Assessing the Effects of Climate Change on Food Security in Rushinga District of Mashonaland Central

A dissertation submitted in partial fulfilment of the requirements for the Master of Science Degree in Food Security and Sustainable Agricultural Production.

Bindura University of Science Education

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June 2026

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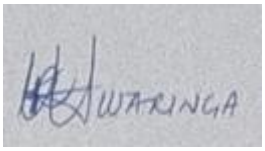
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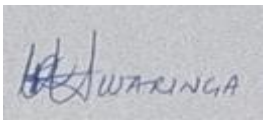
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DECLARATION

I hereby declare that the research project entitled "Assessing the Effects of Climate Change on Food Security in Rushinga District of Mashonaland Central" submitted to Bindura University of Science Education, Department of Agricultural Economics, Education and Extension is a record of an original work done by me under the guidance and supervision of my supervisor and this work is submitted in partial fulfilment of the requirements for the award of a Master of Science Degree in Food Security and Sustainable Agricultural Production. The results embodied in this thesis have not been submitted to any University or Institute for the award of any degree or diploma.

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DEDICATION

To the smallholder farming households of Rushinga District, whose resilience in the face of drought, erratic rainfall and persistent food insecurity inspired every page of this work. This dissertation is also dedicated to Mr Phillip Mupararano and my family, whose unwavering support, patience and encouragement throughout this academic journey made its completion possible.

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I am grateful to the agricultural extension officers, village heads, district officials and Non-Governmental Organisation programme managers in Rushinga District who gave their time and shared their professional knowledge during key informant interviews. Their insights were indispensable to the depth of this study.

My sincere thanks go to the smallholder farming households of Wards 1, 2, 12 and 15 in Rushinga District who participated in the household survey and focus group discussions. Without your willingness to share your experiences, this research would not have been possible.

Finally, I thank my colleagues, friends and family for their moral support and encouragement throughout this demanding but rewarding process.

ABSTRACT

Climate change poses a growing threat to food security among smallholder farming households in semi-arid regions of Zimbabwe, yet context-specific evidence linking observed climate shifts to household food security outcomes in Rushinga District of Mashonaland Central remains limited. This study assessed the effects of climate change on food security in Rushinga District using a mixed methods explanatory sequential design. Quantitative data were collected through household questionnaires administered to 111 smallholder farming households drawn from Wards 1, 2, 12 and 15 using multi-stage stratified random sampling. Qualitative data were obtained through seven key informant interviews and four focus group discussions. Quantitative data were analysed using descriptive statistics and inferential statistics including one-way Analysis of Variance and linear regression in SPSS version 27, while qualitative data were analysed using Braun and Clarke's (2006) six-phase thematic analysis framework with the support of NVivo version 12. The study found that households in Rushinga District perceived statistically significant increases in temperature, delayed onset of the rainy season, more erratic and unpredictable rainfall, longer and more frequent mid-season dry spells, and increased frequency of extreme weather events including droughts and floods. These climate shifts were found to have significantly reduced crop yields, accelerated livestock mortality, narrowed dietary diversity and deepened multidimensional household food insecurity across all four study wards. Regression analysis identified adverse weather frequency as the strongest negative predictor of household food security and adaptation index as the strongest positive predictor. Coping strategies were found to be largely reactive, including meal reduction, distress asset sales, food foraging and reliance on food aid, with limited adoption of long-term adaptation measures. The study concludes that climate change is a primary driver of food insecurity in Rushinga District and that current institutional and household responses are inadequate to address the scale of climate-induced vulnerability. The study recommends targeted investment in irrigation infrastructure, expansion of Climate-Smart Agriculture practices, strengthening of Early Warning Systems, and gender-sensitive food security programming to build sustainable household resilience in the district

Keywords: climate change, food security, smallholder farming, Rushinga District, Climate-Smart Agriculture

LIST OF ACRONYMS AND ABBREVIATIONS

AGRITEX — Department of Agricultural, Technical and Extension Services

ANOVA — Analysis of Variance

BUSE — Bindura University of Science Education

CSA — Climate-Smart Agriculture

EWS — Early Warning System

FAO — Food and Agriculture Organisation of the United Nations

FGD — Focus Group Discussion

FNC — Food and Nutrition Council

IPCC — Intergovernmental Panel on Climate Change

MSD — Meteorological Services Department of Zimbabwe

NGO — Non-Governmental Organisation

QUAN — Quantitative

SLF — Sustainable Livelihoods Framework

SPSS — Statistical Package for the Social Sciences

UNFCCC — United Nations Framework Convention on Climate Change

ZIMSTAT — Zimbabwe National Statistics Agency

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CHAPTER 1: INTRODUCTION

1.0 Introduction

Climate change remains one of the most discussed phenomena globally as it has impacted on the food security and agricultural productivity in all countries including Zimbabwe. Zimbabwe's agricultural sector which heavily relies on natural rains for agricultural productivity is not spared from the climate induced shocks that affect agricultural productivity. Rushinga District in Mashonaland Central is mainly a rural area where most of the residents depend on subsistence farming for survival thereby making it a suitable district for studying the impact of climate change on food security. This dissertation will examine and investigate how climate change adversely affects access to food, agricultural productivity and availability of food in Rushinga District in the face of frequent droughts, temperature variability, erratic rainfall and changing overall climatic conditions. The current chapter provides a background of the study, detailing on discussions surrounding the topic in the global, regional and local contexts. It provides the study's research questions and objectives, as well as the justification of the current study. It also provides the study's statement of the problem as well as revealing its scope and the outline of topics.

1.2Background of the Study

Human activities such industrialisation, the burning of fossil fuels and deforestation have led to the accumulation of greenhouse gases such as Carbon Dioxide and the subsequent entrapment of heat in the earth's atmosphere. This leads to increase in temperatures and the occurrence of adverse weather patterns such as floods, droughts and cyclones (Adeyeri, 2025; Watts et al, 2025). The impacts of these climatic changes are had not been similar across the globe and among countries with varying levels of development. In Bangladesh, for instance, the surge in se levels which thanks to the melting permafrost in mountain peaks and glacial regions have led to a surge in sea levels and continual loss of farming land in coastal regions (Islam, et al., 2015). In contrast, Australia has witnessed an increase in veld fires, heat waves and droughts, culminating in decline in cattle ranching productivity, loss of crops and forestry productivity. While in the context of Australia as a developed country climate change equally translate to economic output, in developing countries such as Bangladesh, it threatens food security (ARC Centre of Climate Extremes, 2023). Hence, Ecological Justice and Climate Colonialism factions have argued that climate change is an artificial phenomenon brought by

factors such as industrialization which benefits core economies and upper classes while tormenting indigenous groups and the rest of the periphery world with burdens of climate change such as food insecurity (Malherbe & Oladejo, 2025; Jahnichen, 2022; Wienhues, 2020).

In Africa, evidence shows that climate change is also a principal global threat to fauna and flora and the humanity's well-being (Zhao, et al., 2022). Tropical regions and, particularly the continent of Africa have witnessed a surge in temperature increase higher than the global average, with some estimates placing the temperature increases in sub-tropical region at 2°C higher than 1850 levels. Unlike other threats, climate change has brought much unpredictable weather patterns on Africa and is only showing signs for intensification, making mitigation strategies futile (Joseph et al., 2023).As proven by Watts et al (2025) and Allen et al (2018), where the communities are less prepared, climate change is leading to a collapse of water and land-based activities such as agriculture and, and in extension food insecurity. Yet, despite these challenges, climate change remains an ongoing trend with the global average temperatures already at 1.59°C than their 1850 level. This threatens food security and livelihoods in Africa as evidence from multiple scholars have shown (e.g. Ajayi & Bankole, 2025; Awazi, 2022; Dubbert & Abdulai, 2021; Joseph & Doon, 2023; Kazaara & Christopher, 2023; Ma, et al., 2022). Ajayi & Bankole (2025) reveals the inseparability of predictable and reliable rain seasons and food security, revealing the positive correlations between food security and sustainable development. However, unlike the rest of the world the continent of Africa and, in particular Sub-Sahara, is less industrialised, underdeveloped and less urbanised, making sustainable development a daunting task for communities and authorities involved (Olawatayo & Ayodeji, 2016; Olawatayo & Ojo, 2024). This translates to more low income and climate change vulnerable households depending on less mechanised and less irrigated agricultural sector (Olawatayo & Ojo, 2024).

Just like elsewhere, climate change poses various levels of threats to Southern Africa thanks to varying levels of land use, climatic zones, institutonal policies and preparedness. Masuka and Dzinamarira's (2023) systematic review focused on Eastern and Southern Africa found that climate change is the leading cause of rural to urban migration in the region, especially in Arid and semi-arid regions. According to Theron (2023) the levels of vulnerability tend to be high on low income and literateracy groups, across heat islands, in arid and semi-arid regions, among young adults with limited land ownership rghts, and among women and children. Alongside Somalia, Lesotho and Eswatini, Zimbabwe emerged as one of the top cuntries

affected by adverse weather between the years 2000-2020, while Kenya, South Africa and Mozambique recorded 75% of the Eastern and Southen Africa's catastrophic floodds over the same period (Masuka & Dzinaarira, 2023).In 2019, 6.5 million South Africans were affected by food insecurity (Dunne, 2022). Due to these challenges, the region lobbied at COP27 in 2022 to direct half of the climate change fonding towards mitiation and adaptation strategies such as Early Warning Systems (EWS) and Climate Smart Agriculture (Pichon, 2022).

In Zimbabwe, the rain season provides an anchor to agriculture, leaving the vulnerable communities especially those without irrigation suffering from the consequences of low agricultural productivity (Projects Today, 2020; Chokuwamba & Chidewe, 2025; Mhembwe et al., 2019; Mwadzingeni et al., 2023). The vulnerability is intensified by the regional vulnerability to climate change which far exceeds the global average as shown by the data provided by (IPCC, 2023). Scholes & Engelbrecht, (2021) in particular reveal that the Southern African region is warming at a rate two-times than average. Where the irrigation schemes are active, the limited financial capacity of households and institutions involved make it impossible for mitigation strategies to be implemented and the irrigation infrastructure to be maintained for continued operation (Mhembwe et al., 2019; Project Today, 2020). Kadenge & Chavhunduka (2019) reveal that these vulnerabilities are further intensified by historical issues such as the land question and Fast-Track Land Reform programme which left Zimbabwe's agricultural output way lower than its pre-2000 levels.

There is little research evidence to link the food insecurity in Rushinga district to the impacts of climate change hence this is a phenomenon which needs to be ascertained by this dissertation. Although a lot of researches were done in Zimbabwe there is still a huge gap when it comes to the impact of climate change and mitigation strategies focusing on Rushinga District. While the literature for this study (e.g. Olawatayo & Ayodeji, 2016; Zhao et al, 2022; Joseph et al., 2022; Islam et al, 2015; ARC Centre of Climate Extremes, 2022) documents global and regional trends in climate change, longitudinal studies discussing food security in the context of climate change are limited, specifically focused on Rushinga are limited. While, local studies reviewed (e.g. Mhembwe et al., 2019; Kadenge & Chavhunduka, 2019; Mwadzingeni, et al., 2023; Chokuwamba & Chidewe, 2025; Masuka & Dzinamarira, 2023) cannot be disregarded for exposing the issues surrounding food security, particularly in the context of climate change, Zimbabwe has varying ecological zones with distinct climatic conditions, soils, and economic base (Madzingeni, et al., 2025; Frischen, et al., 2020). This

justifies a study detailing a particular affected area such as Rusvinga as most of these studies (e.g. Masuka and Dzinamarira, 2023) are focused on broad contexts.

1.3 Problem Statement

Food insecurity is a critical issue in most rural households in Zimbabwe as most rural populations often experience challenges in accessing adequate food to meet their nutritional needs for a healthy living. Reduced agricultural yields, loss of livestock and frequent crop failure have been experienced due to the effects of climate change. The government and Non-Governmental Organisations have been actively intervening in Rushinga District however the households in the district continue to be food insecure due to frequent droughts and poor coping strategies. There is little research evidence to link the food insecurity in Rushinga district to the effects of climate change hence this is a phenomenon which needs to be ascertained by this dissertation.

1.4 Research Objectives

The Study will be guided by the following objectives:

1. To critically analyse the elements of climate change like temperature changes and rainfall in Rushinga District.
2. To examine the effects of climate change on overall agricultural productivity and food availability in Rushinga District.
3. To assess the level of household food security in Rushinga District in the face of climate change.
4. To investigate the coping strategies employed by the households in Rushinga District to mitigate the impacts of climate change.
5. To recommend sustainable adaptation strategies that can be employed to mitigate the impact of climate change and enhance food security.

1.5 Research Questions

The study seeks to answer the following questions:

1. What are the climate change trends over the past 15 years in Rushinga District?

2. How has climate change impacted on the availability of food and overall agricultural productivity in Rushinga District?
3. What is the household food security situation currently prevailing in Rushinga District?
4. What adaptation strategies are the households in Rushinga District employing to mitigate the impacts of climate change?
5. What community-based strategies and policy interventions can be put in place to enhance food security in Rushinga District in the face of the changing climate?

1.6 Justification of the study

Tropical regions, particularly most countries on the African continent are warming faster translating to unprecedented occurrences of El Nino incidents, heat waves, droughts and floods(ACAPS, 2019; Awazi, 2022; Intergovernmental Panel on Climate Change, 2023). However, various systematic and scoping reviews have shown that Africa is lagging behind in terms of studies related to climate change, particularly in the context of security, with only South Africa scoring high in co-authorship by countries (Lindawati & Meiryani, 2024). While, climate change in the context of food security have been studied across the region (e.g. Madzingeni, et al., 2025; Frischen, et al., 2020; Ajayi & Bankole, 2025; Awazi, 2022; Dubbert & Abdulai, 2021; Joseph & Doon, 2023; Kazaara & Christopher, 2023; Ma, et al., 2022), there are limited context-specific and recent study discussing climate change and its effect on food security in Zimbabwe. While recognising its impact on food security, most of the studies reviewed often generalise the threat of climate change in a broader context(e.g. Mhembwe et al., 2019; Kadenge & Chavhunduka, 2019; Mwadzingeni, et al., 2023; Chokuwamba & Chidewe, 2025; Masuka & Dzinamarira, 2023). Yet, for instance, in Zimbabwe varying levels of weather and rainfall patterns are evident across the country, contributing to different levels of climate change impact, with communities in semi-arid and flood prone regions feeling the catastrophic burden of climate change (Chikodzi, et al., 2013). Thanks to these gaps, the current study seeks to reveal climate change trends in the past two decades and their effects on productivity and food security.

1.7 Scope of the Study

This study focuses on assessing the effects of climate change on household food security in Rushinga District of Mashonaland Central Province, Zimbabwe. The study's scope is limited to rural smallholder farming households, as these constitute the dominant livelihood group in the district and are highly dependent on climate-sensitive agricultural systems. The study examines climate-related factors such as changes in rainfall patterns, temperature variability, drought occurrence and extreme weather events, and how these influence food availability, access and utilisation at household level. In line with the Sustainable Livelihoods Framework, the study further investigates household livelihood assets, climate change adaptation and coping strategies, and institutional support mechanisms shaping food security outcomes. The temporal scope of the study considers climatic trends and food security experiences over approximately the past 10–20 years, as recalled by households and supported by secondary climate data. Data collection is conducted within selected wards of Rushinga District to generate context-specific insights relevant to semi-arid rural livelihoods.

1.8 Delimitations of the Study

The study is deliberately delimited in several ways. Geographically, it is confined to Rushinga District and does not seek to generalise findings to the whole of Mashonaland Central Province or Zimbabwe. This delimitation is intentional to allow for in-depth, location-specific analysis of climate-food security interactions. Thematically, the study concentrates on food security impacts of climate change and does not comprehensively assess other climate-related outcomes such as biodiversity loss, migration, or health impacts except where they directly affect food security. Methodologically, the study relies on household surveys, key informant interviews and secondary climate data, excluding experimental or longitudinal tracking approaches. The study also prioritises household-level perspectives rather than national policy evaluation, although institutional factors are examined insofar as they influence household access to assets and adaptation capacity.

1.9 Limitations of the Study

Despite careful design, the study is subject to several limitations. Firstly, reliance on household self-reported data introduces the risk of recall bias, particularly when respondents are asked to describe past climatic events or historical food security conditions. Secondly, limited availability and resolution of local meteorological data may constrain the precision of long-term climate trend analysis for specific wards within Rushinga District. Thirdly, the

cross-sectional nature of the study captures household conditions at a single point in time, limiting the ability to establish causal relationships between climate change and food security outcomes. Fourth, logistical constraints such as accessibility of remote wards, time limitations, and seasonal variations in household availability may affect sample representativeness. Lastly, socio-cultural factors, including gender norms and power dynamics within households, may influence responses and limit full disclosure on food access and coping strategies.

1.10 Outline of Thesis

1. Introduction and background

2. Literature review and conceptual framework

3. Study area and methodology

4. Results: climate trends and household food security

5. Discussion and policy implications

6. Conclusions and recommendations

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The preceding chapter established the background of the study, articulating the problem of food insecurity in Rushinga District in the context of climate change, and set out the research objectives, questions, justification and scope that guide this dissertation. This chapter reviews the existing body of literature relevant to those objectives, providing the theoretical and empirical foundation upon which the study is built. The review is organised thematically to address the key dimensions of the research problem. It begins by examining the global and regional context of climate change, tracing the documented trends in key climate variables and their particular manifestations in Southern Africa and Zimbabwe. It then turns to the conceptualisation and measurement of food security, including its four established dimensions and the evolution of the concept over time, before reviewing the evidence on food security conditions in subsistence farming communities. The chapter proceeds to examine the climate-agriculture nexus and the documented effects of climate change on crop and livestock productivity, followed by a review of adaptation and coping strategies employed by affected households and communities. The policy and institutional landscape for climate resilience in Zimbabwe is also discussed, with particular attention to the National Climate Policy of 2017 and the role of Early Warning Systems in food security management. The chapter concludes by presenting the theoretical frameworks guiding the study, namely the Sustainable Livelihoods Framework, the Framework for Vulnerability Analysis in Sustainability Science and the Protection Motivation Theory, before presenting the conceptual framework developed for this study and identifying the research gaps that this dissertation addresses

2.1 The Global and Regional Context of Climate Change

Climate change is a leading global challenge to humanity's well-being and a threat to the rest of the fauna and flora (Zhao, et al., 2022). It has since shaped and continues to redefine catastrophically ecological systems, the human interaction with the environment and ecological resources and the measure of outcomes obtainable in this interaction (Cheng & Li, 2024; Giupponi, et al., 2022;Inbit, et al., 2024). If anything, climate change has made the outcomes of the interaction unpredictable, threatening economic stability and livelihoods at varying levels across the continents and countries, as noted by Joseph et al (2023).As such, the Intergovernmental Panel on Climate Change (IPCC) publication had classified climate

change as an established and scientific fact before the new millennium (Gates, et al., 1990). It notes that the human factors driven by, among others, industrialisation, the burning of fossil fuels and deforestation, in the presence of a steep population growth, have warmed the atmosphere, ocean and land (Watson, et al., 1991). Independent and collaborative studies have revealed that this is not a singular viewpoint, as their consensus is outright, with various disagreements on the extent of impact and the groups impacted (Vu, 2024; National Research Council, 2013; Malherbe & Oladejo, 2025). For instance, the Feminist Political Ecology school frames its impacts as gendered, with women being on the Frontline with limited power over resources and the outcomes of their food security measures and participation(Fortmann, 1996; Elmhirst, 2015). This is distinct from the Ecological Justice or Climate Colonialism factions, which categorically frames climate change as detrimental to the low-income groups who are often dependent on the core world with whom they relate in a neocolonialistic affair. (Malherbe & Oladejo, 2025).

Tangible evidence from Grates et al (1990) and Watson et al. (1991) of climate change is observable at an unprecedented rate. According to IPCC's recent assessment, global temperatures increased by 1.59°C from their preindustrial levels as of February 2025(Allen, et al., 2018). Their maximum and minimum projection of 2°C by the year 2030 or 2050, respectively, is indicative of a heightened pace in this increase, making the current years warmer than the hottest in the last 125, 000 years or more(Allen, et al., 2018). If the maximum 2030 projection proves to be true, the current millennium will have contributed to around half or more of the global temperature increases witnessed in the Anthropocene or the age of human affluence and its impacts (Summerhayes, et al., 2024). While this warming is not uniform across the globe, it has since deformed the environmental and ecological processes in many ways. For instance, evidence from the International Cyrstosphere Climate Initiative (2024) shows that the cryosphere or the Earth's surface, which comprises glaciers and permafrost are in an incessant retreat. This is causing an increase in seawater to record levels, thus negatively affecting coastal communities and nations such as Bangladesh as revealed by Rahman's (2019)study. Various studies have indicated that the hydrocycle is also intensifying, leading to more severe weather patterns such as unpredictable rainfall patterns, heavy storms and cyclones, and floods (Ma, et al., 2022; Wang & Liu, 2023; Adeyeri, 2025; Watts, et al., 2025) . These changes threaten the viability of land- and water-based productivity such as agriculture, and in extension, food security (Watts, et al., 2025; Allen, et al., 2018).

An increase in concentration of greenhouse such as Carbon dioxide (CO2), Methane (CH4) and Nitrous Oxide (N2O) in the upper atmosphere creates a greenhouse effect by trapping heat from leaving the atmosphere (Kim, et al., 2021; Hwang, et al., 2021). This creates a temperature imbalance known as global warming. As these gases have reaches levels not seen in the last 800,000 years with more to be emitted as more nation's industrialise, global warming will remain a challenge(Liu, et al., 2020). Commitment to climate change curbing strategies such at the Paris Agreement which seeks to limit global temperature at 1.5°C requires deep commitment which has not been seen even among signatories (United Nations, 2015). Even at 1.5° or the current 1.59°C the world still faces severe climate-related challenges, such as food insecurity (Allen, et al., 2018). Among the most affected communities, such as the Rushinga, it is only becoming less liveable when relying solely on farming as a source of livelihood as shown by a quantitative environmental survey conducted in Mutirikwi Sub-Catchment by Ziti et al. (2023).

2.1.1Trends in key climate variables.

