Int. j. adv. multidisc. res. stud. 2026; 6(1):729-737

Received: 25-11-2025
Accepted: 05-01-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Examining Effects of Climate Change on Household Food Security in Rural Areas: A Case Study of Selected Households in Kapela Ward of Mwense Constituency in Mwense District

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DOI: https://doi.org/10.62225/2583049X.2026.6.1.5602

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Abstract

This study explored how climate change affects household food security in rural areas, focusing on selected households in Kapela Ward, Mwense Constituency, Mwense District. The research investigated how climate change is affecting household food security in Mwense District. The study uses a mixed-methods approach, combining both qualitative and quantitative methods for a thorough understanding. Data was collected through household surveys, group discussions, and interviews with local leaders to identify challenges and strategies for coping. Climate data from the region was also reviewed to find links between weather changes and food security trends in recent years. The findings show that the climate change is evident in the study area a unanimous 100% of respondents reported changes in planting season timing over the past decade.92% of respondents observed erratic planting seasons, highlighting climate change's impact. There is also reduced yield of agricultural products,92% of respondents reported a decrease in crop yields over the past 10 years. 82% of respondents reported not being food secure, indicating widespread vulnerability. While 98.04% of respondents reported increased difficulty growing food due to changing weather patterns.84.31% of respondents use drought-resistant crop varieties as a primary adaptation strategy.

Farmers are experiencing significant income reductions due to climate change and market dynamics. Droughts and erratic rainfall are causing reduced yields and crop losses. Reduced crop quality contribute to income decreases. The percentage of income loss varies, ranging from 25% to 60% depending on the farmer and crop.

Considering these results, it's recommended that the government should continue to provide access to and information about drought-resistant crop varieties. Program implementers should support the adoption of other adaptation strategies like soil conservation and agroforestry. Researchers should conduct further research to understand challenges and adaptation effectiveness.

Keywords: Climate Change, Household Food Security, Adaptation Strategies

1. Introduction

1.1 Background

Zambia faces substantial challenges from climate change, especially in agriculture, which relies heavily on rain-fed systems. Rural communities are particularly vulnerable due to their dependence on consistent rainfall for crop production. Despite economic growth, poverty remains high, particularly among small-scale farmers, with approximately 80% of Zambians living below the poverty line (CSO, 2010). In Kapela Ward, many households lack access to essential resources needed for sustainable farming practices, exacerbating their vulnerability to climate variability (Mubanga & Muyangana, 2018).

1.2 Statement of the Problem

Climate change increasingly threatens food security in rural areas, with many households in Mwense District experiencing food shortages due to unpredictable weather patterns. Existing research often overlooks localized impacts, making this study

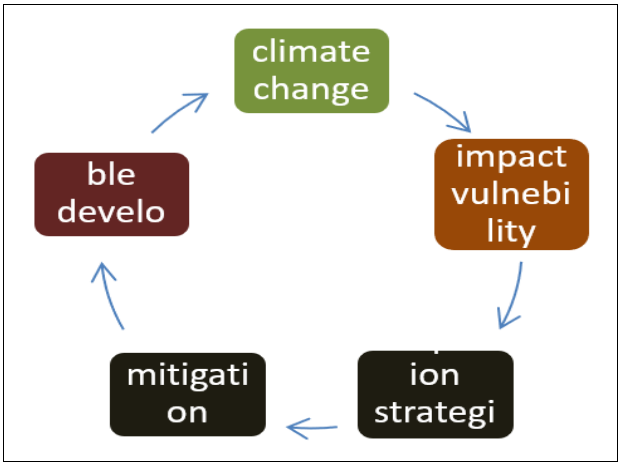
necessary to understand the specific challenges faced by rural families (Mudenda, 2010).

1.3 General Objective of the Study
1. The main or general objective of this study was to assess effects of climate change on household food security in Mwense District.

1.3.1 Specific Objectives
1. To determine how climate change is affecting household food security in Mwense District.
2. To evaluate effectiveness of coping strategies at household level.
3. To ascertain how climate change is affecting income at household level.

1.4 Research Questions
1. How is climate change affecting household food security in Mwense District?
2. What are the effectiveness of coping strategies employed by households in response to climate change?
3. How is climate change affecting household income levels in Mwense District?

1.5 Theoretical Framework



This study examines how climate change affects food security in rural areas, using a framework that focuses on climate change mitigation, adaptation, vulnerability, and sustainable development. This framework was developed by the Zambian government under the National Policy on Climate Change (NPCC, 2016) [35] to coordinate responses to climate issues. It aligns with international agreements like the Paris Agreement, which help countries improve their ability to adapt to climate change (USAID, 2018).

