Resilient Food Systems

Towards a harmonised indicator set and evaluation methodology

Desktop Report

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1 A compendium of the Resilient Food System (RFS) project

To help transform food systems in African countries, Conservation International (CI) introduced a Resilient Food System (RFS) project, which is an Integrated Approach Pilot, with a focus on bringing transformational change within African food systems. This project was implemented in 12 selected Sub-Saharan African countries (Senegal, Burundi, Ghana, Niger, Nigeria, Eswatini, Kenya, Malawi, Tanzania, Burkina Faso, Ethiopia and Uganda) who are faced with detrimental impacts of environmental degradation resulting from unsustainable agricultural practices. The RFS project aims at:

- Developing institutional frameworks for influencing sustainability and resilience; and
- Scaling up integrated approaches for sustainability and resilience (GEF 7 sub-indicator 1.2, core indicator 3, sub-indicator 4.3 and core indicator 6). See Table 13 in the Appendix for the GEF indicators.

The overall **anticipated outcomes** of the project are:

- The development of a multi-stakeholder and multi-scale frameworks in support of policy and institutional reform to facilitate the upscaling of integrated natural resources management in place (FAO/UNEP).
- The introduction of supportive policies and incentives to support smallholder agriculture and diverse and inclusive food value-chains (LD-4, Program 5; BD-4, Program 9).
- Increased land area and agro-ecosystems under Integrated Natural Resource Management (INRM) and Sustainable Land Management (SLM), including sustainable soil and water management, diversified production systems, and integrated crop- livestock systems (LD-1 Program 1, Program 2; LD-3, Program 4; BD-3, Program 7; CCM-2, Program 4).

Summary of each country's project is provided below.

1.1 Burkina Faso - Participatory Natural Resource Management and Rural Development Project (Neer-Tamba Project)

The general objective of this project is to promote and implement sustainably managed agro-ecosystems that are key to food security in the northern region of Burkina Faso. To this end, the Project intervened on:

- Increasing the resilience of households, farms and villages to climatic hazards.
- The accession of households to a sufficient capacity for economic and financial autonomy to enable them, within their rural area of residence, to plan better for the future.

The aim was to improve the resilience of small rural producers and the ecosystems targeted by the Neer-Tamba project in the face of climate change. It strengthens the adaptive capacities of poor rural populations by providing them with innovative approaches, technologies and services. The Neer-Tamba Project is implemented for a period of 8 years and organized into four components focused on:

- Small land developments aimed primarily at improving the resilience of households/family farms to climatic hazards, but also at helping to create or strengthen their financial autonomy.
- The intensification of small farms and enhancement of their production through the dissemination of good practices and the financing of local initiatives and innovations likely to sustainably improve the economic autonomy of the target populations.
- The structuring of actors and their networking.
- Administration and monitoring-evaluation.

1.2 Burundi - Support for Sustainable Food Production and Enhancement of Food Security and Climate Resilience in Burundi's Highlands

The aim of this project is to increase the adoption of resilient, improved production systems for sustainable food security and nutrition through integrated landscape management and sustainable food value chains. The anticipated outcomes of this project include:

- Multi-stakeholder and multi-scale platforms operational in supporting policy, institutional and knowledge sharing mechanisms for scaling out of sustainable agriculture systems and integrated natural resources.
- Increased land area and agro-ecosystems under integrated natural resources/ landscape management and SLM best practices and supported by Farmer Field Schools (FFS) and sustainable value chains for increased production and sustainable livelihood.
- Monitoring and assessment (M&A) framework in place and capacity of relevant institutions built to carry out monitoring activities, communicating experiences and impacts for informed decision making.

1.3 Eswatini - Climate-Smart Agriculture for Climate-Resilient Livelihoods (CSARL)

The project's goal is to contribute to national poverty reduction. The objective of this project is to enhance food and nutrition security, as well as promote the livelihoods of smallholder farmers, through diversified, climate-resilient agricultural production practices and associated market linkages. The project's three main **expected outcomes** encompass:

- The project chiefdoms engage in effective planning and decision-making.
- Soil and water resources are sustainably managed for market-led smallholder agriculture in the project chiefdoms
- Smallholder producers in the project chiefdoms supply crop and livestock products to market partners, while subsistence farmers are enabled to produce sufficient nutritious food for themselves.

1.4 Ethiopia - Integrated Landscape Management to Enhance Food Security and Ecosystem Resilience

The purpose of this project was to enhance long-term sustainability and resilience of the food production systems by addressing the environmental drivers of food insecurity in Ethiopia. The **anticipated outcomes** of this project encompass:

- Multi-stakeholder and multi-scale platforms in support of integrated natural resources management in agricultural landscapes in place.
- Incentives mechanisms and infrastructures in place at national and local levels to support smallholder agriculture and sustainable food production.
- Increased land area and agro-ecosystems under Integrated Land Management and supporting significant biodiversity and the goods and services this provides.
- Increase in investment flows to INRM.
- Capacity and institutions in place to monitor and assess resilience, food security and Global Environmental Benefits (GEBs).

1.5 Ghana - Sustainable Land and Water Management Project (SLWMP)

The objective of this project is to improve food security in Northern Ghana using an ecosystem approach that builds on the existing systems and capacities developed through the SLWMP. The specific objectives of the project are to:

- Demonstrate improved sustainable land and water management practices aimed at reducing land degradation and enhancing maintenance of biodiversity in selected micro-watersheds.
- Strengthen spatial planning for identification of linked watershed investments in the Northern Savanna region of Ghana.

The **expected outcomes** of this project include:

- Strengthened capacities of districts, Civil Society Organisations (CSOs) and rural communities for micro-watershed and land use planning.
- Strengthened multi- stakeholder platforms to support upscaling of integrated natural resources management across scales and sector.
- Increased investments in SLWM under a landscape approach.
- Increased land area and agroecosystems under integrated natural resources management and sustainable land and water management and integrated crop-livestock systems.
- Strengthened systems and extension capacity for SLWM technologies adoption and monitoring to ensure GEBs.
- Increased area of production landscapes that integrate conservation and sustainable use of biodiversity into management.
- Increased community awareness about integrated landscapes management
- Project resources are used effectively.

1.6 Kenya - Upper Tana Nairobi Water Fund (UTNWF)

The aim of this project is to achieve a well-conserved Tana River basin with improved water quality and adequate quantities for downstream users, and strong benefits to agricultural communities in the source watershed. The development objective of the water fund is to:

- Achieve a well-conserved upper Tana River basin with improved water quality and quantity for downstream users (public and private).
- Maintain regular flows of water throughout the year
- Enhance ecosystem services for food security, freshwater, and terrestrial biodiversity
- Improve human well-being and quality of life for upstream communities.

The **expected outcomes** of this project include:

- Multi-stakeholder and multi-scale platforms support policy development, institutional reform and upscaling of INRM.
- Policies and incentives support climate smart smallholder agriculture and food value chains in financially viable and sustainable watershed stewardships.
- Increased land area, freshwater, and agro-ecosystems under INRM and SLM.
- Institutions capacitated to monitor GEBs.
- M & A framework supports the integration of climate resilience into policy making.
- Knowledge management and sharing of lessons learned is facilitated.

1.7 Malawi - Enhancing the Resilience of Agro-ecological Systems Project (ERASP)

The purpose of this project is to enhance the provision of ecosystem services and improve the productivity and resilience of smallholder agricultural systems through addressing land degradation, loss of agro-biodiversity, and climate change adaptation and mitigation. The project comprised **three components**:

- Multi-stakeholder's Institutional Framework for Integrated Catchment Area Management.
- Scaling up Catchment Level Sustainable Land Management Practices.
- Monitoring and assessment of ecosystem services, resilience and food security.

1.8 Niger - Family Farming Development Programme (ProDAF)

The aim of this project is to strengthen sustainable family farming and climate change adaptation, and to improve market access for family farms. The project comprised **three components**:

- Sustainable strengthening of family farming.
- Access to markets for family farmers.
- Monitoring and assessment.

1.9 Nigeria - Integrated Landscape Management to Enhance Food Security and Ecosystem Resilience in Nigeria

The overall goal of this proposed project is to foster sustainability and resilience for food security in Northern Nigeria through addressing key environmental and socioeconomic drivers of food insecurity across three agro-ecological zones. A major focus will be to enhance resilience of communities to the adverse effects of climate change on food security. The **expected outcomes** of this project include:

- Supportive policies, governance structures and incentives in place at Federal and State levels to support sustainability and resilience of smallholder agriculture and food value chains.
- Increased land area and agro-ecosystems under sustainable agricultural practices.
- Improved youth involvement and reduced gender disparities in agricultural production for enhanced food security.
- Harmonised M&E framework in place for food security information, multi-scale assessment of sustainability and resilience in production agro-ecological zones and landscapes, including monitoring of GEBs.

1.10 Senegal - Agricultural Value Chains Resilience Support Project (PARFA)

Its overall objective is to contribute to improve smallholder agriculture and food value chains through prioritising the safeguarding and maintenance of ecosystem services. Its development objective is to improve the food security of smallholders as well as their resilience to environmental degradation and climate variability. The project comprised **three components**:

- Support for multi-stakeholder platforms.
- Scaling up sustainable and resilient good practices.
- Monitoring and evaluation of the environmental impact and results of the Project.

1.11 Tanzania - Reversing Land Degradation trends and increasing Food Security in degraded ecosystems of semi-arid areas of central Tanzania (LDFS)

The project goal is to reverse land degradation trends in central Tanzania and Pemba (Zanzibar) through sustainable land and water management and ecosystem-based adaptation. The project further aims to recover degraded ecological systems through sustainable land use management plans, water availability and improving biodiversity status. The project comprised **three components**:

- Institutional capacity building for sustainable land management and biodiversity conservation at landscape level.
- Up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems.
- Monitoring and assessment.

1.12 Uganda - Fostering Sustainability and Resilience for Food Security in Karamoja sub-region

The overall goal of the project is to improve food security and the long-term environmental sustainability and resilience of food production systems in the Karamoja sub-region by addressing environmental drivers of food insecurity and their root causes. The **expected outcomes** of the project encompass:

- Supportive policies and incentives in place at district level to support improved crop and livestock production, food value-chains and INRM
- Increased land area under INRM and SLM practices for a more productive Karamoja landscape
- Framework in place for multi-scale assessment, monitoring and integration of resilience in production landscape and monitoring of GEBs

2 Conceptualising food system resilience

2.1 Understanding the concept of Food System

The transformation of food systems is a core aspect of the 2030 Agenda for Sustainable Development. According to the High-Level Panel of Experts (HLPE, 2020: 11), "a food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socio-economic and environmental outcomes." Ericksen (2008) notes that cross-scale and cross-level interactions characterise food systems. Scales referred to as activities, can be social, economic, political, institutional, environmental processes and dimensions (Tendall et al., 2015). These processes can take place at different levels (local, national, regional or global) and often interact across levels. (Cash et al., 2006; Ericksen, 2008).

To assess the interactions of food system activities across scales and levels, a food system can broadly be conceived as including the determinants and outcomes of its activities. Bendjebbar and Bricas (2019) and HLPE (2020) identified six main categories of drivers that shape food systems, which include biophysical and environmental; demographic; innovation, technology and infrastructure; economic; socio-cultural and political drivers, as explained below.

- **Biophysical and environmental drivers**: These cover the natural resources available, ecosystem services, and climate change, which mainly shape the production side of food systems since food production highly depends on the availability of natural resources (for example, water, land, biodiversity, etc.).
- **Demographic drivers**: These include population growth, urbanisation, migration, and population displacement. These are crucial to the quantity of food needed (to produce or import), the quality and type of food consumed, and the food environment. Hence, influencing the demand for food in each community.
- **Innovation, technology, and infrastructure drivers**: They influence both demand and supply-for example, by improving the system's productivity of food (van Berkum, Dengerink and Ruben, 2018).
- **Economic drivers**: These include income, globalisation and trade, prices, and financial systems that affect all aspects of food systems, from production to demand. They can provide opportunities that enable supply to meet demand or disrupt systems, for example, through price crises.
- **Socio-cultural drivers**: They refer to education, social traditions, identity, culture, health, religions and rituals, and values that mainly affect diets and the food environment through attitudes, social norms, lifestyles, and cultures embedded in food.
- **Political drivers**: These include governance, public policies, conflicts, and humanitarian crises that greatly influence the other drivers in food systems.

These drivers interact and lead to a number of social, economic and environmental outcomes, as well as a certain level of food security as shown in Figure 1. The impact of these drivers depends on the type of food system in place[1]actors, involved and actions and policies taken (Nesheim et al., 2015). The framework in Figure 1 depicts the main activities and drivers of food systems, as well as the processes and factors influencing a food system's socio-economic and environmental outcomes.

[1] Traditional, mixed or modern food systems (HLPE, 2017). In a traditional food system, people generally live in rural areas; there is heavy reliance on home grown food, which may result in low dietary diversity. In addition, there is often a lack of appropriate infrastructures. In mixed food systems, most of the population are in peri-urban and urban areas, with better income when compared with those in the traditional food system. In a modern food system, the majority of the populace live in urban areas and are better off in terms of income and food choices when compared to the previous two forms of food systems (HLPE, 2017).

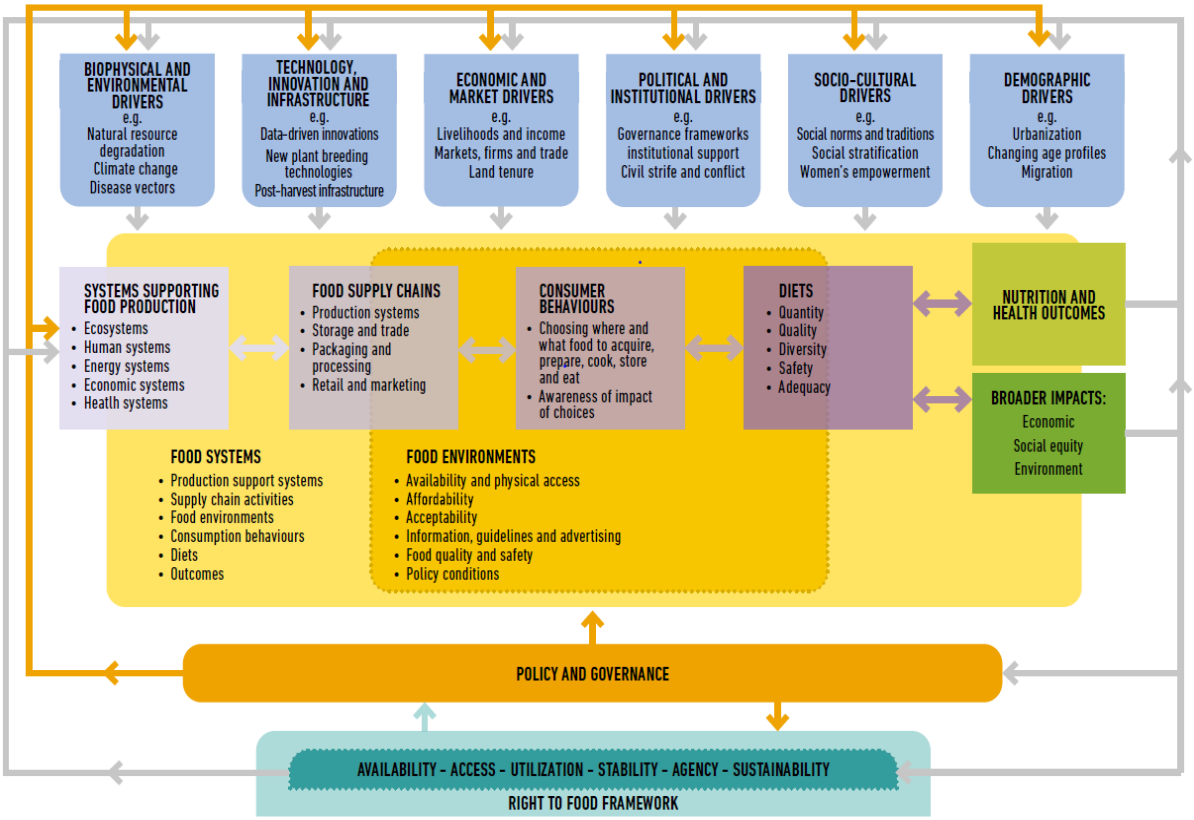

Figure 1: Sustainable Food System Framework (HLPE, 2020: 13)

From the conceptual framework of food systems developed by HLPE, three main food system components are identified - food environments, food supply chains, and consumer behaviour (HLPE, 2017). These core components, which are influenced by food system drivers, shape diets and determine food system outcomes such as health, nutrition, social, economic, and environmental outcomes. As defined by HLPE (2017),

- **Food Environment**: underlines the role of physical access to food (for example, distance to markets), economics access (for example, affordability), promotion (for example, food messaging and advertising), and food quality and safety;
- **Food supply chains**: includes productions systems, distribution and storage, processing, packaging, retail and markets; while
- **Consumer behaviour**: focuses on the choices people make in relation to the foods they have access to. In this sense, it is most concerned with the utilisation pillar of food security.

A sustainable food system is an essential condition for achieving the Sustainable Development Goals (SDGs) as it "delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised" (Food and Agriculture Organisation of the United Nations [FAO] 2018:1). This implies that, for a food system to be sustainable, it needs to generate positive value along three dimensions simultaneously: economic, social and environmental. In a related vein, the Organisation for Economic Co-operation and Development (OECD, 2021) notes that, globally, food systems are expected to deliver on a daunting "triple challenge", which are essential for human survival. These are ensuring food and nutrition security for all, contributing towards the attainment of livelihoods security and rural development, more specifically, as well as contributing towards the attainment of environmental sustainability. These tripartite challenges are further expounded below.

Figure 2: The "triple challenge "of food systems adapted from OECD (2021)

2.1.1 Food and nutrition security

Food security defined as "a situation that exist when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Food and Agricultural Organisation [FAO], 2022a: 202), is an important policy issue in every country. Based on this definition, four dimensions of food security were identified which include food availability, economic and physical access to food, food utilisation and stability. These dimensions are inter-linked and the absence of any component will result in food insecurity (Hwalla, El Labban and Bahn, 2016). However, the concept of food security has evolved to include agency and sustainability (FAO, 2022a). Figure 3 shows the interconnectedness of the six dimensions of food security. The six dimensions of food security, as noted by HLPE (2020) and FAO (2022a), address the following:

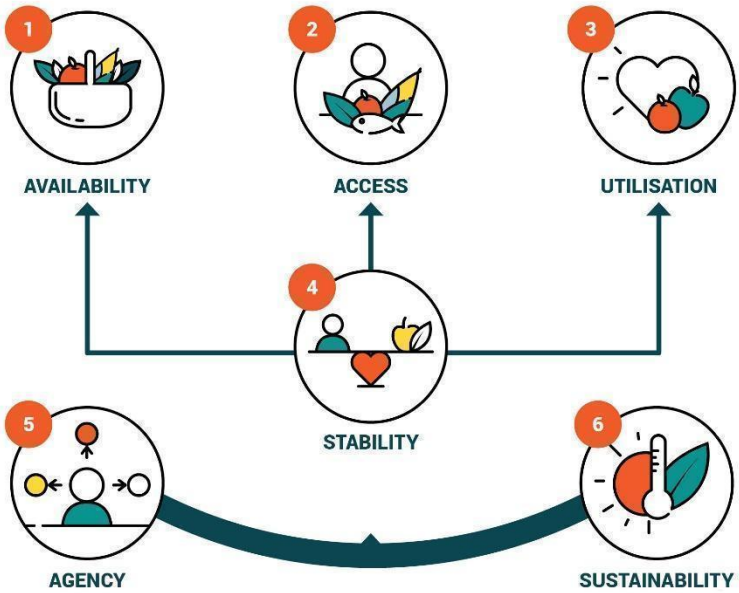

Figure 3: The six dimensions of food security (ICLEI Africa, 2022)

- **Availability**: whether the quantity and quality of food supplied through domestic production or imports are sufficient to meet the dietary needs of households or individuals.
- **Access**: if households or individuals have sufficient physical and economic access to food.
- **Utilisation**: whether households or individuals have adequate diet, clean water, sanitation, and health care, which determines their nutritional status.
- **Stability**: if households or individuals are food secure during sudden shocks (any sudden event that affects the functioning of a system and its components, for example, an economic, health, conflict, or climatic crisis, De Steenhuijsen Piters et al., 2021) or cyclical events (for example, seasonal food insecurity).
- **Agency**: the ability of households, individuals, or groups to decide the food they will eat or produce; how the food will be produced, processed, and distributed within food systems; and their ability to engage in processes that shape food system policies and governance.
- **Sustainability**: the long-term capability of food systems to provide food security and nutrition without compromising the social, economic, and environmental bases that generate food security and nutrition for future generations.

