging lids to divert heavy winds, attempts at covering their crops to protect them, leaving crying babies next to ponds to appease the rain queen and, where necessary, changing planting times. In Mayizekanye, a custom of making sacrifices to *nomkhubulwane* (goddess of rain, nature, and fertility) has been revived and is performed once a year. Farmers from the area are not allowed to touch soil on Tuesdays as this is the day they perform the ritual. All the above points to the socio-cultural beliefs that drive farmer behaviours. Because some traditional practices have become obsolete, farmers believe this is the reason for the adverse climatic conditions and yield declines. Others believe that nature is retaliating against a morally degraded society that has angered the gods.
Practices presented by MDF covered five main categories, namely, water conservation, soil health, soil fertility, livestock management, and crop management. Within these themes came the specific practices that provided practical and feasible solutions for the local contexts.

Micro-tunnels were installed throughout the Midlands to help reduce the impacts of heavy rains and violent winds that damaged crops. The tunnels were erected over deep trenches that were filled with

organic matter and built into raised beds where a variety of crops were planted. Some of these crops were new to farmers, such as mustard spinach, Chinese cabbage, leeks and herbs. To address the water shortage issue, bucket-drip kits were also installed in the tunnels. These are drip irrigation systems that channel water, including grey water, to plants over a period. To date, more than 40 tunnels have been constructed in the Midlands.

Figure 6: Example of a micro tunnel for a smallholder farmer in Mayizekanye, Swayimane

The tower garden is another example of a system designed to be cost-effective and save on water and fertiliser. These gardens are easy to manage and can plant close to 100 seedlings, depending on size. They also have low weed outbreaks. Tower gardens are irrigated using grey water, which means that farmers can save on water by reusing their wastewater to irrigate their plants.

Figure 7: Left: An example of tower gardens in a homestead plot in Swaiymane, and right, a small cage of four-week-old Boschvelder chickens, newly introduced at the household level.

Livestock integration entailed, among other activities, the introduction of Boschvelder chickens, a multipurpose breed that is hardy and a very good source of both meat and eggs. These birds were supplied together with cages to protect the chicks from being eaten by predators. Training on poultry production was provided to capacitate farmers who did not own livestock to integrate them into their farming systems. The training was so well received that in 2023 alone, more than 3000 day-old broiler chicks were purchased by Midlands farmers, and farmers place orders almost on a weekly basis. Broilers are highly popular because of their quick turnover and because they provide a source of meat to households in tough economic times. Fewer farmers have ordered layers, as they are more expensive.

2.1.3.3 Local marketing initiatives

Potential marketing options were explored intensively over a period of two to three years, through workshops, meetings, and semi-structured interviews with individuals and stakeholders, to develop a process of intervention to assess the best options in marketing for these smallholders.
Most of the sales for smallholder farmers occur under the following circumstances:

- Food first, income from surplus (80% of participants).
- Expansion of existing cropping areas and types and number of crops grown (10–15%).
- Production specifically for sale (1–5%).

The following marketing avenues have been explored with the learning groups in the area:

- Farm gate (within villages); small local potential with low-income ceilings.
- ***Local market stalls (combined across villages); a much larger range of products and income potential, also now focus on labelling, branding, pricing, value adding and processing.***
- Bakkie traders, stores in local towns (individuals and groups within villages); generally, commodity-focused, and farmers are price takers – good for larger quantities but no competitive advantage.
- Sale to local retailers and supermarkets (individuals); requires transport, intermittent, price takers, little stability, competitive – overall potential low.

The local market stalls have provided the best option for marketing and show good potential for expansion, both in number and size. Farm-gate sales have been the most common for field crops, poultry (eggs and broilers), and livestock. The following table provides a summary of average incomes for each of these "commodities" across two seasons of implementation.

Table 1: Average incomes for commodities supported in the CRA learning groups: per participant.

Commodity	**Average monthly income per participant**	**Annual income potential**
Broilers	R1 024.50	R12 294.00
Layers (eggs)	R641.00	R7 692.00
Field crops: Maize Beans	 R209.41 R237.50	 R3 713.00 R2 850.00
Vegetables	R247.00	R2 964.00
	Average monthly value of food per participant	
All commodities: This is an estimate only (further corroborated in resilience snapshots)*	R700.00	R8 400.00
Commodity for a selection of participants only	**Average monthly income per participant**	**Annual income potential**
Green maize	R1 300.00	R15 600.00 (up to R24 000)

Stall-fed calves	R750.00	R9 000.00 (up to R50 000)
Total value of production (including all commodities but excluding the selection)	**R3 059.41**	**R36 712.92**

**NOTE 1: Rand value for food was calculated from the individual interview, which elucidated detailed information on the produce consumed at a household level in kgs for vegetables, field crops, and poultry. A Rand value of R5.00 was ascribed to each kg of produce as an estimate.*

NOTE 2: From the resilience snapshots undertaken, the value of R3 060.00 resonates well with actual incomes outlined by participants, which were between R750.00 and R3 650.00 on average across the sites.

Values for the table have been averaged across all participants who were monitored, and we assumed that a particular participant is involved in the production of all commodities supported in this process (poultry, dryland crops, and vegetables). It thus provides a reasonable estimate of average potential incomes (profits – after subtraction of input costs) for participants in this livelihoods intensification and diversification process. This is a substantial livelihood improvement and is often more than participants receive from other sources, such as government grants.

2.1.3.4 Local market stalls

This strategy of aggregating all produce across a selection of villages and selling monthly at a market stall at a central point, such as a social grant pay point or taxi rank, has been the main intervention. It has included working with participants on pricing, produce quality, labelling, and branding of produce and the stall. It appears to be the most appropriate strategy at present that can accommodate small quantities of a range of products, as well as the inconsistency of supply. It also ensures that farmers can charge reasonable prices for their produce.

Farmers have learnt which produce enjoys high demand at the market stall and can now estimate the quantities needed for each market reasonably accurately. They still sell out, however, but no longer have large quantities of unsold produce to take home again. They have also built a reputation among buyers because they have been careful to be there regularly. They provide social support to each other, and if individuals have family emergencies, others in the group will take their produce to the market and do the sales for them.

Figure 8: Above left: Participants setting up their monthly market stall. Note packaging for potatoes, beans, eggs, and vegetables being sold. Above right: An example of the monthly posters and price lists used to advertise this market, both locally and through social media.

Preparation for market days entails substantial planning and logistics because groups need to come together to list their produce availability and quantities, prepare produce and price tags, arrange transport and their market stall equipment, and determine who will be selling on the day. They also

manage the recordkeeping of sales and distribution of monies among the farmers involved. For Ozwathini, because they have decided to sell for three consecutive days each month, they have arranged for storage space in Bhamshela, close to where they have their stall. For this group, a social media platform for the sale of produce to several individual buyers in Pietermaritzburg has also been set up. This platform (WhatsApp and Facebook) is managed by the MDF facilitators, as is transport and delivery.

2.1.4 Cross Visits, Multistakeholder Platforms, Learning Workshops

Since the inception of the project, MDF has opened up platforms for farmers to learn and share knowledge. In 2023, there was a cross visit from the Midlands to Bergville, where farmers witnessed how people from other areas use available resources to improve their livelihoods. During the cross visits, the farmers visited some of the CA trials in Bergville and got to see their tunnels and poultry production. Multistakeholder platforms include farmers' days hosted by MDF and other stakeholders. One such platform was the livestock open day held in Swayimane and Ozwathini that focused on livestock rearing and the integration of cover crops to save on feed expenses. Learning workshops include a wide range of learning sessions and discussions on various topics such as soil fertility, pest and disease control, mixed cropping, and savings, among others. All these platforms open farmers up to the bigger picture and strengthen existing local networks while opening opportunities for the formation of new ones.

2.1.5 Conclusion

The strengthening of local food systems is imperative if the SDGs, as envisioned by the UN, are to be achieved. MDF has been involved in multiple initiatives that seek to empower and capacitate local farmers to improve the productivity of their farming systems and find effective ways to turn their farming activities into income-generating enterprises. All of this while seeking ways to effectively reduce the impacts of climate change and improve the resilience of smallholder farming systems. Experience has shown that one-dimensional interventions do not last long, and if interventions are going to have a lasting impact, they must be multifaceted or at least flexible enough to allow for expansion and incorporation of innovations and technologies into the system. Mahlathini’s approach to rural wealth creation encompasses the identification of interventions at various points of the food value chain, from production to marketing. This approach has allowed for significant improvements in productivity, local food access, and local incomes. It has also provided options for diversification and implementation of climate-resilient agriculture practices, improving the adaptive capacity of participating smallholders. In addition, it also allows for external stakeholders to walk the production journey with farmers and better understand their challenges, needs, and desired outcomes. It also builds relationships between local farmers and external stakeholders because it allows space for vulnerability, learning, reflection and formulation of new ideas.

2.2 CASE STUDY: RESILIENCE IN LOCAL FOOD SYSTEMS

2.2.1 Introduction

A programme focusing on Climate Resilient Agriculture (CRA) in mixed smallholder farming systems was undertaken in KwaZulu-Natal and Matatiele (Eastern Cape) between 2020 and 2022. This initiative was supported by the WWF and the Nedbank Green Trust.

The two main outcomes of this project can be summarised as:

- Food and nutrition security at the household level for poor, rural homesteads with enough farming income to sustainably maintain farming activities in the short term.
- Development of social agency for community-led local economic development and social safety nets, and improvement of the natural resource base.

These outcomes were achieved by working intensively with Climate Resilient Agriculture (CRA) learning groups in 18 villages across KwaZulu-Natal (Bergville, Midlands and Southern KZN) and the Eastern Cape (Matatiele) for 378 participants. The main foci of the project were on improved, diversified, and sustainable production in smallholder farming systems and development of local marketing initiatives and platforms, within a framework of climate change adaptation and improvement of social agency and local governance. Attention was given to multistakeholder engagement at different levels of the food system.

2.2.2 Project summary

In each CRA learning group, participants undertook a climate change assessment and prioritised adaptive measures and practices to be undertaken by each individual in the group. CRA practices included Conservation Agriculture (intercropping, crop rotation, inclusion of cover and fodder crops), livestock integration (poultry micro-businesses, fodder production, winter fodder supplementation and calf rearing) and agroecological homestead vegetable production (micro tunnels, trench beds, rainwater harvesting, mulching, grey water management, composting, mixed cropping, crop diversification, liquid manures, natural pest and disease control, and seed saving). Seasonal reviews and joint learning activities reinforced cyclical learning and adaptation.

The CRA learning groups also formed the basis for improvement of social agency and governance for joint discussion, analysis, and collaborative action, primarily around marketing and water access, but also in resource conservation activities. Eight of the groups formed formal marketing committees and structures for local marketing, three formed water committees and undertook community-owned and managed water schemes in their villages, five set up farmers' associations for calf rearing and livestock management, and two undertook resource conservation activities linked to youth employment in their villages. For the remaining groups, collaboration was strengthened in these areas, but not to the extent of initiating formal structures and initiatives.

Through expansion and intensification of production and productivity, participating smallholders increased both household food availability and incomes. The total value of production averaged around R3 060/per household per month. This equates to a 68% increase in production and incomes as a result of the intervention. Around 80% of participants still produce for household consumption first, and the surplus is sold.. This has meant that farm-gate sales and local marketing stalls are the most appropriate marketing strategies, because these can provide flexibility for the sale of various quantities and types of produce. Participants increased their crop diversity by roughly 10 crops per participant, and each also included around 10 new CRA practices into their farming system.

Membership of the Village Savings and Loan Associations (VSLA) increased to 510 participants, including the initiation of six new VSLAs and one Bulk Loan Fund association. The overall annual value of these VSLAs was roughly R 1 117 420, with an individualised value of around R3 342 per annum. Participants used these savings and small loans for household consumption smoothing, buying household items, education, production inputs, and small businesses. These VSLAs provide a very strong element of financial sustainability to participants in a highly vulnerable environment.

2.2.3 Monitoring and Evaluation

A central concern for this intervention was to develop coherent processes for monitoring and evaluating improvement in livelihoods and incomes, as well as improved climate resilience for participants. We wanted to be able to clearly show the impact of these interventions on participants' livelihoods and on their local food systems.

A methodology for assessing changes (positive or negative) for a suite of bespoke resilience indicators was used. This process was initially piloted in a WRC-supported research process entitled "*Climate change adaptation for smallholder farmers in South Africa: A decision support guide* "(WRC report no: IT/841/1/20; (Kruger, 2021). An integral component of the methodology is the resilience snapshots: An in-depth individual analysis of changes in their food system related to climate resilience. These snapshots are designed to provide a time-based analysis of changes in resilience as well as a process to compare the resilience impact of interventions across different areas and agroecological zones.

The impact survey was conducted with around 40% of participants from each of the areas (Bergville, Midlands, SKZN, and EC – Matatiele), 66 in total, using the resilience snapshot methodology, process, and questionnaire developed for this purpose. Indicators for these snapshots were carefully developed and pre-tested to show changes and impact in a range of resilience-related criteria. Below, the summary tables for the two areas (KZN and EC) are presented, with short discussions.

2.2.3.1 KwaZulu-Natal

In KZN, participants were interviewed in the Bergville (n=21), Midlands (n=15), and SKZN (n=9) sites proportionally according to the number of participants in each site. Each site is in a significantly different agroecological region. In addition, some sites are in proximity to large urban centres, while others are quite isolated. These are the two main factors for differences in production and productivity between these sites. Local production habits also play a part, as do attitudes towards change and new ideas. Table 2 summarises the changes across the three sites.

Table 2: Climate resilience snapshots for 45 participants from KZN; November 2022

Resilience indicators	**Average increase**			**Comment**
	Bergville (n=21)	**Midlands (n=15)**	**SKZN (n=9)**	
Increase in size of farming activities *(Cropping areas measured, no. of fruit trees, and no. of livestock assessed)*	Gardening: 93 m²–234 m² (253%)	Gardening: 1 217 m²–1 664 m² (36%)	Gardening: 25 m²–100 m² (400%)	The sizes of gardens have increased substantially in Bergville and SKZN, where many participants were not gardening before. In the Midlands, most participants already have reasonably sized gardens.
	Field cropping: 2 460 m²–6 175 m² (251%)	Field cropping: 5 163 m²–6 270 m² (21%)	Field cropping: 1 666 m²–1 044 m² (-62%)	Dryland cropping has increased substantially since the introduction of CA and includes fodder production and cover crops in Bergville. Field sizes range from 500–28 0000 m². Field cropping has, however, decreased in SKZN due to adverse weather conditions and economic pressures, and has increased only slightly in the Midlands, where fields are already well established and reasonably large.
	Fruit and other trees: 1–2	Fruit and other trees: -0	Fruit and other trees: -0	Some farmers bought a few more fruit trees. Around 40% of households do not have any trees in their yards.
	Livestock: Cattle: 173–117 (-33%)	Livestock: >22 chickens per	Livestock: >5 layers per participant (5%)	More poultry are kept (broilers and layers) for marketing. Most families' livestock has decreased substantially due to theft, recent floods, and household use.

Resilience indicators	Average increase			Comment
	Bergville (n=21)	**Midlands (n=15)**	**SKZN (n=9)**	
		participant (46%)		
Increased farming activities (*Count of gardening, cropping, livestock integration)*	2	2	2	Several participants have re-initiated certain farming activities: gardening and/or field cropping activities, as well as poultry production (broilers/eggs).
Increased season (*continuity of farming activities throughout the year)*	Yes	Yes	Yes	For field cropping – autumn and winter options, and gardening throughout the year. This is a measure for improved continuity and production.
Increased crop diversity (*Count of number of crops and CRA practices for each farmer)*	Crops: 24 new crops ~ 7 per participant	Crops: 20 new crops ~ 9 per participant	Crops: 19 new crops ~ 6 per participant	*Number of new crops for the area, planted per farmer: C*rops include coriander, basil, fennel, rosemary, lettuce, red lettuce, mustard spinach, kale, carrots, beetroot, Chinese cabbage, spring onions, leeks, onions, cabbage, red cabbage, butternuts, sorghum, sunflower, Sun hemp, Lab-lab, Lespedeza, tall fescue, winter cover crops, turnips, beans and cowpeas.
	Practices: 24 new practices (Average 11 per participant)	Practices: 21 new practices (Average 10 per participant)	Practices: 15 new practices (Average 8 per participant)	*Number of CRA practices implemented per farmer:* These include mulching, trench beds, liquid manure, raised beds, mixed cropping, inter-cropping, crop rotation, tunnels, drip kits, eco-circles, greywater use and management, CA, cover crops, inclusion of legumes, pruning of fruit trees, picking up dropped fruit, pest and disease control, feeding livestock on crops and stover, cutting and baling, fodder supplementation, health and sanitation for poultry, brooding, JoJo tanks and RWH drums.
Increased productivity (*increased yield)*	Gardening: >73 kg /season/ farmer	Gardening: >410 kg /season/ farmer	Gardening: >17 kg /season/farmer	*Increase in kgs of vegetables produced per season:* Based on an increase in yields, mainly from tunnels and trench beds for gardening, for a range of vegetables and herbs.
	Field cropping: >450 kg /season/ farmer	Field cropping: >888 kg /season/ farmer	Field cropping: >181 kg /season/ farmer	*Increase in kgs of field crops produced per season:* Relates to switching to CA and increase in field size for a range of field crops – mainly maize, beans, and potatoes
	Livestock: >2/year/farmer	Livestock: >15 chickens/ year/farmer	Livestock: >21 chickens/ year/farmer	*Increase in number of livestock:* For Bergville, the number relates to cattle; for Midlands, to both layers and broilers; and for SKZN, to layers.
Increased water use efficiency	6	7	5	*Access, RWH, water holding capacity, and irrigation efficiency are rated. Scale: 0=same or worse than before; 1=somewhat better than before; 2=much better than before.* The ratings indicate good improvements in RWH, water holding, and irrigation efficiency, and some improvement in access.4 criteria, each with a value of two were assessed.
Increased income	R741/month/farmer Range: R240– R2 000	R3 641 /month/farmer Range: R800– R7 320	R1 021 /month/farmer Range: R200– R1 500	*Increase in average monthly income (Rands):* This is primarily through local marketing and small businesses. Several participants have lost employment and grant incomes and have replaced these with farming. Around 10% of participants have not improved their income.
	Vegetables: 18kg/week	Vegetables: 27kg/week	Vegetables: 6kg/week	*Food produced (overall kgs per week) and consumed in the household:* For both Bergville and the Midlands, these

Resilience indicators	Average increase			Comment
	Bergville (n=21)	**Midlands (n=15)**	**SKZN (n=9)**	
Increased household food provisioning	Dryland crops (maize, legumes, sweet potatoes): 23 kg/week	Dryland crops (maize, legumes, sweet potatoes): 16 kg/week	Dryland crops (maize, legumes, sweet potatoes): 17 kg/week	figures indicate food secure participants, while for SKZN, the self-produced food is roughly 30% of that required for a household.
	Poultry: 2–3/ month	Poultry: 2–3/ month	Poultry: 2 kg eggs/ month	
Increased food security	Average: 3 food types/2x/ week	Average: 5 food types/3x /week	Average: 3 food types/2x/ week	*No. of food types/no. of times/week:* This is a measure of improved dietary diversity and indicates both improved access and changes in food habits. The largest diversity is found for the more peri-urban communities in the Midlands.
Increased livelihood diversity options	1	1	1	*Average increase in livelihood sources:* Social grants, remittances, farming incomes, small business income, and employment. Increase in no. of livelihood options used. Primarily from farming and small business income.
Increased savings	Average: R152/month/farmer	Average: R354/month/farmer	Average: R280/month/farmer	*Average increase in savings (Rands):* Savings used for food, household, education, and production. In Bergville, the increase is within existing savings groups, and for Midlands and SKZN, new groups have been established.
Increased social agency (collaborative actions)	3	3	1	*Average number of local organisations farmers belong to:* Participants generally belong to church groups and stokvels. New group collaborations include learning groups, farmers' associations, village savings and loan associations, marketing committees, farmer centres, work teams, and local water committees.
Increased informed decision-making	2	2	2	*Average number of sources of information:* Own experience, local facilitators, other farmers/community members, facilitators, extension officers, radio, extension officers.
Positive mindsets	3	3	3	*A qualitative rating of wellbeing for each participant:* SCALE: 0=less positive about the future; 1=the same; 2=more positive about the future; 3=much more positive**. More to much more positive about the future: Much improved household food security and food availability.**

In Bergville, participants doubled the sizes of their gardens and field cropping areas and increased poultry and fruit production. Livestock production decreased by around 33%, mainly due to substantially increased theft in the area, but also due to use for *Lobola*, ceremonies, and household consumption. Twenty-four crops have been introduced and are being grown in the area, as well as 24 CRA practices. Productivity has increased, and farmers are producing on average 73kg more vegetables per season and around 450kg more field crops. Their food security has been improved, and their income has increased by an average of R741/month, from farm-gate and market-stall sales. Savings have increased by R152/month per participant. Participants are now involved in at least three more social organisations, including the learning groups, savings groups, farmers' associations, and water and marketing committees. They have improved their decision-making, now working with local facilitators, DALRRD extension officers, and MDF staff. In summary, their mindsets and outlook on their futures are much more positive, with much improved household food security and food availability.

