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Chapter

The Role of Small-Scale Farmers in Ensuring Food Security in Africa

Samkelisiwe Nosipho Hlophe-Ginindza and N.S. Mpandeli

Abstract

This chapter focuses on the role of African small-scale farmers in ensuring food security going into the future and the support they will need to face the projected climatic conditions. Severe climatic conditions contribute to the uncertainty in water availability for future agricultural production. Adapting to climate change and ensuring food security requires dynamic interventions that will lead to the transformation of current farming and food production patterns as well as food distribution. Nearly 95% of Africa's agriculture is rainfed; therefore, developing and promoting rain-fed small-scale agricultural activities is a cost-effective approach for transforming rural areas in Africa and ensuring food security at local and regional levels. This is crucial in reducing vulnerability to climate change and for building sustainable livelihoods.

Keywords: Africa, small-scale famers, food security, rain-fed agriculture

1. Introduction

The world population is expected to grow by more than one-third, that is, 2.3 billion people, between the years 2009 and 2050. This growth is slower than the one seen in the past four decades, where the population grew by more than 90% (3.3 billion people). Nearly all the predicted growth is to take place in the developing world, predominantly in Africa. The fastest growth (+114%) is forecasted for sub-Saharan Africa and the slowest growth (+13%) for East and Southeast Asia [1].

Food security exists when all people in a society have adequate food for an active, healthy life at all times [2]. As a broad term, 'food security' is defined by: (1) the availability of safe and nutritious food and (2) a guaranteed capability to procure and acquire food of good quality in a socially acceptable way. Food insecurity on the other hand occurs when basic healthy food is not easily accessible, and poor households struggle to secure enough food for their nutritional needs [3]. Food insecurity has been identified as a global crisis [4].

Food insecurity is a major challenge in African countries where the rate at which the population grows far exceeds both the quantity and quality of food required to sustain the population (**Figure 1**). It is reported that 204 million of the 814 million undernourished people in the world live in sub-Saharan Africa [3]. The root causes of hunger are poverty and poor food distribution. The majority of poor households in sub-Saharan Africa are struggling to access high national and healthy food. Food insecurity and hunger in sub-Saharan Africa are caused by agricultural policy uncertain such as land reform and expropriation land without compensation. Increased food requirements from a growing world population will only escalate existing food

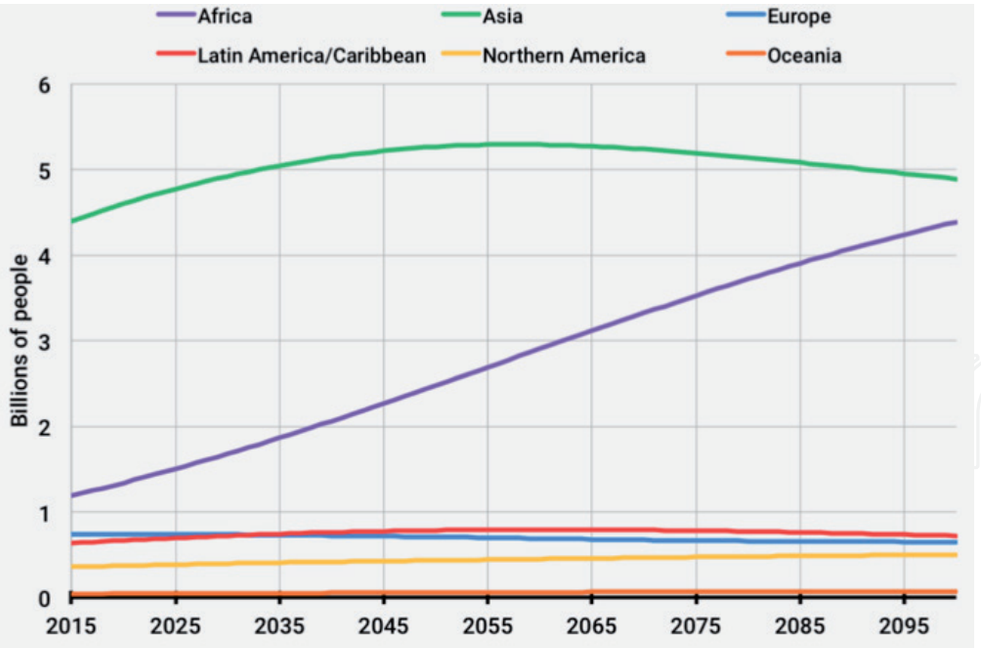


Figure 1.
Population projections. Source: [1].

