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Received: 22 January 2024 | Accepted: 18 November 2024

DOI: 10.1002/uar2.70007

Urban Agriculture & Regional Food Systems OPEN ACCESS

REVIEW

Urban farming system and food security in sub-Saharan Africa: Analysis of the current status and challenges

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Assigned to Associate Editor Alessio Russo.

Funding information
Partnership for Skills in Applied Sciences, Engineering, and Technology (PASET) Regional Scholarship Innovation Funds (RSIF), Grant/Award Number: ICIPE_RS192

Abstract

By 2022, 42.39% of the sub-Saharan Africa (SSA) population was living in urban areas. This urbanization correlates with increasing poverty, unemployment, food insecurity, environmental pollution, and the prevalence of informal settlements. These challenges worsened urban food insecurity during the COVID-19 pandemic in SSA cities. This review analyzed the role of urban farming system as a pivotal means to enhance urban food security, incorporating socioeconomic integration and environmental sustainability. The analysis is grounded in a systematic review using specific keywords, evaluating 46 articles and institutional reports related to the subject. The results revealed that 3.62% of SSA countries have implemented national urban governance and policies with minimal focus on urban farming. Rapid urbanization, urban population growth, and climate change are key factors contributing to cities' vulnerabilities to food insecurity in SSA. Predominantly characterized by horticultural practice, urban farming enhances the food supply system, nutritious security, jobs and income generation, reduces transportation costs, promotes the consumption of fresh food, and mitigates food loss in cities. Despite its importance, urban farming in SSA encounters several challenges: (i) urbanization governance

Abbreviations: IPCC, Intergovernmental Panel on Climate Change; SDG, sustainable development goal; SSA, sub-Saharan Africa; WFP, World Food Program.

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and policy, (ii) knowledge and technology in urban farming, (iii) access to land and water, (iv) financing and capacity building for urban farming, and (v) environmental pollution. SSA countries need a coordinated mix of urbanization policies and technological advancements to integrate innovative urban farming methods, bolstering cities' resilience to food insecurity. Implementing these measures could advance the achievement of sustainable development goals 2 and 11 in SSA cities.

Plain Language Summary

Despite having considerable of the world's remaining unutilized arable land, Africa is still unable to feed its growing population. This situation is principally worsened in sub-Saharan Africa, home to the 15 world's fastest growing cities. In this region, 34.19% of people facing hunger in 2022 were living in urban areas. In this context, urban farming system could be an alternative means of enhancing urban food security. But only 3.62% of sub-Saharan African countries have implemented urbanization governance and policies with minimal focus on urban farming. As a result, urban food insecurity is emerging as a serious problem of development that affects urban poor in this region. This challenge has been exacerbated by the COVID pandemic revealing the vulnerability of this urban poor population. This research underscores the potential of urban farming system to improve food security and contribute to climate change mitigation in sub-Saharan African cities.

1 | INTRODUCTION

Food availability on a daily basis remains a central concern for humanity. From 1974 to 1996, a series of conferences and summits on food and nutrition organized by the World Food Program (WFP) reaffirmed the universal right to safe and sufficient food (FAO, 2019). These gatherings underscored that the population's survival depends on consistent access to food and nutrition, aligning with the global right to be free from hunger. A notable outcome of these conferences was a collective state commitment to halve the number of undernourished people by no later than 2015 (FAO, 2002; FAO et al., 2015). Although farmers have produced adequate food quantities, allowing for a gradual increase in average per capita food consumption, the persistence of food insecurity has increased over the past four decades (FAO et al., 2021). The stability of food capital or reserves has fluctuated, occasionally reaching critically low levels due to numerous factors, including man-made conflicts, climate change, and economic downturns. According to the WFP, 135 million people suffer from acute hunger, predominantly due to these factors (Global Network Against Food Crises, 2020). It is now recognized that the world is not on track to achieve the goal of "Zero Hunger" by 2030, if recent trends continue, the number of people affected by food insecurity could exceed 840 million by that year (FAO et al., 2021). Food insecurity varies in severity across different regions of the world, with Africa being one of the most vulnerable, despite agriculture being a primary economic driver and a major contributor to the balance of payments (Giller, 2020).

Several factors contribute to this situation, including land fragmentation due to population pressure in rural areas and the low prices that farmers receive for their production, which are intended to meet the food needs of the burgeoning urban population in sub-Saharan Africa (SSA) (du Toit et al., 2018; Giller, 2020). Consequently, the available farmlands are insufficient to provide adequate food, ensure food security, or sustain household incomes in SSA. These challenges are related to population dynamics and growth. The global population reached 8 billion in 2022 (UN DESA, 2022), with more than 55% residing in urban areas—a figure projected to rise to 68% by 2050 (UN-DSA, 2018). Africa, which represents 16% of the global population, has 1.4 billion inhabitants in 2022 with 43.8% or 616 million, living in urban areas (Bulkeley, 2013). All 15 of the world's fastest growing cities are in Africa (Wang & Wang, 2017). This urban dynamic is noticeable in SSA.

The average urbanization rate in SSA was over 35% in the 1990s, 40% in 2000, and over 42.39% in 2022 (Kiribou et al., 2024; UN-DESA, 2022). The urban explosion is accompanied by an exponential food demand from rural areas. This highly contributes to food insecurity, which plays an important factor

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in the food crisis in SSA. It greatly contributes to inducing an agrifood deficit and recourse to external supply circuits (FAO et al., 2021). From 1982 to 1984, cereal imports made it possible to feed 50% of the urban population, and the percentage, on the other hand, fell to 32%/33% in 1985–1986 and 1995 due to urban population growth (Renting & Wiskerke, 2010). Cities' populations depend on the agricultural production of rural areas, which are supposed to supply the urban population with food. Paradoxically, these rural areas are already suffering from food insecurity. In addition, the food security crisis is exacerbated by many other driving factors such as regional or national armed conflict, climate change including desert locusts, and economic damage, which are expected of acute food insecurity (FAO et al., 2021; Food Security Information & Network, 2020) in SSA. Furthermore, institution reports show that food insecurity has risen since 2015 in SSA countries, and the situation has worsened owing to the implications of the COVID-19 pandemic threats (Ben Hassen & El Bilali, 2022; Wudil et al., 2022). Those challenges are the main factors of rural population migration to cities in SSA.

Therefore, the main questions in addressing the challenges of urban food insecurity in SSA are: What are the factors of urban population vulnerability to food insecurity in SSA? How can urban farming systems make cities resilient to food insecurity in SSA? What are the challenges that affect the full potential of urban farming systems to enhance urban food security in SSA? This review aimed to assess the contribution of urban farming system to food security challenges mitigation in SSA cities. It specifically consists of (i) analyzing urban population vulnerability to food insecurity in SSA cities, (ii) evaluating urban farming systems' contribution to food security in SSA cities, and (iii) reviewing the challenges that affect sustainable urban farming development in SSA cities.