Figure 9: Clockwise from left: A mixed crop tunnel (Nelisiwe Msele), a protected spring, and a poultry house for broilers, in Stulwane, Bergville.

Figure 10: CRA marketing group with the market stall in Bergville in early August 2022, showing a good range of the crops they are now selling.

In the Midlands, participants have increased their gardens and fields by around 30%, as many were already active farmers. This area is close to large urban centres and has a forgiving climate that can accommodate both winter and summer crop production. Those keeping poultry have increased their flock sizes by around 22 birds per participant. A sizeable group of farmers became involved in calf rearing (around 30 members), where one-week-old calves are reared to yearlings before being sold locally. Twenty crops have been introduced and are being grown in the area, as well as 21 CRA practices. Productivity has increased, and farmers are producing on average 410 kg more vegetables per season and around 888 kg more field crops. Their food security has been improved, and their incomes have improved by an average of R3 641 a month, from farm-gate and market-stall sales. Savings have increased by R354 a month per participant. Participants are now involved in at least three

more social organisations, including the learning groups, savings groups, farmers' associations, calf-rearing groups, and marketing committees. They have improved their decision-making, now working with local facilitators, DARD extension officers, and MDF staff. In summary, their mindsets and outlook on their futures are much more positive, with much improved household food security and food availability.

Here, in addition to the snapshots, an assessment of changes in practices and the impact of these on their farming was undertaken with several participant smallholders. The advantages of a transition to a more agroecological system are evident. In Table 3, a few examples are provided.

Table 3: Assessment of past and present farming practices for Bongiwe Shezi, Mayizekanye: November 2022

Bongiwe Shezi – Mayizekanye				
Past Issue	**Past practice**	**Present practice**	**Impact**	**Lessons**
Bare soil (no soil cover) results in soil erosion.	Ploughing with a tractor.	Planting cover crops, minimal tillage, and mulching.	Improved soil health and prevention of soil erosion, keeping the topsoil.	Bare soil can have high acidity, and the remaining soil lacks nutrients, so she would be required to use fertiliser.
Pests	Use of chemical pesticides.	Planting herbs and using nonharmful chemicals.	Soil health improved.	Nature-based practices are cheaper and much healthier for people and the environment.
Poor quality of crops.	Application of fertiliser.	Crop rotation, intercropping, weeding, and minimal tillage.	Soil health and fertility improved, resulting in healthy plants.	

Bongiwe also provided a self-assessment of her level of improvement for the five fingers principles of agroecological improvement in her farming. Table 4 shows which practices she has included under each of the conservation practices. She has not focused on natural resource management or indigenous plants. Bongiwe was able to assess her level of learning and implementation coherently and give an indication of the impact of these changes on her farming system.

Table 4: Bongiwe's assessment of the implementation of the five conservation principles in her farming system

Five fingers conservation practices				**Detailed description of what is there – list practices**
Water management		×		Storing water (RWH), soil cover to prevent soil erosion, channelling water into the field, and run-off management
Control of soil movement		×		Minimal tillage maintains soil cover, use of winter and summer cover crops, mulching, and use of kraal manure
Soil health		×		Soil testing, soil fertility (manure and compost), cover cropping, and reduced soil erosion
Improved crop management		×		Herbicide use, intercropping, mulching, ridging, and spraying
Improved livestock management			×	Vaccination, grower mash for the broilers
Looking after indigenous plants	×			

Mr Philani Ngcobo from Ozwathini has experimented with a range of practices, including some new ideas introduced through UKZN and DALRRD. He rated each of his most successful CRA practices against several criteria that he considered important, including, for example, soil improvement, efficient water use, increased production, improved income, and improved ability to adapt to variable weather conditions. He rated the impact of these practices as follows.

Table 5: Philani's assessment of the impact of introducing CRA practices on several different sustainability criteria

Name of practice	Soil	Water	Productivity	Labour	Pest and disease control	Cost and maintenance	Livelihoods	Adaptation	Scale used: -1=worse than normal practice; 0=no change; 1=some positive change; 2=medium positive change; 3=high positive change
CA	3	3	3	3	2	3	3	3	
Mulching	3	3	3	3	3	2	3	3	
Tunnel	3	3	3	3	3	3	3	3	
Cover cropping	3	3	3	3	3	3	3	3	
Worm composting	3	2	3	3	3	3	3	3	
Aquaculture	0	-1	3	3	2	3	3	3	
Hydroponics	0	-1	3	3	-1	0	3	2	
Hay harvesting	2	3	3	2	0	3	3	3	

This exercise helped us to understand the impact of introducing specific CRA practices on the farmer's food system. All the practices had a very positive impact on his resilience (adaptation) as well as his livelihood.

In Southern KZN, improvement in productivity has been hampered by the relative isolation of the villages, due to the broken, hilly topography of the area, lack of access to urban centres, and high climate variability. Many participants have started gardening again, albeit on small patches between 25 m^2 and 100 m^2; their field cropping areas have contracted by 62%, due to repeated weather-related crop losses and deteriorating soils, and the increase in livestock has been limited to an increase in the number of layers (~5 per participant farmer). They have suffered losses in livestock numbers (cattle and goats) due to theft and flooding. Nineteen crops have been introduced and are being grown in the area, as well as 15 CRA practices. This is less than in the other two KZN sites and relates to a stronger reticence to change in this area. Nonetheless, productivity has increased, and farmers are producing on average 17 kg more vegetables per season and around 181 kg more field crops. Again, this is less than the other two sites with a 30% increase in food security, compared to around 90% in the other two KZN regions. Incomes have increased by an average of R1 021 per month, primarily from farm-gate sales. It has not been possible to establish joint local marketing actions in this region. Savings have increased by R280 per month per participant. Participants only have the CRA learning groups as a new organisational structure in these villages. Despite these lower levels of success, participants' mindsets and outlook on their futures are much more positive, with much improved household food security and food availability.


Figure 11: Left: Layers' unit for Mr Mandal Mkhize in Ngongonini, and right: Letta Ngubo's CA field with summer cover crops and maize in Spring Valley, SKZN (February 2022)

2.2.3.2 Eastern Cape – Matatiele

Villages in this region are sprawled along the escarpment leading up into Lesotho, and weather conditions are quite extreme at the best of times. Winters are cold with severe frost and sometimes snow. Summers are cool to hot, and rainfall is unreliable but often comes in the form of severe storms that include hail. In addition, soils in the region are poor with low levels of organic matter, high levels of sand, and high levels of compaction. Water access continues to be severely limited, and water for irrigation is almost entirely lacking.

Although there are vast areas of abandoned fields, intervening in dryland cropping would need a very focused and intensive effort. Most smallholders in the area are a lot more focused on household food production, including vegetables, fruit, and small livestock, and thus, much of the focus for this project was there.


Figure 12: Left: A CA plot in Nkau, with reasonably typical patchy growth. Initial improvement through CA in the first season was not enough to convince participants to continue. Right: The really hard and compacted soil, low in organic matter, proved difficult to dig out for trench beds in several households


Figure 13: Left and right: Household gardens in Nkau, Matatiele, showing extensive production of kale and rape, with more intensive production of greens in a tunnel with drip kits and a tower garden. Participants appreciate the value of both practices to produce better quality crops under extreme weather conditions, especially frost in winter.

In the Eastern Cape, 21 participants across three villages (Nkau, Rashule and Nchodu) were interviewed using the resilience snapshot methodology to ascertain progress and changes. The results are summarised in Table 6.

Table 6: Resilience snapshots for 21 participants from the Eastern Cape. November 2022

Resilience indicators	Increase for Matatiele(n=21) August 2022	Comment
Increase in size of farming activities (Cropping areas measured, no. of fruit trees, and no. of livestock assessed)	Gardening: 363 m² – 841 m² (231%)	Garden sizes have doubled on average, ranging from around 35 to 2000 m².
	Field cropping: ~3000 m²	Field cropping areas have not expanded.
	Fruit and other trees: 0	No new fruit trees in the implementation period.
	Livestock: 272–298 (8%)	More poultry are kept (broilers and layers) for marketing. Some, however, lost substantial numbers of birds due to ill health and cold.
Increased farming activities	Yes (1 on average)	Several participants have re-initiated gardening and/or field cropping activities, as well as poultry production (broilers/eggs).
Increased season	Yes	For field cropping – autumn and winter options, and gardening throughout the year.
Increased crop diversity	Crops: 31 new crops (average 11 per participant)	New crops include: Brinjal, parsley, coriander, leeks, thyme, lettuce, beetroot, green pepper, chillies, basil, green beans, rape kale, rosemary, carrots, Chinese cabbage, mustard spinach, spring onions, tomatoes, rosemary, fennel, broccoli, turnips, mustard spinach, kale, Sun hemp, lucerne, fodder rye, peas, sunflower, cowpeas
	Practices: 24 new practices (average 10 per participant)	Practices include; Mulching, trench beds, tower gardens, liquid manure, raised beds, furrows and ridges, mixed cropping, inter-cropping, crop rotation, tunnels, drip kits, eco-circles, greywater use and management, CA, cover crops, inclusion of legumes, pruning of fruit trees, picking up dropped fruit, pest and disease control, feeding livestock on crops and stover, health and sanitation for poultry, brooding, JoJo tanks, RWH drums

Resilience indicators	Increase for Matatiele(n=21) August 2022	Comment
Increased productivity	Gardening:>116 kg/season/farmer	Based on an increase in yields (mainly from tunnels and trench beds for gardening) – Overall kgs of a range of vegetables and herbs produced in a season
	Field cropping: > -218 kg/season/farmer	CA for field cropping – Overall kgs of a range of field crops (mainly maize, beans, cowpeas)
Increased water use efficiency	Average: 6	Access, RWH, water holding capacity, and irrigation efficiency are rated. Scale: 0=same or worse than before; 1=somewhat better than before, 2=much better than before.
Increased income	Average: R1031/month/farmer Range: R80–R3440	Based on average monthly incomes, mostly through the marketing of produce locally and through the organic marketing system
Increased household food provisioning	Vegetables: 23 kg/week	Food produced (overall kgs per week) and consumed in the household
	Dryland crops (maize, legumes, sweet potatoes): 10 kg/week	
	Poultry:2-3/month	
Increased food security	Average: 4 food types/3x/week	No. of food types/no of times/week
Increased livelihood diversity options	Average: 1	Social grants, remittances, farming incomes, small business income, and employment. Increase in no. of livelihood options used. Primarily from farming and small business income
Increased savings	Average: R322/month/farmer	Average increase in savings (Rands). Savings used for food, household, education, and production
Increased social agency (collaborative actions)	3	Participants generally belong to church groups and stokvels. New group collaborations include learning groups, farmers' associations, village savings and loan associations, and marketing committees.
Increased informed decision-making	3	Own experience, experimentation with local facilitators, other farmers/community members, facilitators, radio
Positive mindsets	2	Scale: 0=less positive about the future; 1=the same; 2=more positive about the future; 3=much more positive. More to much more positive about the future: Much improved household food security and food availability

In Matatiele, participants doubled the size of their gardens, while field cropping and fruit production have not changed much. Livestock production, mainly poultry (layers and broilers), increased marginally by 8%, which was a combination of substantial increases for a few participants but decreases for most participants who found it impossible to profitably manage small flocks of 10–20 birds, given the sharp rise in transport and feed costs. Thirty-one crops have been introduced and are being grown in the area, as well as 24 CRA practices. In this area, participants were enthusiastic about trying out crops new to them and to the area, more specifically in their vegetable gardens, and they have now included several crops for localised sales, including, for example, mustard spinach, Chinese cabbage, and leeks. Productivity has increased, and farmers are producing on average 116 kg more vegetables per season, indicating the expansion of production for both consumption and sale. Field cropping has reduced by around 220 kg per participant this season, indicating a very bad dryland cropping season in the area. Their food security has been improved, and their incomes improved by an average of R1 031 per month per participant, primarily from farm-gate sales. Savings have increased by R3 222 per month per participant. Participants are now involved in at least three more social organisations, including the learning groups, savings groups, and marketing groups. They have improved their decision-making, now working with local facilitators and MDF staff. In summary, their mindsets and outlook on their futures are more positive, with improved household food security and food availability.

2.2.3.3 Case Study: Matankiso Rajoale from Rashule (Matatiele)

Matankiso Rajoale is a 53-year-old smallholder farmer from Rhashule, who farms with her husband. They have two children, one foster child, and four grandchildren. She started farming in 2005 with the intention of making an income to help her husband take care of their family because he could only find temporary jobs. The challenge was water and not knowing how to farm. She was planting vegetables common in the area, like cabbage, turnips, and rape. She generally planted these vegetables in winter and potatoes in summer. She was struggling with water and low yields. She also started a small tuck shop.

She joined the CRA learning group in Rashule in 2020 and feels that she has benefited greatly:

- She has introduced new crops that do well and are popular in the area. Examples are Mustard spinach, carrots, and green beans – sales from these alone have come to around R1 000 per month.
- Introduction of trenches, shallow trenches, and eco-circles has assisted her in improving her soil and increasing water holding in her garden and beds.

Figure 14: Matankiso Rajoale from Rashule in Matatiele, standing in a bed planted to mustard spinach. In the foreground is a bed of peas.

- The tunnel provides for very intensive production of high-yielding, high-quality crops.
- She has learnt about the need to buy specific potato seed and different varieties that do well in different seasons, and also about planting and managing them better. Yields have increased significantly, and she also makes around R1 000 from sales of potatoes.
- On average, she now makes around R2 000 from her garden every month.

Figure 15: Left: Matankiso uses her tunnel primarily for seedling production. Right: A view of her garden beds including cabbage, turnips, kale, and rape.

Matankiso also started taking an interest in livestock for both business and integration with her crop farming, mostly adding kraal manure to the soil and making liquid manure to use for soil fertility and pest control. She started with two sheep and two cattle and now has 41 sheep and 15 cattle. She sells them locally, at between R1 500 and R1 800 per sheep. Cattle are sold at auctions. At the latest auction she attended, she sold four cows for R28 000. Locally, she sells a cow for R7 500. She uses the money to buy feed and medicine for her livestock and to assist with household needs or farming inputs. The challenges she has faced with livestock are getting medicine, feed, and theft in their village. With help from the learning group, she also started poultry farming in 2020, and now sells eggs locally at R55 for a tray of 30. Originally, she was the only person selling eggs in the village and had a buyer who took the eggs to town, so she was doing well. Now, she has a competitor, and selling is going quite slowly. She feels that due to COVID, people in the village have less money to spend on food. In addition, feed prices in Matatiele are much higher than the feed she bought that was transported by MDF from Pietermaritzburg, at almost R150/bag. If she has to transport her own feed, it costs an extra R200 per trip, which reduces her profit margin considerably.

Figure 16: Left: Matankiso's layers house. Right: Her sheep kraal.

In summary, these resilience snapshots provide a deep understanding of the resilience impact of the intervention on productivity, diversity, livelihoods, social agency, and individual perception. They

provide a very clear picture of the benefits for smallholders to work in learning groups, introduce new crops and CRA practices, engage in joint local-marketing activities, and be involved in local village savings and loan associations. They also show the development of social agency of individuals and groups in the areas and their ability to effect improved local governance through the initiation and implementation of different committees and focus areas such as livestock, marketing, and water access. They also show the limits of what can be achieved through a locality focus, because some of the broader food system constraints, such as lack of effective, efficient, and diversified input supply systems, cannot be influenced at this level. Despite this, however, food security and livelihoods improvements have been significant for the participants in this programme.

The resilience snapshot methodology has worked well to highlight changes and improvements but still needs a better conceptual framework within which to anchor the indicators, as well as a rigorous review of the indicators themselves to provide a more standardised set of indicators that are more broadly applicable.

2.2.4 Local incomes and marketing

This aspect of the programme was explored through a range of processes, including individual interviews and focus group discussions, both in village-based learning groups and in clusters of learning groups across areas.

A few general observations in terms of the marketing system for smallholders include:

- Farmers produce primarily for food and try to derive an income from the sale of surplus (80% of participants).
- A small proportion of farmers produce specifically for sale (1–5%)
- The ability to expand their productive areas is limited, and only a small proportion of farmers have this capacity (10–15%). Intensification and improved productivity in existing farming enterprises provide an immediate, significant improvement but limit the overall income potential of smallholder farming.

Available marketing avenues for smallholders include:

- Farm gate (within villages); this is the most common marketing avenue but has small local potential with low-income ceilings.
- ***Local market stalls (combined across villages); much larger range of products and income potential, with a focus on labelling, branding, pricing, value adding, and processing.***
- Bakkie traders, stores in local towns (individuals and groups within villages); generally, commodity-focused, and farmers have to accept prices offered (price takers) – good for larger quantities, but does not have a competitive advantage.
- Sale to local retailers and supermarkets (individuals) – requires transport, it is intermittent, price takers, provides little stability, strong competition – overall potential is low.

2.2.4.1 Local market stalls

This strategy of aggregating all produce across a selection of villages and selling monthly at a market stall based at a central point, such as a social grant pay point or taxi rank, has been the main intervention for this project. It has included working with participants on pricing, produce quality, labelling, and branding of produce and the stall. It appears to be the most appropriate strategy at present that can accommodate small quantities of a range of products, as well as the inconsistency of supply. It also ensures that farmers can charge reasonable prices for their produce.

Table 7 provides a running total of sales from the market stalls between April 2021 and August 2022, for the two areas where these stalls have been successfully set up, namely, Bergville and Ozwathini (Midlands).

