



FANRPAN

Food, Agriculture & Natural Resources Policy Analysis Network

POLICY BRIEF

Transitioning to Climate-Resilient Farming Systems in Sub-Saharan Africa (SSA)

KEY MESSAGES



Prioritize the urgent integration of water, energy, and food resources in Sub-Saharan Africa (SSA) to achieve sustainable development and enhance climate resilience.



Promote Circular Economy solutions in food systems that can help the continent feed its growing population while helping address significant societal and environmental issues.



Advance Climate-Resilient Farming Systems through Strategic Partnerships, leveraging each partner's unique strengths and expertise.



Prioritize investments in social inclusion, gender equity, and youth empowerment to ensure the transition to climate-resilient farming systems benefits all stakeholders.



Encourage the adoption of technologies to significantly enhance resource management efficiency and substantially increase agricultural productivity.

BACKGROUND

Sub-Saharan Africa (SSA) is a region that is particularly vulnerable to climate change. Projections indicate a heightened likelihood of more frequent and intense occurrences of droughts and flash floods in the near future (Chiang et al., 2021; Ayugi et al., 2022). These climatic shifts directly threaten agricultural pursuits, impacting crop and livestock enterprises while diminishing water resources crucial for widespread agricultural production across the continent (Shrestha and Aryal, 2011; Zakaria et al., 2020). The agriculture sector in SSA is predominantly rain-fed, making it highly susceptible to the impacts of climate change. As the region faces the realities of a changing climate, transitioning to climate-resilient farming systems becomes imperative for the sustainability of agriculture, food security, and livelihoods.

Water is a critical resource for agriculture, and its availability is essential for crop production. Climate change has resulted in a high rainfall variability in the region, leading to prolonged droughts in some areas and heavy rains and flooding in others, directly affecting water resources. Increasing temperatures further aggravate the situation by enhancing evaporation rates, impacting water availability and distribution. Consequently, climate change's impact on water resources has far-reaching effects, affecting agricultural productivity, food security, and livelihoods. Addressing this issue requires a particular focus on irrigation systems in arid and semi-arid areas where water scarcity persists due to insufficient infrastructure and investment (Rockström & Falkenmark, 2015).

CLIMATE RESILIENT AGRICULTURE SYSTEMS: THE WAY AHEAD

The 2022 IPCC report argues that the climate crisis is so serious that the climate response has to change from incremental to transformative and that there needs to be more focus on tackling the root causes of vulnerability (IPCC 2022). Boyd et al. (2008) argued that “a resilience lens may assist development policy to consider pathways towards more successful livelihood transformations in the face of climate change”. Climate resilient agriculture practices can help reduce hunger and poverty in the face of climate change.

Climate-resilient agriculture (CRA) is an approach that includes sustainably using existing natural resources through crop and livestock production systems to achieve long-term higher productivity and farm incomes under climate variabilities. This practice reduces hunger and poverty in the face of climate change for forthcoming generations. CRA practices can alter the current situation and sustain agricultural production from the local to the global level, especially sustainably. Irrigation, a climate-resilient agricultural practice, provides a controlled and reliable water supply to crops, reducing dependence on unpredictable rainfall. This is particularly crucial in changing precipitation patterns associated with climate change. Irrigation systems can help mitigate the impact of droughts by ensuring that crops receive adequate water even during periods of water scarcity. In areas experiencing rising temperatures, irrigation can help cool the immediate environment, providing a more favourable climate for crop growth. By reducing dependence on rain-fed agriculture, irrigation systems can help minimize the risk of crop failure during dry spells or erratic rainfall. Furthermore, irrigation allows farmers to diversify crops and adjust planting schedules, allowing them to cultivate various crops throughout the year.

TRANSFORMING IRRIGATION IN SOUTHERN AFRICA

The Transforming Irrigation in Southern Africa (TISA) project, initiated in 2013 and funded by the Australian Government through the Australian Centre for International Agricultural Research (ACIAR), aims to revitalize smallholder irrigation schemes in Mozambique, Tanzania, and Zimbabwe. Over the last decade, Mozambique has experienced an average of three cyclones per year, affecting over 2 million people. Furthermore, the country experienced El Niño conditions in 2015–2016, which caused the worst drought in 35 years, reducing food availability by 15%. Food insecurity caused by the drought worsened in 2017 with Cyclone Dineo, which made landfall near Inhambane, southern Mozambique, and damaged crops and infrastructure. The priority actions for transitioning to climate-resilient farming systems in Mozambique include investing in flood- and drought-resistant agricultural practices, improving early warning systems for extreme weather events, and promoting the sustainable management of water resources. Only 2.5% of Mozambique's agricultural land is currently irrigated.