The FAO (2012) notes that nutrition security exists when all people have access to nutritious diets, which comprise all essential nutrients, water, sanitation and hygiene, adequate care, and health services to ensure a healthy and active life. Thus, emphasising the health status and reflecting on the nutritional status of the individual or household. The ability to achieve food security and nutrition hinges on the interplay of factors or activities within the food system. As noted by Ericksen (2008), if food systems are defined broadly and generically, any group's food security status can be considered the primary outcome of these systems.

According to HLPE (2020), a sustainable food system encompasses qualities that support the six dimensions of food security. These qualities include: "**productive and prosperous** (to ensure the availability of sufficient food); **equitable and inclusive** (to ensure access for all people to food and to livelihoods within that system); **respectful and empowering** (to ensure agency for all people and groups to make choices and exercise voice in shaping that system); **resilient** (to ensure stability in the face of shocks, stress and crises); **regenerative** (to ensure sustainability in all its dimensions), and **healthy and nutritious** (to ensure nutrient uptake and utilisation) " (HLPE, 2020: 13).

2.1.2 Livelihoods

Numerous people and organisations along the food value chain uphold and rely on the food system because it provides them and their households with income and livelihood. These include those involved in food production, processing, aggregation, distribution, and retail, just to name a few.

Agriculture and food production are deeply embedded into African livelihoods. Namely, small-holder farmers make up approximately 60% of sub-Saharan Africa's population, and 23% of sub-Saharan Africa's GDP is linked to agriculture (Goedd et al., 2019). Goedd et al. (2019) also note that Africa can produce two to three times more cereals and grains to contribute to the global output due to its vast land area. According to estimates by the United Nations (2015), the world's population nearly tripled from 2.5 billion to 7.3 billion people between 1950 and 2015, and is estimated to reach 8.5 billion by 2030. This implies the demand for food will increase. Hence, the need to produce more food to meet demand, thus, creating more job opportunities and improvement in livelihood. With this potential growth in agriculture and food production, there is a need to scale up downstream value chain processes.

According to the Organisation for Economic Co-operation and Development (OECD, n.d), despite the fall in employment in agriculture as countries develop, labour has shifted to other sectors, which are often still food-related, such as manufacturing, logistics, distribution, and retail. Even in developed countries, food-related activities play a significant role in the economy. For instance, food and beverage manufacturing accounts for more than 9 million jobs in OECD countries. Therefore, the importance of

food systems for livelihoods is not limited to agriculture alone. Thus, further investment will be needed to streamline distribution, improve retail-service levels, and strengthen trade (where there is excess), among other aspects.

2.1.3 Environmental sustainability

The relationship between food systems and environmental sustainability is complex and multifaceted. Activities of the food system, such as food production, processing, transportation, distribution, consumption, waste, and others, can affect the environment positively or negatively. For instance, the way we produce or process food and design or manage the food system can significantly impact the environment through greenhouse gas emissions, air and water pollution, land and soil degradation, deforestation, and resource depletion (OCED, 2021).

The food production industry is responsible for about 25% of the global greenhouse gases emitted annually (Juneau, 2021). Figure 4 below shows the breakdown of the emissions emitted per usage linked to food production. The figure also highlights that the largest contribution to those greenhouse gases is linked to livestock and aquaculture production. In recent years, there have been various campaigns to encourage individual level reduction in consumption of animal products to mitigate some of these emissions, for example the rise in veganism and vegetarian (diets) and rise of alternative meat products available on the market.

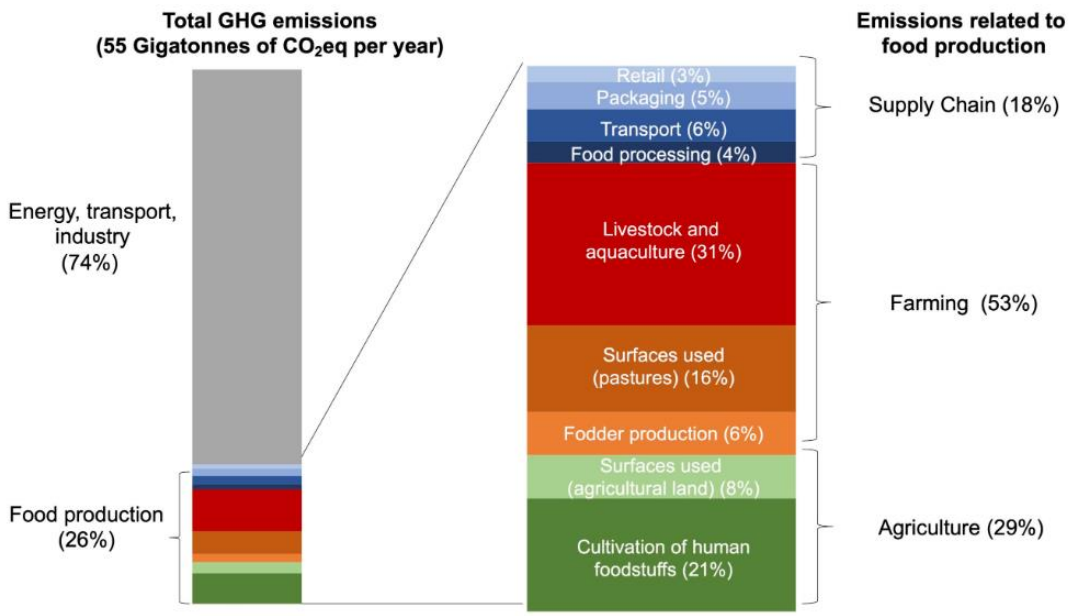

Figure 4: Contribution of the food sector to the annual production of greenhouse gases. From Juneau (2021), adapted from Ritchie and Roser (2020).

As African populations increase, there will be an expected increase in food production to meet the needs. This production increase will require more land, despite the expected improvements in production technology, more nutrients (fertiliser), water and energy, among other inputs. This potential drastic change in land use, and increase in resources, could cause biodiversity breakdown in these areas, decrease in water quality, and decrease in water available for human consumption and other uses. To prevent further environmental damage, scaling up of food production, especially on previously natural lands, will need to use holistic, sustainable and environmentally friendly methods.

Besides the production aspects of the food value chain, food systems are also becoming increasingly vulnerable to multiple internal and external drivers of change that will further negatively affect environmental sustainability. These drivers of change can range from sudden shocks to long-term stressors (long-term trends that undermine the functioning and vulnerability of a system, for example,

climate change) (De Steenhuijsen Piters et al., 2021). And thus, for an economy to function efficiently without jeopardising the outcome for future generations, there is a need to build resilience against these sudden shocks and long-term stressors.

2.2 The Concept of Resilience

As noted earlier, resilience thinking has a high potential to contribute to sustainable food systems and food security (Prosperi et al., 2014). Resilience thinking originates from ecological stability theory, which explains the ability of ecosystems to return to their original state after a disturbance (Holling, 1973). It has been applied in various disciplines (for example ecology, psychology, engineering, and economics) and different definitions of the concept exist based on the discipline for which they have been developed. The concept of resilience thinking as noted by Varyvoda and Taren (2022) has increasingly been adopted as a generic approach to the behavioural understanding of social-ecological systems, which comprise a nexus of food production, processing, distribution and consumption systems, and ecosystem services.

According to Anderies et al. (2013), resilience thinking is a paradigm rather than a testable body of theory. In addition, Carpenter and Brook (2008) note that resilience is not a single testable theory or hypothesis since it is “a broad, multifaceted, and loosely organised cluster of concepts, each related to some aspect of the interplay of transformation and persistence”. Due to the multifarious characteristics of resilience, there are many definitions of the concept (Walker et al., 2004; Van Wassenaer et al., 2021) and therefore, different models and analyses. However, most of these definitions relate system resilience to the capacity of the system to respond to stressors and shocks over time (See Misselhorn et al., 2012; Hoddinott, 2014; Tendell et al., 2015; Barrett and Constas, 2014; Rotz and Fraser, 2015; Béné et al., 2016; Schipanski et al., 2016; De Steenhuijsen Piters et al., 2021).

With regards to sustainability, which is broadly defined as the ability to achieve today's goals without compromising the future ability to achieve them, that is, preserving the ability of a system to function in the long-run (Maleksaedi and Karami, 2013), resilience can broadly be defined as the ability to continue to achieve goals or provide a function over time despite stressors and shocks (Tendell et al., 2015). Figure 5 reveals that resilience and sustainability are complementary concepts since the notion of sustainability is also one of the conditions of maintaining resilience and resilience forms an essential aspect of what enables sustainability (Maleksaedi and Karami, 2013). Anderies et al. (2013) added that sustainability is a measure of the performance of a system, while resilience is a means to achieve it during periods of disturbances.

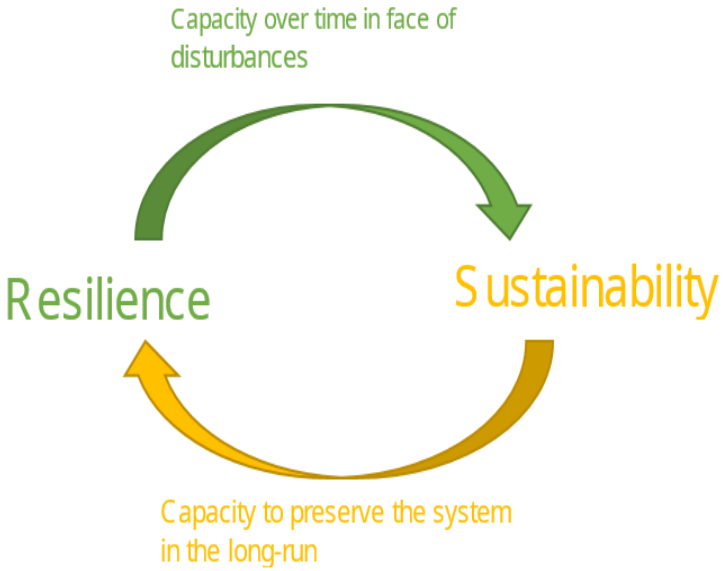

Figure 5: Resilience and sustainability as complementary concepts (Tendell et al., 2015)

2.3 Food System Resilience

Defining resilience within the context of food systems is quite challenging and has led to debates as different types of resilience interact (such as socio-economic, agricultural and political resilience). This triggers the question of whether there is a possibility of having a unified conceptualization of a resilient food system. As an integration of food systems and resilience, Tendall et al. (2015: 19) defined food system resilience as the "capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances". Tendell et al. (2015) further note that there can be internal or external, structural or cyclical, gradual or sudden disturbances, consisting for example, socio-economic, political or natural shocks, which need to be considered when using a resilient food system perspective, since these disturbances may interact and have cumulative impacts.

How food systems affected by stressors or shocks deliver the desired outcomes depend on the following five capacities to respond to these disturbances Tendell et al., 2015; Béné et al., 2016; Ansah, Gardebroek, and Ihle, 2019; De Steenhuijsen Piters et al., 2021):

- **Anticipation**: the ability to manage risks and plan strategies to deal with shocks when they occur;
- **Prevention**: preventive actions to mitigate the impacts of expected shocks or stressors;
- **Absorption**: the capacity to cope immediately with the effects of shocks and stressors;
- **Adaptation**: the ability to adapt strategies and actions while maintaining stable functioning of the system; and
- **Transformation**: the ability to transform the entire system.

Béné et al. (2016) emphasise that not all these responses will eventually bring positive outcomes in the long run. Figure 6 presents the different resilience capacity levels of a food system to respond to shocks and stressors, which ranges from poor to high resilience capacity.

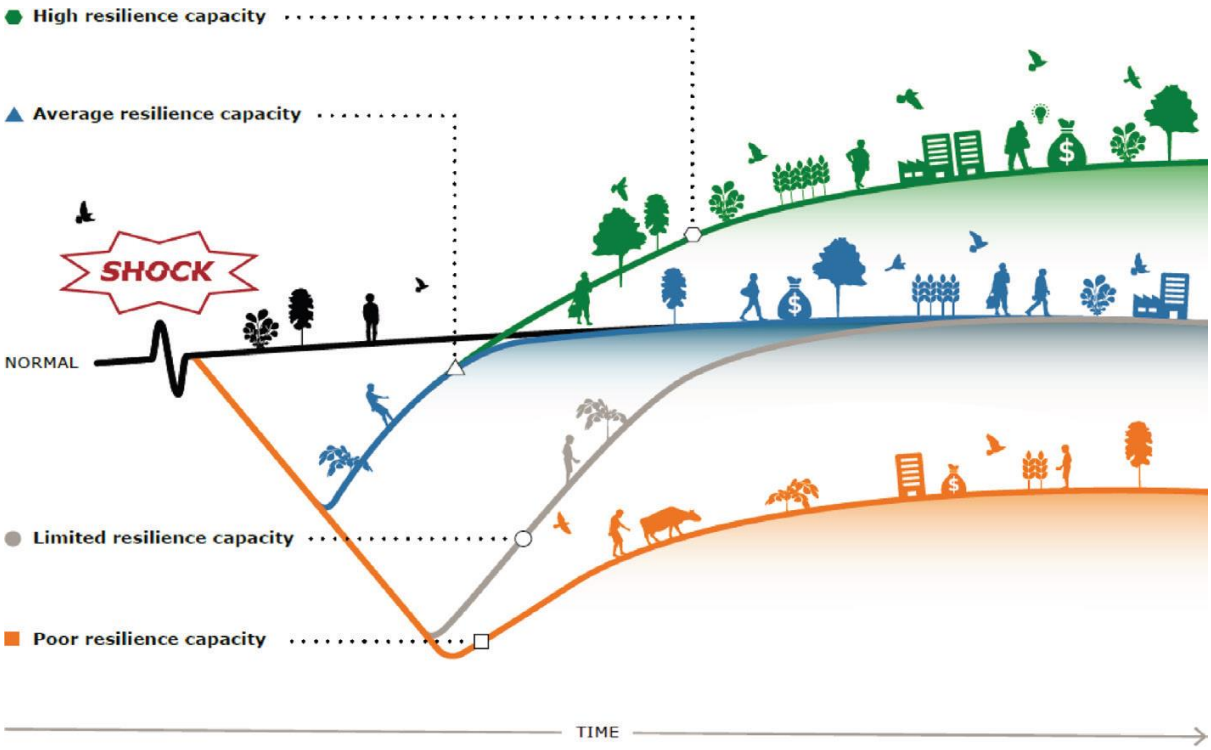

Figure 6: The capacity of a food system to respond to shocks and stressors (De Steenhuijsen Piters et al., 2021: 6)

A food system vulnerable to disturbances can cause persistent poverty, economic crisis, and environmental degradation. De Steenhuijsen Piters et al. (2021) ascertain that for food systems to deliver the desired outcomes for future generations, resilience building should be complemented with sustainable development.

2.4 Overview of African food systems

According to the International Fund for Agricultural Development (IFAD), approximately 70% of the very poor live in rural areas, with the majority relying on agriculture (partly or completely) for their livelihoods. It is estimated that 500 million smallholder farms in the developing world support nearly 2 billion people and that these small farms produce approximately 80% of the food consumed in Sub-Saharan Africa (FAO, 2015). Several disturbances continue to affect African food systems, thereby affecting food security in the region. These include weather and climate events, limited adoption of yield-increasing technologies, dependency on rain-fed agriculture and low levels of irrigation, and most recently, the COVID-19 pandemic and armyworms. This section presents the state of food and nutrition security in Africa and the resilience and drivers of African food systems.

2.4.1 State of food and nutrition security in Africa

For decades, food security has been on the global and African development agenda. For instance, the New Urban Agenda (NUA), the SDGs and Agenda 2063 of the African Union. The SDGs include a direct and specific focus on food security. The SDG number 2 on “zero hunger” seeks to “end hunger and to achieve food security as a matter of priority and to end all forms of malnutrition” by 2030 (United Nations, 2015: 7). However, the goal of attaining food security for all people in Africa is far-reaching. The number of food-insecure people in the region is increasing faster than in any other part of the world (see Figure 7 below), with an estimated 278 million undernourished people in 2021 compared with 171.5 million in 2011 (FAO, 2022b). A similar trend is observed in Sub-Saharan Africa with an increase in the number of undernourished people from 158.8 million in 2011 to 260.6 million in 2021 (FAO, 2022b). This can be attributed to the Coronavirus (COVID 19) pandemic coupled with the effects of

climate shocks, the exclusivity of women and youths, poor governance and conflicts that were already causing hunger in many parts of the region.

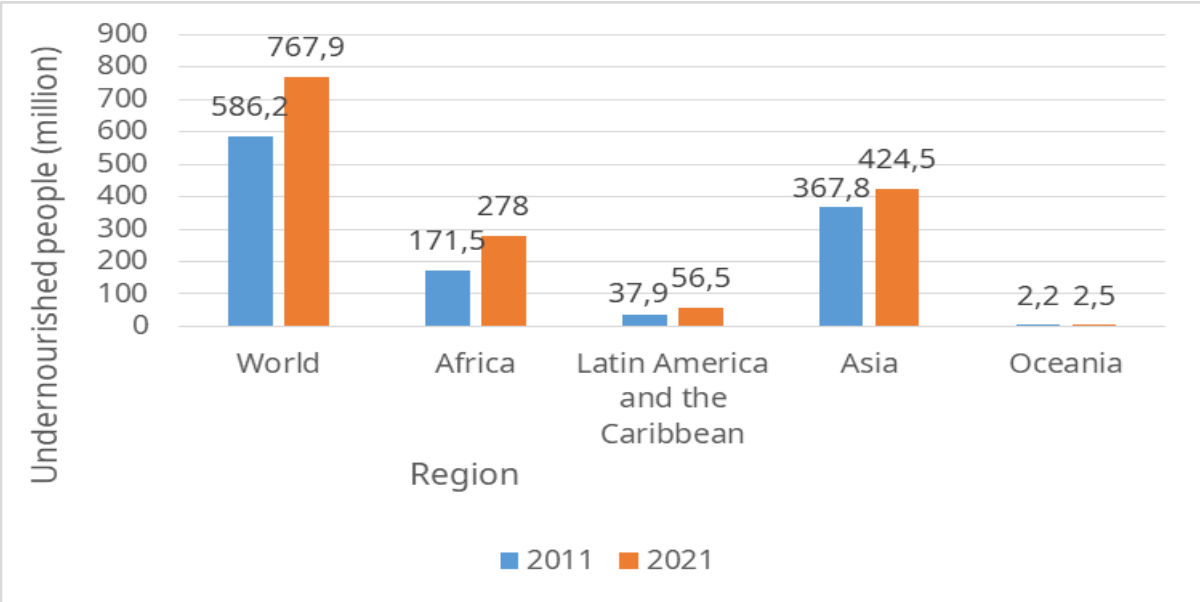

Figure 7: Number of undernourished people in the world (FAO, 2022)

Concerning nutrition outcomes, globally, the current trend is towards decreasing undernutrition (having inadequate food intake to meet the dietary energy requirements). Although undernutrition is still present in Africa, it declined in prevalence from approximately 33% to 23% between 1990–1992 and 2014–2016 respectively (May and Mentz-Coetzee, 2021). The number of underweight (defined as being under the expected weight for age) children in Africa declined from approximately 23.6% in 2000 to 15.7% in 2020 (WHO, 2021). Stunting (defined as being under the expected height for age) decreased from around 41.5% in 2000 to 30.7% in 2020. The positive change in the rate of undernutrition in the continent could be attributed to the consistent strong economic growth experienced by countries in the continent (Jayne, Meyer and Traub, 2014; May and Mentz-Coetzee, 2021). Despite the overall percentage decrease in the prevalence of stunting, the number of stunted children increased from 54.4million in 2000 to 61.4million in 2020. This could be attributed to the consistently increasing population growth rates (UNICEF, WHO and WB, 2021).