Key Components of the Framework

1. Climate Change Mitigation

This involves reducing greenhouse gas emissions to limit global warming. The UNFCCC (2013) defines mitigation as efforts to prevent or reduce emissions. In Zambia, sustainable land management practices, such as agroforestry and conservation agriculture, are essential for mitigating climate change impacts. These practices help farmers adapt while also reducing emissions (Kaliba *et al*., 2019).

2. Adaptation Strategies

Adaptation refers to adjustments that communities make in response to climate change to reduce harm or take advantage of opportunities (IPCC, 2014). In Zambia, community-based adaptation strategies that incorporate local knowledge are crucial for helping rural households cope with climate challenges. Research shows that these strategies empower communities to manage their food production systems better (Mubanga & Muyangana, 2018).

3. Vulnerability Assessment

Understanding the specific threats rural households face due to climate change is vital. Vulnerability assessments can identify areas at risk of food insecurity, allowing for targeted interventions (Kabinga & Chileshe, 2017). Rural communities, especially those relying on rain-fed agriculture, are among the most vulnerable (Mudenda, 2010). Enhancing their resilience can involve introducing drought-resistant crops and improving access to education and healthcare.

4. Sustainable Development Goals (SDGs)

The framework integrates SDGs to ensure that responses to climate change contribute to long-term food security. Aligning climate actions with sustainable development can promote inclusive growth and resilience in rural Zambia (UNDP, 2018) [42].

2. Literature Review
2.1 Overview
This chapter reviews existing research related to climate change and its impact on food security, especially in rural areas where agriculture is vital for livelihoods. It highlights how climate change makes rural households more vulnerable due to issues like droughts, floods, and changing rainfall patterns. The focus is on studies relevant to Kapela Ward in Mwense District.

2.2 How Climate Change Affects Household Food Security
The FAO (2018) found that climate change significantly disrupts agricultural production, affecting food availability and access. Households facing irregular rainfall and droughts experience reduced food production and increased food insecurity. Vulnerable groups, especially smallholder farmers, are hit hardest, leading to higher food prices and poverty (Thornton *et al*., 2019). Immediate actions, like promoting drought-resistant crops and improving water management, are essential for helping these households adapt (Houghton & Smith, 2017). However, the review notes a lack of localized studies focused on specific regions in sub-Saharan Africa, including Zambia (Akinboade & Kinfack, 2019).

2.3 Effectiveness of Coping Strategies
Several studies show that rural households use various coping strategies to deal with climate change impacts. For example, Akinboade & Kinfack (2019) found that smallholder farmers diversify crops and sell livestock to adapt. Nelson *et al*. (2016) highlighted that many households face barriers like limited access to resources and financial support. Effective coping strategies are context-specific and require government support to succeed (Adger *et al*., 2018). Overall, while some strategies are documented, there is a need for more research on specific coping mechanisms used by households in Zambia (Mwanza *et al*., 2021).

2.4 Impact on Household Income
Research shows that climate change leads to significant income reductions for rural households in sub-Saharan Africa. Households relying solely on agriculture suffer the most due to erratic weather patterns (Deressa *et al*., 2017). The study by Chisanga & Nyambe (2020) highlighted that reliance on maize makes households particularly vulnerable, as changing rainfall patterns affect yields and push families into poverty. Effective adaptation strategies, such as diversifying income sources and improving access to resources, are crucial for enhancing resilience (Lobell *et al*., 2014; Banda *et al*., 2021).

2.5 Personal Critique of Literature Review
The literature review provides a solid foundation on climate change and food security but could benefit from deeper exploration of specific local impacts and coping strategies. While it highlights the importance of community support, it lacks detailed analysis of how local governance affects adaptation efforts (Mubanga & Muyangana, 2018). More localized case studies from Zambia would enrich the understanding of how climate change affects rural households (Kabanda *et al*., 2017) [23].

2.6 Establishment of Research Gaps
The review identifies several research gaps:
1. Localized Vulnerabilities: More studies are needed to examine the specific vulnerabilities of rural households in Zambia, as existing research often focuses on broader trends (Mudenda, 2020; Chipinda *et al*., 2019 [8]).
2. Effectiveness of Adaptation Strategies: There is limited empirical research on how well different coping strategies work in various contexts (Mwanza *et al*., 2021; Akinboade & Kinfack, 2019).
3. Role of Governance: The impact of local policies on food security and adaptation strategies needs further investigation (Banda *et al*., 2021; Tembo & Mbiti, 2022).
4. Longitudinal Studies: Most studies are cross-sectional, lacking insights into long-term impacts of climate change on food security (Chisanga & Nyambe, 2020; Tembo & Mbiti, 2022).
5. Economic Impacts: More research is needed on the direct economic effects of climate change on rural livelihoods (Mubanga & Muyangana, 2018; Mwanza *et al*., 2021).
Addressing these gaps will help develop better policies and interventions to enhance food security and sustainable agricultural practices in Zambia (UNDP, 2018) [42].