Core Ideas

- Only 3.62% of sub-Saharan African countries implemented national urban policies, with little focus on urban farming integration.
- Limited technology and innovation, including land and water access, hinder urban farming productivity in SSA cities.
- Urban farming system is a nature-based solution that promotes food security, jobs, and climate resilience in SSA cities.
- To fully harness the benefits of urban farming, urban governance in SSA must incorporate it into cities' land-use planning.

1.1 | Concepts aspect

1.1.1 | Urban farming and food security

According to UN-Habitat, urbanization is the growth in the proportion of persons living in cities, a shift in population from rural to urban areas that is characterized by high human density and building (FAO et al., 2015; UN-HABITAT, 2020). There is no standard definition of urban, but it depends on national considerations concerning population statistics to consider a given area as a city. This phenomenon has become important with the world urban population expected to double by 2030 (Hutyra et al., 2014). Thus, urban farm systems are defined as plants and livestock production at home or in plots in the city or peri-urban areas, and their informal activity makes it difficult to characterize with precise data and tendencies (FAO, 2022). It consists of vegetable and fruit tree cultivation and production, including certain specialized crops such as medicinal and ornamental plants, wood production, and animal breeding or rearing, extending from common with bovines and poultry, and adding local species (Orsini et al., 2013). Urban farming is therefore a subcategory of urban agriculture that specifically emphasizes the cultivation of plants and the raising of animals for food within the urban environment or area (FAO et al., 2023). It is a component of urban agriculture, which is defined by the Food and Agriculture Organization of the United Nations (FAO) as "growing plants or livestock within and around cities including urban food supply systems" (Taguchi & Santini, 2019). Urban agriculture aims to integrate agriculture into the urban ecosystem, including food processing, distribution, and food waste management within the city (Rogus & Dimitri, 2015; Varzakas & Smaoui, 2024), while urban farming is only focused on plants and animal raising. The differences between the two concepts are the sizes of the plots, the purposes of the practices, and the main activities (Table 1).

It is clear that urban farming is a great component of urban agriculture, and there are no real differences in the practices. The main goals of both are food security improvement, urban sustainability, and community well-being (Nogeire-McRae et al., 2018).

Food security is usually a situation where all people at all times socially, physically, and economically have access to sufficient and nutritious food that meets their needs for an active, healthy life (Matemilola & Alabi, 2021; Taguchi & Santini, 2019). The 2022 World Food Summit reaffirmed the four main dimensions of food security, such as food availability, access, use, and food stability (World Bank, 2007). All these four dimensions raise the necessity of appropriate energy and nutrient eating by individuals for healthy diets and nourishing performance. These dimensions may be affected by many factors that can lead to food insecurity and malnutrition (Taguchi & Santini, 2019). In the coming 20 years, cities will accommodate more poor and undernourished people than the countryside in developing countries

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TABLE 1 Concepts aspects.

Concepts	Dimensional aspects	Characteristics
Urbanization	Multidimensional process with changes in landscape characterized by a high density of human settlement with land use and land cover change (Güneralp & Seto, 2013). Transformation owing to a mix of natural growth, rural-to-urban migration, and redefinitions of administrative boundaries at the national level.	A high density of human settlement and infrastructure development. Rapid growth with spatial sprawl in SSA, Economic activities are dominated by secondary and tertiary sectors. Large-scale social mobility and different occupations.
Urban agriculture	Great scoop with all aspects of the food system: production, processing, distribution, and waste management (Taguchi & Santini, 2019). Not only limited to growing plants and raising animals, but integrating food systems into urban ecosystems, and considering larger scale agricultural production (Ernwein, 2014).	Community gardens, rooftop gardens, greenhouses, aquaculture, livestock farming, and urban orchards (Renting & Wiskerke, 2010; Taguchi & Santini, 2019). – Food processing and distribution. – Communities-oriented farming: School gardens, food justice, and food educational programs in cities.
Urban farming	Widely focuses on growing plants and raising animals including food production for commercial purposes. It can be family or individual production.	Uses small plots or small areas. Commercial farming, small-scale farming, and innovative farming techniques (hydroponics, aquaponics, and aeroponics).

Source: Adapted from Ernwein (2014).

because of the exponential urban population growth (FAO et al., 2023; Varzakas & Smaoui, 2024). To overcome this situation in cities, urban farming, highly dominated by horticultural practice, has become an alternative to urban food sustainability.

1.1.2 | Urban farming system and sustainable development goals (2 and 11)

Urban farming is mainly oriented on horticultural practice. It consists of sustainable crop or plant development, marketing with intensive food cultivation mainly composed of fruits, vegetables, and ornamental and aromatic plant production including medicinal plants (Kaldate et al., 2021). According to Kaldate et al. (2021), these types of crops perform well and play an important role in agricultural prosperity and many countries' economies where the practice is developed. It contributes to the sustainable development goal (SDG) 2 achievement in the sense that it procures dietary and nutritional components and has become indispensable to meet the fruits and vegetables, including ornamental products, demands of the world's rapidly growing population in cities (Kullaj, 2016). Horticultural crop production constitutes a source of income for people and a great source of carbohydrates, proteins, organic acids, vitamins, and minerals for population nutrition all over the world, particularly in urban areas (Imahori, 2014). Thus, developed in urban farming, horticulture practice grants cities fresh vegetables and fruits, which is very crucial for diet and citizens' nutrition.

The achievement of sustainable food and nutritious systems is highly connected to SDGs through all SDGs with social and economic inclusion and safe environmental development (Varzakas & Smaoui, 2024). Furthermore, SDG 2 is targeted to make sure the world has sufficient delightful and nutritious food to eat for everyone and that no one is left behind (FAO et al., 2015). The 2.6 related to agricultural infrastructure investment and production tends to be focused on rural. But, with 55% of the current global population living in cities and projected to increase by 60% by 2030, it becomes critical to address the importance of urban farming. The urban farming practice integrated with nature-based solution could help address SSA African urban climate resilience and natural disaster management (Kiribou et al., 2024). It can contribute to the achievement of many SDGs in the face of climate change in cities such as SDG 1, SDG 2, SDG 3, SDG 8, SDG 11, SDG 12, SDG 13, and SDG 15. It therefore joins the implementation of urban greening development in cities (Table 2).