security problems. The United Nations estimates that by 2050, 86% of the world's population living in extreme poverty will be concentrated in sub-Saharan Africa [1]. And in order to ensure food security in the future, current food production levels will need to be increased by at least 70% [1].

Projected climate change and unexpected extreme weather events will worsen the fragile agricultural systems, negatively affecting the natural resource base, particularly in places prone to soil degradation, water scarcity and desertification [5]. The sub-Saharan Africa is well known for relying heavy on rainfed agriculture, however, due to threats posed by extreme climatic events, high climate variability and change, the majority of the climate sensitive sectors are struggling to cope and adapt to challenges posed this natural vagaries. The general effect of climate change on agriculture will differ between different geographic regions, and it will still be difficult for farmers to plan and manage production while preventing crop losses or outbreaks of pests and diseases.

2. Food demand and production

Most of the poor population in Africa depends on agriculture, particularly small-scale farming, as the primary source of their livelihoods. Ensuring food security and poverty reduction in many African countries depends largely on the on the growth and development of the agricultural sector [6]. Agriculture in Africa is dominated by small-scale famers who rely on family labour; with 33 million farms that are less than 2 ha, small-scale farms represent 80% of all farms [7]. The role of small-scale farmers in ensuring food, nutrition security and sustainable rural development in Africa is becoming more crucial as the world faces increasing climate change challenges. Africa needs ecologically sound and climate-resilient farming systems to provide nutritionally balanced food and ensure food security for the most vulnerable.

Getting rural households to actively participate in small-scale agricultural activities for subsistence farming can play a vital role in minimizing the vulnerability to hunger in rural food-insecure households [8]. Studies done in different countries indicate that the gross domestic product (GDP) growth originating from

agricultural activities is at least twice as effective in advancing the poorest half of a country's population than GDP growth generated from any other sector [9]. This benefit from the agricultural sector is to be anticipated considering that 75% of the poor in African countries live in the rural areas and derive their livelihood from agriculture as well as other agriculture-related activities. In another study, [10] also reported that people who depend on agriculture for their livelihood in African countries are typically much poorer than those working in other sectors; these people, however, represent a relatively large portion, often the majority, of the total number of the poor people in these countries.

The term smallholder or small-scale farmers refers to producers who farm in smallholdings [11]. This term includes farmers growing in home-food gardens or homestead gardens, irrigated farmers and people farming in rain-fed fields outside of the homestead [11]. Characteristics differentiating small-scale/smallholder from commercial farmers include scale and size of farm system, proportion of crops sold, household expenditure, and use of family labour, mechanization, capital intensity, financial ability and level of linkages with larger economic systems [11, 12].

According to Antonaci et al. [13], 80% of the food produced in sub-Saharan Africa is produced by smallholder farmers and these farmers are also the largest employers for the local labour force in these countries. This is partly because poverty is still a major challenge in sub-Saharan Africa and also because the agricultural sector also contributes a large share of the GDP and employment. Agriculture employs between 60 and 90% of the total labour force in sub-Saharan Africa [14].