The data provided by IPCC (2023) reveals that it has been getting warmer and warmer with each decade passing since 1850, with a steady trend of global climate increase observed since the 1970s. Official data shows that, in comparison land and polar regions are witnessing a higher temperature increase when compared to seas(Rahman, 2019; International Crystosphere Climate Initiative, 2024). Yet, provided this data, increase in global greenhouse gases that are the leading causes of climate change remains pronounces across the globe(IPCC, 2023).These increments translate to a further increase in global temperatures beyond the already threatening figures, and contributing at large to the global climate change(Hwang, et al., 2021; Hansen, et al., 2025). Ecologically beneficial climate change whereby global temperatures decreases and climates change shifts positively towards 1850s patterns is thus made a near impossibility that to these factors (Ma, et al., 2022; Giupponi, et al., 2022; Murkhejee, et al., 2022). Researchers have intensified their efforts on adaptation strategies, revealing that an ecologically beneficial climate change is rather dystopian than practical adaptive strategies (Murkhejee, et al., 2022; de Palma, et al., 2025; de Palma, et al., 2025). Each camp of researchers focuses on bringing solutions that tallies with their school of thought. For instance, the Feminist Political Ecology camp is focused distributive solutions and degendering climate response strategies along equitable lines (Elmhirst, 2016).

Rising temperatures have led to an increase in hydrological cycles which in turn are changing rainfall patterns globally (Hansen, et al., 2025; Ma, et al., 2022). The Clausius-Clapeyron relationship reveals that for every 1.7°C in temperature increase, the amount of water vapour air can hold increases by 7%(Thompson & Paluch, 2023). As such, the current 1.59°C increase from the 1850 global average explains the global surge in weather related natural disasters (IPCC, 2023; Adeyeri, 2025; Rahman, 2019; Kim, et al., 2021). A simplified sponge metaphor associates the increase in water vapour the air can contain amount of average rainfall per hour an average storm can deliver in millimetres, which have been shown to have been on the increase thanks to global temperature increases (Thompson & Paluch, 2023). Saligheh's (2021) survey employing transect flow maps powerful bands of winds called jet streams, which are known to steers climate patterns, have been affected by the increase in temperatures in polar regions. Since these are determined by differences between polar air temperature and equatorial air temperatures the warming of Arctic regions at a pace higher than the rest of globe bring about an effect known as Arctic Amplifications (Saligheh, 2021;Maleshko, et al., 2016).In other words, it is hypothesised that thanks to global warming jet streams have become weaker and wavier, leading to storms that are less mobile and droughts, with drier and subtropical regions becoming drier(Stendel, et al., 2021). More often than not, this change is not in rainfall regimes and in patterns, where for instance, rains are concentrated in two months of the expected four months of the rain season, thus exposing crops to both drought and leaching conditions (Salingeh, 2021; Thompson & Paluch, 2023; Riaz, et al., 2024). In both cases, a farmer is expected to be financially capacitated as soil quality declines (Riaz, et al., 2025; Szejgis, et al., 2024; Bigi, et al., 2017).

2.2 Climate change trends in Southern Africa and Zimbabwe

The IPCC (2023) identified the Southern African region to be vulnerable to climate change. Empirical evidence reveals that the region's interior territory is warming at a rate twice than that of the Global Average. This culminates to increased occurrences of wild fires and heat waves, all of which affect beef production and milk lactation in dairy cattle (Gaughan, et al., 2023). While this double increase has been ongoing for at least 5 decades, the region's contribution to global Carbon Dioxide emissions is not comparable to developed nations and emerging economies in Asia in per capita terms (Worldometer, 2024). This is making adaptation in the region a daunting task than elsewhere across the globe, where the average temperature increases are comparatively lower (Scholes & Engelbrecht, 2021). A further

increase in the temperature projected by the IPCC (2023) further invalidates the already adopted strategies of coping with this change, making a long-term and definitive solution to climate change in the region harder to establish.

In Southern Africa studies such as Ayanlade (2022) and Muteyesi et al. (2024) reveal that climate change is also characterised by shifts in rainfall patterns. This shift disrupts farm planning and preparedness of the already disadvantaged small-scale and subsistence farmers who are responsible for more than half of the produce, exerting pressure on the communities affected to establish coping and adaptation strategies beyond their means (Matimolane, et al., 2021; Zhou, et al., 2022; Ndlovu & Prinsloo, 2020). The region has an increasing share of pockets that are increasingly turning more arid and prone to erratic rainfall patterns and heavy downpours that expose the soil to erosion and the riverine environment to siltation (Matimolane & Mathivha, 2023). This paradox of excessive downpours and droughts is more difficult to manage and predict given the fact that the region lack not only resources but efficient forecasts and environmental prediction technology, which is quintessential in improving institutional preparedness (Awuni, et al., 2023; Ayanlade, et al., 2022; Joseph & Doon, 2023). A systematic literature review by Gayo (2025) shows that scholars agree that across Africa, areas where humans share land resources such as watering points with wild mammals climate change has heightened the Human Wildlife Conflict. In addition, sporadic bursts of rainfall coupled with longer dry spells mean that small-scale and subsistence farmers cannot rely solely on rain-fed farming, despite not being able to afford to acquire irrigation equipment (Awazi, 2022). As highlighted in a qualitative study by Mhembwe et al.(2019) in Zimbabwe, small-scale farming is the backbone of food security, yet they are extremely in the face of climate shocks than medium and large-scale farmers. Governments in the region are thus burdened with expanding irrigated land across the country, regardless of the fact that they lack in financial capacity to invest in a nation-wide response (Mhembwe et al. 2019). In Zimbabwe, for instance, the most recent irrigation scheme covering close to a full Ward was financed by a 15 million donation from the Japan International Cooperation Agency in Nyanga. After construction have been multiple problems pertaining to the scheme's continued operation without the involvement of the donor have been immense, leading to months of inactivity in 2024 and 2025 (Mhembwe, et al., 2019; Project Today, 2020).

The region is exposed to the recurrence of El-Nino cycles, such as the catastrophic events of the 1991 to 1992 season and 2001 to 2002 season left the South African countries, such as Zimbabwe, in a drought-induced famine (Meteorological Services Department of Zimbabwe, 2025). Mwadzingeni et al. (2023) review study focusing on irrigation schemes for small-scale holders shows that where land is irrigated, water supplies are frequently dwindling to levels that cannot sustain agriculture in the dry season than ever before. While El Niño is not an outcome of climate change, its magnitude is enhanced by global increments in average temperatures, as it is already a natural phenomenon resulting from the warming of the Pacific and the subsequent changes in weather patterns leading to droughts and food insecurity (Hansen et al, 2025; Vu, 2024; Joseph & Doon, 2023). In the Southern African region, as well as across the southern hemisphere, climate changes have meant that these El-Nino events start earlier, with up to 25% strength with double frequency over the years, and the recent incident contributed to a 0.4 °C increase in the already higher temperature(Hansen, et al., 2025; Mukherjee et al. 2022).

In addition, the region has also become a hotspot of cyclones in recent years. In 2019, Cyclone Idai tragically brought unprecedented storms in Zimbabwe, Mozambique and Malawi. Mozambique, along with Tanzania and Madagascar, experienced Cyclone Keneth later in May, making it the only recorded cyclone making landfall in the region as late as 25 April (Cone & Yarnell, 2019). With wind speeds reaching 210 kilometres per hour, Cyclone Kenneth was the strongest cyclone to ever affect the region. Both natural disasters crossed a billion dollars in property and crop damages, while claiming lives (Cone & Yarnell, 2019; ACAPS, 2019). A study by Awuni et al (2023) on climate change challenges and mitigation in Ghana revealed that the juxtaposition of droughts and floods within a short timeframe overwhelms the coping capacities of communities and governments, eroding developmental gains and deepening poverty. In Northern Mozambique, these disasters created a fertile ground for the rise of terror groups and further displaced communities, leaving them incapable of conducting any form of agricultural activities essential for recovery and food security (Rosario, 2022; Cone & Yarnell, 2019).

Conceptualising and Measuring Food Security

In the review study, Makombe(2023) asserts that, food security is a complex topic that cannot be determined by the simple presence of food or per capita food production in a given space, village or group of households. According to the United Nations' Food and Agriculture Organisation (FAO)(2022) food security is a state whereby a household, a community, a region or a nation has not only the physical, social and economic access to food but a guaranteed access that meets their dietary needs. These definitions show that even with guaranteed access, a community can be said to be facing food insecurity (FAO, 2022; Makombe, 2023). Developed in a 1996 World Food Summit, FAO's (1996) method of assessing whether or not a certain studied community, household or group of households can be said to be food insecure balances on four standardised pillars.

The first of the four dimensions is food availability, which refers to the physical availability of food in the country (FAO, 1996). Four sub-pillars, namely, food imports, food production, food transportation and distribution and food aid, shape food availability depending on the region's capability to import, the culture of consumption, production and logistics (FAO, 1996; Nkoko et al, 2025; Makombe, 2023). For instance, the island state of Nauru imports tinned foodstuffs while Japan imports grains such as wheat (Lun, et al., 2022; IMF, 2023). The former is thus subjected to obesity thanks to her culture of consumption, producing a food problem which cannot be solved by a mere ability to import, but a shift in the consumption culture (Mclennan, 2017). A culture of consumption is a market force shaping the quantity and quality of food physically produced or imported and physically available to a given community (FAO, 2022; Ginsburg, et al., 2020). Experts generally assess food availability in terms of the sufficiency of food in or fora given area. Given the limited logistics in most rural areas dependent on agriculture as their main economic activity in Zimbabwe and the country's inability to cover shortages with imports, availability is mostly determined by the quantity of food produced(Allen, et al., 2018; Makombe, 2023; Kaoje, et al., 2019).

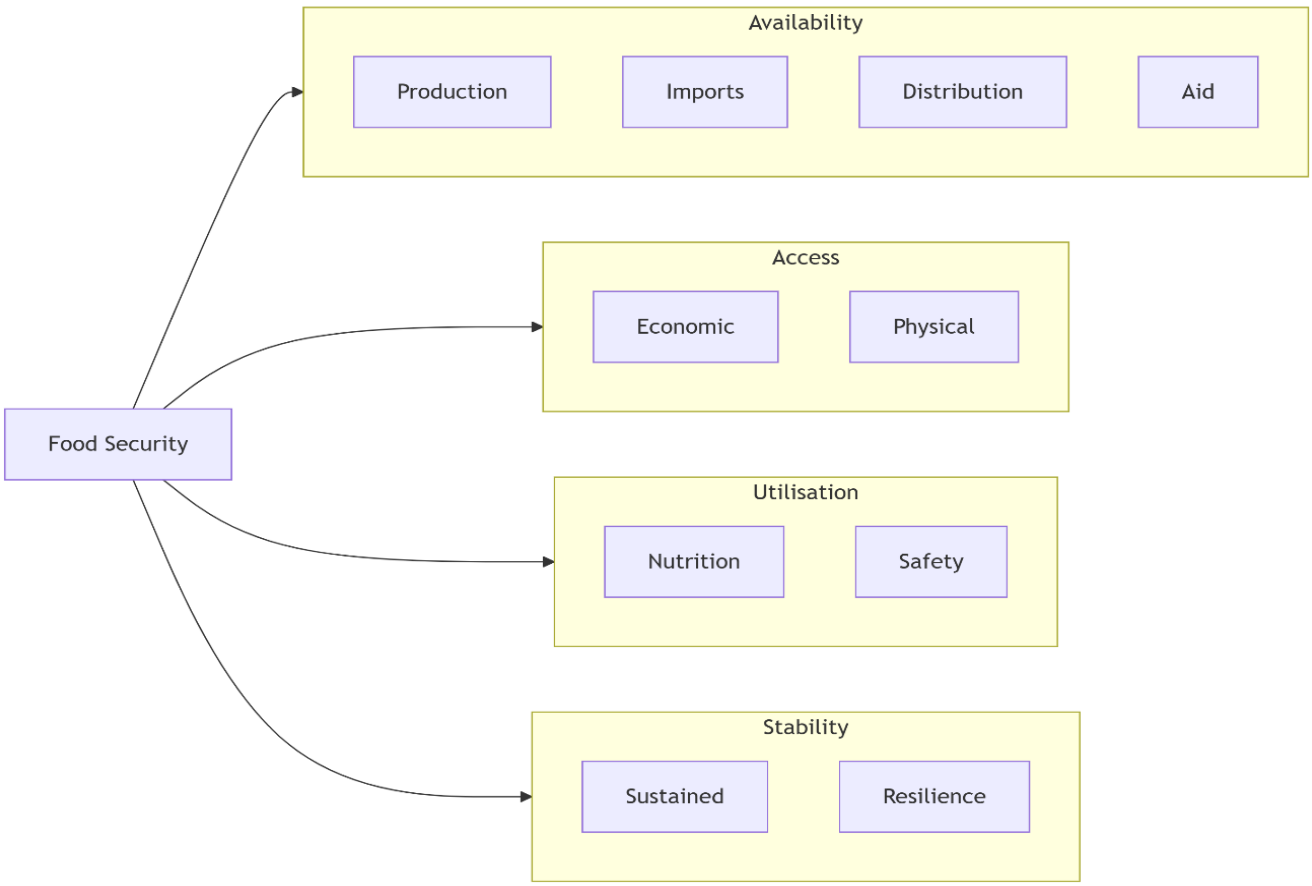
The second dimension of food security is food access, which refers to the family's capacity and ability to access the food available in markets or provided by donor flows (FAO, 1996; Facendola, et al., 2023; Kaoje et al, 2019). This dimension assesses per capita and per

household irregularities in food distribution as determined by the family's economic and physical access (Ginsburg, et al., 2020). The economic access relates to market and production forces governing what and how food can be purchased or access and who can access it. This access creates variations in food security among households in the same community that cannot be understood in terms of the season's per household harvest tonnage (Nkoko, et al., 2025).Physical access refers to the physical structures that are available for food to reach the markets. In a donor facilitated access setting, physical access is also determined by the spatial location of distribution centres and the absence of nepotism in setting them (Facendola, et al., 2023; Nkoko, et al., 2025). In alignment to these arguments, a cluster analysis quantitative study conducted by Nkoko et al (2025) in Lesotho positioned food security as governed by diffusion factors, governing the flow from high food concentration households and areas.

The utilisation dimension of food security is primarily focused on how the body benefits nutritionally from the food consumed contributes to the well-being of the individual consuming it, as shown in major FAO publications dedicated to exploring these food security dimensions, such as FAO, (2008), FAO (1996) and Demeke, et al., (2013). This facet of security, also known as nutritional security in studies assessing dietary diversity, such as Sarkar (2022) and Pérez-Escamilla (2024) clarify the nature of food security beyond just calories and the size of calories consumed per capita by a group of individuals. Thus, to be food secure, an individual or group must access food with balanced nutritional value and consume proper amounts of all required nutrients (Hendriks, et al., 2023; Simelane & Worth, 2020). Under the utilisation dimension, food security is also assessed in terms of its safety; that is, the food type and preparation must meet minimum hygiene benchmarks set by organisations the World Health Organisation(2022) in its food safety strategy framework. Food is also considered safe when it is free from toxins that can affect one's health in both the long and short term. In addition, FAO (2008) also included food stability as the third dimension, noting that an individual or households are considered to be food secure if all the other dimensions are sustainably maintained in the long term. Scholars view this dimension as a core pillar of food security, noting that the community must have access to food at all times despite shocks such as floods, conflict and economic crisis (Sarkar, 2022; (Demeke, et al., 2013; Facendola, et al., 2023).

2.3 The evolution of the concept of food security

The term food security was first used in 1974 at a World Food Conference as a description of the global food crisis of 1972-74, which led to at least 1 million mortalities across the globe (FAO, 2006). Across the globe, multiple hotspots of famine with varying degrees of fatalities, including the Bangladesh Famine (1974), the Wollo Famine in Ethiopia (1972-75, the West Sahel countries (1968-74) and Darfur, Sudan (1972-974), were of key concern(Hossain, 2025). Political governance failures in Ethiopia, post-war fragility in Bangladesh, which eliminated what Hossain (2025) theorised as political incentives that ruling systems utilise to prevent famines to food security, and droughts in West Sahel countries made a direct negative impact on food production. This led FAO to frame food security as a challenge driven by food unavailability. Having concluded that the famine was driven by a critical shortage in staple grains was evident in all the hotspot regions, the World Food Conference adopted multiple resolutions aimed at boosting food production and availability (United Nations, 1974). These include emphasising the use of fertilisers, seed certification, ensuring the balance between population and food production and facilitating aid flows(Malherbe & Oladejo, 2025; Nagaraju, 2023).



The pioneering work Ingredients of Famine Analysis: Availability and Entitlements by the economists Sen (1981) led to a shift in narrative of food insecurity, through what would be known as the Entitlement Theory. For the first time it was food security was not only solely treated as a supply-side problem, but also a household access issue (Muzerengi, et al., 2021). This introduced the crucial dimensions of poverty, entitlement, and purchasing power into the definition (Bowbrick, 2022; Muzerengi, et al., 2021). The 1972-74 crisis was also revisited, broadening the discussion on transport and logistics crisis created by the global fuel crisis while also including household impediments to access (Rwomire, 1992). By the 1990s, the discussion on food security had broadened to the qualitative aspects of food aspects by taking into account the utilisation aspects of food security. The shift positioned food security as a marker of household, community and national development, not solely as a description of the prevailing economics (Frankenberger, et al., 2000; Bigi, et al., 2017). In the early 2000s, stability became the last dimension of food security, as experts noted the importance of a fluent timeline of access to quality food over time (FAO, 2006). For the first time, the three pillars were not only regarded as important, but saw their durability and resiliency as the

ultimate description of food security (Anderson, 2018; Suqie, 2024). The emphasis on stability is seen in a much recent descriptive survey by Ajayi and Bankole (2025) utilising 600 participants in South West Sahara, food security is positioned as a vital factor for sustainable community and national development.

Food security in subsistence-farming communities.

The Sub-Saharan context presents one of the leading food security challenges globally (Kaoje, et al., 2019; Ajayi & Bankole, 2025; Awuni, et al., 2023; Ayanlade, et al., 2022; Matimolane, et al., 2021). Most communities rely on rain-fed subsistence crop farming and animal husbandry, with the latter playing a supplementary role of providing protein in the diet and as easily traded assets in times of need (Awazi, 2022; Bagagnan, et al., 2019; Frischen, et al., 2020). Kweka's (2022) study in Tanzania found that due to a combination of factors such as climate change, poor infrastructure, leaders face a daunting task in setting and keeping small-scale irrigation schemes running. In essence, the dependence on the direct variables of climate, such as the delayed onset of rains, mid-rain-season dry spell, early cessation of rains, heavy storms and subsequent floods, which lead to crop failure, makes it difficult to meet their dietary requirement following poor harvests (Scholes & Engelbrecht, 2021). In some subsistence communities, a varied approach whereby crops are traded for grains and vice versa, making the disruption of any of the two forms of husbandry a disaster to all communities in the given region (Mbatha, et al., 2021). Scholars argue that whereas the nexus of indigenous knowledge and modern technology is supposed to be liberating to such communities, climate change has made the accumulation of knowledge and capital impossible for the transition of these communities from unreliable subsistence(Awazi, 2022; Awuni, et al., 2023; Frischen, et al., 2020; Bagagnan, et al., 2019; Kaoje, et al., 2019).Ndlovu et al.'s (2020)qualitative study involving 129 subsistence farmers in semi-arid regions of Zimbabwe reveals that these changes have also stretched the indigenous knowledge thin, driving the local communities to abandon them altogether.

Farming planning and execution are now restricted to a few crops that can either perform well in a short season or lead to presumed higher yield, leading to the decline of smaller grain crops such as finger millet and the applicability of indigenous knowledge involved in farming them(Onwnonga, et al., 2018; Thukur, 2025). While this decline appears to be a form of

adaptation, it reduces variety in cropping and negatively impacts the dietary quality of the food available for consumption, thus further leading to food insecurity (Thakur, 2025).Crop Trust (2025) reveals that there has not been a time when farming a variety of crops has been a requirement to salvage harvests from the surge in pests and diseases driven by an increase in temperatures. In most cases, smaller grains such as finger millet are restricted to small-scale and subsistence farming, where they are used as bargaining chips in case they are sold as surpluses, due to a lack of competition from medium and large-scale farmers (Gupta, et al., 2017). Climate change is, therefore, threatening to dwindle potential sources of extra income among subsistence and small-scale farmers(Bigi, et al., 2017; Joseph & Doon, 2023).Unlike commercial farmers and urban dwellers, these households consume much of their produce and have limited buffers, as they do not have much produce to sell (Ziti, et al., 2023). In most cases, they cannot farm designated cash crops without contract facilitators, donors and cooperative partnerships (Food and Agriculture Organisation, 2022). Being without a limited buffer means a preceding poor season can potentially lead to a poor season in the following years, even when there is good rain in that year (Awuni, et al., 2023).

While it is shown to bring positive outcomes, particularly in reducing climate change by Dapilah's (2023) study in Northen Ghana and Magersa & Assefa (Magersa & Assefa, 2019) in Oromia, Ethiopia, contract farming has not been entirely positive in the context of climate change. Small-scale farmers under contractual farming also gave serious consequences, including loss of farming land when they fail to pay back their loans following poor seasons, as shown (Ndlovu & Dube, 2024; Mafirakureva, et al., 2025). Climate change in this context becomes a natural resource for empowering the contractor and a curse for disempowering the small-scale farmers (Dubbert & Abdulai, 2021). Where the small-scale farmers were supposed to employ disadvantaged subsistence farmers in the community, whom they pay in cash or in kind using grain crops such as maize, the accumulation of debt removes that seasonal employment as a critical time (Fink, et al., 2017; The Arab Weekly, 2021).

While there are many ways to explain food insecurity, studies by Mashizha & Tririvangasi (2025) found that poverty remains the mediating variable, worsening the ability of farmers to respond to climate shocks such as drought in Zimbabwe. Due to poverty, subsistence households in Zimbabwe lack proper access to financial services, inputs and irrigation

equipment (Chokuwamba & Chidewe, 2025). Without any proper means to adapt to repeated droughts and floods, the farmers slip into further impoverishment (Camillion, et al., 2020). The Ecological Justice and the Climate Colonialism factions frame this as the only description of the effects of climate change (Fischer, 2024; Balaraj, 2025). They do not only regard the escalation of emissions and deforestation as emanating from the practices of established business orders and developed countries, but also as a strategic path to enrichment at the expense of climate stability and the communities that depend on this stability (Jähnichen, 2022). In the long term, the richer core and established agro-businesses with the means to cope become well-adapted and richer, while desperate communities struggle with food insecurity (Ferdowsian, 2021). With limited empowerment, the affected communities struggle to represent themselves in the climate change dialogue (Fischer, 2024; Balaraj, 2025).

