

# CLIMATE CHANGE: IMPACTS AND ADAPTATION STRATEGIES

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# Climate Change Impacts and Adaptation Strategies among Smallholder Farmers in The Gambia

## **Abstract**

Smallholder farmers play a pivotal role in global food production, yet they face mounting challenges from climate change, resource constraints, and market volatility. This desk review examines adaptation strategies used by smallholder farmers to enhance resilience and ensure food security. Drawing on secondary data, the review identifies key practices, including crop diversification, adoption of climate-smart technologies, improved water management, and collective action through farmer cooperatives. Findings show that while these strategies significantly contribute to household food security, their effectiveness is constrained by limited access to credit, extension services, and infrastructure. The study concludes that strengthening institutional support, integrating local knowledge with scientific innovation, and promoting inclusive policy frameworks are essential to scale up successful adaptation practices. By addressing these systemic barriers, smallholder farmers can be better equipped to sustain livelihoods and contribute to long-term food security in vulnerable regions.

## **Introduction**

Climate change poses a significant threat to agricultural systems worldwide, but its impacts are particularly acute in countries like The Gambia, where smallholder farmers form the backbone of food production and rural livelihoods. Rising temperatures, unpredictable rainfall, recurrent droughts, and flooding events are already undermining crop yields and livestock productivity, thereby jeopardizing national food security. For a country whose economy and employment depend heavily on agriculture, these challenges demand urgent and coordinated policy responses.

Climate change is increasingly affecting agricultural production and the livelihoods of smallholder farmers, particularly in developing countries where farming is highly dependent on natural resources and climatic conditions.

Changes in rainfall, rising temperatures, droughts, floods, pest outbreaks, and soil degradation can reduce crop productivity and threaten household food security. In The Gambia, these challenges are particularly important because many rural households depend heavily on agriculture for their livelihoods. Therefore, understanding the impacts of climate change, the adaptation measures farmers use, and the challenges limiting their adoption is essential for strengthening agricultural resilience and food security.

This desk review research investigates the impacts of climate change on smallholder farmers in The Gambia and explores the adaptation strategies currently in use. Recommendations include strengthening agricultural extension services, investing in climate-resilient infrastructure such as irrigation systems, expanding access to affordable credit and insurance schemes, and integrating climate-smart agriculture into national development plans. By prioritizing these measures, policymakers can empower smallholder farmers to adapt effectively, safeguard food security, and contribute to sustainable rural development.

## **Background**

Climate change is increasingly affecting smallholder farming through rising temperatures, changing rainfall patterns, droughts, floods, soil degradation, and increasing pest and disease outbreaks. These changes can reduce crop yields, threaten household food security, and negatively affect the livelihoods of farming communities.

The Gambia is particularly vulnerable because many rural households depend heavily on agriculture and natural resources. Farmers have already experienced changes in rainfall and temperature, as well as droughts, floods, strong winds, and other climate-related hazards. These challenges make it increasingly important for farmers to adopt strategies that can help maintain agricultural production and strengthen their resilience.

Farmers use various adaptation measures, including crop diversification, drought-resistant varieties, water conservation, mixed cropping, agroforestry, improved pest management, and timely planting. However, limited access to finance, credit, information, technology, and adequate

infrastructure can make it difficult for farmers to adopt these strategies effectively.

### **Climate change and its impact on smallholders**

In developing countries, smallholder farmers, along with landless populations and the urban poor, constitute some of the most vulnerable and disadvantaged groups. Climate change poses a serious threat to agriculture and food security by disrupting production through irregular rainfall, rising temperatures, prolonged droughts, and extreme weather events. It also contributes to biodiversity loss, ecosystem changes, and increased risks of food and waterborne diseases and antimicrobial resistance<sup>i</sup>.

Climate change and climate variability, particularly the significant decline in rainfall that began in the late 1960s and has continued over subsequent decades, have placed considerable pressure on natural resources and ecosystems<sup>ii</sup>. Changes in rainfall patterns can affect water availability, soil conditions, vegetation, and agricultural activities, making it increasingly difficult for communities that depend on natural resources to maintain their livelihoods. These changes can also contribute to the degradation of ecosystems and increase the vulnerability of agricultural systems to drought and other climate-related stresses.

One significant effect of climate change on small-scale agricultural production is the decline in soil organic matter resulting from rising soil temperatures. Higher temperatures can accelerate the natural decomposition of organic matter and increase other soil processes that affect soil fertility. In addition, prolonged dry conditions can restrict root development and reduce the decomposition of organic materials. Reduced soil cover may also expose the farmland to wind erosion, particularly in areas where wind speeds are expected to increase. In certain regions, climate change may lead to more intense rainfall due to increased atmospheric moisture and stronger temperature and pressure differences. Such heavy rainfall can contribute to serious soil erosion and further reduce the quality and productivity of agricultural soils, making farming difficult in such areas<sup>iii</sup>.