3. Impact of climate change on the productivity of small-scale farmers

Climate change has had and will continue to have a significant impact on the livelihoods and food security of the rural poor in developing African countries. The 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) forecasts that climate change is expected to have a significant effect on water availability and agricultural production in many African countries. Projections by [15] suggest that when the effects of climate change are not considered, the total production of major agricultural products (cereals, fruits and vegetables oilseeds, pulses, roots and tubers, and meat) is projected to double or even triple between 2010 and 2050 (**Table 1**). However, with the inevitable adverse effect of climate change, production will be adversely affected, and different crops will be affected differently (**Table 1**). Climate change is projected to have a slightly positive effect on oilseed production and minimum effect on production of pulses, while showing and small negative

	No climate change			**Effects of climate change**		
	2010	**2030**	**2050**	**2010**	**2030**	**2050**
Cereals	114.2	178.4	237.1	108%	−2.9%	−5.1%
Fruits and vegetables	101.4	187.4	293.7	190%	−0.3%	−0.1%
Oilseeds	52.9	90	113.9	115%	0.3%	1.0%
Pulses	11.6	18.2	27.5	137%	0.0%	0.0%
Roots and tubers	224	346.6	483.2	116%	−1.0%	−1.7%
Meat	10.8	20.4	34.4	219%	−0.1%	−0.1%

Adapted from: AGRA [15].

Table 1.
Projected effect of climate change on agricultural production (million metric tons) in Africa.

effects on production of fruit and vegetables and meat [15], (**Table 1**). The projected negative effects of climate change are higher for cereals (reductions of 2.9% in 2030 and 5.1% in 2050) and roots and tubers (reductions of 1% in 2030 and 1.7% in 2050) compared to when the effect of climate change is not considered (**Table 1**).

Additionally, Makate et al. [12] found that smallholder farmers are faced with a variety of challenges, which include drought, pests and crop diseases, scarce arable land with water, lack of market availability, old age, low level of education, limited availability of quality infrastructure, lack of good cell phone network connections and limited access to quality inputs. 'A poorly functioning rural economy with undeveloped infrastructure, weak market linkages and poor agricultural support services isolates rural households from the mainstream economy and from important agricultural value-chains', reported [11].

The economies and food security of many African countries are dependent on sectors that are influenced by changing climate conditions, including agriculture, forestry, fisheries and tourism [3]. The effect of climate change is expected to vary in the different regions, for example, an increase in desertification and decrease in forest cover is expected in the arid north, with rainfall shortages predicted in the Sahara and Sahel, accompanied by soil degradation and an increasing frequency of dust storms. In West Africa, frequent and longer dry periods are projected, whereas rising sea levels will be observed in coastal areas [3].

African countries are more vulnerable to the impacts of climate change because the bulk of the population relies on rain-fed agriculture for food and their livelihoods [16]. In 2007, [17] estimated that the total agricultural yield produced in some African countries could be reduced by as much as 50% in 2020. These authors further projected that the net crop revenues could fall by 90% by the year 2100. These predictions indicate a serious threat to food security, and, by proxy, the achievement of the sustainable developmental goals set by the UN.

The deleterious effects of climate change, climate variability and food insecurity will continue to negatively impact the livelihoods of people in at-risk regions. With the increased frequency of droughts and dry spells, increasingly inconsistent rain, and heavier torrential downpours, the risk of soil erosion and vegetation damage through run-off is likely to increase. Additionally, higher than average temperatures will result in increased evapotranspiration and soil moisture evaporation rates. However, forecasts also indicate that not all changes in climate and climate variability will be negative. For instance, in some parts of the Ethiopian highlands and Mozambique, climate change effects may extend the agricultural growing season owing to increased temperatures and rainfall [14].

The inevitable change in climate necessitates regional and country initiatives to adapt. This is especially critical in African countries where vulnerability is high due to the low capacity to mitigate sudden climatic changes. Adaptation strategies are important to help farmers attain food, income as well as livelihood security despite the unpredictable climatic conditions, and extreme weather events such as droughts and floods [18, 19].

4. The potential of small-scale farmers in ensuring food security

Small-scale agriculture presents an opportunity to improve the livelihoods of the rural poor and ensure food security; however, many of the rural farmers, who had previously managed to successfully cultivate crops for subsistence use and to supplement their income, now experience poor yields or have ceased production. This can be attributed to increased urbanization, poor productivity and competition from commercial agriculture, which is producing food more effectively and at lower

prices [20]. It is, therefore, imperative that small-scale farmers adopt new technologies to increase production and, consequently, ensure food security. Improved productivity of these small farmers is the key to providing practical, sustainable solutions able to address the growing problem of food security on a global scale.