2.4.2 Resilience in Africa's food systems

Sintayehu (2018) notes that Africa's agricultural sector has great influence in promoting economic growth, reducing poverty, and improving food and nutrition security. However, Africa is faced with serious environmental challenges, including deforestation, land degradation, biodiversity loss and extreme vulnerability to climate change (United Nations Environmental Programme [UNEP], 2020). Braimoh (2020) notes that if appropriate adaptation measures are not taken the number of undernourished people in Africa could increase to 350 million by 2050.

Sintayehu (2018) notes that Africa is the most vulnerable continent to climate change (despite contributing the least to the climate crisis), which is both a cause and an effect of biodiversity and ecosystem change in Africa. According to the Mo Ibrahim Foundation (2022), approximately 70% of African cities are extremely vulnerable to climate shocks, with small and medium-sized towns and cities being the most vulnerable. Climate change is expected to push 39.7 million more people into extreme poverty in Sub-Saharan Africa by 2030, more than in any other region of the world, due to loss of livelihood and shrinking resources. Climate change is forecasted to push an additional 78 million people into chronic hunger by 2050, with Sub-Saharan Africa accounting for more than half of them (Mo Ibrahim Foundation, 2022). Climate change affects agriculture by shortening growing seasons and increasing

water stress, which then impacts food availability, which can trigger a hike in food prices (World Bank Group, 2016). Hence, increasing food insecurity.

Africa is also suffering from extreme weather events such as droughts and floods. It is the world's most drought-affected region (Mo Ibrahim Foundation, 2022). Between 2010 and 2022, twenty-nine African countries experienced at least one drought event. The worst affected African countries are Kenya and Somalia (6 drought events each over 2010-2022), Mauritania (5), Ethiopia, Lesotho, Madagascar, Niger, South Africa and Zimbabwe (4 each). With respect to floods, it is the second most affected region in the world (Mo Ibrahim Foundation, 2022). All African countries but two (Equatorial Guinea and Eritrea) have experienced at least one flood event from 2010-2022. The five worst-affected African countries are Angola (24), Kenya (22), Nigeria, Tanzania (21 each), and DR Congo (20). Food insecurity in Sub-Saharan Africa increases by 5-20 percentage points with each flood or drought (World Meteorological Organisation [WMO], 2021). Many pre-existing challenges in Africa make countries and people more vulnerable and less resilient to the effects of global warming. This creates a disturbing vicious cycle (see figure 8 below) in which the effects of climate change and extreme weather conditions are amplified due to already low resilience, while also worsening adaptation and resilience capacities.

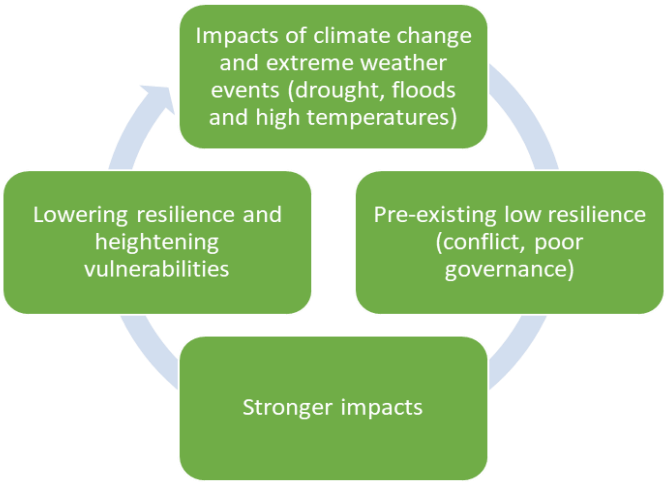

Figure 8: The vicious circle of climate change and resilience (adapted from Mo Ibrahim Foundation, 2022)

Land degradation is frequently thought to have detrimental effects on agricultural ecosystems and crop production in Africa, posing a barrier to food security and improving livelihoods (Economics of Land Degradation [ELD] Initiative and UNEP, 2015). The degradation of natural ecosystems decreases their ability to store and regulate water availability, soil formation, and energy and nutrient flow, which in turn negatively affects agricultural productivity and subsequently food and nutrition security.

In 2020, the COVID-19 disease presented yet another shock to the region and the agriculture sector. It disrupted food supply chains by restricting the movement of people, goods, and services, closing markets, affecting workers. The resulting economic downturn decreased consumers' demand for food. Food security is threatened by the loss of livelihood, jobs, and rising food prices. The vulnerability of Africa's food system makes it susceptible to disturbances. Hence, building resilience in Africa's food system is crucial if the region is to achieve food security, poverty alleviation and environmental sustainability and is dependent on the underpinning drivers of its food systems.

2.4.3 Drivers of Africa's Food System

This section examines the key drivers that transcend local food system variation and condition opportunities and pose challenges to governments and actors in Africa's food system. The three key food systems drivers discussed below affect options for more resilient African food systems to tackle environmental degradation, loss of ecosystem services, and low crop and livestock productivity. These negatively impact food security.

2.4.3.1 Climate Change

As seen in the previous section, the consequences of climate change in large parts of Africa include more intense, prolonged, and frequent periods of drought, heatwaves, and flooding. These devastating environmental issues severely impacts crop and livestock production due to unfavourable growth conditions, post-harvest crop loss and a higher frequency of disease breakouts (HLPE, 2019). Given the strong interdependency between the environment and food systems, reducing the environmental footprint of food systems is very crucial.

2.4.3.2 Urbanisation

Africa's urban population is growing rapidly from an estimated 200 million (31% of the total population) in 1990 to an estimated 548 million (43%) in 2018 and expected to rise to 1489 million (59%) by 2050 (United Nations, Department of Economic and Social Affairs, Population Division [UN DESA], 2019), which puts increasing pressure on water and land resources with main consequences for biodiversity and ecosystem services upon which communities depend. These drive increasing levels of urban food insecurity, poverty, and malnutrition (through changes in dietary pattern).

2.4.3.3 Access to technology

Access to technology development is essential to enable actors within food value chains to develop new techniques for food production, preservation and processing, markets, and other opportunities. However, globally, Sub-Saharan Africa has the least mechanised agricultural systems (Thompson and Gyatso, 2020). According to the African Agricultural Technology Foundation report (AATF, 2018), African farmers have one-tenth the number of mechanised tools per farm area as farmers in other developing regions, and access to these tools has grown at a slower rate. Muzari, Gatsi and Muvhunzi (2012) note that another technological challenge faced by farmers in SSA which affects crop productivity is the acute shortage of improved varieties (particularly high-yielding varieties that are drought and pest-resistant).

2.5 Understanding resilience from the RFS projects

This section presents the conceptualisation of food system resilience in each country project as gleaned from country project documents. It is apt to state that these conceptualisations are driven majorly by the contextual factors in the respective countries as well as the experience of project teams working in these countries. In other words, each conceptualisation is specific and unique to the characteristics of the food systems, environments and livelihoods of individuals and communities in each country.

In the Burkina Faso country project, food system resilience is about building autonomy, self-determination, self-sustenance and providing enabling environments for food and livelihoods security. It is conceptualised as building and strengthening the autonomy of the targeted population, as well as improving their ability to play a prominent and driving role (fully recognized by others), in attaining food security, as well as in the construction of their livelihoods and of a sustainable socio-economic fabric.

The Burundi country project conceptualises food system resilience as moving from a reactive to a more proactive approach which fundamentally connects food security together with land rehabilitation, biodiversity conservation, as well as climate change adaptation and mitigation. It lays emphasis on ensuring sustainable food production and sufficiently addressing unsustainable land management practices. It establishes, in essence, that sustainable food production cannot be achieved without sustainable land management.

In the Eswatini country project, food system resilience is viewed as having the capacity to anticipate and respond to climate change and associated hazards and shocks, as well as the capacity to ensure sustainable food production for improved food security, nutrition, and incomes. In addition, the project maintains that to achieve food system resilience, enhanced market linkages and sustainable environment upon which agricultural production depends are of utmost importance.

For the Ethiopian country project, food system resilience entails effectively addressing both the internal and external stressors of food production systems. While external stressors refer to uncertainties caused by changing climate and impacts on the spatial and temporal pattern of rainfall, temperature increases, human (and livestock) population growth and movement, and changes to production and market conditions, internal stressors include continuing lack of income security faced by sections of the rural population. Addressing these stressors or barriers will create conditions for improved food and livelihoods security through sustainable use of natural resource endowments and improved livelihoods diversification.

In the Ghana country project, food system resilience entails creating a tripartite situation of increased agricultural productivity, improved ecosystem services, as well as enhanced livelihoods, income, and food security. This is to stem the tide of continued vulnerability to food insecurity, poverty, and climate. Sustainable natural resources management and post-harvest management improvements are considered as important in achieving food system resilience.

The Kenya country project perceives food system resilience as achieving a combination of food security, water security, sustainable environments, and biodiversity, as well as improved quality of life and well-being. This would be achieved through integrated natural resources management, enhanced ecosystem services, and climate-smart activities including in agricultural production.

The Malawi country project views food system resilience as achieving food security through sustainability of farming productivity, water security, and enhanced adaptation to climate change.

In the Niger country project, food system resilience is taken to imply attaining sustainable food security together with livelihoods security through increase and diversification of agricultural production, enhanced capacities to adapt to external shocks particularly climate change, and improved market access.

The Nigerian country project conceptualises food system resilience to mean the capacity to ensure sustainable food and nutrition security through the protection of the environment, climate change adaptation, sustainable land management, crop diversification and enhanced food value chains.

In the Senegal project, food system resilience is taken to mean achieving combined improvements of food security, economic situation, and the ecological environment of communities. This includes the improvement of the communities' resilience to environmental degradation and climate variability.

In the Tanzanian country project, food system resilience focuses on recovery. It is about reversal of degraded land. Food system resilience is conceptualised as improving the nutrition and economic status of communities, coupled with the reduction of climate vulnerabilities, particularly for subsistence, smallholder and agro-pastoralist farmers through ecosystem-based adaptation, reversal of land degradation, and fostering market linkages.

The Ugandan country project sees resilient food systems as achieving both food and environmental security. While scaling up improved and diversified food production will be instrumental in achieving the former, achieving the latter will rely on sustainable land management practices as well as environmental monitoring and assessment.

2.6 Towards a joint understanding of food system resilience in Africa

When there is a unified narrative on food system resilience, the desired food system outcomes are less fluctuating. This section presents a joint understanding of food system resilience based on the twelve resilient projects.

Drawing from the 12 RFS projects, the definition of food system resilience is not unified and depends on the context-specific challenge. Therefore, contextual analysis is critical in conceptualising food system resilience because challenges are not always homogeneous. Hence, the indicators to measure and the models to analyse resilience in these countries may vary. However, the commonality in the projects is the ability of the system to deliver the desired food system outcomes, both in the short and long term, when faced with stressors or shocks. As a result, in this project, **we define resilient food systems as the capacity of food systems[2] to deliver desired outcomes sustainably in the face of shocks[3] and stressors[4].**

In building resilience food systems in the face of crises in Africa, the following should be taken into consideration:

- The need to move from a **reactive approach** to a **proactive approach**: According to Rasmussen (2010), a proactive approach involves initiating plans and actions before a threat occurs, whereas a reactive approach involves putting plans and actions in place after a threat has occurred. The proactive approach is preferable to the reactive approach because it gives people (for example, policymakers and disaster management) more time to plan how to respond, what to do, and when to act when a shock or stressor occurs. This helps in keeping up with changing dynamics (FAO, 2022c).
- Africa needs to have **autonomy** on how it feeds itself and its people.
- The system needs to have the **capacity to anticipate, adapt and respond** to shocks and stressors.
- The actions taken need to be **sustainable**: That is the solution for one problem should not lead to another challenge.
- There is a need for **contextual analysis**: This is important because different regions or areas may face different crises (like the 12 RFS projects). So, solutions to problems may not be uniform across the board.

[2] See section 2.1 for the definition.
[3] See section 2.1.1 for the definition.
[4] See section 2.1.3 for the definition.

3 Measuring Food system resilience

Resilience indicators aim to measure the resilience and/or adaptive capacity of a system, community population, household or individual to withstand social, economic and or political instability, climate shocks, natural disasters, and supply chain disruptions for example. More specifically, food resilience indicators gauge vulnerability, stressors and shocks affecting food and nutrition security (Tendall et al., 2015; Schipanski et al., 2016). Food system resilience, like other complex social-ecological systems, cannot be measured on a single scale (Béné et al., 2016). There are numerous resilience indexes some of which include food-related indicators as sub-sections and others which are entirely concerned with food reliance (Tendall et al., 2015). While each index has its own objectives, assumptions, methods, and focus areas (see section 3.2.1 below), resilience indicators function by identifying themes and relevant indicator dimensions to measure how resilient a system, community, household or individual is in relation to said indicator. Most indexes adopt a qualitative, quantitative, or mixed approach, for which a methodology – sometimes including formulas – is developed so that a standardised procedure can be followed to select samples, collect data, and test and validate resilience across a group.

3.1 Why measure food system resilience?

The purpose of food resilience indicators is to provide useful information on the current state of resilience, vulnerabilities, trends, and thresholds for the target sample group, and can be used to identify several important factors such as priority areas, causes and timeframes. Some of the key benefits of measuring food system resilience are:

- Producing reliable measurements
- Developing comparative, standardised data
- Evaluating food and nutrition security
- Supporting evidence-based decision-making
- Identifying entry points for interventions
- Highlighting lessons for building resilience
- Assessing baselines and/or current states
- Identifying urgencies and priorities

3.2 Current indicators and methodologies for evaluating resilience

This section reviews the current approaches and key indicators used globally and regionally to evaluate resilience.

3.2.1 Approaches

There are various dimensions or attributes that can be considered when evaluating food resilience. The different indexes each have a different combination of dimensions considered to produce specific insights that relate to the overarching purpose of the index. Resilience indexes can adopt quantitative/qualitative/mixed approaches. An index can assess resilience at different scales, for example, individual, household, community, country, sector, or system. Furthermore, an index can focus on different timescales such as sudden crises, hazards or shocks, or more sustained stressors and long-term, unfolding disasters. Different indexes are developed for specific purposes and thus provide different measures, such as the degree or severity of resilience, security or insecurity phases. In addition to these dimensions, many food-related themes can be considered when measuring food resilience, which include hunger, nutrition, production, distribution, access, nutrition, and food systems efficiency. The themes included in a given index can range from focused to broad, depending on the extensiveness of the index.

3.2.2 Key indicators

3.2.2.1 Resilience, Adaptation Pathways and Transformation Approach (RAPTA)

The Resilience, Adaptation Pathways and Transformation Approach (RAPTA) is a comprehensive tool to assess interventions that aim to support sustainability goals in uncertain and altering contexts. RAPTA can be used to design, implement and evaluate resilience, adaptation and transformation projects and programmes (O'Connell et al., 2019). By making use of RAPTA, a project design team can better understand resilience factors, align project outcomes with project objectives, and assess realistic goals based on project resources (O'Connell et al., 2016). In this way, the approach can ensure resources are channelled into sustainability pathways that can cope with shocks and improve a project or programme to handle shocks, and therefore improve the likelihood of success for resilience projects.

The RAPTA tool is a thorough design process comprising three modules, with each having three components and their respective steps as detailed in Table 1 below. The modules span across the design, implementation and evaluation stages of a project or programme. There are two ongoing processes for Active Learning and Adaptive Governance. Focusing on the systems level, the RAPTA modules and components are tailored and implemented to suit project contexts.

Table 1: Resilience, Adaptation Pathways and Transformation Approach modules, components, and steps

Module	Module components	Steps
Module 1 People – dialogue, values, vision This module is used to identify stakeholders, their roles, and connections, and bring people together to set goals, imagine future change and participate in other RAPTA components.	1. Scoping and goal setting Use this component to establish the provisional purpose and nature of the work you intend to complete. This component helps you to position that work in a wider context and time scale, identify previous work to build on, and allocate resources to the design process.	1. Explore context, problems, and aspirations of the stakeholders.
		2. Set provisional scope, scale, location, and boundaries.
		3. Start to develop, modify or design goals depending on the situation; a) These may be mandated goals in a 'top down' process that is less amenable to changing, or (b) These may be goals emerging from a 'bottom up' process, in which case it is often helpful to initially set these as provisional goals so they can be reviewed and revised after iterating through other RAPTA components that promote elicitation and deliberation with multiple stakeholders not yet involved as well as across jurisdictions and levels of decision making to develop shared goals
		4. Review past and current relevant work and consider how the intervention will build upon and/or be different from it.
		5. Identify relevant stakeholders that ought to be engaged and involved in RAPTA modules i.e. for all stages of project design and implementation.
		6. Scope and allocate resources for RAPTA components informed by the Theory of Change, available budgets, capacity and time.
		7. After applying other RAPTA components: revisit and revise Scoping to reflect Active Learning from other components.
	2. Stakeholder mapping and engagement Use this component to bring together a set of key stakeholders in appropriate ways. This component shows you how to use ethical and transparent processes to provide salient and legitimate methods to design, implement and assess interventions, and to build capacity and agency	1. Conduct stakeholder mapping and network analysis: who will be affected by interventions and who needs to be involved (recognising this will change as more is learned in other modules)? Give particular attention to considerations of values, incentives, power, politics, governance, formal and informal decision making, marginalisation, gender, different types of knowledge and who holds them, and identify potential 'agents of change' (those who can effectively catalyse or drive desired intentional change towards goals).
		2. Explore a range of approaches to stakeholder engagement. Many methods and tools exist and can be used or tailored to the context, or new approaches can be designed to ensure voice and participation of the different groups identified in Step 1.
		3. Assess the requirements for specific dialogue processes and facilitation skills to match the context, and the type and level of change required to reach the goals
		4. Consider and recognise the role of different types of knowledge, experience, and learning styles (e.g., visual, logical, emotional) to enhance engagement and participation.
		5. Create an ethics protocol to ensure no additional risk to stakeholders through participating in the process, to provide an appropriate forum for respectful dialogue, and to assure appropriate confidentiality and informed consent.
		6. Create a stakeholder map and engagement plan, addressing all of the above issues, and assess the relevance to various RAPTA components, including implications for Active Learning and Adaptive Governance
	3. Imagining change Use this component to engage people's emotions, inspire hope and help individuals imagine change and recognise roles they can play in shaping their future. This component explains how to do this by outlining broad pathways of change to achieve goals and vision	**Imagining the future**
		1. Use knowledge gained from Stakeholder mapping and engagement to identify appropriate methods and tools for this exercise. Consider using methods from the creative arts (e.g., interactive theatre).
		2. Conduct an engagement process to elicit values, visions and stories about the future, and to spark people's imagination to explore desired and undesired characteristics of plausible narratives of what could be.
		3. Summarise and document visions for the future and review Scoping and goal setting if appropriate.
		Theory of Change
		1. Revisit and refine goals identified in Scoping and goal setting, and then work backwards from them to specify necessary and sufficient long-term, medium-term and immediate outcomes, outputs, activities and resources for achieving them.
		2. Describe the causal logic and assumptions and organise into 'pathways' of impact. Create preliminary narratives to explain these in ways that engage and resonate with stakeholders (e.g., relate to narratives developed in Imagining the future).
		3. For impact pathways within scope, list the evidence that exists or is required to support the Theory of Change. Challenge existing assumptions and logic on how and why change could happen, and ensure key assumptions are plausible and valid.