All these types of urban farming mentioned in Table 2 are found in SSA African cities. They are emerging in some cities, like Nairobi, Kenya, with a program of fresh food promotion, which provides training in innovative urban farming to people (Sarker et al., 2019; Drescher, 2000). Given the SDGs' connectivity and interdependence, the efforts toward the achievement of one goal can contribute to the achievement of others through the targets. Thus, urban farming practices that concern SDG 2, particularly in cities, help make efforts to the achievement of many other goals.

1.1.3 | Sub-Saharan Africa crop system and food security

SSA has agricultural potentiality in terms of area and population. It contains 61% of the population classified as farmers and is relatively well-endowed with natural resources, and almost an area of 173 million hectares is under annual

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TABLE 2 Benefits of urban farming system.

Type of agriculture	Types	Benefits for urban food and climate resilient	SDGs
Gardens	Community gardens, Growing flowers. Backyard gardens. Rooftop gardens, tactical gardens, market gardening, green walls, and balcony gardens (Dhar & Boruah, 2024).	Diversity of vegetables and fruit production. Reduction in floods. Mitigation of urban heat stress. Carbon sequestration. Soil stability and erosion reduction. Biodiversity preservation. Health and quality of life in cities.	2, 3, 11, 12, 13, and 15
Urban agriculture/farming	Aquaponics, aquaculture, beekeeping, and growing flowers and plants. Community farms. Crop-type diversification and rotation in suburban areas, and urban agroforestry. Horticulture (Kaldate et al., 2021).	Revitalization of abandoned or underutilized urban land. Fresh fish, fruit, vegetable, and honey production with horticultural crop (Kullaj, 2016). Urban fresh food supply, distribution and reduction of food loss. Development of income and increased employees. Reduction in floods and water wasting. Agrofood innovation and technology development. Mitigation of urban heat stress. Biodiversity preservation, Carbon sequestration, and urban air quality improvement.	2, 6, 8, 9, 11, 12, 13, and 15
Animal husbandry	Urban livestock, animal breeding, and poultry.	Urban fresh meat and cow's milk production. Reducing poverty and increasing income.	1, 2, 8, 9, 11, and 12

Source: Adapted from UN sustainable development goals (SDGs) (Gerstetter et al., 2020; United Nations, 2024; Kiribou et al., 2024).

farming or permanent crops (FAO, 2002). This represents one over four of the potentially arable areas in SSA. The agroecological diversity varies from northern Mali with arid drylands to Congo with humid tropics. There are six agroecological zones, distinguished by the extent of the potential growing period for rainfed agricultural production, such as desert, arid, semiarid, subhumid, humid, and highland. Rainfall ranges dramatically, from over 2000 mm/year in central Africa to less than 400 mm/year in arid areas (Bationo et al., 2007) (Figure 1).

The crop production varies from the coastal artisanal fishery, pastoral, sorghum, rice, and forest-based production to irrigation crops. In the region of SSA, the arid and semiarid agricultural and ecological zones encompass 43% of the land extent, the dry subhumid zone is equivalent to 13%, and the humid and subhumid zones jointly account for 38% (Mendelsohn, 2008).

Moreover, two-thirds of the SSA population primarily derive their livelihoods from agriculture (Bart, 2013). As urban areas attract people and exponentially expand in the territory, agricultural activities in rural areas turn out to be less prevalent in terms of persons employed despite 56% of the African population living in rural areas (ILO, 2020). In 2019, the International Labor Organization reported that the labor force participation rate is larger in rural areas than in urban ones in Africa and has been projected to increase in the next two decades in Africa (ILO, 2019). It is also characterized by a large diversity of crop production with smallholder farmers whose production is highly affected by the effects of climate change and causes food insecurity directly or indirectly (Livingston et al., 2014). The climate change impacts affecting crop production vary significantly, depending on the farming system and the agroecological zones, which is particularly factual for SSA. For example, severe drought or flooding can directly threaten crop production, while indirectly, favorable environmental conditions in desert areas can increase the number of desert locusts, which jeopardizes crop yield and increases food insecurity (FAO et al., 2021). Compared to historic climate scenarios, climate change will lead to changes in yield and area growth, higher food prices and therefore lower affordability of food, reduced calorie availability, and growing childhood malnutrition in SSA (Global Network Against Food Crises, 2020). Moreover, the inadequate growth of population increases and food production in SSA has led to a food deficit where more than 34 countries out of the global 44 low-income food-deficit countries are in SSA (FAO, 2019). This food deficit has increased food importation by SSA countries over the past two decades, which affects their economy. The analysis of the FAO data (FAOSTAT, 2023) shows that from 2000 to 2022, SSA Africa imported an average of 3.7 billion tonne of food for consumption with an average of 61.6 million tonne (Figure 2).

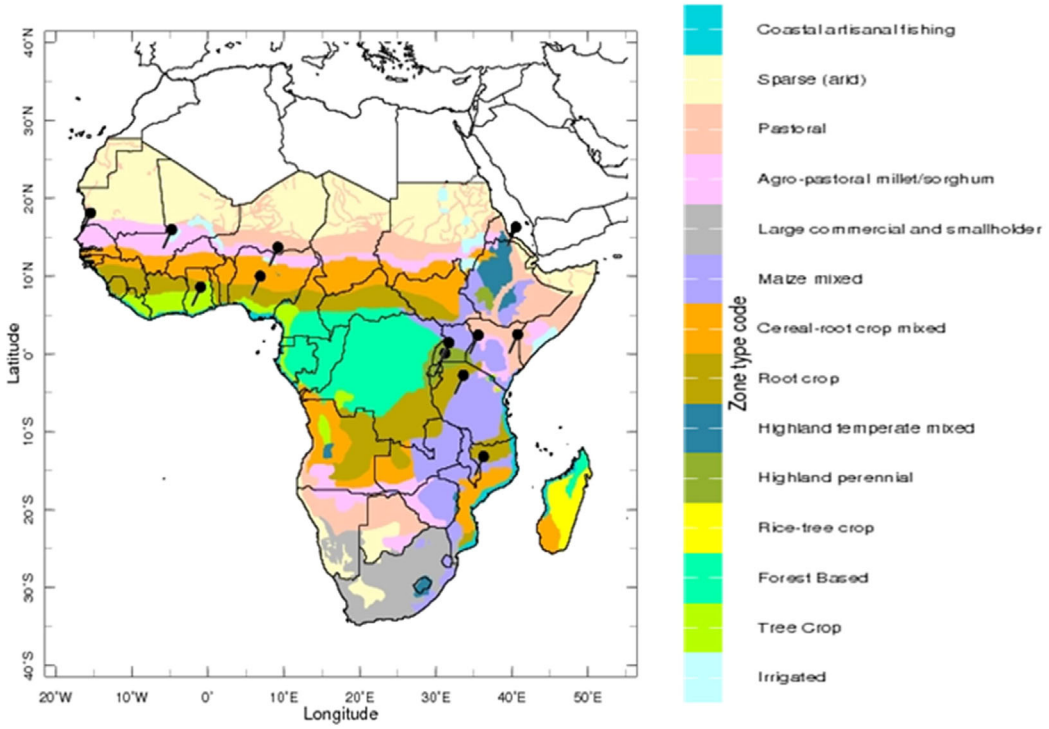
Annually, the SSA countries import an average of 1.6 billion tonne of food. This farming system with insufficient food production in the context of climate change effect makes the SSA region vulnerable to severe food security challenges.

