

TRANSFORMING FOOD SYSTEMS FOR A CLIMATE-RESILIENT, WELL-NOURISHED NIGERIA

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KEY MESSAGES

- Climate change is a threat to the sustainability of global and national food systems. Unsustainable food systems cannot ensure food and nutrition security or healthy eating patterns. Climate change is already altering agricultural production, food processing, distribution, and consumption. Its impacts disrupt food supply, limiting people's access to the diverse, safe, and nutritious foods that make up high-quality diets.
- Addressing the interconnected concerns of climate change and food systems demands an integrated approach to improve sustainability, resilience, and adaptation. Such an approach allows for collaborative responses to climate change and hunger or malnutrition that build on and go beyond simply understanding the consequences of climate change for agrifood systems and vice versa.
- Food systems can respond to climate and environmental change through efforts to mitigate, adapt to, and manage ongoing challenges. Key responses include adopting climate-resilient crop varieties, promoting resilient and adaptive agricultural practices, and diversifying food sources, as well as tackling food loss and waste at all stages of the value chain.



INTRODUCTION

Globally, food systems both influence and are influenced by climate change. On one hand, food systems contribute significantly to climate change through greenhouse gas emissions (GHG) associated with agricultural production (including from land-use change), processing, transportation, and consumption. Conversely, climate change poses significant challenges to food systems by altering weather patterns, increasing the frequency and intensity of extreme weather events, and exacerbating environmental degradation^{1,2}. This negatively impacts crops, livestock, fisheries, and overall food availability, access, and quality, leading to increased food insecurity and malnutrition³. Addressing the intersection of food systems and climate change is thus essential for promoting sustainable development, resilience, and food security. Both **Figure 1** and **Box A** set out the two-way link between climate change and food systems in more detail.

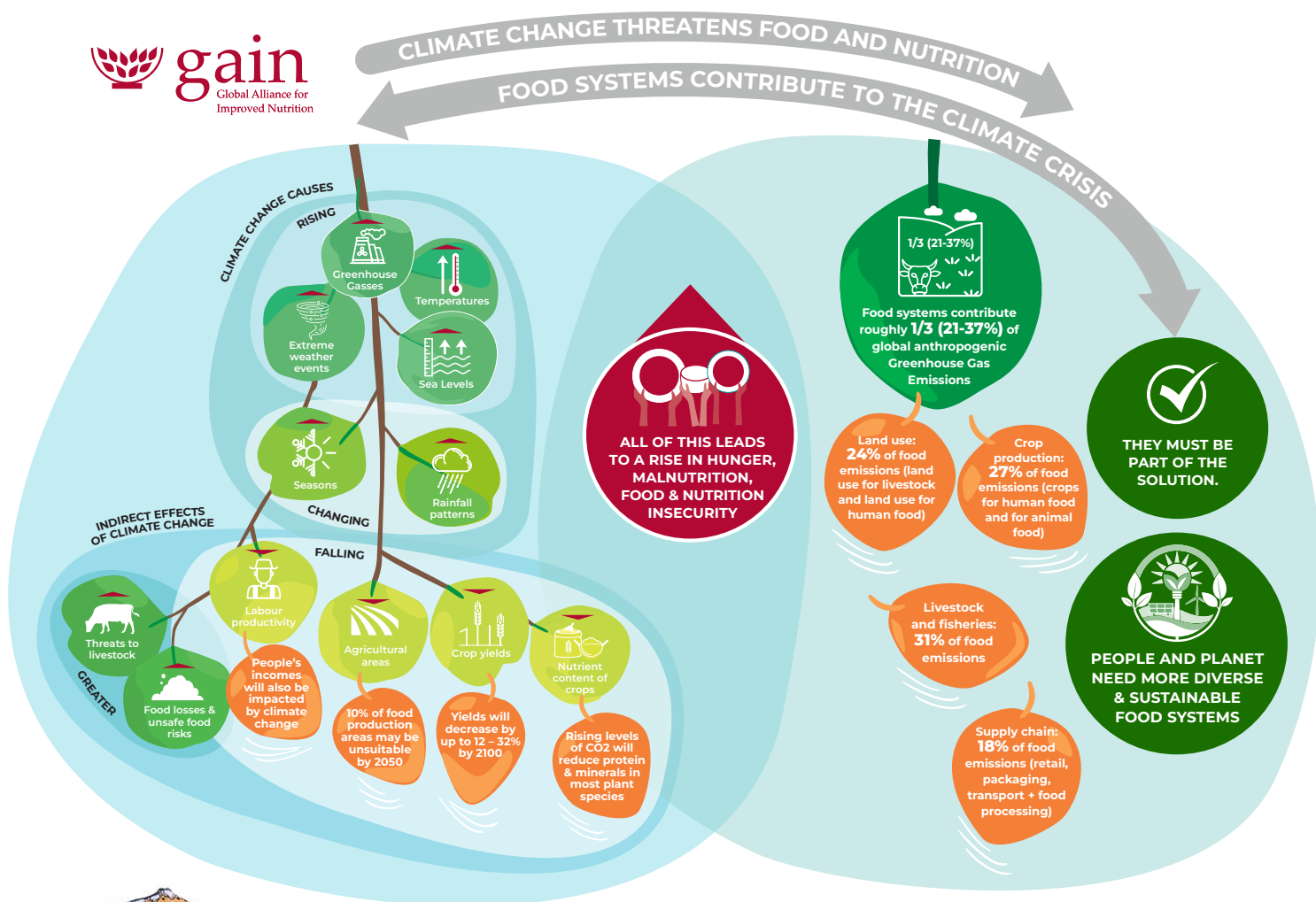
Africa is one of the world's lowest emitters of GHGs, contributing only 4% of global emissions equivalent to 1.45 billion tonnes annually⁴. In fact, it is a net-positive contributor in terms of carbon balance⁵. Despite this, the continent is disproportionately vulnerable to the impacts of climate change, highlighting the urgent need for adaptation strategies to ensure food security and sustainable development. Nigeria, Africa's fourth largest emitter, contributes 129 metric tonnes of emissions⁶. Although substantial compared to other African countries, this contribution is small in global terms. The vulnerability of Africa – including Nigeria – arises from biophysical factors, such as its equatorial position (which accelerates warming rates), and socioeconomic factors, including widespread poverty and low availability of resources dedicated to improving climate resilience.

