

# Enhancing Food Security in a Changing Climate in Africa<sup>1</sup>



*Improved feeding trough in Mongu, Western Zambia © Theworldfishcenter*

## KEY MESSAGES

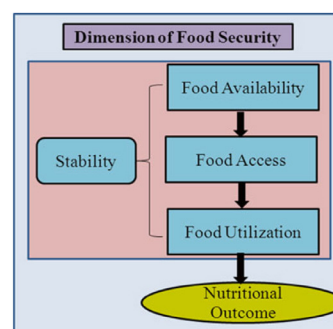
- 1. Climate and socio-ecological change scenarios are invaluable tools in developing appropriate response options for ensuring food security and human wellbeing in the future: evidence-based approach.**
- 2. Climate change necessitates research on crops, livestock and systems that are resilient to variability and extreme events.**
- 3. Prioritize and mainstream food security and nutrition issues into regional and national climate change adaptation and mitigation programmes and initiatives.**
- 4. Opportunities exist for the development of climate-proof and resilient food systems across Africa through technology diffusion, agronomic practices and innovations that can be optimized and scaled up.**

## Introduction

The current food system supports the livelihoods of majority of African people. Agriculture as an economic activity generates between 3% and 45% of national gross domestic product (GDP) in many African countries, with a continental average of about 30% in 2017. Even though the global food supply per capita has increased more than 30% since the beginning of 1960s, accompanied by greater use of nitrogen fertilizer, improved seeds and water resources for irrigation, the success in Africa lags far behind the global average largely impacted by climate variability and change.

Climate change has direct impacts on food systems, and thus to food security and nutrition, and so demands for deployment of land-based technologies, among others. The food system approach adopted in the Intergovernmental Panel on Climate Change (IPCC) Special Report on Climate Change and Land (SRCL) addresses how climate change affects food security including nutrition, the options for the food system to adapt and mitigate, synergies and trade-offs among these options, and enabling conditions for their adoption. Some measures that are intended to achieve climate mitigation and adaptation, combat desertification and land degradation and enhance food security risk are creating more pressures on land.

According to FAO, food security is a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Climate change is projected to negatively impact the four pillars of food security – availability, access, utilization and stability – and their interactions.



<sup>1</sup>Based on Chapter 5 of the IPCC Special Report on Climate Change, Desertification, Land degradation, Sustainable Land Management, Food Security and Greenhouse gas fluxes in Terrestrial Ecosystems, 2019.

Food is predominantly produced on land, with, on average, 83% of the 697 kg of food consumed per person per year, 93% of the 2884 kcal per day, and 80% of the 81 g of protein eaten per day coming from terrestrial production. Thus, it is not surprising to see that almost all African countries have included mechanism to safeguard the food production system into the nationally determined contributions (NDCs) in accordance with the provisions of Article 4 of the Paris Agreement on Climate Change.

Empowering and valuing women increases their capacity to improve food security in a changing climate and substantially improve the wellbeing of themselves, their families and their communities. Women empowerment includes economic, social and institutional arrangements and may include targeting men in integrated agriculture programmes to change gender norms and improve nutrition. Empowerment through collective action in the near term has the potential to equalise relationships on the local, national and global scale. Empowered women are crucial to creating effective synergies among adaptation, mitigation and food security.

### Impacts of climate change on food systems and Adaptation options

There are many routes by which climate change can impact food security and thus human health. One major route is via climate change affecting the amount of food, both from direct impacts on yields and indirect effects through climate change impacts on water availability and quality, pests and diseases, and pollination services. Another route is via changing CO<sub>2</sub> in the atmosphere, affecting biomass and nutritional quality. Food safety risks during transport and storage can also be exacerbated by changing climate.

Climate drivers relevant to food production and availability may be categorized as modal climate changes, seasonal changes, extreme events, and atmospheric conditions. Potential changes in major modes of climate variability can also have widespread impacts such as occurred during late 2015 to early 2016 when a strong El Niño contributed to regional shifts in precipitation in the Eastern and Southern Africa and the Sahel region. Significant drought across the continent

resulted in widespread crop failure and more than 60 million people required food aid in these regions.

In recent years, yields of staple crops such as maize, wheat, sorghum, and fruit crops have decreased across Africa, widening food insecurity gaps. In Nigeria, there have been reports of climate change having impacts on the livelihoods of arable crop farmers. The Sahel region of Cameroon has experienced an increasing level of malnutrition, partly due to the impact of climate change since harsh climatic conditions leading to extreme drought have a negative influence on agriculture. Furthermore, pastoralism which is a predominant livelihood mainly in drylands of Africa is impacted by climate change through decreasing pasture productivity, lower animal growth rates and productivity, damaged reproductive functions, increased pests and diseases, and loss of biodiversity.