3. Research Methodology
3.1 Overview
This chapter outlines the research methodology used to examine the effects of climate change on household food security in Mwense District, Zambia. It describes the systematic processes for designing, conducting, and analyzing the research, which involved gathering both qualitative and quantitative data through questionnaires (Creswell & Clark, 2007).

3.2 Research Design
The study employed a descriptive research design to collect information through interviews and questionnaires (Brink & Wood, 2014). This approach provides a clear picture of the situation as it naturally occurs, allowing for the exploration of participants' attitudes and experiences related to climate change and food security (Orodho, 2003; Burns & Grove, 2003). A mixed-methods approach was used to enhance the depth of the analysis (Creswell, 2009).

3.3 Target Population
The target population consisted of households in Kapela Ward, Mwense District, which has 163 households. This area was chosen for its relevance to the study, allowing researchers to gather insights about local challenges related to climate change and food security (White, 2003).

3.4 Sampling Design
A random sampling technique was utilized to select participants, ensuring that every household had an equal chance of being included. This method helps avoid bias and allows for a more accurate representation of the community (Burns & Grove, 2007).

3.5 Sample Size
To determine the sample size, the study used a formula for finite populations. With a population of 163, the calculated sample size was 51, based on an 80% confidence level and a 7.2% margin of error (Cochran, 1977).

3.6 Data Collection Instruments
The study employed multiple data collection instruments, including semi-structured questionnaires, structured interview guides, and observation schedules. This triangulation approach enhances the reliability of the findings (Kothari, 1997; White, 2009).

3.7 Data Analysis
Data collected from participants were analyzed using STATA software, which helped organize the data and create statistical tables and visual representations (STATA, 2021). This analysis allowed researchers to identify patterns and relationships between different variables.

3.8 Triangulation
While the study initially planned to use triangulation to enhance reliability by combining various data sources, it ultimately focused solely on survey questionnaires due to time constraints. This decision simplified data collection but limited the potential benefits of a more comprehensive approach (Creswell, 2009).

3.9 Limitations of the Study
The researcher faced several challenges, including high transportation costs and issues with participant honesty. Some farmers were reluctant to share accurate information about their farming practices, fearing repercussions. These factors could affect the reliability of the data collected (Mudenda, 2010).

3.10 Ethical Considerations
Ethical guidelines were followed throughout the study. Participants were treated respectfully, and informed consent was obtained, ensuring they understood the research's purpose and how their data would be used. Confidentiality and anonymity were guaranteed, promoting a safe environment for participants to share their experiences honestly (Creswell & Clark, 2007).

4. Results/Findings

This chapter presents the findings of the study on the effects of climate change on household food security in Mwense District. The findings were according to the objectives of the study Data interpretation involves the process of analyzing and making sense of the presented data. It goes beyond the raw numbers or visuals, involving the identification of patterns, relationships, and implications. Below are the presentations and interpretation of the study.

4.1 Presentation of results on background characteristics of the respondents

Gender of the respondents

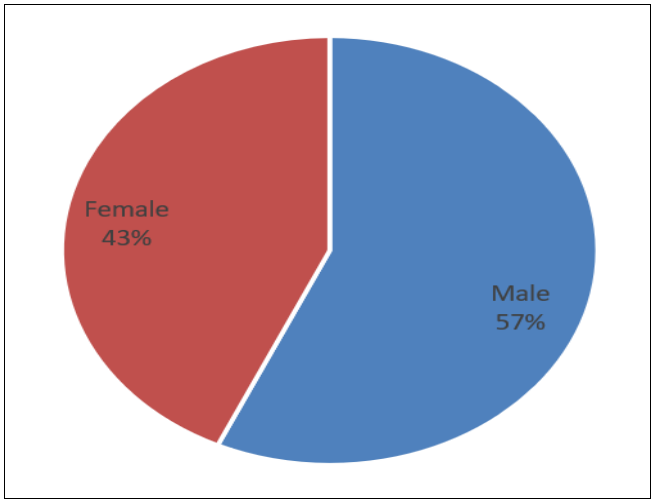


Fig 4.1.1: Statistical table: Gender of the respondents

The study shows that there are more male participants (57%) than female participants (43%). This gender imbalance is important because men and women often have different roles and perspectives on food security. In rural areas, men typically handle farming and resource management, while women often manage food preparation and nutrition for the family. This means that the views of women, who may face unique challenges related to food security, might be underrepresented in the findings.