This brief discusses the challenge of climate change in the context of Nigerian food systems and offers seven critical recommendations for action that can be taken to enhance agricultural productivity while promoting adaptation, sustainability, resilience, and inclusivity across Nigeria's food systems to help drive better nutrition.



- 1 Mbow, C. et al. (2019). Food Security in Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. <https://doi.org/10.1017/9781009157988.007>
- 2 Mirzabaei, A., Olsson, L., Kerr, R.B., Pradhan, P., Ferre, M.G.R., Lotze-Campen, H. (2023). Climate Change and Food Systems. In: von Braun, J., Afsana, K., Fresco, L.O., Hassan, M.H.A. (eds) Science and Innovations for Food Systems Transformation. Springer, Cham. https://doi.org/10.1007/978-3-031-15703-5_27.
- 3 FAO (2015). Climate Change and Food Security: Risks and Responses <https://openknowledge.fao.org/server/api/core/bitstreams/a4fd8ac5-4582-4a66-91b0-55abf642a400/content>
- 4 Data Page: Annual CO₂ emissions by world region", part of the following publication: Hannah Ritchie, Pablo Rosado and Max Roser (2023) - "CO₂ and Greenhouse Gas Emissions". Data adapted from Global Carbon Project. Retrieved from <https://ourworldindata.org/grapher/annual-co-emissions-by-region> [online resource].
- 5 Carbon Balance is the measure of the CO₂ equivalent and the net sum of the carbon emissions and storage. A positive carbon balance means that the carbon storage is growing, a desirable achievement in the light of, for example, the Paris Agreement.
- 6 Global Carbon Atlas <https://globalcarbonatlas.org/emissions/carbon-emissions/>

Figure 1: The two-way relationship between climate change and food systems



Sources: <https://www.gainhealth.org/sites/default/files/publications/documents/GAIN-goes-green-infographic.pdf>
<https://ourworldindata.org/food-ghg-emissions>

IPCC, 2023. Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, <https://dx.doi.org/10.59327/IPCC/AR6-9789291691647>



Box A: How Climate Change and Food Systems Impact Each Other

Impact of Climate Change on Nutrition and Food Systems

Climate change has adverse effects on all aspects of food security, including availability (is the food there?), access (is it affordable?), utilization (is the body able to absorb its nutrients?), and stability (is it consistently available or is supply and pricing very volatile?). Crop, livestock, and fish productivity and availability have been and are expected to be altered by climate-related factors such as temperature increases and alterations in rainfall patterns¹. Increased temperatures and unpredictable rainfall, for instance, stress crops and reduce their growth, harming productivity³. Extreme weather events like droughts can do even more damage to crops and livestock alike. This not only decreases the immediate availability of food, but also affects people's livelihoods and the long-term viability of agricultural practices, as land becomes less fertile and productive.