2 | METHODOLOGY

2.1 | Review area

SSA is an African subregion with a surface area of 24 million km^2, or 2455 million hectares, which is therefore one of

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Adapted from IRI (November 2023) and FAO library data (2020)

FIGURE 1 Sub-Saharan African farming system under current climate condition.



FIGURE 2 Crop and livestock production and importation balance.

the larger developing regions. It contains a total population of 1152 million in 2022 and is expected to reach 1401 million by 2030 and 2094 million people by 2050 (UN-DESA, 2022). More than 384 million are classified as farmers, and comparatively, the region is well-endowed with natural resources, with 173 million hectares under annual farming (FAO, 2002). This agroecological diversity ranges from the arid drylands of northern Mali to the humid tropics of the Congo. This subcontinent is composed of 46 countries (Figure 3).

The urban population in 2022 was 513,149,000 inhabitants, which represents 42.39% of the SSA population, an increase of 3.86% from 2021 (Tuholske et al., 2019; United Nations et al., 2019).

2.2 | Materials and method

The methodology is based on a systematic review of scientific articles, institutional reports, and books. The documents are retrieved using keywords such as "*Urban*," "*Urbanization*," "*agriculture*," "*Urban agriculture*," "*Urban farming*," "*food*," "*insecurity*," "*Sub-Saharan Africa*," and "*horticultural*." The Boolean operator "*AND*" is used for keyword combination. The inclusion criteria for the document retrieval are based on the geography of the study area, the languages, the publication timeframe, research questions, and objectives. Thus, the peer-reviewed articles that focused on food security in developing countries, in Africa, and SSA in the

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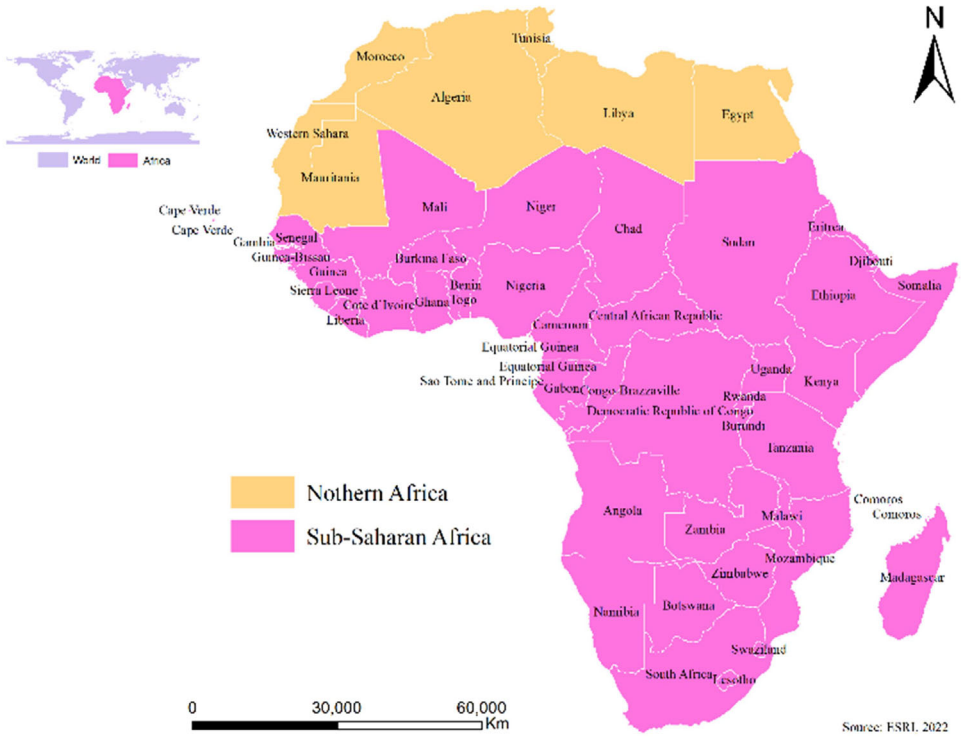


FIGURE 3 Presentation of the review area.

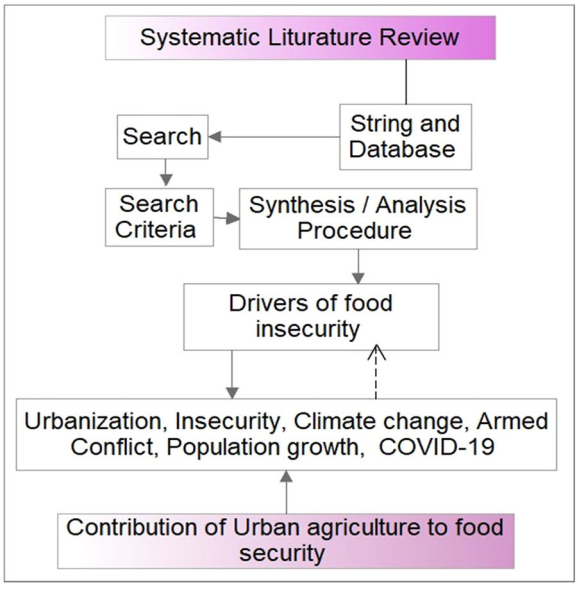


FIGURE 4 Research review flowchart.

past two decades are considered using Scopus search. Mendeley software is used to manage the references and citations. The analysis is critically based on the drivers of the food security crisis, highlighting the importance and challenges of urban agriculture in SSA cities as shown in the review flowchart (Figure 4).

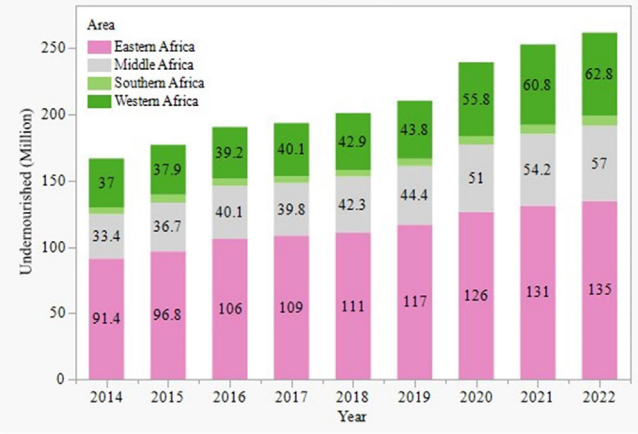
More than 46 articles and reports have been assessed. Additionally, secondary data from the International Research Institute for Climate and Society, FAO, and UN-DESA are used to retrieve data to highlight drivers and phenomena that exacerbate the urban food security challenges in SSA. Qgis Software 3.20 (QGIS Development Team, 2021) including R software version 4.2 (R Core Team, 2023) are used to analyze statistics and geospatial data using the SRI country shapefile 1996–2019 MapCruzin.