Education levels by respondent

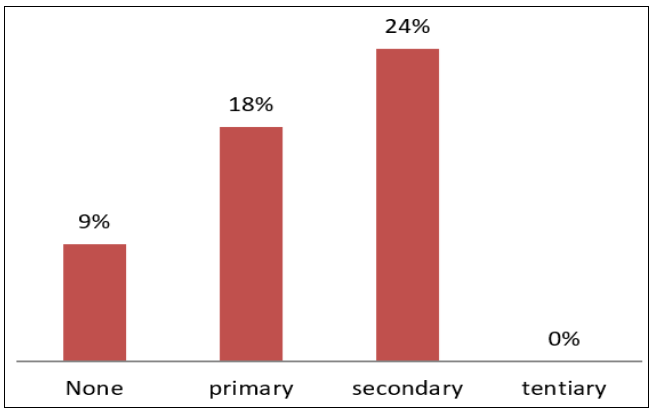


Fig 4.1.2: Education levels by respondent

The data revealed that most residents had secondary education (47.06%), followed by primary education (35.29%), no education (9.8%), and tertiary education (0%).

4.2 Presentation of results based on a thematic area developed from objective one: To determine how climate change is affecting household food security in Mwense District.

Have you noticed any changes in the timing of planting seasons in the last 10 years? (Yes/No)

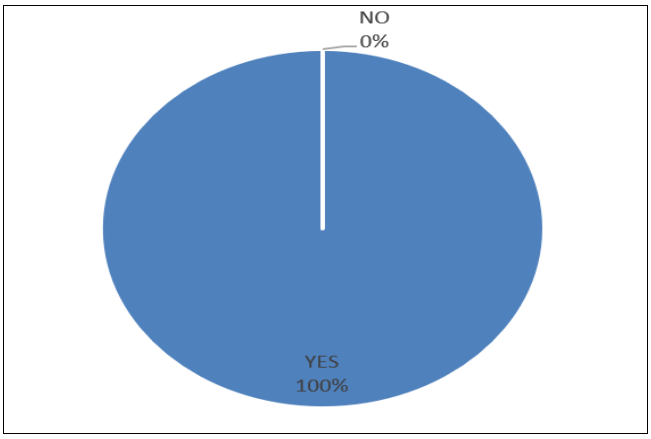


Fig 4.2.1: Changes in the timing of planting seasons in the last 10 years? (Yes/No)

All the respondents indicated that they have noticed changes in the timing of planting seasons in the last 10 years which was 100% of all respondents. This shows the evident changes which may have occurred in the past years.

If yes, please describe the changes (e.g., earlier, later, more erratic).

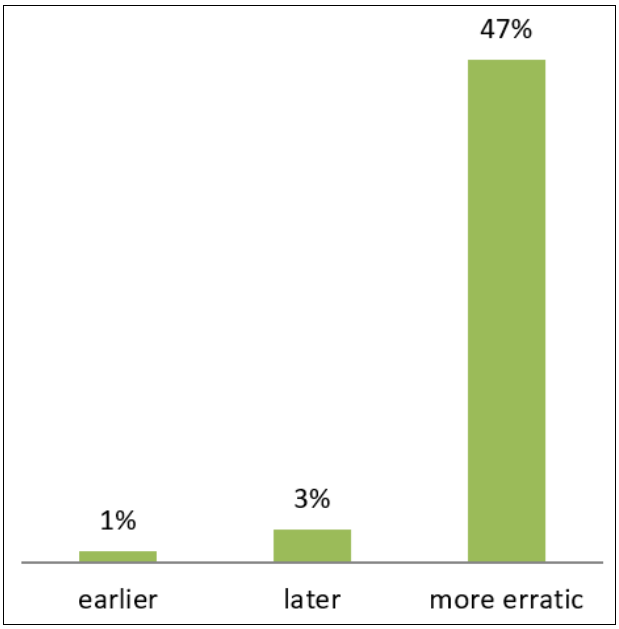


Fig 4.2.2: If yes, please describe the changes (e.g., earlier, later, more erratic)

The noticed changes in the timing of planting seasons in the last 10 years 2% of the respondents felt that the planting season has been coming earlier than before,6% felt the planting season has been coming later, while 92% felt the planting season is more erratic.