Smallholder farming systems have been recognized as highly vulnerable to climate change because they are highly dependent on agriculture and livestock for their livelihood. For example, in Zimbabwe, farmers were found vulnerable due to their marginal location, low levels of technology, and lack of other essential farming resources. Farmers observed high frequency and severity of drought, excessive precipitation, drying up of rivers, dams and wells, and changes in timing and pattern of seasons as evidence of climate change, and indicated that prolonged wet, hot, and dry weather conditions resulted in crop damage, death of livestock, soil erosion, bush fires, poor plant germination, pests, lower incomes, and deterioration of infrastructure. In Madagascar, smallholder farmers were found to be exposed to chronic food insecurity due to the vulnerability of their agricultural system to any shocks, particularly extreme events.



The East Africa drought caused the death of many animals in the horn of Africa. (©2017 World Vision/photo by Jon Warren)

Even though it is possible to reduce or even avoid some of the negative impacts of climate change on food security by formulating effective adaptation strategies, if unabated climate change continues, limits to adaptation will be reached. In the food system, adaptation actions involve any activities designed to reduce vulnerability and enhance resilience of the system to climate change and such measures can be autonomous, incremental or transformative.

Autonomous adaptation in food systems does not constitute a conscious response to climatic stimuli but is triggered by changes in agroecosystems, markets, or welfare changes. It is also referred to as spontaneous adaptation. While incremental adaptation maintains the essence and integrity of a system or process at a given scale and focuses on improvements to existing resources and management practices, transformational adaptation changes the fundamental attributes of a socio-ecological system either in anticipation of or in response to climate change and its impacts.

Given the site-specific nature of climate change impacts on food system components together with wide variation in agroecosystems types and management, and socio-economic conditions, it is widely understood that adaptation strategies are linked to environmental and cultural contexts at the regional and local levels. Developing systemic resilience that integrates climate drivers with social and economic drivers would reduce the impact on food security in African countries. That is, improving food security in Africa requires evolving food systems to be highly climate resilient, while supporting the need for increasing yield to feed the growing population.

### Impacts of food systems on climate change and Mitigation options

Food systems contribute to greenhouse gas (GHG) emissions within and beyond the farm gate. Both crops and livestock production systems contribute to agricultural GHG emissions and there is also diet or food related emissions. It is widely acknowledged that animal-based foods are associated with higher environmental impact as compared to plant-based foods. However, there is uncertainty of estimations of food systems emissions beyond the farm gate due to lack of sufficient studies.

Total contribution of input, processing, storage and transport combined is not well documented. Overall, food systems emissions beyond the farm gate, such as those upstream from manufacturing of e.g. inputs (fertilisers, pesticides and feed production), or downstream such as food processing, storage, refrigeration, transport and retail, food consumption and waste disposal, contribute to emissions from agriculture and land use, but their estimation is very uncertain due to lack of sufficient studies.

Emissions from aquaculture and fisheries are estimated at 10% of the total agriculture emissions, or about 0.58 Gt CO<sub>2</sub>-eq yr<sup>-1</sup>. Two-thirds are non-CO<sub>2</sub> emissions from aquaculture and the rest due to fuel use in fishing vessels. However, these estimates were not included in the IPCC special report specifically under agriculture emissions, because they are not included in national GHG inventories and global numbers are small as well as uncertain.

Methodologies to measure aquaculture emissions are still being developed. In recognition of diet or food related emissions, the report highlights that dietary shifts significantly reduce GHG emissions. However, the scientific literature assessing the link between food products and emission has a focus on high-income countries (a gap that needs to be explored in low-income countries). For example, using evidence from the US, the IPCC special report highlights that animal-based foods are associated with higher environmental impact as compared to plant-based foods hence as a demand-side adaptation, recommends dietary shifts - reduction of (red) meat consumption and increase proportions of plant based foods in diets.



Fish ponds in Mungoye Village, Vihiga. Photo: <https://www.cabe-africa.org>

<sup>2</sup>Adaptation in the demand side of the food system involves consumption practices, diets, and reducing food loss and waste

There is recognition of vast opportunity for mitigation in grassland, rangelands and croplands, principally through both the supply and the demand side mitigation pathways. The supply side includes opportunities to reduce greenhouse gas emission in crop production, livestock production, aquaculture and beyond the farm gate. The demand side includes changes in diet, reduction in food loss and waste, changes in wood consumption during food preparation. Other recommendations involve land use changes including fertilizer management and land restoration as well as the consumption of locally produced foods.