Climate change also impacts the nutritional quality of available foods. Increased atmospheric carbon dioxide (CO₂) levels have been shown to reduce the concentrations of essential nutrients such as iron, protein, and zinc in staple crops like rice, maize, wheat, and potatoes^{7,8}. Reduced levels of these micronutrients in food crops will drive micronutrient deficiencies and poor nutrition outcomes, particularly among low-income communities. For instance, lower levels of iron and zinc can lead to anaemia and weakened immune systems, while reduced protein content can impair growth and development in children. Thus, the nutritional degradation of staple crops due to climate change exacerbates the risk of malnutrition and related health issues, highlighting the urgent need for integrated strategies to address both climate and nutritional challenges.

Impact of Food Systems on Climate Change

Food systems have been estimated to contribute a significant portion (21-37%) of global GHG emissions¹⁹. These emissions occur at various stages along the food supply chain, including production, packaging, distribution, consumption and waste. Food production alone is responsible for one-quarter of global GHG emissions¹⁰. Additionally, other stages such as food processing, packaging, distribution, and consumption contribute 18% of the global emissions from food systems¹¹. This underscores the need for comprehensive strategies across the entire food value chain to effectively reduce GHG emissions.

The major sources of Nigeria's GHG emissions related to food systems in 2020 were estimated to be: energy (53.0%), agriculture (19.8%), waste (3.5 %), and land-use change (11.1%)¹². In Nigeria, agricultural activities contribute to GHG emissions through practices that release CO₂, methane (CH₄), and nitrous oxide (N₂O) – all potent greenhouse gases. Agriculture, forestry, and other land uses accounted for a quarter of Nigeria's GHG emissions in 2018¹³, with the majority attributable to livestock (through enteric fermentation and manure) and rice cultivation (owing to anaerobic conditions in flooded fields)¹⁴. Unsustainable agricultural practices also contribute to soil erosion, water pollution, and biodiversity loss. Agricultural expansion for instance, often leads to deforestation, that releases CO₂ stored in trees and soil. Moreover, the use of fossil fuels for agricultural machinery emits GHGs. Indeed, substantial amounts of energy are used during food processing, packaging, and storage, predominantly from non-renewable sources, further increasing the carbon footprint of food. The production and use of synthetic fertilizers emit N₂O and can further impact the environment when leaching or runoff occurs. These combined factors highlight the critical need for sustainable agricultural practices in reducing Nigeria's overall GHG footprint and ensuring long-term food security.

7 FAO (2023). Climate action and nutrition – Pathways to impact. Rome. <https://doi.org/10.4060/cc8415en>

8 Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change and Land: IPCC Special Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. Cambridge, UK, Cambridge University Press. <https://doi.org/10.1017/9781009157988>

9 Hannah Ritchie (2021). "How much of global greenhouse gas emissions come from food?" Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/greenhouse-gas-emissions-food' [Online Resource] Accessed 30 May 2024

10 Hannah Ritchie (2019). "Food production is responsible for one-quarter of the world's greenhouse gas emissions" Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/food-ghg-emissions' [Online Resource] Accessed 30 May 2024

11 Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987-992.

12 Climate Watch (2023) – with major processing by Our World in Data. "Greenhouse gas emissions by sector" <https://ourworldindata.org/grapher/ghg-emissions-by-sector?time=latest&country=~NGA>

13 Federal Republic of Nigeria. Nationally Determined Contribution (NDC), (2021). https://unfccc.int/sites/default/files/NDC/2022-06/NDC_File%20Amended%20_11222.pdf

14 Climate Transparency (2020). Nigeria's Climate Action and Responses to the Covid-19 Crisis <https://www.climate-transparency.org/wp-content/uploads/2021/01/Nigeria-CT-2020.pdf>

THE THREAT OF CLIMATE CHANGE IN NIGERIA

Climate change poses a threat to food systems already struggling to meet people's needs for diverse, safe, and nutritious foods. Nigeria is not alone in facing the dual challenges of malnutrition and climate change – but these have been exacerbated by growing conflict and insecurity across the country's food producing regions, as well as rising cost of food. **Figure 2** shares some examples of Nigeria's malnutrition burden. These factors all contribute to a public health and environmental sustainability challenge that needs to be urgently addressed on multiple fronts.