		4. After taking a full system view, look within the remit of specific organisational requirements and intervention scope, and identify partnerships which might be necessary to lead or support impact pathways beyond that scope. Revisit this step as system understanding further develops in Systems analysis.
		5. Discuss the implications of the outcomes of the Theory of Change exercise on Scoping and Goal Setting (especially budget), Stakeholder mapping and engagement, Adaptive governance and Active learning. This process may be run iteratively with different groups of stakeholders and will be revisited and modified throughout the process.
Module 2 Systems Analysis This module is used to describe and analyse the system, recognise values and perspectives of diverse stakeholders, explore future scenarios, and identify uncertainties, stresses, and shocks. Systems Analysis assists with the assessment of key points of intervention and resilience, adaptation and/or transformation needs.	1. Describing the system Use this component to elicit and build upon stakeholder knowledge to provide the basis to explore and understand the system and needs for resilience, adaptation, or transformation.	1. Identify what in the system is valued by stakeholders under different contexts and the issues or barriers in delivering these values now and in the future. Use appropriate methods to elicit and document values and any conflicts.
		2. Identify the drivers of the system – influences from outside the system that are not themselves influenced by the system – as well as potential shocks and key stresses (either externally imposed or emerging from internal system interactions).
		3. Describe the social and economic aspects, including institutions and governance of the system (i.e., rules), focusing on; a. social groups and social structure of system, cultural norms and unspoken rules b. livelihood strategies, economic sectors, interests and influences c. governance and decision making in the system – who makes what decisions and by what process? What values, rules and knowledge underpin decision-making processes? d. conflict resolution processes and levels of public trust in governance systems.
		4. Describe the biophysical aspects of the system (e.g., hydrology, ecology, and land use), focusing on key determinants of system structure (e.g., nutrient cycles or food webs), quantities ('stocks', such as area of land used for cropping) and rates of change ('flows', such as annual crop productivity).
		5. Describe key relationships between people and the biophysical system, how they generate the problems and attempts to address it using causal loop diagrams or models to identify feedbacks that amplify or dampen change (e.g., poverty traps in agricultural systems), as well as trends and thresholds (e.g., stocking density and debt-to-income ratio at which pastoral business becomes unsustainable or economically non-viable).
		6. Identify interactions with scales above and below the focal scale (e.g., thresholds at which food insecurity at household level increase likelihood of civil unrest and migration).
		7. Synthesise the current state of system understanding and supporting evidence, including characterisation of key points of consensus and disagreement, inconsistencies, uncertainties and needs for more rigorous analysis or further evidence.
	2. Exploring scenarios Use this module to apply an evidence-based approach in analysing projected trajectories and plausible futures. This component shows you how to test how broad pathways of change will fare in each plausible future.	1. Build upon engagement methods and forums identified in Stakeholder mapping and engagement to facilitate participatory scenario development and exploration.
		2. Work with stakeholders to define scenarios that span a range of plausible futures, including a worst-case scenario and most likely scenario(s). Dimensions of change can be informed by key external drivers or potential shocks identified in Describing the system, key uncertainties faced, and scenarios established by others (e.g., IPCC climate change projections).
		3. Depending on the models, data and capability used in Describing the system, use appropriate approaches to explore scenarios and their implications.
		4. Use vision exercises (such as conducted in the Imagining change module), identify tensions or dissonance between aspirational desired futures and the more likely (often undesired) future trajectories if no changes are made. Facilitate stakeholder reflection on scenario analysis results. Reflections can include: a. the desirability of each scenario b. how different stakeholders would behave and fare if they found themselves in any of these futures c. how the imagined futures from Imagining change compare with the range of scenarios d. assess how initial impact pathways from the Theory of Change perform in different scenarios and prioritise pathways that improve the likelihood of desired futures across the full range of scenarios.

		1. Assess the general resilience or adaptive capacity of the system to cope with unknown risks, trends and shocks. Approaches include: a. identify what has conferred coping capacity in the past or use outputs from Step 2 to identify attributes that confer resilience across many different kinds of shocks. Develop a stakeholder-derived account of where the system is considered to be weak and strong in terms of capacity to deal with disturbances b. look to published lists of indicators of general resilience and adaptive capacity and assess their relevance to the system.
		2. Assess specified resilience – resilience 'of what, to what, for whom?' for specific risks, trends or shocks a. identify key variables, trends and thresholds, along with the likelihood of thresholds being crossed. b. develop shared understanding among stakeholders of the kind of shocks they can expect, critical thresholds and system properties that promote recovery.
		3. Identify key points of intervention in the system using causal loop diagrams, qualitative and quantitative models or other suitable methods.
		4. Check conclusions against evidence and multiple stakeholder perspectives.
		5. Identify potential benefits of maintaining the current system and where incremental or transformational changes are needed: a. which parts of the system are satisfying values and aspirations and can continue under future projections, suggesting a need to build resilience to maintain system identity? b. which parts of the system would need minor adaptive changes to maintain the capacity to deliver values in future? c. which parts of the system are anticipated to experience large structural or transformational changes, and so require deliberate transformational actions by stakeholders?
		6. Summarise resilience status and needs for building resilience, adaptation and/or transformation.
Module 3 Options and Pathways to Action This module is used to identify intervention options and arrange them into a provisional order for implementation pathways. This module demonstrates how to estimate qualitative and quantitative benefits and costs, assemble them into an implementation plan with triggers and alternative pathways, and take action.	1. Generating options Use this component to explore and assess options according to their effectiveness in maintaining, adapting, or transforming parts or all the system to meet the defined goals, steer towards desired future states and stay away from undesired ones, while keeping future options open.	1. Identify what types of intervention options are needed in the system to address identified problems. These could include options that: • maintain the system in the short-term while longer-term interventions are being developed • build resilience to avoid crossing points of no return or other unwanted thresholds • enable the system or parts of it to adapt or transform. Multiple options are likely to be needed at different spatial scales and at different times. Use this step to generate many kinds of options for interventions, drawing on all other components and using creative processes to encourage imaginative and innovative thinking.
		2. Assess options using the following guiding questions to better understand and prioritise them. Where answers are uncertain or ambiguous it highlights the need for options that are about learning and improving system understanding: • is it a foundational intervention, i.e., an intervention that must be implemented if other interventions are to work? • is it to prevent a threshold being crossed? • is it resilient or robust to a wide range of scenarios, and potential stresses or shocks? • will it impact other options? • will there be a long delay between implementation and effect? • is it necessary but not yet feasible, salient, legal, legitimate or credible? • is it fair and will it build social cohesion? • is the set of options sufficient to achieve the desired changes?
		3. Use the following principles to characterise benefits and costs of intervention options: • estimate the benefits and costs of each option for each stakeholder group, noting that each option may have effects beyond the group it is designed to benefit • describe unquantifiable benefits and costs and do not assume that because they have no monetary value or physical expression that they are less valuable than the tangible benefits and costs • characterise any losses and trade-offs necessary to realise long-term net benefits • make clear statements about potential benefits, costs, risks and uncertainties of crossing a threshold, and potential impacts on stakeholders, especially future generations.
		4. Conduct the above steps for the different scenarios developed in Exploring scenarios to identify options that are robust to different plausible futures.

	2. Sequencing pathways Use this component to prioritise and sequence intervention options, alternative pathways, and decision triggers for switching paths, addressing whether, where, when and how to start, as well as who should be responsible.	1. Specify the requirements and lead times required to implement options, including decisions that would need to be made, and any rules that would need to change.
		2. Lay out a range of options based on performance against projected changes in the system (Imagining change and Exploring scenarios) and the evaluation criteria (Generating options) and develop workable sequences for implementing options.
		3. Identify decision points and set provisional implementation triggers for each pathway.
		4. Document and visualise alternative pathways for implementing changes as a route map or some other visualisation.
	3. Implementing pathways Use this component to prioritise and sequence intervention options, alternative pathways, and decision triggers for switching paths, addressing whether, where, when and how to start, as well as who should be responsible.	1. Build the understanding gained from all components into an implementation plan, ensuring that there is compatibility/ congruence between the range of actions generated by all components of RAPTA.
		2. Action the implementation plans according to processes and outcomes from Adaptive Governance and Active Learning.
		3. Re-iterate and revise components of RAPTA as appropriate to ensure sufficient rigour to provide stakeholder trust and confidence in investment and actions, and to adapt pathways as the future unfolds.

Source: O'Connell et al., 2019

3.2.2.2 Food Insecurity Experience Scale (FIES)

The Food Insecurity Experience Scale (FIES) measures access to adequate food and the severity of food insecurity (FAO, [n.d]). The driving objective behind the FIES is to measure hunger and access to food as per SDG 2 – End hunger, achieve food security and improved nutrition and promote sustainable agriculture by 2030 – and specifically Target 2.1 - By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round. While this is a universally shared goal, the FIES functions as a comparative scale indicating current progress to achieve this goal.

The FIES consists of eight standard questions related to different experiences of food accessibility. It is a tool for measuring food insecurity at the household or individual level. The FIES provides a high-level picture of hunger according to a statistical scale and can therefore be used quantitatively to assess how moderate or severe food insecurity is (Table 2). While it is a relatively simple tool, the FIES not only provides a measure of food insecurity but also useful insights about the psychological experiences of uncertainty or anxiety associated with one's capacity to access sufficient food (FAO, [n.d.]).

Table 2: Food Insecurity Experience Scale indicators

No	Standard label	Question
1	Worried	During the last 12 MONTHS, was there a time when You were worried you would not have **enough food** to eat because of a lack of money or other resources?
2	Healthy	Still thinking about the last 12 MONTHS, was there a time when you were unable to eat **healthy and nutritious food** because of a lack of money or other resources?
3	Few foods	Was there a time when you **ate only a few kinds of foods** because of a lack of money or other resources?
4	Skipped	Was there a time when you had to **skip a meal** because there was not enough money or other resources to get food?
5	At least	Still thinking about the last 12 MONTHS, was there a time when you **ate less than you thought you should** because of a lack of money or other resources?
6	Runout	Was there a time when your household **ran out of food** because of a lack of money or other resources?
7	Hungry	Was there a time when you were **hungry but did not eat** because there was not enough money or other resources for food?
8	Whole day	During the last 12 MONTHS, was there a time when you **went without eating for a whole day** because of a lack of money or other resources?

Source: FAO, (n.d)

3.2.2.3 Household Dietary Diversity Score (HDDS)

Based on the premise that diverse diets are linked to socioeconomic factors, the Household Dietary Diversity Score (HDDS) is a proxy measure of a household's economic access to different foods. The purpose of the HDDS is to support a holistic picture of food security and nutritional status and can be used in combination with other food-related tools (Kennedy, Ballard and Dop, 2013).

The HDDS comprises a qualitative questionnaire survey (Table 3) in which participants recall the food and drinks consumed within the last 24 hours. It can be used to gather individual or household data depending on the survey objective, with the main respondent providing information on his/her consumption (individual level) and/or all other members of the households (household level) (Kennedy, Ballard and Dop, 2013). For individual level surveys, the main target population should be selected prior to the commencement of the survey for selecting respondents. For household-level surveys, the primary food preparer for the most recent 24 hours should be the survey respondent. Once the questionnaire surveys have been completed, the HDDS scorecard (Table 4) is populated to derive a score. Given that socio-cultural factors can influence dietary diversity, the HDDS does not specify a generalizable 'correct' or 'adequate' number of food groups. As a result, it is suggested that the average score should be used for analysis and target setting.

Table 3: Household Dietary Diversity Score questionnaire

Dietary Diversity Questionnaire:	Meal	List (Descriptive)
Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning. Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients. When the respondent has finished, probe for meals and snacks not mentioned.	Breakfast	
	Snack	
	Lunch	
	Snack	
	Dinner	
	Snack	

Source: Kennedy, Ballard and Dop, 2013

Table 4: HDDS scorecard

No	Food group	Examples	Yes = 1 No = 0
1	Cereals	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. ugali, nshima, porridge or paste	
2	White roots and tubers	white potatoes, white yam, white cassava, or other foods made from roots	
3	Vitamin A rich vegetables and tubers	pumpkin, carrot, squash, or sweet potato that are orange inside + other locally available vitamin A rich vegetables (e.g. red sweet pepper)	
4	Dark leafy vegetables	dark green leafy vegetables, including wild forms + locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach	
5	Other vegetables	other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables	
6	Vitamin A-rich fruit	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + other locally available vitamin A rich fruits	
7	Other fruits	other fruits, including wild fruits and 100% fruit juice made from these	
8	Organ meats	liver, kidney, heart or other organ meats or blood-based foods	
9	Flesh meats	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	
10	Eggs	eggs from chicken, duck, guinea fowl or any other egg	
11	Fish and seafood	fresh or dried fish or shellfish	
12	Legumes, nuts and seeds	dried beans, dried peas, lentils, nuts, seeds or foods made from these (e.g. hummus, peanut butter)	
13	Milk and milk products	milk, cheese, yogurt or other milk products	
14	Oils and fats	oil, fats or butter added to food or used for cooking	
15	Sweets	sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	Spices, condiments, beverages	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	
Household level only	Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday?		
Individual level	Did you eat anything (meal or snack) OUTSIDE the home yesterday?		

Source: Kennedy, Ballard and Dop, 2013

3.2.2.4 Integrated Food Security Phase Classification (IPC)

The Integrated Food Security Phase Classification (IPC) is an internationally recognised tool for classifying food insecurity, malnutrition, and famine. In particular, the IPC analyses the magnitude and scale of food insecurity and malnutrition and can provide useful information for decision-makers (IPC Global Partners, 2021). It is a multi-context scale that can be used in rural, urban, and crises or disaster contexts with or without humanitarian aid.

The purpose of the IPC is to synthesize complex food security and malnutrition data into easy-to-understand information. It provides estimates for the number of people experiencing food insecurity and malnutrition at different scales. It identifies the main drivers and characteristics of the situation. Because

different measures are differently suited to different situations, the IPC distinguishes between i) acute food insecurity, ii) chronic food insecurity, and iii) acute malnutrition (Table 5) (IPC Global Partners, 2021). It is then further broken down to strategic measures, severity, and phases. To facilitate classifications in a swift and mainstream-oriented manner, the IPC includes an established platform, the Information Support System (ISS) (IPC Global Partners, 2021).

Table 5: Integrated Food Security Phase Classification table

IPC scale	Acute Food Insecurity	Chronic food insecurity	Acute malnutrition
IPC definitions of food insecurity and malnutrition	Food insecurity found at a specific point in time and of a severity that threatens lives or livelihoods, or both, regardless of the causes, context, or duration.	Food insecurity that persists over time mainly due to structural causes, including intra-annual seasonal food insecurity	Global Acute Malnutrition (GAM) as expressed by thinness of individuals or presence of oedema.
Informs action with specific strategic objectives	Short-term objectives to prevent or decrease acute food insecurity that threatens lives or livelihoods.	Medium- and long-term improvement of the quality and quantity of food consumption for an active and healthy life.	Short- and long-term objectives to prevent or decrease high levels of acute malnutrition.
Severity categories	Five Severity Phases: 1. Minimal/None 2. Stressed 3. Crisis 4. Emergency 5. Catastrophe/Famine	Four Severity Levels: 1. Minimal/None 2. Mild 3. Moderate 4. Severe	Five Severity Phases: 1. Acceptable 2. Alert 3. Serious 4. Critical 5. Extremely Critical
Analytical focus	Identifying areas with a large proportion of households with significant food energy gaps or livelihood change strategies that can endanger lives or livelihoods.	Identifying areas with a large proportion of households that have long-term inability to acquire adequate food requirements both in terms of macro- and micronutrients.	Identifying areas with a large proportion of children wasted or with oedema.
Purpose	To guide convergence of evidence by using generally accepted international standards and cut-offs. The classification is intended to guide decision-making aiming at short-term improvements in food security.	To guide convergence of evidence by using generally accepted international standards and cut-offs. The classification aims to guide decision-making aiming at medium-term improvements in food security.	To identify areas in different phases based on the prevalence of acute malnutrition at the population level. The classification is aimed to guide decision-making in terms of priority areas and interventions to reduce acute malnutrition.
Phase name and description	Phase 1 None/Minimal Households are able to meet essential food and non-food needs without engaging in atypical and unsustainable strategies to access food and income.	Level 1 No/Minimal Chronic Food Insecurity In a common year, households are continuously able to access and consume a diet of acceptable quantity and quality for an active and healthy life. Household livelihoods are sustainable and resilient to shocks. Households are not likely to have stunted children.	Phase 1 Acceptable Less than 5% of children are acutely malnourished
	Phase 2 Stressed Households have minimally adequate food consumption but are unable to afford some essential non-food expenditures without engaging in stress coping strategies.	Level 2 Mild Chronic Food Insecurity In a common year, households are able to access a diet of adequate quantity but do not always consume a diet of adequate quality. Household livelihoods are borderline sustainable, and resilience to shocks is limited. Households are not likely to have stunted children.	Phase 2 Alert 5-9.9% of children are acutely malnourished.

	Phase 3 Crisis Households either: • Have food consumption gaps that are reflected by high or above-usual acute malnutrition; or • Are marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies.	Level 3 Moderate Chronic Food Insecurity In a common year, households have ongoing mild deficits in food quantity and/or seasonal food quantity deficits for 2 to 4 months of the year, and consistently do not consume a diet of adequate quality. Household livelihoods are marginally sustainable, and their resilience to shocks is very limited. Households are likely to have moderately stunted children.	Phase 3 Serious 10-14.9% of children are acutely malnourished.
	Phase 4 Emergency Households either: • Have large food consumption gaps which are reflected in very high acute malnutrition and excess mortality; or • Are able to mitigate large food consumption gaps but only by employing emergency livelihood strategies and asset liquidation.	Level 4 Severe Chronic Food Insecurity In a common year, households have seasonal deficits in quantity of food for more than 4 months of the year and consistently do not consume a diet of adequate quality. Household livelihoods are very marginal and are not resilient. Households are likely to have severely stunted children.	Phase 4 Critical 15-29.9% of children are acutely malnourished. The mortality and morbidity levels are elevated or increasing. Individual food consumption is likely to be compromised.
	Phase 5 Catastrophe/ Famine Households have an extreme lack of food and/or other basic needs even after full employment of coping strategies. Starvation, death, destitution and extremely critical acute malnutrition levels are evident. (For Famine Classification, an area needs to have extreme critical levels of acute malnutrition and mortality.)		Phase 5 Extremely Critical 30% or more children are acutely malnourished. Widespread morbidity and/or very large individual food consumption gaps are likely evident.

