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# How to transform Africa's food system

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In 2021, one in five people in Africa was affected by hunger, and the continent had the highest prevalence of undernourished people globally. We argue that food systems in Africa can be more resilient if their development includes climate adaptation.

About 64% of the world's available arable land is in Africa<sup>1</sup>. The continent is also host to a young workforce<sup>2</sup>, and a range of traditional agricultural practices and emerging technologies that can revolutionize food production and trade. Yet, the number of undernourished African people is rising, with an increase from 15.5% to 20.3% between 2010 and 2021<sup>3</sup>. The population in Sub-Saharan Africa is expected to almost double by 2050, to reach about 2.1 billion people<sup>4</sup>, which will further increase demand for food. While efforts are being made to enhance Africa's food security and resilience, existing food systems have not properly addressed its needs and priorities<sup>5</sup>.

We propose five pathways to help shape and transform Africa's food systems, drawing on ideas discussed at a session at the Adaptation Futures Conference held in October 2023 in Montreal, Canada that was convened by the African Research Initiative for Scientific Excellence programme<sup>6</sup>. The pathways range from the development of food systems on urban fringes to revamping urban agroforestry policy and practices; reforming land use policies; investing in research, technology, and innovation; and minimizing inequalities in adaptive capacity strengthening.

## Develop food systems on urban fringes using green infrastructure

Peri-urban spaces in Africa have rapidly grown over the last three decades, not only in big cities such as Dar es Salaam, Tanzania<sup>7</sup> and Accra, Ghana<sup>8</sup>, but also in small municipalities such as Wa in north-western Ghana<sup>9</sup>. By 2050, African cities are expected to accommodate an additional 950 million people<sup>10</sup>, highlighting the urgent need for implementation of sustainable and smart urban food systems to feed this growing population. One way to reach this goal is to use all available urban spaces for food production including vertical walls, rooftops, community gardens, and vacant lots. Growing vegetables and fruits in controlled environments, such as in containers or hydroponically by feeding them nutrient mineral salts dissolved in water, also presents an opportunity for sustainable food production. The use of climate-smart agriculture techniques by, for instance, using drought tolerant crop varieties and drip irrigation, can significantly contribute to the supply of fresh produce in urban areas.

Working with local communities and relevant private sector actors is crucial to fostering a sense of ownership and collective responsibility and ensuring that initiatives are tailored to local needs for long-term

maintenance and success. The public-private partnerships can help secure funding and technical support to overcome the challenges of implementing peri-urban agricultural practices. For instance, the City of Tshwane Metropolitan Municipality in Gauteng province, South Africa, has demonstrated how one-on-one extension programmes and the revitalization of local traditional institutions can help develop successful climate-smart adaptive strategies. Public and private sector actors can partner to implement agricultural development support programs that build the capacity of smallholder farmers through demonstration projects and learning activities<sup>11</sup>.

## Revamp urban agroforestry policy and practices

The integration of trees with crops and/or livestock via agroforestry has proven to be an effective multifunctional approach to food production and conservation<sup>12</sup>. One of the notable examples of agroforestry initiatives is the parklands system in the Sahelian zone of West Africa where crops are grown under a discontinuous cover of scattered trees<sup>13</sup>, thus providing a buffer to extreme climate events that can sustain agricultural production. In northern Tanzania, multi-storeyed agroforestry cropping systems integrate several shrubs and trees with food crops and animals on the slopes of Mount Kilimanjaro<sup>14,15</sup>.

For agroforestry initiatives to thrive, urban (agro) forestry policy reforms should provide an environment that enables the development of integrated urban farming and good practices for their application<sup>12</sup>. The policy reforms should address issues such as land tenure and ownership, high agroforestry investment costs, and limited availability and access to training<sup>16,17</sup>. Training programs and workshops on agroforestry techniques can equip urban farmers with the knowledge and skills needed to maintain sustainable tree-crop systems. Agroecological practices such as organic farming or polyculture within urban agroforestry systems should be encouraged to increase yield and minimize environmental impacts.

## Reform land use policies

Africa's high population growth rate, coupled with the resulting urban expansion, puts agricultural land at risk of encroachment. For instance, Egypt's Nile Delta lost 74,600 hectares of fertile agricultural land to urban expansion between 1992 and 2015<sup>18</sup>. This is a significant loss in a country where about 96% of the total land area is an uninhabited desert<sup>19</sup>. Hence, implementation of robust land use policies and regulations, such as zoning in which an area is divided into specific land-use zones, is required to preserve agricultural land and help meet the current and future food demands<sup>20</sup>.