In the greater Sub-Saharan region, women are mostly on the frontline as food producers (Akpa, et al., 2024). Paradoxically, they are supposed to fulfil this responsibility without control over the land and other socio-economic capital involved in small-scale and subsistence farming, thus limiting their role in what Igwe et al (2025) titled as nutrition-sensitive agricultural practices. Chidhakwa et al. (2020) study investigating the impact of gender imbalance in Zimbabwe's agrarian sector shows that women struggle to secure other traditional forms of social capital, such as cooperatives and labour pools, invited to till the land in exchange for beer and other items. Land transfers and negotiations, borrowing of draught cattle and manure, cannot be easily facilitated or done by women (Ndlovu & Mjimba, 2021). Yet, the same system that alienates them expects them to provide the bigger share of input in labour, long-term soil fertility maintenance, and sustainable land practices Chidhakwa, et al., (2020). Males in the households also manage surpluses and cash crops or exhaust non-surpluses without consulting women, leading to spillages of potential revenues that could be used for adaptive strategies. In the long term, this perpetuates low food productivity and food insecurity (Igwe et al., 2025).

In the Zimbabwean context, food security is shaped by the country's historical and economic challenges (Kadenge & Chavunduka, 2019). The Zimbabwean Government initially redistributed land through a willing seller and willing buyer basis. Through the aid of grants

from the British Government, the Zimbabwean Government acquired land which it would later redistribute to stranded communities (Mkodzongi & Mujere, 2025; Mudau, et al., 2018). This resettlement programme was also extended to communities in Rushinga, allowing them to move to better farmlands out of their provinces of origin (Bandara, et al., 2025). However, the fast-track land reform programme did not guarantee the continued resettlement of the affected communities (Matsvai, 2018). It also led to an economic decline in the agricultural supply chain, impacting all farmers and their ability to accumulate capital from the sale of their crops (Kadenge & Chavhunduka, 2019). Combined with the legacy of hyperinflation, the agricultural sector in Zimbabwe has not performed as well per capita as it did at its pre-2000 level. Although Dube (2025) found CARE's Ensure programme which is strongly aligned with the Sustainable Livelihoods Framework effective at improving community adaptation in Zimbabwe, NGOs are overwhelmed in their role in alleviating food insecurity and the impacts of climate change (Kabonga, 2023; Muzerengi, et al., 2025).

2.4 Effects of Climate-Agriculture Nexus Productivity

In any given setting, farming is subject to a deeply entrenched interdependent relationship with climate (Awuni, et al., 2023; Bagagnan, et al., 2019; Dapilah, 2023). Combustion fuel mechanised farming coupled with poor conservation approach, particularly deforestation and poor reclamation strategies on forest resources, dwindles the nature's capacity to act as a carbon sink (Cheng & Li, 2024). Nzabarinda et al (2025) shows that rapid deforestation of equatorial rainforest for human settlement, agriculture and extraction of forest resources is contributing to a surge in Carbon dioxide escaping into the upper atmosphere and consequently contributing to global warming and the disruption of the natural climate pattern. Finer &Mamani (2021) show that where deforestation is intense in rainforests, particularly in areas that are not protected or inhabited by indigenous populations, the areas are emerging as net carbon sources, contributing to climate change, known as the Savannisation of the rainforests (Nath, et al., 2024). While this is the case, a stable and favourable climate is a necessity for agriculture (Azadi, et al., 2021), as historically proven by dominant agrarian civilisations throughout the last 11, 000 years known as the Holocene (Ljuša & Sitaula, 2016). When food production is rain-fed, a stable and predictable climate change reduces the

occurrence of droughts and a decline in productivity, translating to viability in climate adaptation strategies (Azadi, et al., 2020; Awuni, et al., 2023).

The common biophysical impact of rising temperatures, provided adequate rainfall, is the shortening of the lifespan of ephemeral plants that can complete their lifecycle in a single rain season and the number of insects, birds and other animals that thrive in longer rain seasons (Barrett & Brown, 2021). This reduces the amount of time for biomass accumulation, which ultimately reduces soil fertility and pollination of crops, thus negatively impacting food production. In addition, a study by Mu et al (2022) reveals that stress-tolerant ephemeral plants can easily become evasive as less-tolerant ones struggle to maintain their pre-climate change survival rates. Wu et al (2024) reveals that Staple crops such as maize also experience heat stress when subjected to excessively high temperatures, which can consequently reduce flowering and grain filling, contributing to a yield loss. Concurrent changes in precipitation, especially when characterised by heavy storms and dry spells, expose crops to both water logging and wilting conditions, exposing plants to moisture stress, leached soils and wilting conditions (Furtak & Wolińska, 2023).

This nexus also profoundly affects livestock productivity a key asset for rural households (Mugambiwa & Rapholo, 2024). An increase in temperatures thanks to global warming exposes livestock to heat stress, which consequently leads to low food intake and poor beef and milk productivity (Godde, et al., 2021). Heat stress is one of the leading non-infection or injury causes of calf mortality in small-scale and subsistence farming, with dwindling preventability due to further increases in average temperatures projected for the Southern African region (Cartwright et al., 2023; Erasmus & van Marle-Köster, 2025).Focused group studies conducted by Mugambiwa & Rapholo(2024) reveal that communities in Mutoko, Zimbabwe, are increasingly disposing of their livestock due to concerns about the declining carrying capacity of grazing lands and water holes, which are not being adequately replenished by current rainfall patterns. Combined with the unprecedented rates of conversion of pastureland into farming and residential land, thanks to population growth, the mortalities induced by heat stress contribute to a decline in livestock productivity per household (Uddin & Kebreab, 2020). Climate change reduces the carrying capacity of the remaining pastureland by altering the distribution and abundance of pastures and forage (Uddin & Kebreab, 2020; Mugambiwa & Rapholo, 2024). This reduces the quality and quantity of available feed, especially during dry periods, leading to poorer animal health and increased

mortality, directly diminishing a critical source of nutrition, income, and draught power for farming operations (Uddin & Kebreab, 2020).

2.5 Adaptation and Coping Strategies to Climate Change

Rural households in affected areas are increasingly employing a range of adaptation and coping strategies in the wake of climate change, as indicated by Awuni et al. (2023) study in Northern Ghana. While both forms of coping and adaptation strategies are usually presented as bundled together, researchers(e.g. Awuni et al, 2023; Giupponi et al. 2022), agree that there are stark differences between adaptation strategies and coping strategies, with the latter being varied and short-term in nature. In contrast, adaptation strategies are a grand strategy of alleviating the impact of climate change through a combination of all forms of knowledge and the input of multiple stakeholders shown by Ljusa et al (2016). They seek to build capacity and preparedness beyond reactions and survival-focused approaches, and, hence, are the most emphasised climate change response strategies (Ndlovu, et al., 2020). This adaptive capacity also shapes the immediate coping strategies available to the community in the event of an environmental shock such as floods. As such, less-adapted or diversified communities cannot easily cope in the event of such climate shocks (Makwindi & Ndlovu, 2022).

2.5.1 Common coping and strategies

The food consumption pattern of communities shifts in response to climate change. A considerable decrease in the number of meals has been observed in various communities affected by poor yields (Afshin et al., 2019; Oluwatayo & Oyo, 2016). The decrease is strategic, often involving the elimination of a mid-day meal by moving an early morning towards noon.Some families may start their day with lighter meals that a less taxing on their remaining stocks of grain, such as porridge. Some of the coping strategies identified, however, have been long ingrained in the local cuisine for ages, and show signs of persistence in good seasons and among food-secure households (Afshin, et al., 2019). For instance, Daji et al (2022) study Nutritional and Phytochemical Composition of mahewu reveals that leftovers that are recycled into livestock and human feed, particularly a fermented beverage known in Shona as mahewu, which is made out of leftover sadza or porridge in Zimbabwe, is highly nutritious. In addition, communities may also forage and gather wild tubers, mushrooms, and fruits, and often dry and preserve some for consumption for the rest of the year (Åhlberg, 2025). Some mushrooms, can be consumed when dried, and have been known as substitutes for garden-farmed vegetables or livestock meat that can last for years when preserved well (Åhlberg, 2025).

Surplus crops are not only easily convertible to cash, but they are also a medium of exchange. They serve are the direct outcome of the industrious effort of most rural households. Without cash crops surpluses on food crops, households are forced by the situation to convert structural assets with no easy replaceability into cash. Assets such as ploughs are normally purchased during good season harvests, and are meant to be a one-time investment. Selling such assets disrupts the viability of farming in future seasons, threatening the household with food insecurity. Alternatively, affected communities depend on food aid from the government and NGOs or resort to distress door-to-door food begging or exchange items and labour for food in a practice known as kusunza in Shona (Voice of America, 2019). During the Ethiopian famine of 1984, affected Tigrinya communities migrated town wards in the hope of securing food handouts. This also earned them publicity in the international and local media, warranting them the much-needed donor attention. Because recovery is harder is such famines, depending food donations alone is not enough to ensure that the affected communities recover from the catastrophic impacts of food insecurity (Beckford, 2018). As such, adaptation is required due to its long-term focus and involvement of multiple stakeholders (Nzabarinda, et al., 2025).

Families have increasingly adopted off-farming activities to ensure that their lives are not entirely dependent on agriculture (Rajashekhara, 2015; Beyene et al, 2023). The swift transition to other income-generating activities, such as craft-making, observed in tourist areas where tourist visits increase in dry seasons, allows the communities to supplement their food with the incomes they generate through such activities (Makwindi & Ndlovu, 2022). This livelihood diversification also empowers growth points into growth by ensuring year-round income generation. Where women are active participants in such alternative income generation activities, these alternatives may reduce income inequality, with women tending to spend on household items and addressing food insecurity without having to confront the resistance from their husbands (Bagagnan, et al., 2019; Makwindi & Ndlovu, 2022). Yadav & Lal's (2018) study *Gender and Vulnerability to Climate Change Impacts in India* shows that where both males and females are active participants in such activities, women tend to have less bargaining power preventing them from having the incomes.

2.5.2 Climate-Smart Agriculture (CSA) as a Resilience-Building Strategy

Experts have argued that since climate change is the leading threat to food security proper scrutiny in communities where agriculture is the mainstay must be directed toward climate-responsive strategies. Climate-Smart Agriculture (CSA) is a framework that was developed

by FAO and other international bodies. It seeks to increase agricultural productivity and incomes in a sustainable way, building resilience to climate change and reducing or removing greenhouse gas emissions where possible. Where intensification of farming activities is driven by population growth or necessity, the CSA framework seeks to achieve this through sustainable practices. It emphasises key soil and water conservation practices, namely, minimum tillage, mulching, crop rotation, contour ridge construction, moisture retention, and water harvesting, as tantamount to sustainable agriculture. Tamagnoe et al (2020) revealed that that where micro-catchments have been used to capture and retain rainwater in Africa, crops and other plants can get guaranteed access to water throughout the season.

The CSA seeks to promote the farming of drought-resistant crops such as sorghum, millet and legume crops such as round nuts (Kazaara & Christopher, 2023). These crops can also be farmed on a crop rotation basis, with legumes being utilised to replenish nitrogen, in conjunction with other forms of indigenous farming knowledge, since most of such crops have been farmed before colonisation (Walker, 2016). The framework also emphasises the adoption of early maturity varieties that can survive seasons that are now characterised by dry spells towards the end (Kazar & Christopher, 2023). Testimonials from other farmers highlight that floods and disastrous storms have intensified at the end of the season, and cultivating a variety that allows early removal of the produce from the field shields them from the catastrophic impacts of such disasters (Ajayi & Bankole, 2025). This strategy produces the best result when integrated with practices such as mixed cropping systems that have been the mainstay of indigenous farming systems (Chandra, et al., 2017).

2.6 Policy and Institutional Frameworks for Climate Resilience

Just as international coordination is important towards mitigating and addressing climate change at the global level, effective policy instruments are required to establish and guide actionable adaptation strategies at the local and national level (Governent of Zimbabwe, 2017). Zimbabwe is a signatory to international climate agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement on climate, which commits it towards establishing and implementing national policy tools that address climate change and mitigate its impacts in line with the international targets (United Nations, 2015). Where possible, these commitments operationalise the structure of policing and business across industries, and the level of financial and technical support the government provides to affected communities (Tveit et al., 2024; Zizinga et al., 2021). In

extension, these policy tools seek to address not only climate change but also its impacts, such as food insecurity (Makwindi et al., 2023).

2.6.1 The National Climate Policy of Zimbabwe (2017)

Developed in response to the growth concern of climate change, Zimbabwe's National Climate Policy (2017) is a key climate-proofing policy covering sectors such as health, agriculture and water and the key roles they must play towards addressing the impacts of climate change [cite here].It is a formal recognition of the country's dependence on climate and the unprecedented increase in vulnerability thanks to climate change. As a developing country, Zimbabwe still witnesses a surge in Carbon emissions. The policy framework's goals highlight the need for a long-term approach in pursuing low-carbon development across industries (Parikh et al., 2020). The policy's main vision is to enhance the country's adaptive capacity and resilience to climate change, ensuring sustainable socio-economic growth while reducing greenhouse gas emissions (UNDP, 2019). The framework recognises the importance of equity and inclusiveness through guaranteeing the participation of all vital stakeholders and the inclusion of vulnerable groups in the climate change dialogue, while taking a precautionary approach, prioritising early action and risk reduction (Rida, 2024). It also seeks to embed climate change in all considerations across the corporate, informal and public structure (Maponga & Hanyana, 2021).

The policy enforces that communities must be shielded against climate change through adaptation strategies that enhance their resilience and promote healthy ecosystem (Makwindi & Ndlovu, 2022). The policy document details Climate-proofing agriculture which is centred on promoting Climate-Smart Agriculture, drought-resistant crops and irrigation development (Mpala & Simatele, 2024). This demands that the communities be provided with water management resources, climate-proofing infrastructure, and strengthening early warning systems (Akzar & Amandaria, 2021). Hence, the framework establishes mechanisms for climate change adaptation, resource allocation and financing, and strengthening cross-ministry institutional capacity towards the attainment of this goal (Governent of Zimbabwe, 2017).

2.7 Early Warning Systems (EWS) for food security and drought.

An EWS is an informative system that predicts the occurrence of natural disasters and reveals their threat levels (Olaoye & Egon, 2024). It ensures that information on likely climate disasters is based on tangible evidence as well as assists in disseminating timely information

to the vulnerable communities and decision makers (Otugha, 2024; Agbehadji, et al., 2023). In the context of food security, the goal is to be reactive to immediate threats to reduce the damage to crops, storage facilities and transportation systems (Teku & Tariku, 2025). These reactive steps ensure that the communities affected can still remain food secure in the aftermath of the disaster, ensuring that they will be prepared to face more climate disasters ahead (Otugha, 2024; Olaoye & Egon, 2024). In essence, an effective EWS proactively prevents the escalation of disasters such as floods into a full-blown humanitarian disaster, especially when all-encompassing Multi-Hazard EWS are utilised (Chavula, et al., 2025). It allows a continuous cycle of data collection, analysis, risk assessment, and communication in real-time (Olaoye & Egon, 2024).

The four key pillars of EWS are risk knowledge, monitoring and forecasting, dissemination and communication and response preparedness. Risk knowledge involves establishing a detailed understanding of all risk factors, such as baseline poverty levels and prevailing market assets, through systematic data collection and analysis procedures. As noted from Ansari et al's (2025) study investigating the applicability of Artificial Intelligence in EWS, technology can play a crucial role in data collection and analysis and in establishing correlations and insightful information on the risk factors recorded. Monitoring and evaluation entail the continuous tracking of weather and climate variables such as rainfall and agricultural conditions as crop growth and pasture availability (Haque, et al., 2023). Through this pillar, responsible authorities and systems are able to predict the status of such variables in months or years ahead based on the current dynamics (Ansari et al., 2025).

Dissemination and communication involve transforming the forecast data and the risk knowledge into collective early action, and mobilisation of all stakeholders into their areas of rescue and participation specialisation (Matekenya & Ruhode, 2025). Muhame et al, (2024) note that this facet of EWS is vital for sustainability in climate adaptation strategies. Through dissemination, official and community channels of communication are engaged to provide valid information that is understandable to the target groups through multiple channels such as radio bulletin (Sharma, et al., 2021). Due to the variations in technical, digital and overall literacy, the dissemination process is strategic, often involving simplification of the information where required, trend revelations and risk preparedness discussion (Muhume et al, 2025). This stage is followed by the final pillar known as response preparedness. It normally involves setting contingency plans in response to the disaster and prepositioning resources such as food aid and cash transfers (Klein, et al., 2023). In sophisticated response

systems, triggers are set based on the forecasted patterns and thresholds exceeded or projected to be exceeded (Haque, et al., 2023; Ansari et al., 2025).

2.8 Theoretical Frameworks

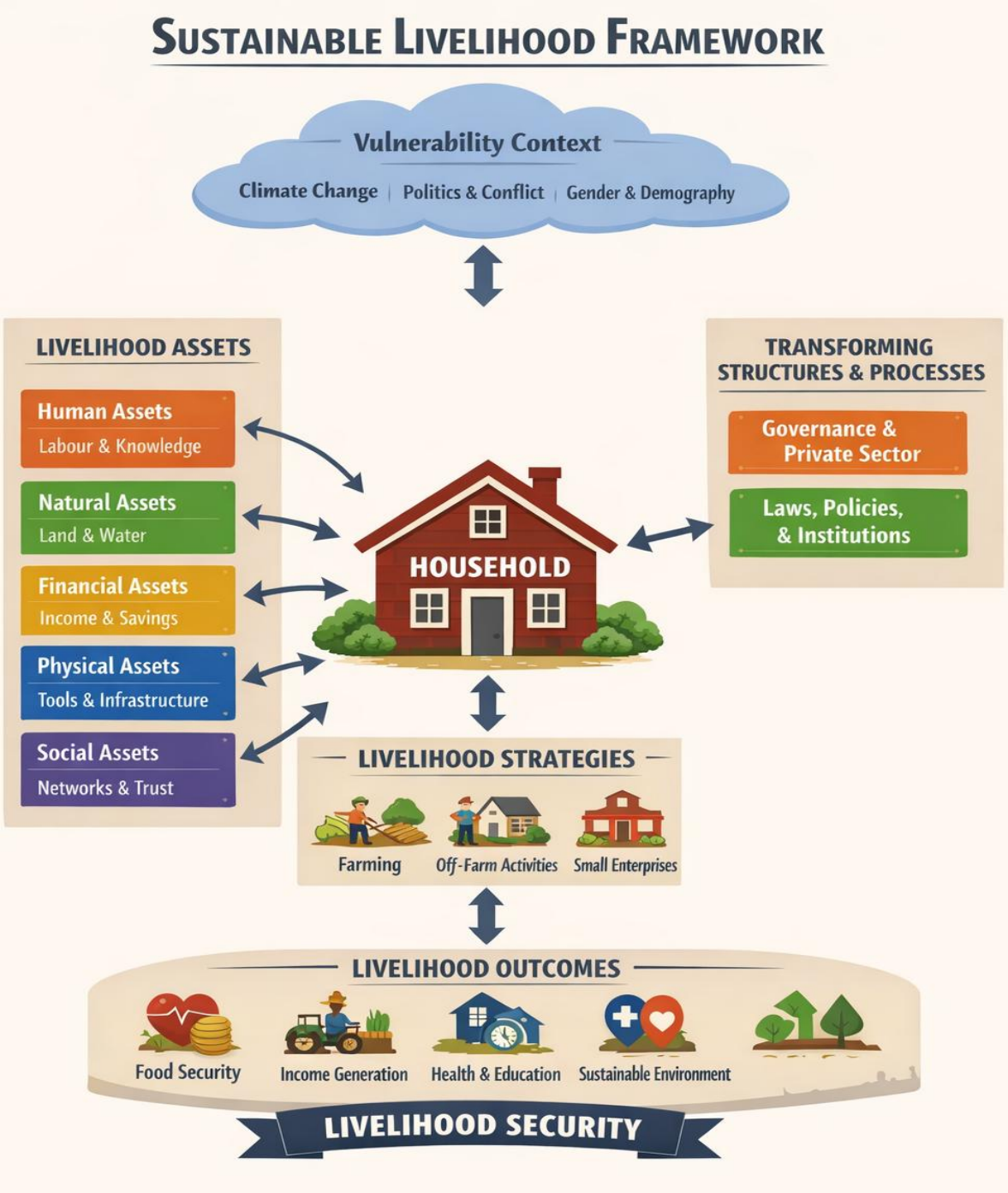
2.8.1 Sustainable Livelihoods Framework (SLF)

The SLF was developed by Chambers and Cornway (1992). Already, the discussion on food security was shifting towards qualitative and long-term elements of food security, revealing the need to have food security not only determined by national self-sufficiency by household and individual access dynamics, ultimately influencing the SLF. According to Singh et al.(2024), the SLF theorise that all livelihood strategies, for instance, farming, are based on the asset base, which in the case of agriculture are natural assets, which are seemingly renewable yet depletable when unsustainable interactions between humans and the assets are employed, leading to what Frankenberger (2000) described as livelihood security. While they are pathways towards positive outcomes such as food security, livelihood strategies cannot be regarded as sustainable if they deplete soils and forests, and pollute the environment (Sapkota, 2021). This depletion depreciates the asset base, making it impossible for a livelihood strategy to achieve its intended outcomes and perpetuating food insecurity (Singh et al, 2024). A combination of assets collaborating on the attainment of food security are human assets such as labour and knowledge, natural assets such as water and land, financial assets, physical tools and assets and social assets such as networks and trust (Cornway, 1992). Xu et al.'s (2023) study in Pakistan reveals that livelihood strategies are specific to a given region, its husbandry and crop specialisation, climate change challenges, resources and gender norms.

Employing a context analysis approach, the revised SLF by Sapkota (2021) theorise that governance structures, and the private sector are transformative structures, while laws, policies, culture and institutions are transforming structures that determine access and, in extension, food security. These structures bridge the gap between livelihood assets, such as land and livelihood outcomes, such as food security (Sapkota, 2021). A similar version by Scoones (1998) mentions the importance of institutions and organisations as mediatory factors between natural capital and livelihood strategies. It frames contextual factors such as history, politics, conflict, gender equality and demography as determinants of livelihood strategies that are to be applied and their potential (Scoones, 1998; Morse, et al., 2009).

CARE's Livelihood Model,derived from the SLF, places the household at the centre of livelihood security on one hand and natural resources and the infrastructure on the other hand (Frankenberger, et al., 2000).

In the current study, the SFL provides a holistic lens for assessing the sustainability of food security strategies in Rushinga as well as understanding why the households in this study context are vulnerable. The SFL guided the researcher in crafting the research questions inquiring on the asset bases such as land, water, knowledge and tools, as well as determining whether the current adaptation strategies are sustainable or not. It brought a lens for understanding the vulnerability of the communities studied in their context of climate shocks, rather than generalised perspectives on climate change on food security in the regional context. In general, the framework informed the framing of the study's methodological positioning and findings.