Source: IPC Global Partners, 2021

3.2.2.5 Household Hunger Scale (HHS)

The Household Hunger Scale (HHS) aims to be a simple measure of hunger at the household level particularly in areas that are food insecure (Ballard, Coates, Swindale, and Deitchler, 2011). It is designed to measure and compare food deprivation across cultures and settings. In this way, the experience of hunger among different groups can be articulated and compared meaningfully. The purpose of the HHS is to support efforts to overcome food insecurity by providing reliable data that can inform targeted interventions. In this way, the HSS data can be used in the design, implementation, monitoring and evaluation of intervention programmes, and can also provide lessons to improve food security efforts (Ballard et al., 2011).

Specifically focused on hunger and deprivation, the HSS focuses on quantity of foods at the household level and does not account for food quality, nutrition, nor food production, utilisation, and availability dimensions. As such, the HSS is intended to be used as one part of a larger group of measures to capture a full picture of food insecurity (Ballard et al., 2011). The HSS comprises several set questions based on the recollection of deprivation experience over the last 4-weeks (Table 6) and is administered to a representative sample of households. Based on respondents' answers, hunger is categorised as i) little to no hunger in the household, ii) moderate hunger in the household, and iii) severe hunger in the household (Table 7).

Table 6: Household Hunger Scale (HHS) questionnaire

No.	Question	Response option	Code	Intended Meaning of HHS Question
Q1	In the past [4 weeks/30 days], was there ever no food to eat of any kind in your house because of lack of resources to get food?	0 = No (Skip to Q2) 1 = Yes		This question asks about a situation in which there is no food to eat of any kind in the house because food was not available to household members through usual means (e.g., through purchase or barter, gifts, from the garden or field, from storage structures).
Q1a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1–2 times) 2 = Sometimes (3–10 times) 3 = Often (more than10 times)		
Q2	In the past [4 weeks/30 days], did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (Skip to Q3) 1 = Yes		This question asks whether the respondent or other household members felt hungry at bedtime because they did not have enough food to eat during the day and evening.
Q2a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1–2 times) 2 = Sometimes (3–10 times) 3 = Often (more than10 times)		
Q3	In the past [4 weeks/30 days], did you or any household member go a whole day and night without eating anything at all because there was not enough food?	0 = No (Skip to the next section) 1 = Yes		This question asks whether any household member did not eat from the time they awoke in the morning to the time they awoke the following morning because there was not enough food. A person who chooses not to eat for a whole day for reasons other than lack of food (for example, if fasting or on a diet) should not respond affirmatively to Q3.
Q3a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1–2 times) 2 = Sometimes (3–10 times) 3 = Often (more than10 times)		

Source: Ballard et al., 2011

Table 7: HSS categorical indicators

Household Hunger Score	Household Hunger Categories
0–1	Little to no hunger in the household
2–3	Moderate hunger in the household
4–6	Severe hunger in the household

Source: Ballard et al., 2011

3.2.2.6 Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP)

The Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP) is a self-assessment tool for farmers and pastoralists that aims to collect data, support evidence-based decision-making and provide a forum for sharing information and common threats and interests amongst pastoral and farming communities (Hernández Lagana, Phillips and Poisot, 2022). The SHARP process supports smallholders with sustainable production in order to build resilience to climate change. Focusing on household- and project-level, the SHARP tool identifies weak resilience points and appropriate interventions and can be used as a once off, or ongoing monitoring and evaluation assessment tool (Hernández Lagana, Phillips and Poisot, 2022).

Based on Cabell and Oelofse's 13 agro-ecosystem indicators of resilience (Cabell and Oelofse, 2012), the SHARP tool investigates rural livelihoods in terms of social, economic, environmental, and agronomic dimensions (Table 8). Comprising questions, the SHARP tool explores smallholders' perspectives, actions, and interests with the intention of improving food security and resilience (Hernández Lagana, Phillips and Poisot, 2022). SHARP is administered digitally using tablets that capture qualitative and quantitative in-depth details that translate into numerical scores. Because of the range and depth of information captured, SHARP is useful for systematic monitoring and evaluation to track project intervention (Hernández Lagana, Phillips and Poisot, 2022). Additionally, it can be administered at longer-term time scales to measure food security and resilience at different times.

Table 8: Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP) indicators

Indicator	Definition	Implication	What to look for
Socially self-organized	The social components of the agro-ecosystem are able to form their own configuration based on their needs and desires.	Systems that exhibit a greater level of self-organisation need fewer feedbacks introduced by managers and have greater intrinsic adaptive capacity.	Farmers and consumers are able to organize into grassroots networks and institutions (e.g. cooperatives, farmers' markets, advisory networks).
Ecologically self-regulated	Ecological components self-regulate via stabilizing feedback mechanisms that send information back to the controlling elements.	A greater degree of ecological self-regulation can reduce the need for external inputs (e.g. nutrients, water and energy) to maintain a system.	Farms maintain plant cover and incorporate perennials, provide habitat for predators and parasitoids, use ecosystem engineers, and align production with local ecological parameters.
Appropriately connected	Connectedness describes the quantity and quality of relationships between system elements.	High and weak connectedness provides diversity and flexibility to the system; low and strong connectedness imparts dependency and rigidity.	Farmers collaborate with multiple suppliers, outlets and fellow farmers; the presence of polycultures encourages symbiosis and mutualism while providing movement corridors, etc
Functional and response diversity	Functional diversity is the variety of ecosystem services that components provide to the system; response diversity is the range of responses of the different components to environmental change.	Diversity protects against shocks and provides seeds of renewal following disturbance	Heterogeneity of features within the landscape and on the farm; diversity of inputs, outputs, income sources, markets, pest controls, etc.
Optimally redundant	Critical components and relationships within the system are duplicated in case of failure.	Redundancy may decrease a system's efficiency, but it gives the system multiple response options.	Multiple crop varieties and animal breeds; multiple sources of nutrients, several water sources, etc.
Spatial and temporal heterogeneity	There is patchiness across the landscape, which changes over time.	Like diversity, spatial heterogeneity provides seeds of renewal following disturbance; over time, it allows patches to recover and restore nutrients.	Patchiness on the farm and across the landscape, mosaic pattern of managed and unmanaged land, diverse cultivation practices, crop rotations, etc.
Exposed to disturbances	The system is exposed to discrete, low-level events that cause disruptions without pushing the system beyond a critical threshold.	Such frequent, small-scale disturbances can increase system adaptive capacity in the long term by promoting natural selection and novel configurations during the phase of renewal; known as "creative destruction".	Testing new land/water management techniques; changing practices; incorporation of improved seeds/ breeds; pest management that allows a certain controlled amount of invasion, etc.
Coupled with local natural capital	The system functions as much as possible within the means of the local natural resource base and ecosystem services.	Responsible use of local resources encourages a system to live within its means; this creates an agro-ecosystem that recycles waste, relies on healthy soils and conserves water.	Builds (does not deplete) soil organic matter; presence of trees; recharges water; limited need to import nutrients or export waste, etc.
Reflective and shared learning	Individuals and institutions learn from past experiences and from present experimentation to anticipate change and create desirable futures.	The more people and institutions can learn from the past and from each other, and share that knowledge, the more capable the system is of adaptation and transformation.	Extension and advisory services for farmers; cooperation and knowledge sharing among farmers; knowledge about the state of the agroecosystem; behavioural change
Globally autonomous and locally interdependent	The system has relative autonomy from exogenous (global) control and influences and exhibits a high level of cooperation between individuals and institutions at the more local level.	A system cannot be entirely autonomous, but it can strive to be less vulnerable to forces that are outside its control. Local interdependence can facilitate this by encouraging collaboration and cooperation rather than competition.	Less dependence on commodity markets and on external inputs; more sales to local markets; reliance on local resources; existence of farmer cooperatives and community-based organizations; close relationships between producers and consumers.

Honours legacy	The current configuration and future trajectories of systems are influenced and informed by past conditions and experiences.	Also known as path dependency, this relates to the biological and cultural memory embodied in a system and its components.	Maintenance of heirloom seeds and breeds; engagement of elders in education and production; combination of traditional cultivation techniques with modern knowledge; traditional forecasters use.
Builds human capital	The system takes advantage of and builds resources through increased knowledge and education, social relationships and membership in social networks.	Human capital includes cultural (individual skills and abilities), social (social organizations, norms, formal and informal networks) and constructed (economic activity, technology, infrastructure) aspects.	Access to education and training; nutrition; gender equality; festivities; public programmes that give training opportunities; investment in farm infrastructure; group membership; expenditure on education.
Reasonably profitable	The segments of society involved in agriculture are able to make a livelihood from the work they do without relying too heavily on subsidies or secondary employment	Being reasonably profitable allows participants in the system to invest in the future; this adds buffering capacity, flexibility, and builds wealth that can be tapped into following release.	Farmers manage to sell the desired agricultural produce; produces are paid on time; access to private land; size of herds; farmers manage to invest in their farms (inputs and (infrastructure).

Source: Hernández Lagana, Phillips and Poisot, 2022)

3.2.2.7 Resilience Index Measurement and Analysis II (RIMA II)

The Resilience Index Measurement and Analysis II (RIMA II) is a quantitative tool for measuring resilience to food insecurity at the household level (FAO, 2020). It measures the resilience capacity of households by calculating their Resilience Capacity Index (RCI). It does not measure food security as such, but rather food security is framed as an outcome of a resilient system. The RIMA indicators look at the ways in which households cope better or worse with external disturbances and environmental stressors (FAO, 2020). Comprising a questionnaire, the RIMA II indicators analyse direct and less direct measures of resilience for descriptive as well as inferred causal links. Because collecting sufficient data at the household level can be time consuming and is not always possible in contexts of instability, the short RIMA questionnaire has been designed to gather the minimum information required to estimate resilience capacity of households (Table 9). The short RIMA questionnaire may be administered digitally using mobile phones and/or tablets. In combination with a suite of other measures, the RIMA II can contribute towards a holistic baseline picture upon which project interventions can be designed (FAO, 2020).

Table 9: The Resilience Index Measurement and Analysis II

Pillars of Resilience	Definition	RIMA short questionnaire	
Access to Basic Services (ABS)	Access to Basic Services shows the ability of a household to meet basic needs, and access and effective use of basic services; e.g., access to schools, health facilities, infrastructures and markets.	Is the main source of drinking water for households a piped connection to the household, public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs or rainwater collection?	[1=yes 0=no]
		Is the main type of toilet facility used by household members a flush/pour flush (to piped sewer system, septic tank, or pit latrine), a ventilated improved pit (VIP) latrine, a pit latrine with slab, or a composting toilet?	[1=yes 0=no]
		Is electricity the main source of energy used in the household for cooking or lighting?	[1=yes 0=no]
		How far (one way) is the household dwelling from the closest accessible/ functioning [SERVICE] in minutes (walking distance)? *	[minutes]
		• Water source	[minutes]
		• Primary school	[minutes]
		• Public hospital / health facility	[minutes]
		• Livestock market	[minutes]
		• Agricultural/crops market	[minutes]
		• Public means of transport	[minutes]
Assets (AST)	Assets comprise both productive and non-productive assets. Productive assets are the key elements of a livelihood, enabling households to produce consumable or tradable goods. Examples of indicators include land, livestock and durables. Context-specific sets of productive assets which are able to determine the creation of the household income are evaluated. Other tangible non-productive assets such as house, vehicle, and household amenities reflect living standards and wealth of a household.	How many [DURABLES/ASSETS] do the household members own?	[number]
		• Car	[number]
		• Bicycle	[number]
		• Gas/electric cooker	[number]
		• Mobile	[number]
		How many [DURABLES/ASSETS] do the household members own?	[number]
		• Ox-plough	[number]
		• Machete	[number]
		• Tractor	[number]
		Do the household members use [INPUTS]?	[1=yes 0=no]
		• Purchased seeds (traditional/local)	[1=yes 0=no]
		• Pesticides/herbicides	[1=yes 0=no]
		• Fertilizers	[1=yes 0=no]
		• Livestock feed	[1=yes 0=no]
		What is the total area in hectares of agricultural land (owned, leased or used) that the household uses?	[hectares]
		How many [LIVESTOCK] does the household currently own?	[number]
		• Cows/calves	[number]
		• Sheep, goat	[number]
		• Chicken	[number]
		• Camels	[number]

Social Safety Nets (SSN)	The Social Safety Nets pillar measures the ability of households to access help from relatives and friends, from government and timely and reliable assistance provided by international agencies, charities, and NGOs.	What is the total amount of formal cash transfers received in the last 12 months by the household members?	[monetary value in local currency]
		How often have you or other members of the household received formal cash transfers in the last 12 months? [Please ask this question only if question 10a is greater than 0. In case of multiple cash transfers, please refer to the most frequent one].	[1 = daily; 2 = weekly; 3 = biweekly; 4 = monthly; 5 = bimonthly; 6 = quarterly; 7= twice a year; 8 = only once/ lump-sum]
		Have the cash transfers been received regularly in the last 12 months? [Please ask this question only if question 10a is greater than 0 and 10b different from 8. In case of multiple cash transfers, please refer to the most frequent one].	[1 = yes 0 = no]
		What is the total amount of formal in-kind transfers received in the last 12 months by the household members?	[monetary value in local currency]
		How often have you or other members of the household received formal in-kind transfers in the last 12 months? [Please ask this question only if question 11a is greater than 0. In case of multiple in-kind transfers, please refer to the most frequent one].	[1 = daily; 2 = weekly; 3 = biweekly; 4 = monthly; 5 = bimonthly; 6 = quarterly; 7= twice a year; 8 = only once/ lump-sum]
		Have the in-kind transfers been received regularly in the last 12 months? [Please ask this question only if question 11a is greater than 0 and 11b different from 8. In case of multiple in-kind transfers, please refer to the most frequent one].	[1 = yes 0 = no]
		How many meals have the children living in the household received during the last month they attended school? [Please ask this question only if children are living in the household].	[number of school meals]
		What is the total amount of informal transfers received in the last 12 months by the household members?	[monetary value in local currency]
		Are members of this household formally participating in a local group/association, such as farmers groups, women support groups, youth groups, business associations, unions, etc.? If so, how many of these associations can provide support in case of need?	[number of associations]
		How many relatives/friends/family members can the household members rely on in case of need?	[number]
Adaptive Capacity (AC)	Adaptive Capacity is the ability of a household to adapt to a new situation and develop new livelihoods strategies.	Can the head of the household read and write (in any language / alphabet)?	[1=yes 0=no]
		How many years has the household head attended formal school?	[number]
		How many years has the household head attended non-formal (e.g. Koranic) school?	[number]
		How many years has the household member with the highest level of education attended formal school?	[number]
		How many years has the household member with the highest level of education attended non-formal (e.g. Koranic) school?	[number]
		On average, how many years have the household members of working age (>14 and <65 years old) attended formal school?	[number]
		In the past 12 months, what percentage of the household's overall income was generated by [SOURCE]?	[%]
		• Agriculture, animal breeding, fishing	[%]
		• Family business (other than agriculture)	[%]
		• Government wage and salary	[%]

		• Private sector wage and salary	[%]
		• Transfers and social assistance	[%]
		• Other	[%]
		. Over the past 12 months, what is the total value of loan(s) received by household members?	[monetary value in local currency]
		How many different crops have the household members grown during the last season?	[number]
		Have the household members used improved quality seeds during the last season? [Please refer to both rainy and off-season culture].	[1 = yes 0 = no]
		Have the household members received any training in the last 12 months?	[1 = yes 0 = no]
		if "Yes", which type of training?	[1 = good agricultural practices; 2 = livestock management; 3 = agri-business and value addition; 4 = vocational training; 5 = other]
		Have the livestock owned by the household received any vaccination in the last 12 months?	[1 = yes 0 = no]
Food security	Food Insecurity Experience Scale (FIES)	You or others in your household worried about not having enough food to eat because of a lack of money or other resources?	[1 = yes 0 = no 98 = don't know 99 = refused]
		Still thinking about the last 12 months, was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?	[1 = yes 0 = no 98 = don't know 99 = refused]
		Was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?	[1 = yes 0 = no 98 = don't know 99 = refused]
		Was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?	[1 = yes 0 = no 98 = don't know 99 = refused]
		Still thinking about the last 12 months, was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?	[1 = yes 0 = no 98 = don't know 99 = refused]
		Was there a time when your household ran out of food because of a lack of money or other resources?	[1 = yes 0 = no 98 = don't know 99 = refused]
		If "Yes", did it happen in the past 4 weeks (30 days)?	[1 = yes 0 = no 98 = don't know 99 = refused]
		If "Yes", how often did this happen in the past 4 weeks (30 days)?	[2 = rarely (1 or 2 times) 3 = sometimes (3-10 times) 4 = often (more than 10 times) 98 = don't know 99 = refused]
		Was there a time when you or others in your household were hungry but did not eat because there was not enough money or other resources for food?	[1 = yes 0 = no 98 = don't know 99 = refused]
		If "Yes", did it happen in the past 4 weeks (30 days)?	[2 = rarely (1 or 2 times) 3 = sometimes (3-10 times) 4 = often (more than 10 times) 98 = don't know 99 = refused]
		How often did this happen in the past 4 weeks (30 days)?	[2 = rarely (1 or 2 times) 3 = sometimes (3-10 times) 4 = often (more than 10 times) 98 = don't know 99 = refused]

		Was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?	[1 = yes 0 = no 98 = don't know 99 = refused]
		If "Yes", did it happen in the past 4 weeks (30 days)?	[1 = yes 0 = no 98 = don't know 99 = refused]
		If "Yes", how often did this happen in the past 4 weeks (30 days)?	[2 = rarely (1 or 2 times) 3 = sometimes (3-10 times) 4 = often (more than 10 times) 98 = don't know 99 = refused]
	Food expenditure and Consumption	What is the amount of money spent on the food consumed by the household members during the past 7 days?	[monetary value in local currency]
		What percentage of your income is used for buying food?	[%]
		Can you quantify how much your household consumed in the past 7 days using credit (because of inability to cover the cost)?	[monetary value in local currency]
		Can you quantify how much your household consumed in the past 7 days from its own production?	[monetary value in local currency]
		Can you quantify how much your household consumed in the past 7 days from assistance/gifts?	[monetary value in local currency]
		Over the past 7 days, how many days have the household members consumed [FOOD GROUP]?	[number of days]
		• Cereals	[number of days]
		• White tubers and roots	[number of days]
		• Vitamin A rich vegetables and tubers	[number of days]
		• Dark green leafy vegetables	[number of days]
		• Other vegetables	[number of days]
		• Vitamin A rich fruits	[number of days]
		• Other fruits	[number of days]
		• Organ meat	[number of days]
		• Flesh meat	[number of days]
		• Eggs	[number of days]
		• Fish and seafood	[number of days]
		• Legumes, nuts and seeds	[number of days]
		• Milk and milk products	[number of days]
		• Oils, fats	[number of days]
		• Sweets	[number of days]
		• Spices, condiments, beverages	[number of days]
Shocks	Shocks	In the last 12 months, what are the most severe shocks faced by the household?	[open answer]
		What did the household members do to cope with the shocks?	[open answer]
Household demographic characteristics	Household demographic characteristics	Gender of household head.	[1=male 2=female]
		Total number of members of the household (adults, >14 years old and children, < 15 years old).	[number]
		Total number of household members of working age (>14 and <65 years old).	[number]
		Region.	[open answer]
		Livelihood.	[open answer]

Source: FAO, 2020

3.2.2.8 Committee on Sustainability Assessment (COSA)

The Committee on Sustainability Assessment (COSA) is a tool that measures the capacity and preparedness of households and communities to cope with stressors and shocks in ways that minimise vulnerability and support sustainable agricultural practices (COSA, 2022). It aims to identify and improve households' responses to contextual challenges including climate change, food insecurity and conflict.