Table 7: Sales records for local market stalls in Bergville and Ozwathini; April 2021–August 2022

Summary of market incomes for Market stalls: April 2021–August 2022					
Date	**No farmers**	**Villages**	**Amount**	**Market**	**Produce**
2021/04/10	11	2	R2 419.00	Emmaus	
2021/05/09	16	3	R1 580.00	Emmaus	
2021/06/09	18	4	R5 072.00	Emmaus, Stulwane	
2021/07/10	16	4	R3 415.00	Emmaus, Stulwane	
2021/08/07	9	3	R2 379.00	Emmaus	
2021/09/09	18	4	R3 745.00	Emmaus	
2021/10/08	8	4	R845.00	Bergville market	**VEGETABLES**: Broccoli, cauliflower, cabbage, kale, Chinese cabbage, mustard spinach, leeks, onions, lettuce, carrots, beetroot, green peppers, chilies, brinjals, green maize, green beans, tomatoes. **HERBS:** Coriander, parsley, fennel. **FIELD CROPS:** Maize, dry beans, sweet potatoes, *amadumbe*, pumpkins, butternut. **FRUIT**: Bananas, avocado, naartjies, lemons. **MEAT:** Pork, broilers, chicken pieces, eggs. **PROCESSED FOOD**: Bottled chilies, mealie bread vetkoek **OTHER**: *incema*, seed potatoes, pinafores, grass brooms, mats, beads, artwork. Combo packs – via social media in Pietermaritzburg: Potatoes, carrots, eggs, chillies, onions, cabbage (half and chopped), green beans, beetroot, avocado, brinjals, green peppers, chopped mixed veg. **Average income per participant: R382 per market day (R100–R1 600)**
2021/06/04	16	4	R11 527.50	Bamshela – Ozwathini	
2021/08/04	8	4	R3 866.00	Bamshela – Ozwathini	
2021/09/03–07	12	5	R5 448.00	Bamshela – Ozwathini	
2021/10/05–06	12	5	R3 354.00	Bamshela – Ozwathini	
2021/11/03–04	9	4	R2 964.00	Bamshela – Ozwathini	
2021/10/11	3	2	R19 800.00	Sale to shops in Bergville: Boxer and Saverite	
2022/03/02	19	4	R1 310.00	UEDA – Emmaus Hall	
2021/12/02–03	10	4	R2 964.00	Bamshela – Ozwathini	
2021/12/03	10	4	R1 400.00	Ozwathini – social media	
2022/01/05–06	6	3	R2 610.00	Bamshela – Ozwathini	
2022/02/05;12;19	8	4	R3 010.00	Bamshela – Ozwathini	
2022/03/11	6	4	R1 216.00	Bamshela – Ozwathini	
2022/05/03–04	7	3	R2 565.00	Bamshela – Ozwathini	
2022/06/02–04	7	4	R4 782.00	Bamshela – Ozwathini	
2022/07/05	11	3	R2 500.00	Bergville town market stall	
2022/08/03	17	6	R4 823.00	Bergville town market stall with FSG farmers	
2022/08/04–06	7	3	R4 248.00	Bamshela – Ozwathini	
	11	**4**	**R96 626.50**	**INCOME: ~ R6 901 /month**	




Figure 17: Images of the latest markets in Bergville and Ozwathini, August 2022. Note the range of products, including dry beans as well as unusual vegetables such as Chinese cabbage, kale, and cauliflower.

The participants in both marketing groups now manage the whole process of marketing independently, and MDF only supports on rare occasions when transport challenges are unavoidable. They also keep their own records and provide copies for MDF for reporting purposes. Farmers have learnt which produce has high demand at the market stall and can now reasonably accurately estimate the quantities needed for each market. They still sell out, however, but no longer have large quantities of unsold produce to take home again. They have also built a reputation among buyers because they have been meticulous about being there regularly. They provide social support to each other, and if individuals have family emergencies, others in the group will take their produce to the market and sell it for them.
Preparation for market days entails quite substantial planning and logistics because groups need to come together to list their produce availability and quantities, prepare produce and price tags, arrange transport and their market stall equipment, and determine who will be selling on the day. They also manage to keep records of sales and distribution of monies among the farmers involved. For Ozwathini, because they have decided to sell for three consecutive days each month, they have arranged storage space in Bamshela, close to where they have their stall. For this group, a social media platform for the sale of produce to several individual buyers in Pietermaritzburg has also been set up. This platform (WhatsApp and Facebook) is managed by the MDF facilitators, as is transport and delivery.
There are some challenges in the process:

- The number of farmers who participate in the market has decreased, compared to when they all started. This has a knock-on effect on the produce (volumes and varieties) available to sell.
- Some of the commodities that farmers produce are the same, i.e. cabbages, spinach, and eggs. The impact is the creation of competition between them.
- Some farmers continue to prioritise buyer-seller relationships developed locally and, as a result, bring smaller volumes of produce to the market. This is a cautious decision because the market is a “once-in-a-month" event.
- Farmers are not familiar with using social media platforms, especially to advertise and sell their produce. Despite them taking ownership of the market in terms of planning, coordinating, and execution, they are still largely dependent on MDF staff to support with online advertising.

The highlights of these market stalls include:

- Farmers are managing to plan their production to coincide with the once-monthly marketing process and have managed to have a range of high-quality crops available.
- Sales have been picking up again after the unrest and are now becoming a “real income” for them.
- Farmers have added meat (pork and chicken) and processed products (bottled chilies, mealie bread) to the market, which attracts more customers.
- Every farmer who participates in the market makes some money.

In conclusion, around a year after the initiation of the markets, they show a level of consistency that is sustainable, despite irregularities in sales, volumes, varieties, and availability of commodities. Farmers continue to learn from the process how to adapt to changes as and when they arise.

2.3 RECOMMENDATIONS AND GUIDELINES

To intervene effectively in the improvement and transformation of local food systems, it is important to use a comprehensive framework to analyse all drivers, activities, and outcomes of the system. This allows assessment of the critical gaps and opportunities for intervention that are likely to provide the greatest impact. It will also allow an assessment of the boundaries of the potential of the intervention.

Because local food systems are an effect of the broader regional, national, and global food systems, these drivers need to be well understood if one is to act coherently at a local level.

Several aspects of food systems cannot be changed or transformed at a local level, but can be mitigated. This also implies the need for involvement of a range of role players and stakeholders and for the importance of multifaceted interventions to provide opportunities and strategies for effecting positive change in the food system.

When planning for a food systems intervention, the following aspects need to be considered:

- Focus on poor and vulnerable people because they are the most likely to be negatively affected by the present food system.
- Use a systemic approach to food security, including access, availability, affordability, and nutrition, to ensure the broadest impact possible. As an example, just intervening in homestead gardens to improve vegetable production is unlikely to have a significant impact on household food security. Such actions need to be combined with interventions around improved nutrition, especially for young children, alternative income-generation opportunities, improved supply-chain options, and microfinance options, as examples.
- Work at multiple levels (local, regional, and national) with a wide range of stakeholders.
- Provide a focus on building social agency at a local level to engage across different thematic areas and at multiple levels with a range of stakeholders.
- Use a multi-pronged approach that can provide synergy for different aspects of the system, such as input supply, production, nutrition, income generation, microfinance, water management, and natural resource management.
- Learning is central and works better in localised groups.
- Use climate change impacts and adaptive strategies as the central overarching theme (given the disproportionate impact of climate change on the rural poor),
- Sustainable farming practices for improved resilience and productivity are crucial and need to be a central aspect of food system interventions.
- Improved systems for the provision of agricultural inputs need to be considered – focus on local options, renewable resources, and aggregation strategies.
- Resource management and conservation need to be included. Deterioration of the resource base has a significant and increasing negative impact on the potential productivity of farming activities.
- Access to water for multi-purpose uses, as well as water use efficiency, are central and crucial components to improved productivity and livelihoods.
- Microfinance options for the rural poor need to be woven into potential interventions. Without these, no significant improvements in livelihood conditions can be effected.
- Local marketing options that take into account the conditions under which smallholders operate need to be developed.

3 CBCCA CASE STUDIES IN THREE AGROECOLOGICAL ZONES

3.3 PREAMBLE

To enable the compilation of case studies in CbCCA, the monitoring and evaluation framework developed in the WRC project entitled *Climate change adaptation for smallholder farmers in South Africa* (WRC K5-2179-4) (Kruger, 2021), has been reviewed and updated to allow for greater methodological coherence and improved measurability of the climate resilient indicator sets outlined.
The resultant framework was used to design individual interviews (resilience snapshots) and a participatory impact assessment outline for focus group discussions, emphasising the human, social, and governance aspects of the process.
The following interviews and PIA workshops were undertaken between May and July 2024.

Table 8: CbCCA interviews and focus groups undertaken in different agroecological zones

Province/area	**Agroecological zone** (HarvestChoice; International Food Policy Research Institute (IFPRI), 2015)	**Villages**	**Number of individual Interviews**	**PIAs (focus group discussions)**
Limpopo – Mametja – Sekororo	Tropic – warm, semi-arid	Willows, Sedawa, Santeng, Worcester, Turkey	20	Willows (33) Sedawa (19)
Eastern Cape – Matatiele	Sup tropic, cool, semi-arid	Nchodu, Ned, Nkau, Rashule	17	Nchodu (18) Ned (22)
KwaZulu-Natal – Northern Drakensberg	Sup tropic, cool, Subhumid	Eqeleni, Ezibomvini, Stulwane, Vimbukhalo, Ezinyonyane	20	Eqeleni (13) Ezibomvini (15) Stulwane (35)
KwaZulu-Natal – Southern Region	Sub tropic cool subhumid	Mahhehle, Ngongonini, Centocow, Matirathal	20	Mahhehle (36) Centocow (32)
KwaZulu-Natal – Midlands	Sub tropic warm subhumid	Ozwathini, Mayizekanye	13	Ozwathini (22) Mayizekanye (26)
TOTALS		**20**	**90**	**271**

The three areas chosen for CbCCA case studies are Mametja-Sekororo, Matatiele, and Bergville.

3.4 METHODOLOGY: REVISION OF FARMER-LEVEL RESILIENCE INDICATORS FOR MAHLATHINI DEVELOPMENT FOUNDATION (MDF)

4.4.3 Introduction

MDF has spent many years developing and refining various tools for monitoring and evaluating its work of building resilience among smallholder farmers. These tools are varied and are used for different purposes and on different time scales, for example:

- Baseline assessments are once-off assessments of farming practices used when working in an area for the first time.
- Regular farmer monitoring forms are used for monitoring various aspects, at different frequencies (e.g., savings groups are monitored monthly, but poultry are only monitored every six months).
- Seasonal reviews are done together with farmers to assess changes and benefits.
- Participatory impact assessments are done by farmers in focus groups on a less frequent basis (e.g., every few years).
- Livelihood surveys are also carried out occasionally.
- Research projects sometimes provide opportunities for more in-depth monitoring or focused case studies.
- The resilience snapshot tool is used to provide a summary of resilience, either annually or at the end of a project. It is based on a questionnaire for farmers and brings together data from some of the other sources mentioned above. Farmers are asked to compare their current situation and farming practices to their situation and practices before they started working with MDF, to see whether resilience has indeed improved as intended.

In May 2023, MDF initiated a process to strengthen and further develop the resilience snapshot so that it is more strongly tied to resilience theory and is more generalisable across agroecological zones.

4.4.4 A theoretical foundation for assessing resilience of smallholder farming systems

The first step in strengthening MDF's tools for assessing smallholder farmer resilience was to strengthen the underlying theoretical framework. This was done by combining Cabell and Oelofse's indicators of agroecosystem resilience (Cabell and Oelofse, 2012) with the concept of absorptive, adaptive, and transformative resilience capacities as used by Oxfam and others (Jeans et al., 2017), to produce the theoretical framework shown in Figure 18.

Cabell and Oelofse's (2012) indicators of agroecosystem resilience have a solid foundation in that they are based on the resilience principles outlined by Biggs et al. (2012), Biggs et al. (2015), and numerous other resilience scholars (see Folke, 2006, for an overview). Cabell and Oelofse (2012) present thirteen behaviour-based indicators[1] which together provide a measure of agroecosystem resilience, particularly for smallholder farmers (see Table 1). Agroecosystems are defined as social-ecological systems bounded by the intentionality to produce food, fuel, or fibre and influenced by farmers' decision-making, including the physical space and resources used as well as related infrastructure, markets, and institutions at multiple, nested scales (Cabell & Oelofse, 2012).

Cabell and Oelofse's framework forms the basis for the SHARP+[2] tool (Hernandez et al., 2022; https://www.fao.org/in-action/sharp), which is being widely used by the FAO and others to assess household climate resilience based on the knowledge and priorities of farmers, using an integrated approach. For example, the IFAD and GEF-financed Resilient Food Systems Impact Programme is currently using SHARP+ in seven countries in sub-Saharan Africa as part of its monitoring and evaluation framework, and SHARP+ has also been included in operational guidelines on monitoring and evaluation of nature-based interventions, climate adaptation in agriculture, and implementation of resilience thinking (Hernandez et al., 2022).

[1] These are not specific, measurable indicators but rather aspects or dimensions of resilience that should be included.

[2] Self-evaluation and holistic assessment of climate resilience of farmers and pastoralists.

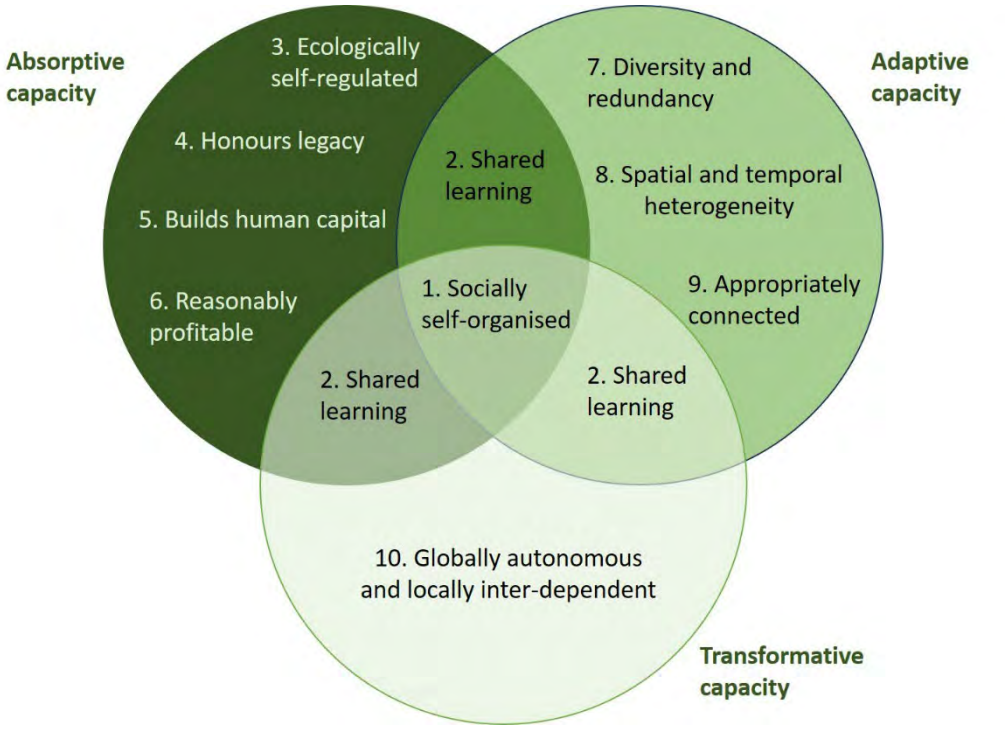


Figure 18: Theoretical framework for assessing resilience of smallholder farmers. Based on Cabell & Oelofse (2012) and Jeans et al. (2017).

The Oxfam Framework for Resilient Development, *The Future is a Choice*, describes three types of resilience capacity: absorptive, adaptive, and transformative capacity (Jeans et al., 2016). Resilience is seen as a result of enhancing the capacity (ability, agency, power) of people to proactively and positively manage change in ways that contribute to a just world without poverty. The three capacities are seen as interconnected, existing at multiple levels, and mutually reinforcing (Jeans et al., 2017). This is in line with prominent resilience scholars' characterisation of resilience as having dimensions of persistence, adaptability and transformability in complex social-ecological systems (Walker et al., 2004; Folke, 2006; Folke, 2016).

Absorptive capacity ensures stability because it prevents or limits the negative impact of shocks. It is the capacity to "bounce back" after a shock by anticipating, planning, coping with and recovering from specific shocks and short-term stresses. Adaptive capacity is the capacity to make intentional incremental adjustments in anticipation of or in response to change in ways that create more flexibility in the future. Transformative capacity is the capacity to intentionally change the deep structures that cause or increase vulnerability and risk and change how risk is shared within societies and the global community (Jeans et al., 2017).

For the purpose of creating a coherent theoretical framework for resilience in this context, the different aspects of agroecosystem resilience described by Cabell and Oelofse (2012) were mapped onto the three types of resilience capacity as shown in Figure 2, to produce a guiding framework for monitoring and evaluating resilience. This framework includes the different aspects of resilience as well as the interplay between stability and change.

4.4.5 Revision of the MDF resilience snapshot tool

The SHARP+ tool was considered too complicated for MDF's current purpose because it involves a very lengthy survey, which MDF felt would not be practical in the contexts in which it works. Although the length and the questions can be customised to some extent, it was considered not ideal to combine all the monitoring and evaluation into a single survey carried out at one point in time. As described above, MDF staff already do several different types of monitoring and evaluation activities with farmers on different time scales, because different activities require different monitoring frequencies. Furthermore, MDF's resilience snapshot tool has been tested and refined for the South African context over many years. It was therefore decided to align what MDF is already doing with the Cabell and Oelofse framework, and to strengthen and modify the resilience snapshot where necessary.
Comparing the resilience snapshot indicators with the Cabell and Oelofse (2012) aspects of agroecosystem resilience revealed that the resilience snapshot did cover most areas, although some more strongly than others. By comparison, the Committee on Sustainable Assessment's (COSA)[3] resilience indicators used by the Adaptation Fund do not cover all the aspects of resilience.

The thirteen aspects of agroecosystem resilience described by Cabell and Oelofse (2012) were reduced to ten as follows. One was removed because it was felt not to be relevant to South African smallholder farmers ("carefully exposed to disturbance" – South African smallholder farmers do not have the luxury of controlling the amount of disturbance to which their activities are exposed). Another ("coupled with local natural capital") was removed because it was felt to be sufficiently covered by another ("globally autonomous and locally interdependent"). Finally, "functional and response diversity" and "optimally redundant" were combined because in practice, having more diversity usually also provides redundancy, or the ability of some entities (e.g., inputs, outputs, or crops) to functionally compensate for the loss of others (Kotschy, 2013).

Table 9: Alignment of the MDF resilience snapshot indicators and the COSA resilience indicators with the dimensions of agroecosystem resilience described by Cabell and Oelofse (2012)

Cabell & Oelofse's (2012) agroecosystem resilience	MDF resilience snapshot	COSA resilience indicators used by the Adaptation Fund
ABSORPTIVE CAPACITY (STABILITY)		
Socially self-organised – social components able to form their own configuration based on their needs and desires (e.g., grassroots networks, co-ops, markets, associations, advisory networks)	Collaborative actions/social agency	
Reflective and shared learning – collaborations, knowledge sharing, record-keeping, and the ability to learn from past experimentation	Informed decision-making (information used)	Access to information early warning systems
Ecologically self-regulated – stabilising ecological feedback mechanisms (e.g., maintain cover, soil health, regulate predators & pests, use ecosystem engineers)	Embodied in soil and water conservation practices of agroecology and conservation agriculture	SWC practices, including integrated pest management

[3] A non-profit independent global consortium that has developed an indicator library for resilience. COSA indicators are aligned with global norms such as the SDGs, multilateral guidelines, international agreements and normative references. The indicators ensure comparability and benchmarking across regions or countries, making it easier for managers and policymakers.