A Framework for Vulnerability Analysis in Sustainable Science

The Vulnerability Framework by Turner et al (2003) frames vulnerability as more than just exposure to hazards, but a factor determined by sensitivity and resilience. It operationalises the sensitivity of the coping systems in place to shield the affected population or zone from the hazard. Turner et al. (2003) define sensitivity as the system's response and susceptibility to the hazard, noting that systems are characterised by a human subsystem which is influenced social, economic, institutional and demographic conditions and the environments or biophysical subsystem which is influenced by natural capital. Resilience is operationalised

in terms of the short-term responses households, communities and governments will resort to in the face of a hazard. It also refers to its adaptive or long-term capacity to withstand hazards and thrive despite the threats. Resilient mechanisms, such as building flood defences have a transformative capacity which translates to improved outcomes on the asset bases households and communities have. In order to achieve higher levels of resilience, communities are required to inform their systems based on learnt past successes and failures (Turner et al., 2003).

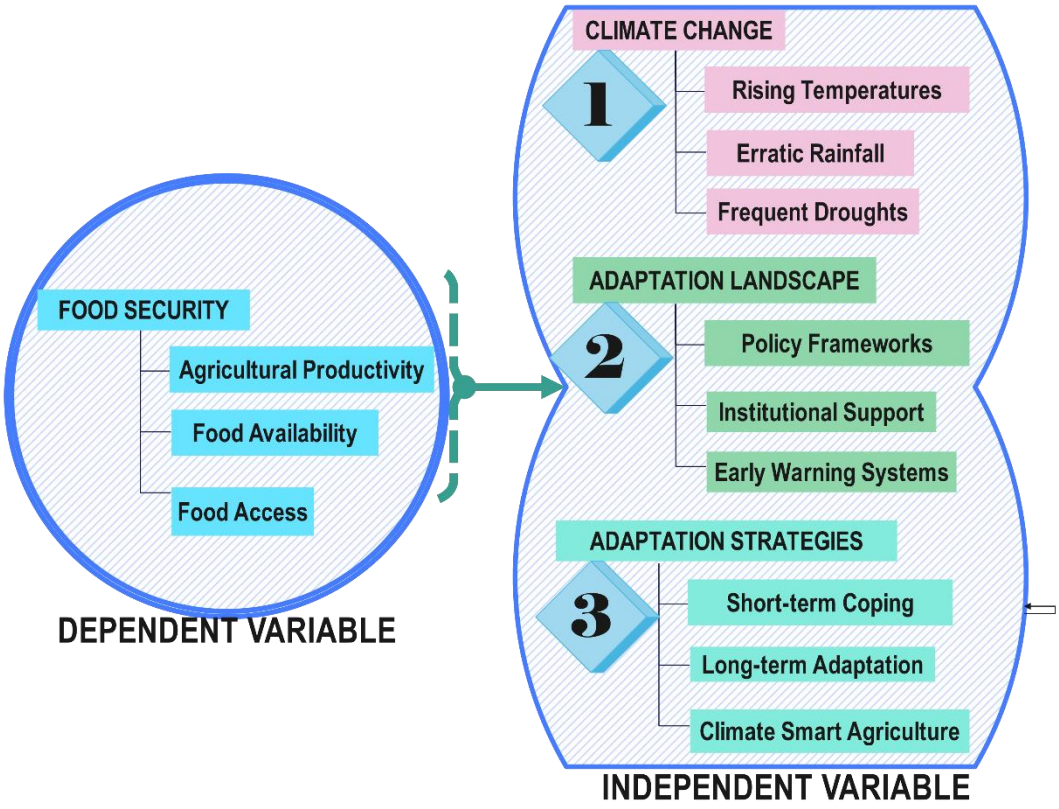
In this study, the framework directly frames and informs the research problem, revealing the mismatch between vulnerability deterrents and hazards affecting communities in Rushinga. In line with the objectives, the framework addresses exposures and offers the basis for analysing climate trends aligning with the first objective. It also opens a discussion on sensitivity aspects allowing the study to fully examine the effects of climate change to agriculture according to the second objective of the study. Ultimately, the framework equips the researcher with a better understanding of the adaptive capacity of the communities in Rushinga, providing a theoretical anchor through which coping strategies they adopted can be assessed and new ones can be recommended. Overall, the framework provides a structured, cause-and-effect language to discuss the impact of climate change, equipping the study's research methodologies and questionnaire construction.

2.8.2 Protection Motivation Theory (PMT)

The PMT was developed by Rogers (1975) in the field of health psychology, and was eventually promoted to be applicable to climate change adaptation. Rogers (1975; 1983) theorised that one's motivation to build protection and defences against perceived and real threat is based on two main cognitive processes that are seemingly uniform among individuals or group of individuals. First is threat appraisal, which involving a thorough understanding of the threat and the perceived severity (Purwanti, et al., 2023). At this stage they try to understand their levels and chances of vulnerability to the threat (Rogers, 1975). This threat appraisal is followed by a coping mechanism appraisal which it continuously informs through feedback loops (Bagagnan, et al., 2019). At this stage the would-be victims try also to determine the effectiveness of their adaptation strategy and understand whether they will be able to implement it or not (Rogers, 1975; Purwanti, et al., 2023).

Applying the theory on an underrepresented group of potato farmers in Indonesia in climate adaptation research, Purwanti et al (2023) found the perceived climate variability, namely changes in rain, temperature and a possible occurrence of drought, determining the adaptation intention. However, they found farmers with a stronger awareness of climate change as capable of long-term adaptation to climate change without resorting to maladaptation and fatalism (Purwanti, et al., 2023). In the current study the theory provides a detailed understanding into the reasons behind the coping strategies employed in Rushinga. In extension, it reveals shed a picture on the motivational factors as well as material factors affecting adaptation strategies, providing an angle of analysis and subject understanding other two theories lack in line with the fourth objective. It helps explain why some households may adopt certain strategies while others do not, based on their perception of the climate threat and their belief in their ability to cope.

2.9 Conceptual Framework



The study proposes that the dependent Variable, Food Security, is significantly affected by Independent Variables, namely, Climate Change, Adaptation Strategies and Adaptation

Landscape. In the current study, Food Security is a composite variable characterised by Agricultural Productivity, Food Availability and Food Access while Climate Change is manifested through rising temperatures, erratic rainfall, frequent droughts and their direct effects. Adaptation Strategies refers to all long-term and short term and long-term strategies towards addressing climate change and food insecurity, while Adaptation Landscape extends to the supportive structures such as aid and government contribution along with the policy framework that has been put in place.

2.9.1 Defence of the Conceptual Framework

This conceptual framework is robust and analytically valuable because it moves beyond simplistic cause-and-effect models to capture the multi-layered, mediated nature of climate change impacts on food security. By positioning Climate Change as the primary exogenous driver, operationalised through specific, measurable variables like temperature rise and erratic rainfall, it grounds the analysis in observable biophysical realities. Crucially, the framework does not assume a direct linear impact but instead introduces two critical mediating variables: Adaptation Strategies (agency-level responses) and Adaptation Landscape (structural and institutional contexts). This design acknowledges that climate shocks are filtered through human agency and institutional structures before manifesting as food security outcomes, reflecting the complex socio-ecological systems perspective advocated in sustainability science.

The framework's strength lies in its theoretical integration and policy relevance. It synthesises insights from the Sustainable Livelihoods Framework (asset-based adaptation), Turner's Vulnerability Framework (exposure-sensitivity-resilience), and Protection Motivation Theory (behavioural responses). By distinguishing between coping/adaptation strategies and the enabling landscape (policies, aid and governance), it allows for targeted analysis: Are food insecurity outcomes due to inadequate strategies, unsupportive structures, or overwhelming climate shocks? This clarity helps identify intervention points, whether at the household strategy level or the policy-institutional level, making the framework not just explanatory but also action-oriented, directly supporting the study's goal of informing resilience-building in Rushinga District.

2.10 Research Gaps

While the literature for this study documents global and regional trends in climate change, longitudinal studies discussing food security in the context of climate change are limited, specifically focused on Rushinga are limited. Zimbabwe's rural regions fall in various ecological zones with varying levels of rainfall and temperatures, which leads to varying severity levels of climate change effects (Madzingeni, et al., 2025; Frischen, et al., 2020). Understanding the manifestations of climate change, such as heatwaves, increased prevalence of droughts across all the ecological zones in Zimbabwe helps understanding the effects. Most studies focus on broad agricultural impacts, but few examine how climate change specifically affects mixed crop-livestock systems in semi-arid regions like Rushinga. While this gap exists, Mbatha et al (2021), argues that mixed husbandry of crops and livestock is the mainstay of subsistence and small-scale farming.

2.11 Conclusion

The Chapter provided a detailed review of literature along the thematic areas suggested by the study's research questions and objectives. The empirical literature review was conducted on recent studies showing the recent development in the context of climate change and food security, and the dominant scholarly arguments surrounding climate change. The section also provided point of departures and similarities across different regions and contexts affected by climate change and food security. This approach allowed the researcher to identify geographical and methodological gaps in the reviewed literature. The chapter also detailed on the theories that align with study, namely, the Sustainable Livelihood Framework, the Protection Motivation Theory and the Framework for Vulnerability Analysis. These theories informed the methodology of the study, particularly, assisting in crafting the study's instruments. The section concluded by setting the study's conceptual framework and the research gaps.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

The previous section provided a detailed review of relevant literature, conceptual framework, and theoretical frameworks guiding the study. The current section describes the methodology and techniques used to guide the researcher to investigate the impact of climate change on food security in Rushinga District. It also justifies the researcher's methodological choices based on the research questions and objectives, and the theoretical frameworks detailed in the previous section. The chapter covers the research design and paradigm adopted for the study, along with the instrumentation and sampling techniques that determined the study's participants. The section concludes with an outline of data collection and data analysis approaches utilised for the study, as well as ethical guidelines guiding the two processes and the preservation of the primary data over the course of its life-cycle.

3.2. Description of Study Area

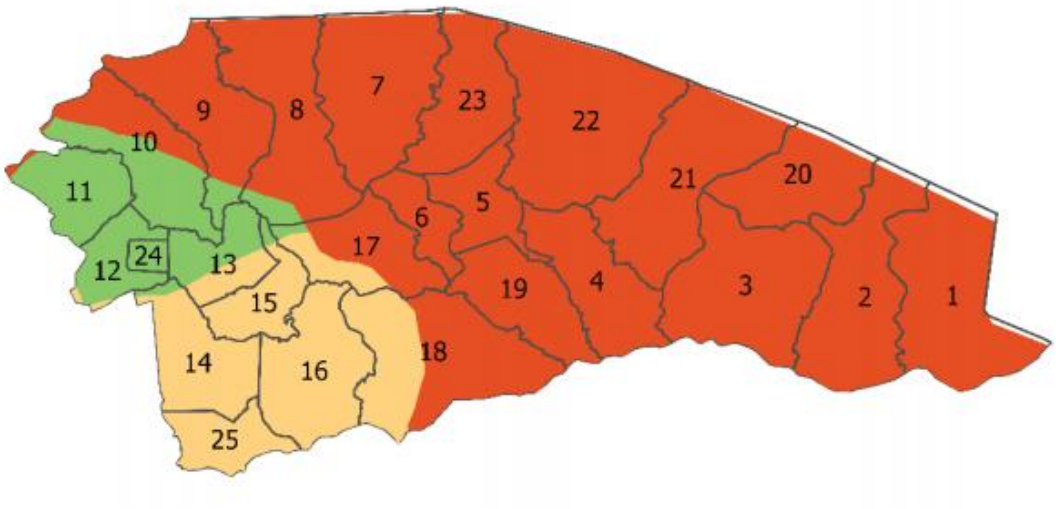


Figure 3. 1. Map of Rushinga District Showing Wards 1-25.
Source: Food and Nutrition Council (2022)

The study will be conducted in Rushinga district, which is situated in Mashonaland Central Province in Zimbabwe, and lies approximately between the coordinates 16°30'S latitude and 32°30'E longitude. Situated in Agro-Ecological Zone IV, which receives 450-600 mm the district is bordered by Mozambique in the north, and by the Mount Darwin and Mazowe districts in the south and west, respectively. As part of the low-lying Zambezi River catchment, the region's flood risk classification in comparison to many other districts across Zimbabwe is high (Food and Nutrition Council, 2022), while its drought risk classification is

also high (Meteorological Services Department of Zimbabwe, 2025). While these classifications fail to capture ward-to-ward and household-to-household susceptibility (Mekuyie, 2021), the researcher compensated for this by incorporating four wards with varying levels of productivity, poverty prevalence and susceptibility. Wards 1, 2,12, and 16were specifically selected as they fall in three distinct zones of agricultural intensity with slight variations in rainfall patterns and land arability as shown in Table 3.1.*Due to academic time limits, the study was restricted to several administrative wards in the district selected using land arability profiles, rainfall patterns and agriculture intensity indicated by the Food and Nutrition Council* (2022).The inclusion of 8 of the district's wards ensures that the data collected captures more themes for the qualitative section, while enhancing the sample size to the requirements recommended for the quantitative part of the study.

Table 3.1. Information on Wards Studied

Ward Number, Name& H/hold Population	**Size (m^2)**	**Number of Households**	**Arable Land**	**Grazing Area**	**Rainfall (mm)**	**Poverty Prevalence %**	**Farming Intensity**
1 (Mukosa)	14000	742	6000	8000	Less than 650mm	84.8	Extensive Farming
2 (Nyamuzeya)	11000	462	4000	7500		85.9	
15 (Chimhanda)	3875	1114	3075	800	450-650mm	73.4 (lowest in Rural areas)	Semi-intensive
12 (Magaranhewe)	5187	1096	4225	962	650-800mm	77.7	

Source: Modified from Food and Nutrition Council (2022)

While the district is entirely classified in the semi-arid Agro-Ecological Region IV, recent publications noted of some variations in rainfall patterns which sees wards 1 & 2 classified as IV, ward 15 in the middle ground of both Region III and IV and ward 12 as Region III (Food and Nutrition Council, 2022). In these wards decline of cash crop prices especially cotton have increased the poverty prevalence of the affected wards. The combined effects of climate change and population growth threaten to further reduce productivity of the land and increase the vulnerability of communities in the district (Food and Nutrition Council, 2022).

3.3. Research design

The study adopted a mixed methods approach, which incorporated the explanatory research design in a QUAN →qual approach, meaning the researcher collected quantitative data and

analysed it before adding a qualitative layer. This approach ensures that items in qualitative research instruments were developed from the insights obtained during the analysis of quantitative data (Hesse-Biber, 2022). According to Ivankoka et al(2006), the design exploits qualitative data to explain and interpret the seemingly silent findings from the quantitative layer, with the latter guiding the design and development of instruments used in collecting qualitative data.

Justified mixed methods with concurrent triangulation by noting that the quantitative layer provides statistical generalisation and a room to test relationships between variables and outcomes (Muzingili, et al., 2025). In addition, scholars (e.g., Saunders & Lewis, 2018; Morgan, 2007; Ivankova et al., 2006) argue that the qualitative component can provide a layer of participant experiences and perceptions that numbers alone cannot capture. This approach ensures that the study gets the benefits of both research approaches (Edmonds & Kennedy, 2017).

3.3.1. Research Paradigm

The study adopted pragmatism as its overarching philosophical paradigm to allow the integration of quantitative and qualitative approaches. In the paper *Paradigms Lost and Pragmatism Regained,* Morgan (2007) indicates that the pragmatic researchers seek to derive the methodology from the research problems and the particular findings sought, instead of dogmatically adhering to a particular paradigm. According to Albrecht et al., (2018), the complexity of the food-climate nexus requires the utilisation of multiple forms of evidence and methodologies. The scholars lamented that the 75% of studies on the water-food-nexus as of 2018 were biased towards the quantitative methodologies (Albrecht, et al., 2018).

3.4. Target Population

The study's target population was all drawn from households actively involved in farming and have been living in wards 1, 2, 12 and 15 in Rushinga district since 2016. These households are reliant on rain-fed crop production as their primary source of income. The condition of being resident to the four wards under study ensured that the study is informed by participants with knowledge of climate change's effects in their wards for the past decade. The study excluded recent arrivals in the selected wards, commercial farming operations, and

households engaged in non-farming activities or any activities with no direct linkages to farming. Overall, these inclusion criteria determined that the questionnaire is distributed to household leaders, both husband and wife, as well as widowed family heads.

3.4.1. Sampling Strategy for the Quantitative Component

The sampling frame for the quantitative component was based on household lists obtained from the agricultural extension officers, ward registers and village head records. Official census data based on the 2022 census report by ZIMSTAT (2024) were also utilised in framing the sample. In the publication *Household Sample Surveys in Developing and Transition Countries,* the United Nations (2005) justified using multiple sources, noting that they address challenges of incomplete records typical in developing countries. After framing the sample, the researcher utilised a multi-stage random stratified sampling as recommended by Lohr (2010). According to the initial process of subdividing the sample into clusters may be complicated and time-consuming, but once this phase is done, the sampling strategy is cost-effective and time-saving (Draeger, 2025). In this study, the first stage was centred on stratifying the four wards based on variations in rainfall patterns and climate change vulnerability. These captured variations in climate risk exposure while ensuring that the selected ward represented all variations in the selected wards represent a wide range of variations across the district.

Although factors such as accessibility were considered at the second stage, the researcher randomly selected 2 to 3 villages in accessible parts of the ward, making a total of 10 villages qualifying for the study. In the final stage, household lists obtained from the village head were randomly selected to determine the final sample of 120 participants. At this final stage, the sample size for the quantitative component was determined through Yamane's (1967) formula: $n = \frac{N}{(1=N(e)2)}$ where:

- N = estimated total households in the selected 10villages in the qualifying strata
- e = margin of error (0.05-0.07 acceptable for social science)
- Target sample: A total of 132households
- Buffer for non-response set to 10%
- Final target of 120 households

3.4.2. Sampling Procedures for the Qualitative Component

For the quantitative component, key informants were purposively sampled. This ensured that a single agriculture extension officer per ward was selected, a headman familiar and literate in climate change issues, a district coordinator and 2 Non-Governmental Organisational programme managers working on food security. In total, 8 key informants were selected for this study. In addition, the researcher utilised convenience sampling and voluntary response sampling in Focus Group Discussions (FDGs). For this cohort, up to five individuals who indicated their willingness to participate in FDGs were selected.

3.4.3. Sampling Limitations

While the sampling techniques utilised aligned with the research design and paradigm, a few limitations were identified. The researcher observed that excluding some villages due to concerns about their accessibility limited the utility of stratified random sampling in quantitative research. Most of the villages that were excluded were only inaccessible during the wet season, when most of the data collection was conducted. This compromised the probabilistic character of the sampling approach used.

3.5. Data Collection Procedures

The primary data for the study were extracted from household surveys, which built the quantitative component, while key informant interviews and focus group discussions provided qualitative data. Secondary data, including climate data from sources such as the Meteorological Department of Zimbabwe and agricultural production statistics, policy documents, and food security assessments from AGRITEX, were also consulted. According to Ajayi (2023), utilising both primary and secondary sources ensures that the researcher builds the narrative through the originality in primary data and cross-verifies with existing findings for consistency and emerging findings.

3.5.1. Research Instruments

The study's data were collected through three separate interview guides following the recommendation by Creswell (2009). The first guide was a quantitative survey distributed to households, mostly on paper, with only 20 being disseminated in the format of Google Forms online, with the help of an assistant who is well-acquainted with the terrain and the communities. To conform with the recommended ethics standards in the *Handbook for Postgraduate Studies* prepared by BUSE (2022), the assistant's roles were limited to

navigating the researched area, with any of the queries related to the questionnaire being handled by the researcher through the input of the assistant as a translator, where necessary. The quantitative data collection process took a total of four weeks, spanning from mid-January to mid-February 2026, with the first week being dedicated to attaining the necessary paperwork from district and ward authorities, such as district coordinators, councillors and village heads. The researcher scheduled another return to the Rushinga district in the first week of March 2026 to secure both Key Informant Interviews and Focus Group Discussions. Both participants in the last two qualitative cohorts were informed of the researcher's possible return to the field in February. This reduced the time required in securing informed consent and responses.

3.5.1.1. Quantitative Interview Guide

It was structured into seven sections, with the first two sections of the guide focused on household demographics, socio-economic characteristics and livelihood assets to capture the SFL framework. The third and fourth sections focused on the perception of households on climate change and their agricultural productivity. The last three sections focused on household food security status and their adaptation and strategies for mitigation. The sections also explored the institutional support available to communities affected and the policy frameworks. Creating an interview guide with such sections and clear questions was endorsed for enabling the researchers to craft a coherent questionnaire which yields usable data by Marshall (2005).

3.5.1.2. Qualitative Interview Guide

The key informant interview guide contained open-ended questions on climate change and food security trends in Rushinga district. Since it was developed after the data obtained in a quantitative household survey questionnaire described at 3.5.2.1, most of the questions were a follow-up to trends observed in the quantitative data as a means of interpreting the data or filling the gaps in the quantitative data. This guide contained open-ended questions with themes on observed climate trends in the district, food security threats and solutions, adaptation programmes, institutional coordination, existing policy frameworks and recommendations. According to Edmonds & Kennedy (2017), where quantitative is the emphasis as in this study, the sequential use of qualitative techniques ensures that the

qualitative component clarifies the results and ensures that the study benefits from the advantages of both qualitative and quantitative study.

3.5.1.3. Focus Group Discussion Guide

A Focus Group Discussion guide used incorporated 5 main sections covering historical climate events, seasonal calendar analysis, ranking climate risks and adaptation options available at the household and community level. The FGDG also functioned as a tool for mapping resources available to the community as well as assessing their vulnerability levels. According to Adekola & Olumati et al. (2023) discussion covered in FDGs are vital for discovering collective community experience and pinpointing the social capital and institutional and policy support available to the community, and are, hence, essential in community research and development.

3.5.2. Validity

According to Saunders and Lewis (2018), validity involves ensuring that the findings strongly depict the evidence they are based on. It is achieved through careful subject selection, which fully represents the studied population, rigorous testing of data collection instruments and processes, and addressing any ambiguity on the flow of causes and their effects (Saunders & Lewis, 2018). To ensure the validity of the research instruments, pilot testing of the interview guides was conducted with 10 households in a non-sample village as recommended by Creswell (2009). This allowed the researcher to assess the clarity and comprehensibility of the questions and their natural appropriateness. In addition, the researcher was able to determine the time resources required for the completion of data collection. Necessary refinements were made to the research instruments based on feedback gained from the pilot survey.

An extensive literature review enabled the researcher to ensure that the instrument's development has high context validity. Subject matter experts, including the supervisor and fellow researcher, were consulted. This ensured that the instruments have high face-validity. According to Turner (2024), for a pilot test to have evidence of face-validity, the researcher must ensure that the items in the instruments are clear and understandable, relevant and easy to administer and are not judgmental, intrusive or distressing to the target audience.