Prioritising scientific rigour with practical logic, the COSA tool is designed to offer a thorough picture of household sustainability status that can inform pragmatic and strategic decision-making for agriculture (COSA, 2022). The COSA focuses on the household and community level and uses a three steps approach: i) Define the Pathway: Developing a realistic understanding and practical pathway to sustainability, ii) Gather the Facts: Ensuring you have the right info at the right time, and iii) Answer and Advise: Employing broad experience and advanced analysis to ensure you get the most out of the data (COSA, 2022). The COSA is customisable to meet analysis needs and comprises many themes under the four overarching aspects of social, environmental, and economic (Table 10).

Table 10: Committee on Sustainability Assessment (COSA) themes

Themes	Core elements	Name	Description
Social			
Shock	Shock exposure	Severity of shock	Perceptions about the severity of the main shock experienced in the last production year with respect to similar events that occurred in the last two and five years.
		Occurrence of shocks	Occurrence of three major shocks (social, economic, or environmental) that led to a serious reduction in household's income, assets, or consumption in the last production year, in the last two years, and five years. Shocks ranked in order of severity.
		Shock context information	The array of risks that people are exposed to in a given context.
		Economic context information	Perceptions about the economic conditions of household with respect to two and five years ago.
	Coping Strategies	Severity of coping strategy	Perceptions about severity of coping strategies that household might implement to face a shock.
		Type of coping strategy	Type of coping strategies that household applied to face the main shock experienced in the last production year (migration, aid, new sources of income, reducing expenses, using savings).
		Recovery ability	Perceived speediness and ability to recover from the main shock experienced in the last production year.
	Mitigation plans	Individual preparedness strategies	Strategies implemented by the household to face shocks (stock of feed/seeds, storage of water, measures taken to overcome leaf rust, new seeds varieties/animal breeds, irrigation systems).
		Dissemination of critical information (early warning)	Access, source (extension agents, government officials, ICT), and frequency of critical information about adverse events. Perceptions about quality of information.
		Access to insurance	Availability (presence and affordability) of insurance organizations in the community.
		History of insurance	Number of insurance plans held by household and relative repayment history.
		Quality of insurance	Perceptions about quality of insurance plans held.
Community and institutional environment	Safety nets	Access to safety nets	Availability of safety nets, both formal and informal, providing reasonable or ready support (food, work, and cash) in case of necessity. Affiliation to informal safety nets and support used in the last year.
	Inclusion	Participation in decision-making structures	Involvement and participation of household and minority groups (women, youth) in decision-making structures (village councils, tribal council, producer organisations).
		Participation in community activities	Involvement and participation of household members in community activities (improvements in agricultural facilities, access to water or sewage, medical care, road, or school construction).

	Political environment	Perceptions about political environment	Perceptions about accountability and transparency of political process, feeling of safety in community life, and trust in institutions.
Services and infrastructure	Basic services	Access to health care	Availability (presence and affordability) of medical care (nurse, doctor, or clinic) within reasonable travel distance.
		Access to school	Availability (presence and affordability) of school within reasonable travel distance.
		Quality of school	Perceptions about the quality of the school (teaching and physical structure).
		Quality of health care	Perceptions about the quality of the health care.
		Access to extension service	Availability (presence) of extension services.
		Quality of extension service	Perceptions about the quality of the extension service.
		Access to veterinary service	Availability (presence and affordability) of veterinary care within a reasonable travel distance.
		Quality of veterinary service	Perceptions about the quality of veterinary services.
		Market access	Availability (presence and affordability) of market for selling and buying products within a reasonable travel distance.
	Infrastructure	Safe Water for Domestic Use	Household access to water they consider safe to drink
		Access to electricity	Availability (presence) of electricity at home (private generator or public electricity supply).
		Access to sanitation facilities	Availability (presence) of sanitation facilities in the household.
		Access to ICT	Availability (presence) of telephone/mobile phone, TV, radio, and internet at home.
		Access to paved roads	Conditions of roads in the community (sandy, paved, gravel).
Basic Human Rights and Equity	Food Security	Days Without Sufficient Food	Days without sufficient food tracks number of days in past year that any member of household cut food consumption due to lack of food and months/times of year of comparatively less household food security.
		Nutritional Diversity	Number of different food types (from list) that a family has eaten in the past seven days.
	Education	Household adult education level	Number of household members aged 15 years and older who have primary school or higher level of education.
		Household adult literacy level	Number of household members aged 15 years and older who are able read and write.
		Children in school at appropriate grade level	Number of household members through age 18 who have completed appropriate number of grades for age
		Training	Data include: Training topics and hours attended, fees, time and cost for travel, provider of training. As well as information on why women did not participate in the training.
Living and Working Conditions	Living Conditions	Poverty status	Comparison of household revenue to national (or regional if available) poverty line; PPI score evaluation of poverty propensity
		Health status	Frequency of serious and non-serious illness of household members in the last year.
Learning and innovation	New technologies	Adoption of new technologies	Adoption of new cropping/livestock practices and new agricultural equipment in the last five years.
		Access to new technology	Events that allowed household to adopt new technology.
	Individual empowerment	Power to enact changes	Perceptions about having power to enact change as an individual on community, household, and farming decisions.
	Traditional knowledge	Elder's influence	Elders' (people aged 50 and above) influence in household's production decision-making.
	Information	Frequency of information	Frequency of information received.
		Source of information	Source of information: extension agents, government officials, ICT.
		Quality of information	Perceptions about the quality of information.

Environmental			
Water	Water Quantity	Water Conservation Measures	Practices used to conserve water: drip irrigation, catchments, water-efficient processing, etc.
	Water Quality	Water Contamination Prevention Measures	Practices used to prevent water contamination from: crop processing wastewater, animals, domestic discharge, cleaning of agrochemical application equipment, etc.
Soil	Conservation	Local nutrient cycle	Recycling of organic matter and crop wastes
		Erosion	Severity and prevalence of observed erosion on farm (in relation to slope)
		Intercropping	Interplanting species for soil health, diversification, fertility
Resource Management	Resource/Input Management	Integrated pest management	IPM practices employed on farm
		Integrated Nutrient Management	Producer's method(s) to determine fertilizer needs (soil analysis report, advice or assessment of a professional, observation, knowledge of nutrient depletion by previous crop, etc.)
		NPK use and efficiency	Nitrogen, phosphorus, and potassium amounts in synthetic fertilizers used and compared to focus crop yields - indicates both efficiency and potential pollution
		Toxicity class of pesticides	Amount of active ingredients in pesticides by toxicity class
	Waste Management	Responsible Waste Management	Materials recycled, reused, or disposed of properly
Climate Change	Sequestration and Mitigation	Land Use Change	Conversion of natural land (e.g., prairie, forest, savanna) to land used for cultivation or pasture, or conversion from cultivated or pasture land to natural land
		Carbon stock	Number, size, type of trees and other perennial woody plants
		Other climate mitigation and sequestration practices	Refers to practices from previous indicators: Forestation, Nutrient Balance and Fertilizer Use and Efficiency, Responsible Waste Management, Local Nutrient Cycle
		Energy	Energy sources, costs for purchasing or producing, and use (electricity, gasoline, LPG, diesel, solar, wind, hydropower, wood from forests, pruning, managed woodlot, etc.)
	Adaptation	Climate adaptation practices	Refers to practices from previous indicators: Soil and Water Conservation Measures, Species and Varietal Diversity.
		Environmental Training	Producer's opinion on the value of environmental training programs: general perception of usefulness and indication of specific practices implemented as a direct result of training
Biodiversity	Tree Density	Trees per hectare	Density of trees in farm habitats
		Forestation	Number and types of trees planted or removed; land area altered by planting or removing trees
	Plant Diversity	Plant and tree diversity	Levels of biodiversity: cleared land or pasture, monoculture, 2-3 cultivated species (sparse trees), 4-10 cultivated species (some trees), crop presence with multi-strata forest, fully functional natural forest; practices followed that preserve or enhance biodiversity
Economic			
Other/Financial resources	Credit	Access to Credit	Producer indicates that he or she could access medium sized production loan within a reasonable time, if needed; potential source of the loan
		Credit history	Amount of credit received by a producer compared to the amount of credit requested (if any); terms of the loan, repayment history
	Assets	Productive assets	Number of agricultural productive assets (medium scale equipment and large vehicles), livestock, and hectares of land owned/rented, and relative value.
	Savings	Access to savings	Availability (presence and affordability) of savings organizations in the community.
		Savings history	Type of savings tools implemented by the household and the corresponding amount saved (when applicable): investment in livestock/crops/material assets; participation in local savings group; money lending to others; money savings at home; savings at banks and formal institutions.
Producer Livelihoods	Income	Net household income	Total household revenue fewer total costs for focus crop production, other crop and livestock production costs, and costs for businesses run by household members
	Diversification	Dependency	Portion of total production net income from focus crop, other crops, livestock activities, business activities.

		Number of income sources	Number of other crops (including those intercropped with focus crop) cultivated by the household. Number of self-employed (e.g., taxi driver, plumber, technician, etc.), or business activities (e.g., convenience store, handcrafting, etc.) in which households are involved. Number of animal products (meat, dairy, wool, honey, etc.) produced on farm for sale or for consumption. Number of other sources of income for the household (gifts, remittances, land rental, etc.).

Source: COSA, 2022

4 Detailed Mapping of Project Tools, Methods and Indicators

This section presents the tools/methods and indicators used in the respective projects. The information presented in this section is extracted from the respective country project documents[5].

4.1 Country Project Tools and Methods used

The tools and methods used to design/measure/determine the impact of the respective projects are listed in table 11 below. How these tools/methods were used is summarized in table 2 in the Appendix.

[5] Where there is missing information, this could not be extracted from the documents provided.

Table 11: Tools and Methods used by RFS projects

Tool/ method used	Burkina Faso	Burundi	Eswatini	Ethiopia	Ghana	Kenya	Malawi	Niger	Nigeria	Senegal	Tanzania	Uganda	Sum
Biological Condition Gradient (BCG)						■							1
Calorie proxy/Food stock stability (CP)									■				1
Chiefdom Development Plan Monitoring Tool			■										1
Collect Earth		■			■								2
Computer assisted personal interviewing (CAPI) technique									■				1
Conservation and Nutrition Monitoring Tool			■										1
Dam Assessment and Identification of potential irrigation schemes Tool			■										1
Dimensional Resilience Score (DRS)									■				1
District Health Information System (DHIS)						■							1
Diversity Assessment Tool for Agrobiodiversity and Resilience (DATAR)		■					■						2
Eswatini Water and Agriculture Development (ESWADE) Project Management Information System			■										1
EX-Ante Carbon-balance Tool (EX-ACT)	■	■	■		■	■	■	■			■		8
Farm Specific Action Plan						■							1
Food Consumption Score (FCS)									■			■	2
Food Stability Index (FSI)									■				1
Geographic Information System (GIS)	■		■		■	■		■					5
Global Forest Watch (GFW)										■			1
Global Positioning System (GPS)					■	■							2
Household Baseline Assessment Tool (HH-BAT)		■										■	2
Household Dietary Diversity Score (HDDS)									■				1
Household Food Security Index									■				1
Household Hunger Scale Accessibility Index (HHSAI)									■				1
Household Resilience Scorecard											■		1
Land and Water Inventory			■										1
Land Degradation Assessment in Drylands (LADA) and the World Overview of Conservation Approaches and Technologies (WOCAT) (LADA-WOCAT)		■											1
Land Degradation Surveillance Framework (LDSF)			■			■	■				■		4
Management Effectiveness Tracking tool (MET)					■								1
Multidimensional Poverty Assessment Tool (MPAT)	■		■			■	■				■		5
Normalised difference vegetation index (NDVI)	■			■	■								3
Open Data Kit (ODK)								■					1
Resilience, Adaptation Pathways and Transformation Approach (RAPTA)				■		■						■	3
Results and Impact Management System (RIMS)	■		■			■		■		■			5
River Gauging Stations (RGS)						■							1
Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP)		■										■	2
Short Message Service (SMS) Mobile platform						■							1
Vital Signs monitoring framework				■					■			■	3
Women Empowerment in Agriculture Index (WEAI)						■							1
Totals per Country	5	6	10	3	6	13	4	4	9	2	4	5	71

4.2 Country Project Indicators

In this project, each country had to collect their own set of resilience indicators. At minimum, countries had to collect socio-economic and environmental data. However, the later was the responsibility of Conservation International, which entails Global Environmental Benefits (GEB). The data collected at country level had to be divided into household data, farm agriculture data, administrative/community groups management and market information. This section maps the project-level indicators, tools and indices used respectively. The indicators presented in this section are those used to track the project outcomes of each country project as seen in table 12.

The outcome indicators were classified according to the food security, food system, resilience building (based on RIMA II's resilience pillar and incorporating climate change and institutional environment as additional pillars), and project implications. ***The PDF version is available as an Annexure to this document.***

Table 12: List of Country's project indicators

Country	Project development Objective and Outcome Indicators	Further Detail (where needed)	Indicator Format (Qualitative, %, Integer)	Unit of measurement	Number of indicators
Burkina Faso	Developed Rainfed Rice Project (RRP) lowland areas (new + extension)	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Rehabilitation/Consolidation of low RRP funds from other projects	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Rehabilitation / Consolidation of lowlands Neer-Tamba	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Action Plan for Rice Sector (APRS) low-floor development	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Storage infrastructure (store)	Indicator to track small land developments (development component)	Integer	Infrastructure	55
Burkina Faso	Storage infrastructure (onion cannery)	Indicator to track small land developments (development component)	Integer	Infrastructure	55
Burkina Faso	Action Plan for Rice Sector (APRS) technical studies	Indicator to track small land developments (development component)	Qualitative	Study	55
Burkina Faso	Market garden perimeter area	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Area of soil and water conservation (SWC) / soil defence and restoration (SDR)	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Number of traditional ponds called 'boulis'	Indicator to track small land developments (development component)	Integer	Number	55
Burkina Faso	Number of pastoral boreholes	Indicator to track small land developments (development component)	Integer	Number	55
Burkina Faso	Assisted Natural Regeneration (ANR) and fertility management	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Land area reclaimed by mechanical and/or biological techniques	Indicator to track small land developments (development component)	Integer	Ha	55
Burkina Faso	Number of School Management Committees (SMCs) set up	Indicator to track small land developments (development component)	Integer	Number	55
Burkina Faso	Number of micro-irrigation kits (500 to 1000 m2)	Indicator to track small land developments (development component)	Integer	Number	55
Burkina Faso	Number of project implementation sites equipped with solar pumping	Indicator to track small land developments (development component)	Integer	Number	55
Burkina Faso	Number of village land commissions (VLC) set up	Indicator to track small land developments (land sector)	Integer	Number	55
Burkina Faso	Number of VLC training sessions	Indicator to track small land developments (land sector)	Integer	Number	55
Burkina Faso	Number of land agreements	Indicator to track small land developments (land sector)	Integer	Number	55
Burkina Faso	Land Support Guide	Indicator to track small land developments (land sector)	Qualitative	guide	55

Burkina Faso	Number of people trained in good sustainable land management practices	Indicator to track strengthening the offer of advisory support services	Integer	Number	55
Burkina Faso	Trained farmer-managers/advisory support staff	Indicator to track strengthening the offer of advisory support services	Integer	Number	55
Burkina Faso	Support fund micro-projects	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Qualitative	Yes/No	55
Burkina Faso	Area of lowlands benefiting from support fund inputs	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Ha	55
Burkina Faso	Market gardening areas benefiting from support fund inputs	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Ha	55
Burkina Faso	Area of SWC/SDR benefiting from support fund inputs	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Ha	55
Burkina Faso	Number of initial information/sensitization workshops	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Number	55
Burkina Faso	Number of video films produced and broadcast	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Number	55
Burkina Faso	Number of members of evaluation frameworks (Project Approval Committee [PAC] and [CPS]) trained in the evaluation of MPs	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Number	55
Burkina Faso	Regional Chambers of Agriculture (CRAs)-micro-project database (updating and maintenance)	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Qualitative	package	55
Burkina Faso	Number of trained endogenous writers	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Number	55
Burkina Faso	Support fund manual prepared or reviewed	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Qualitative	Yes/No	55
Burkina Faso	Number of capitalization studies on MPs	Indicator to track support for local initiatives for the development of agricultural production, livestock or enhancement of natural resources	Integer	Number	55
Burkina Faso	Number of Business Development Plan (BDPs) financed excluding bio-energy	Indicator to track investment funds (gef)	Integer	Number	55
Burkina Faso	Number of trained facilitators	Indicator to track investment funds (gef)	Integer	Number	55
Burkina Faso	Number of BDPs financed on bio-energy	Indicator to track investment funds (gef)	Integer	Number	55
Burkina Faso	Number of FTS sessions	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55

Burkina Faso	Number of FE sessions/centres	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55
Burkina Faso	Number of mobile libraries equipped	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55
Burkina Faso	Number of people with access to Information, Education, Communication (IEC)	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55
Burkina Faso	Number of "OR" development plans and action plans developed	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55
Burkina Faso	Number of "ORs" equipped and trained	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55
Burkina Faso	Number of "CVDs" trained	Indicator to track capacity building of target populations, rural organizations and local elected officers	Integer	Number	55
Burkina Faso	Number of computer workstations acquired for the benefit of CAs	Indicator to track institutional support to the Chambers of Agriculture (CA)	Integer	Number	55
Burkina Faso	Number of pick-ups (4x4) acquired for the benefit of CAs	Indicator to track institutional support to the Chambers of Agriculture (CA)	Integer	Number	55
Burkina Faso	Strengthening of CA human resources	Indicator to track institutional support to the Chambers of Agriculture (CA)			55
Burkina Faso	Number of people trained on climate change adaptation measures in the agricultural sector.	Indicator to track institutional support to the Chambers of Agriculture (CA)	Integer	Number	55
Burkina Faso	Number of computer workstations acquired for the benefit of Deconcentrated Technical Services (DTSs)	Indicator to track institutional support to regional department	Integer	Number	55
Burkina Faso	Number of motorcycles acquired for the benefit of DTSs	Indicator to track institutional support to regional department	Integer	Number	55
Burkina Faso	Number of pick-ups (4x4) acquired for the benefit of DTSs	Indicator to track institutional support to regional department	Integer	Number	55
Burkina Faso	Number of sub-catchment user associations set up	Indicator to track capacity building of multi-stakeholder frameworks (national and regional)	Integer	Number	55
Burkina Faso	Number of members of regional food security councils trained	Indicator to track capacity building of multi-stakeholder frameworks (national and regional)	Integer	Number	55
Burkina Faso	Number of political processes on climate issues to which the project contributed (national and international)	Indicator to track capacity building of multi-stakeholder frameworks (national and regional)	Integer	Number	55
Burkina Faso	Number of computer workstations acquired for the benefit of partner structures	Indicator to track capacity building of multi-stakeholder frameworks (national and regional)	Integer	Number	55
Burkina Faso	Number of direct beneficiaries (receiving services promoted by the project)		Integer	Number	55