In Tanzania, agriculture contributes about 28% of GDP and employs approximately 67% of the workforce. The country has experienced a 15% decrease in average annual rainfall over the past 20 years. Additionally, it has faced six major droughts in the past 30 years, notably the 2006 drought. This specific drought is estimated to have cut GDP growth by approximately 1%. The priority actions for transitioning to climate-resilient farming systems in Tanzania include the adoption of irrigation systems that use water more efficiently, the promotion of drought-resistant crop varieties, and the implementation of soil conservation practices. Currently, only 5% of Tanzania's agricultural land is under irrigation. This figure represents a small fraction of the country's potential, as only 2.5% of Tanzania's total land suitable for irrigation is currently being utilized.

Zimbabwe faces increasing temperatures and reduced rainfall, with average temperatures rising by 0.5°C in the last decade and annual rainfall reducing by 5%. Zimbabwe's agricultural sector is highly dependent on rainfall, making it vulnerable to climate-related hazards. Historically, the country has faced significant challenges due to natural events, experiencing 7 droughts and 12 floods from 1900 to 2017. These events have affected over 20 million people and caused substantial economic losses, underlining the critical need for resilient agricultural practices and effective disaster risk management strategies to mitigate the impacts of such climatic fluctuations. The priority actions for transitioning to climate-resilient farming systems in Zimbabwe include investing in irrigation infrastructure, promoting conservation agriculture practices, and improving farmers' access to climate information. As of 2022, only 10% of farmers in Zimbabwe had access to timely climate information.

Focusing on technological innovations and institutional changes, TISA employs Agricultural Innovation Platforms (AIPs) and soil moisture monitoring tools to enhance farmer productivity and transition from subsistence to market-oriented agriculture. By 2021–22, the project had engaged 41 irrigation schemes, demonstrating significant improvements in irrigation practices and crop yields and fostering economic growth through initiatives like the issuance of 615 bank loans in Tanzania. Aligned with the African Union's CAADP/Malabo Declaration targets, TISA aspires to create more productive, profitable, and sustainable irrigation systems, contributing to regional food security and reducing food import dependency.

EMBRACING CLIMATE-RESILIENT FARMING SYSTEMS IN SUB-SAHARAN AFRICA

In March 2023, the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) and its partners organised and convened a Regional Multistakeholder Policy Dialogue focused on unpacking the essential elements for transitioning to Climate-Resilient Farming Systems in SSA in order to inform African policymakers on the necessary steps they need to take to create an enabling policy environment for the transition. as crucial elements in the development of climate-resilient food systems.



WATER-ENERGY-FOOD (WEF) NEXUS AND RESILIENT FOOD SYSTEMS

A well-coordinated and integrated Water-Energy-Food (WEF) nexus approach offers opportunities to build resilient systems, harmonise interventions, mitigate trade-offs, and improve sustainability (Mpandeli et al., 2018). This would be achieved through greater resource mobilisation and coordination, policy convergence across sectors, and targeting nexus points in the landscape. The WEF nexus approach has the potential to increase the resilience of marginalised communities in southern Africa by contributing towards attaining the Sustainable Development Goals (SDGs 1, 2, 3, 6, 7, and 13). The Water-Energy-Food (WEF) Nexus in Sub-Saharan Africa (SSA) emphasizes the interconnectedness of these critical resources and the need for integrated management approaches to ensure sustainable development and resilience against climate change.

A key aspect of this approach is cultivating partnerships across public, private, NGO, academic, and community sectors, which play a crucial role in implementing and managing the WEF Nexus. Exciting initiatives such as The Virtual Irrigation Academy (VIA) and Digital Earth Africa demonstrate practical applications of the WEF Nexus principles. VIA offers online training to young African professionals on water monitoring and governance and has engaged more than 750 farmers using soil-monitoring tools, illustrating how technology can be leveraged to improve productivity and sustainability in agriculture. Digital Earth Africa utilizes geospatial technologies for sustainable resource management. It empowers decision-makers across Africa to take country-led climate action by providing open, free and accessible Earth observation data on a continental scale. This creates an opportunity to access data for high-quality continental, country and local scale analyses to produce actionable information for decision-makers.