Urbanization guidelines and policies should encourage high density residential development, limit urban expansion, and designate green spaces and agricultural land. A good example where controlled urbanization has worked is in Egypt's Nile River Valley and Delta where urban expansion is



**Fig. 1 | Agroforestry and land optimization.** A hillside farm at Andasibe, Madagascar as seen in December 2023. Photo: Linnus Ngine, African Academy of Sciences.

now limited to desert areas to minimize loss of agricultural land<sup>18</sup>. Other interventions include improving land tenure security to incentivize communities and landowners to keep their land in agricultural production (Figure 1). Additionally, real estate developers should invest in urban redevelopment projects in previously built-up areas rather than greenfield sites. Focussing on brownfield sites contributes to the protection of agricultural land and thus enables sustainable development.

### Invest in technology, research, and innovation

Africa spends about 4.3% of its total public spending on Agriculture—falling short of the 10% target of the 2014 “Malabo declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods”<sup>21,22</sup>. Under the Comprehensive Africa Agriculture Development Programme framework, African countries are required to increase their agriculture spending to at least 10% of their public expenditure by the year 2025<sup>22</sup>. More investments are needed to facilitate the transition of African agriculture from labor-intensive, low-productivity activities to skills-intensive approaches<sup>23</sup> and build a resilient African food system.

Other relevant interventions include shifting the narrative from food availability to the development of resilient food systems by ensuring that farming is intensive, climate-smart, and technology-enabled<sup>24</sup>. Efficiency improvement in Africa’s food system is required in areas such as production, storage, processing, and packaging of foods<sup>23</sup>. Digital technologies should be leveraged to deliver agricultural information and training to remote areas and expand access to capital and resources. For instance, smallholder farmers can rent farm equipment such as tractors through mobile applications that would, otherwise, be too costly to own. The digital technologies can also help integrate smallholder farmers into the agricultural value chain as well as improve efficiencies<sup>25,26</sup>.

Considering the pivotal role played by agricultural research in agri-food systems, food system transformation requires intentional and targeted investment and innovation capacity strengthening<sup>27,28</sup>. Scientific exchanges in Africa and beyond should be strengthened to facilitate awareness of technological and scientific advances in the transformation of the food system and contribute to investments in the creation of locally relevant urban food systems. Additionally, education programs should be adapted to benefit from industry expertise, good practices, and emerging technologies through innovative initiatives. For instance, demonstration farms have

shown great potential to revolutionize Africa’s agriculture by providing a platform for technology transfer and peer-to-peer learning<sup>29</sup>.

### Reduce inequalities and enhance inclusive adaptive capacity

Existing social and structural inequalities perpetuate differential impacts and responses to shocks and stressors on various social groups, including women, indigenous communities, and smallholder farmers<sup>30</sup>. Moreover, disparities in gendered roles in land ownership and access to credit, financial services, markets, and agricultural labor influence the degree of exposure and sensitivity to disruptions in food security<sup>31</sup>. Hence, strengthening of inclusive adaptive capacity of both communities and systems can enhance food system resilience in the context of a changing climate.

In 2018, women accounted for just 33.3% of researchers globally and 33.5% in sub-Saharan Africa<sup>32,33</sup>. This calls for more investment in building gender-responsive research and innovation capacities for both individuals and institutions to ensure that food system innovations are locally relevant, equitable, and inclusive. Women with young children should be able to participate in capacity building initiatives by getting access to a caregiver, minimizing barriers such as gendered mobilities and immobilities<sup>34</sup> and enhancing inclusivity.

Achieving food security entails ensuring that all people have physical, social, and economic access to safe and nutritious food at all times, allowing them to lead active and healthy lives. If adequate measures are implemented, Africa can become a food secure continent and shift from being a primary food importer to a net food exporting continent, contributing to feeding the world.

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### Author contributions

O.O. conceptualized the study, O.O., D.O., and J.T. drafted the manuscript, L.K., P.O., D.O., and J.T. edited the draft manuscript and O.O. wrote the final manuscript.

### Competing interests

The authors declare no competing interests.

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