Burundi	Integrated Approach Pilot (IAP) TT LD-4 (ii): Type of mechanisms, institutions, legal and regulatory frameworks	Indicator to track multi-stakeholder and multi-scale platforms operational in supporting policy, institutional and knowledge sharing mechanisms for scaling out of sustainable agriculture systems and integrated natural resources management approaches	Qualitative	Documents	10
Burundi	IAP TT LD-3 (ii): Application of INRM practices in the wider landscape	Indicator to track land area and agro-ecosystems under integrated natural resources/ landscape management and supported by FFS and sustainable value chains for increased production and sustainable livelihoods	Qualitative	Yes/No	10
Burundi	Extent of adoption of SLM/integrated landscape management practices	Indicator to track land area and agro-ecosystems under integrated natural resources/ landscape management and supported by FFS and sustainable value chains for increased production and sustainable livelihoods	Qualitative	Yes/No	10
Burundi	Percentage of farmers producing for market (disaggregated by gender)	Indicator to track land area and agro-ecosystems under integrated natural resources/ landscape management and supported by FFS and sustainable value chains for increased production and sustainable livelihoods	%	%	10
Burundi	Percentage of farmers with improved production (disaggregated by gender)	Indicator to track land area and agro-ecosystems under integrated natural resources/ landscape management and supported by FFS and sustainable value chains for increased production and sustainable livelihoods	%	%	10
Burundi	Metric tons of carbondioxide (CO_2) eq avoided	Indicator to track land area and agro-ecosystems under integrated natural resources/ landscape management and supported by FFS and sustainable value chains for increased production and sustainable livelihoods	Integer	Tons	10
Burundi	Staff in concerned institutions trained and applying tools and systems for monitoring GEBs, SLM/INRM and interlinked value chains and their impacts on food and livelihood security and ecosystem services. Targeted institutions: IGEBU, OBPE, MINAGRIE, MEEATU, universities	Indicator for the M&A framework in place and the capacity of relevant institutions built capacitated in carrying-out monitoring activities and communicating experiences and impacts for informed decision making.	Qualitative	Yes/No	10
Burundi	Farmers applying Participatory impact Monitoring tools	Indicator for the M&A framework in place and the capacity of relevant institutions built capacitated in carrying-out monitoring activities and communicating experiences and impacts for informed decision making.	Qualitative	Yes/No	10
Burundi	Communication Strategy in place (visibility and Communication for Development) Availability of project results and communication materials in country and shared with regional Hub	Indicator for the M&A framework in place and the capacity of relevant institutions built capacitated in carrying-out monitoring activities and communicating experiences and impacts for informed decision making.	Qualitative	Yes/No	10

Burundi	Number of project reports submitted in time	Indicator for the M&A framework in place and the capacity of relevant institutions built capacitated in carrying-out monitoring activities and communicating experiences and impacts for informed decision making.	Integer	Number	10
Eswatini	Number of Chiefdom Development Planning (CDPs) having a completion rate of 50% or more	Indicator to track effective planning and decision-making by the Project chiefdoms	Integer	Number	9
Eswatini	Number of effective advisory services programmes coordinated with the Community Development Committee (CDC) approach	Indicator to track effective planning and decision-making by the Project chiefdoms	Integer	Number	9
Eswatini	Number of external (non- Project) funding secured by the Chiefdoms for their CDPs	Indicator to track CDP process institutionalized in three of the four Regions	Integer	Number	9
Eswatini	Percentage of crop production from the command area of the dams (% increase, above baseline)	Indicators to track sustainable soil and water management for market-led smallholder agriculture in the Project chiefdoms	%	%	9
Eswatini	Number of groups effectively maintaining irrigation commands and erosion control areas	Indicators to track sustainable soil and water management for market-led smallholder agriculture in the Project chiefdoms	Integer	Number	9
Eswatini	Hectare of land with rehabilitated or restored ecosystem services (Risk Management Survey [RIMS] 1.1.17) including CA, erosion control and irrigation commands, managed rangelands and designated protected areas	Indicator to track sustainable land management	Integer	Ha	9
Eswatini	Number of smallholder household members supported in coping with the effect of climate change (RIMS 1.8.6) measured by number of households engaged in Component 2 activities*	Indicator to track sustainable land management	Integer	Number	9
Eswatini	Percentage of annual revenue from smallholder agriculture by year 6	Indicator to track smallholder producers' income derived from crop- and livestock products supplied to market partners	%	%	9
Eswatini	Percentage of households with increase production for household consumption	Indicator to track food deficit poor households who enhanced production for household consumption	%	%	9
Ethiopia	Number of new partnership mechanisms with funding for sustainable management solutions of natural resources, ecosystem services.	Indicator to track enhance long-term sustainability and resilience of the food production systems by addressing the environmental drivers of food insecurity in Ethiopia (PDO indicators)	Integer	Number	13
Ethiopia	Number of jobs and livelihoods created through management of natural resources, ecosystem services, disaggregated by sex,	Indicator to track enhance long-term sustainability and resilience of the food production systems by addressing the environmental drivers of food insecurity in Ethiopia (PDO indicators)	Integer	Number	13

Ethiopia	Number of direct project beneficiaries.	Indicator to track enhance long-term sustainability and resilience of the food production systems by addressing the environmental drivers of food insecurity in Ethiopia (PDO indicators)	Integer	Number	13
Ethiopia	Extent of land productivity project sites	Indicator to track enhance long-term sustainability and resilience of the food production systems by addressing the environmental drivers of food insecurity in Ethiopia (PDO indicators)	Integer	Ha	13
Ethiopia	Beneficiary HH's have reduced Food security risk (measured by standard FS methodology) compared to non-beneficiary households	Indicator to track enhance long-term sustainability and resilience of the food production systems by addressing the environmental drivers of food insecurity in Ethiopia (PDO indicators)	%	%	13
Ethiopia	Number of multi-stakeholder and multi-scale platforms in place to support integration of natural resources management in food production practices	Indicator to track the multi-stakeholder and multi-scale platforms in support of the integration of natural resources management in food production practices	Integer	Number	13
Ethiopia	Number of gender-responsive- & age-sensitive decision-support tools and participatory processes for INRM in food production practices in place	Indicator to track incentives mechanisms and infrastructures in place to support smallholder agriculture and sustainable food production at national and local levels	Integer	Number	13
Ethiopia	Number of incentive mechanisms and infrastructures in place at national and local level to support smallholder farmers for value chain development	Indicator to track incentives mechanisms and infrastructures in place to support smallholder agriculture and sustainable food production at national and local levels	Integer	Number	13
Ethiopia	Number of smallholder farmers (60% of whom should be women) benefiting from sustainable food value-chains	Indicator to track incentives mechanisms and infrastructures in place to support smallholder agriculture and sustainable food production at national and local levels	Integer	Number	13
Ethiopia	Extent of land area and Agro-ecosystems under Integrated Land Management	Indicator to track the land area and Agro-ecosystems under Integrated Land Management and supporting significant biodiversity and the goods and services this provides	Integer	Ha	13
Ethiopia	Amount of financial resources ($) invested in Integrated and Sustainable Land Management at woreda/ landscape level	Indicator to track the investment flows to INRM	Integer	$	13
Ethiopia	Integrated web-based and Geographic Information System (GIS) embedded information management system (IWB&GE-IMS) for ecosystem services monitoring developed and being functional by year 5	Indicator to track capacity and institutions in place to monitor and assess resilience, food security and GEBs (Global Environmental Benefits)	Qualitative	Yes/No	13
Ethiopia	Number of gender-responsive systems/ initiatives in place to monitor multi-scale ecosystem resilience, food security and GEBs at national and landscape levels sites	Indicator to track capacity and institutions in place to monitor and assess resilience, food security and GEBs (Global Environmental Benefits)	Integer	Number	13

Ghana	Land area where sustainable land and water management practices have been adopted as a result of the project	Indicator to track improved sustainable land and water management practices (PDO indicators)	Integer	Ha	18
Ghana	Land users adopting sustainable land management practices as a result of the project	Indicator to track improved sustainable land and water management practices (PDO indicators)	Integer	Number	18
Ghana	Management effectiveness according to the Management Effectiveness Tracking Tool score: Gbele Resource Reserve and Wuru Kayero, Wahabu Wiasi, Sumboru Bechausa and Gbele-Mole corridor sites	Indicator to track improved sustainable land and water management practices (PDO indicators)	Integer	Number	18
Ghana	Direct project beneficiaries	Indicator to track improved sustainable land and water management practices (PDO indicators)	Integer	Number	18
Ghana	Pre-feasibility studies conducted for new large-scale multi-purpose water storage investments	Indicator to track capacity building for integrated spatial planning	Integer	Number	18
Ghana	Integrated spatial development framework produced for Northern Savannah zone	Indicator to track capacity building for integrated spatial planning	Qualitative	Yes/No	18
Ghana	Communities with Community Watershed Development Plans consistent with the Watershed Development Planning Manual	Indicator to track land and water management	Integer	Number	18
Ghana	Demonstration plots established in target watersheds	Indicator to track land and water management	Integer	Number	18
Ghana	Targeted Community Resource Management Areas (CREMA) communities adopting management plans according to criteria defined in CREMA agreements	Indicator to track land and water management	Integer	Number	18
Ghana	A study on feasibility of sustaining SLWM activities through PES market mechanism	Indicator to track land and water management	Qualitative	Yes/No	18
Ghana	Area reforested [within target forest reserves]	Indicator to track land and water management	Integer	Ha	18
Ghana	Forest area brought under management plans	Indicator to track land and water management	Integer	Ha	18
Ghana	Community governance structures established, trained, and operational	Indicator to track land and water management	Integer	Number	18
Ghana	Forest users trained, including female	Indicator to track land and water management	Integer	Number	18
Ghana	Beneficiaries that feel project investments reflected their needs. Breakdown by gender (Male and Female) and unit of measurement is number	Indicator to track land and water management	Integer	Number	18
Ghana	New areas outside protected areas managed as biodiversity-friendly	Indicator to track land and water management	Integer	Ha	18
Ghana	Smallholder households supported in coping with the effects of climate change	Indicator to track land and water management	Integer	Number	18
Ghana	Project M&E system providing required reports and data in a timely manner	Indicator to track project management and coordination	Qualitative	Yes/No	18
Kenya	Water Fund (WF) operational	Indicator to track multi-stakeholder and multi-scale platform supports policy development, institutional reform and upscaling of INRM	Qualitative	Yes/No	11

Kenya	Relevant policies and strategies refer to the WF as an incentive model (Number of policies/strategies)	Indicator to track multi-stakeholder and multi-scale platform supports policy development, institutional reform and upscaling of INRM	Integer	Number	11
Kenya	WF provides incentives to smallholder farmers	Indicator to track policies and incentives to support climate smart smallholder agriculture and food value chains in financially viable and sustainable watershed stewardships	Qualitative	Yes/No	11
Kenya	Coordinated watershed management policies at county and federal levels (Number of CDP and strategies)	Indicator to track policies and incentives to support climate smart smallholder agriculture and food value chains in financially viable and sustainable watershed stewardships	Integer	Number	11
Kenya	Sustainable Land Management (SLM) implemented (RIMS 1.1.17)	Indicator to track change in land area, freshwater, and agro-ecosystems under INRM and SLM	Integer	Ha	11
Kenya	Area influenced to adopt SLM	Indicator to track change in land area, freshwater, and agro-ecosystems under INRM and SLM	Integer	Ha	11
Kenya	GHG emissions avoided and/or sequestered (RIMS 1.1.18) (tons CO_2 equivalent)	Indicator to track change in land area, freshwater, and agro-ecosystems under INRM and SLM	Integer	Tons	11
Kenya	Increased ability of people to manage environmental and climate-related risks (RIMS 2.6.5)	Indicator to track change in land area, freshwater, and agro-ecosystems under INRM and SLM	%	%	11
Kenya	Information sharing platforms established (County and National levels)	Indicator to track knowledge management and sharing of lessons learned	Integer	Number	11
Kenya	Inputs to meetings held at national, regional and international levels	Indicator to track knowledge management and sharing of lessons learned	Integer	Number	11
Kenya	Lessons learned outscaled to at least 2 other catchment areas in Kenya (No. Lessons learnt document and Feasibility studies)	Indicator to track knowledge management and sharing of lessons learned	Integer	Number	11
Malawi	Sub- Catchment Management Committee established		Integer	Number	18
Malawi	Village Natural Resources Committees established/Strengthened		Integer	Number	18
Malawi	Catchment Area Management Plans Developed		Integer	Number	18
Malawi	Community forest management plans for woodlots and forest conservation developed and adopted		Integer	Number	18
Malawi	Establishment/strengthening of village tree nurseries		Integer	Number	18
Malawi	Ha reforested and conserved		Integer	Ha	18
Malawi	Ha with natural regeneration of vegetation cover		Integer	Ha	18
Malawi	Non Timber Forest Products (NTFP) promoted		Integer	Number	18
Malawi	Training of lead farmers and follower farmers in SLM practices through FFS		Integer	Number	18
Malawi	Number of farmers adopting improved soil and water management practices and ha where they are applied		Integer	Number	18
Malawi	Households benefiting from improved chicken management and goats pass on system		Integer	Number	18

Malawi	Farmer groups trained in nutrition and resilience benefits of indigenous crops, seed selection and multiplication and operation of community seed selection and multiplication and operation of community seed banks		Integer	Number	18
Malawi	Village groups established and performing participatory variety selection		Integer	Number	18
Malawi	Community established and operating		Integer	Number	18
Malawi	Ha covered and Indigenous plant/crop/ animal varieties used per ha		Integer	Ha	18
Malawi	Farmers reach and using meteorological forecasts		Integer	Number	18
Malawi	Model for participatory Catchment land-use planning and management and application of SLM practices up-scaled in other catchments with PRIDE investment		Integer	Number	18
Malawi	Number of district and government staff trained by the project in Monitoring and Assessment of Ecosystem services		Integer	Number	18
Niger	Reclamation of degraded land in upstream watersheds (mechanical treatment)	Indicator for development of Watersheds	Integer	Ha	42
Niger	Treatment of watersheds against erosion and runoff	Indicator for development of Watersheds	Integer	Ha	42
Niger	Development of corridors and silvopastoral area	Indicator for development of Watersheds	Integer	Ha	42
Niger	Preparation of live hedges	Indicator for development of Watersheds	Integer	Ha	42
Niger	Dune fixation (ponds and basins)	Indicator for development of Watersheds	Integer	Ha	42
Niger	Promotion of assisted natural regeneration	Indicator for development of Watersheds	Integer	Ha	42
Niger	Feasibility studies for the development of ponds	Indicator for water mobilization infrastructure	Qualitative	Yes/No	42
Niger	Monitoring of pond development works	Indicator for water mobilization infrastructure	Qualitative	Yes/No	42
Niger	Carry out pond development works	Indicator for water mobilization infrastructure	Qualitative	Yes/No	42
Niger	Support for the High Commission for the 3N Initiative (HC3N) database collection and intelligence system	Indicator for water mobilization infrastructure	Qualitative	Yes/No	42
Niger	Establishment and operationalization of an environmental information exchange platform	Indicator for water mobilization infrastructure	Qualitative	Yes/No	42
Niger	Supporting Documentation Centers	Indicator for water mobilization infrastructure	Qualitative	Yes/No	42
Niger	Microprojects of binomial irrigation around ponds	Indicator for the development of production basins	Integer	Number	42
Niger	Microprojects of binomial irrigation in dams	Indicator for the development of production basins	Integer	Number	42
Niger	Microprojects of binomial irrigation linked to the new production basins	Indicator for the development of production basins	Integer	Number	42
Niger	Hydro-agricultural development work downstream of the mini-dams	Indicator for water mobilization infrastructure	Integer	Ha	42
Niger	Mini-dams constructed	Indicator for water mobilization infrastructure	Integer	Number	42
Niger	Small community perimeters				42
Niger	Standard Type 1 spreading weirs built	Indicator for water mobilization infrastructure	Integer	Number	42
Niger	Standard Type 2 spreading weirs built	Indicator for water mobilization infrastructure	Integer	Number	42

Niger	Development of ponds	Indicator for water mobilization infrastructure	Integer	Number	42
Niger	Farmer Field Schools	Indicator for adaptation of rain-fed agriculture to climate change	Integer	Number	42
Niger	Implementation of farmers' agricultural advisory support	Indicator for adaptation of rain-fed agriculture to climate change	Integer	Number	42
Niger	Farmer Field Schools market gardeners	Indicator for the improvement of small-scale irrigation	Integer	Number	42
Niger	Demonstrations of farmers'/peasants' initiatives in animal husbandry	Indicator for small livestock and poultry improvement	Integer	Number	42
Niger	Granting animal kits (goats)	Indicator for small livestock and poultry improvement	Integer	Number	42
Niger	Granting animal kits (poultry)	Indicator for small livestock and poultry improvement	Integer	Number	42
Niger	Vaccination against Newcastle disease	Indicator for small livestock and poultry improvement	Integer	Campaigns	42
Niger	Implementation of Women's Welding Granary/Cereal Bank	Indicator for female leadership and improved nutrition security	Integer	Granary	42
Niger	Granting agricultural-seed-fertilizer kits to the most vulnerable households	Indicator for female leadership and improved nutrition security	Integer	Number	42
Niger	Setting up gardens hut		Integer	Gardens	42
Niger	Promotion of Income - Generating Activities (women and youth)	Indicator for female leadership and improved nutrition security	Integer	Number	42
Niger	Women/youth literacy centres	Indicator for female leadership and improved nutrition security	Integer	Number	42
Niger	Satellite collection centres built	Indicator for trade Infrastructure Development	Integer	Number	42
Niger	Semi-wholesale markets	Indicator for trade Infrastructure Development	Integer	Number	42
Niger	Marketing platforms built	Indicator for trade Infrastructure Development	Integer	Number	42
Niger	Farmers' houses	Indicator for trade Infrastructure Development	Integer	Number	42
Niger	Runway/track construction work	Indicator for construction of rural roads	Integer	Km	42
Niger	Runway rehabilitation works	Indicator for construction of rural roads	Integer	Km	42
Niger	Strengthening promoters and small and medium-sized enterprises	Indicator for Promotion of commercial activities	Integer	Number	42
Niger	Capacity Building of Financial Institutions	Indicator for capacity building	Integer	Number	42
Niger	Support for the establishment of local technical units and corridors	Indicator for regional trade integration	Integer	Number	42
Nigeria	Number of additional people (smallholder farmers) benefiting from strengthened livelihoods through solutions for management of natural resources, ecosystems services, chemicals and waste	Indicator to track PDO	Integer	Number	12
Nigeria	Number of jobs and improved livelihoods created through management of natural resources, ecosystem services, chemicals and waste, dis-aggregated by sex, and rural and urban	Indicator to track PDO	Integer	Number	12