Have you noticed any changes in the yields of your crops in the last 10 years? (Yes/No)

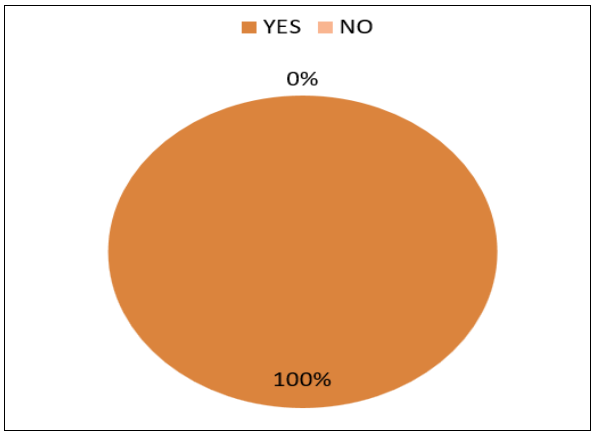


Fig 4.2.3: Have you noticed any changes in the yields of your crops in the last 10 years

The respondents were asked if they have noticed any changes in the yields of their crops in the last 10 years of which 100% indicated having noticed changes in their yield of crops.

If yes, please describe the changes for crop yield (e.g., increased, decreased, no change).

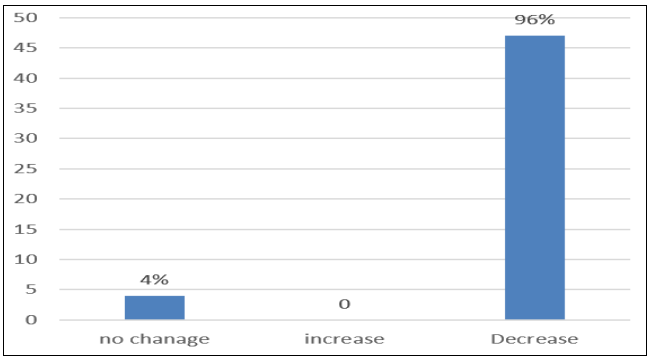


Fig 4.2.4: If yes, please describe the changes for crop yield (e.g., increased, decreased, no change)

The respondents were asked to describe the changes for crop yield (e.g., increased, decreased, no change). The majority which is 96% indicated having seen a degree in yield over the past 10 years, while 4% indicated having seen no change.

What has contributed to reduced yield in your areas

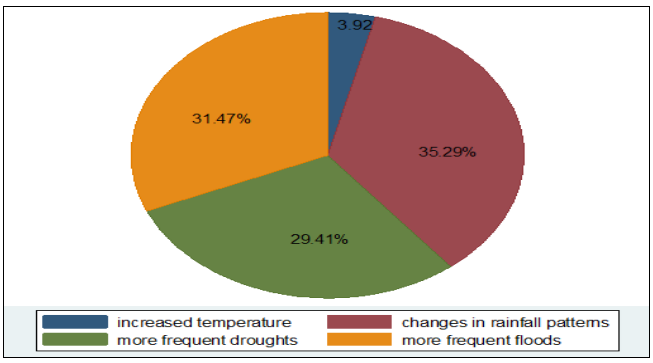


Fig 4.2.5: What has contributed to reduced yield in your areas

The pie chart illustrates the changes in weather patterns that respondents have noticed, highlighting several key issues. The largest portion, 35.29%, reported "changes in rainfall patterns," which can lead to either too much or too little water for crops. "More frequent droughts" followed closely at 29.41%, indicating that dry spells are becoming more common. Additionally, 31.47% noted "increased temperature," which can stress plants and reduce yields. A small percentage, 3.92%, mentioned "more frequent floods," which can damage crops and disrupt food supply.

Rate of household food security over the past years)

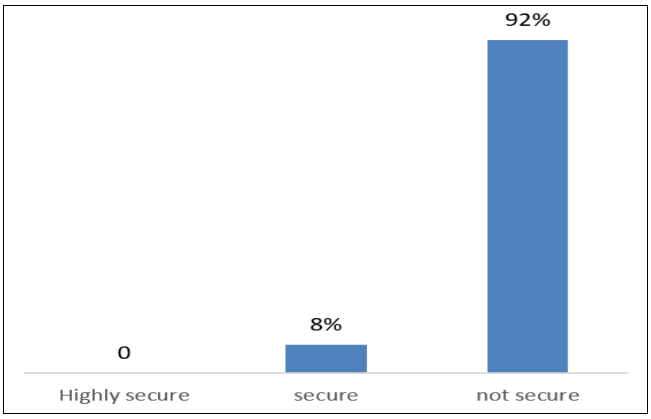


Fig 4.2.6: Rate of household food security over the past years)

The respondents were asked to indicate the state of their food security in the last 10 years. None of the respondents indicated having been high food secure, while 8% indicated that they are food secure while 92% of the respondents indicated having not been food secure.

How have these changes in weather patterns affected your ability to grow food?