Historically, a vibrant agricultural sector has, in most cases, been the foundation for positive economic growth or transformation in many developed countries. Agricultural growth was the precursor to several industrial revolutions in Europe and the United States and more recently to the industrial revolutions in China, Republic of Korea, Taiwan, Vietnam Thailand and other rapidly growing economies in Asia. At the heart of these transformations, investment in agriculture resulted in surpluses of agricultural produce; this helped to keep food prices low and played a hand in stimulating overall economic growth. This agriculture-based economic development helped to create new employment opportunities that were pivotal in absorbing the rural labour surplus. The potential of agriculture to improve a country's overall economy can never be overemphasized, [21] estimated that 1% increase in crop yields would reduce the total number of people living in poverty by 0.48% in Asia and by 0.72% in Africa.

5. Strategies to increase food production in Africa

5.1 Diversification of crops

Farming in most African countries is characterized by many small- and marginal-scale farmers with small farm holdings. These farmers produce only a limited number of crops, which occupy a relatively large portion of the production area. These 'modern' agricultural systems have degraded the natural biological interactions responsible for generating ecosystem services that are essential to agriculture, including soil fertility (nutrient cycling and retention), water-holding capacity, pest/disease control and pollination [22]. In 'modern' monocultural agricultural systems, crops rely on external nutrient inputs such as fertilizers and pesticides to replace interactions that occurred naturally. This reliance on external inputs has several consequences, including climate change, polluted air and water and the degradation of fertile soils [23]. Growing the same crops continually each year results in the emergence of several biotic and abiotic constraints and progressive reduction in yield. Therefore, crop diversification is one of the cost-effective and simple methods that can be implemented to ensure sustainable and increased agricultural production.

Increasing climate variability, fluctuating temperature and rainfall patterns, is an indicator that agricultural processes will not remain the same as crop and ecosystem responses are also expected to change. These changes comprise variations in nutrient cycling, changes in evapotranspiration, soil moisture content, as well as changes in pest incidences and plant diseases, all these entirely impact food production and food security [24, 25].

A resilient agricultural system is important in mitigating the effects of climate change. Resilience is defined as the ability or tendency of a system to maintain its organizational structure and efficiency after perturbation [26]. Therefore, a resilient agricultural system will keep producing high crop yields even after severe climate changes such as droughts or significant rainfall reductions. Crop biodiversity can therefore provide the connection between climatic stress and resilience of the system because a diversity of organisms is important for ecosystems to perform optimally and provide essential services [27].

According to Vandermeer et al. [28], crop diversification improves the functioning of an ecosystem because different species perform differing roles and

consequently occupy different niches within the system. Diversification also increases ecosystem function as some components of the system may seem redundant at some point in time but become important when change in some environmental conditions is experienced. Therefore, the importance of crop diversification is that when climatic or environmental change is experienced, the redundancies within the system permit for continual functioning of the ecosystem and production of high yields [28].

Crop diversification is one of the ways small-scale farmers can use to develop a resilient agricultural system. Crop diversification forms part of the risk aversion strategy, the majority of small-scale farmers have moved away from monocropping system due to high climatic variability and change. It ensures effective use of land, water and other resources for increased yield and productivity, playing a pivotal role in poverty reduction in rural communities. Diversification in farms can also include livestock production, including aquaculture, as well as the production of commercial crops such as cotton, sugar cane, oilseeds, fruits and vegetables. Crop diversification also reduces the risk of crop failure and uncertainty due to unforeseen climate events that could adversely impact agricultural production, including the sudden onset of frost or drought and the emergence of pests [29]. This is achieved by planting crops with varying drought resistance abilities and/or selecting crops for harvest based on their seasonal suitability.