Nigeria	Number of smallholder farmers practicing climate resilient sustainable agriculture and with increased access to food and improved nutrition dis-aggregated by sex.	Indicator to track PDO	Integer	Number	12
Nigeria	Number of supportive policies and incentives in place at the Federal and State levels to support sustainable smallholder agriculture and food value chains	Indicator to track supportive policies, governance structures and incentives in place at Federal and State levels to support sustainability and resilience of smallholder agriculture and food value chains	Integer	Number	12
Nigeria	Number of gender-sensitive and inclusive multi-stakeholder platforms established at Federal and State and local levels supporting sustainable agriculture	Indicator to track supportive policies, governance structures and incentives in place at Federal and State levels to support sustainability and resilience of smallholder agriculture and food value chains	Integer	Number	12
Nigeria	Number of public- private partnerships (PPPs) established for food commodity value chains, particularly cassava, maize, rice and sorghum that will give a major boost to food processing, production and distribution, enhance national food self-sufficiency and food security, as well as create employment and improve the well-being of smallholder farmers.	Indicator to track supportive policies, governance structures and incentives in place at Federal and State levels to support sustainability and resilience of smallholder agriculture and food value chains	Integer	Ha	12
Nigeria	Number of hectares of land under gender-sensitive integrated sustainable land and water management and climate smart agricultural practices, managed by both men and women	Indicator to track land area and agro-ecosystems under sustainable agricultural practices	Integer	Ha	12
Nigeria	Percentage reduction in soil erosion and increase in vegetation cover and carbon stored in target farmers' plots	Indicator to track land area and agro-ecosystems under sustainable agricultural practices	%	%	12
Nigeria	Percentage increase in total production of targeted value chains among participating small-and medium-scale commercial farmers (disaggregated by rice, cassava, maize, sorghum, yam, fruit trees, poultry, aquaculture and dairy and maize)	Indicator to track land area and agro-ecosystems under sustainable agricultural practices	%	%	12
Nigeria	Number and percentage of women and youth who adopt new production and post-harvest technologies for rice and groundnut	Indicator to track youth involvement and reduced gender disparities in agricultural production for enhanced food security	Integer/%	Number/%	12
Nigeria	Number of women and youth actively involved in food production and value chains for rice and groundnut	Indicator to track youth involvement and reduced gender disparities in agricultural production for enhanced food security	Integer	Number	12
Nigeria	Level of gender-dis-aggregated data on resilience and global environmental benefits of sustainable agriculture for food security	Indicator to track harmonized M&E framework in place for food security information, multi-scale assessment of sustainability and resilience in production agro-ecological zones and landscapes and monitoring of global environmental benefits (GEBs)	Integer	Number	12
Senegal	Number of mechanisms for consultation and integration of best practices promoted - National Strategic Investment Framework for Sustainable Land Management (NSIF-SLM) and National Agro-	Indicator to track support for multi-stakeholder platforms	Integer	Number	28

	sylvo-pastoral Development Fund (FNDASP)				
Senegal	Number of regional and local awareness workshops	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Number of people sensitized (disaggregated by gender and age)	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Number of training sessions (20 on good agricultural practices, six on cereal processing, two on dairy processing)	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Number of beneficiaries (disaggregated by sex and age)	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Resource mobilization strategy for SLM (CSI and FNDASP)	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Number of knowledge products produced and shared at Regional Hub platform	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Number of participants in workshops and exchange visits (disaggregated by gender and age)	Indicator to track support for multi-stakeholder platforms	Integer	Number	28
Senegal	Number of agricultural sectors integrating a resilient approach	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Number of m3 of water storage capacity created	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Number of ponds rehabilitated	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Number of ha of degraded land rehabilitated	Indicator to track scaling up sustainable and resilient good practices	Integer	Ha	28
Senegal	Number of hectares of land reclaimed with anti-salt barriers	Indicator to track scaling up sustainable and resilient good practices	Integer	Ha	28
Senegal	Number of ha of exposed land treated in SWC/SDR	Indicator to track scaling up sustainable and resilient good practices	Integer	Ha	28
Senegal	Number of ha of mangrove restored	Indicator to track scaling up sustainable and resilient good practices	Integer	Ha	28
Senegal	Quantity of CO_2-eq stored	Indicator to track scaling up sustainable and resilient good practices	Integer	Tons	28
Senegal	Number of solar pumping systems installed	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Number of biomethanation units installed	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Number of solar cooling units installed	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Quantity of CO_2-eq reduced (by solar pumping and biomethanation)	Indicator to track scaling up sustainable and resilient good practices	Integer	Tons	28
Senegal	Number of beneficiaries trained in the use of recovery and conservation equipment	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28
Senegal	Number of pilot projects for the valorization of agricultural and livestock products	Indicator to track scaling up sustainable and resilient good practices	Integer	Number	28

Senegal	Operational environmental impact monitoring and evaluation system	Indicator to monitor and evaluate the environmental impact and results of the project	Qualitative	Yes/No	28
Senegal	Number of users of the environmental impact monitoring and evaluation system	Indicator to monitor and evaluate the environmental impact and results of the project	Integer	Number	28
Senegal	Number of strategic tools based on data from the environmental monitoring system	Indicator to monitor and evaluate the environmental impact and results of the project	Integer	Number	28
Senegal	Percentage points increase in food and nutrition security level	Indicator to track PDO	%	%	28
Senegal	Percentage point reduction in land degradation prevalence	Indicator to track PDO	%	%	28
Senegal	Percentage of targeted households with increased resilience to climate variability and change (using household resilience scorecard)	Indicator to track PDO	%	%	28
Tanzania	Number of functioning inter-village NRM committees supported (to be disaggregated by percentage of women in leadership positions)	Indicator for institutional capacity building for sustainable land management and biodiversity conservation at landscape level	Integer	Number	21
Tanzania	Number of district staff, village staff and community members trained (% women, % youth)	Indicator for institutional capacity building for sustainable land management and biodiversity conservation at landscape level	Integer/%	Number/%	21
Tanzania	Number of land use plans adopted at village and landscape levels	Indicator for institutional capacity building for sustainable land management and biodiversity conservation at landscape level	Integer	Number	21
Tanzania	Number of households reporting an increase in production (disaggregated by sex of the head of the household)	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21
Tanzania	Number of tons of greenhouse gas emissions (CO_2) avoided and/or sequestered	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	tons	21
Tanzania	Number of persons trained in production practices and/or technologies	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21
Tanzania	Number of farmers adopting conservation and climate smart farming and SLM practices disaggregated by gender and age	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21
Tanzania	Number of groups operating tree nurseries and practicing woodland management (% women and %youth participating).	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer/%	Number/%	21
Tanzania	Number of ha of rangeland and crop land under conservation and climate smart farming and sustainable management	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Ha	21
Tanzania	Number of ha woodlands, rangeland, and degraded land reforested or afforested	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Ha	21
Tanzania	Number of persons/households reporting reduced water shortage vis-à-vis production needs	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21

Tanzania	Number of groups practicing rangeland rehabilitation and management (% women and %youth participating	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer/%	Number/%	21
Tanzania	Number of hectares covered with management practices integrating biodiversity conservation	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Ha	21
Tanzania	Number of households reporting an increase in their income per season from produce supported by the project	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21
Tanzania	Number of supported rural producers that are members of a rural organization (to be disaggregated by sex) OR Number of supported rural producers' organization members reporting new or improved services provided by their organization (to be disaggregated by sex)	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21
Tanzania	Number of youth participating in producer groups and income generating activities	Indicator to track up-scaling of sustainable and climate-smart agriculture, land, water and pastoral management systems	Integer	Number	21
Tanzania	Number of districts adopting global environmental and resilience benefit assessment tools (Exact, LDSF, Resilience scorecard) and protocols and using the information for policy and programme design	Indicator for monitoring and assessment	Integer	Number	21
Tanzania	Number of people at village and District levels trained in assessment tools (disaggregated by gender and age)	Indicator for monitoring and assessment	Integer	Number	21
Tanzania	Number of assessments conducted and results used by inter-village committees	Indicator for monitoring and assessment	Integer	Number	21
Tanzania	Number of knowledge products	Indicator for monitoring and assessment	Integer	Number	21
Tanzania	Number of regional programme meetings attended by the project coordination unit and district facilitators	Indicator for monitoring and assessment	Integer	Number	21
Uganda	Increase in intra and inter-seasonal livestock and crop productivity arising from SLM and INRM practices	Indicator to track contribution of the project in enhancing long-term environmental sustainability and resilience of food production systems in the Karamoja Sub-Region (PDO)	Integer	Number	13
Uganda	Percentage of households suffering from hunger in Karamoja	Indicator to track contribution of the project in improving food security by addressing the environmental drivers of food insecurity and their root causes in Karamoja sub-region (PDO)	%	%	13
Uganda	Number of supportive policies and incentives in place at district level to support viable SLM/INRM approaches	Indicator to track supportive policies and incentives in place at district level to support improved crop and livestock production, food value-chains and INRM	Integer	Number	13

Uganda	Number of multi-stakeholder platforms established supporting INRM per district, within which a percentage of women, men, youth, and indigenous people are represented	Indicator to track supportive policies and incentives in place at district level to support improved crop and livestock production, food value-chains and INRM	Integer	Number	13
Uganda	Number of legal instruments, policies, by-laws applied in Karamoja sub-region enabling INRM, land use planning and enforcement	Indicator to track supportive policies and incentives in place at district level to support improved crop and livestock production, food value-chains and INRM	Integer	Number	13
Uganda	Number of hectares of cropland/rangeland/forest under integrated natural resources management and SLM per district Increase in crop yields by farmer records; Increase in water availability through biophysical monitoring	Indicator to track land area under integrated natural resources management (INRM) and SLM practices for a more productive Karamoja landscape	Integer	Ha	13
Uganda	Number of people trained on INRM, among which a percentage are women	Indicator to track land area under integrated natural resources management (INRM) and SLM practices for a more productive Karamoja landscape	Integer	Number	13
Uganda	Number of community members trained in INRM and SLM practices, 60% of which are women	Indicator to track land area under integrated natural resources management (INRM) and SLM practices for a more productive Karamoja landscape	Integer	Number	13
Uganda	Number of people participating in alternative livelihoods schemes addressing SLM/INRM in the broader Karamoja landscape, 60% of which are women Increase in household incomes measured by household surveys	Indicator to track land area under integrated natural resources management (INRM) and SLM practices for a more productive Karamoja landscape	Integer	Number	13
Uganda	Number of Civil Society practising SLM / INRM issues in Karamoja through the Small Grants Program	Indicator to track land area under integrated natural resources management (INRM) and SLM practices for a more productive Karamoja landscape	Integer	Number	13
Uganda	Number of monitoring and assessment exercises conducted during the project, within multi-stakeholder platform	Indicator to track framework in place for multi-scale assessment, monitoring and integration of resilience in production landscape and monitoring of GEBs output	Integer	Number	13
Uganda	Number of workshops held at regional level on monitoring resilience within multi-stakeholder platforms (created in Component 1)	Indicator to track framework in place for multi-scale assessment, monitoring and integration of resilience in production landscape and monitoring of GEBs output	Integer	Number	13
Uganda	Number of knowledge products produced and shared at Regional Hub platform	Indicator to track framework in place for multi-scale assessment, monitoring and integration of resilience in production landscape and monitoring of GEBs output	Integer	Number	13

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6 Appendix

Table 13: GEF 7 Indicators

Indicator	Name	Data Required
Core Indicator 1	**Terrestrial protected areas created or under improved management for conservation and sustainable use**	- sum of Hectares indicators 1.1 & 1.2 expected versus achieved
Indicator 1.1	Terrestrial protected areas newly created	- Hectares (expected versus achieved) - World Database on Protected Areas (WDPA) ID - UNIC Category
Indicator 1.2	Terrestrial protected areas under improved management effectiveness	- Name of protected area - Hectares - World Database on Protected Areas (WDPA) ID - UNIC Category - Management Effectiveness Tracking Tool (METT) Score (Baseline vs achieved)
Core Indicator 2	**Marine protected areas created or under improved management for conservation and sustainable use**	- sum of Hectares indicators 2.1 & 2.2 (expected versus achieved)
Indicator 2.1	Marine protected areas newly created	- Hectares (expected versus achieved) - World Database on Protected Areas (WDPA) ID - UNIC Category
Indicator 2.2	Marine protected areas under improved management effectiveness	- Name of protected area - Hectares - World Database on Protected Areas (WDPA) ID - UNIC Category - Management Effectiveness Tracking Tool (METT) Score (Baseline vs achieved)
Core Indicator 3	**Area of land restored**	- sum of Hectares indicators 3.1, 3.2, 3.3, 3.4
Indicator 3.1	Area of degraded agricultural land restored	- Hectares (expected vs achieved)
Indicator 3.2	Area of forest and forest land restored	- Hectares (expected vs achieved)
Indicator 3.3	Area of natural grass and shrublands restored	- Hectares (expected vs achieved)
Indicator 3.4	Area of wetlands (including estuaries, mangroves) restored	- Hectares (expected vs achieved)
Core Indicator 4	**Area of landscapes under improved practices (hectares; excluding protected areas)**	- Sum of Hectares indicators 4.1, 4.2, 4.3, 4.4 (expected vs achieved)
Indicator 4.1	Area of landscapes under improved management to benefit biodiversity	- Hectares (expected vs achieved)
Indicator 4.2	Area of landscapes that meet national or international third-party certification that incorporates biodiversity considerations	- Hectares (expected vs achieved)
Indicator 4.3	Area of landscapes under sustainable land management in production systems	- Hectares (expected vs achieved)
Indicator 4.4	Area of High Conservation Value Forest (HCVF) loss avoided	- Hectares (expected vs achieved)
Core Indicator 5	**Area of marine habitat under improved practices to benefit biodiversity**	- Hectares
Indicator 5.1	Number of fisheries that meet national or international third-party certification that incorporates biodiversity considerations	- Number of third party certification/s (expected vs achieved)
Indicator 5.2	Number of large marine ecosystems (LMEs) with reduced pollution and hypoxial	- Number (expected vs achieved)
Indicator 5.3	Amount of Marine Litter Avoided	- Metric tons (expected versus achieved)
Core Indicator 6	**Greenhouse gas emission mitigated**	- sum of expected Metric tons of CO_2e from indicator 6.1 + 6.2 (direct and indirect)
Indicator 6.1	Carbon sequestered or emissions avoided in the AFOLU sector	- Expected Metric tons of CO_2e from direct and indirect - anticipated start year of accounting - duration of accounting

Indicator 6.2	Emissions avoided Outside AFOLU	- Expected vs achieved metric tons of CO_2e from direct and indirect - anticipated start year of accounting - duration of accounting
Indicator 6.3	Energy saved	- Megajoules (expected vs achieved)
Indicator 6.4	Increase in installed renewable energy capacity per technology	- Megawatts per new technology (expected vs achieved)
Core Indicator 7	**Number of shared water ecosystems (fresh or marine) under new or improved cooperative management**	- Number
Indicator 7.1	Level of Transboundary Diagnostic Analysis and Strategic Action Program (TDA/SAP) formulation and implementation	- each shared water ecosystem rated on scale 1 - 4
Indicator 7.2	Level of Regional Legal Agreements and Regional Management Institutions to support its implementation	- each shared water ecosystem rated on scale 1 - 4
Indicator 7.3	Level of National/Local reforms and active participation of Inter-Ministerial Committees	- each shared water ecosystem rated on scale 1 - 4
Indicator 7.4	Level of engagement in IWLEARN through participation and delivery of key products	- each shared water ecosystem rated on scale 1 - 4
Core Indicator 8	**Globally over-exploited fisheries Moved to more sustainable levels**	- Metric tons of each fishery
Core Indicator 9	**Reduction, disposal/destruction, phase out, elimination and avoidance of chemicals of global concern and their waste in the environment and in processes, materials and products**	- Sum of metric tons of indicators 9.1 + 9.2 + 9.3 + 9.4 (expected vs achieved)
Indicator 9.1	Solid and liquid Persistent Organic Pollutants (POPs) removed or disposed (POPs type)	- Type of POP/s and their respective metric tons (expected vs achieved)
Indicator 9.2	Quantity of mercury reduced	- Metric tons (expected vs achieved)
Indicator 9.3	Hydrochloroflurocarbons (HCFC) Reduced/Phased out	- Metric tons (expected vs achieved)
Indicator 9.4	Number of countries with legislation and policy implemented to control chemicals and waste	- Number of countries (expected vs achieved)
Indicator 9.5	Number of low-chemical/non-chemical systems implemented particularly in food production, manufacturing and cities	- Name each technology - sum of total number of technology/ies (expected vs achieved)
Indicator 9.6	Quantity of POPs/Mercury containing materials and products directly avoided	- Metric tons (expected and achieved) - grams of toxic equivalent gTEQ
Core Indicator 10	**Reduction, avoidance of emissions of POPs to air from point and non-point sources**	- grams of toxic equivalent gTEQ
Indicator 10.1	Number of countries with legislation and policy implemented to control emissions of POPs to air	- Hectares (expected vs achieved)
Indicator 10.2	Number of emission control technologies/practices implemented	- Hectares (expected vs achieved)
Core Indicator 11	**Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment**	- Number (expected vs achieved) of females and males

Table 14: Application of the Tools/methods used by RFS projects

Tool/method used	Further Details
Biological Condition Gradient (BCG)	Developed to continuously monitor and map the impacts of project activities on aquatic and terrestrial biodiversity
Calorie proxy/Food stock stability (CP)	Used to measure food availability
Chiefdom Development Plan Monitoring Tool	
Collect Earth (Data collection and analysis tool)	Used to develop land use system and for impact analysis
	Used to map-out and monitor changes in different land-use types
Computer assisted personal interviewing (CAPI) technique	Used for data collection
Conservation and Nutrition Monitoring Tool	
Dam Assessment and Identification of potential irrigation schemes Tool	
Dimensional Resilience Score (DRS)	Used to measure resilient food secured household
District Health Information System (DHIS)	A platform used for data collection, validation, and analysis
Diversity Assessment Tool for Agrobiodiversity and Resilience (DATAR) (Data collection tool and framework)	Used for impact analysis
Eswatini Water and Agriculture Development (ESWADE) Project Management Information System	
EX-Ante Carbon-balance Tool (EX-ACT) (Data collection tool and framework)	Used for the assessment of carbon footprint
Farm Specific Action Plan	Used for collecting routine monitoring data for beneficiaries
Food Consumption Score (FCS)	Used to measure food utilisation
	Used to measure the level of food insecurity
Food Stability Index (FSI)	used to measure food stability
Geographic Information System (GIS) (Data collection and analysis tool)	Used to provide spatial information
	Used to produce transition maps
Global Forest Watch (GFW)	Used for monitoring
Global Positioning System (GPS)	Used to assess the actual size of an area
	Used to geo-reference all the project activity sites including households reached and installed technologies such as water pans, biogas units, and drip kits
	Used in combination with Geographic Information System (GIS) tools used to prepare maps and spatial aids for extension teams and other stakeholders
Household Baseline Assessment Tool (HH-BAT) (Data collection and analysis tool)	Used to measure level of resilience
Household Dietary Diversity Score (HDDS)	Used to measure food utilisation
Household Food Security Index	Composite index– comprises of CP, HHSAI, FCS, HDDS, and FSI
Household Hunger Scale Accessibility Index (HHSAI)	Used to measure food access
Household Resilience Scorecard	Used to measure percentage of targeted households with increased resilience to climate variability and change
Land and Water Inventory	
Land Degradation Assessment in Drylands (LADA) and the World Overview of Conservation Approaches and Technologies (WOCAT) (LADA-WOCAT) (Data collection tool and framework)	Used to collect and document SLM good practices.
Land Degradation Surveillance Framework (LDSF) (Data collection tool and framework)	Used to provide a biophysical baseline at landscape level
	Used to monitor and evaluate the extent of land degradation, ecosystem health, and the effectiveness of rehabilitation measures over time
	Used to assess the number of watersheds
Management Effectiveness Tracking tool (MET) (Data collection tool)	Used to determine expanded area under improved sustainable land and water management in selected watersheds
	Used to conduct the baseline survey
	Used to measure project outcomes and impacts on community livelihoods
	Used to measure fundamental dimensions of rural poverty at household and village level
Normalized Difference Vegetation Index (NDVI)	Used to measure the extent of land productivity
	Used to determine vegetation cover
Open Data Kit (ODK)	For data collection
Resilience, Adaptation Pathways and Transformation Approach (RAPTA) (Framework)	Used for project design
	Used to measure the level of resilience
Results and Impact Management System (RIMS)	Data collection and analysis

River Gauging Stations (RGS)	Used to monitor both water quality and quantity
Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP) (Data collection and analysis tool)	Used to establish basic indicators of resilience, strengths and weaknesses of the households.
Short Message Service (SMS) Mobile platform	Used for messaging, polling, and tracking materials distribution, including targeted surveys on tree survival rates
Vital Signs monitoring framework (Data collection and analysis tool)	Used to monitor and assess food and nutrition security in project communities.
	Used to measure level of resilience
Women Empowerment in Agriculture Index (WEAI) (Data collection tool)	Used to assess women empowerment across 5 domains, namely: production, resources, income, leadership and time use