Figure 2: Nigeria's malnutrition challenge



The adverse effects of climate change on Nigeria's agricultural productivity and food systems are increasingly evident. The country experiences droughts, excessive rainfall, farmland flooding, rising temperatures, increased aridity and soil acidity, and changes in relative humidity. These impacts reduce agricultural productivity, escalate food insecurity, and threaten the livelihoods of millions who depend on agriculture¹⁵. Addressing these is crucial for the sustainable development of Nigeria and the health and food security of its people.

Nigeria's Nationally Determined Contributions (NDCs) target aims to unconditionally reduce GHG emissions by 20% by 2030 instead of 50% as set out in the Paris Agreement¹⁵, with a 47% conditional commitment which can be achieved with financial assistance, technology transfer and capacity building. Achieving such a target would require an investment of \$17.7 billion annually.

¹⁵ <https://www.un.org/en/climatechange/paris-agreement>

International moments increasingly emphasise the interconnections between climate and food

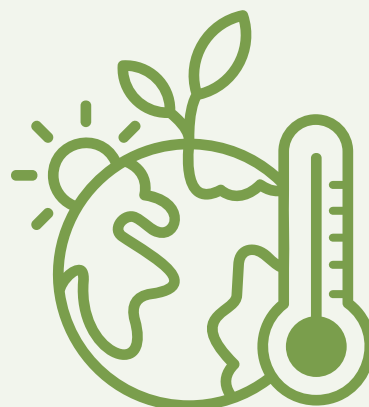
Recognizing the urgent need for coordinated action at the intersection of climate change and nutrition, the Government of Egypt, together with partners, launched the Initiative on Climate Action and Nutrition (I-CAN) during its presidency of the 27th Conference of the Parties (COP27) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2022 ^{7,16}. This initiative, designed to address some of the fragmentation in climate and nutrition action, aims to engage multiple stakeholders and sectors to accelerate transformation of food systems in order to deliver positive outcomes for people and planet. Building on this momentum, representatives at COP28 recognised the urgent need to address the intersecting challenges of food security and climate change. This urgency culminated in the endorsement of a *Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action* signed by 159 countries, including Nigeria, at COP28 – covering over 5.7 billion people, nearly 500 million farmers and 76 percent of the total emissions from the global food system^{17,18}. Over USD\$2.5 billion in additional funding was mobilized to advance the food-climate agenda¹⁸. This is a welcome collective commitment; however, the scale of need remains substantial.

OPPORTUNITIES FOR ACTION

Given the strong interdependency between climate change and food systems, opportunities for action arise in two areas:

Firstly,

the profound impact of climate change on food systems shows the need to adapt and increase the resilience of food systems to these changes. Implementing climate-smart agricultural practices, investing in research and development of resilient crop varieties, as well as improving infrastructure to better withstand extreme weather events and ensure better access to food are critical steps. Enhancing social protection mechanisms and ensuring policy coherence across sectors will also be essential to mitigate the effects of climate change on nutrition and food security.



Secondly,

the substantial contribution of food systems to climate change deserves heightened attention. Strategies to reduce GHG emissions from food systems include promoting adaptive agricultural practices, reducing food loss and waste, and improving energy efficiency in food production and distribution. Sustainable practices such as agroforestry, conservation agriculture, and organic farming, can reduce emissions from land use and deforestation. Enhancing energy efficiency and transitioning to renewable energy sources in food processing and packaging can lower the carbon footprint of these stages. Additionally, improving food supply chains to minimize loss and waste can reduce the overall carbon footprint of food systems. Policies and investments that support these changes are crucial for creating resilient food systems that contribute to climate mitigation and ensure food and nutrition security for future generations.

16 Global Alliance for Improved Nutrition. I-CAN <https://www.gainhealth.org/sites/default/files/publications/documents/initiative-on-climate-action-and-nutrition-I-CAN.pdf>. Accessed 24 April 2024.