FOSTERING RESILIENT FOOD SYSTEMS THROUGH CIRCULAR APPROACHES IN AGRICULTURE

Circular Food Systems (CFS) are pivotal for advancing climate-resilient agriculture in Sub-Saharan Africa, offering an innovative framework that emphasizes waste minimization and resource optimization. These systems focus on nutrient recycling, which involves reusing organic matter and waste products to enhance soil health and reduce dependence on synthetic fertilizers (Jurgilevich et al., 2016). Additionally, CFS address food waste reduction by improving supply chain efficiency, enhancing storage and transportation methods, and fostering responsible consumption patterns.

A key component of CFS is the integration of renewable energy sources, such as solar and wind power, into food production processes. This shift reduces reliance on non-renewable energy sources and mitigates the impact of external energy price fluctuations. Efficient water management is another crucial aspect, focusing on the reuse and recycling of water in agricultural processes to ensure judicious use of this essential resource (Hamam et al., 2021). Circular Food Systems present a holistic and sustainable approach to agriculture. Their adoption in Sub-Saharan Africa is a strategic move towards achieving efficient, environmentally friendly food production. This approach contributes significantly to the sustainability and resilience of the agricultural sector, ensuring long-term food security and environmental health in the region, especially in the face of climate change and resource scarcity challenges.

LEVERAGING AGRICULTURAL TECHNOLOGY TO FOSTER RESILIENT FOOD SYSTEMS

The integration of technology into the agricultural sector in Africa remains suboptimal despite its immense potential to enhance agricultural productivity, improve food security, and bolster resilience in the face of climate change (FAO, 2021). Recognizing the critical role of improved technologies, African governments and the African Union/New Partnership for Africa's Development acknowledge the necessity of fostering sustainable food security and reducing rural poverty (NEPAD, 2022). However, adopting these technologies necessitates a conducive governance environment that fosters innovation, collaboration, and knowledge-sharing among stakeholders (Murendo et al., 2020). In the Southern Africa region, effective implementation of agricultural technologies demands the active involvement of small-scale farmers, who form the backbone of the agricultural sector (Diao et al., 2021). The African Agricultural Technology Foundation (AATF) has successfully harnessed the technology governance framework in South Africa, Mozambique, Kenya, and Nigeria to develop DroughtTEGO—a climate-resilient agricultural technology addressing issues of insects and drought exacerbated by climate change (Muinga, 2019). Despite these advancements, numerous socio-economic and biophysical constraints limit the ability of smallholder farmers to adopt such technology (Mujawamariya et al., 2020). Therefore, developing effective and efficient strategies for transferring these technologies to farmers is imperative (FAO, 2021). A crucial step in this process is obtaining comprehensive information about the current adoption levels of these technologies, as this knowledge is fundamental for formulating policies aimed at increasing adoption and subsequent improvements in agricultural productivity (Murendo et al., 2020).

PARTNERSHIPS TO CATALYZE GREATER INVESTMENTS IN RESILIENT FOOD SYSTEMS

Transformative partnerships in Sub-Saharan Africa (SSA) are crucial in fostering resilient food systems by driving innovative solutions. Noteworthy collaborations include Mozambique's public-private partnerships, which are instrumental in sustainable smallholder irrigation management, and Tanzania's transformative engagements under the Transforming Irrigation in Southern Africa (TISA) project. These initiatives have significantly enhanced irrigation schemes, established robust market linkages, and improved access to quality inputs for small-scale farmers, addressing disparities in agricultural investment and support across SSA. The SADC Groundwater Management Institute's efforts have facilitated partnerships between Zambia and Zimbabwe's River Basin Organizations (RBOs) and national governments. This collaboration has proven effective in boosting climate-smart investment opportunities and managing shared resources, as seen in the improved water allocation, conflict resolution, and joint investment in water infrastructure along the Zambezi River. The International Water Management Institute (IWMI), leading the CGIAR Initiative on Diversification in East and Southern Africa, known as Ukama Ustawi, aims to mitigate food and nutrition security risks in the region by adopting a climate-resilient, water-secure, and socially inclusive approach. Ukama Ustawi, a bilingual term combining Shona and Swahili, signifies partnerships and well-being, respectively. IWMI collaborates innovatively with local and regional partners like FANRPAN to achieve system-level development.