3.6. Data Analysis Procedure

3.6.1. Quantitative Data Analysis

The researchers utilised Microsoft Excel for data entry, due to its high compatibility with and exportability to other data analysis utilised in quantitative data analysis (Elliott, et al., 2006). In addition, descriptive statistics in the form of frequency distributions of categorical variables such as gender and adaptation variable and measures of central tendency such as mean age and yields were also utilised in data presentation and analysis. The data from the Excel document were assigned numerical codes such as 1 for strongly disagree and 5 for strongly agree, before exporting to SPSS version 27 for tests and further analysis, namely Analysis of Variance and Linear Regression. In addition, the researcher was guided by a regression model:

$$Y = \beta_0 + \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) + \beta_4(X_4) + \varepsilon$$

Where,

Y	=	Food Security (A composite variable including agricultural productivity, food availability and food access).
β_0	=	Intercept (constant term)
X_1	=	Adverse weather frequency
X_2	=	Household size
X_3	=	Adaptation index
X_4	=	Wealth quintile
ε	=	Error term

3.6.2. Qualitative Data Analysis

The data preparation process started with a verbatim transcription of audio recordings collected from the field, and translation to English where necessary. The researcher also integrated field notes with transcripts and conducted quality checks on the qualitative audio recording. These final transcripts were kept for further analysis, while audio recordings were discarded. In addition, the researcher utilised the NVivo v12 software to code the data into themes and codes following the guidelines set in Braun & Clarke's (2006) six-phase framework for thematic analysis approach. The framework indicates that the researcher should start by familiarising themselves with the data available by reading the transcripts multiple times and taking initial notes on observations they make in the process. At the second stage, initial codes are generated. In this study, the researcher utilised deductive coding informed by the theoretical framework provided in Chapter 2, as well as inductive

coding, to discover codes emerging from the data as recommended by Braun & Clarke (2006). This was followed by searching a thorough search for themes and the creation of thematic tables in Excel showing thematic groups. Lastly, the themes were named and reviewed according to Braun & Clarke's (2006) framework. The analysed data were presented verbatim.

3.6.3. Ensuring Rigour

Although limited to several accessible participants who are literate in academic findings and biased towards key participants, the researcher conducted member checking. According to Candela (2019), prolonged engagement with participants to cross-verify all initial findings enables the researcher to construct a narrative that accurately represents the participants. This also enhances the trustworthiness of the findings in qualitative research, where the researcher's own interpretations of the data can negatively affect the outcome. In addition, the researcher kept a record of field and data analysis decisions together with the original transcripts that will be kept in an encrypted file for five years before they are finally deleted as per the university's guidelines in BUSE (2022).

3.7. Ethical Considerations

3.7.1. Ethical Approval

The researcher submitted the research proposal for ethical approval to Bindura University of Science Education Research to ensure that an ethical clearance was obtained before any field work could be done, as recommended by Saunders & Lewis (2018). In the field, participants were given an information sheet in any language they were flexible with, containing the research objectives, procedures involved and the potential risks of participating in the study. An additional consent form or a thumbprint for non-literate participants, citing their right to withdraw at any time without consequences were distributed to the participants. The researcher also obtained separate informed consent for audio recordings in FGD and key informant interviews as recommended by Saunders & Lewis (2018, pp. 76-7)

3.7.2. Confidentiality and Anonymity

The collected data were anonymised with name tags such as P0001 or P0110 for the primary participant and KII03 for a key informant. According to Hoft (2021),the useof participant codes ensures that the researcher cannot identify the participant with their respective data

transcripts. To add a layer of confidentiality, the researcher kept transcript files in a password-protected digital file. The researcher also took measures to ensure that any access to these files could only be accessed by the researcher and the supervisor with permission of the former until after the researcher was published. Those to be guaranteed access after the publication of the study will be thoroughly verified, and their institutional affiliations will be known before they gain limited access to the files during the course of five years, during which the researcher will keep the files. This strategy was endorsed by Kercher (2023) as part of the research data lifecycle.

3.8. Summary

The section provided a detailed outline of the methodology of the research study conducted in Rushinga district. It highlighted that a mixed methods approach with an explanatory sequential design was adopted in a QUAN → qual approach was adopted, meaning the study utilised a qualitative layer to support and interpret the findings in the quantitative component. The section also indicated that a multi-stage stratified sampling was adopted for the quantitative component with qualitative components having a purposively selected sample. The section concludes by showing the data collection tools utilised for the study, along with ethical measure taken and the data analysis approach adopted in the Chapter 4.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 Introduction

This chapter analyses and presents data collected in pursuit of the five research objectives guiding this study. The data were collected using questionnaires to the smallholder farming households of Wards 1, 2, 12 and 15 in Rushinga District. In addition, afore-stated method was complemented by key informant interviews and focus group discussions. The data are presented with the help of a quantitative method that provides the data in the form of descriptive statistics created in SPSS version 27 and then presents qualitative themes created with the help of the NVivo v12 based on the data. The chapter discusses response rate, demographic features of respondents and objective-by-objective representation of data. The triangulation analysis is combined with both the data strands preceding the summary of the chapter. Therefore, the response rate of the interviewees is shown in Table 4.1

4.1 Response Rate

Table 4.1: Response Rate

Data Collection Instrument	Distributed/Targeted	Returned/Completed	Non-Responses	Response Rate (%)
Household Questionnaires	132	111	21	84.1%
Key Informant Interviews	8	7	1	87.5%
Focus Group Discussions	5 groups	4 groups	1 group	80.0%
Overall				**84.8%**

Source: Primary Data (2026)

Among the 132 questionnaires sent to households with smallholder farmers in the four study wards, 111 of them were returned, representing a household questionnaire response rate of 84.1 percent. The reason behind non-responses was related primarily to the unavailability of the house heads at the time of data collection because they either had agricultural work or were temporarily migrated to work at piece jobs. 7 of the eight targeted key informants responded, which provided a key informant response rate of 87.5 percent. The five cohorts of focus group discussions were successfully completed, which is 80.0 percent FGD completion

rate. The 84.8 percent response rate on all the instruments can be deemed sufficient to conduct a community-based mixed methods study and aligns with the acceptable levels provided by Saunders and Lewis (2018).

4.2 Demographic Characteristics of Respondents

The demographic profile of the 111 household questionnaire respondents is presented across four attributes: gender distribution, ward of residence, age group and highest level of education attained. Each attribute is displayed in a separate figure to enable visual comparison and interpretation. The demographic profile informs the contextual analysis of climate change and food security findings in subsequent sections. Therefore, the gender distribution of respondents is displayed in Figure 4.1.

4.2.1 Gender Distribution

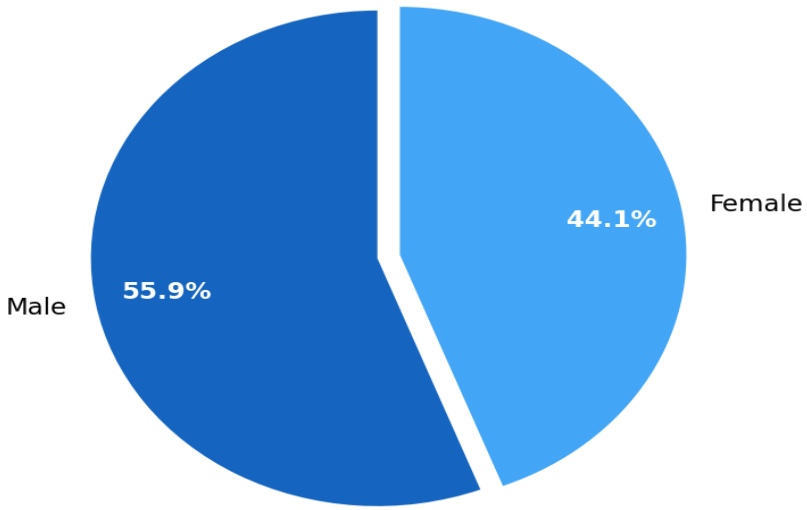


Figure 4.1: Gender Distribution of Respondents (n=111)

Source: Primary Data (2026)

Gender distribution of the household respondents indicates that male household heads were 62 household respondents (55.9 percent) as compared to the female household respondents 49 household respondents (44.1 percent). The almost equal proportion between the two sexes represents the conscious attempts of the researcher to sample the female-headed households as the researcher is aware that in the rural Zimbabwean context, women are disproportionately required to produce food and feed the family. On the contrary, Chidhakwa *et al*. (2020) verify that women in the agrarian sector of Zimbabwe are supposed to provide

the most significant portion of labour and are limited in terms of control over land, livestock and productive resources, so their attitudes towards the food insecurity caused by climate change are of particular interest. However, the 44.1 percent representation of female respondents allows analysing food security outcomes in the study wards meaningfully in terms of gender disaggregates.

4.2.2 Ward of Residence

The results of the distribution of respondents in the four study wards are illustrated in figure 4.2. Ward 15 (Chimhanda) had the highest number of respondents at 33 (29.7 percent), then Ward 1 (Mukosa) with 28 respondents (25.2 percent), Ward 2 (Nyamuzeya) with 26 respondents (23.4 percent) and Ward 12 (Magaranhewe) with 24 respondents (21. The excessively higher representation in Ward 15 is due to its greater household population and its location at the border of the Agro-ecological Regions III and IV, which is why it is one of the most suitable areas to examine the intersection of climate variability and food security. As the Food and Nutrition Council (2022) points out, all these four wards are different degrees of rainfall, land arability and poverty levels, which serves as a solid cross-section of the conditions to analyze the impact of climate change on the district.

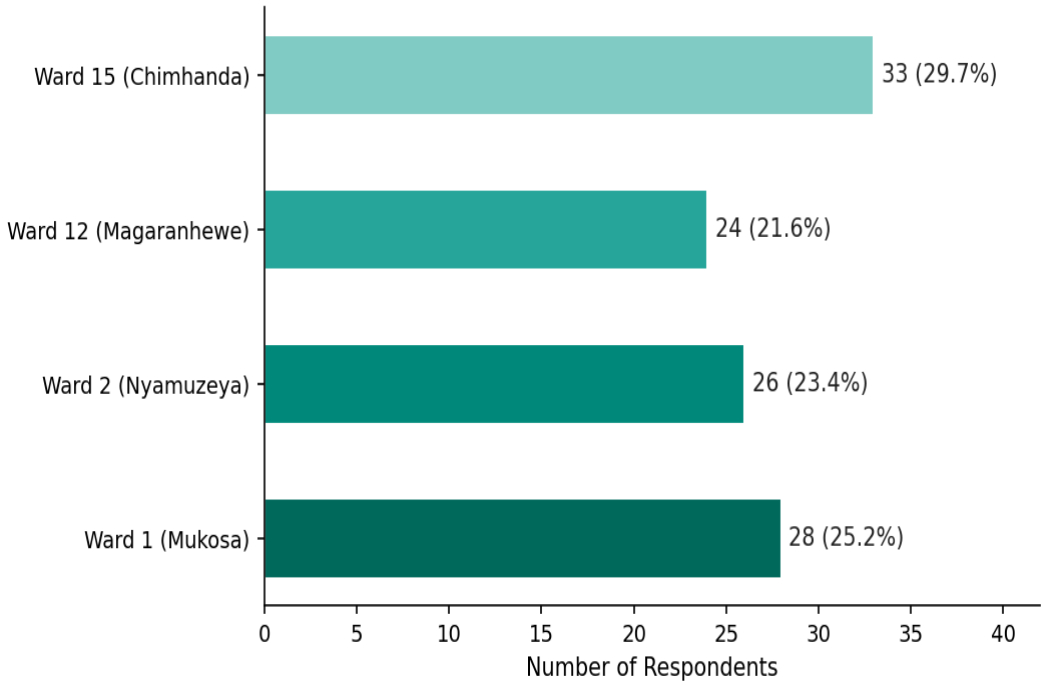


Figure 4.2: Distribution of Respondents by Ward (n=111)

Source: Primary Data (2026)

4.2.3 Age Group Distribution

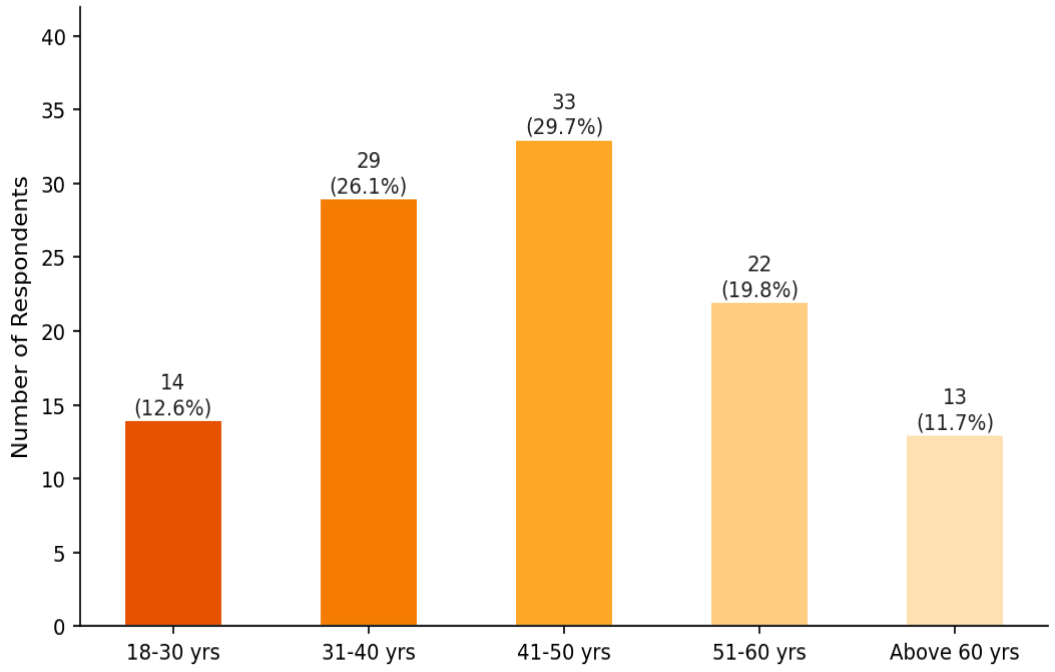


Figure 4.3: Age Group Distribution of Respondents (n=111)

Source: Primary Data (2026)

The age distribution of people who responded shows that the biggest group was 41 to 50 years and had 33 respondents (29.7 percent) then there was the 31 to 40 years with 29 respondents (26.1 percent). The sample size included 22 (19.8 percent) respondents between the ages of 51-60 years and 14 (12.6 percent) respondents between the ages of 18-30 years and 13 (11.7 percent) respondents above 60 years (Figure 4.3). The fact that majority of the heads of households of middle age are consistent with trends in the rural farming sector in Zimbabwe where skilled farmers still form the core decision-makers in regards to the farming and food management practices. Ndlovu et al. (2020) observe that this cohort is likely to have the best experience of climatic changes hence they are good informants of past climate trends and its impacts on agriculture.

4.2.4 Highest Level of Education Attained

The most frequent level of education was secondary level education with 52 respondents (46.8 percent) and then the primary level education with 34 respondents (30.6 percent). Fourteen (12.6 per cent) respondents had a tertiary qualification and 11 respondents (9.9 per cent) did not have any formal education (Figure 4.4). The primary and secondary education level concentration of the respondents is generally in line with the education levels of rural communities in Mashonaland Central and directly relates to the understanding and adoption

of formal climate adaptation advice. Theron (2023) emphasizes that reduced literacy and educational levels are linked to increased vulnerability to climate change, since it limits access to climate information, extension services and institutional support systems.

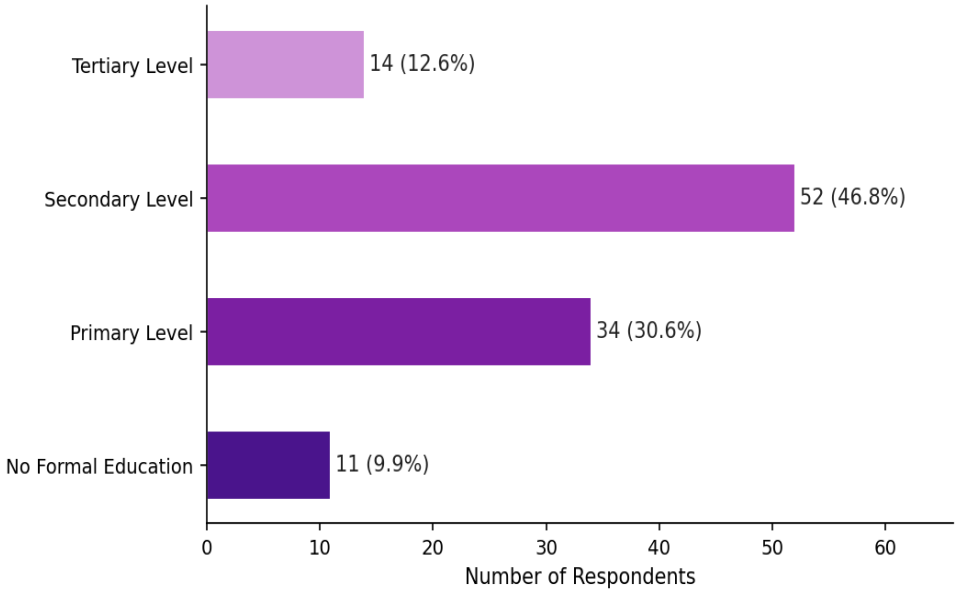


Figure 4.4: Highest Level of Education Attained by Respondents (n=111)

Source: Primary Data (2026)

4.3 Data Presentation and Analysis

This section discusses quantitative results of the household survey and then qualitative results of key informant interviews and focus groups discussions, arranged as per the five research objectives. Descriptive statistics that have been produced in SPSS version 27, such as frequency distributions, means and standard deviations are used to present quantitative results. Inferential statistics are given where appropriate in the form of Analysis of Variance (ANOVA) and linear regression. The Likert scale questions involve a five-point scale (1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Strongly Agree (A). The inferential analysis model to be used is the regression model:

$$Y = \beta_0 + \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) + \beta_4(X_4) + \varepsilon$$

Where:

Y = Food Security (a composite variable including agricultural productivity, food availability and food access)

β_0 = Intercept (constant term)

X_1 = Adverse weather frequency

X_2 = Household size

X_3 = Adaptation index

X_4 = Wealth quintile

ε = Error term

4.3.1 Objective One: Climate Change Trends in Rushinga District

The first research objective sought to critically analyse the elements of climate change, including temperature changes and rainfall patterns, in Rushinga District over the past 15 years.

4.3.1.1 Quantitative Findings: Climate Change Trends

Table 4.2 presents descriptive statistics for household perceptions of observed climate change trends in Rushinga District.

Table 4.2: Household Perceptions of Climate Change Trends (n=111)

Statement	SD	D	N	A	SA	Mean	SD
1. Temperatures have noticeably increased in Rushinga over the past 15 years.	2.7%	5.4%	7.2%	36.9%	47.7%	4.22	0.92
2. The onset of the rainy season has become increasingly delayed in recent years.	1.8%	6.3%	9.0%	38.7%	44.1%	4.17	0.91
3. Rainfall events have become more erratic and unpredictable compared to 15 years ago.	3.6%	4.5%	8.1%	37.8%	45.9%	4.18	0.95
4. Dry spells within the rainy season have become longer and more frequent.	2.7%	7.2%	10.8%	39.6%	39.6%	4.06	0.97
5. Extreme weather events such as floods and droughts have increased in frequency.	1.8%	5.4%	9.0%	37.8%	45.9%	4.21	0.91

Source: Primary Data (2026); Key: SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

Table 4.2 descriptive statistics shows that there is a high level of agreement among the households when it comes to deteriorating climate patterns in Rushinga District. The highest mean score of 4.22 (SD = 0.92) was given by the statement on noticeable temperature increase, with 84.6 percent of the respondents indicating an agreement or strongly agreeing. The perceived upsurge in extreme weather events was the second highest with a mean of 4.21 (SD = 0.91) and 83.7 percent agreed. Little rainfall registered an average of 4.18 (SD = 0.95) and late onset of the rainy season an average of 4.17 (SD = 0.91). The mean of the perceived increases in mid-season dry spells was lowest (4.06, SD = 0.97) but 79.2 percent still agreed or strongly agreed. These results match the information of the Meteorological Services Department of Zimbabwe (2025), according to which Rushinga is considered a high-risk area in terms of drought and reports a long-term warming tendency in the area. The IPCC (2023) also confirms that Southern African interior is warming at a rate that is twice as high as that of the world.

Further frequency information of Section 3 of the survey on the household indicated that 78.4 percent of people indicated a reduction in yearly rainfall in the last ten years with 66.7 percent reporting that effective rainy season had been reduced to less than four months to two or three months. These frequency distributions highlight the magnitude and multidimensionality of climate change that is realized in the district.

In SPSS version 27, a one-way Analysis of Variance was conducted to determine whether or not there was significant difference in perceptions of climate change trends among the four study wards. The results are shown in Table 4.3.

Table 4.3: ANOVA Results for Climate Change Trend Perceptions Across Wards (n=111)

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value
Between Wards (Groups)	14.82	3	4.94	3.61	0.016
Within Wards (Error)	146.21	107	1.37		
Total	161.03	110			

Source: SPSS Version 27 Output, Primary Data (2026)

The result of the ANOVA in Table 4.3 shows that the difference in the climate change trend perceptions between the four study wards is statistically significant ($F(3,107) = 3.61$, $p = 0.016$, $p < 0.05$). This affirms that there was ward-level difference in climate conditions experienced that generated significantly different household perceptions. Ward 1 (Mukosa) with a higher drought risk classification and low annual rainfall (less than 650mm) scored the worst trend perceptions whereas Ward 12 (Magaranhewe) with the lowest drought risk classification scored relatively lower. These variations are in line with Mekuyie (2021) who observed that within-district climatic gradients generate radically different vulnerability patterns across neighbouring communities.

4.3.1.2 Qualitative Findings: Climate Change Trends

Qualitative data are reported through thematic analysis findings, with representative verbatim responses from key informants and focus group participants presented under each theme. Thematic analysis of key informant interviews and focus group discussions aligned with Objective One generated four themes.

Theme 1: Perceptible and Sustained Temperature Increases

Key informants and FGD participants consistently described noticeably hotter conditions across all seasons, with livestock and crop production both visibly affected by the prolonged heat. The following responses illustrate this shared experience.