Cabell & Oelofse's (2012) agroecosystem resilience	MDF resilience snapshot	COSA resilience indicators used by the Adaptation Fund
Coupled with local natural capital – using local natural resources and ES, reduced need for external inputs	Increased water use efficiency (including rainwater harvesting, water holding, water access, and water productivity)	
Honours legacy – maintaining memory of past conditions and experiences (e.g., heirloom seeds, elders, traditional practices)	Informed decision-making (information used)	Access to information
Builds human capital – constructed (economic activity, technology, infrastructure), cultural (individual skills and abilities), and social capital (social organisations, norms, networks)	Savings Collaborative actions/social agency	No. of agricultural productive assets (equipment, livestock, land)
Reasonably profitable – farmers can make a livelihood, able to invest in the future (buffering capacity), not needing to rely on distortionary subsidies	Increased livelihood security (income) Increased livelihood security (household provisioning & food security) Increase in farming (size) Increased productivity Savings (safety, security, achievement) Positive mindsets	Net household income
ADAPTIVE CAPACITY (FLEXIBILITY)		
Socially self-organised – social components able to form their own configuration based on their needs and desires (e.g., grassroots networks, co-ops, markets, associations, advisory networks)	Collaborative actions/social agency	
Reflective and shared learning – collaborations, knowledge sharing, record-keeping, and the ability to learn from past experimentation	Informed decision-making (information used)	Adoption of new practices/equipment Access to information Early warning systems
Appropriately connected – relationships between system elements. High no. of weak connections imparts flexibility, few strong connections imparts dependency and rigidity (e.g. no. of suppliers, outlets, farmers, crops)	Collaborative actions/social agency?	
Functional and response diversity – diversity of ES, inputs, outputs, markets, income sources, pest control. Diversity of response options to environmental & other changes	Increased diversity in farming, increased diversity of practices, increased water use efficiency, and increased livelihood diversity options	Adoption of new practices/equipment Diversification of income
Optimally redundant – duplication (partial functional overlap) of components and relationships in the system (e.g., crop types, equipment, water sources, nutrient sources, sales outlets), but not so that it is too costly/unwieldy	Increased diversity in farming, increased diversity of practices, increased water use efficiency, and increased livelihood diversity options	No. of income sources
Spatial and temporal heterogeneity – patchiness of land use, rotations, practices, in space and over time	Increased growing season Increased diversity in farming (gardening/field cropping/ livestock/trees)	

Cabell & Oelofse's (2012) agroecosystem resilience	MDF resilience snapshot	COSA resilience indicators used by the Adaptation Fund
Carefully exposed to disturbance – disturbance not excluded totally but managed where possible (e.g., pest and disease exposure allowed to promote selection and resistance)		
TRANSFORMATIVE CAPACITY (STRUCTURAL CHANGE)		
Reflective and shared learning – collaborations, knowledge sharing, record-keeping, and the ability to learn from past experimentation	Collaborative actions/social agency	Adoption of new practices/equipment Access to information Early warning systems
Socially self-organised – social components able to form their own configuration based on their needs and desires (e.g., grassroots networks, co-ops, markets, associations, advisory networks)	Informed decision-making (information used)	
Globally autonomous and locally interdependent – relative autonomy from exogenous control, but with a high level of cooperation locally	Collaborative actions/social agency	

Specific, measurable indicators were then developed for all the aspects of resilience and resilience capacity as shown in Figure 3, using the existing indicators in MDF's resilience snapshot and the COSA indicators as a starting point. Further development is still required, for example, to add the methodology, people responsible for data collection and analysis, frequency of collection, and data limitations for each indicator.

Ongoing work will involve developing a visually engaging way of presenting and sharing the data. This could include:

- A "traffic light" system (red, orange, green) for each indicator to provide a simple overview of status and progress.
- Web-based dashboards which convert the data into engaging visual representations (e.g. graphs, charts, tables, word clouds) and make it accessible to stakeholders.
- An interactive network mapping tool such as Kumu (https://kumu.io/), which allows stakeholders to map and visualise their connections interactively and can also be used to gather and analyse data such as numbers and types of connections, strength of connections, and social self-organisation.

Table 10: Expanded and modified set of resilience indicators for MDF's resilience snapshot

Indicator name and no.	Rationale	Definition	Unit of measure
Absorptive capacity			
1. Socially self-organised (Focus on support networks)			
1.1 Support networks/groups	Support networks build absorptive capacity by helping farmers to absorb and survive shocks.	Networks or groups that farmers use for emergency and psycho-social support	Average no. of groups, % of farmers belonging to different types of groups
1.2 Increased social agency (collaborative actions)	Absorptive capacity is enhanced by support networks that enable individual and collective agency to make farming activities more efficient and productive.	Extent of collaboration e.g. market days, assistance with ploughing, labour, seed sharing, saving groups etc.	Average no. of collaborative actions in which farmers are involved

Indicator name and no.	Rationale	Definition	Unit of measure
2. Shared learning (Focus on learning for productivity)			
2.1 Increased knowledge sharing	Sharing of knowledge helps farmers to farm more effectively and to mitigate the impacts of shocks and disturbances. Also, the act of sharing knowledge promotes learning for the person doing the sharing as well as the recipient. Sharing shows that people have internalised information.	How knowledge is shared (e.g., informally with other farmers, in meetings with local orgs, meetings with external orgs such as DARD interest groups, in co-ops). What is shared: categories/ types of knowledge or sharing.	List of who shared with, list of types of knowledge shared
3. Ecologically self-regulated			
3.1 Increased water use efficiency Five-finger indicators Pest and disease management Pollinators	The five-finger principles promote ecological self-regulation through improved nutrient cycling, water use efficiency, soil health, maintenance of indigenous vegetation, and pollinator populations. Important for resilience, but MDF has not had any success with monitoring most of these. Most farmers are not aware of things like pollinators, pests, diseases, and soil health.	Whether the soil's water-holding capacity has improved (Y/N)	% Y vs. N responses
4. Honours legacy			
4.1 Traditional practices, crops, and livestock in use	Traditional practices are a way of maintaining memory of past conditions and experiences.	Which traditional practices are in use? (e.g., seed saving, heirloom/indigenous seeds or breeds, banana basins) – or changes to these.	List of traditional practices being used by farmers
5. Builds human capital			
5.1 Increased savings	Savings provide a buffer, allowing farmers to absorb and recover from shocks, and to plan and manage their cash flow.	Average increase in savings	Average increase in savings (Rands)
5.2 Use of savings for livelihoods improvement	If farmers are using savings for livelihood improvements rather than just on essentials such as food, it suggests that human capital is being built.	How savings are being used	List of options
5.3 Increased knowledge and agency as a result of CRA	Building skills, knowledge, and agency increases human capital, which enables farmers to farm more effectively.	What farmers are able to do now that they weren't able to do before.	List of options
5.4 Increase in agricultural productive assets	Agricultural assets enable farmers to farm effectively and to absorb and recover from shocks .	Change in agricultural productive assets	List, maybe count and categorise (equipment, livestock, etc.)

Indicator name and no.	Rationale	Definition	Unit of measure
6. Reasonably profitable			
6.1 Increased income	If farmers are able to make a livelihood through farming, they are able to remain in their communities and provide for their families, avoiding the social and psychological disruption of migration or circular migration.	Average monthly incomes are mostly though marketing of produce locally and through the organic marketing system.	Average monthly income (Rands)
6.2 Increased household food provisioning	If farmers are able to produce sufficient food locally, it reduces their dependency on store-bought food.	Food produced and consumed in the household	Overall food produced (kg per week)
6.3 Increased food security	Having a dependable supply of food and a good variety of foods is beneficial for health and well-being.	No. of food types and how often eaten. A recognised food security indicator.	No. of food types/no. of times per week
6.4 Increase in size of farming activities	An expansion of farming indicates that farmers have the resources and commitment to make this possible.	Size of farming activities (cropping, trees & livestock)	Cropping area (ha), no. of fruit trees and no of livestock.
6.5 Increased productivity	Apart from food security, productivity increases create opportunities for participation in markets or value-added activities.	Increase in yields and/or livestock	Overall kg produced in a season, livestock increase/decrease
6.6 Increased savings	An increase in savings reflects successful livelihoods. Savings also allow farmers to invest in the future.	Average increase in savings	Average increase in savings (Rands)
6.7 Positive mindsets	This is an integrative measure of whether farmers feel they are "making it".	How positive farmers feel about the future	SCALE: 0=less positive about the future; 1=the same; 2=more positive; 3=much more positive.
Adaptive capacity			
1. Socially self-organised (Focus on learning networks)			
1.4 Learning networks/groups	Learning networks build adaptive capacity by promoting experimentation and evaluation of results.	Networks or groups to which farmers belong, which enable learning about CRA. (Will be mainly just the MDF learning group in most cases).	Average no. of groups, % of farmers belonging to different types of groups
2. Shared learning (Focus on learning for adaptation)			
2.2 Use of information from past experimentation in decision-making	Successful adaptation is more likely when experimentation and learning inform farmers' decisions.	Whether information from past experimentation is used	% of farmers using info from past experimentation
2.3 Prevalence of record-keeping	Record-keeping facilitates recall of past events/results and analysis of trends.	Whether farmers keep records of anything	Question Y/N
2.4 Most significant change in farming practices	Changed practices indicate learning (?)	Most significant change in farming practices	List of practices
7. Diversity and redundancy			

Indicator name and no.	Rationale	Definition	Unit of measure
7.1 Increased livelihood diversity options	Having a diversity of livelihood options increases farmers' response diversity (capacity to adapt to different shocks).	No. of livelihood options (sources of income), e.g., social grants, remittances, farming incomes, small business income, employment	Average no. of options per farmer
7.2 Increased diversity of farming activities	Having a diversity of farming activities also increases response diversity and provides for the spreading of risks.	No. of farming activities (gardens, field cropping, livestock, trees, etc.)	Average no. of activities per farmer
7.3 Increased crop diversity	Increased crop diversity increases functional and response diversity (different crops perform different roles, provide different nutritional benefits, and respond differently to stress, disease, and disturbance).	No. of crops planted by farmers which were not planted previously ("new" crops)	Average no. of "new" crops added, overall and per farmer
7.4 Increased CRA practice diversity	Different practices have different functions within the agroecosystem (functional diversity).	No. of CRA practices used by farmers that were not used previously (e.g. mulching, trench beds, liquid manure, raised beds, mixed cropping, inter-cropping, crop rotation, tunnels, drip kits, eco-circles, greywater use and management, Conservation Agirculture, cover crops, inclusion of legumes, pruning of fruit trees, picking up dropped fruit, pest and disease control, feeding livestock on crops and stover, cutting and baling, fodder supplementation, health and sanitation for poultry, brooding, JoJo tanks, RWH drums)	Average no. of "new" practices added, overall and per farmer
7.5 No. of water sources	Redundancy in the water supply reduces the impact of the failure of one source.	List of water sources available to the farmer.	Average no. of water sources, overall and per farmer
7.6 No. of nutrient sources	Redundancy in nutrient supply	List of nutrient sources available to the farmer	Average no. of nutrient sources, overall and per farmer
7.7 No. of suppliers	Redundancy in the supply of inputs	No. of suppliers available to farmers for gardening, field cropping, and livestock needs	Average no. of suppliers available, overall and per farmer
7.8 No. of sales outlets	Redundancy in sales outlets	No. of sales outlets available to farmers for selling produce from gardening, field cropping, and livestock	Average no. of sales outlets available, overall and per farmer
8. Spatial and temporal heterogeneity			

Indicator name and no.	Rationale	Definition	Unit of measure
8.1 Increased season	Seasonal variation of activities determines how farming benefits are distributed in time.	Has the seasonal extent of farming increased? (i.e., autumn and winter, and all-year options).	Question Y/N
8.2 Heterogeneity of land use	Spatial variation in land use influences landscape connectivity, which may influence the movement of fire, pests and diseases, pollinators, or water. It also provides response diversity because areas under different land use may respond differently to shocks.	Size and spatial connectivity of fields and natural vegetation.	?
8.3 Crop rotation/mixed cropping	Crop rotation and mixed cropping allow time for soil and vegetation to recover and increase temporal variation.	Whether farmers practice this and to what extent	Question Y/N with comments, maybe a degree
8.4 Livestock integration	Livestock and crop integration, such as through grazing management, rotational grazing, fodder production, buying fodder, or baling, allows for functional integration of spatially and temporally heterogeneous activities.	Which livestock integration practices are used?	List of practices used per farmer from the drop-down list
9. Appropriately connected			
9.1 Flexibility of networks	Flexibility of networks (many weak connections) allows configurations to change according to members' needs and desires.	Could be applied to networks of suppliers, marketing networks, governance networks, etc.	No, and the strength of connections between people
Transformative capacity			
1. Socially self-organised (Focus on networks for structural change)			
1.7 Inclusivity of networks/groups	Inclusive social and governance structures build transformative capacity by reducing marginalisation, exclusion, and inequity.	The extent to which farmer learning groups include women, youth, and marginalised individuals (e.g., disabled, minority languages)	Average % of group members who are women, youth, or from marginalised groups
1.8 Extent to which networks cross scales or hierarchies	Connections across scales or hierarchies provide opportunities for advocacy and structural change.	No. of "active" connections between farmer learning groups and macro-level stakeholders (meaning that there has been interaction or exchange of information, etc., within the past year).	Average no. of active cross-scale connections
2. Shared learning (Focus on learning for transformation)			
2.4 Changes in personal attitudes, motivations or beliefs	Such changes reflect personal transformation, which is the foundation for and motivator of broader transformation.	Farmers' perceptions of how they think they have grown and how their personal attitudes have changed	Average no. of farmers reporting changes
10. Globally autonomous and locally interdependent			

Indicator name and no.	Rationale	Definition	Unit of measure
10.1 External vs. local inputs	If farmers are highly dependent on external inputs, they will be at the mercy of external structures and circumstances (e.g., wars, politics, inflation, multi-national corporations) and will therefore have little ability to bring about structural change. If inputs are obtained locally, it suggests local interdependence.	No. of external inputs divided by no. of local inputs (e.g., seed, fertiliser, pest control products, feed, etc.)	Ratio of external to internal inputs

An important consideration in developing the indicators in Table 5 was how to promote coherent monitoring and evaluation across the different scales (micro-, meso-, and macro-levels as shown in Figure 2). The two aspects of resilience shown in the intersections between the three circles in Figure 3, namely social self-organisation and shared learning, are important for all three types of resilience capacity and at all three levels, although they are expressed in slightly different ways in each. For example, at the micro-level, farmer self-organisation is measured by the number of local groups that provide support, the inclusivity of groups, and the extent of collaborative actions among farmers. At the macro-level, similar indicators for social self-organisation are used, but they are applied at the regional or national level (e.g., collaborative actions would not be between individual farmers but between organisations or groups). Additional indicators may also be included at higher levels, such as whether all stakeholder groups are adequately represented.

4.5 MERL TOOLS DEVELOPED

The resilience snapshot was improved and updated to incorporate the methodological considerations in the section above. A copy of the survey form is provided in Attachment 1. These questionnaires are called snapshots as they can be administered at any time in the individual's progression towards resilience. They are not project-specific and are not meant as outcome assessments for projects; instead, they highlight changes the participant has made to adapt to climate change and the assessment of the improved resilience from such changes. It would be useful to undertake these snapshots repeatedly over time to get an indication of ongoing improvement for the participant.

In addition to the individual interviews, there are aspects of resilience, notably social organisation, changes in human capacity, and learning related to climate change that are better analysed in groups because these aspects are more relational in nature and rely on people's understanding, thinking, and opinions. For these aspects, a participatory impact assessment process was developed. The outline of these discussions is provided in Attachment 2.
A third tool has been developed to explore in some depth the impact of the VSLAs on a selected number of individuals' income generation and business development and expansion activities. The outline of this questionnaire is provided in Attachment 3.

Results from these three tools have been collated, analysed, and summarised into the case studies presented below.

4.6 AGROECOLOGICAL ZONE CLIMATE RESILIENCE CASE STUDIES

The community-based climate change adaptation approach and methodology used in all three provinces has relied on village-level learning groups and clusters of learning groups undertaking cyclical

analysis, implementation, and review processes to explore adaptive strategies and processes for adaptation to climate change.

Incorporation of aspects from different themes within the smallholder farming system and the natural landscape has been undertaken through the five fingers model to allow for implementation across a wide range of activities, including climate-resilient agriculture, water and natural resources management, stewardship, and local governance.

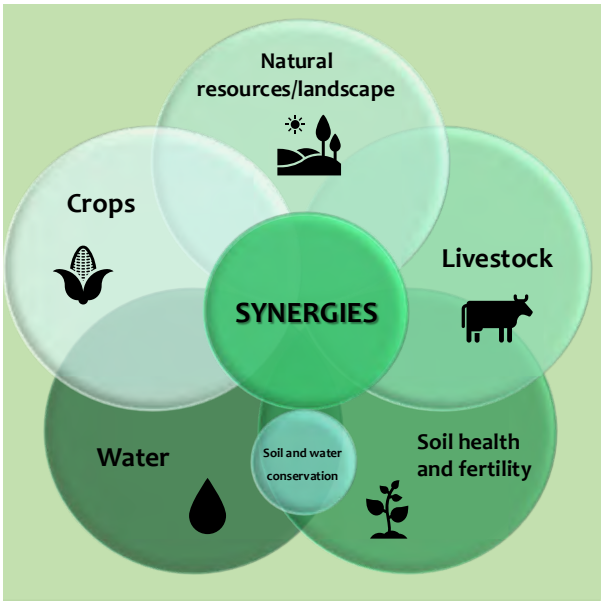


Figure 19: The five-finger model for implementation of adaptive strategies to allow for a coherent systemic approach and development of synergies across activities

CRA and innovation system development for sustainable and productive use of land and water have broadly included the following activities:

- **Conservation/Regenerative Agriculture**: (Low External Input) Quantitative research support to the Smallholder Farmer Innovation Programme; intercropping, crop rotation, cover crops, fodder production.
- **Livestock integration**: Winter fodder supplementation, hay baling, conservation agreements, and local livestock auctions.
- **Intensive homestead food production**: Agroecology – tunnels, trench beds, crop diversification, mulching, greywater management, fruit production.
- **VSLAs**: Village-based savings groups for savings and small loans for productive activities.
- **Local marketing and food systems**: Monthly produce market stalls organised per village, exploration of further marketing options, and small mills for maize.

Water and Natural Resource Management for sustainable and productive use of land and water has broadly included the following activities.

- **Community-owned local water access**: Water committees, spring protection, water reticulation, pipes, and tanks at the homestead level.
- **Soil and water conservation**: Village-based learning groups in CCA undertake resource conservation activities.

For each CRA learning group, community members prioritised the basket of activities most important to them. Thus, different practices were prioritised and implemented in different villages and areas. In Limpopo, for example, in the dry and hot Mametja-Sekororo region, participants prioritised intensive homestead food production, whereas in Bergville, KZN, participants strongly prioritised dryland field cropping and livestock, and in Matatiele in the north-eastern Eastern Cape, participants favoured gardening and poultry production in some areas and field-cropping in others.

4.7 MAMETJA-SEKORORO (LIMPOPO) CLIMATE RESILIENCE CASE STUDY

This area falls within the Lower Olifants' river basin, a warm sub-tropical, dry savannah agroecological zone, with average annual temperatures of 28°C, extremely hot conditions prevailing in summer, and warm winters. Average annual rainfall is around 550 mm. Evaporate potential is around 1200 mm and far exceeds rainfall.

A key vulnerability identified for the region is that of the potential for increasing food insecurity under changing climatic conditions, especially for the poor in former Apartheid Bantustans into which many people were forcibly resettled. Communal areas tend to be densely populated, and over-utilisation of natural resources combined with a lack of management of these resources has led to erosion and reduction of water availability, leading to severe water stress in these villages. In addition, between 70–80% of inhabitants are entirely reliant on social grants (child grants and pensions) for their incomes. Thus, pressure on existing natural resources to fulfil basic needs (grazing for livestock, firewood, plants for food and medicine, and water) is likely to continue and intensify. Not only are poor land-use practices impacting production and ecological health and integrity, but these impacts will be greatly exacerbated by the hotter and more erratic rainfall conditions due to climate change that are predicted for the lowveld (AWARD-BOOKLET-Climate-smart-agriculture-lower-Olifants-Catchment-2018-v3.pdf).