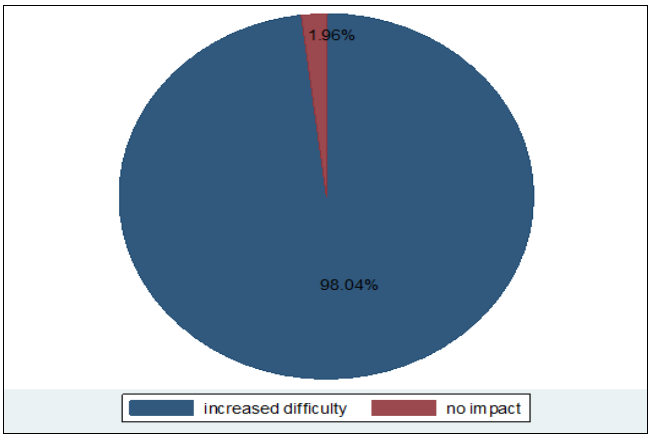


Fig 4.2.7: How have these changes in weather patterns affected your ability to grow food

The pie chart indicates that 98.04% of respondents experienced increased difficulty in growing food due to changes in weather patterns, while only 1.96% reported no impact.

This significant finding raises concerns about household food security. The overwhelming majority facing challenges suggests that many families may struggle to produce sufficient food, potentially leading to increased reliance on external sources and higher food costs. This situation can

exacerbate economic stress, particularly for low-income households, as they may have to allocate more of their budget to purchasing food. Reduced food production can negatively impact nutritional quality, as families may resort to cheaper, less nutritious options. The results highlight the urgent need for support systems, such as agricultural training, access to resilient crop varieties, and financial assistance, to help households adapt to changing weather conditions. Addressing these challenges is crucial for enhancing overall food security and ensuring that all families can maintain consistent access to adequate and nutritious food.

4.3 Presentation of results based on a thematic area developed from objective two: To evaluate the coping mechanisms and adaptation strategies employed by households to mitigate the effects of climate change on food security.

Specific measures to adapt to the effects of climate change

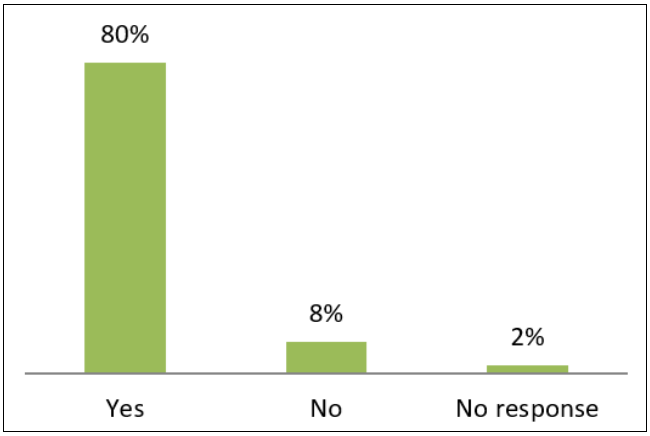


Fig 4.3.1: Specific measures to adapt to the effects of climate change

The data shows that 80%) reported taking specific measures to adapt to the effects of climate change, while only 8% did not, and 3% did not answer. This suggests a strong awareness and proactive approach among the majority regarding the challenges posed by climate change.

Adaptation Strategies Implemented

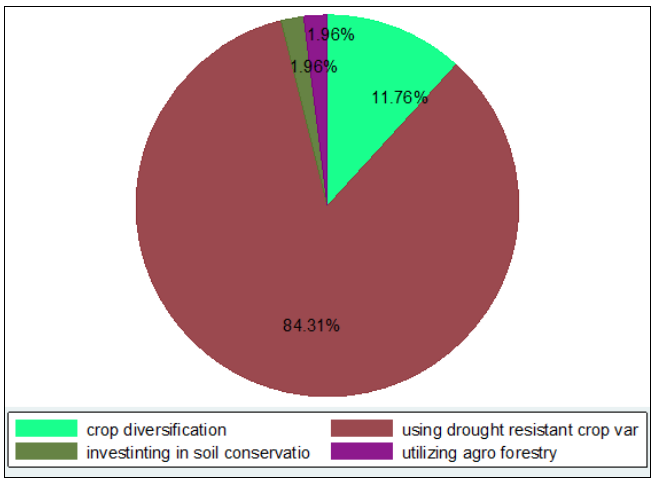


Fig 4.3.2: Adaptation strategies implemented

The pie chart illustrates the various strategies that respondents are implementing to adapt to climate change impacts on agriculture. The majority, 84.31%, are focusing on "using drought-resistant crop varieties," which highlights a significant reliance on this method to ensure food production in the face of changing weather patterns. Additionally, 11.76% are investing in "soil conservation," while 1.96% are engaging in "crop diversification" and "utilizing agroforestry."