Extended growing seasons may allow certain insect pests to reproduce more frequently throughout the spring, summer, and autumn months. In addition, warmer winter conditions may allow pest larvae to survive the winter in regions where low temperatures previously limited their survival. As a result, farmers may face increased pest infestation during the subsequent planting season<sup>iv</sup>. This can reduce crop yields and negatively affect income and household food availability. For smallholder farmers who depend heavily on agricultural production for their livelihoods, increased pest pressure may make it more difficult to maintain stable food production under changing climatic conditions. This highlights the need for farmers to adopt adaptation measures effectively, such as timely planting, the use of pest-resistant crop varieties, improved pest management practices, and other climate-smart agricultural approaches.

According to Lehnhardt et al (2024), The Gambia is increasingly experiencing the effects of climate change, raising serious concerns for the country's development and the sustainability of livelihoods that depend heavily on natural resources. Historical climate records show considerable variability in rainfall patterns over the years, accompanied by repeated periods of drought. Between 1951 and 2018, for instance, the country recorded five major drought events, demonstrating its continued exposure to climate change. Beyond drought, the country is also affected by several other climate-related hazards, including flooding, strong winds, heavy and extreme rainfall, heatwaves, dust storms, prolonged dry spells, low temperatures, and inter-seasonal droughts. The occurrence of these events presents immediate challenges, particularly for communities whose livelihoods depend highly on agriculture.

While some climate change impacts are already being experienced, others are expected to intensify over time. In the short term, events such as droughts, irregular rainfall, strong winds, and dust storms can disrupt agricultural activities, reduce crop production, and negatively affect rural livelihoods. In the long run, challenges such as rising sea levels, coastal erosion, and the loss of productive land could further affect agricultural resources and sustainable development.

Research was conducted by Lehnhardt et al (2024) in The Gambia, and the study revealed that most farmers attributed climate change to a combination of human activities and natural environmental processes. Farmers reported experiencing a wide range of climate-related risks that have increasingly affected agricultural production and livelihoods. Among these, rising temperatures were identified as a climate threat, with approximately 69% of respondents recognizing high temperatures as a major climate-related concern. Similarly, about 64% reported an increase in the occurrence of droughts and windstorms, while 56% and 44% observed more frequent flooding and dust storms, respectively.

In addition to these climatic hazards, farmers also perceived an increase in agricultural and livestock-related challenges as a result of climate change. Around 31% of respondents indicated that cattle diseases had become more common, whereas 25% reported a rise in crop diseases. Other perceived climate-related risks included excessive rainfall (31%), reduced rainfall (11%), increased insect infestations (8%), higher soil salinity (7%), and colder temperatures (6%). These findings suggest that farmers are experiencing multiple and interconnected climate stressors that threaten agricultural productivity and rural livelihoods.

The study further revealed gender differences in climate risk perception, with female farmers generally reporting a slightly higher awareness of most climate-related hazards than their male counterparts. This may indicate that women, who are often closely involved in agricultural production and household food security, possess a heightened understanding of the diverse impacts of climate change on farming systems, communities, and the environment at large. Recognizing farmers' perceptions of climate-related risks is therefore essential for designing adaptation strategies that are responsive to local experiences and needs. Supporting this view, approximately 88% of the respondents reported having observed noticeable changes in climatic conditions over the previous 10 to 20 years, reinforcing evidence from earlier studies that farmers are increasingly aware of ongoing climate variability and change<sup>v</sup>.

## **Adaptation Measures for Maintaining Food Production**

According to Altieri and Koohafkan 2008, research indicates that many farmers are actively adapting to climate change by implementing a range of strategies to minimise the risk of crop failure. These strategies include cultivating drought-resistant local crop varieties, harvesting and conserving water, practicing extensive planting, carrying out timely weeding, adopting mixed cropping and agroforestry systems, and collecting wild plants for food and other uses. The widespread use of these traditional agricultural practices underscores the need to reassess indigenous knowledge as a valuable resource for strengthening adaptive capacity. It also demonstrates farmers' ability to experiment, innovate, and build resilience in response to the challenges posed by climate change.

**The following are some of the challenges faced by smallholder farmers in adopting climate change strategies: Mosha and Ngulube (2025)**

### **❖ Financial constraints**

Limited financial resources prevent smallholder farmers from adopting climate adaptation and mitigation measures, including modern technologies and equipment. About 60% of farmers face financial constraints, while 55% lack access to credit.

### **❖ Low literacy levels**

Low literacy limits farmers' access to climate-related information and resources. Farmers with higher education were more likely to diversify crops and adopt Climate-Smart Agricultural practices, while younger farmers also showed higher adoption rates.

### **❖ Inadequate infrastructure**

Poor irrigation, transportation, roads, storage facilities, and limited access to modern technologies restrict farmers' adaptation capacity,

market access, and resource availability while increasing post-harvest losses.

**The following are adaptation measures (Mosha and Ngulube, 2025):**

❖ **Access to credit and financial resources**

Access to credit and financial resources is essential for farmers to adopt climate adaptation and mitigation practices. Insurance and financial support can enable farmers to manage climate-related risks, invest in new technologies, and maintain agricultural production.

❖ **Impact of financial support**

Credit enables smallholder farmers to adopt practices that increase their ability to cope with climate change. Programs such as the Productive Safety Net Program (PSNP) support income diversification, while selling livestock can generate funds for food and strengthen household resilience.