Community members in this region acutely experience the climate change impacts of increased heat (throughout the year) and increased variability in rainfall patterns with associated decrease in water availability, crop failures, livestock mortality, and increased pest and disease incidence, as well as the decrease in natural resources. The negative impact on participants' livelihoods and the social fabric of their communities has also been emphasised.

MDF has been implementing a systemic approach to climate change adaptation and climate resilient agriculture in partnership with AWARD in the Mametja-Sekororo region of Limpopo since 2016. Work was conducted under the auspices of two large USAID programmes – RESILMO and Resilient Waters, and more recently under the auspices of an SODI-BMZ-funded community-based CCA programme. Close cooperation and sharing of information and learnings with other NGOs such as K2C (Kruger to Canyons), Conservation South Africa, Seeds of Light, Lima-RDF, World Vision, and ACBio were important throughout the implementation processes. Other major stakeholders in the lower-Olifants water and biodiversity stewardship landscape have included the South African National Biodiversity Institute (SANBI) and the WRC, among others.

Work has been undertaken in seven villages, with around 250 smallholder farmers. The case study focused on five villages (Willows, Sedawa, Santeng, Worcester, and Turkey), with 20 individual snapshot interviews conducted and two participatory impact assessments (PIA) sessions in Willows (33 participants) and Sedawa (19 participants), respectively.

The following table provides a summary overview of the Adaptive and absorptive capacity indicators for Limpopo (n=20)

Table 11: Adaptive and absorptive capacities analysed for Limpopo, 2024

Absorptive capacity			
Socially self-organised	Collaborative actions/social agency	Change in no. of groups (average); e.g., learning groups, savings groups, water committee, livestock association, policing forums	2
Shared learning	Increased knowledge sharing	Change in types of knowledge shared (average); e.g., written information, learning groups, local facilitators, other farmers	2
Ecologically self-regulated	Water use efficiency	Change in no. of practices for improved water holding (average); e.g., trench beds, tunnels, tower gardens, mulching, small dams, mandala beds, JoJo tanks	4
		Change in no. of practices for reduced run-off (average); e.g., diversion ditches, furrows and ridges, banana basins, stone bunds	2
	Improved soil health	Improved soil structure (% of respondents)	80%
		Improved organic matter	50%
		Fewer pests and diseases	90%
		Better able to deal with drought	50%
Honours legacy	Traditional practices	No. of practices in use (average); e.g., timing and planting of Bambara groundnuts, seed saving, traditional seed storage techniques	1
Reasonably profitable	Increased livelihood options	Average change in no. of options, e.g., farming, small business, part-time employment	1
	Increased income	Average monthly income change (ZAR)	R1 222.22
	Increased food security	Average no. of food types consumed weekly. Five food types eaten 1–3 times per week – shows good nutritional diversity for rural communities	5
	Increased productivity	Average change in no. of crops (garden and field); including spring onions, kale, brinjal, green pepper, beetroot, carrots, sun hemp, Dolichos, sorghum, lucerne, mustard spinach, coriander, parsley, broccoli, lettuce	11
		Change in no. of fruit trees, including lichi, mango (Tommy, Kiet), avocado, macadamia	3
	Increased savings	Change in monthly savings (ZAR)	R462.50
	Positive mindsets	Scale (0 to 2): 0=same or worse, 1=somewhat improved, 2=much improved	2
Adaptive capacity			
Increased diversity in farming	Farming activities (gardening, field cropping, livestock, fruit trees)	Average change in no. of farming activities; mostly due to now doing gardening activities that weren't undertaken before, and fruit production. A few participants have included small livestock in the form of poultry.	2
Increased CRA practice diversity	Adoption of new practices	Average change in no. of CRA practices, including tunnels, trench beds, shallow trenches, eco-circles, tower gardens, drip irrigation, mulching, liquid manure, underground rainwater harvesting, small dams, crop rotation, mixed cropping, CA, furrows and ridge, banana basins, seed saving, and propagation from seed.	8
Increased water sources	Names of sources	Average change in no. of water sources. New group-based local schemes with boreholes, rainwater harvesting, but mostly no new water sources for access.	1

Adaptive capacity			
Redundancy in nutrients, input suppliers	Names of inputs	Average no. of inputs/supplier types; including VKB, Obaro, Alzu, Parma, Provet.	4
	Names of nutrients	Average no. of nutrient types; e.g., kraal manure, compost, mulching, liquid manure.	1
	Names of suppliers	Average no. of sales outlets, including local (farm gate), market stalls in Hoedspruit, Meat Naturally Auctions, and Makhona supermarket.	1
Spatial and temporal heterogeneity	Increased growing season	Gardening (% of respondents)	100%
		Field cropping (% of respondents)	0%
		Livestock and/or fruit (% of respondents)	40%
	Mixed cropping	Now practising (% of respondents)	100%
	Crop rotation	Now practising (% of respondents)	90%
	Livestock integration practices	Grazing management, restoration, firebreaks, fodder production, etc.	0%

In Mametja-Sekororo in Limpopo, the CRA learning group participants have primarily focused on household food production (gardening, small livestock integration, and fruit production) because the change in climate has already rendered dryland field-cropping untenable as an activity. Even at the household level, access to water for production is severely limited for most households in the region. Learning-group members have been involved in local water access group-based schemes, from drilling new boreholes, and have increased their rainwater harvesting and storage options. They have enthusiastically incorporated many CRA practices introduced through the interventions, with an average of eight new practices for each participant, and have equally enthusiastically incorporated a range of vegetable, field, and fodder crops into their farming systems, with an average of 11 crop types that were not cultivated before the interventions. They have also increased their growing seasons by planting at different times and more consistently through the year, as well as including different crop types that yield better under the changing seasonal conditions. They are using mixed cropping and crop rotation to good effect to improve soil fertility and soil health, as well as water use efficiency.

In terms of absorptive adaptive capacities, participants have increased their livelihood options through farming and small businesses and have managed to improve their productivity, incomes, and savings. They are better connected socially, collaborate and learn in several new ways, and generally feel a lot more positive about their future.

The sunburst diagram (Figure 20) shows the proportion (%) of participants who have undertaken different CRA practices. Those practices where less than 6% of participants undertook the activity have not been named in the diagram. The largest uptake was for trench beds, mixed cropping, crop rotation, micro-tunnels, and mulching. These practices had the most immediate impact on crop growth and improved yields and have been very popular with participants.

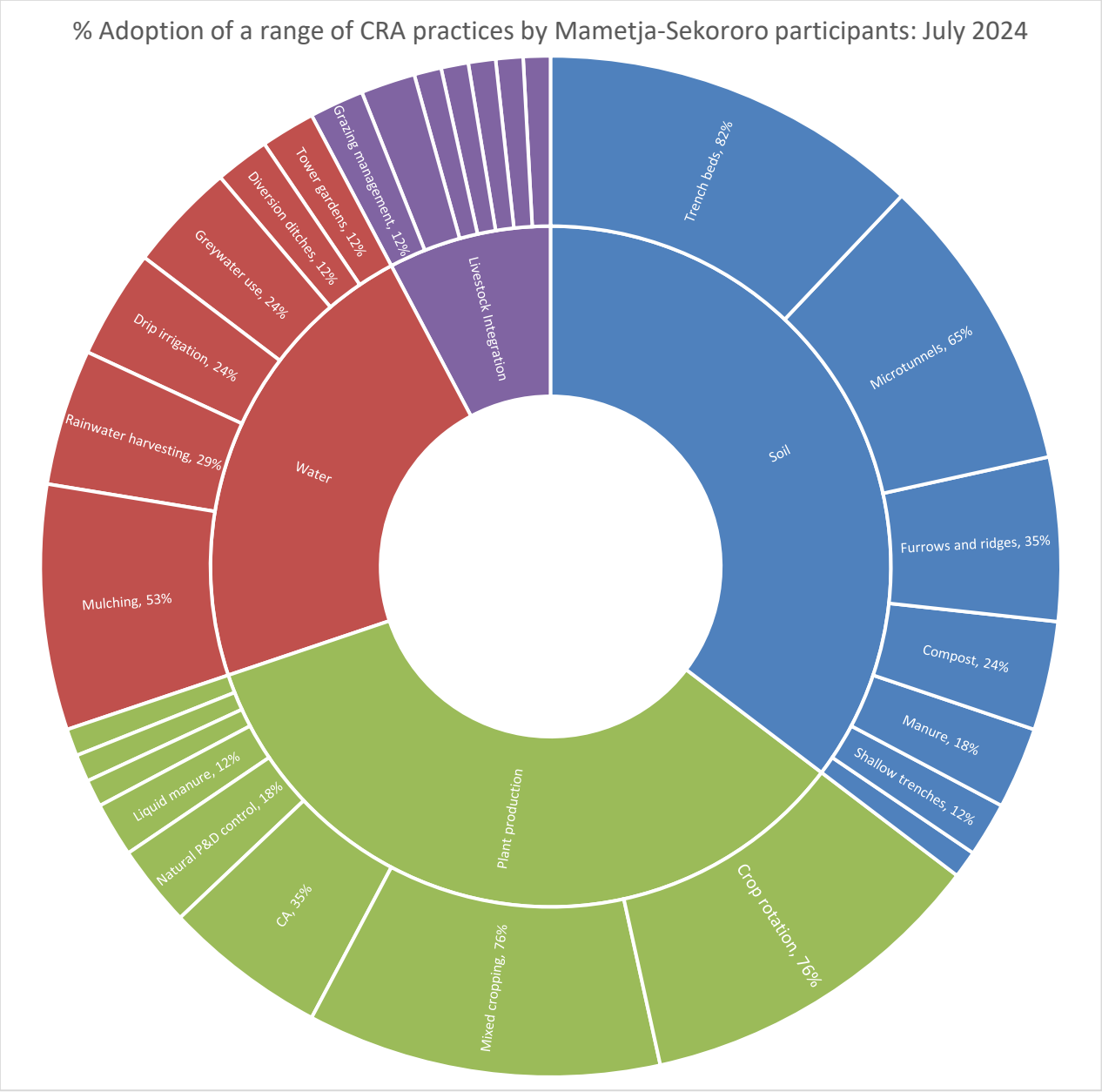


Figure 20: Diagram indicating uptake of CRA practices by learning-group members in the Mametja-Sekororo region of Limpopo, July 2024 (n=20)

In the focus group discussions, participants also undertook a matrix ranking exercise to outline the effectiveness of the various CRA practices according to criteria that are important to them as farmers. The outcome of the exercise is shown in Table 12, using a scale of 1–3, where:
1=worse/no change/harder
2= some positive change
3=a lot better

Table 12: Effectiveness of CRA practices taken up assessed with criteria developed by the group members for Sedawa, Limpopo, June 2024

EFFECTIVENESS OF PRACTICES: Limpopo, Sedawa, June 2024									
	Name of practice	**P&D control**	**Water**	**Crop quality**	**Climate control**	**Accessibility**	**Labour**	**Soil fertility**	
1	Tunnel	3	3	3	3	1	2	1	16
2	JoJo tank	1	3	1	1	1	3	1	11
3	Tower garden	3	3	3	2	1	2	1	15
4	Mulching	1	3	3	3	3	3	3	19
5	Underground RWH tanks	1	3	1	1	1	1	1	9
6	Trench beds	1	3	3	1	1	2	3	14
7	Kraal and chicken manure	3	1	3	1	3	3	3	17
8	Mandala beds	1	3	3	1	3	2	3	16
9	Diversion ditches	1	2	1	1	3	1	1	10
10	Stone bunds	1	3	3	1	3	3	3	17
11	Furrows and ridges	1	2	1	1	3	2	2	12
12	Compost	3	1	3	1	3	3	3	17
13	Mixed cropping	3	1	1	1	3	3	3	15
14	Poultry and livestock	1	1	2	1	1	3	3	12
15	Fruit production	1	1	1	1	2	3	3	12
16	Indigenous plants	3	2	1	1	3	3	3	16
		28	35	33	21	35	39	37	

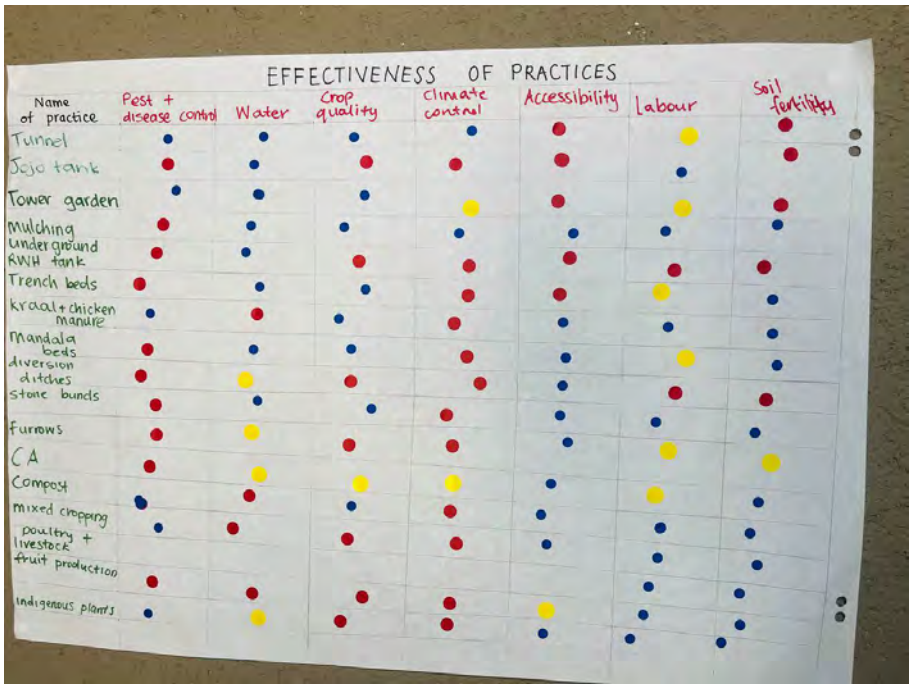


Figure 21: A picture of the original matrix diagram developed by the Sedawa participants, from which the above table was developed

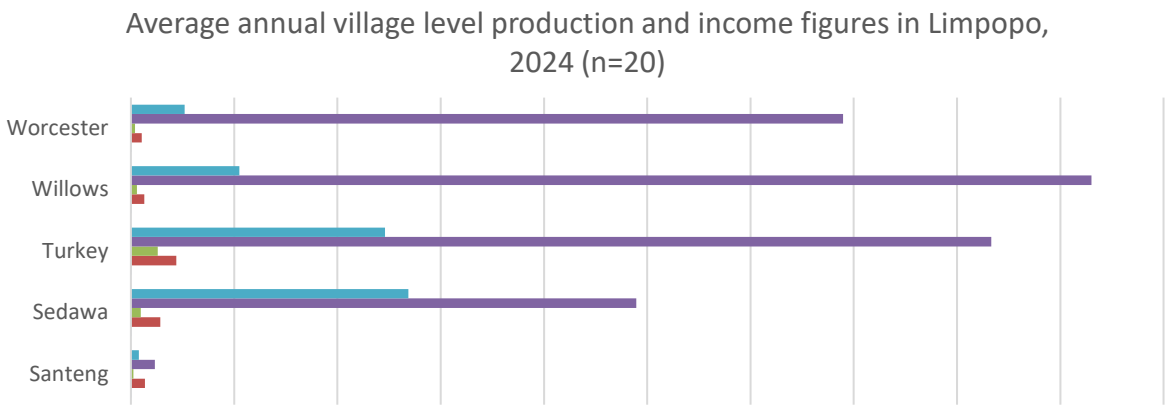
For the participants, the most significant changes have been in greater efficiency in labour and improved soil fertility from the range of practices they have assessed. The most significant CRA practices have been the introduction of mulching, micro-tunnels, the use of kraal and chicken manure, mandala beds, stone bunds, the making of compost, and the incorporation of indigenous plants.

In Willows, participants made the following comments based on their matrix ranking. Participants who have been using tunnels explained how grateful they are to have these and the huge impact on production that these tunnels have had. It has also encouraged them to work even harder and extend the shade netting area in their gardens to protect crops that are not inside the tunnel. Not burning tree leaves and instead using them to mulch their gardens has saved them water. In addition, many participants implemented trench beds because they greatly appreciated the results they observed in other participants' use of trench beds and tunnels. Boshvelder chickens (a multi-purpose indigenous breed) were introduced last year, and more farmers want them because they are much easier to house and care for, and both eggs and chickens for meat can be sold. The meat is found to be tastier than that of the broiler and indigenous chickens.

Annual crop yields and income for five of the villages in Limpopo are summarised in Figure 22, where farmers have undertaken CRA practices – a combination of gardening, field cropping, fruit production, and small and large livestock.

In this region, due to the change in climatic conditions, participants have focused mainly on homestead food production because dryland field-cropping has become untenable. In the two villages – Sedawa and Turkey – where MDF assisted with water access, the average production (amount in kgs) is substantially higher than in the other three villages – Willows, Worcester, and Santeng – where lack of access to water for both household purposes and multiple-use options is severely restricted. Average annual farming income in Willows and Turkey is substantially higher (~R44 000) than in the other three villages, mainly because livestock farming is prioritised, better organised, and linked to external support related to local auctions for livestock, Meat Naturally, and Conservation South Africa. Santeng, which has the lowest average annual income (~R1 100), is also the village with the poorest access to water. For a large portion of the year, the villagers need to buy water to survive because there is no access to surface water in the village, and springs and boreholes have been drying out.

On average, the annual income for these farmers is around R36 600, and they have managed to increase their annual incomes by R8 440 on average, through the implementation of CRA practices.



	Santeng	Sedawa	Turkey	Willows	Worcester
Average of increase in income	R 385,50	R13 438,30	R12 304,74	R5 251,88	R2 604,00
Average of Income	R1 152,50	R24 470,00	R41 659,00	R46 515,00	R34 476,50
Average of Inc in amount	115,0	474,3	1301,9	284,4	193,0
Average of Amount in kg	675,0	1430,5	2200,5	650,4	523,8
Average of Eaten	75%	59%	62%	73%	82%

Figure 22: Average production and income figures for farmers participating in CRA in Limpopo for 2023–2024

The focus group discussions also explored the different organisations at the village level, their relationships, importance to community members, and their functions. In addition, they provided a focus for outlining the learnings and changes people have been making, to provide a qualitative view on adaptive capacity and improved resilience. Table 13 summarises the different categories and numbers of both internal and external organisations in their villages.

Table 13: Number and categories of internal and external organisations in two villages in Limpopo, July 2024

Organisational clusters (Limpopo)			
	Sedawa (19)	**Willows (33)**	
Farming, livestock			
Internal	3 (poultry and crop farming co-ops and livestock associations – DARD)	1 (Livestock association-DARD)	Several NGOs operate in the region: AWARD, K2C, CSA, Meat Naturally, World Vision, Lima-RDF, and MDF, but generally are quite specialised and work with a restricted number of individuals in the community. DARD is important but provides limited and sporadic support.
External	2 (MDF, DARD)	4 (MDF, Lima, Meat Naturally, DARD	
Water			
Internal	1	-	Support for multipurpose water provision is lacking in Willows, and no internal self-supply options were mentioned.
External	1 (MDF)	-	
Community engagement			
Internal	3 (drop-in centre, football)	4	Cultural clubs, child support centres, and feeding schemes
External	-	2 (Community Work Programme, Hlokomela)	

Organisational clusters (Limpopo)			
	Sedawa (19)	**Willows (33)**	
Church			
Internal	4	-	In some villages, churches aren't seen to support the community, but in others, church members provide social support to the needy in their area.
Savings			
Internal	14	9	Stokvels are a traditional practice and are common in the villages. The VSLAs are seen to be different because members can save for productive activities and small businesses.
external	1 (MDF)	1 (MDF)	
Funeral and ceremonies			
Internal	9	10	These groups are seen as important for maintaining the social fabric and for assisting people in managing cash flow for these ceremonies, which can be very expensive.