One of the key informants argued:

> *"In my memory as an agricultural extension officer in this district, the past eight years have been consistently hotter than anything recorded in my first five years of service. Livestock are visibly distressed in October and November in ways they were not ten years ago, and planting windows have shifted in ways that none of the older farmers anticipated."* ***(KII02, Agricultural Extension Officer, Ward 2)***

Another participant opined:

> *"We now experience what we call double heat. Not only is the summer hotter, but the winter is also warmer than before. The cold months that used to help control pests and allow soil to recover are barely cold anymore, and we are seeing pest species that were never present here ten years ago."*
>
> ***(KII04, Village Head, Ward 12)***

A further respondent remarked:

> *"The heat waves come earlier and stay longer. There is a season between October and December where nothing we plant survives unless we irrigate. In*

the old days we would plant in October and the rains would support the seedlings. Now we wait, sometimes until January, and even then the rains are not reliable."

(FGD1-P3, Female Farmer, Ward 1)

Theme 2: Shrinking and Delayed Rainy Season

All participants in the four wards reported a general delay in the beginning of rainy season and reducing duration of the rainy season that shrunk the growing window and undermined crop performance. The following responses reflect the aspect of this disruption.

One of the key informants noted:

*"The rains used to start reliably in November. Now we are lucky if we see meaningful rain before Christmas or even January. By March the rains are already tailing off, giving crops barely two months, which is not enough for most varieties of maize. Families plan based on these timelines and the plans are constantly failing."****(KII01, District Agricultural Coordinator, Ward 1)***

Another participant stated:

*"The dry spells within the rainy season are now as damaging as delayed rains. You can start the season with good rains, plant your maize, and then face three weeks of intense heat in January before the rains resume. By that time the crop has already suffered irreversible moisture stress and the yield is already compromised."****(KII06, NGO Programme Manager, Ward 15)***

One FGD participant added:

"There is no longer a reliable pattern. What used to be a four-month rain season is now two or three months at best, and the rains within those months are concentrated in heavy downpours followed by long dry gaps that leave the soil cracked and the crops wilting."

(FGD4-P1, Male Farmer, Ward 12)

Theme 3: Increased Frequency of Extreme Weather Events

The respondents mentioned experiencing a significant rise in extreme weather conditions, such as flash floods, heavy hailstorms, and long droughts, and a combination of floods and drought during one season was noted as especially challenging to cope with.

One key informant argued:

"We had a situation in 2022 where our crops were waterlogged in January by heavy floods and then we experienced severe drought conditions by March of the same year. It is this combination of extremes within one season that makes planning impossible and strips farmers of any chance to recover."

(KII03, Agricultural Extension Officer, Ward 15)

Another participant opined:

> *"Hailstorms have become much more frequent. I have counted three severe hailstorms in the past four years that completely destroyed standing crops just weeks before harvest. This was entirely unheard of when I was growing up, and the frequency is clearly accelerating."*
>
> ***(FGD1-P1, Male Farmer, Ward 1)***

A village head further observed:

> *"The 2018 to 2019 El Nino-induced drought was the worst in living memory for this district. Almost nothing was harvested in most of the villages and entire communities relied on food aid for close to eighteen months before any meaningful recovery was possible."*
>
> ***(KII05, Village Head, Ward 1)***

Theme 4: Erosion of Indigenous Seasonal Knowledge

The participants reported that due to the uncertainty of climate change, conventional seasonal indicators were no longer reliable and disrupted community-based knowledge systems in which generations of agricultural decisions had previously been based.

One FGD participant remarked:

> *"The elders in our community used to read signs from the environment, such as the flowering of certain trees and the behaviour of certain birds, to determine when to plant. These signs no longer work because the seasons themselves have shifted so unpredictably that even the most respected community knowledge holders are confused."*
>
> ***(FGD2-P5, Female Farmer, Ward 15)***

Another respondent contended:

> *"Indigenous farming knowledge was built on predictable patterns. Climate change has made those patterns obsolete. We are now forced to rely on radio weather forecasts which are also often wrong for our specific location, leaving us making decisions based on neither tradition nor science."*
>
> ***(KII07, NGO Programme Manager, Ward 2)***

A third participant stated:

> *"Our community knowledge was passed down over centuries of farming the same land and observing the same environment. Within one generation that knowledge has become largely irrelevant because the environment no longer behaves as it used to, and there is nothing to replace it at the community level."*
>
> ***(FGD3-P2, Male Farmer, Ward 12)***

4.3.1.3 Discussion

The Objective One reveals positive household agreement on temperature changes, decreased rainy seasons, unpredictable rain and more extreme weather conditions in Rushinga District. The mean scores of all the five quantitative items (mean scores greater than 4.0) and the statistically significant ANOVA outcome ($F = 3.61$, $p = 0.016$) are validating the severity and the variation of climate change impacts at the ward level. These findings are consistent with the Meteorological Services Department of Zimbabwe (2025) report of the high level of drought risk in Rushinga and with Scholes and Engelbrecht (2021), who demonstrate that the Southern African interior warms at a rate of twice the global average. The IPCC (2023) also attests that unpredictable rain patterns and temperature changes are some of the most noticeable regional climate indicators. The qualitative uncovered result of the loss of indigenous seasonal knowledge aligns with Ndlovu et al. (2020), as their study in semi-arid Zimbabwe found that climate variability had made traditional environmental indicators unreliable. Ma et al. (2022) give the biophysical explanation of the paradox of flooding coupled with prolonged dry spells which were reported in all four wards.

4.3.2 Objective Two: Effects on Agricultural Productivity and Food Availability

The second research objective sought to examine the effects of climate change on overall agricultural productivity and food availability in Rushinga District.

4.3.2.1 Quantitative Findings: Agricultural Productivity and Food Availability

Table 4.4 presents descriptive statistics for household perceptions of the effects of climate change on agricultural productivity and food availability.

Table 4.4: Effects of Climate Change on Agricultural Productivity (n=111)

Statement	SD	D	N	A	SA	Mean	SD
1. Crop yields have declined significantly over the past decade due to changing climate conditions.	2.7%	5.4%	8.1%	35.1%	48.6%	4.21	0.93
2. Livestock productivity, including milk and beef yield, has declined due to heat stress and feed scarcity.	4.5%	8.1%	13.5%	37.8%	36.0%	3.93	1.07
3. Crop failures linked to drought and erratic rainfall have increased in frequency.	1.8%	4.5%	9.0%	40.5%	44.1%	4.21	0.89

4. Food availability in our household has decreased due to poor harvests caused by climate change.	2.7%	7.2%	10.8%	36.0%	43.2%	4.10	0.99
5. We are experiencing earlier-than-expected crop failures compared to 10 years ago.	3.6%	9.0%	11.7%	38.7%	36.9%	3.97	1.04

Source: Primary Data (2026)

The quantitative results uphold the importance of decline in agricultural productivity in the Rushinga District which is caused by climatic factors. Crop yield reduction and higher frequency of crop failure were found to give an identical mean of 4.21 with 83.7 and 84.6 percent agreeableness respectively. The decrease in household food supply recorded a mean of 4.10 (SD = 0.99) and early crop failures 3.97 (SD = 1.04) and livestock productivity decline 3.93 (SD = 1.07). Frequency data showed that 71.2 percent of the sampled said that their average yearly maize yields were less than 300 kg/ha, and 63.1 percent said that their total crop yields had failed at least two out of the last five seasons.

One-way ANOVA was used to determine whether there were significant differences in agricultural productivity declines among the four wards of study (Table 4.5).

Table 4.5: ANOVA Results for Agricultural Productivity Perceptions Across Wards (n=111)

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value
Between Wards (Groups)	18.43	3	6.14	4.87	0.003
Within Wards (Error)	134.81	107	1.26		
Total	153.24	110			

Source: SPSS Version 27 Output, Primary Data (2026)

The Table 4.5 of the ANOVA results shows that there was statistically significant difference in the agricultural productivity perceptions among wards ($F(3,107) = 4.87$, $p = 0.003$, $p < 0.05$). The worst productivity decreases were reported in Ward 1 (Mukosa) which is proportional to its greater risk of drought classification whereas the best productivity was

reported in Ward 12 (Magaranhewe). This difference at ward level highlights the importance of location-specific agricultural support policies as Mekuyie (2021) observes.

To ascertain the predictors of the household food security composite score (Y), linear regression was done based on the regression model and the results are shown in (Table 4.6).

Table 4.6: Linear Regression Results: Predictors of Household Food Security (n=111)

Variable	B (Unstandardised)	Std. Error	Beta (β)	t	p-value
(Constant / β_0)	3.821	0.312		12.24	< 0.001
Adverse Weather Frequency (X_1)	-0.412	0.087	-0.389	-4.74	< 0.001
Household Size (X_2)	-0.187	0.092	-0.161	-2.03	0.045
Adaptation Index (X_3)	0.328	0.081	0.312	4.05	< 0.001
Wealth Quintile (X_4)	0.219	0.076	0.211	2.88	0.005

Model Summary: $R = 0.641$; $R^2 = 0.411$; Adjusted $R^2 = 0.389$; $F(4,106) = 18.43$; $p < 0.001$

Source: SPSS Version 27 Output, Primary Data (2026)

The overall regression model is statistically significant ($F(4,106) = 18.43$, $p < 0.001$) and has an explanatory power of 41.1 percent of the variation in the food security composite score (R^2= 0.411, Adjusted $R^2 = 0.389$). The strongest negative predictor (Beta = -0.389, $p < 0.001$) is adverse weather frequency (X_1), which confirms that households that have higher adverse weather frequency have much less food security. The best positive predictor is the adaptation index (X_3), which has a Beta = 0.312 and a p-value = 0.001 (meaning the higher the adaptive capacity of households, the better food security outcomes they are likely to have). Wealth quintile (X_4) also positively predicts food security (Beta = 0.211, p = 0.005) whereas the household size (X_2) has a significant negative influence (Beta = -0.161, p = 0.045).

4.3.2.2 Qualitative Findings: Agricultural Productivity and Food Availability

Thematic analysis of key informant and FGD data for Objective Two produced four themes.

Theme 1: Severe and Recurring Crop Failures

Participants described increasingly severe and recurrent crop failure seasons that left households with minimal or no harvest, with maize identified as the most vulnerable staple crop.

One of the key informants argued:

> *"In 2018 and again in 2022, virtually nothing was harvested in most of our villages. Families that had invested in seeds and labour inputs returned with empty hands. The psychological toll of these repeated failures is immense and is driving many families to abandon farming altogether, which will worsen food insecurity in the long term."*
>
> ***(KII01, District Agricultural Coordinator, Ward 1)***

An FGD participant remarked:

> *"I planted three acres of maize in 2022. By March, when the rains stopped completely, my crop was knee-high and already wilting. I harvested less than two 50-kilogram bags from three acres, which is not enough to feed my family for even two months after all the labour invested."****(FGD1-P2, Male Farmer, Ward 1)***

Another key informant contended:

> *"The seed companies keep promising drought-resistant varieties but even these fail when dry spells extend to six or eight weeks within the rainy season. The varieties are drought-tolerant, not drought-proof, and the droughts we are experiencing now far exceed any tolerance threshold built into currently available seed."****(KII03, Agricultural Extension Officer, Ward 15)***

Theme 2: Declining Livestock Productivity

The respondents noted that the heat stress resulted in a significant decrease in the number and productivity of livestock, a shrinking grazing area and a drying water supply, and drought power and household earnings were weakened by the loss of cattle.

One participant stated:

> *"My cattle herd was fourteen animals in 2015. It is now five. I lost several to diseases that appear to come with prolonged drought conditions and sold others to buy food for the family. Without cattle, ploughing becomes impossible and we fall into further food insecurity in every subsequent season."*
>
> ***(FGD2-P1, Male Farmer, Ward 15)***

A key informant further observed:

> *"Heat stress in cattle is visible to anyone in this community. Animals spend hours standing in the shade and refuse to graze during the hottest parts of the day. This directly reduces their weight and dairy production, and milk yields from our communal cows have dropped noticeably over the past five years."*
>
> ***(KII02, Agricultural Extension Officer, Ward 2)***

Another respondent opined:

> *"The grazing lands that used to sustain our livestock throughout the dry season are now almost completely bare by July. Animals that survived on grazing alone now need supplementary feed, which most households simply cannot afford, accelerating both livestock mortality and household impoverishment."*
>
> ***(KII04, Village Head, Ward 12)***

Theme 3: Reduced Dietary Diversity and Food Variety

The two factors of crop collapse and livestock loss had decreased the diversity and variety of food at household level, the traditional food of importance being forgotten and the diet becoming dangerously monotonous.

One FGD participant argued:

> *"We used to grow groundnuts, jugo beans, finger millet, sorghum, sweet potatoes and maize. Now most families only grow maize because other crops have been abandoned due to poor performance or lack of seed. Our diet has become dangerously monotonous and nutritionally deficient as a consequence."*
>
> ***(FGD3-P1, Female Farmer, Ward 2)***
>
> A key informant noted:
>
> *"Finger millet was our most resilient crop. It survived droughts that killed maize entirely. But because it requires hand processing and yields small volumes, younger farmers have abandoned it in favour of maize, and now the climate is directly punishing that generational choice."*
>
> ***(KII06, NGO Programme Manager, Ward 15)***

Another participant remarked:

> *"The variety of food on our tables has reduced dramatically. We eat more sadza and fewer relishes because vegetables, legumes and small grains have all declined with the rains. Children are not getting balanced nutrition and we are seeing more stunting and related health problems in our community."*
>
> ***(FGD4-P2, Female Farmer, Ward 12)***

Theme 4: Increased Competition for Dwindling Water Resources

Drying out of seasonal rivers, boreholes and irrigation sources were found to be a second-order impact of climate change on agricultural productivity which resulted in a community-level competition over access to water.

One key informant argued:

> *"The seasonal rivers that used to run from November to May now dry up by February. Our irrigation scheme cannot operate after February, which means the winter crop is impossible for most farmers. This has eliminated one of our most important food security buffers at exactly the time when the hunger gap is approaching."*
>
> ***(KII01, District Agricultural Coordinator, Ward 1)***

An FGD participant stated:

> *"Boreholes that used to produce water year-round are now running dry by August. When there is no water for livestock and household use, there is certainly not enough for any form of supplementary irrigation. We are back to being entirely and dangerously dependent on the rain."*
>
> ***(FGD2-P3, Male Farmer, Ward 15)***

Another respondent contended:

> *"Community conflicts over water at the few remaining functional boreholes have increased significantly over recent years. This social tension is an indirect but very real consequence of climate change that affects community cohesion and the collective ability to coordinate any meaningful adaptive responses."*
>
> ***(KII07, NGO Programme Manager, Ward 2)***

4.3.2.3 Discussion

The findings of Objective Two support the argument that climate change has already resulted in drastic and quantifiable agricultural productivity and food availability reductions in Rushinga District. The regression equation shows that the frequency of adverse weather is the leading adverse predictor of food security (Beta = -0.389, p = 0.001), though the outcome of ANOVA (F = 4.87, p = 0.003) attests to significant ward-level differences in productivity results. Other studies have reported similar productivity losses and loss of livestock resilience in rural areas in Zimbabwe due to heat stress and degradation of pastures (Mugambiwa and Rapholo, 2024). Mhembwe et al. (2019) put the losses of livestock in context as cattle offer draught power, protein, and liquid savings, thus their decrease leads to compounding impacts of food insecurity on a seasonal basis. The qualitative result on the crop diversity erosion fits in with Onwnonga et al. (2018), who found that there is a reduction in small grain farming and farmers switch to maize farming. Wu et al. (2024) posit that high heat in maize filling diminishes the yields, which justifies harvest losses.

4.3.3 Objective Three: Household Food Security Status

The third research objective sought to assess the level of household food security in Rushinga District in the face of climate change.

4.3.3.1 Quantitative Findings: Household Food Security Status

Table 4.7 presents descriptive statistics assessing household food security across the four FAO dimensions of availability, access, utilisation and stability.

Table 4.7: Household Food Security Status Indicators (n=111)

Statement	SD	D	N	A	SA	Mean	SD
1. Our household runs out of food before the next harvest season (food availability).	2.7%	8.1%	9.0%	37.8%	42.3%	4.09	0.99
2. We cannot afford to purchase adequate food when own production falls short (food access).	2.7%	9.0%	12.6%	38.7%	36.9%	3.98	1.03
3. The nutritional quality of our household meals has declined due to food shortages (food utilisation).	3.6%	8.1%	13.5%	40.5%	34.2%	3.94	1.03
4. Our household faces food insecurity for at least five months of the year (food stability).	4.5%	9.0%	11.7%	36.9%	37.8%	3.95	1.08
5. Our ability to access food has worsened over the past five years due to climate change impacts.	2.7%	5.4%	9.9%	36.0%	45.9%	4.17	0.96

Source: Primary Data (2026)

The most frequently agreed-upon indicator was the worsening food access indicator with a mean of 4.17 (SD = 0.96). The food availability indicator was 4.09 (SD = 0.99) with 80.1 percent of the respondents agreeing or strongly agreeing. The registered means of food stability, access and utilisation are 3.95, 3.98 and 3.94 respectively, which is a sign of widespread household food insecurity on four FAO dimensions. Table 4.6 regression outcomes confirm adverse weather frequency is the best predictor of these food security outcomes and overall, the model explains 41.1 percent of the variance in the composite score.

One-way ANOVA was conducted to find out whether there was a significant difference in household food security status in the four study wards.

Table 4.8: ANOVA Results for Household Food Security Status Across Wards (n=111)

Source of Variation	Sum of	df	Mean Square	F-value	p-value

	Squares (SS)		(MS)		
Between Wards (Groups)	21.14	3	7.05	5.62	0.001
Within Wards (Error)	134.31	107	1.26		
Total	155.45	110			

Source: SPSS Version 27 Output, Primary Data (2026)

According to the ANOVA results, the food security level among the four study wards is statistically significant ($F(3,107) = 5.62$, $p = 0.001$, $p < 0.05$). The worst food insecurity scores were observed at Ward 1 (Mukosa) and Ward 2 (Nyamuzeya) as they are classified into the high-risk group of droughts and have lower average rainfall levels. Ward 15 (Chimhanda) which cuts across Regions III and IV has slightly improved food security results but well within the food-insecure category. These differences at the ward level attest to the fact that geographic and agro-ecological variables interact with climate change to create the differentiated food security results within the same district.

4.3.3.2 Qualitative Findings: Household Food Security Status

Thematic analysis of qualitative data for Objective Three generated four themes.

Theme 1: Food Exhaustion Before the Next Harvest

The respondents mentioned a growing food gap of three to six months a year whereby household food supply was depleted and families were reliant on other forms of survival and that gap was growing every year.

One FGD participant argued:

> *"There is a period we call the hunger gap that runs from about August to November. Before, it used to be two or three months long. Now it is four to five months and in poor harvest years it extends to six months or more, meaning we are essentially hungry for half of the entire year."*
>
> ***(FGD1-P4, Female Farmer, Ward 1)***

A key informant noted:

> *"Our records show that food aid distributions in Rushinga are now required for nine to ten months of the year in the worst affected wards. This was not the case five years ago when distributions were needed for only four to six*

months. That expansion is a clear and measurable indicator of deteriorating food security."

(KII06, NGO Programme Manager, Ward 15)

Another participant stated:

"Children are the most visibly affected. Teachers report increased absenteeism during the hunger gap months because parents cannot send children to school on an empty stomach. Food insecurity is directly undermining the educational future of this community."

(KII05, Village Head, Ward 1)

Theme 2: Declining Nutritional Quality of Household Diets

The participants reported the worsening nutritional diversity in domestic foods due to the reduction in the production of legumes and vegetables and the losses of livestock with children and pregnant women being reported to be the most affected.

One participant remarked:

"We used to eat meat at least twice a week from our own livestock. Now it is once a month if we are lucky. The rest of the time it is sadza with green leaves or nothing at all. The children are not growing well and the health centre is confirming more cases of stunting linked to nutritional deficiency."

(FGD2-P4, Female Farmer, Ward 15)

A key informant opined:

"We are seeing a pattern where families eat the same food, mainly stiff porridge, for weeks on end. When people eat the same monotonous diet for extended periods, nutritional deficiencies develop rapidly. This is particularly serious for young children and pregnant women whose nutritional requirements are highest."

(KII03, Agricultural Extension Officer, Ward 15)

Another FGD participant added:

"The variety of wild vegetables and fruits that used to supplement our diets during dry spells has also declined noticeably. Even the wild food sources are being affected by the changing climate, which is particularly alarming because they were our final nutritional safety net when all else failed."

(FGD1-P5, Male Farmer, Ward 1)

Theme 3: Deteriorating Food Access Due to Income Losses

Poor harvests and loss of livestock had greatly lowered household incomes, causing a decreased ability to buy food when there was a deficit in own production and furthering the cycle of food insecurity.

One participant argued:

> *"A poor season means not only that we have no food from the field, but also that we have no money to buy food. The livestock and surplus crops that we would normally sell to raise cash for the lean months are gone. We have no fallback and no buffer of any kind."*
>
> ***(FGD4-P4, Male Farmer, Ward 12)***

A key informant contended:

> *"Prices of food in local markets rise sharply during drought years because everyone is buying and nobody is selling. The households that are already poor suffer the most because the same income buys progressively less food during a shortage, creating a double burden of poverty and high prices."*
>
> ***(KII01, District Agricultural Coordinator, Ward 1)***

Another respondent stated:

> *"I sold my plough after the 2022 drought just to buy food for the family. Now I have no means to cultivate properly and borrow a plough from a neighbour during planting season. Each poor season strips us of productive assets that we have no capacity to replace."*
>
> ***(FGD3-P5, Male Farmer, Ward 2)***

Theme 4: Gender-Differentiated Food Security Impacts

The study found that there were differences in the effects of food security between men and women, where women and children were always at the highest nutritional cost and lowest control over food distribution decisions.

One participant remarked:

> *"As a mother, when food is short, I am the last one to eat. I give the children what is available and ensure my husband eats enough to work. By the time it comes to me there is often very little or nothing left. This is the daily reality for most women in our community."*
>
> ***(FGD1-P3, Female Farmer, Ward 1)***

A key informant noted:

> *"Women are the ones who manage household food stocks but they are the last to benefit from whatever is available. They also carry the emotional burden of watching children go to bed hungry, which has serious mental health consequences that nobody in this community talks about openly."*
>
> ***(KII07, NGO Programme Manager, Ward 2)***

Another respondent opined:

"Women in our community work harder during drought years because they must forage, collect wild vegetables and search for any available income to supplement what little the farm produced. Yet they eat less and are rarely included in decisions about food aid distribution at the household or community level."