### Mitigation, Adaptation, Food Security, and Land Use – Synergies, Trade-Offs, and Co-Benefits

There are numerous identified options for addressing mitigation and adaptation with emphasis on climate resilient and nutrition sensitive agriculture. There is an emphasis on integrated approach including conservation agriculture, climate smart agriculture, agro-ecology and urban agriculture. It is widely acknowledged that mixed farming systems integrating livestock, crops, fisheries and agroforestry could maintain crop yields in the face of climate change and help the system to adapt to climate change and minimise GHG emissions. Figure 1 below summarizes the synergies and trade-offs.

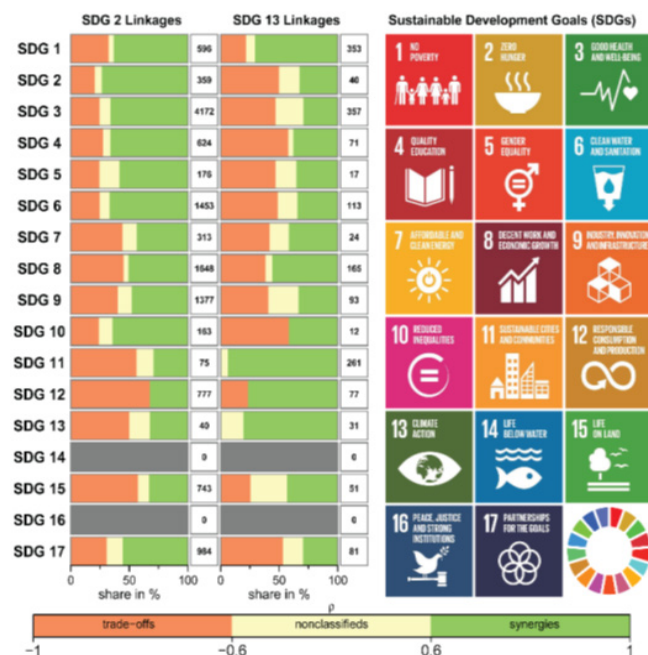


Figure 1. Intra and inter-linkages for SDG 2 and SDG 13

### Future Challenges, Gaps and Enabling Conditions

To achieve mitigation and adaptation to climate change in food systems enabling conditions are central to scale up adoption of effective strategies. Multi-level governance, multi-sector institutions and multi-policy pathways are widely recognised as some of the key enabling environments and central for scaling up in the achievement of adaptation, mitigation and food security objectives. Thus, to facilitate the scaling up of adaptation throughout the food system, institutional measures are needed at global, regional, national, and local levels.

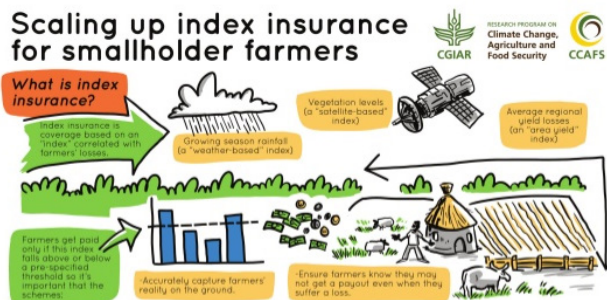
**EXAMPLES OF RELEVANT POLICY INTERVENTION AREAS**

1. Increasing agriculture efficiency
2. Land use planning
3. Trade liberalisation
4. Premium price for premium goods
5. Reduction of food waste and loss
6. Reduction of consumption of carbon intensive foods (policies that promote shift in dietary patterns)

However, it is worth noting that institutional aspects including policies and laws depend on scale and context. International institutions (financial and policies) are driving many aspects of global food systems (e.g., UN agencies, international private sector agribusinesses and retailers). Many others operate at local level and strongly influence livelihoods and markets of smallholder farmers. Hence, differentiation in the roles of the organisations, their missions and outcomes related to food and climate change action need to be clearly mapped and understood.

The importance of insurance and reinsurance is widely recognised. Despite this recognition, their efficacy and the ability to scale-up, in any given context, are poorly understood. Other enabling conditions to address climate change related challenges and ensuring food security are: (a) mobilization of formal and non-formal knowledge and information (including local and

indigenous), education and capacity building issues disaggregated by geographical location (e.g. rural based), age and gender; (b) recognition of food sovereignty and a need to balance local production and imports (trade regulation), and (c) recognition of the importance of research and development and data.