4.4 Presentation of results based on a thematic area developed from objective three: To ascertain how climate change is affecting income at household level.

Has your household's income from agriculture changed in the past 5 years? (Yes/No)

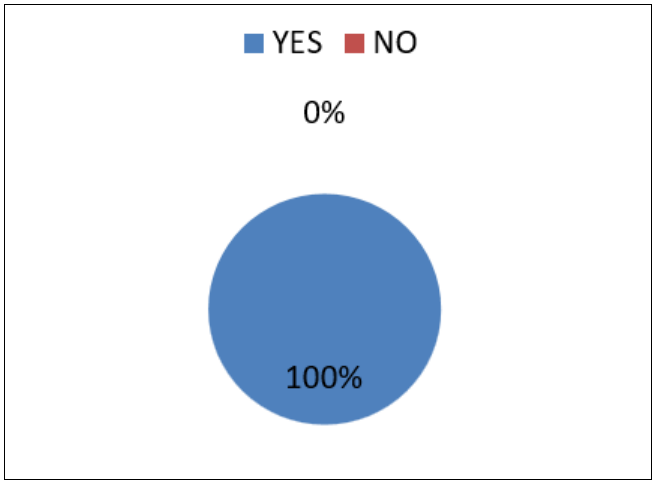


Fig 4.4.1: Has your household's income from agriculture changed in the past 5 years

The respondents were asked if their household's income from agriculture has changed in the past 5 years indicating Yes/No of which 100% of them indicated that they have seen a reduction in income from Agriculture while 0% indicated no change in agricultural income.

if yes, by how much (percentage or amount)? What were the main reasons for the change?

Respondent 1: Maize Farmer: "Yes, my income has been significantly reduced. In the past five years, we've experienced three major droughts. The most recent one, in 2024, was particularly devastating.

Respondent 2: Maize Farmer: My **income from maize production decreased by approximately 40% compared to the five-year average before the drought years.** The main reasons were a combination of factors: reduced yields due to lack of rainfall during critical growth stages, increased irrigation costs (which we had to implement to try and salvage the crop), and lower market prices due to an oversupply of maize from regions less affected by the drought. We also had to spend more on pest control because the drought weakened the plants, making them more susceptible to infestations."

Respondent 3: "Yes, my income has been affected. We rely heavily on the monsoon rains for our rice crops. The last few years have seen erratic rainfall patterns, with prolonged dry spells.

Respondent 4: vegetable farmer: **My income has fallen by about 30% on average over the past three years.** The

primary causes were lower yields due to water scarcity during the growing season, increased expenses for pumping water from dwindling groundwater sources, and the need to replant crops that failed due to drought. Furthermore, the quality of the vegetables was sometimes affected, leading to lower prices in the market."

Respondent 5: My income from Agriculture has decreased by roughly 55% in the last two years. The main drivers of this decline were severely reduced yields, particularly in 2024, due to insufficient rainfall and high temperatures. This led to a significant reduction in the amount of crops we could harvest and sell. We also had to spend more on drought-resistant seeds and on trying to conserve water, which further squeezed our profits."

Respondent 6: Beans Farmer: **My income has dropped by approximately 25% over the past four years.** The main reasons for this were lower yields due to water stress, which affected the size and quality of the beans. We also had to invest in irrigation systems, which increased our production costs. Furthermore, the drought made the beans plants more vulnerable to pests and diseases, leading to additional losses."

Respondent 7: Mixed farmer My income has decreased by about 60% in the last year alone. The main reasons were complete crop failures in some areas due to the drought, leading to zero income from those fields. We also faced increased costs for transporting water to the fields and for purchasing alternative crops that are more drought-resistant, but which often yield less revenue. The lack of water also affected the quality of the vegetables, making them less marketable."

4.5 Discussion of Results

4.5.1 Impact of Climate Change on Household Food Security

The study found that all respondents (100%) noticed changes in the timing of planting seasons over the past decade, indicating a significant impact of climate change on agriculture. Most respondents (92%) reported that planting seasons have become more erratic, making it difficult for farmers to plan their planting activities. This unpredictability is linked to changing rainfall patterns and increased temperatures (IPCC, 2021).

The survey also showed that 92% of respondents experienced a decline in crop yields over the last ten years. This decline can be attributed to various factors, including the timing of planting, increased pests, and changes in water availability (Rosenzweig *et al*., 2001) [53]. Overall, the findings highlight the urgent need for strategies to help farmers adapt to these changes to ensure food security.