3 | RESULTS

3.1 | Situation of urban food insecurity in sub-Saharan Africa

The 2022 FAO's report has highlighted about 239.6 million people malnourished in SSA, and the region has the second-largest number of people who are facing acute hunger (FAOSTAT, 2023). Moreover, the analysis of Food and Agriculture Organization Corporate Statistical Database data from 2014 to 2022 revealed an increase of 1.3 million people facing hunger each year in SSA, either a growth rate of 5.02%. Eastern Africa has the highest number of undernourished people, followed by Western Africa. For instance, in 2022, Eastern Africa had 135 million people facing hunger, while it was 91.4 million in 2014 (Figure 5).

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FAOSTAT (2023)

FIGURE 5 Prevalence of severe food insecurity in the sub-Saharan African region from 2014 to 2022 (FAOSTAT, 2023).

In 2021, the WFP evaluation of food insecurity in cities revealed that urban areas of SSA are at high risk of hunger. It is estimated that 68 million people in SSA cities were at risk of severe food insecurity (WFP, 2022). This includes 22 million in Central (middle) Africa, 16 million in West Africa, 15.7 million in East Africa, and 14.4 in Southern Africa (Figure 6A). The share of the urban food insecurity revealed 32.3% for Central Africa, followed by West Africa with 23.5% (Figure 6B).

In 2022, people under food insecurity in urban areas represented 34.19% of the total SSA population facing hunger. In the context of rapid urbanization that outpaces infrastructure development, urban food insecurity will become a serious problem of development in the future. The situation of food insecurity in SSA cities concerns more urban poor people (WFP, 2022). This confirms that food insecurity is a real concern among the urban poor in SSA that has been exacerbated by the COVID pandemic.

The COVID-19 pandemic has affected all SSA African countries, particularly in the urban areas, and has been associated with higher levels of food insecurity, income losses, and increases in food prices (Tabe-Ojong et al., 2023). This has aggravated undernourishment prevalence with hunger that affected 21% of the African population (FAO et al., 2021; Tabe-Ojong et al., 2023). With the disruption of the food supply chain due to the prolonged lockdown measures during the COVID-19 pandemic, food prices have increased in the SSA cities. Thus, this pandemic has been a severe menace to food security, particularly in SSA cities, which is characterized by challenges in food availability, food affordability, and poverty (Orsini et al., 2013). In this trend, SSA could not be on track to meet SDG 11, related to sustainable cities, and two targets of SDG 2, related to ending hunger and ensuring access by all people to safe, nutritious, and sufficient food all year round to end all forms of malnutrition. Indeed, this food insecurity and malnutrition are driven by many factors that are highly amplified by climate change (FAO et al., 2021).

3.2 | Factors of urban population vulnerabilities to food insecurity in sub-Saharan Africa

3.2.1 | Climate change and its impacts

Hunger in SSA is affecting not only the rural population but also becoming perceptible in urban areas despite more than 60% of its population being farmers (Goedde et al., 2019). Hunger persistence makes SSA one of the most affected by food insecurity with climate change effects as one of the major factors (Food Security Information & Network, 2020; IPCC, 2022).

Climatic change in SSA is especially pronounced with intensified temperature extremes, precipitation anomalies, and natural disasters that annually leave millions of people in peril, injured, homeless, or food insecure, and cause serious and costly economic damage (Serdeczny et al., 2017). The high levels of dependence on precipitation for the viability of SSA agriculture, in combination with observed crop sensitivities to maximum temperatures during the growing season (Puthalpet, 2022), indicate significant risks to the sector from climate change. The Intergovernmental Panel on Climate Change (IPCC) states with great levels of assurance that the overall effect of climate change on yields of cereal crops in the African region is very probable to be negative, with strong regional disparity (FAO et al. 2021). "Worst case" climate predictions show losses of 27%–32% for maize, sorghum, millet, and groundnut for a warming of about 2°C upstairs preindustrial levels by mid-century (Serdeczny et al., 2017). Agricultural potentiality and productivity are highly impacted by climate change, which exposes 240 million people to daily hunger (FAO, 2022). It is observed that extreme climate impacts on agriculture and poverty are rising, and farming outputs, as well as the livelihoods of people who depend on it, are becoming particularly vulnerable (IPCC, 2022). This becomes a major threat to food production and food security in SSA countries.

Urban weather patterns are highly affected by climate change through droughts and floods, which impact urban farming system production, affecting food availability and prices in cities (Food Security Information & Network, 2020). Furthermore, urban heat including environmental degradation in SSA cities supplementary exacerbates the challenges of food production and distribution within the urban areas. All these together expose the urban population to food insecurity. For instance, by 2050, the warming of temperature by 1.2–1.9°C, according to the current IPCC projection, could highly increase the malnourished