❖ **Institutional factors and climate-smart agriculture**

Institutional support, particularly access to credit, positively influences the adoption of climate-smart agricultural practices. Strengthening local institutions, policy advocacy, participatory research, and access to finance can promote climate-resilient farming methods.

❖ **Policies supporting adaptation**

Policies should provide financial incentives, research support, and infrastructure development to strengthen agricultural adaptation. Measures such as livestock migration, grain storage, reduced meal consumption, and increased fodder production can also improve resilience during difficult periods.

### ❖ **Crop diversification**

Crop diversification can reduce farmers' vulnerability to climate impacts. Gambian farmers can diversify by cultivating crops such as sorghum, millet, maize, groundnuts, vegetables, rice and cassava. Growing different crops can minimise dependence on a single crop and help maintain food production when climate conditions affect particular crops.

### ❖ **Infrastructure investment**

Investment in rural infrastructure, particularly irrigation, roads, and storage facilities, is important for climate adaptation and mitigation. Improved infrastructure can increase market access, reduce post-harvest losses, improve resource availability, and enhance agricultural productivity<sup>vi</sup>.

## **Recommendations**

- ❖ **Improve access to finance:** Financial institutions and relevant agricultural programmes should provide affordable credit, insurance, and financial support to smallholder farmers.
- ❖ **Strengthen agricultural training:** Farmers should receive more training on climate-smart agriculture, improved farming techniques, pest management, and climate-related information.
- ❖ **Promote crop diversification:** Farmers should be encouraged to cultivate crops such as millet, sorghum, maize, rice, groundnuts, vegetables, and cassava to reduce dependence on a single crop.
- ❖ **Invest in rural infrastructure:** Greater investment in irrigation, roads, storage facilities, and other agricultural infrastructure is needed to improve production, market access, and reduce post-harvest losses.
- ❖ **Support indigenous knowledge:** Traditional farming practices such as mixed cropping, agroforestry, water conservation, and the use of

drought-tolerant local varieties should be recognized and integrated with modern agricultural practices.

- ❖ **Strengthen climate information services:** Farmers should have timely and accessible information on rainfall, drought, extreme weather, pests, and appropriate planting periods to support informed agricultural decisions.

## Conclusion

Smallholder farmers in The Gambia have begun adopting various adaptation strategies, including crop diversification, soil and water conservation, and reliance on indigenous knowledge. However, these efforts are often constrained by limited access to credit, inadequate extension services, poor infrastructure, and weak institutional support. Without targeted interventions, the resilience of smallholder farmers will remain fragile, leaving households vulnerable to food insecurity and poverty.

This study highlights that smallholder farmers remain at the frontline of global food security challenges, particularly in the face of climate variability, resource constraints, and market fluctuations. The evidence suggests that adaptation strategies such as crop diversification, adoption of climate-smart agricultural practices, improved access to extension services, and community-based resource management are critical for enhancing resilience. However, the success of these strategies depends not only on farmers' willingness and capacity to adopt them but also on supportive policies, infrastructure development, and access to financial and technological resources.

Ultimately, ensuring food security for smallholder farmers requires a holistic approach that integrates local knowledge with scientific innovation, strengthens institutional support, and promotes inclusive participation in decision-making. By empowering smallholder farmers with the tools, knowledge, and networks they need, societies can build more resilient agricultural systems capable of sustaining livelihoods and securing food supplies in the face of future uncertainties.

Climate change poses significant challenges to smallholder farmers and food production in The Gambia. Rising temperatures, changing rainfall patterns, droughts, floods, pests, and soil degradation can reduce agricultural productivity and threaten rural livelihoods. Although farmers are adopting various traditional and modern adaptation strategies, their ability to respond effectively is limited by financial, educational, technological, and infrastructural constraints. Strengthening farmers' access to resources, information, technology, and supportive institutions is therefore essential for building climate-resilient agriculture and improving food security.

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<sup>i</sup> Ceesay, S., Lehnhardt, F. L., Ndiaye, M.B.O., Thiaw, D., Sawaneh, M., Schuler, J. (2025), Farmers' Perceptions of Efficacy of Current Climate Risk Adaptation and Mitigation Strategies on Agriculture in The Gambia

<sup>ii</sup> Government of The Gambia, (2007), Gambia National Adaptation Programme of Action (NAPA) on Climate Change

<sup>iii</sup> Altieri, M. A., Koohafkan, P. (2008), Enduring Farms: Climate Change, Smallholders and Traditional farming communities

<sup>iv</sup> Altieri, M. A., Koohafkan, P. (2008), Enduring Farms: Climate Change, Smallholders and Traditional Farming Communities

<sup>v</sup> Lehnhardt, F. L., Ceesay, S. Ndiaye, M.B.O., Thiaw, D., Sawaneh, M. (2024), Discover Sustainability: Climate Risk Perception and Adaptation Strategies of Smallholder Farmers in The Gambia

<sup>vi</sup> Mosha, N. F. V., Ngubule, P. (2025). Discover Sustainability: Adaptation of Climate Change Mitigation and Adaptation Strategies Among Smallholder Farmers in African Countries: A systematic Review