Being the only organisation explicitly assisting communities to adapt to devastating climate change impacts, MDF was given a central role in both villages. Comments from farmers have included the following.

Willows: *Things are easy as we can use the space available in our gardens, and we do not have to purchase vegetables from shops. Farmers can implement different practices that work for their gardens, and these practices have helped increase production, and hunger will never affect them. It is the most important as it has helped farmers to do things on their own*.

Sedawa: *We have learnt to continue farming under difficult climatic conditions (hot and dry), sell, and make an income. One can eat well from one's garden and generate an income from a small garden. Life is better and less stressful*.

The DARD is considered important, with the caveat that in recent years, farmers have received little support. Presently, they are assisted through the livestock associations, but have not received any support for production for the last 4–5 years.

Support from the Traditional Authorities (TAs) appears to be a mixed bag. In Willows, they say that the TA only assists with land allocations and community conflicts. But in Sedawa, the community is grateful for the significant role played by the TA, which has helped with borehole installation to secure water access for people, land allocations, has helped to solve community conflicts, has installed WiFi hotspots, and has hired nighttime security patrols to control crime in the area. Municipal Ward councillors help with solving conflicts in the community, identifying indigent people, and reporting electricity and water issues and the need for housing, but they do not assist with agricultural, livelihood, or environmental management issues.

NGO support seems to be patchy – they are present in some villages but not others, and also tend to support specific, smaller numbers of community members. NGOs such as AWARD, Lima-RDF, World Vision, K2C, World Vision, CSA, and Meat Naturally provide learning, collaboration, and limited support for agricultural, livelihoods, nutrition, livestock and resource management, and small business development. There is little to no focus on climate adaptation, community organisation for resource

management, water access, and water management in these communities – support that only MDF provides.

Both internally organised funeral groups and savings groups are well distributed within the two villages. Generally, groups have between 10 and 40 members, with a few being larger. This process developed as whole-community organisations experienced difficulties with some households not contributing to the schemes but expecting support. Participants regard these groups as important because they feel it is better to work together to support each other and that this also assists with being able to afford more substantial expenses and helps people to plan for unforeseen events. The vast majority of participants in these groups are women (~80%).

The diagram in Figure 23 indicates the importance to the community of organisations (those closest to the middle) as well as their relationships. The orange dotted lines in the diagram depict strong relationships, and the blue lines depict neutral relationships where organisations are aware of each other but do not proactively interact.
The diagram indicates that the community gets support from external organisations – both NGOs and the DARD appear to be significant (larger orange boxes) and that they deem their relationships with these to be good. More often than not, they rely on the NGOs to bring the government departments to them – especially Agriculture, but also health, education, social welfare, roads, and water service authorities. In this village, the groups formed for financially supporting funerals and local ceremonies are also seen as very important. These groups know about each other but do not proactively collaborate. The local stokvels and savings groups are not considered that important (smaller blue and yellow boxes). Again, the groups are aware of each other but do not interact.

When asked what they have learnt and how things have changed through being involved in local organisations, farmers made the following comments:

- The groups have been very helpful. Burial groups started in the community, and everyone had to contribute when there was a funeral, but not all people participated, knowing that they would be assisted regardless. Now there are smaller groups where only those who are prepared to or can contribute and benefit from the support. Funerals happen almost every week and are very expensive, so taking part allows one the peace of mind that you will bury your loved one with dignity.
- The MDF learning group has helped small-scale farmers who were active but who had low yields. It has also helped poor households change their livelihoods by having a small backyard garden and making an income from it to provide for their families.
- We have started small businesses through being part of the savings groups. Savings groups have also decreased our debt from loan sharks. We can borrow money and buy agricultural inputs and household essentials, start up small businesses, and pay for our children's college fees.
- Working together as a community has helped a lot of people have things they have in their households, even where they depend on social grants and selling vegetables from their gardens.
- Farmer learning groups have taught us more about how to feed our families in these states of high unemployment and helped us make an income. This alone has improved our livelihood because some are now able to farm in big fields and employ people to work.
- With regard to how organisations have assisted the community to adapt to climate change, the villagers (in Sedawa and Willows) made the following comments.
- MDF has helped with a lot of things, starting with managing the water we have, the use of grey water, and harvesting rainwater. We have stopped burning organic matter and instead use this material for mulching and in the deep trench beds to improve soil fertility and reduce evaporation. We no longer pay for tractors to plough, instead using conservation agriculture when planting field crops.
- We used to do mostly dryland cropping, but this practice was becoming very difficult due to a lack of rain and changing weather patterns, with many crop failures and low yields. Now we know how

to collect water from far to use for both consumption and irrigation in our household gardens. We would not have thought of doing this if we were working on our own.

- We know how to control soil and water movement in our households and outside our yards.
- We have lessened conflicts in the community. An example is the smaller groups of community burial societies, which reduces conflict and also assists us, as there is a high number of deaths.
- The MDF learning group has helped us adapt to climate change. We have been active in farming for years, and some of us use borehole water in our homesteads for irrigation. We have been struggling with pests and diseases in our farming activities and also suffered a decrease in productivity, but through the Climate Resilient Agricultural trainings and support, we are able to make organic sprays for both pest and disease control. We know the importance of improving soil health and protecting the soil from extreme heat. We also use tunnels that help protect our crops from the extreme climate and pests.
- We have learnt how to grow fodder for our livestock and save that for winter when there is little grass and a lot of burning happening in the villages.
- We have also learnt the importance of farmers' networks and working together with both livestock and crop farming.

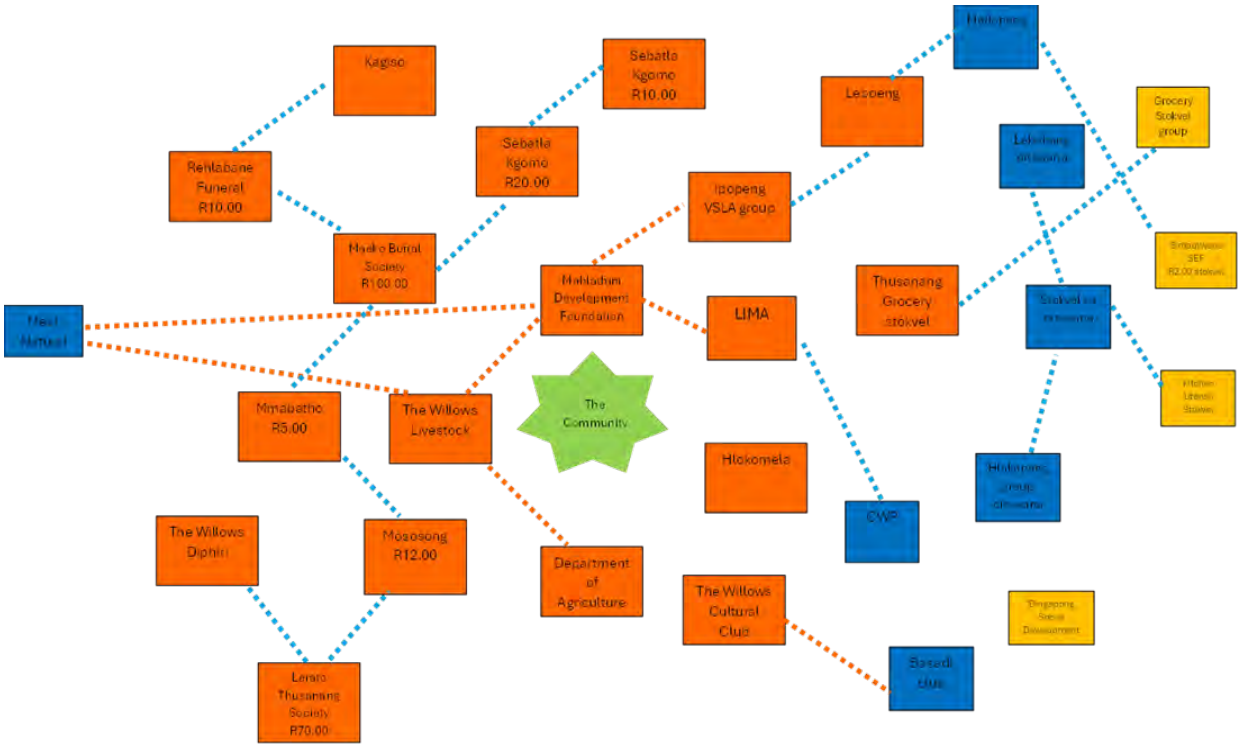


Figure 23: Diagram of the importance of organisations and relationships between them for the Willows community in Limpopo, July 2024

Table 14 outlines the participation of community members in different internal and external organisations and groups. It highlights the greater participation of women compared to men and youth. It also highlights that a reasonably large proportion of inhabitants in these villages do not belong to any groups or organisations.

Table 14: Community members' participation in internal and external organisations in Willows, Limpopo, June 2024

Village	Organisation	Type	No. in the village	No. of participants	Men	Women	Youth	Internal	External	Importance (Scale: 1–3)
Willows	**Farming**	Livestock committee (DARD)	1	200	200			1	1	3
No. of community members ~800		CRA learning group (MDF)	1	69	10	53	6	1	1	3
		Meat naturally – auctions	1	100	80	20			1	2
		Lima RDF (food security)	1	26	7	2	17		1	3
	Funeral support	Funeral groups	8	200	28	172		1		3
	Savings	Stokvels	10	141	7	134		1		2
		VSLAs (MDF)	2	37	3	30		1	1	3
		Clubs (farming and saving)	1	24		24		1		3
	Community Development	Primary health care (Hlokomela)	2	7	1	2	4	1		2
	NGOs	Climate and food security	3	**132**	**13**	**85**	**23**		1	3
	Govt Departments	CWP and DARD	2	200					1	3
	TA	Land and conflict resolution	1	800					1	2
	Municipal council	Services, poverty	1	800					1	2

In summary, the complexity of local and self-organisation in the villages is quite low and restricted to socially important aspects such as funerals, ceremonies, and saving for household needs. Connections, both local and cross-scale, are generally made through linkages with external organisations that focus on this aspect – invariably, certain NGOs. In these villages, where the CRA learning groups have been active, participants implemented a range of farming, water, and resource management activities that have made a significant difference for them. Many now have food on the table and make a modest living from farming and small business activities, which they have found to be crucial in the present economic downturn and lack of employment opportunities. However, some of the climate change impacts mentioned, such as the destruction of houses, roads, and other infrastructure (such as electricity), increased poverty, crime, and impacts on human health, could, to date, not be coherently tackled by the communities. There is little to no institutional support for these aspects. Youth are considered disinterested in contributing to village life, often waiting for better opportunities rather than getting involved in household food production.

4.8 BERGVILLE, KWAZULU-NATAL CASE STUDY

This area lies in the upper uThukela river basin in the Northern Drakensberg. It falls within the cool sub-tropical sub-humid, montane and alpine grassland zones, with average annual temperatures of around 15°C, with good summer rainfall (650–1300mm/annum) and cold dry winters. Rainfall variability has

increased significantly in the last ten years, as has temperature and frequency of heatwaves. The frequency of extreme weather patterns such as wind, hail, and storms has also increased significantly in the region.

A key vulnerability identified here is the potential for increased food insecurity under changing climatic conditions, with very high levels of unemployment and poverty. Over-utilisation of natural resources combined with a lack of management of these resources has led to erosion and reduction of water availability, leading to water stress in these villages. In addition, between 70% and 80% of inhabitants are entirely reliant on social grants (child grants and pensions) for their income.
Community members in this region highlighted climate change impacts such as increased variability in rainfall patterns (late onset of rain, storms, and hail) with increased heat and reduced rainfall, with associated decrease in water availability, increased erosion and alien vegetation, decrease in grazing quantity and quality linked to damage to houses and infrastructure such as roads and electricity. The negative impact on participants' livelihoods and the social fabric of their communities was also emphasised.

MDF has been implementing a systemic approach to climate change adaptation and climate resilient agriculture in partnership with the Maize Trust (for CA) and SAEON/EFTEON, UKZN-CWRR, the INR, WWF, and WILDTRUST (for water and resources stewardship processes) for around eight to ten years, across five to 18 villages in the area. Close cooperation and sharing of information and learnings with other stakeholders through a strategic water-source-area partnership called the Northern Drakensberg Collaborative has been important throughout the implementation processes. Other major stakeholders in the upper uThukela region have included SANBI and the WRC, among others. Close collaboration also with the local authorities – traditional councils, ward councillors, and the local municipality – as well as the KZN Department of Agriculture and Rural Development (KZNDARD) has been a hallmark of work in this area.

Work has more recently been undertaken in five villages, with around 150 smallholder farmers. This case study focuses on four villages (Vimbukhalo, Stulwane, Ezibomvini, and Eqeleni), with 20 individual snapshot interviews conducted and three PIA sessions in Stulwane (35 participants), Eqeleni and Ezibomvini (25 participants), respectively.

The focus group discussions explored the different organisations at the village level, their relationships, importance to community members, and their functions. In addition, they provided a focus for outlining the learnings and changes people have been making, to provide a qualitative view on adaptive capacity and improved resilience. Table 15 summarises the different categories and numbers of both internal and external organisations in their villages.

Table 15: Number and categories of internal and external organisations in Bergville, KZN, June 2024

Organisational clusters (Bergville, KZN)				
	Stulwane (35)	**Eqeleni (12)**	**Ezibomvini (16)**	
Farming, livestock				
Internal	5 (poultry and livestock association, stock theft association, firewood cutting and	3 (livestock association, stock theft group, and agricultural cooperative)	4 (marketing group, livestock association, stock theft association, and agricultural coop)	DARD supports with livestock, dipping, and vaccinations. In the past, assisted with field cropping, but COVID and climate change have stopped this. MDF is important in the villages. FSG has supported biochar experiments, some fencing, and limited fencing and marketing

Organisational clusters (Bergville, KZN)				
	Stulwane (35)	**Eqeleni (12)**	**Ezibomvini (16)**	
	sale group, CA work group)			support. Agricultural cooperatives were formed in 2016, but have not been active due to a lack of support from DARD CRA learning groups: Ezibomvini (52), Stulwane (30)
External	2 (MDF, DARD)	2(MDF, Farmer Support Group-FSG, DARD)	2 (MDF, FSG, DARD)	
Water and natural resource management				
Internal	4 (water committee, resource management committee, craft group, community forest for burials)	1 (river cleaning group)	2 (water and resource management committees)	Committees look after the 2 self-supply water schemes (94 households) in Stulwane and 1 scheme in Ezibomvini (11 households), undertake grazing management, alien clearing, and erosion control activities. MDF supports the CRA learning groups, to which other committees are linked.
External	1 (MDF)	1 (MDF)	1 MDF)	
Community engagement, social				
Internal	3 (soccer, hunting group)	3 (youth group, hailstorm group, men's group)	2 (youth group, hailstorm group)	Cultural clubs, sports, hunting, prayer groups, and traditional ceremonies
External	-	-	-	
		Church		
Internal	1	2	4	
		Savings		
Internal	5	3	4	Stokvels are a traditional practice and are common in the villages. In Bergville, the stokvels are arranged according to purpose, e.g. firewood, building, Christmas, food and funerals. The VSLAs are seen to be different because members can save for productive activities and small businesses.
External	2 (MDF – VSLA; and BLF – bulk loan fund)	3 (MDF)	4 (MDF VSLAs including new youth group)	
Health				
External	Dept. of Health (DoH) – mobile clinic	-	-	

MDF was considered very important in all three villages, as the only organisation that has consistently supported smallholder farmers and villagers to adapt to climate change and find avenues for improved livelihoods despite difficult environmental and economic conditions. Table 16 outlines community members' analysis of climate change impacts and their adaptive strategies.

Table 16: Climate change impacts with strategies and actions undertaken, and thoughts of the Bergville community, June 2024

Natural			
CC Impact	**Solutions tried**	**Facilitated by MDF (*)**	**Proposed solutions**
↓Rain	Clearing alien trees and greywater use	* *	

Natural			
CC Impact	**Solutions tried**	**Facilitated by MDF (*)**	**Proposed solutions**
	Avoiding veld fires Trench beds and drip irrigation Micro-tunnels and mixed cropping Mulching, no-till, cover crops Rainwater harvesting	* * * *	
↓Access to water	Locally led water access – spring protection, pipes, taps	*	
↓Grazing lands (grasses)	Prevented veld fires Make fire belts/breaks		Rotational grazing * Herding of livestock and fencing of fields and gardens to avoid conflicts when livestock eat neighbours' crops
↑Heat	Cover crops and tunnels	*	Reduce burning of veld and waste to reduce emissions Promote recycling
↑Floods	-		
↑Soil Erosion	Herding livestock and interchanging grazing points Stone and brush packing	* *	
↑Winds	*Ukuteta ikhomani* (traditional method where a woman puts a calabash on her back like a baby, which is believed to calm heavy winds)		Planting of trees and fruit for wind protection
↑Alien vegetation	Alien clearing	*	
↑Hailstorms	*Ukuzila inhlabathi* (traditional method of stopping the use of the soil for that particular period)		
↓**H**ouses	Water channelling using gutters and V-drains Cutting grass around the houses to prevent it from catching fire during windy seasons		Building stronger houses (using cement/concrete) Diversion furrows
↓Roads and bridges	Stone packs Diversion furrows Cleaning blockages in stormwater pipes	* *	Digging furrows for water drainage next to roads
↑**C**ar accidents	Speed humps		Reducing speed
↑Falling of trees (along the road/next to houses)			Cut damaged trees near roads
↑**D**iseases and increased mortality	-*Ukuchatha* (traditional stomach cleansing practise Traditional herbs and medications		Eating healthy foods – more organic and traditional food * Regular clinic check-ups
↑Hunger/Poverty	CRA: CA, livestock integration, intensive homestead gardening, poultry (broilers, layers, Boschvelders)	*	Workshops to learn about financial management Diversification of enterprises

Natural			
CC Impact	**Solutions tried**	**Facilitated by MDF (*)**	**Proposed solutions**
↑Crime	-Not buying stolen goods -Selling livestock		Spreading awareness of the consequences of crime to children
↑Drug abuse			Educating children about the consequences of drug abuse
↑Divorces			
Farming inputs (need more as fertilizers get washed away by rain)	Microdosing of fertilizer	*	
↑Prices	Farm a larger area with a diversity of crops	*	
↑Infrastructure costs (rebuilding costs)	Apply for government assistance		
↓**J**obs	Farming for selling	*	Venture into other business enterprises

This table provides a good overview of the CC impacts in the region and of activities undertaken or proposed at the community level to mitigate against these impacts. It also shows that communities are experiencing significant levels of shocks and stressors related to climate change. The integrated approach used by MDF with the learning groups has helped to provide answers and action in several of these categories. Community members have commented on the range of new activities now undertaken, including CA, taking care of the environment and natural resources, poultry production as a business, saving water, taking care of water sources, and working together. They have gained knowledge and skills to be self-sustainable through new methods and approaches to farming (including fodder production and planting of cover crops), support for access to inputs, business development skills, saving and support in marketing, as well as access to water closer to their homes. They stated repeatedly that they are now a lot more self-sustainable than before and that their livelihoods have improved considerably.