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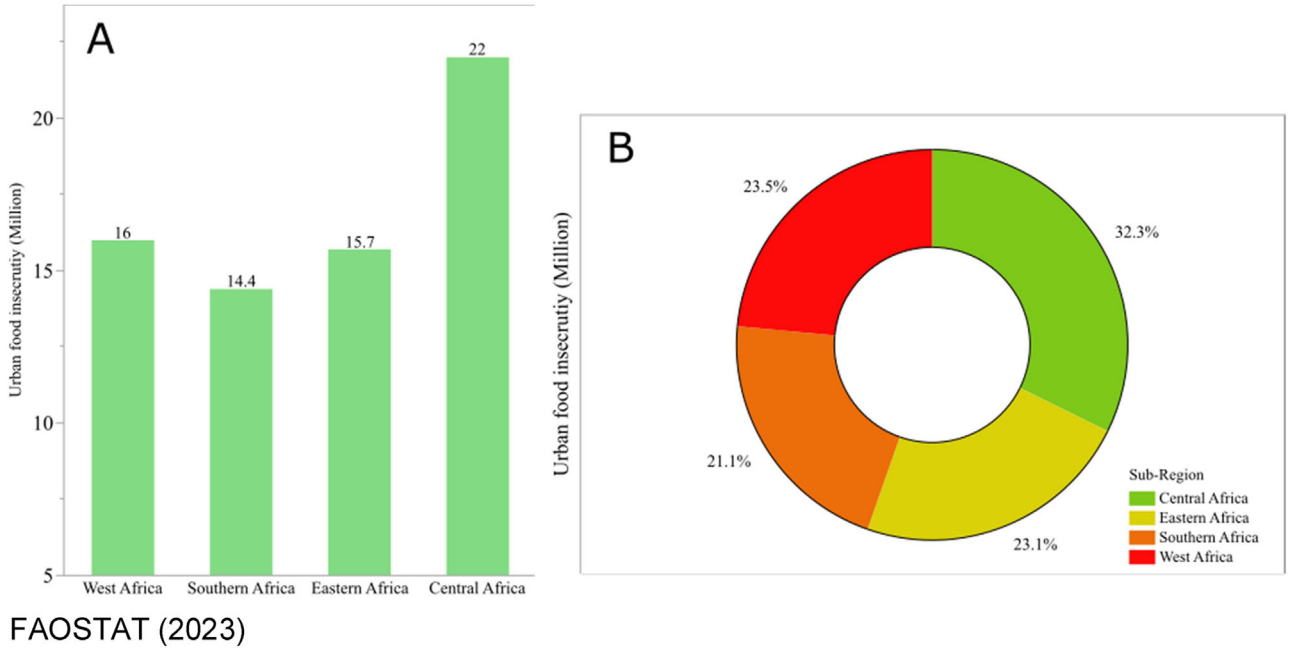


FIGURE 6 Prevalence of urban food insecurity in SSA in 2023 (A) Number of people under urban food insecurity, (B) Share of urban food insecurity in SSA area (FAOSTAT, 2023).

population in SSA by 25%–95%, with Central Africa at 25%, East Africa at 50%, southern Africa at 85%, and in west Africa 95% (Muluneh, 2021). Climate change severity can therefore contribute to reduced access to drinking water, affecting poor people, and poses a factual threat to urban food production and food security challenges in SSA cities (IPCC, 2021). The impact is expected to act as an effective barrier to agricultural growth in many regions, especially in developing countries such as SSA, which is heavily dependent on rain-fed agriculture (Mereu et al., 2018). Considering the annual growth rate (5.19%) of people under food insecurity in cities, urban areas will bear more than 82 million population with hunger in SSA cities by 2030.

3.2.2 | Urbanization and population growth in SSA

With urban population growth rate of 3% in SSA in 2018, it is estimated that an average population of 1.9 million inhabitants live in cities (UN et al., 2015; UN-DESA, 2022; UN-DSA, 2018). The high and low growth rates of each country's cities revealed a wide variety of urbanization performances for different city growth rates. It indicated a disparity in population settlement between countries with cities of more than 14 million inhabitants, such as Lagos in Nigeria, Kinsasha in R.D Congo, and more than 12 cities with 5–10 million population including 58 cities that have above 1 million populations (Figure 7).

The UN urban population projection by 2030 highlighted that the SSA will accommodate 1.40 billion and may grow up to 3.78 billion at the end of this century, or 2100 (UN-DESA, 2022). This exponential increase in urban population is due to the high fertility of women, rural migration in SSA, and so forth. Women in SSA have an average of 5.1 children, a decline from 6.7 children in 1970 but still more than double the world average of 2.5 children (PRB, 2012). Moreover, 2/3 of the SSA people rely on small-scale farming for livelihood. With the rural population growing, farms are likely getting smaller because of the family members dividing land for the benefit of their kids. In Kenya, for instance, farmers in their majority have reported that their land's production is not appropriate to sustain their families, and two over three confirmed that there is a lack of available land for their children to stay in the community and farm (FAO, 2022). Furthermore, in 2022, 42.39% of the SSA population was living in urban areas with a high urbanization rate in Western Africa, followed by Eastern Africa. It is projected to have more than 500 million people in urban areas in Western Africa by 2050 (Figure 8).

This increase in urban population in conjunction with rural poverty will impact food production and could make food insecurity worse in cities with disruptions of conflicts affecting the regional food supply chain.

Even though it is very difficult to assess and quantify up to date the existing relationship between conflict and food insecurity in SSA, it has been reported that between 2009 and 2019, violent conflicts have had more and more significant

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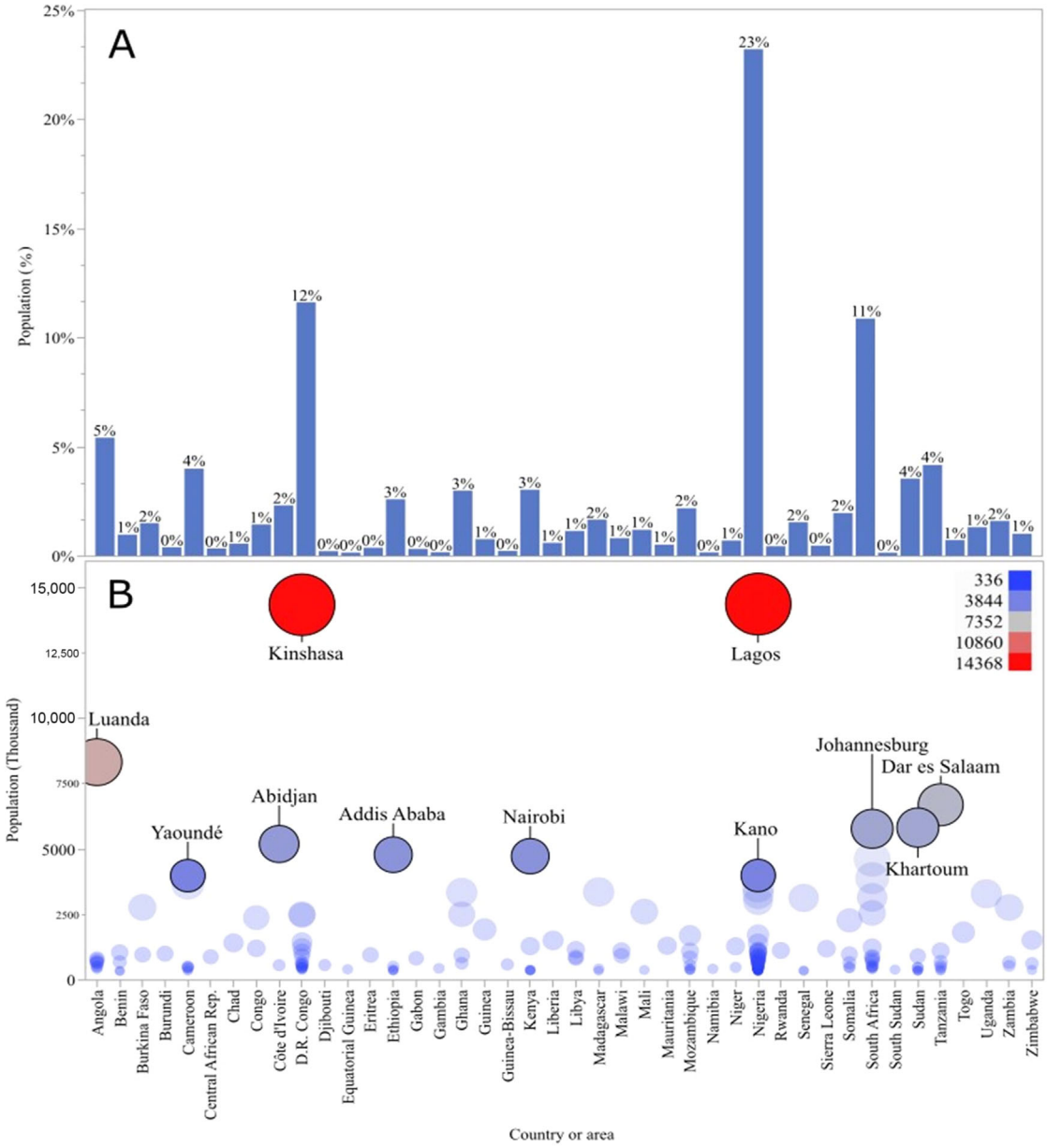