(KII02, Agricultural Extension Officer, Ward 2)

4.3.3.3 Discussion

Objective Three findings provide a multi-dimensional image of food insecurity in Rushinga District, which is supported by all four FAO pillars. The regression model shows that the adverse weather frequency is the main predictor of food insecurity (Beta = -0.389, p = 0.001) and the ANOVA outcome (F = 5.62, p = 0.001) proves significant ward level variation. These results are consistent with the FAO (2022) four pillar framework, which emphasizes the food stability as the most vulnerable to the disruption of climate in rain dependent systems. Sarkar (2022) points out that food security is not only about caloric sufficiency but also about dietary diversity and nutritional quality, which is impaired. Gendered effects are in line with Chidhakwa et al. (2020), who demonstrate that women decrease consumption in the short term. The most significant mediating variable according to Makombe (2023) is poverty, which is backed by the wealth quintile outcome (Beta = 0.211, p = 0.005) and Kaoje et al. (2019) emphasize that lack of food access occurs when production is not the answer.

4.3.4 Objective Four: Household Coping Strategies

The fourth research objective sought to investigate the coping strategies employed by households in Rushinga District to mitigate the impacts of climate change.

4.3.4.1 Quantitative Findings: Household Coping Strategies

Table 4.9 presents descriptive statistics on the frequency and perceived prevalence of household coping strategies.

Table 4.9: Household Coping Strategies (n=111)

Statement	SD	D	N	A	SA	Mean	SD
1. Our household reduces meal frequency or portion sizes when food stocks are low.	2.7%	5.4%	9.0%	36.9%	45.9%	4.18	0.97
2. We engage in piece work or off-farm income activities to supplement food shortfalls.	4.5%	9.0%	14.4%	38.7%	33.3%	3.87	1.07

3. We rely on food aid from government or NGOs during lean seasons.	3.6%	7.2%	12.6%	36.0%	40.5%	4.03	1.01
4. We sell livestock or household assets to purchase food during shortfalls.	5.4%	10.8%	14.4%	36.0%	33.3%	3.81	1.13
5. We forage for wild foods such as tubers, fruits and mushrooms to supplement meals.	4.5%	8.1%	16.2%	37.8%	33.3%	3.87	1.07

Source: Primary Data (2026)

The coping strategy that was most popular was meal reduction with an average of 4.18 (SD = 0.97) and 82.8 percent agreement. Addiction to food aid by government or NGOs scored an average of 4.03 (SD = 1.01) and 76.5 percent of the respondents agreed. The means of off-farm income activities and wild food foraging were all 3.87 with the means of distress sale of assets being the lowest at 3.81 (SD = 1.13). Frequency data indicated that 82.0 percent of households had cut back on meals during at least three years in the last five years and 68.5 percent had received some food aid during at least one year in the last five years. The fact that the adaptation index has a negative coefficient in the regression model (Beta = 0.312 of food security, or, the lower the adaptation capacity of household, the more insecure the household is), confirms the fact that the reactive coping with no adaptive investment increases vulnerability in the long run.

4.3.4.2 Qualitative Findings: Household Coping Strategies

Thematic analysis of qualitative data for Objective Four generated four themes.

Theme 1: Meal Reduction and Dietary Adjustment

The most general coping reaction reported was the strategic constraint of meal frequency and shifting to less nutritious yet more satiating food meticulously in times of food scarcity, which is a common coping technique that has been identified as detrimental to nutritional well-being.

One FGD participant argued:

> *"When food is very scarce, we eat twice instead of three times a day. The midday meal is eliminated first. When things are worse still, we eat once a day in the evening and try not to let the children go to school without eating, but sometimes it is simply unavoidable."*

(FGD2-P2, Male Farmer, Ward 15)

A key informant observed:

> *"Children in this community suffer the most from this strategy. When they go to school without adequate food, their concentration and academic performance decline visibly. We are slowly sacrificing the intellectual development of our children to manage a food crisis that is driven by climate change, not by a lack of effort."*

(KII05, Village Head, Ward 1)

Another participant stated:

> *"We have adapted to eating less over the years. It is not something we are proud of but it has become a survival habit that persists even in slightly better seasons. We eat more sadza and fewer relishes because sadza fills the stomach even if it does not provide the required nutritional balance."*

(FGD1-P1, Female Farmer, Ward 1)

Theme 2: Livelihood Diversification Into Off-Farm Activities

Respondents spoke of a growing dependence on non-farm sources of incomes in years of bad harvests such as piece work, trading and seasonal migration, but again these pursuits tended to be in conflict with agricultural labour demands.

One participant noted:

> *"After a drought year, most men from our village travel to Harare or Mount Darwin to find piece work on construction sites. This income keeps the family going until the next planting season but it means women are left to manage the entire farm alone during the most critical preparation period."*

(FGD4-P1, Male Farmer, Ward 12)

A key informant opined:

> *"Livelihood diversification is happening across the district but it is reactive rather than planned. Families are diversifying because farming is failing, not because they have chosen to build alternative livelihoods strategically. This means they are abandoning farming investment at exactly the time when the land needs attention most."*

(KII06, NGO Programme Manager, Ward 15)

Another respondent contended:

> *"I make and sell bricks during the dry season when there is nothing to farm. The income from bricks is not much but it provides enough to buy food for a month or two. It is currently the only thing standing between my family and starvation during the lean season months."*

(FGD2-P3, Male Farmer, Ward 15)

Theme 3: Dependence on Food Aid and Social Safety Nets

Government programmes and NGO food aid came to be a vital survival tool to an increasing proportion of households, and the participants reported that the aid was systematically inadequate and untimely in comparison with real need.

One FGD participant argued:

> *"The government food assistance programmes keep us alive during the worst months but they are never enough. We receive a 50-kilogram bag of maize meal for a family of seven, which lasts two weeks. For the remaining six weeks of the distribution interval we must find our own food from wherever we can."*
>
> ***(FGD1-P4, Female Farmer, Ward 1)***

A key informant stated:

> *"The NGO food distributions arrive late, after the hunger has already peaked and people have made desperate decisions such as selling livestock or removing children from school. Early and consistent distribution would prevent many of these irreversible decisions but coordination between agencies is very poor."*
>
> ***(KII07, NGO Programme Manager, Ward 2)***

Another participant remarked:

> *"The social safety net here is the extended family. When you run out of food you go to your relatives, but when climate change affects the whole region, all families run short at the same time and the relatives have nothing to give either. The communal safety buffer has been completely eroded."*
>
> ***(FGD3-P2, Female Farmer, Ward 2)***

4.3.4.3 Discussion

The coping strategies reported in Objective Four indicate an almost entirely reactive and short-term orientation that aligns with the regression result that low adaptation index (X_3) correlates with worse food security results. The predomination of meal reduction (mean = 4.18; 82.0 percent frequency aligns with Afshin et al. (2019), who found dietary reduction as the coping mechanism first-line in food-insecure Sub-Saharan society. Makwindi and Ndlovu (2022) mention that livelihood diversification is a valuable addition, but its reactive character restricts its capacity to be an effective strategy in addressing climate change, which is directly mirrored in Theme Two. The growing reliance on food aid is consistent with Kabonga

(2023), who discovered that NGOs in Zimbabwe are overburdened by the magnitude of food insecurity and are often incapable of providing adequate and prompt aid. The depletion spiral of assets as described in Theme Four echoes in Awuni et al. (2023) who report that frequency of climate shock deprives communities of the productive capital that would enable recovery, reinforcing poverty and food insecurity. This can be explained through the Sustainable Livelihoods Framework (Scoones, 1998), which demonstrates that the trend of increased climate shock gradually eats away the capital assets on which food security of households ultimately rests.

4.3.5 Objective Five: Sustainable Adaptation Strategies

The fifth research objective sought to recommend sustainable adaptation strategies that can be employed to mitigate the impact of climate change and enhance food security in Rushinga District.

4.3.5.1 Quantitative Findings: Adaptation Strategies

Table 4.10 presents household perceptions of the effectiveness and desirability of available climate adaptation strategies.

Table 4.10: Household Perceptions of Adaptation Strategies (n=111)

Statement	SD	D	N	A	SA	Mean	SD
1. Adoption of drought-resistant crop varieties can significantly improve food security in our community.	2.7%	5.4%	9.0%	40.5%	42.3%	4.14	0.96
2. Water harvesting and conservation practices such as mulching and contour ridges improve yields under drought.	3.6%	6.3%	10.8%	37.8%	41.4%	4.07	1.02
3. Diversifying crops to include small grains, legumes and vegetables reduces climate-related food insecurity.	2.7%	6.3%	11.7%	40.5%	38.7%	4.06	0.99
4. Access to irrigation infrastructure would substantially improve food security in our household.	1.8%	4.5%	7.2%	33.3%	53.2%	4.32	0.91
5. Improved access to agricultural extension services and climate	2.7%	4.5%	9.0%	37.8%	45.9%	4.20	0.96

information would assist our farming decisions.							

Source: Primary Data (2026)

The highest mean of 4.32 (SD = 0.91) was obtained on irrigation infrastructure access, with 86.5 percent of the respondents agreeing. Improved agricultural extension and climate information access registered 4.20 (SD = 0.96), drought-resistant varieties 4.14 (SD = 0.96), water harvesting practices 4.07 (SD = 1.02) and crop diversification 4.06 (SD = 0.99). In spite of this high approval, access to irrigation of any type was only 23.4 percent and only 31.5 percent of households claimed regular extension contact indicating a large disparity between household need of adaptation support and institutional provision. These gaps are directly echoed in the regression model, with the adaptation index (X_3) as the most positive predictor of food security (Beta = 0.312, $p < 0.001$), which supports the fact that higher adaptive capacity is directly associated with better food security results.

4.3.5.2 Qualitative Findings: Adaptation Strategies

Thematic analysis of qualitative data for Objective Five generated four themes.

Theme 1: Climate-Smart Agriculture as a Priority Framework

The most viable means of adaptation available to smallholder farmers as long-term solutions to the current climate change was largely supported by key informants and the FGD participants who all supported Climate-Smart Agriculture practices such as minimum tillage, mulching, crop rotation, and water harvesting.

One key informant noted:

> *"Minimum tillage and mulching have made a visible difference on farms of households that have consistently practised them over several years. These practices retain moisture in the soil and reduce evaporation, which extends the effective growing period by several weeks even when rains are late or stop early than expected."*
>
> ***(KII02, Agricultural Extension Officer, Ward 2)***

Another key informant argued:

> *"The farmers who use contour ridges and water harvesting pits are consistently outperforming their neighbours even in poor rainfall years. The difference is not luck, it is water management. But adopting these practices requires initial labour investment and training that most households do not currently have access to."*
>
> ***(KII03, Agricultural Extension Officer, Ward 15)***

An FGD participant stated:

> *"I have been using minimum tillage for three seasons after receiving training from an NGO. My yields are not large but they are consistent. Before, I would get nothing in a dry year. Now I get something every season, which is the difference between my children eating adequately and not eating at all."*
>
> ***(FGD2-P1, Male Farmer, Ward 15)***

Theme 2: Drought-Resistant and Early-Maturing Crop Varieties

The introduction of drought-resistant and early-maturing types of crops was also broadly supported as the most immediate actionable adaptive response measure with the participants emphasizing the necessity of the availability of varieties that are locally tested.

One key informant argued:

> *"We need crop varieties that mature in 75 to 90 days rather than the standard 120 days. When the effective rainy season is now only two to three months, a 120-day variety will always fail at the critical grain-filling stage. Early maturity has become more important than yield potential in this district."*
>
> ***(KII01, District Agricultural Coordinator, Ward 1)***

An FGD participant stated:

> *"The SC403 and ZM523 drought-tolerant maize varieties have performed noticeably better than traditional varieties in dry years on my field. I first received the seed through an NGO programme and have now saved and replanted it for two seasons. Making quality seed consistently accessible is key to any adaptation effort."*
>
> ***(FGD1-P2, Male Farmer, Ward 1)***

Another respondent remarked:

> *"I have reintroduced sorghum and pearl millet on my field alongside maize. In 2022 when the maize failed completely my sorghum produced a reasonable harvest that kept my family going through the lean months. Crop diversification is our most reliable and accessible insurance against climate variability."*
>
> ***(FGD4-P5, Male Farmer, Ward 12)***

Theme 3: Irrigation Infrastructure as the Most Transformative Investment

The basic problem that was identified by participants and key informants as the most transformative infrastructure investment to break the rainfall dependence was the increased access to irrigation, and the poor performance of the current schemes was heavily criticised.

One FGD participant argued:

"If we had functioning irrigation in this ward, climate change would still be a challenge but it would not be a food security crisis. Irrigation gives us control over one of the most critical production variables. Without it we are entirely at the mercy of the rains, which are now completely unpredictable."

(FGD3-P1, Female Farmer, Ward 2)

A key informant noted:

"The Nyakomba irrigation scheme serves a limited number of households and currently operates at less than half capacity due to maintenance challenges. If the government and development partners invested in expanding and properly maintaining these schemes, the food security situation in this entire district would be fundamentally transformed."

(KII01, District Agricultural Coordinator, Ward 1)

Another key informant observed:

"The communities with access to even small-scale drip irrigation systems have visibly better food security than those without, and we see this consistently across the district. The investment required is significant but the return in terms of reduced food aid dependency and sustained production is enormous."

(KII06, NGO Programme Manager, Ward 15)

Theme 4: Strengthening Institutional Support and Policy Alignment

The interviewees identified the major gaps in institutional support such as a lack of regularity in extension visits, the lack of access to climate information and the ineffective execution of the available climate and food security policy frameworks.

One FGD participant noted:

"An extension officer visits our ward once a month if we are lucky. The training sessions are generic and do not address the specific challenges of our local soil type and rainfall conditions. We need more frequent, localised and practical training that genuinely acknowledges the specific situation we face here."

(FGD4-P3, Female Farmer, Ward 12)

A key informant argued:

"Zimbabwe has good climate policies on paper, including the National Climate Policy and the Nationally Determined Contributions, but we do not see these policies translated into concrete support in communities like ours. The gap between policy commitment and ground-level implementation remains enormous and is growing."

(KII04, Village Head, Ward 12)

Another key informant contended:

> *"Early warning systems for droughts and floods are essential tools that are not adequately reaching this community. The Meteorological Services Department issues national advisories but these rarely translate into ward-level guidance that tells a farmer specifically when to plant, when to harvest early or when to expect flooding."*
>
> ***(KII02, Agricultural Extension Officer, Ward 2)***

4.3.5.3 Discussion

The results of Objective Five affirm that there is high Household demand in evidence-based climate adaptation support and regression model on the adaptation index shows that this index is the most significant positive predictor of food security (Beta = 0.312, $p < 0.001$). The greatest support was given to irrigation infrastructure (mean = 4.32) as demonstrated by Mhembwe et al. (2019), who reported that small scale irrigation schemes have a massive impact on food security of small holders in Zimbabwe. The gap in extension services (only 31.5 percent of the households reported regular contact) is also consistent with Kweka et al. (2022), who note the lack of extension as one of the institutional barriers. Theme One practices of the CSA are congruent with those of Walker (2016), which established that minimum tillage, mulching and water harvesting are best practices in semi-arid regions. Kazaara and Christopher (2023) advocate the adoption of drought resistant and early maturing crops as a readily available approach, and Maponga and Hanyana (2021) emphasize the lack of policy implementation at sub district level.

4.4 Triangulation Analysis

Quantitative and qualitative data triangulation of all five objectives provides a high degree of convergence between the household survey responses and institutional perspectives through interviews and focus groups, thus improving the validity of the results. In Objective One, the rise in temperatures and unpredictable rainfall, with a high mean score of above 4.0, and a significant ANOVA value ($F = 3.61$, $p = 0.016$) is supported by qualitative explanations of changing seasons, traditional signs failing, and increase in extreme events. Qualitative observations also indicate that there has been erosion of indigenous knowledge. In Objective Two, the regression outcome that determined the frequency of adverse weather as the most significant predictor (Beta = -0.389, $p < 0.001$) matches the reports of crop failure, livestock loss, and decreased crop diversity. The statistical patterns are linked to the lived experiences of the declining productivity to explain significant ward variation ($p = 0.003$) through the differences in local water availability.

In Objective Three, the ANOVA outcome (F = 5.62, p = 0.001) validates the difference in food security in wards, which is supported by qualitative data of gendered food distribution that reveals concealed inequalities to women and children. The regression result of wealth quintile (Beta = 0.211) is substantiated by accounts of loss of income and increasing food prices. In Objective Four, the strong adoption of the reduction of meals (mean = 4.18; 82.0 percent) is further elaborated by the descriptions of food boredom and the lack of a strong social support system. Divergence is seen in asset sales, which experience a moderate quantitative uptake (mean = 3.81) but harsh long-term effects qualitatively. In Objective Five, the high mode of supporting irrigation (mean = 4.32) and a high index of the adaptation (Beta = 0.312) is aligned to the poor performance of the schemes and low access to the extension, which reinforces the policy relevance of the study.

4.5 Chapter Summary

This chapter has presented, analysed and discussed primary data on 111 respondents to household questionnaires in four wards in Rushinga District, with some support of seven key informant interviews and four focus group discussions. The results validated widespread and intensifying trends of climate change, extreme and drastic agricultural productivity and livestock performance, multidimensional household food insecurity, largely reactive coping mechanisms and high demand of institutional adaptation aid. The results of the ANOVA test revealed statistically significant variation of a ward level of all three main outcomes, whereas the regression analysis revealed adverse weather frequency as the most important negative outcome predictor and adaptation index as strongest positive outcome predictors of the household food security. Triangulation ensured good convergence of the quantitative and qualitative results and the fruitful divergences to deepen the interpretation of the statistical tendencies. Chapter Five will generalize these findings in the theoretical frameworks of the study, make conclusions under each objective and promote evidence-based policy and practice recommendations in Rushinga District.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary of the key findings, conclusions consistent with each of the five research objectives and recommendations targeted at specific stakeholders. The study was conducted to look at the effects of climate change on food security of smallholder farming households in Rushinga District, Zimbabwe. Information was gathered from a total of 111 respondents of the household questionnaires, seven key informants and four focus group discussions in four wards. The chapter brings together the quantitative and the qualitative aspects of the study to present a coherent conclusion. It further outlines the scope for further research as a result of the limitations of the study and ends the study on a provisional note by highlighting the importance of the study for semi-arid smallholder communities in Zimbabwe.

5.1 Summary of Major Findings

5.1.1 Objective One: Climate Change Trends in Rushinga District

The study revealed high consensus in the Rushinga District on the observed changes in the climate from the last 15 years among the households. The study was able to establish that the households in Rushinga District agreed strongly on the observed changes in the climate during the past 15 years. Responses to temperature increases recorded the highest mean score of 4.22 out of 5.0 with 84.6 percent agreeing and strongly agreeing that temperature increases was the factor. There was also a high level of reported rainfall variability, as well as delayed onset of the rainy season and extended dry periods during the rainy season in all four wards. A mean of 4.21 was obtained for extreme weather events like floods and droughts, which had increased in frequency. The one-way ANOVA found a significant result ($F = 3.61$, $p = 0.016$), suggesting that there are significant differences in the climate perception scores among the wards. The trends were the worst in Ward 1 (Mukosa), which falls in a high risk drought zone and has the lowest average annual rainfall. All four wards experienced a qualitative loss of indigenous seasonal knowledge due to the changing patterns of the climate; they relied on plantings in the past based on patterns in the environment.

5.1.2 Objective Two: Effects on Agricultural Productivity and Food Availability

The impact of the climate change has significantly affected the agricultural productivity in all four study wards of Rushinga District. The mean scores for crop yield decline and increasing crop failure frequency were 4.21, and both scores had more than 83 percent household

agreement. The district experienced severe productivity losses as 63% of households reported complete failure of crops in the last five seasons. The livestock productivity was also affected by heat stress, decrease in grazing land, and lack of water at communal sources. The difference between the wards was found to be statistically significant ($F = 4.87$, $p = 0.003$), with the worst result being that of Ward 1. The regression model accounted for 41.1 percent of the variance in the food security composite score, with adverse weather frequency being the most negative contributor to food security (Beta = -0.389, $p < 0.001$). The qualitative data verified the most severe and compounding effects of the crop failures that were being experienced, the progressive depletion of assets, and the loss of productive livestock.

5.1.3 Objective Three: Household Food Security Status

The study identified food insecurity in all four dimensions of FAO, availability, access, utilisation and stability. Food access deterioration had the highest mean of 4.17 while food stability, utilisation and access each scored under 4.0, indicating a systemic vulnerability. Overall, ANOVA showed that there was a significant variation across wards in food security outcomes ($F = 5.62$, $p = 0.001$). Ward 1 (Mukosa) and Ward 2 (Nyamuzeya) had the highest food insecurity levels, reflecting their high level of drought risk, combined with lower average rainfall. The household hunger gap had increased from two to three months per year in most of the affected wards, to four to six months. There had been a significant deterioration in nutrition status with low dietary diversity and stunted child growth being reported at community health clinics. There was a significant gender differential and women and children experienced a greater burden of nutrition.

5.1.4 Objective Four: Household Coping Strategies

Most coping strategies used by households to deal with the consequences of food insecurity were reactive and short-term. The most common strategy was meal reduction, which had a mean of 4.18, where 82 percent of households reported using this strategy for at least three of the last five seasons. Reliance on government and NGO food assistance had a mean score of 4.03, and 68.5 percent of households were receiving food assistance from the government or NGOs in at least one of the most recent seasons. The means for both off-farm income diversification and wild food gathering were 3.87, as was distress asset sales, although the latter had the most detrimental long-term effects on household productive capacity. Qualitative data showed that livelihood diversification was not planned, but rather opportunistic, and that the need for a communal social safety net had been largely sacrificed due to the pressure of multiple climate events over time. The adaptation index was also found

to be a significant positive predictor of food security (Beta = 0.312, $p < 0.001$) which indicated that the food security of households with poor adaptive capacity was far worse.

5.1.5 Objective Five: Sustainable Adaptation Strategies

The practical and evidence-based support to address climate change was in high demand from households, but was very low across all four wards in relation to the need. Access to irrigation infrastructure had the highest mean of 4.32 with an agreement of 86.5 percent, and only 23.4 percent of the households reported any type of irrigation access. The improved agricultural extension services and access to climate information had a mean score of 4.20 while only 31.5 percent of the households had regular contact with agricultural extension officers. Means for drought resistant and early-maturing crop varieties, water harvesting practices and crop diversification were all above 4.0. Minimum tillage, contour ridges and mulching were qualitatively supported by existing adopters of CSA with observed yield gains even in challenging rainy season periods. The national level of climate policy frameworks and community level implementation was a key structural barrier that was constantly identified by the key informants. Regardless, the adaptation index continued to be the most significant positive factor in food security in the regression model, confirming the importance of adaptive capacity in shaping the outcomes of food security in the household.