Inclusion of cash crops is particularly important for small-scale farmers in making their farms viable [30]. Diversification helps protect small-scale farmers against drops in profit that ensue if the price for a crop is lower than average in a given year [31]. This improves the purchasing power of the household, thus allowing these households to purchase other food products not produced on the farm. Consequently, farm-level crop diversification should include a wider range of crops; this way, it can contribute positively to improved health, household nutrition and food security, as well as ensuring climate resilience [32]. Thus, diversification can be used to improve and stabilize income flow, thereby providing increases in gainful employment while further reducing farm income variability.

The inclusion of horticultural crops, especially fruits and vegetables, can be used to address food and nutritional security [33]. Households practising crop diversification are more likely to have a varied diet than those who do not [32]. These authors also reported that households practising higher crop diversification are less food-insecure compared to those with relatively lower or no crop diversification.

5.2 Improve agricultural extension services

Agricultural extension can be defined as the application of scientific research and scientific principles/knowledge to agricultural practices through the education of farmers [34]. The role played by extension officers is invaluable in equipping farmers with the necessary skills to improve productivity. Agricultural extension is also critical in translating new knowledge into innovative practices [35].

The declining effectiveness of public extension services is one of the factors impeding the productivity of small-scale famers in most African countries. Increasing the productivity of small-scale farmers requires significant investment and ongoing support in agricultural extension services. Agricultural extension services can provide farmers with the vital tools and critical knowledge needed to adopt and implement new, more sustainable farming methods. Small-scale farmers face a number of risks, which require a more interactive extension system. The adoption of new technologies will serve to increase product yields, improve local food security and livelihoods, as well as build resilience against severe climate changes.

The traditional extension system, which uses a top-down approach in transferring technology, is rapidly becoming outdated in the market-oriented and more

competitive climate of today's agricultural scene. In order to ensure continued and increased contribution of small-scale farmers to food security in Africa, there needs to be renewed emphasis on, as well as new approaches to, agricultural extension. The role of extension officers should not be limited to providing and transferring knowledge for increased productivity, but should also focus on new roles, including linking small-scale farmers to high value and export markets, ensuring sustainable production and mitigating the effect of climate change.

5.3 Use of improved crop varieties

To ensure increased and sustainable crop productivity, sub-Saharan Africa should focus on improved crop varieties that are adapted to diverse environments [36]. The cultivation of improved crop varieties is a strategy that can be used to enhance quality, productivity, health and nutritional value of crops. Improved varieties can also help in building crop resilience to diseases, crop pests and environmental stresses such as the emergence of new pests, water stress (including salinity changes) and heat stress. Using improved crop varieties developed to resist adverse climatic conditions will help to ensure sustained and even increased crop production despite the impacts of climate change. Additionally, varieties with improved nutritional content can reduce nutritional insecurity, thereby reducing susceptibility to diseases and improving overall health.

The use of improved crop varieties has shown to have a positive impact on the performance of smallholder farmers. A study by [36] showed that planting improved groundnut varieties in Uganda resulted in increased income by US$130–254/ha while decreasing poverty by 7–9%. These authors also reported that as the area allocated to improved maize varieties increased in Tanzania, household food security also increased while poverty declined [36]. Similarly, [37] found that the introduction of a new improved rice variety decreased poverty significantly. In a study conducted in Madagascar, [38] reported that communities that readily adopted and planted new crop varieties enjoyed higher crop yields, lower food prices, as well as higher wages for unskilled workers, greater food security and lower poverty.

6. Conclusions

It is therefore prudent to conclude that to ensure food security in Africa, especially at the household level, we need to rethink the way we produce and distribute food. The empowerment and support of small-scale farmers must be a priority. This includes improved and more inclusive agricultural extension services as well as the use of technology (such as applications) in communicating agricultural advice or climate information. The adoption of new agricultural practices is more important now than it was in the past. When small-scale farmers adopt and plant improved crop varieties they increase their agricultural income and escape poverty, thereby increasing local food security.

Several European countries already have policies and incentives that encourage diversification in farms.

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Conflict of interest

The authors declare no conflict of interest.

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