FIGURE 7 Urban population in sub-Saharan Africa (SSA) in 2018.

impacts on food availability and accessibility (Rachel Fritts, 2021). Thus, conflicts exacerbate and prolong the displacement and relocation including population migration to cities. For example, violent conflicts in Nigeria, Somalia, and South Sudan have contributed to conflict-driven food insecurity, by the way emphasizing that conflicts are very context-specific crises for food security (Anderson et al., 2021). Since SSA African countries depend on food importation such as wheat, cereals, and other food commodities that are much consumed by urban populations, they are affected by certain conflicts far away from Africa. The clearest example is the recent Russian military offensive in Ukraine, which has aggravated hunger throughout the region and threatened food security around SSA cities. In 2020, five countries (Eritrea, Benin, Sudan, Djibouti, and Tanzania) in SSA imported over 70% of their wheat from Ukraine (Ben Hassen & El Bilali, 2022; Yohannes-Kassahun, 2023).

Thus, SSA cities are highly dependent on cereal imports, which represent less than a third of the economic value of urban food consumption (Bricas & Tchamda, 2017). The increase in food import bills, which stood at a huge amount of $43 billion in 2019, has attracted mounting attention as a worrying tendency (Korth et al., 2014). In 2011, the African Development Bank estimated around USD 35 billion for food importation in SSA, and it is expected to reach USD 90 billion by 2030 (Bart, 2013). For years, researchers wondered why Africa appeared progressively unable to feed itself, despite having considerably of the world's remaining

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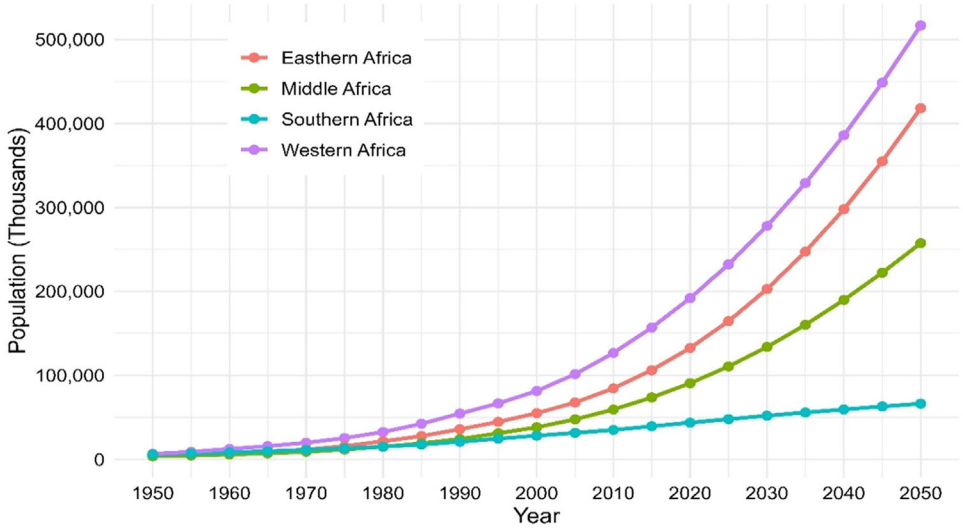


FIGURE 8 Subregional urban population dynamic in sub-Saharan Africa (SSA).

unutilized arable land. This situation can be explained by many factors such as climate change, lack of agricultural finance, and governance in both rural and urban food production, including lack of innovation and technological development in agricultural practices. In this context, how can urban farming play a significant role in addressing food insecurity in SSA cities?

3.3 | Urban agriculture role in cities' food insecurity resilience in SSA

3.3.1 | Urban agriculture benefits for SSA cities' food sustainability

It is well known that agricultural production has always been linked with the rural environment, which means that it was exclusively for that area. This has led the urban population to rely on rural food production to survive, and the lack of adequate agricultural production has directed SSA countries to import food to supply urban people (Orsini et al., 2013). Therefore, the living reality of cities, including poverty and high unemployment rates, can show that the city dwellers are facing a high rate of food demand. In this context, some city dwellers produce some crops and farm in the cities including the surrounding areas, and specialize in fresh products such as vegetables, milk, eggs, and chickens (Korth et al., 2014). In Kumasi city, Republic of Ghana, it has been reported by Moustier and Danso (2006) that the origin of food items sold/consumed by the population is from urban farming. For example, urban and peri-urban farming provides up to 40% cassava products, 80% chicken/eggs, 90% lettuce, and 95% fresh milk (Moustier & Danso, 2006).

Urban agriculture is mainly dominated by horticultural plants, including vegetables, and aromatic and flowering plants, such as amaranth, beans, broccoli, cabbage, cassava leaf, cucumber, and lettuce. This includes aromatic and flowering plants composed of lemon grass, basil, Indian borage, mustard, and fruits, ornamental plants, and so forth. (Orsini et al., 2013). This type of farming is due to the effective use of ordinary assets including soil and water availability, which, as compared to normal farm systems, presents more profits in small-scale areas (Sarker et al., 2019; Drescher, 2000). Urban agriculture has the benefit of promoting smart agriculture practices through the use of new technologies (FAO, 2002). This practice has generally revealed its importance and plays a key role in cities' food security and contributes to generating income and creating jobs (Weinberger & Lumpkin, 2005). The localization of the gardens near the markets reduces the need for conditioning and storage infrastructures and reduces postharvest losses, which can be as high as 30% (Orsini et al., 2013). Urban agriculture also provides households with food security and income. A finding of a study carried out in 2015 in Addis Ababa showed that 74.4% of households practicing urban farming were food secure, while 24.4% and 1.2% were mildly and severely food insecure, respectively, at Yeka Sub City (Mezgabu & Tolossa, 2016). It was also revealed that there is a significant relationship between food security status and income. Urban agriculture contributes to one-third of the total income in cities.