These interventions have led to the formation of several groups and committees, including, for example, water committees, resource management committees, and marketing groups. More recently, youth groups have formed, and youth have also set up their own village savings and loan associations.
The DARD is seen as important and has, in the past, provided support with ploughing, seed and seedlings, as well as training in value addition and livestock management. Presently, DARD support is restricted to dipping and support for the livestock associations. They were rated 2 on a scale of 1–5 in increasing importance due to the low level of service presently provided.

The TAs and ward committees (councillors) in this region do provide some support with land allocation, community conflicts, planting and harvesting, and RDP housing, respectively, but generally do not have meetings with the community and provide little ongoing support or services. Ward councillors in particular enjoy little respect in the community and are seen to only be interested in community affairs when elections are looming.

The stokvels, funeral groups, and church groups are important internal organisations for maintaining the fabric of the society and allowing householders to function in a cash-deficient environment.
In general, the lack of government and institutional engagement in infrastructure and service delivery support is notable, as is the “disengagement” of both the traditional councils and the local municipality from the development needs and processes of these communities.

When asked what they have learnt and how things have changed through being involved in local organisations, farmers made the following comments:

- We have learnt many new practices and approaches in farming and looking after our environment.
    - How to save water in our farming and the importance of planting cover crops.
    - Soil maintenance – soil cover, intercropping, crop rotation, run-off, crop mixing.
    - Poultry – both meat and egg production, as well as multipurpose breeds.
        - Building micro-tunnels; now able to see improvement of crops inside the tunnel compared to outside.
        - Trench beds that have a lot of organic matter and produce very good crops.
        - Water saving through drip irrigation and using greywater.
        - Hay-baler making, making our own protein blocks, planting winter and summer crops, and supplements have helped our livestock.
        - Alien trees and bushes are invading space for indigenous plants and finishing the grazing land and water. There is improvement when these are removed.
        - Closing dongas, land rehabilitation, and reducing runoff.
        - Cleaning our environment to protect our land from pollution.
- We have learnt how to work together as groups, which has made many things possible that we couldn't do before – such as running our own water access schemes, improving our grazing lands, doing firebreaks, negotiating with our traditional council and ward councillors. The savings groups work together to improve livelihoods.
- We have improved our financial status through saving money and specifically saving for farming inputs, which has allowed us to continue farming despite the very difficult conditions. In our neighbouring villages, most people have stopped farming, but we have even expanded. We have also learnt how to do farming for/as a business and have improved our business skills. Before, we were planting only for food.
- We have learnt about marketing, including advertising our products, pricing, working out profits, and have also included food exchange as a way to work with our produce.
- We have learnt about livestock integration and now can provide feed and supplementation during winter to allow our livestock to survive. We have learnt about better medications and management of our livestock. We now have healthy-looking, well-fed livestock.
- We have learnt about spring protection to stop contamination and make water available for both households and livestock, and have learnt to look after our streams to improve the quality and quantity of water.

Concerning how organisations have assisted the community to adapt to climate change, the villagers (Stulwane, Eqeleni, and Ezibomvini) made the following comments:

- The farming practices that we have learnt and are now using have improved our production and the quality of our produce, while most other community members have stopped farming altogether. We now have enough food and can even, at times, sell some surplus produce.
- We have learnt how our actions have reduced water availability in our landscape and are now implementing practices to ensure better management of our veld and water, including, for example, alien clearing, spring protection, firebreaks, control of livestock movement, and winter feeding of cattle.
- By working together, we can deal with some of the negative impacts of increased storms and flooding. We assist those farmers and households that were impacted, rather than just leaving them to cope by themselves. We fix our roads and bridges and do not wait for someone to come and help us.

Table 17 outlines the participation of community members in different internal and external organisations and groups. It highlights the greater participation of women compared to men and youth.

Table 17: Participation of community members in local organisations in the Stulwane village in Emmaus, Bergville, June 2024

KZN: Bergville	Stulwane village	No. of community members 400 in total					
Organisation Type	**Organisation Name**	**No. of people**	**Men**	**Women**	**Youth**	**Internal/ external**	**Importance (scale 1–3)**
Agriculture	Mahlathini Development Foundation	30	3	24	3	external	3
	Poultry group	10	3	6	1	internal	3
	Livestock farmers association	150	145	5	0	internal	3
	Agricultural extension	20	3	17	0	external	3
Governance	Ward council meetings	400	100	250	150	external	1
	Stock theft association	50	35	15	0	internal	3
Economic	Poultry group	10	3	6	1		3
	VSLA	30	0	18	12–	external	3
	Small entrepreneurs (grass mats)	14	0	14	0	internal	1
Religious, social & infrastructure	Soccer team	32	0	0	32	internal	1
	Beverages stokvel group	19	19	0	0	internal	2
	Firewood stokvel	50	0	50	0	internal	2
	Church	8	1	7	0	Internal	2
	Amanqina (hunting group)	60	45	0	15	internal	2
	Umdiklizo (funeral stokvel)	170	0	140	30	internal	2
	Grocery stokvel + Christmas stokvel	90	0	60	30	internal	2
	Ukutina (group that helps each other make blocks for house building)	13	0	13	0	internal	2
Water & natural resources	Water committees	30	10	20	0	internal	3
	Grazing land management	30	24	6	0	internal	2
	Alien species cutting	20	5	12	3	internal	2
Health	Department of Health (local mobile clinic)	400+	+-100	+-200	-+200	external	3

Note: Blocks marked in green are those community members who interact directly with MDF.

In summary, the complexity of local and self-organisation in the villages is quite low and restricted to socially important aspects of funerals, ceremonies, and saving for household needs. Connections, both local and cross-scale, are generally made through linkages with external organisations which focus on this aspect – invariably, certain NGOs. In these villages, where the CRA learning groups have been active, participants implemented a range of farming, water, and resource management activities that have made a significant difference for them. Many can now have food on the table and make a modest living from farming and small business activities, which they have found to be crucial in the present economic downturn, given the lack of employment opportunities. However, some of the climate change impacts mentioned, such as the destruction of houses, roads, and infrastructure (such as electricity), increased poverty, crime, and impacts on human health, could, to date, not be coherently tackled by the communities. There is little to no institutional support for these aspects. Youth in these villages have started to become involved in the activities, an aspect that was also supported through the provision of stipends to eco-champs. These youths learnt a lot about their environment and management options through this process and also provided a service in their communities that was valued by their elders, enabling them to integrate better into the learning groups and activities undertaken.

4.9 DEVELOPMENT OF A MONITORING AND EVALUATION PLATFORM AND DASHBOARD

This aspect is part of the development and refinement of the overall MERL process for measuring and reporting climate resilience for community-level engagements in adaptation. The intention is that this tool will be available to all stakeholders involved in this field upon completion and will form part of the MERL handbook that is being developed as well.

The intention of this tool is also that it is interactive and will have the capability built in to compare data from different sites and regions. The framework of using absorptive, adaptive, and transformative capacities has been used to group, analyse, and visualise data. Below, the recent snapshot interviews (n=20) undertaken in Matatiele, Eastern Cape, will be used as an example.

4.9.3 Matatiele, Eastern Cape case study

This area falls within the Umzimvubu catchment of the Southern Drakensberg, bordering on Lesotho, in a cool sub-tropical semi-arid agroecological zone, with average annual temperatures of around 17°C, with summer rainfall averaging ~600 mm and cold dry winters, with potential for snow. Rainfall variability has increased significantly in the last 10 years, as has the occurrence of extreme weather patterns such as strong winds, hail, and storms.

A key vulnerability identified for the region is the potential for increasing food insecurity under changing climatic conditions, with very high levels of unemployment and poverty. Over-utilisation of natural resources combined with a lack of management of these resources has led to erosion and reduction of water availability, leading to water stress in these villages. In addition, between 70% to 80% of inhabitants are entirely reliant on social grants (child grants and pensions) for their income. Thus, pressure on existing natural resources to fulfil basic needs (grazing for livestock, firewood, plants for food and medicine, and water) is likely to continue and intensify. Not only are poor land-use practices impacting production and ecological health and integrity, but these impacts will be greatly exacerbated by the hotter and more erratic rainfall conditions that are predicted for the region.

Climate change impacts of increased variability in rainfall patterns (late onset of rain, storms, and hail) with increased heat and reduced rainfall, with associated decrease in water availability, increased erosion and alien vegetation, decrease in grazing quantity and quality linked to damage to houses and infrastructure such as roads and electricity, were highlighted by community members in this region. The negative impact on participants' livelihoods and the social fabric of their communities was also emphasised.
MDF has been implementing a systemic approach to climate change adaptation and climate resilient agriculture in partnership with Environmental and Rural Solutions (ERS), SaveAct, and Lima Rural Development Foundation, also working in the region.

4.9.3.3 The dashboard – LANDING PAGE

The first dashboard is the landing page, which includes a map, an overall description of the area, and basic demographics of the community or communities in question.

For Matatiele (n=20) the gender of respondents in the snapshots were 71% women and 29% men and the age group categories are as shown in Figure 24, with 5,9% between the ages of 18 and 35, 35,3% between the ages of 36 and 50, 52,9% between the ages of 51 and 65, and 5,9% over the age of 65.

These two small graphs are considered representative of the target group in Matatiele, showing beneficiaries as primarily women and between the ages of 51 and 65 years of age, with a slightly smaller beneficiary group between the ages of 35 and 50. This indicates that participants are no longer dominated by retirees, which is typical of these communities, but by working-age unemployed people who are farming to make a living. Included in these two target groups is what we call the “missing middle”, which is a sub-category of people who do not receive any social grants (because their children have grown up), but who are still too young to receive pensions. This group has, in recent years, been shown to be the most vulnerable, but also the most active group in these communities.

Figure 24: Gender and age distribution for resilience snapshot respondents in Matatiele, June 2024

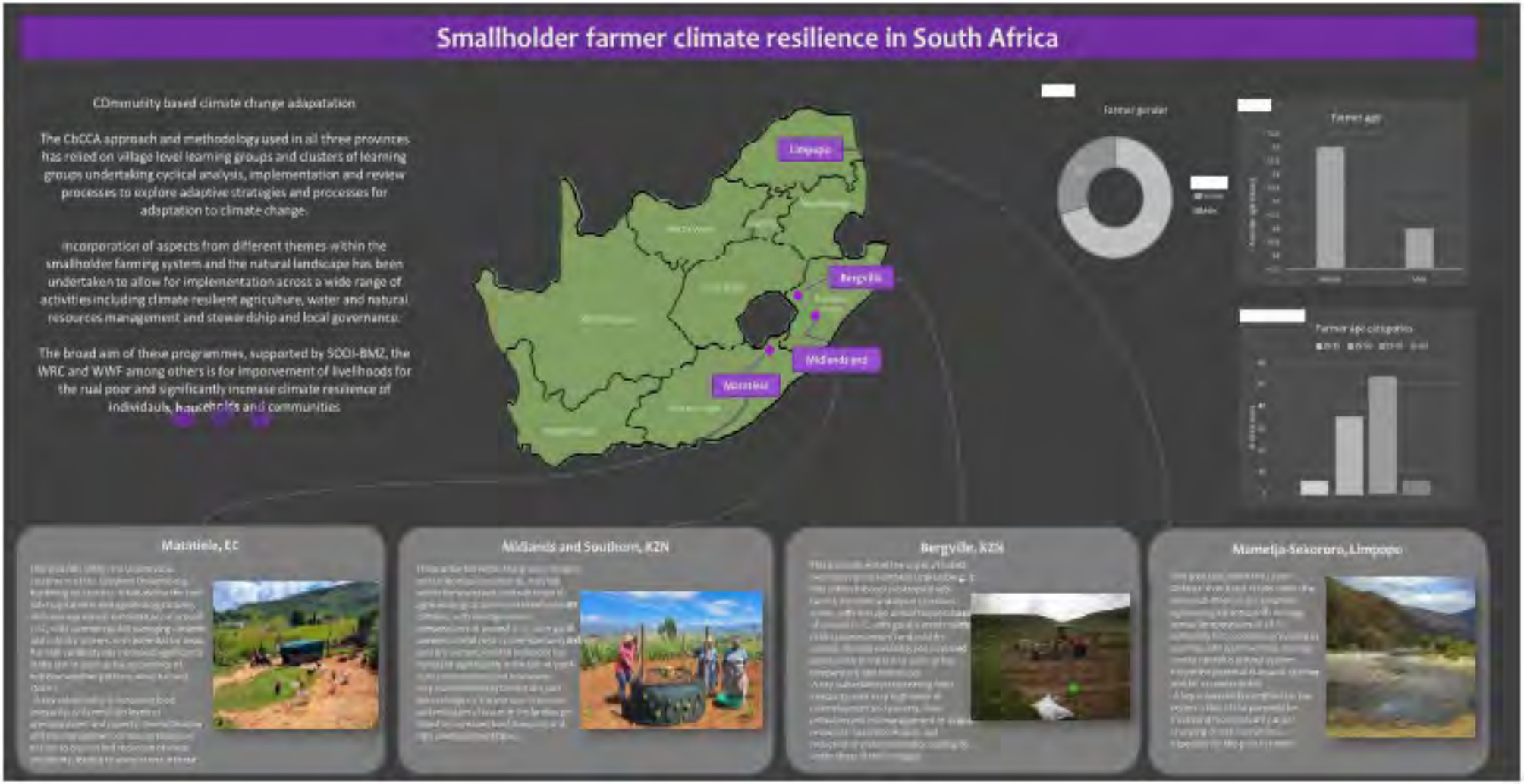


Figure 25: The landing page in the dashboard visualisation tool for smallholder farmer climate resilience in South Africa

4.9.3.4 The dashboard – ABSORPTIVE and ADAPTIVE CAPACITY

These dashboards focus on indicators that show change in several facets and have the following resilience indicators and information sets.

Resilience indicator	Datasets
Socially self-organised	- Increased participation in collaborative action/social agency groups - Average number of new groups that individuals belong to
Shared learning	- Increased diversity of knowledge-sharing mechanisms - Increased number of information sources
Ecologically self-regulated	- Improved water use efficiency - Improved soil health
Honours legacy	- Traditional practices (number in use per participant)
Builds human capital	- Use of savings - Use of loans
Reasonably profitable	- Increase in income - Increase in savings - Increase in the size of farming activities
Diversity and redundancy	- Increase in income sources - Increase in the number of farming activities (gardening, field cropping, livestock, trees, and natural resources) - Increased crop diversity - Water sources and reliability - Number of sources for nutrients, suppliers, and sales outlets
Spatial and temporal heterogeneity	- Increased growing season - Crop rotation/mixed cropping - Livestock integration

The results for these indicator sets for Matatiele are shown below:

SOCIALLY SELF-ORGANISED

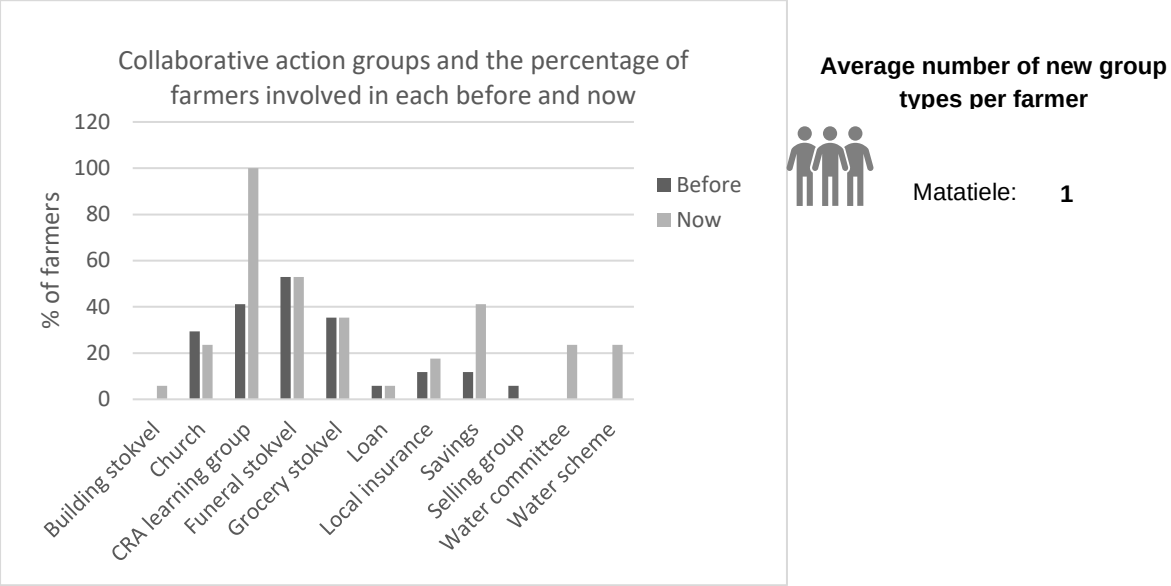


Figure 26: Left: The different groups farmers belong to. Right: The number of new groups on average that each individual has joined since undertaking CRA.

The changes in social organisation are primarily reflected in participants' belonging to the CRA learning group, initiating new savings groups, setting up a building stokvel and water committees, and participating in water schemes. This indicates that participants now belong to different categories of groups, and ones that focus on agriculture and environmental concerns.

SHARED LEARNING

For this indicator, respondents were asked about how they learn and share knowledge, and how this was done before their involvement in CRA and now. The figure below outlines these sharing mechanisms. From the graph, it can be seen that there has been an increase in sharing between community members, participation in the learning group, and, significantly, in recent years, a marked increase in using cell phones, WhatsApp, and written information. On average, whereas participants used three information sources in the past, they are making use of six. This provides evidence of greater interconnectivity between community members and with the broader environment, which is a strong building block towards the use of more digital platforms for information and knowledge sharing.

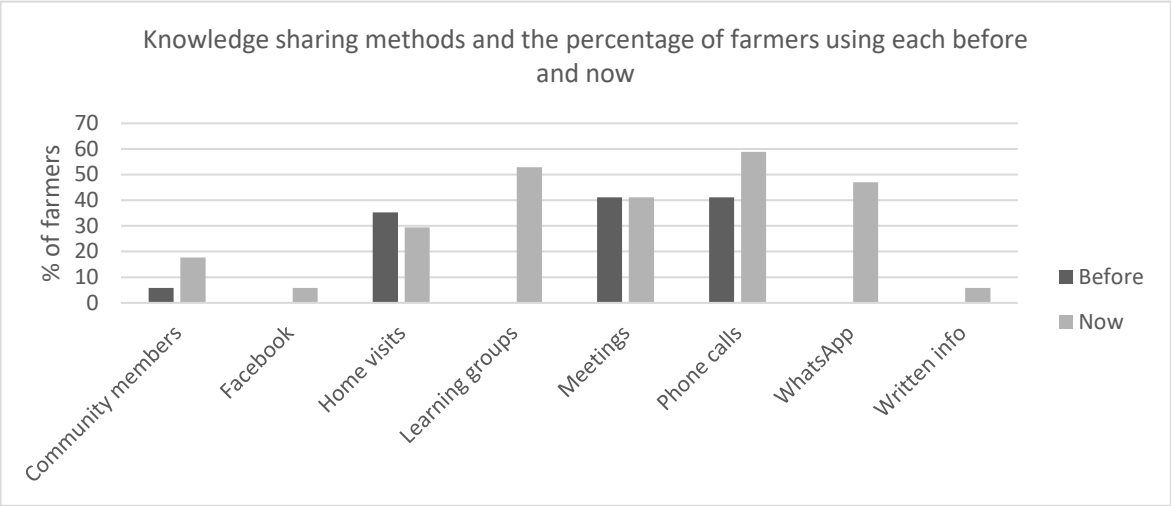


Figure 27: Knowledge sharing methods for participants from Matatiele before and after their involvement in the CbCCA programme

ECOLOGICALLY SELF-REGULATED

This indicator encompasses concepts of ecological integrity, ecosystem services, and functionality of ecosystems. It is difficult to assess directly, given that these smallholder communities live in areas where ecological functioning is already compromised through overuse and erosion.