POLICY RECOMMENDATIONS

In addressing the pressing challenges facing agriculture and food security, decisive action must be taken. The following recommendations are crafted to provide clear directives for policymakers, offering strategic insights that can contribute to developing robust, forward-thinking policies. Implementing these recommendations creates a tangible opportunity to catalyze positive transformations in agricultural practices, fortify resilience against climate change, enhance resource efficiency, and foster equitable and sustainable food systems.

Prioritize the urgent integration of water, energy, and food resources in Sub-Saharan Africa (SSA) to achieve sustainable development and enhance climate resilience: Recognizing the imperative for proactive and integrated strategies in Sub-Saharan Africa (SSA), a focused policy approach prioritising the seamless integration of water, energy, and food resources is imperative. This strategic alignment is essential for fostering sustainable development and enhancing the region's resilience in the face of climate challenges. By acknowledging the interconnected nature of these vital resources, policymakers can lay the foundation for holistic and adaptive solutions that address immediate concerns and contribute to the region's long-term well-being and sustainability. It is crucial to cultivate a policy framework that identifies synergies and navigates potential trade-offs, ensuring a harmonized and resilient trajectory for SSA's development journey.

Promote Circular Economy solutions in food systems that can help the continent feed its growing population while helping address significant societal and environmental issues: This approach not only addresses the pressing challenge of feeding a burgeoning population in Sub-Saharan Africa but also provides an effective means to tackle substantial societal and environmental issues concurrently. By promoting strategies such as waste reduction, resource efficiency, and the recycling of organic matter within the food production and distribution cycles, Circular Economy solutions contribute to sustainable agricultural practices. This optimizes resource use, minimizes environmental impact, mitigates food waste, and fosters economic resilience. Policymakers are urged to explore and implement policies that incentivize and support the adoption of Circular Economy principles within the food systems framework, fostering a more sustainable and resilient future for the continent.

Advance Climate-Resilient Farming Systems through Strategic Partnerships: Recognizing the imperative for effective resource management and sustainable solutions, policymakers are urged to prioritize and foster diverse partnerships. These collaborations, spanning public, private, academic, and community partners, are pivotal in successfully implementing sustainable practices, particularly climate-resilient farming. Policymakers should actively promote and facilitate such partnerships, leveraging each partner's strengths and expertise. By doing so, they can effectively navigate intricate challenges, ensuring the enduring sustainability of agricultural practices in the face of climate variability and change."

Prioritize investments in social inclusion, gender equity, and youth empowerment to ensure the transition to climate-resilient farming systems benefits all stakeholders: In light of the imperative transition towards climate-resilient farming systems, policymakers are strongly advised to prioritize targeted investments in social inclusion, gender equity, and youth empowerment. This proactive approach is designed to ensure that the benefits of the transition are accessible to and impactful for all stakeholders involved. By directing resources towards social inclusion, emphasis is placed on dismantling barriers that may hinder marginalized communities from participating equitably in the agricultural sector. Simultaneously, prioritizing gender equity involves addressing existing disparities and ensuring women have equal access to resources, opportunities, and decision-making processes. Furthermore, investing in youth empowerment aims to equip the younger generation with the necessary skills, education, and opportunities to actively engage in and contribute to the transition towards climate-resilient farming systems. Through these targeted investments, policymakers can foster an inclusive agricultural landscape, promoting sustainability, equity, and resilience among diverse stakeholders.

Encourage the adoption of technologies to significantly enhance resource management efficiency and substantially increase agricultural productivity: To advance resource management efficiency and bolster agricultural productivity, policymakers are encouraged to actively advocate for and support the adoption of technologies such as soil-monitoring tools and geospatial technologies. This approach leverages innovative tools to provide real-time insights into soil health and land conditions, enabling farmers to make informed decisions. By integrating these technologies, policymakers can significantly improve resource allocation, minimise environmental impact, and foster sustainable agricultural practices. This proactive stance aligns with the broader goal of creating a technologically advanced and efficient agricultural sector that maximizes productivity while minimizing environmental footprint."

CONCLUSION

In conclusion, addressing the formidable challenges confronting agriculture and food security demands decisive action. The recommendations presented in this brief offer clear directives for policymakers, providing strategic insights to develop robust and forward-thinking policies. By implementing these recommendations, there is a tangible opportunity to catalyze positive transformations in agricultural practices, fortify resilience against climate change, enhance resource efficiency, and foster equitable and sustainable food systems.