4.5.2 Coping Mechanisms and Adaptation Strategies

The study revealed that a majority (78.43%) of respondents have adopted adaptation strategies to cope with climate change. The most common strategy (84.31%) was using drought-resistant crop varieties, which helps address water scarcity. Other strategies included soil conservation (11.76%) and crop diversification (1.96%). These findings align with research showing that adopting drought-resistant crops is crucial for maintaining food security in changing climates (FAO).

However, the low adoption rates of other strategies like crop diversification suggest that more support and education are needed to help farmers implement these practices effectively. Future research should explore barriers to adopting these strategies and assess their effectiveness in improving agricultural productivity.

4.5.3 Impact of Climate Change on Household Income

The study found that all respondents reported a decrease in agricultural income over the past five years. Factors contributing to this decline include increased droughts, rising input costs, and market volatility (FAO, 2023). For instance, one maize farmer noted a 40% drop in income due to reduced yields and higher irrigation costs, demonstrating the financial strain caused by climate change.

The findings show that climate change significantly impacts agricultural income, leading to food insecurity and poverty in vulnerable communities. Effective adaptation strategies, such as improving access to resources and financial support, are necessary to help farmers cope with these challenges (World Bank, 2024).

4.6 Conclusion

Overall, the study highlights the serious effects of climate change on food security, coping strategies, and household income in Mwense District. The findings emphasize the need for targeted interventions and policies to support farmers in adapting to climate change and ensuring sustainable agricultural practices. Further research is needed to understand the long-term impacts of climate change and evaluate the effectiveness of various adaptation measures.

5. Conclusion and Recomendations

5.1 Conclusion

The research highlights significant changes in planting seasons due to climate change, with all respondents (100%) reporting shifts. Most notably, 92% observed that planting seasons have become more erratic, posing risks to crop yields and household food security. The findings indicate a widespread decline in agricultural productivity, with 92% of respondents noting decreased crop yields over the past decade. This decline raises serious concerns about food security and the economic viability of farming.

The study reveals a critical food security situation among participants, with none reporting being highly food secure and only 8% indicating any level of food security. A substantial 82% reported food insecurity, suggesting many struggle to access sufficient and nutritious food. 98.04% of respondents experienced increased difficulties in growing food due to changing weather patterns, including unpredictable rainfall and extreme temperatures. These challenges significantly impact agricultural practices and crop yields.

Adaptation strategies were also examined, with 84.31% of respondents using drought-resistant crop varieties as the most common approach. Other strategies, such as soil conservation (11.76%), crop diversification (1.96%), and agroforestry (1.96%), were less frequently reported but indicate some households are exploring additional resilience measures.

The research further indicates that farmers are facing significant income reductions, primarily due to climate change and market dynamics. Droughts and erratic rainfall lead to reduced yields, while increased expenses and lower market prices exacerbate income losses, with reductions varying from 25% to 60% depending on the farmer and crop.

5.2 Recommendations

Government should Continue to provide access to and information about drought-resistant crop varieties, as this is the most widely adopted strategy. This could include research and development of new varieties, as well as training and extension services for farmers.

Program implementers should Implement programs to encourage and support the adoption of other adaptation strategies, such as soil conservation, crop diversification, and agroforestry. This could involve providing financial incentives, technical assistance, and educational resources.

Researchers should Conduct further research to understand the specific challenges faced by households and the effectiveness of different adaptation strategies. This will help to inform the development of more effective and targeted interventions.

6. Acknowledgments

I would like to express my heartfelt gratitude to all those who have contributed to the development and realization of this research in Development Studies. Without their unwavering support, guidance, and encouragement, this endeavor would not have been possible.

First and foremost, I extend my deepest appreciation to my research supervisor, Dr Kelvin Chibomba, whose expertise and mentorship have been invaluable throughout this process. Your profound knowledge and guidance in the field of Development Studies have not only shaped the direction of this research but also broadened my understanding of the subject. Your constant encouragement and insightful feedback have been instrumental in refining my research objectives and methodology.

I would also like to express my gratitude to the faculty members of the Department of Development Studies at Information and Communication University. Their dedication to teaching and research has laid the foundation for my academic journey. I am grateful for the stimulating discussions, critical insights, and valuable resources provided by them, which have enhanced the quality of my research.

I would also like to acknowledge the contributions of my friends and family for their unwavering support and understanding throughout this research journey. Their belief in me and their constant encouragement have been a source of motivation during challenging times.

Lastly, I would like to express my gratitude to the broader academic community, including researchers, scholars, and practitioners in the field of Development Studies. Their groundbreaking work and thought-provoking insights have been instrumental in shaping my understanding and providing a solid foundation for this interesting research.

Thank you all for your invaluable support and encouragements.

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