There is a range of integrated agricultural systems being tested to evaluate synergies between mitigation and adaptation and lead to low-carbon and climate-resilient pathways for sustainable food security and ecosystem health (robust evidence, medium agreement). There is high confidence that integrated agricultural systems and practices can enhance food system resilience to climate change and reduce GHG emissions, while helping to achieve sustainability. However, best-integrated agricultural systems and practices that can enhance food system resilience to climate change and reduce GHG emissions for specific agricultural systems are under consolidated. Given the diversity of agricultural systems in developing countries, mapping these best practices is key for upscaling, while helping to achieve sustainability.

In the context of knowledge and information, many studies agree that local food systems are embedded in culture, beliefs and values, and indigenous and local knowledge can contribute to enhancing food system resilience to climate change. Given the diversity of societies and indigenous knowledge systems (IKS) (which are site specific), it is essential to analyse and understand the links between culture, beliefs and values, and indigenous and local knowledge (disaggregated by geographical location (e.g. rural based), age and gender) and food system resilience to climate change (including best practices and challenges for upscaling/support) in specific areas. This also include taking a participatory approach in knowledge sharing, technology transfer and capacity building e.g. extension learning such as Farmer Field Schools. This is particularly important for informed decision-making, policies and interventions. Gaps in our understanding of such linkages remain especially in many developing countries.

There are several knowledge gaps and key research areas around options and solutions. Concerning Climate impact models (in relation to food availability), understanding the full range of climate impacts on staple crops (especially those important in developing countries), fruits and vegetables is missing in the current climate impact models. Further, CO<sub>2</sub> effects on nutrition quality of different crops are just beginning to be parameterised in the models. Bridging these gaps is essential for projecting future dietary diversity, healthy diets, and food security. Crop model improvements are needed for evapotranspiration to guide crop water management in future climate. Similarly, more studies are needed to understand the impacts of climate change on global rangelands and livestock and aquaculture, which have received comparatively less attention than the impacts on crop production.

**ICT for agriculture**  
How does it work?

**ANALYSING**

- Soil
- Crop
- Climate
- Market
- Input
- Infrastructures
- Demographic & socio-economic data

**IMPROVING**

- Efficiency/transparency in distribution and use of water resources
- Producers become providers of data
- Technology transfer and knowledge sharing
- Productivity, increase in income
- Establishment of bridges between rural producers and markets
- Services offered by governments to rural people

**HELPING**

- Farmers to manage a range of risks
- Farmers to participate in higher-value agriculture
- Land and natural resource management
- Governance for the rural poor
- Smallholder productivity and incomes
- Connection between poor farmers and urban and between regional and global markets
- Agricultural markets to become more efficient and transparent
- Inclusion of smallholders in agricultural innovation
- Development of a more diverse rural economy and supporting rural families decisions

**Gnucoop**  
IT for non profits

In relation to resilience to extreme events (food availability, access, utilisation, and stability), there are knowledge gaps on impacts of climate shocks as opposed to impacts of slow-onset climate change, how climate-related harvest failures in one continent may influence food security outcomes in others, impacts of climate change on fruits and vegetables and their nutrient contents. In this regard, it is important to analyze how the African countries manage the impacts of climate shocks on the four pillars of food security, how climate-related harvest failures in one continent may influence food security outcomes in others, impacts of climate change on fruits and vegetables and their nutrient contents. Furthermore, it is important to

understand the widely recognised future challenges to food security and recommended adaptation strategies as one pathway to future food security management.