REFERENCES

- Ayugi, B., Shilenje, Z. W., Babaousmail, H., Sian, K. T. C. L. K., Mumo, R., Dike, V. N., et al. (2022). Projected changes in meteorological drought over East Africa inferred from bias-adjusted CMIP6 models. *Nat. Hazards* 113, 1151–1176. doi: 10.1007/s11069-022-05341-8
- Challinor, A. J., Arenas-Calles, L. N., & Whitfield, S. (2022). Measuring the effectiveness of climate-smart practices in the context of food systems: Progress and challenges. *Frontiers in Sustainable Food Systems*, 6, 853630.
- Chiang, F., Mazdiyasn, O., and AghaKouchak, A. (2021). Evidence of anthropogenic impacts on global drought frequency, duration, and intensity. *Nat. Commun.* 12, 1–10. doi: 10.1038/s41467-021-22314-w
- FAO. (2020). Irrigation in Africa in figures: AQUASTAT Survey. Food and Agriculture Organization of the United Nations.
- FAO. (2021). The State of Food Security and Nutrition in the World 2021. Food and Agriculture Organization.
- Hamam, M., Chinnici, G., Di Vita, G., Pappalardo, G., Pecorino, B., Maesano, G., & D'Amico, M. (2021). Circular economy models in agro-food systems: A review. *Sustainability*, 13(6), 3453.
- Jennings, S. A., Challinor, A. J., Smith, P., Macdiarmid, J. I., Pope, E., Chapman, S., ... & Benton, T. (2022). A new integrated assessment framework for climate-smart nutrition security in sub-Saharan Africa: the integrated Future Estimator for Emissions and Diets (iFEED). *Frontiers in Sustainable Food Systems*, 6, 868189.
- Jurgilevich, A., Birge, T., Kentala-Lehtonen, J., Korhonen-Kurki, K., Pietikäinen, J., Saikku, L., & Schösler, H. (2016). Transition towards circular economy in the food system. *Sustainability*, 8(1), 69.
- Kenya Meteorological Department. (2023). Variability of Rainfall Patterns. Ministry of Environment and Forestry, Government of Kenya.
- Mpandeli, S.; Naidoo, D.; Mabhaudhi, T.; Nhemachena, Charles; Nhamo, Luxon; Liphadzi, S.; Hlahla, S.; Modi, A. T. 2018. Climate change adaptation through the water-energy-food nexus in southern Africa. *International Journal of Environmental Research and Public Health*, 15(10):1-19. doi: 10.3390/ijerph15102306
- Muinga, G., Marechera, G., Macharia, I., Mugo, S., Rotich, R., Oniang'o, R., Obunyali, CO., Oikeh, S. (2019). Adoption of climate-smart DroughtTEGO® varieties in Kenya. *African Journal of Food Agriculture Nutrition and Development*. 19. 15090-15108. 10.18697/ajfand.87.18355. Diao, X., Cossar, F., Housso, N., Kolavalli, S., & Jimah, K. (2021). Southern Africa Agriculture Transformation. International Food Policy Research Institute.
- Mujawamariya, G., Mugambi, I., & Muricho, G. (2020). Socioeconomic and Institutional Factors Influencing Smallholder Farmers' Adoption of Climate-Resilient Agricultural Technologies in Sub-Saharan Africa. *Sustainability*, 12(19), 8161.
- Murendo, C., Nhambeto, M., Sibanda, L. M., & Swarts, M. (2020). Adoption of Sustainable Agricultural Technologies by Smallholder Farmers: Evidence from Conservation Agriculture in Malawi. *Sustainability*, 12(15), 6061.
- Rockström, J., & Falkenmark, M. (2015). Agriculture: Increase water harvesting in Africa. *Nature*, 519(7543), 283-285.
- van Wijk, M. T., Merbold, L., Hammond, J., & Butterbach-Bahl, K. (2020). Improving assessments of the three pillars of climate-smart agriculture: current achievements and ideas for the future. *Frontiers in Sustainable Food Systems*, 4, 558483.
- World Bank. (2019). Agriculture's Contribution to Sub-Saharan Africa's Economy. The World Bank Group.

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About FANRPAN

The Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) is an autonomous regional stakeholder driven policy research, analysis and implementation network that was formally established by Ministers of Agriculture from Eastern and Southern Africa in 1997. FANRPAN was borne out of the need for comprehensive policies and strategies required to resuscitate agriculture. FANRPAN is mandated to work in all African countries and currently has activities in 17 countries namely Angola, Benin, Botswana, Democratic Republic of Congo, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

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