5.2 Conclusions

The impact of climate change is clearly seen and measurable in all four study wards in the Rushinga District. The last 15 years have seen an increasing trend in the intensity of temperature rise and irregular rainfall as well as rising frequency of extreme weather events. The differences in the perception of the climate at the ward level is not due to differences in awareness or perception but due to actual difference in agro-ecological exposure. Loss of indigenous seasonal knowledge is a major and unrecognized community-based adaptive asset loss. Communities in Rushinga are facing climate change, not as a future or potential threat but as a reality that is increasingly impacting their daily lives and livelihoods.

The effects of climate change on agricultural productivity in Rushinga District are very deep and largely undermining the agricultural productivity especially across seasons. The staple food, maize is especially susceptible to the effects of the unprecedented and often unpredictable rainfall patterns which fail to meet the needs of traditional farmers. An additional impact of crop failure has been livestock losses, which has taken away both the draught power needed to support crop cultivation and household income in lean times. The significant productivity differences among the wards further validate the notion that agricultural production is highly vulnerable to the effects of proximity to agro-ecological

zones vulnerable to and impacted by drought. Without structural adaptation investment in the field of agriculture, continued use of rain-fed means that the losses in productivity will deepen in the district.

Household food insecurity in Rushinga District is multidimensional involving all four dimensions of food security framework used by FAO. (Date) Increased hunger gaps and reduced food diversities underscore an intensification and exacerbation of food security problems beyond just being calorie deficits. Women and children are disproportionately affected by food insecurity, but are under-represented in the food distribution decision-making process. The geographic and agro-ecological location of households is a key determinant of food security outcomes at the household level in the district. Food insecurity is also driven by poverty as a structural factor, which further compounds the impact of climate shocks and poor households' recovery capacity in the study wards.

Household coping mechanisms in Rushinga District are mainly oriented towards the short term and reactive, with no sustainable way forward to alleviate food insecurity. As successive distress asset sales progressively erode households' productive capacity for recovery, households are increasingly caught in deeper cycles of vulnerability. Food aid dependency in terms of size and duration is growing in the district, and the existing safety nets are proving to be insufficient in meeting the size of the dependency. Households that lack livelihood diversification strategy are vulnerable to the impact of repeated climate shocks as their coping ability is being weakened. Left uninvested proactively, coping mechanisms will get worse and worse, leading to a worsening food insecurity situation, instead of solving it.

Households in all four study wards are very responsive to adaptation support across all four wards, but institutional provision is well below the levels needed. The water gap between irrigation water requirements and availability is the biggest structural challenge to food security in the district and is expanding in size. Agricultural extension visits are often few and far between and have a significant impact on the ability to disseminate and spread knowledge and practice of climate smart agriculture from the institutional to the farm level. The country has climate policies, such as the National Climate Policy and the Nationally Determined Contributions, but there is a lack of effective application and integration of these policies into action at district and ward level. The narrow adaptive capacity demand and institutional supply gap is the major challenge to the food security in Rushinga District. Therefore, the researcher suggested the following recommendations.

5.3 Recommendations

5.3.1 Recommendations for the Government of Zimbabwe (Ministry of Lands, Agriculture, Fisheries, Water and Rural Development)

The government should prioritise the rehabilitation and expansion of small-scale irrigation infrastructure across the wards of Rushinga District. Dedicated funding allocations for ward-level irrigation schemes should be embedded in national agricultural budgets and tracked annually. Early warning advisories issued by the Meteorological Services Department should be translated into ward-specific planting calendars that farmers can act on directly. The implementation mechanisms of the National Climate Policy should be devolved to district and ward-level agricultural offices, with clear accountability structures and measurable targets assigned to local officials.

5.3.2 Recommendations for the District Agricultural Development Unit (DADU), Rushinga

The deployment of extension officers should be increased to ensure a minimum of monthly structured visits to each ward in the district. Extension training content should be locally adapted to the specific soil types, rainfall patterns and crop varieties that are relevant to each ward, rather than delivered as generic national guidance. Demonstration plots for Climate-Smart Agriculture practices, including minimum tillage, mulching and contour ridging, should be established in each ward to enable practical farmer-to-farmer knowledge transfer. District-level climate vulnerability mapping should be used to inform the prioritisation and targeting of agricultural support resources across the four wards.

5.3.3 Recommendations for NGOs and Development Partners Operating in Rushinga

Food aid distribution should be co-ordinated at the district level to ensure timely delivery and to prevent duplication and targeting gaps. Adaptive livelihood programmes should be designed and funded as sustained long-term investments in household resilience rather than as short-term emergency responses. NGO seed support programmes should give priority to locally tested drought-tolerant and early-maturing varieties, including SC403 and ZM523, which have demonstrated consistent performance in ward conditions. Gender-sensitive food security programming should ensure that women are meaningfully included in food aid targeting, distribution decisions and agricultural training activities.

5.3.4 Recommendations for Smallholder Farming Households

Households should progressively adopt Climate-Smart Agriculture practices, including minimum tillage, mulching and the construction of water harvesting pits, to extend the effective growing period during erratic seasons. Crop diversification to include sorghum, pearl millet and legumes alongside maize should be actively pursued as a practical and

accessible means of reducing climate-related production risk. Households should engage consistently with extension services and NGO training programmes to build the adaptive knowledge and practical skills needed to improve farm-level resilience. Community-based savings groups should be strengthened as a local financial buffer against distress asset sales in drought seasons, protecting the productive capacity that households need for recovery.

5.3.5 Recommendations for Traditional and Community Leadership (Village Heads and Ward Councillors)

Village heads and ward councillors should facilitate structured community-level dialogues on local climate adaptation priorities and food security challenges. Community leaders should actively advocate with district government structures for ward-specific extension support, irrigation access and timely food aid distribution. Traditional leaders should support efforts to document surviving indigenous knowledge systems that remain locally relevant and that can complement formal climate information in guiding adaptation decisions. Ward councillors should ensure that food aid targeting processes are transparent, equitable and inclusive of the most vulnerable households, with particular attention to female-headed households and households affected by chronic food insecurity.

5.3.6 Areas for Future Research

This study was limited to four wards in Rushinga District and its findings cannot be generalised to other districts without further investigation. Future research should undertake a district-wide or provincial study examining the relationship between climate change and food security across a broader range of agro-ecological zones in Mashonaland Central. Such a study would enable stronger policy generalisations and provide comparative data on adaptation outcomes across districts with differing rainfall regimes, livelihood systems and institutional support structures.

The cross-sectional design of this study did not permit the capture of longitudinal changes in household food security across multiple agricultural seasons. Future research should adopt a panel or longitudinal design to track household food security outcomes over time and to assess the sustained effects of climate shocks and adaptation interventions across successive growing seasons. This approach would provide more robust causal evidence on the long-term trajectory of climate-driven food insecurity and the conditions under which households are able to recover or adapt.

The gender dimensions of food insecurity were observed and noted in this study but were not the central analytical focus. Future research should examine gender-differentiated climate vulnerability and food security outcomes in Rushinga District in greater depth, using a

dedicated gender analysis framework. A focused gender study would generate targeted evidence to support the design of more equitable and responsive food security interventions for women and female-headed households in the district.

5.4 Chapter Summary

This chapter has provided a summary of findings for each of the five research objectives, made conclusions based on quantitative and qualitative findings, and provided recommendations to each of the five key stakeholder groups. The results show that climate change is contributing to food insecurity in Rushinga district through the triple effects on food production, household income and dietary diversity and resilience. The overall picture that emerges from the findings is a district in which the stress of climate change is increasing rapidly and institutional support and investment in adaptation is woefully inadequate compared to the need. Recommendations have been made to the government, the District Agricultural Development Unit, NGOs and development partners, smallholder farming households and traditional and community leadership structures. Based on the geographic scope, cross sectional design and gender focus limitations of this study, three areas of future study have been identified. This chapter has also addressed the five research objectives and met the research purpose of the study. This provides a preliminary end of the study and the study outcomes are expected to have a meaningful contribution to the evidence-based policy discussion for climate adaptation and food security in Rushinga District and other semi-arid settings in Zimbabwe.

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BINDURA UNIVERSITY OF SCIENCE EDUCATION

Faculty of Agriculture and Environmental Science

Department of Agricultural Economics, Education and Extension

HOUSEHOLD QUESTIONNAIRE

Research Topic:

Assessing the Effects of Climate Change on Food Security in Rushinga District of Mashonaland Central

Institution: Bindura University of Science Education (BUSE)

INSTRUCTIONS TO RESPONDENTS

This questionnaire is designed to gather information on the effects of climate change on food security in Rushinga District of Mashonaland Central. Your honest responses are vital to the success of this study. Please note the following:

- This questionnaire is strictly for academic purposes and all responses will be treated with the strictest confidentiality.
- Do NOT write your name anywhere on this questionnaire.
- For Section A, please tick (x) the box that best describes your situation.
- For Sections B to F, please use the 5-point Likert scale provided by ticking (x) the box that most closely reflects your level of agreement with each statement. Data will be analysed using SPSS version 27.
- Please answer ALL questions as honestly as possible. There are no right or wrong answers.

1 = Strongly Disagree	2 = Disagree	3 = Neutral	4 = Agree	5 = Strongly Agree

SECTION A: DEMOGRAPHIC INFORMATION

Please tick (x) the appropriate box for each question below.

Q1. Gender	[ ] Male [ ] Female [ ] Prefer not to say
Q2. Age Group	[ ] 18-30 [ ] 31-40 [ ] 41-50 [ ] 51-60 [ ] Above 60

Q3. Ward of Residence	[ ] Ward 1 (Mukosa) [ ] Ward 2 (Nyamuzeya) [ ] Ward 12 (Magaranhewe) [ ] Ward 15 (Chimhanda)
Q4. Highest Level of Education	[ ] No Formal Education [ ] Primary [ ] Secondary [ ] Tertiary
Q5. Household Size	[ ] 1-3 members [ ] 4-6 members [ ] 7-9 members [ ] 10 or more

SECTION B: *Climate Change Trends in Rushinga District*

Please indicate your level of agreement with each of the following statements.

Objective 1: To critically analyse the elements of climate change including temperature changes and rainfall in Rushinga District.

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. Temperatures in Rushinga District have noticeably increased over the past 15 years.	( )	( )	( )	( )	( )
2. The onset of the rainy season has become increasingly delayed in recent years.	( )	( )	( )	( )	( )
3. Rainfall events in Rushinga have become more erratic and unpredictable compared to 15 years ago.	( )	( )	( )	( )	( )
4. Dry spells within the rainy season have become longer and more frequent in Rushinga District.	( )	( )	( )	( )	( )
5. Extreme weather events such as floods and droughts have increased in frequency in Rushinga District.	( )	( )	( )	( )	( )

SECTION C: *Effects on Agricultural Productivity and Food Availability*

Please indicate your level of agreement with each of the following statements.

Objective 2: To examine the effects of climate change on overall agricultural productivity and food availability in Rushinga District.

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. Crop yields in my household have declined significantly over the past decade due to changing climate conditions.	( )	( )	( )	( )	( )
2. Livestock productivity including milk yield	( )	( )	( )	( )	( )

and draught power has declined due to heat stress and reduced pasture availability.					
3. Crop failures linked to drought and erratic rainfall have increased in frequency in Rushinga District.	( )	( )	( )	( )	( )
4. Food availability in my household has decreased due to poor harvests caused by climate change.	( )	( )	( )	( )	( )
5. The variety of crops I can successfully grow has reduced due to changing climate conditions.	( )	( )	( )	( )	( )

SECTION D: *Household Food Security Status*

Please indicate your level of agreement with each of the following statements.

Objective 3: To assess the level of household food security in Rushinga District in the face of climate change.

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. My household has experienced food shortages lasting more than one month in at least two of the past five years.	( )	( )	( )	( )	( )
2. My household is unable to consistently access adequate and nutritious food throughout the year due to climate-related production losses.	( )	( )	( )	( )	( )
3. The nutritional diversity of my household's diet has declined due to reduced availability of legumes, vegetables and livestock products.	( )	( )	( )	( )	( )
4. Climate-induced income losses have reduced my household's ability to purchase food during periods of production deficit.	( )	( )	( )	( )	( )
5. My household's food security situation has deteriorated compared to ten years ago due to the effects of climate change.	( )	( )	( )	( )	( )

SECTION E: *Household Coping Strategies*

Please indicate your level of agreement with each of the following statements.

Objective 4: To investigate the coping strategies employed by households in Rushinga District to mitigate the impacts of climate change.

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. My household reduces meal frequency or portion sizes when food stocks are low due to	( )	( )	( )	( )	( )

poor harvests.					
2. My household engages in piece work or off-farm income activities to supplement food shortfalls caused by climate change.	( )	( )	( )	( )	( )
3. My household relies on food aid from government or NGO programmes during lean seasons linked to climate shocks.	( )	( )	( )	( )	( )
4. My household sells livestock or productive assets to purchase food during climate-induced shortfalls.	( )	( )	( )	( )	( )
5. My household forages for wild foods such as tubers, fruits and mushrooms to supplement meals during lean periods.	( )	( )	( )	( )	( )

SECTION F: *Adaptation Strategies*

Please indicate your level of agreement with each of the following statements.

Objective 5: To recommend sustainable adaptation strategies that can be employed to mitigate the impact of climate change and enhance food security.

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. Adoption of drought-resistant and early-maturing crop varieties can significantly improve food security in my community.	( )	( )	( )	( )	( )
2. Water harvesting and conservation practices such as mulching and contour ridges would improve yields under drought conditions.	( )	( )	( )	( )	( )
3. Diversifying crops to include small grains, legumes and vegetables would reduce climate-related food insecurity in my household.	( )	( )	( )	( )	( )
4. Access to irrigation infrastructure would substantially improve my household's food security regardless of rainfall variability.	( )	( )	( )	( )	( )
5. Improved access to agricultural extension services and climate information would assist my household's farming decisions and food security.	( )	( )	( )	( )	( )

THANK YOU FOR YOUR PARTICIPATION

Your time and honest responses are greatly appreciated and will contribute meaningfully to this research.

SEMI-STRUCTURED INTERVIEW GUIDE

Research Topic:

Assessing the Effects of Climate Change on Food Security in Rushinga District of Mashonaland Central

Institution: Bindura University of Science Education (BUSE)

Target Respondents: Agricultural Extension Officers, District Agricultural Coordinator, Village Heads, NGO Programme Managers

Estimated Duration: 30 to 40 Minutes

INTRODUCTION

My name is Paul Kwaringa, a student at Bindura University of Science Education (BUSE), currently conducting academic research in partial fulfillment of the requirements of my degree programme. This interview is part of a research study titled "Assessing the Effects of Climate Change on Food Security in Rushinga District of Mashonaland Central." The purpose of this interview is to gather qualitative insights from key informants who have professional and institutional knowledge of climate change and food security dynamics in Rushinga District.

Your participation in this interview is entirely voluntary, and you may withdraw at any point without any consequences whatsoever. All information shared will be treated with the strictest confidentiality and used solely for academic purposes. With your permission, this interview will be audio recorded to ensure accuracy of data capture. You may request that recording be stopped at any time.

SECTION 1: Climate Change Trends in Rushinga District

Objective 1: To critically analyse the elements of climate change including temperature changes and rainfall in Rushinga District.

1. From your professional experience, how would you describe the changes in temperature and rainfall patterns that have occurred in Rushinga District over the past 10 to 15 years?
2. To what extent have extreme weather events such as droughts, floods and hailstorms increased in frequency and severity in Rushinga District, and how have they manifested across different wards?
3. How have changing climate patterns in Rushinga District affected the traditional seasonal indicators and indigenous knowledge systems that farmers historically relied upon for planting decisions?

4. In your view, what ward-level or spatial differences in climate change impacts have you observed across Rushinga District, and what factors explain these differences?

SECTION 2: Effects on Agricultural Productivity and Food Availability

Objective 2: To examine the effects of climate change on overall agricultural productivity and food availability in Rushinga District.

5. How would you describe the trend in crop yields and the frequency of crop failures in Rushinga District over the past decade, and how directly do you attribute these changes to climate variability?
6. To what extent has climate change affected livestock productivity and the availability of livestock-derived foods such as milk and meat in Rushinga District?
   [Probes: Heat stress; pasture decline; water scarcity; livestock mortality]
7. How has reduced agricultural productivity affected the overall availability and diversity of food at household and community level in Rushinga District?
8. In your view, are there specific groups of farming households that are disproportionately affected by climate-induced productivity declines in Rushinga District, and why?

SECTION 3: Household Food Security Status

Objective 3: To assess the level of household food security in Rushinga District in the face of climate change.

9. How would you assess the overall food security situation of households in Rushinga District, and how has this situation changed in the past 10 years due to climate variability?
10. How does climate change affect not just the quantity but also the nutritional quality of food available to households in Rushinga District?
11. To what extent does climate-induced income loss affect households' ability to access food through markets during periods of own-production deficit?
12. In your observation, how are gender and household wealth linked to differences in food security outcomes across Rushinga District?

SECTION 4: Household Coping Strategies

Objective 4: To investigate the coping strategies employed by households in Rushinga District to mitigate the impacts of climate change.

13. What are the most prevalent coping strategies you have observed households in Rushinga District employing during periods of climate-induced food shortages?
14. To what extent does reliance on food aid from government and NGO programmes adequately address the food security needs of households in Rushinga District during climate-induced lean seasons?
15. How does the progressive depletion of household productive assets such as livestock and farming equipment through distress sales affect households' long-term capacity to recover from climate shocks?
16. In your view, what are the limitations of current coping strategies employed by households in Rushinga District, and how do these limitations deepen long-term food insecurity?

SECTION 5: Sustainable Adaptation Strategies

Objective 5: To recommend sustainable adaptation strategies that can be employed to mitigate the impact of climate change and enhance food security.

17. What climate adaptation strategies do you consider most practical and effective for improving food security among smallholder farming households in Rushinga District?
18. How adequate is the current agricultural extension service delivery in equipping farmers in Rushinga District with the knowledge and skills required for climate adaptation?
19. To what extent would expanded access to irrigation infrastructure transform food security outcomes in Rushinga District, and what barriers currently limit this expansion?
20. What specific policy or institutional improvements would you recommend to strengthen climate adaptation and food security outcomes in Rushinga District?

CLOSING REMARKS

Thank you sincerely for taking the time to participate in this interview. Your insights are extremely valuable and will contribute significantly to the findings of this study. Please be assured that all information shared will remain confidential and will only be used for the stated academic purpose. Should you wish to review a summary of the findings once the study is complete, please do not hesitate to reach out.

FOCUS GROUP DISCUSSION GUIDE

Research Topic:

Assessing the Effects of Climate Change on Food Security in Rushinga District of Mashonaland Central

Institution: Bindura University of Science Education (BUSE)

Target Participants: Smallholder Farming Households (Mixed Gender), Wards 1, 2, 12 and 15, Rushinga District

Group Size: 8 to 12 Participants Per Group | Estimated Duration: 60 to 90 Minutes

INTRODUCTION

Good [morning/afternoon]. My name is Paul Kwaringa from Bindura University of Science Education (BUSE). I am conducting research on the effects of climate change on food security in Rushinga District as part of my academic programme. I have invited you here today to share your experiences and perspectives on how climate change has affected farming and food security in your community.

This is a group discussion and there are no right or wrong answers. All views are equally important and I encourage everyone to participate. This discussion will be audio recorded with your permission to ensure that no important information is missed. All responses will be kept strictly confidential and will only be used for academic purposes. You may withdraw from this discussion at any time without any consequence.

Ground Rules for the Discussion

- Please speak one at a time so that all contributions can be clearly recorded.
- Please respect the views of others even when they differ from your own.
- There are no right or wrong answers. Your personal experiences are what matter most.
- Please feel free to build on or respectfully challenge the contributions of others.
- All information shared today will remain strictly confidential.

SECTION 1: Climate Change Trends in Rushinga District

Objective 1: To critically analyse the elements of climate change including temperature changes and rainfall in Rushinga District.

1. Looking back over the past 10 to 15 years, what changes in temperature and rainfall have you noticed in your community in Rushinga District?

2. Can you describe the dry spells and extreme weather events that your community has experienced in recent years, and how these compare to what you experienced when you were younger?
3. Have the traditional signs that your community used to predict the start and pattern of the rainy season remained reliable? Please explain.
4. Are there differences in how climate change has affected different parts of Rushinga District? Which areas seem to have been hit hardest and why?

SECTION 2: Effects on Agricultural Productivity and Food Availability

Objective 2: To examine the effects of climate change on overall agricultural productivity and food availability in Rushinga District.

5. How have the changes in climate that you described affected crop production in your community over the past 10 years?
6. How have climate changes affected the livestock that households in this community keep, and how has this affected the food available to your families?
7. How has the amount and variety of food available to your household changed over the past 10 years as a result of poor harvests linked to climate change?
8. Are there households or groups in your community that have been more severely affected by climate-induced food shortages than others? Who are they and why?

SECTION 3: Household Food Security Status

Objective 3: To assess the level of household food security in Rushinga District in the face of climate change.

9. How would you describe the food security situation of households in your community today compared to 10 years ago? Has it improved, worsened or remained the same?
10. When food becomes scarce in your community, who tends to eat less first within the household, and how does this affect different family members?
11. How has climate change affected the quality and nutritional variety of food that your household is able to eat throughout the year?
12. Have income losses from poor harvests made it more difficult for your household to purchase food from markets when your own production is insufficient?

SECTION 4: Household Coping Strategies

Objective 4: To investigate the coping strategies employed by households in Rushinga District to mitigate the impacts of climate change.

13. What do households in your community typically do when food runs short due to drought or crop failure? What strategies are most commonly used?
14. How helpful has food aid from government programmes and NGOs been in meeting your community's food needs during climate-induced lean seasons?
15. Have community members been forced to sell livestock or farming equipment to buy food during difficult seasons? What long-term consequences has this had?
16. How has the extended family and community support network functioned during climate-induced food shortages? Has this changed over time?

SECTION 5: Sustainable Adaptation Strategies

Objective 5: To recommend sustainable adaptation strategies that can be employed to mitigate the impact of climate change and enhance food security.

17. What farming practices have households in your community adopted to reduce the effects of climate change on crop production, and how well have these worked?
18. How have households in your community dealt with the challenge of reduced and unreliable rainfall, and what water management practices have been most helpful?
19. How frequently do agricultural extension officers visit your community, and how useful is the guidance they provide for adapting to climate change?
20. If you could advise the government and development organisations on the most important investments needed to help your community adapt to climate change and become more food secure, what would your top recommendations be?

CLOSING REMARKS

Thank you very much for your time and for sharing your experiences so openly and honestly. The information you have provided will contribute significantly to research that aims to improve understanding of climate change and food security challenges in Rushinga District. Your responses will remain strictly confidential. If you have any questions about this research, please do not hesitate to contact the researcher at Bindura University of Science Education.

End of Focus Group Discussion Guide