Practices that improve water and soil management were taken as proxies for self-regulation, and the percentage of farmers using each of these practices was measured, as shown in Figure 28.

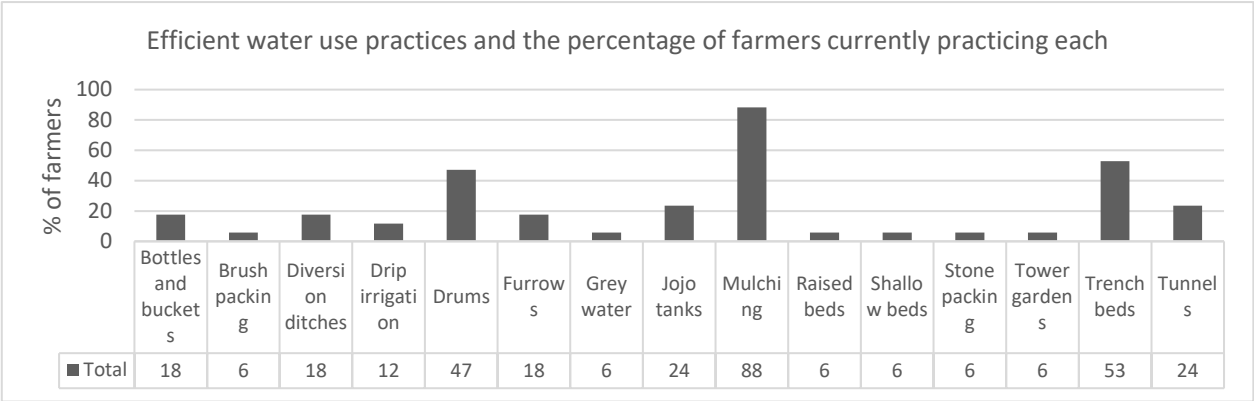
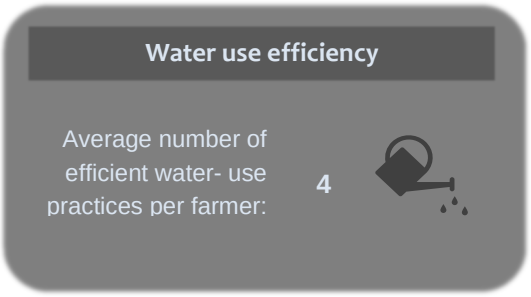


Figure 28: Percentage of farmers using different water use efficiency practices



The percentage of participants using mulching was 88%, trench beds (53%), rainwater harvesting drums (47%), Jo-Jo tanks (24%), and micro-tunnels (24%) in their homestead gardens to improve water use.

The use of greywater and tower gardens was quite low (6%).

Erosion control measures included furrows and diversion ditches (18%), stone packing and brush-packing (6%), mostly also in and around the homesteads.

These practices, combined with soil improvement (organic matter and soil health), as well as crop diversification, mixed cropping, and integrated pest and weed management, provide a suite of practices building self-regulation in the homestead farming system. To explore this, the participants were asked to assess the improvement of their soil health in their production system.

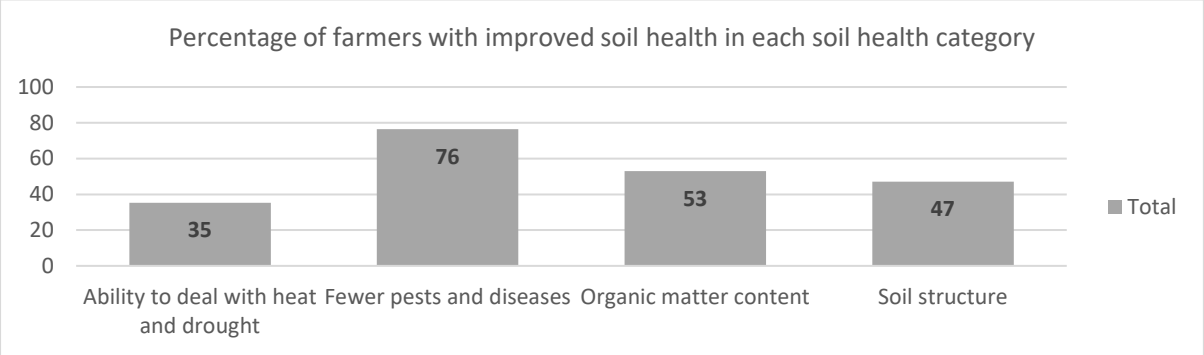


Figure 29: Percentage of farmers who have noticed an improvement in their soil health functions

From the graph in Figure 29, it is clear that around 75% of farmers have noticed a reduction in pests and diseases since implementation of the CRA system in their gardens and fields, 53% have noticed an improvement in the organic matter content of their soil, 47% have seen an improvement in soil structure (less compaction and increased friability of soil) and 35% have noticed an improved ability of the soil to deal with heat and drought (reduced wilting and heat stress in crops).

Several aspects were looked at in terms of production, productivity, diversity, and livelihood options. Smallholder farmers work within a mixed farming system of gardening, field cropping, livestock production, and production of trees and multi-purpose species. Not all farmers undertake all these activities. An assessment of the number of farmers who increased their activities, as well as the seasonality of these activities, was undertaken. Examples for increased seasonality include planting vegetables in both winter and summer, increasing field cropping by planting winter or cover crops going into autumn, and changing small-livestock practices and breeds to be able to also do poultry husbandry in winter.

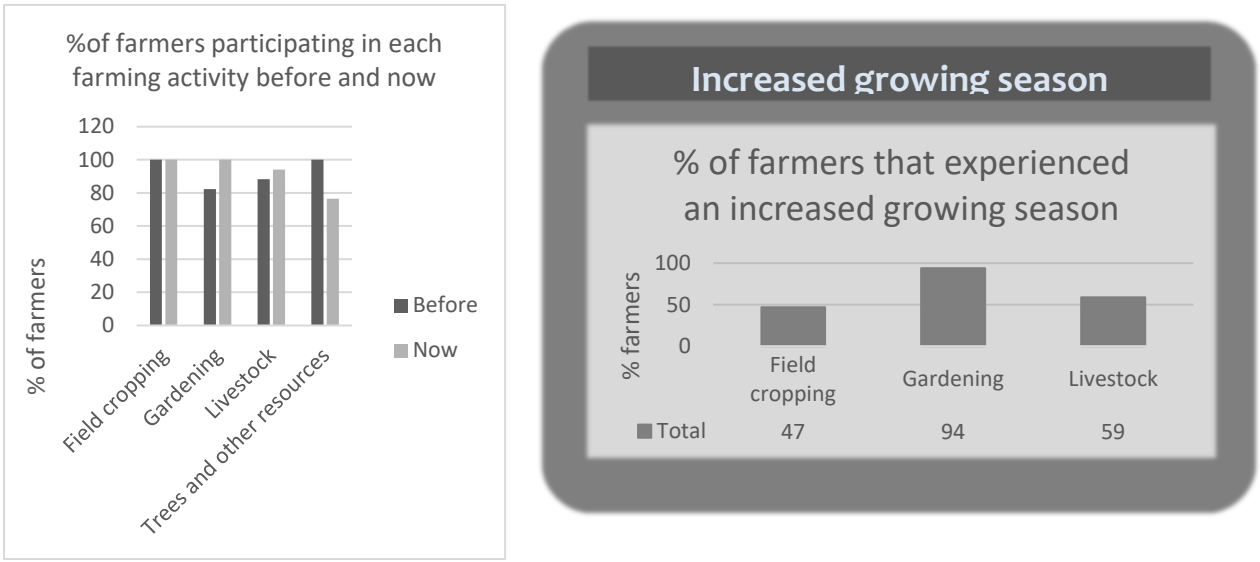


Figure 30: Percentage of farmers who increased their farming activities and also increased their growing season for different farming activities

From the graphs, it can be seen that involvement in gardening and livestock husbandry has increased, field cropping has remained constant, and tree production has decreased. Eighteen percent of farmers have increased their farming activities. Most of the farmers (94%) increased their growing season in their gardens (winter and summer production), 59% increased the season for livestock production (mostly through better housing and introduction of multipurpose breeds of poultry), and 47% increased their field cropping growing season (through production of winter cover crops).

Mixed cropping and crop rotation were also introduced to farmers. These practices increased from 29% to 59% for field cropping, and 88% of farmers introduced these practices in their gardens.
Farmers were then asked about the range of (income-generation) livelihood activities they have access to. The intention was to get some indication of the contribution of farming to their livelihoods. The graphs are shown in Figure 31.

Categories for incomes have shifted in the last four to five years, and many more people are relying on farming to provide a livelihood (between 29% and 76%). This means other options (usually day labour or part-time employment programmes) have decreased. Mostly, it appears, formal employment opportunities in the cities and other regions have decreased dramatically since the COVID-19 pandemic. These figures point towards the possibility that practising CRA is making farming a viable option for these households, reducing migration for employment.

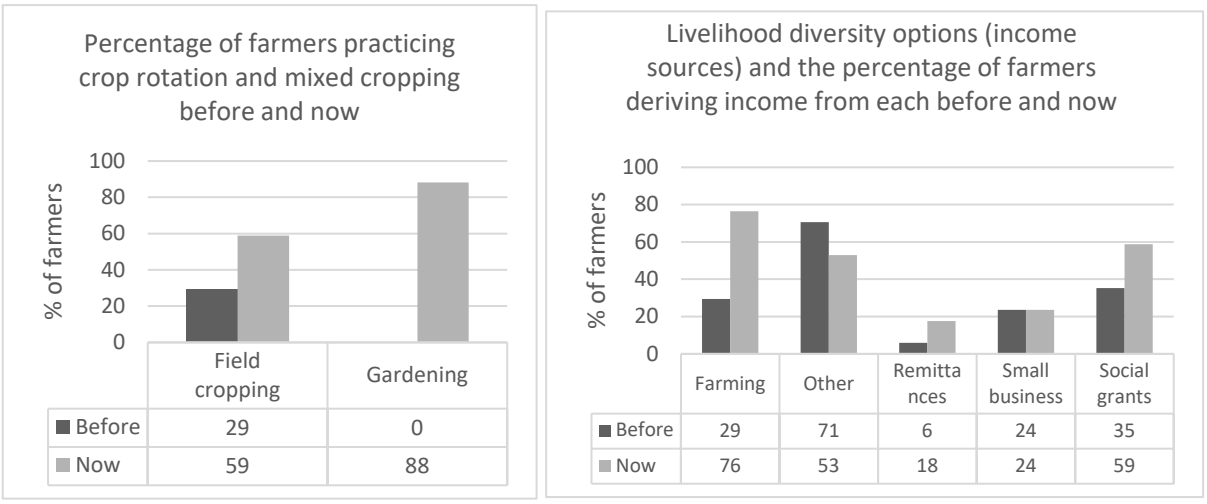


Figure 31: Left: Percentage of farmers using crop rotation and mixed cropping. Right: Percentage of farmers who have access to different livelihood options

The CRA practices implemented by farmers were also assessed. These include practices related to soil, water, plant production and livestock integration. Examples of practices mentioned by farmers were trench beds, mixed cropping, crop rotation, rainwater harvesting, drip kits, grey water, mulching, planting of herbs, CA, use of compost and manure, shallow trenches, poultry housing, micro tunnels, liquid manure, foliar spray, natural pest control, diversion ditches, and furrows and ridges. The average increase in the number of CRA practices per farmer in the last three years has been four practices, as shown in the image alongside.

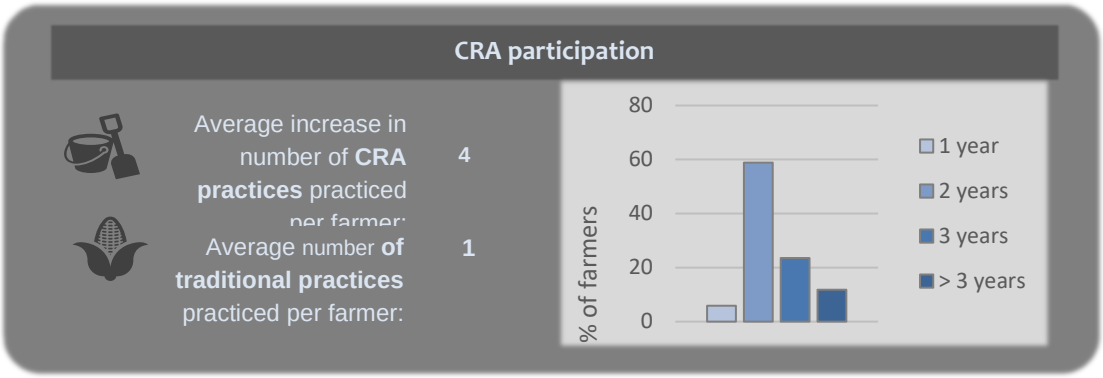


Figure 32: Left: Average number of CRA and traditional practices undertaken by participants. Right: the average number of years participants undertook CRA

The tree diagram in Figure 33 shows the percentage of farmers who have undertaken the range of practices.

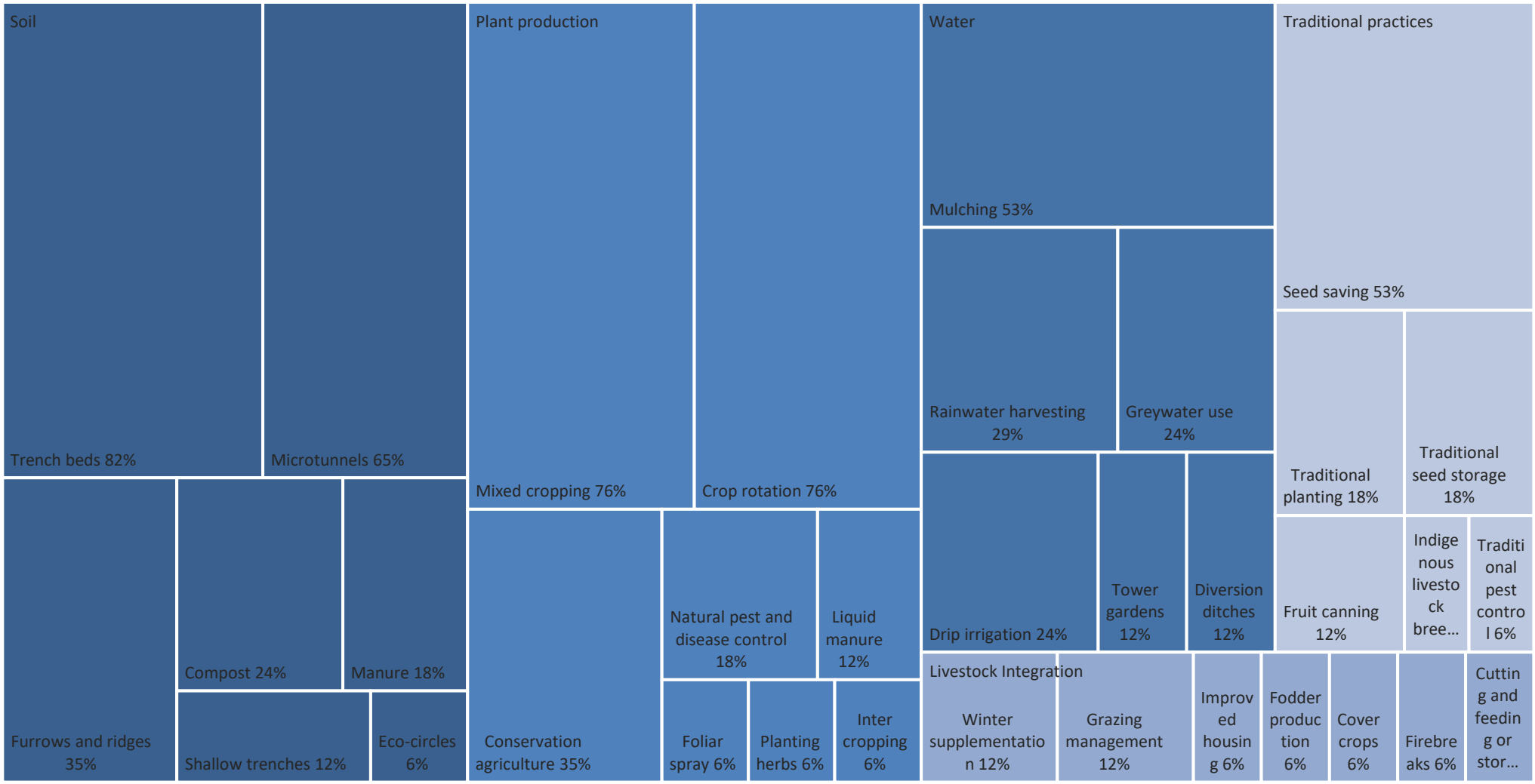


Figure 33: Percentage of farmers undertaking CRA practices in Matatiele, June 2024

4.10 CONCLUSIONS

These case studies, although highly complex and detailed in nature, clearly indicate the improved climate resilience of smallholder farming communities working within a community-based climate change adaptation framework, working to implement climate-resilient agriculture practices across their mixed farming systems, including water and resource stewardship and management in the portfolio of activities. This has also increased annual farmer incomes by roughly R16 000 per annum, over and above providing for household food security. This is in a context where rural poverty has deepened substantially in the last five years. This research has indicated that smallholder households not involved in coherent adaptation activities have experienced an average of a 40% reduction in incomes post-COVID-19. The process has also significantly increased human capacity, through improved knowledge and skills as well as local governance, leading to the concept of self-sustainability emerging in these villages.

These case studies provide a strong evidence base for the success of this approach and the urgent need for expanding the reach of these interventions to many more rural communities.

REFERENCES

BRUNORI G, BARTOLINI F, AVERMAETE T, MATJIS E, BRZEZINA N, MORAGUES FAUS A, SONNINO R, MARSDEN T. (2014) *Conceptual Framework* TRANSMANGO Project D2.1

FAO, EUROPEAN UNION, CIRAD, and DSI-NRF CENTRE OF EXCELLENCE IN FOOD SECURITY (COE-FS) (2022) *Food Systems Profile – South Africa. Catalysing the sustainable and inclusive transformation of food systems*. Rome, Brussels, Montpellier, France, and Bellville, South Africa.

GLOBAL ALLIANCE FOR THE FUTURE OF FOOD. (2021) *Principles for Food Systems Transformation: A Framework for Action*. Global Alliance for the Future of Food, June 2021

HLAHLA SE, NGIDI M, DUMA E, SOBRATEE-FAJURALLY N, MODI AT, SLOTOW R, and MABHAUDHI T. (2023) Policy gaps and food systems optimization: a review of agriculture, environment, and health policies in South Africa: Frontiers in Sustainable Food Systems Vol 7.

KUSHITOR SB, DRIMIE S, AND DAVIDS R. (2022). The complex challenge of governing food systems: The case of South African food policy. Food Sec. 14, 883–896. https://doi.org/10.1007/s12571-022-01258-z

NESHEIM MC, ORIA M, AND YIH PT. (2015). *A Framework for Assessing Effects of the Food System. Washington (DC)*: National Academies Press (US); 2015 Jun 17.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). (2016) *Food Systems and Natural Resources. A Report of the Working Group on Food Systems of the International Resource Panel.* Nairobi, Kenya.

PEREIRA LM. (2014) *The Future of South Africa's Food System: What is research telling us?* SA Food Lab, South Africa.

UNITED NATIONS, SOUTH AFRICA. (2021) *The slow violence of malnutrition in South Africa.* Pretoria: UNICEF. Retrieved from https://southafrica.un.org/en/123531-slow-violence-malnutrition-South-Africa.