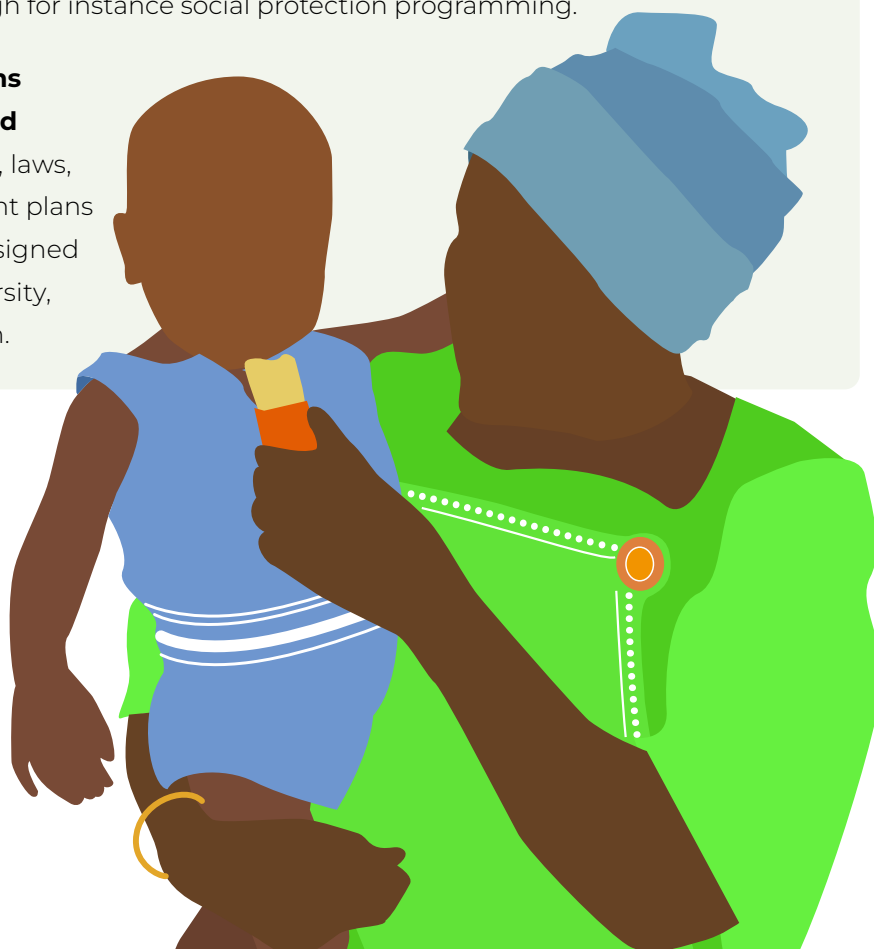
17 COP28 UAE Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action <https://www.cop28.com/en/food-and-agriculture>

18 United Nations Development Programme. <https://www.undp.org/blog/10-ways-forward-transform-food-systems-climate-and-nature>

The task ahead is not easy, but it is essential. Multifaceted and integrated approaches must be encouraged. In exploring opportunities for action, Nigeria should adopt innovative strategies that not only enhance agricultural productivity but also promote adaptation, sustainability, resilience, and inclusivity across food systems, while improving nutritional outcomes.

Seven key opportunities for Nigeria to both mitigate the impacts of climate change while adapting to their ongoing reality are set out below.

- Adoption of **climate-smart agriculture** practices, including investment in research and development of **climate-adapted crops and technologies**, to increase productivity on existing land, thereby reducing the need for agricultural expansion and mitigating GHG emissions.
- **Promotion of biofortified varieties** to improve nutrition and health outcomes, contributing to overall community resilience in the face of climate change.
- **Diversification of diets to promote** dietary choices that enhance nutrition, reduce reliance on monocropping systems and support agrobiodiversity.
- Building understanding of and facilitating the adoption of **sustainable diets** that are nutritionally balanced, environmentally friendly, and culturally appropriate for the Nigerian context.
- Implementation of strategies to reduce post-harvest losses and improve food distribution systems to minimize environmental harm, **address food loss and waste** thus enhancing food security.
- Undertaking to **increase the resilience of communities** most affected by climate change and malnutrition (particularly those most vulnerable such as young children living in low-income households), through for instance social protection programming.
- **Integration of food systems into Nationally Determined Contributions** with policies, laws, programmes and investment plans across agrifood systems designed to yield benefits for biodiversity, climate, water and nutrition.



CONCLUSION

The interconnected problems of food insecurity, malnutrition, and climate change intersect with other global challenges, including poverty, inequality, and environmental degradation. Addressing this complex web requires concerted efforts to encourage coherence in policies, programmes, and partnerships. Indeed, strategic collaboration and coherent policy frameworks spanning multiple sectors and subjects will be essential for achieving long-term sustainable development goals. Climate change cannot be dealt with in isolation from food systems.

In Nigeria, it is increasingly clear that by leveraging food systems interventions to advance the country's climate goals, the nutrition and health of the population will also benefit. There is a need for urgent action to tackle the interconnected challenges of public health and environmental sustainability. We need an equally robust and determined response in terms of political will to act decisively, organize effectively, and confront the challenges posed by climate change. Furthermore, promoting dietary diversification will play a crucial role in enhancing both nutrition and environmental sustainability, ensuring a more resilient and healthier future for all.



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Healthier Diets. **For all.**

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