The urban farming systems are therefore contributing to safe food access in cities, generating income for people across SSA countries, and increasing access to jobs for many urban households (Korth et al., 2014). It allows for the development of a variety of environmental, economic, and social benefits to the surrounding communities, conserving biodiversity,

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and makes cities sustainable with a nature-based solution approach (Gerstetter et al., 2020; Kiribou et al., 2024). Urban farming can reduce transportation costs, contribute to cities' climate resilience, and help reduce runoff associated with heavy rainfall in SSA (Kiribou et al., 2024). However, this agricultural practice is facing many challenges.

3.3.2 | Urban farming and cities' governance challenges in SSA

The challenges that SSA nations are facing in their urbanization range from cities' vulnerability to climate change, urban food insecurity, the explosion of informal settlements, urban pauperism, and urban environmental pollution. All these urban challenges in SSA find their origin in urban governance and policies (UN Habitat, 2017). Thus, sustainable urbanization and urban farming depend on urban governance, development strategies, and accurate policy implementation to make cities free from hunger (Varzakas & Smaoui, 2024). The lack of urban governance has led more than 62% of the SSA urban population to reside in abnormal or anarchic settlements, according to the 2020 report of UN-Habitat (UN-HABITAT, 2020). Moreover, in the face of urban challenges persistence, limited countries in SSA have developed a national urban governance roadmap. We observed 17 over 47 countries, or 3.62%, had an explicit national urban policy in 2015 (UN Habitat, 2017). The lack of this urban governance has left SSA cities facing many additional challenges such as land and water accessibility, increasing urban food insecurity, and urban environmental pollution. Water accessibility is often a great factor limiting urban farm production, and most urban farming systems are based on traditional irrigation using water from gutters drainage. This practice often contributes to air and soil in the context of a lack of innovation and technology deployment in urban farming production (Food Security Information & Network, 2020; Varzakas & Smaoui, 2024). The farmers often produce plants in high-stress conditions with urban air pollution, produced via urban transport and traffic (Agrawal et al., 2011). Those are therefore presenting a high risk of contamination not only for consumers but also for producers. Other challenges that are affecting urban farming in SSA are problems of finance, lack of training, and absence of promotion of urban farming. All these can be associated with urban planning and governance, which do not integrate urban agriculture into urban policies (Grasham et al., 2019).

Urban poverty has led to undernutrition among city dwellers. Populations with low income are involved in a food and nutritious deficit, and per capita vegetable consumption in SSA cities is usually low, and there is no chance of encountering the World Health Organization/FAO daily lowest suggested fruits and vegetables quantity of 400 g (150 kg/year) consumption (Orsini et al., 2013). This can be explained by urban poverty. The context of SSA city development with spatial sprawl in building requires space, which consequently increases the land value and compromises land access for the urban farmers, thus negatively affecting urban agriculture productivity (Mezgabu & Tolossa, 2016). The difficulties in land accessibility are due to either its availability or the cost, limiting the variety and choices of some species cultivation, which impacts crop performance (Weinberger & Lumpkin, 2005). Another challenge is a lack of an adequate data for accurately driven decision-making to improve urban farming.

4 | CONCLUSION AND RECOMMENDATIONS

In 2024, 34 countries (73.9%) were defined by FAO as low-income food deficit in SSA. More than 34.19% of the urban population is under food insecurity in SSA cities, or 68.1 million in 2022. In this context, urban farming offers a pivotal solution to alleviate the adverse food security of urban poor populations. Despite it being difficult to estimate with accurate data, it has been proved that urban farming contributes to safe food access and creates income, and jobs for city' dwellers. It highly contributes to improving food security among the poor in urban contexts across SSA countries. Thus, focusing on community engagement, sustainable food production, and economic opportunities, urban farming can enhance food security, improve nutrition, and build resilience in vulnerable urban communities in SSA cities. Despite its importance for cities' resilience to food insecurity, climate change-resilient urban farming in SSA faces many challenges, mainly due to urban governance and policy. This includes climate change impacts, water and land accessibility, lack of finance and knowledge, and demographic growth. Only 3.62% of SSA countries own their urban governance and policies in 2015. For sustainable urban farming systems, SSA countries should:

- integrate urban farming into cities' governance and policies;
- create and maintain urban green belt that could leverage urban farming and urban climate resilient;
- create a framework of urban farming promotion with emphasis training on horticultural practice;
- leverage innovation and technology development to unlock the full potential of urban farming in SSA cities;
- Strengthening the capability of city leaders and policy to address equity and sustainability of urban farming at local, regional, and national levels in SSA;
- develop a sustainable food supply chain in the cities with the integration of urban farmers into the local market.

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To help achieve SDGs 2 and 11, through urban farming, SSA cities have to deploy innovation and technological development, including accurate urban planning and governance.

AUTHOR CONTRIBUTIONS

Razak Kiribou: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; validation; visualization; writing—original draft; writing—review and editing. **Bobe Bedadi**: Conceptualization; investigation; methodology; project administration; resources; supervision; visualization; writing—review and editing. **Kangbéni Dimobe**: Methodology; supervision; writing—review and editing. **Julius Ndemere**: Visualization; writing—review and editing. **Tiga Neya**: Methodology; writing—review and editing. **Valentin Ouedraogo**: Visualization; writing—review and editing. **Sintayehu W. Dejene**: Investigation; methodology; project administration; resources; supervision; validation; visualization; writing—review and editing.

ACKNOWLEDGMENTS

We are grateful to the Natural Resources Institute (NRI) at Greenwich University in the UK for their support and guidance during our internship. Great thanks to the Partnership for Skills in Applied Sciences, Engineering, and Technology (PASET) Regional Scholarship Innovation Funds (RSIF) for their financial support. Great thanks to Haramaya University, our host institution.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest

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How to cite this article: Kiribou, R., Bedadi, B., Dimobe, K., Ndemere, J., Neya, T., Ouedraogo, V., & Dejene, S. W. (2024). Urban farming system and food security in sub-Saharan Africa: Analysis of the current status and challenges. *Urban Agriculture & Regional Food Systems*, *9*, e70007. https://doi.org/10.1002/uar2.70007

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