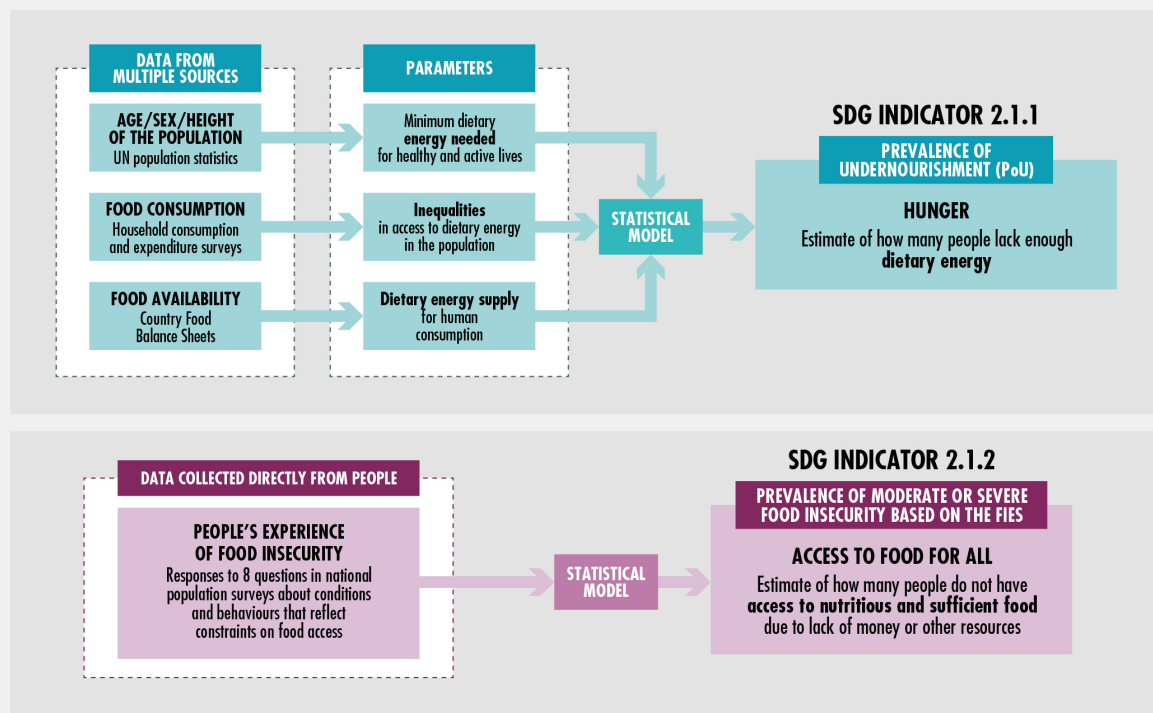
## Conclusion

With many of the resources needed for sustainable food security already stretched, the food security challenges are huge. Climate change will make it even harder to overcome them, as it reduces the productivity of the majority of existing food systems and harms the livelihoods of those already vulnerable to food insecurity. In addition, the likelihood of increased variability and extreme events means that management of risk, both locally and internationally, will be even more important than it is today. Consequently, Africa's agriculture will need to transition to systems that are more productive, use inputs more efficiently, have less variability and greater stability in their outputs, and are more resilient to risks, shocks and long-term climate variability. This transformation must be accomplished without depleting the natural resource base. It will also have to entail a decrease of GHG emissions intensity and an increase of carbon sinks, which will contribute significantly to the mitigation of climate change.

### FUTURE CHALLENGES TO FOOD SECURITY AND ADAPTATION STRATEGIES

1. Food price spikes low food supplies due to impacts of frequent and intense shocks (driven by changing patterns of extreme weather that are to increase with climate change) on food systems.
2. Migration and conflict as a result of enhanced droughts and floods which will have adverse impacts on livelihoods and livelihood assets – especially of the poor.
3. Population growth that will put pressure on food demand.
4. Uncertainties regarding future climate change and other extreme weather events.

### TWO INDICATORS FOR SDG TARGET 2.1 TO MONITOR PROGRESS ON ENDING HUNGER AND ENSURING ACCESS TO FOOD FOR ALL



SOURCE: FAO, 2019

## Recommendations

*1. Develop low-emissions and climate resilient agricultural development strategies that do not compromise food security.* Incentive-based systems that target the vulnerable while mitigating emissions and increasing climate change resilience have multiple benefits. With well-chosen technology deployment, agronomic practices and innovations, degraded lands can be restored, contributing to food security, adaptation and to mitigation by increased carbon sinks.

*2. Increase resilience of food systems to climate change.* Increasing resilience of food systems must be done at every level, from the field to landscape and markets. Farmers need to be supported to

adopt practices that enhance their resilience and food security and that also provide long-term climate benefits. With well-chosen agro-ecological practices, degraded lands can be restored, contributing to food security, adaptation and to mitigation by increased carbon sinks.

*3. Integrate data collection across all dimensions of climate change and food security to feed into policy making.* Inadequate information is available to deal effectively with many aspects of the food security challenges from climate change. Furthermore, climate models generate vast amounts of data about possible future outcomes but not always summarized in ways that are useful to understanding potential effects on agricultural systems.

## Further Reading

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## CONTACTS

ICRPE Duduvile Campus, Kasarani  
P.O.Box 45801 - 00100  
Nairobi, Kenya  
+254 759 402 260  
info@agnesafrica.org  
www.agnesafrica.org



This policy brief was prepared with technical and financial support of the following partners:

