

Exploring Climate Change Impacts on Subsistence Agriculture in Chirumanzu District, Midlands, Zimbabwe

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ABSTRACT

In Zimbabwe, most rural communities depend on rainfed agriculture for their livelihoods, yet subsistence farming remains highly affected by climate change. In Chirumanzu District, climate change challenges include erratic rainfall, prolonged droughts, soil degradation, and declining crop yields. This study aims to explore how climate change affects subsistence farming in Chirumanzu District. Guided by the Vulnerability and Adaptation framework, the study employed a mixed-methods research design. Data were collected through focus group discussions with farmers and interviews with other stakeholders. Purposive random sampling was used to select participants, ensuring the inclusion of diverse perspectives across Ward 21. Findings show that farmers in Chirumanzu have observed significant climatic shifts, including late rainfall, unpredictable seasons, heatwaves and frequent dry spells. These changes have resulted in reduced maize yields, crop failures, livestock losses, and severe food insecurity in households. Farmers have resorted to coping strategies such as small-grain farming, tillage farming, rainwater harvesting, crop rotation, and planting drought-resistant crops. However, limited resources, weak extension support and limited climate information systems hinder long-term adaptation. The study, therefore, concludes that climate change has significantly altered agricultural production and livelihoods in Chirumanzu. It recommends improved access to agricultural inputs, increased support from agricultural extension officers, investment in water infrastructure, strengthening of early warning systems, and support for community-driven adaptation strategies.

Keywords: *Adaptation, Climate change, Climate- sensitive diseases, Food security, Rural livelihoods, climate-smart agriculture.*

1. INTRODUCTION

Climate change is one of the global environmental changes that affect livelihoods. Climate change refers to any change in climate over time, whether due to natural variability or human activity (Kundzewicz et al., 2007). It is the change in weather patterns that occurs over a defined area. The effects of climate change are characterised by crop failure, livestock deaths and low crop yields, all of which lead to declining agricultural productivity, particularly in nation-states that rely on subsistence farming, such as Rwanda, Uganda, Namibia and Zimbabwe (Tayengwa, Tirivangasi, & Rankoana, 2020). Subsistence farming, which is also known as smallholder farming, has been defined by Barnett et al. (1997), cited in Morton (2007) as farming and associated activities which together form a livelihood strategy where the main output is consumed directly, where there are few, if any, purchased inputs and where only a minor proportion of output is marketed. This means that subsistence farming is not for commercial purposes; hence, production is on a small scale, meant only for the family. This form of farming in which nearly all the crops or livestock raised are used to maintain the farmer and the farmer's family, living little, if any, surplus for sale or trade (Kaya, 2016).

Subsistence agriculture is the primary source of livelihood for over 70% of Zimbabwe's population, with rural households relying heavily on small-scale, rain-fed farming systems (Nciizah, 2015). Increasing climate variability, including erratic rainfall, prolonged droughts and rising temperatures, has severely undermined agricultural

productivity and household food security, particularly for small-scale farmers in developing regions (Dlamini, Crespo, van Dam, Gaso, & de Wit, 2026). Smallholder and subsistence farmers in Zimbabwe face significant vulnerability to climate variability, largely because most of them rely on rain-fed agriculture. The combination of increasingly erratic rainfall, recurrent droughts and heatwaves exacerbated by El Niño has led to widespread crop failure and reduced food security. With limited access to modern technology, irrigation and financial resources, the adaptive capacity of these farmers is low (Nkonya, Kato, Msimanga, & Nyathi, 2023). While the effects of climate change on agriculture have been recorded at national and regional scales, there is a lack of localised evidence representing the experiences of smallholder farmers in Chirumanzu. This research fills this gap by analysing the impact of climate change on subsistence farming and rural quality of life in the region.

The aim of the study was to explore the impacts of climate change on subsistence agriculture in Chirumanzu District, Midlands, Zimbabwe. The main objectives were 1. To assess subsistence farmers' perceptions and awareness of climate change in Chirumanzu District. 2. To examine the impacts of climate change on agricultural production, food security and household livelihoods. 3. To identify the coping and adaptation strategies used by farmers in response to climate variability. 4. To analyse the challenges and constraints that hinder effective climate adaptation among subsistence farmers. 5. To provide recommendations for strengthening climate resilience and sustainable agricultural practices in the district.

2. BACKGROUND

Subsistence agriculture is the primary source of livelihood in Zimbabwe's Chirumanzu district, with rural households relying heavily on maize and small grain production for both food security and income. However, this sector is increasingly vulnerable to climate-related shocks, including delayed onset of rain and mid-season dry spells. These adverse weather patterns have resulted in significantly lower crop yields, recurrent crop failures, and growing food insecurity, reflecting broader national challenges (Kori, Francis, & Zuwarimwe, 2021). According to recent analyses, rainfall variability has disrupted traditional agricultural calendars, reducing soil moisture availability and shortening growing seasons, thereby diminishing yields and heightening vulnerability among smallholder farmers (Mensah, Osei-Acheampong, Jacobs, Cunningham, & Akoto, 2025). These trends have increased food insecurity in rural areas and weakened household resilience, especially for farmers with restricted access to irrigation, improved seed varieties and adaptive technologies.

Existing research confirms that farmers' perceptions of climate change act as a primary driver of local coping and adaptation behaviours (Asrat & Simane, 2018). These perceptions, often shaped by lived experiences, agricultural practices and indigenous knowledge, directly influence the decision to implement adaptation strategies, such as switching crop varieties, altering planting dates and adopting soil conservation techniques (Han, Youn, Yin, Lee, & Choe, 2026). For example, farmers in Chirumanzu have reported observing changes in rainfall and temperature regimes, leading them to adjust crop choices and management practices, yet despite awareness of these climatic shifts, the effectiveness of locally adopted adaptation strategies remains constrained by socio-economic barriers such as limited access to climate information, financial resources and agricultural extension services (Kori et al., 2021).

Given these challenges, comprehending the specific effects of climate change on subsistence farming in Chirumanzu district is essential for guiding policy measures, institutional assistance and community resilience development. This research addresses the demand for localised data on the impacts of climate change on agricultural productivity, livelihoods and adaptation practices, information crucial for creating effective, context-specific interventions to improve food security and rural sustainability in Zimbabwe

2.1. Study Area

The study was conducted in Chirumanzu District Ward 21, which is one of the rural wards with a high concentration of subsistence farmers. Ward 21 has four villages, which are Kwayedza, Manhovo A, Manhovo B and Nyamandi.

Table 1. Rainfall patterns and temperatures.

Climate condition	Range
Rainfall	500- 750 mm
Temperature	12-34 °C

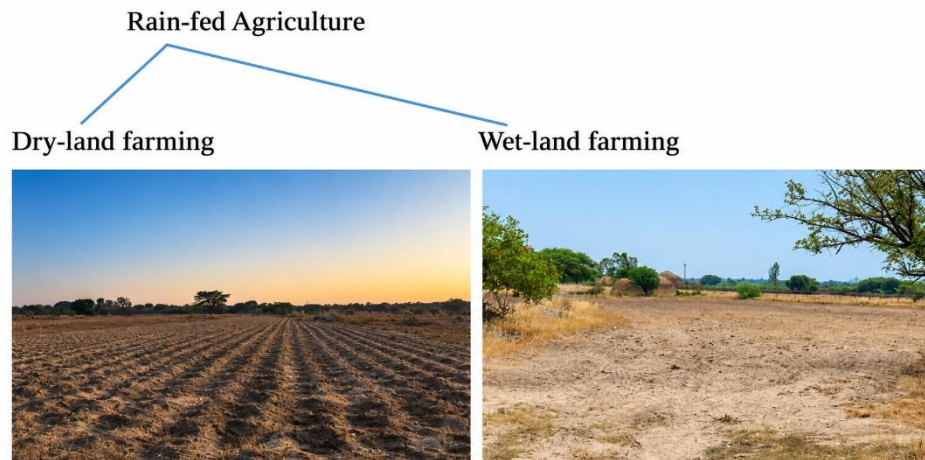


Figure 1. Types of agriculture in Chirumanzu.

2.2. Theoretical Framework

This study is guided by the Vulnerability and Adaptation Framework. The Vulnerability and Adaptation Framework, widely developed by the Intergovernmental Panel on Climate Change (IPCC), is one of the most influential approaches for analysing climate change impacts on human and environmental systems.

The IPCC Third Assessment Report (TAR) describes vulnerability as “The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes (Brooks, 2003). Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity” (Intergovernmental Panel on Climate Change, 2001). Climate Change Vulnerability is also defined by the IPCC as the susceptibility of a species, system or resource to the negative effects of climate change and other stressors. *Vulnerability* refers to the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes (Food and Agriculture Organisation, n.d). The fifth assessment report of the IPCC Working Group II defines vulnerability as “the propensity or predisposition to be adversely affected” (Intergovernmental Panel on Climate Change, 2014). Therefore, vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed (exposure), its sensitivity, and its adaptive capacity. This refers to the ability of systems, institutions, humans, and other organisms to adapt to potential damage, capitalise on opportunities, or respond to consequences (Intergovernmental Panel on Climate Change, 2014). With regard to climate change, the vulnerability of a given system or society is a function of its physical exposure to climate change effects and its ability to adapt to these conditions. The framework views vulnerability as a function that includes three interrelated components: exposure, sensitivity, and adaptive capacity.

Exposure is defined in the same report as “The nature and degree to which a system is exposed to significant climatic variations” (Intergovernmental Panel on Climate Change, 2001). Climate Action Tool (2026) defines exposure as the amount and rate of change that a species or system experiences from the direct (e.g., temperature, precipitation changes) or indirect (e.g., habitat shifts due to changing vegetation composition) impacts of climate change; It says that exposure includes the nature, magnitude and frequency of climate-related events affecting a particular region. Food and Agriculture Organisation (n.d) also defines *Exposure* as the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected. Chirumanzu district farmers experience climate hazards such as droughts, erratic rainfall, and rising temperatures, which increase their vulnerability to the impacts of climate change (Intergovernmental Panel on Climate Change, 2022).

Sensitivity, on the other hand, is “the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).” Climate Action Tool (2026) defines sensitivity as the characteristics of a species or system that depend on specific environmental conditions and the degree to which it is likely to be affected by climate

change (e.g., temperature or hydrological requirements). [Food and Agriculture Organisation \(n.d\)](#) defines *Sensitivity* as the degree to which a system or species is affected, either adversely or beneficially, by climate variability or change", but it is not "how affected a system is after the exposure. Subsistence farming systems that depend largely on rainfall are highly sensitive to climatic changes, which makes rural communities vulnerable to crop failures and livestock losses ([Food and Agriculture Organization of the United Nations, 2013](#)).

Adaptive capacity is "The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" ([Intergovernmental Panel on Climate Change, 2001](#)). In the context of assessments of impact and vulnerability (sometimes termed outcome vulnerability) that adopt a top-down approach, adaptive capacity is understood as the system's ability to avoid potential damage, take advantage of opportunities, and cope with the consequences of damage ([Food and Agriculture Organisation, n.d](#)). Adaptive capacity is influenced by access to resources, information, institutions, and technologies that enable communities to respond effectively to climate-related challenges ([Adger, 2006](#); [Intergovernmental Panel on Climate Change, 2022](#)). These three components interact dynamically, meaning that vulnerability increases when exposure and sensitivity are high but adaptive capacity is low.

2.3. Relevance of the Framework to the Study

The vulnerability and adaptation framework is the most suitable theory for this study because it provides a guide for analysing how climate change affects subsistence farming. In Chrumanzu, farmers are exposed to erratic rainfall, droughts and extreme temperatures, all of which affect agricultural productivity. Subsistence farmers are also sensitive to climatic variations because they depend largely on rain-fed agriculture and natural ecosystems ([Food and Agriculture Organization of the United Nations, 2013](#)). The framework enables examination of adaptive capacity through access to agricultural inputs, climate information, and socio-economic resources, which determine farmers' ability to cope with climate-related stresses ([Intergovernmental Panel on Climate Change, 2022](#)). Overall, the framework provides a structured way to analyse how climate risks are experienced, interpreted, and managed by subsistence farmers, making it highly relevant for examining vulnerability and resilience in rural Zimbabwe.

3. LITERATURE REVIEW

Climate change has become a topical issue, and many studies have been conducted worldwide on it. [Jalloh, Edo, Onyibe, and Nwosu \(2023\)](#) conducted a study titled "Farmers' Perception of Climate Change: A Case Study from Subsistence Farming in Lalehun Kovama of Kailahun in Eastern Sierra Leone." This study looked at the impact of climate change on subsistence farming. Farmers in rural Sierra Leone mostly practice subsistence agriculture. Many predictions have been made by the scientific community using climate and crop modelling techniques regarding the impact of climate change on agriculture and other spheres of life. This research aimed to explore the knowledge and perceptions of subsistence farmers regarding the impacts of climate change on their farming activities and well-being. This study hoped to broaden the research on subsistence farmers' perceptions of climate change. The study revealed that most farmers (67.5%) were illiterate and thus lacked knowledge of climate change; some farmers (27.3%) were able to sense changes in climatic patterns. The majority of respondents (49.4%) agreed that the rice farming calendar has changed. According to the respondents, this was responsible for the low rice productivity in the study area. There is an urgent need to provide agricultural education to empower farmers with the methods and techniques of climate-smart agriculture and to sensitise them to the impacts of climate change in extremely rural areas.

[Landaverde, Rodriguez, Niewoehner-Green, Kitchel, and Chuquillanqui \(2022\)](#) conducted a study titled "Climate Change Perceptions and Adaptation Strategies: A Mixed Methods Study with Subsistence Farmers in Rural Peru." In Peru, subsistence farmers experience the direct and indirect impacts of climate change (CC) firsthand. To understand how farmers adapt their livelihoods to climatic variability, this mixed-methods study explored their perceptions and climate-adaptation strategies in Huayhuay, Peru. 20 farmers participated in semi-structured interviews, and 103 completed a survey. The results indicated that most farmers perceive changes in temperature, precipitation, and drought that negatively affect agricultural production and local natural resources. To address CC, farmers are implementing 26 climate adaptation strategies. Diversifying agricultural products and practices and exploring new economic activities were adaptability strategies identified in this study that the literature has previously documented

as having positive implications for agricultural livelihoods. However, some farmers reported that adaptability strategies are failed attempts at local climate action. The results, along with the literature on adaptation, revealed that farmers implement locally accessible adaptation strategies based on their perceptions of climate variability. Therefore, this study recommends exploring CC perceptions and adaptability strategies with a site-based approach. It is also recommended that future research, local climate planning, and action must focus on the efficiency and inclusiveness of strategies rather than their frequency or levels of adoption. Finally, strengthening CC technical capacities and knowledge among subsistence farmers must be a priority for authorities and practitioners in Huayhuay, Peru.

Climate change has also had an impact in Africa. [Asare-Nuamah \(2021\)](#) conducted a study on climate variability, subsistence agriculture, and household food security in rural Ghana. This study investigated smallholder farmers' perceived impact of climate variability on subsistence agriculture. The study further explored household food security from an access perspective and the factors that influence food accessibility in the rural Adansi North District of Ghana. Results show that climate variability significantly affects subsistence agriculture, reducing yields and leading to household food insecurity. It also emerged that the majority of households (58%) experienced food anxiety, while 62% were unable to access their preferred quantity and quality of food. Household food security is significantly influenced by gender, household size, years of farming experience, access to forest and adaptation. Research indicates that Zimbabwe has experienced a marked decrease in seasonal rainfall and increased frequency of extreme weather events over the past three decades ([Unganai & Murwira, 2010](#)). Smallholder farmers often report declining crop yields attributed to late rainfall onset, mid-season dry spells and excessive heat ([Mavhura, Manyangadze, & Aryal, 2022](#)). [Tayengwa et al. \(2020\)](#) examined Rural Community Perceptions of the Impact of Climate Change on Subsistence Farming: The Mutoko Community in Zimbabwe. The study explored the impact of climate change on subsistence farming in the Mutoko community, Zimbabwe. Mutoko is a rural community situated in the eastern part of Zimbabwe. Climate change is one of the biggest environmental challenges. The most affected people are the rural poor because they are highly dependent on climatic and environmental factors and have a greater reliance on climate-sensitive sectors such as agriculture and health, posing critical challenges to natural development. Focus group discussions were conducted to explore perceptions of climate change and its impacts on subsistence farming. The study reports community members' awareness of changes in the local natural environment. The changes are increased temperature and scarcity of rain. Observable impacts of these changes are decreased crop yields due to drought. The findings are supported by the observation that Zimbabwe lies in a semi-arid region with limited, unreliable rainfall and temperature variability. Rainfall exhibits considerable spatial and temporal variability. It is concluded that climate change is having a real impact on subsistence farming and negatively affecting food security in the study area.

[Ndlovu, Prinsloo, and Le Roux \(2020\)](#) investigated the Impact of climate change and variability on traditional farming systems: farmers' perceptions from south-west, semi-arid Zimbabwe. Despite the annual climate variability that threatens it, traditional farming in semi-arid Zimbabwe remains entrenched in unproductive, rain-fed agricultural practices. Farmers' adaptation strategies seem to be failing to mitigate climate impacts, as evidenced by annual crop and livestock losses. Matabeleland South Province was a thriving livestock- and small-grain-producing province in the 1970s. Today, the province relies heavily on humanitarian assistance from the government and humanitarian agencies. Through a literature review, observations, and focus group discussions with 129 farmers, the qualitative study established farmers' perceptions of the impacts of climate variability over the past 20 years in the Mangwe, Matobo, and Gwanda districts of Zimbabwe. The study (1) analysed changes in climate and weather patterns in the past 20 years; (2) analysed climate impacts on traditional farming systems in the past 20 years in Gwanda, Mangwe and Matobo districts in Zimbabwe; and (3) established farmers' perceptions, experiences and their climate adaptive strategies. The findings showed that the farmers experienced annual heat waves, protracted droughts, erratic rainfall, frost, and floods, resulting in environmental degradation. Traditional farming systems and practices have been abandoned in favour of buying and selling, gold panning, and other alternative livelihood options because of climate-related threats and misconceptions about climate change. Farmers lack access to timely and comprehensive weather forecasts, resulting in annual crop and livestock losses and compromising decision-making. Given that the smallholder farming system sustains the bulk of the population in Matabeleland South Province, Zimbabwe, climate education and capital investment are needed to change traditional farmers' perceptions of climate change impacts on farming practices. Increased climate awareness initiatives, the establishment of village-based weather stations,

and the integration of traditional farming climate knowledge with modern practices are highly recommended to enhance climate resilience.

Tayengwa et al. (2020) conducted a study exploring the impact of climate change on subsistence farming in the Mutoko community, Zimbabwe. Mutoko is a rural community situated in the eastern part of Zimbabwe. Climate change is one of the biggest environmental challenges. Its impact is more intense in developing countries, particularly in rural communities, which have become a major concern for the societal livelihood. The most affected people are the rural poor because they are highly dependent on climatic and environmental factors and have a greater reliance on climate-sensitive sectors such as agriculture and health, posing critical challenges to natural development. The study reports community members' awareness of changes in the local natural environment. The changes are increased temperature and scarcity of rain. Observable impacts of these changes are decreased crop yields due to drought. The findings are supported by the observation that Zimbabwe lies in a semi-arid region with limited, unreliable rainfall and temperature variability. Rainfall exhibits considerable spatial and temporal variability. It is concluded that climate change is having a real impact on subsistence farming and negatively affecting food security in the study area.

Kori et al. (2021) investigated the Intangible and Indirect Costs of Adaptation to Climate Variability Among Maize Farmers: Chirumanzu District, Zimbabwe. They noted that maize farming in the resettlement areas of Zimbabwe's Chirumanzu District is vulnerable to climatic variations. The Government of Zimbabwe encourages maize farmers in resettlement areas to adapt to climate variability through conservation farming and diversification, among other measures. It is envisaged that the measures will improve maize farmers' resilience and ability to safeguard food and nutrition security in the country. However, the process of adaptation is dynamic, complex, and multifaceted. Several problems and dangers accompany the process of adaptation. The problems and dangers are associated with intangible and indirect costs. The focus of this study was to explore the intangible and indirect costs associated with measures adopted by maize farmers in the resettlement areas of Chirumanzu, Zimbabwe. Diversification, changes in planting dates, and the use of drought-tolerant varieties were among the measures adopted. Several problems and dangers accompanied the adaptation measures adopted. Intangible costs such as pain and suffering, embarrassment, ridicule and stereotyping were experienced. Indirect costs, including additional and unplanned costs, were also encountered. This chapter concluded that intangible and indirect costs associated with adaptation may reduce maize farmers' adaptive capacity and resilience. Therefore, national governments should exercise extreme caution and refrain from encouraging farmers to adapt on their own. Rather, they should consider the intangible and indirect costs of providing solutions to reduce them, to avoid situations where farmers are worse off, and to facilitate sustainable adaptation.

While all these studies on climate change and subsistence farming examined specific aspects of climate change, such as adaptation strategies, adaptation costs, and psychosocial impacts, among other issues. There is limited literature on the combined effects of climate change on the broader subsistence farming system, including crop production, livestock management, household food security and rural livelihoods, especially in Chirumanzu district. Chirumanzu was specifically chosen because the district is characterised by low, erratic rainfall, recurrent droughts, rising temperatures, and frequent mid-season dry spells. Agriculture is largely rain-fed, making the community highly vulnerable to climate variability and climate change. There is a need to understand the interconnected effects of climate change on crop production, livestock farming, and rural livelihoods, and Chirumanzu was the best area of study. The study, therefore, seeks to fill this gap by employing the vulnerability and adaptation framework to assess farmers' exposure, sensitivity, and adaptive capacity in relation to climate change impacts on Subsistence farming in Chirumanzu District, Zimbabwe.

4. METHODOLOGY

This study adopted a mixed-methods approach, combining both qualitative and quantitative research. The quantitative component included data collection and analysis of rainfall patterns, temperatures and crop yields in Ward 21 through questionnaires given to local agricultural extension officers and farmers in the area. In addition to the quantitative data, qualitative insights were gathered through focus group discussions (FGDs) with 60 local subsistence farmers (15 from each village, randomly selected) and made up 4 Focus Groups and semi-structured interviews with 5 agricultural extension officers, 3 Ward officials and 15 community leaders.

These participants were selected because they are residents of Chirumanzu in Ward 21 and have been living there for more than 10 years and are directly involved in the farming system in the area. The rationale for this choice is that these participants are best positioned to provide relevant, first-hand insights into how climate change has affected the agriculture system in Chirumanzu Ward 21. Focusing on this population ensures that the findings are contextually grounded and applicable to improving farming strategies in the Chirumanzu area.

Ethical considerations were implemented, including measures to ensure confidentiality by protecting the identities and personal information of all participants. Participants' names and any identifying details were not disclosed in the research report and pseudonyms or codes were used instead. All data collected, including recordings, transcripts, and digital materials, were stored securely on password-protected devices and were accessible only to the researcher. Participants were informed about the purpose of the study and their right to privacy before data collection. Any information shared during the research was used strictly for academic purposes and was not disclosed to unauthorised individuals. This process ensured that participants' confidentiality, dignity and anonymity were fully protected throughout the research process. They also signed a consent form to this effect.

Data were analysed using SPSS to identify statistical patterns and NVivo for thematic coding of qualitative responses. (In this study, NVivo was used to organise and analyse interview and focus group data. First, the researcher transcribed all the recorded conversations and loaded them into NVivo. She then highlighted key points and grouped them into themes. These themes helped in understanding common ideas and experiences. SPSS, on the other hand, was used to enter and clean climate and crop data. Numbers for rainfall, temperature and crop yields were entered into the software. SPSS helped summarise the data by calculating averages, medians and measures of variability. It was also used to create graphs and pie charts showing how rainfall, temperatures and crop yields have changed over time. The software was used to analyse whether changes in rainfall and temperature affect crop yields.

5. FINDINGS AND DISCUSSION

This section presents the study's findings from questionnaires, interviews and focus group discussions conducted with subsistence farmers, community leaders and agricultural extension officers in Chirumanzu District. The results are organised into themes derived from the study objectives. Verbatim quotes are included to illustrate participants' experiences and perceptions.

5.1. Perceptions and Local Experiences of Climate Change

Most participants, especially elderly farmers and those who have stayed in Chirumanzu for more than 10 years, showed a clear awareness of changes in climatic conditions over the past decade. They acknowledged that the seasons had changed because the rainy season was no longer predictable, as it had been in earlier decades. They said that farming was now done by trial and error because one is not sure when to start planting. The nature of rainfall patterns made planning nearly impossible. The participants observed that the rains now typically began in late November or early December and ended before the crops were ready. Farmers fail to access timely and comprehensive weather forecasts, resulting in annual crop and livestock losses, as decision-making is compromised (Ndlovu et al., 2020)

Farmers consistently noted shifts in rainfall patterns, increased temperatures and more frequent dry spells.

"In the past, we knew the rains would start in September or October, but now we wait until late November or even December. Things have changed" (Community leader 7)

Our challenge is that we do not know when to start planting, so we may end up planting the same field three or more times. Rains come, we plant, the plants dry up, we start again, because we don't know whether we should start planting or not (FGD 3)

The community is unable to predict whether to embark on early or late farming. The first rains in 2025 came on November 2, after they had held a rain-making ceremony and they did not stop until April 2026. Actually, there was too much rain this season, such that those who had planted maize in wetlands did not get any yield. All the plants were soaked in water and they had to switch to traditional rice. One of the Agriculture Extension Officers (AEO) in the area said that, rainfall in Chirumanzu this year recorded over 1000 ml, which had not happened in the past decade.

Participants reported that in the past few years, they have been experiencing hotter days than nights. Farmers said that temperature variations have negatively impacted their well-being. The changes threaten their physiological

needs, including access to water and agricultural resources, according to their reported concerns. Exposure to such conditions can harm the agricultural sector by causing water shortages for farming and human use, significantly impacting the community.

“The heat is just too much now. Wetlands (Matoro) are very dry. We used to get rain in June and then we would do winter ploughing, but these days there is no winter rain anymore. So we can’t even plant crops in wetlands in August, as we used to. It was never this hot when we were growing up.” (FGD2)

It’s now so hot that all nearby rivers and wells have dried up. We now travel 2 to 4 km to fetch water for domestic use because even the nearest boreholes no longer have water (FGD3).

We used to have cooperative gardens where we planted various crops throughout the year. This helped us to have enough food and a surplus to sell. Now, the river we used to draw water from for the garden has dried up due to the high temperatures and we are grounded. (Community leader 4).

The study revealed that subsistence farmers clearly recognize and articulate changing weather patterns, including erratic rainfall, delayed seasons and increased heat. This finding aligns with other studies in Zimbabwe and Southern Africa, which show that rural communities are highly attuned to climate variability due to their direct dependence on environmental conditions for their livelihoods (Jalloh et al., 2023; Landaverde et al., 2022; Ndlovu et al., 2020). Tayengwa et al. (2020) assert that the developing world needs to be taught how to address environmental problems, such as water shortages, and how to diversify to remain relevant in responding to changing climatic conditions. Agricultural Extension officers confirmed these observations. In 2025, temperatures in Chirumanzu reached 40 degrees, a level never experienced before. One Agricultural Extension Officer (AEO) said,

“Farmers are experiencing climate change firsthand. They tell us the temperatures have risen and seasons have shifted.” (AEO1)

Overall, participants recognised climate change as a real and worsening challenge. This resonates with the Intergovernmental Panel on Climate Change (IPCC)’s Fourth Assessment Report, which indicates that changes in temperature patterns and erratic rainfall across the African Continent can impact agriculture, reducing crop yields by almost half by 2020 (Kundzewicz et al., 2007). This will have adverse impacts on the already vulnerable and poor communities that rely on climate-sensitive livelihood sources like agriculture and the exploitation of biodiversity. Changes in temperature and seasonality have direct, immediate effects on flora and fauna as well as on human activities and health (Bhusal 2009, cited in Tayengwa et al. (2020)).

5.2. Impacts of Climate Change on Agricultural Production

Table 2. Climate change impacts in Chirumanzu District.

Impact of climate change	Number of respondents
Decreased crop production	80
Changed rainfall patterns	81
Short season for growing crops	78
Soil degradation	70
Increased pest populations	67
food insecurity	77
Reduced pastures	79
Reduced water sources	78
Increasing diseases	74
Death of livestock	80
Lack of money	75

The study reports that climate change has had a significant impact on subsistence farming and people's livelihoods. Farmers reported reduced crop production, altered rainfall patterns, shorter growing seasons, soil degradation, increased pest populations, food insecurity, reduced pastures, reduced water sources, rising disease incidence, livestock deaths and lack of money as some of the impacts of climate change.

Due to inconsistent rainfall and prolonged droughts. Maize, traditionally the staple crop, was described as increasingly unsustainable. During Focus group discussions, one farmer lamented:

We used to take tonnes of maize bags to GMB at Hama there, but now, hey, you can't even get enough maize to last you until the next season. (FGD3)

You plant maize, but you harvest nothing. Sometimes you don't even get a single bucket. It just dries up or there may be too much rain and you get nothing." (FGD1)

Here in Chirumanzu, we always planted maize and it would do very well. We used to harvest twice per season. We would plant in August, then harvest in December, plant again in December and harvest in April. In wetlands, we would plant rice. But now, wetlands are dry. When rain comes, it comes in abundance for a short season and wetlands get waterlogged. (Community leader 2)

This resonates with [Morton \(2007\)](#) who found that aggregate yields of maize in smallholder rain-fed systems in Africa and Latin America are likely to show a decrease of 10% by 2055, but that these results hide enormous variability and give cause for concern, especially in some areas of subsistence agriculture.

Reduced agricultural productivity directly affected household food availability. During interviews, some farmers said, *"We now buy mealie-meal almost every month like people in towns. Before, seasons changed, our fields gave us enough for the whole year and even surplus to sell."* (FGD 3)

We had to ask every household to give us at least 10 kg of maize so we could take it to GMB, where it could be distributed to the chiefs to give to those who no longer have anything to eat. That never used to happen here, but now things have changed. (Ward leader 2).

We are thinking of reintroducing Zunderamambo (The chief's field), which is planted by all the people of that area, so that we may be able to help those in need in case of drought (Community leader 9)

These impacts contributed to increased poverty, hunger and economic vulnerability.

5.3. The structured dataset below synthesizes crop yield findings for household farming in Chirumanzu District

Table 3: Comparative Analysis of Household Crop Yield Trends, Climate Resilience and Adoption Dynamics in Chirumanzu District

Crop Type	Agronomic Role	10-Year Yield Trend	Climate & Soil Resilience	Farmer Adoption Status	Primary Drivers & Constraints
Maize	Primary staple food crop	Severe continuous decline	Low resilience to soil degradation and dry spells	High persistence (resistant to shifting despite low output)	Nutrient depletion, acidic soils, erratic rainfall, and low drought tolerance.
Sorghum	Traditional small grain/food security backup	Stable to moderate increase	High drought tolerance and low nutrient requirement	Partial adoption; hindered by dietary preference and labor	Deep root system withstands mid-season dry spells; high labor demand for bird-scaring.
Rapoko	Traditional finger millet/cereal crop	Stable yield profile	High resilience to marginal soils and moisture stress	Moderate adoption among traditional/older farming units	Excellent grain storage longevity; intensive labor needed for weeding and processing.
Sunflower	Newly introduced cash/oilseed crop (~3 years)	Emerging positive trajectory	Moderate-to-high drought tolerance; deep taproot system	Selective adoption; growing among early adopters	Short growing period, provides household cooking oil and income, but limited local processing infrastructure.

Data show a dramatic reduction in maize productivity among households in Chirumanzu. As the principal staple crop in Zimbabwe, this sharp decline poses severe threats to household food security. The empirical findings align with broader environmental dynamics in semi-arid districts like Chirumanzu, where agricultural production is predominantly rainfed ([Nyamangara et al., 2014](#)). The observed yield collapse is primarily driven by the

compounding effects of progressive soil degradation exacerbated by continuous monocropping without adequate nutrient replenishment and increasingly unpredictable rainfall patterns characterized by late onset and prolonged mid-season dry spells (Chanza & de Wit, 2016).

In contrast to the steep decline in maize output, traditional small grains demonstrated remarkable resilience and steady yield progression throughout the 10 years. Rapoko (finger millet) and sorghum yields rose consistently. These trends underscore the morphological and physiological advantages of indigenous small grains in moisture-stressed environments. Sorghum and rapoko possess deep root architecture and efficient stomatal mechanisms that enable survival during extended dry spells (Kauma, 2021). The steady increase in small grain production reflects both their inherent drought tolerance and growing agronomic familiarity among local smallholders adapting to climate variability.

The introduction of sunflowers in Chirumanzu marked a pivotal shift in crop diversification strategies for Chirumanzu. Over the three years following their introduction, sunflower yields increased rapidly. This rapid upward trajectory highlights sunflowers' strong adaptability to sandy, nutrient-depleted soils and low-rainfall regimes. As an oilseed crop, sunflowers offer dual socio-economic benefits: enhancing household nutritional security through localized edible oil processing and serving as a viable drought-tolerant cash crop alternative to hybrid maize.

Despite clear empirical evidence demonstrating the vulnerability of maize and the superior performance of small grains and sunflowers, a significant proportion of smallholders exhibit marked resistance to crop transition. This reluctance to abandon maize stems from deeply ingrained socio-cultural, economic, and institutional factors:

1. **Dietary Preferences and Cultural Stigma:** Maize meal (*sadza*) remains the culturally preferred staple. Small grains are often associated with distress foods or historical subsistence diets, creating a cultural barrier to widespread dietary transition.
2. **Labor Demands and Processing Constraints:** Rapoko and sorghum require intensive manual labor for bird scaring, harvesting, and manual processing (threshing and de-hulling), which heavily burdens labor-constrained households.
3. **Market Structures:** Established market channels, seed distribution networks, and institutional grain reserves historically favored maize, leaving value chains for sunflowers and small grains underdeveloped in rural districts (Kauma, 2021).

To counteract the trajectory of declining cereal output and recurring drought impacts, national policy in Zimbabwe has increasingly promoted conservation agriculture through the Pfumvudza/Intwasa program. Grounded in three core agronomic principles- minimum soil disturbance (basin digging), organic mulching, and strategic crop rotation- Pfumvudza aims to climate-proof smallholder farming by maximizing water retention and nutrient efficiency on localized plots (Mujere, 2022). Empirical evaluations of the initiative indicate that full adherence to these conservation practices can substantially boost maize productivity and household food security compared to conventional tillage, even during low-rainfall seasons (Mavesere & Dzawanda, 2023). However, as highlighted in regional adaptation studies across semi-arid zones like Chirumanzu, the broader institutional rollout faces persistent operational bottlenecks, including high manual labor requirements for hole digging, mixing manure and soil, sourcing mulch and mulching (Manyani, Chagweda, Muzenda-Mudavanhu, & Chanza, 2017). Addressing these systemic barriers is essential if climate-smart frameworks are to successfully drive small grain adoption and stabilize communal crop yields alongside broader diversification strategies (Kauma, 2021). A Pfumvudza plot is usually 16 m x 36 m. It has 52 x 28 lines, each basin 15 x 15 cm deep, spaced 60-75 cm apart. 500g of manure or compost is placed in the hole and mixed with soil. Mulching is then done using tree leaves or grass. A coke lid of compound D fertiliser is added on the day of planting, and 3 seeds are placed in a hole in a single line. After 4-6 weeks, the first dressing is done and from 6-8 weeks, a second dressing is done; a bottle cap/ lead 25g of top-dressing fertiliser is added onto the plant. This plot is expected to produce 1 ton of maize, or 52 buckets of grain. All the activities are recorded. Both farmers and extension officers agree that this practice is economical, yields good results in good seasons, and benefits those who no longer have cattle.

Farmers also reported livestock deaths, especially cattle, due to what they called "January disease". Most farmers reported that they no longer have cattle for ploughing. Two farmers combine their cattle so that they can plough their fields. Others have to pay those who still have cattle to get their fields cultivated. During FGDs, farmers said *I had 27 cattle; they all died. I am only left with 2. It's that bad (FDG2)*

I no longer have any cattle; they all died because of January disease. Now it's just me. I will have to do dry planting (dhigaudye) because when the rains come, it will be difficult to find someone to plough for you. People will be busy in their fields (FGD1)

We lost most of our cattle because the rivers dried up. There was no grass to feed them. They would graze on dry soil; it was that bad. (Community Leader 12).



Figure 2. Cattle grazing on dry pastures.

The loss of cattle is devastating for subsistence farmers, as it is their source of wealth; without it, their lives are shattered. Increased livestock losses due to drought reflect broader patterns of climate-linked livestock mortality in Southern Africa (Hove et al., 2021).

Participants described a range of short-term coping mechanisms employed during difficult seasons.

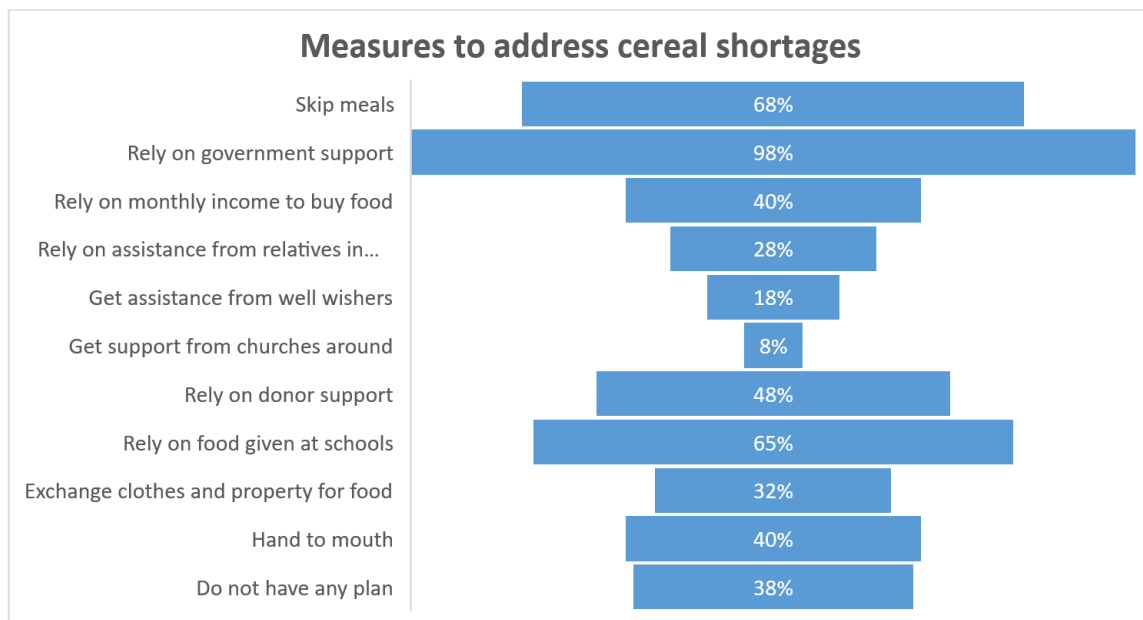


Figure 3. Household and Community Coping Strategies.

Results from the study show that a higher percentage of farmers rely on government support as a coping strategy. According to respondents, the government usually provides seeds, fertilisers and even maize for people to eat during droughts. However, they lamented that not everyone can get these, since they are sometimes not enough for everyone. Preference is then given to the most vulnerable, the elderly, the orphans and those who did not get much during harvest.

A greater percentage also relies on skipping meals. Most respondents said they reduced the number of meals they eat per day. They eat twice a day, in the morning and in the evening.

"We now eat once or twice a day. It is painful, especially for children, but that is how we can manage what we have so that we may safely get to the next season." (FGD4)

Some, especially those with children who go to school, rely on the food provided to schoolchildren at lunchtime. Others, however, rely on donor support. At times, donors bring food to the community and distribute it. This will help to ease the burden. Some who have other things, like clothes, shoes, or books, exchange them for food to survive. However, a few people did not have a plan. They did not know what they would do to survive.

Some relied on assistance from relatives and friends who live in towns;

"Sometimes we survive because our relatives in towns send us groceries or money for mealie-meal." (FGD1)

These strategies help households survive but do not guarantee long-term resilience. Thus, while coping practices mitigate immediate hunger, they often do not build long-term resilience.

5.4. Long-Term Adaptation Strategies and Effectiveness

Participants used several adaptation practices.

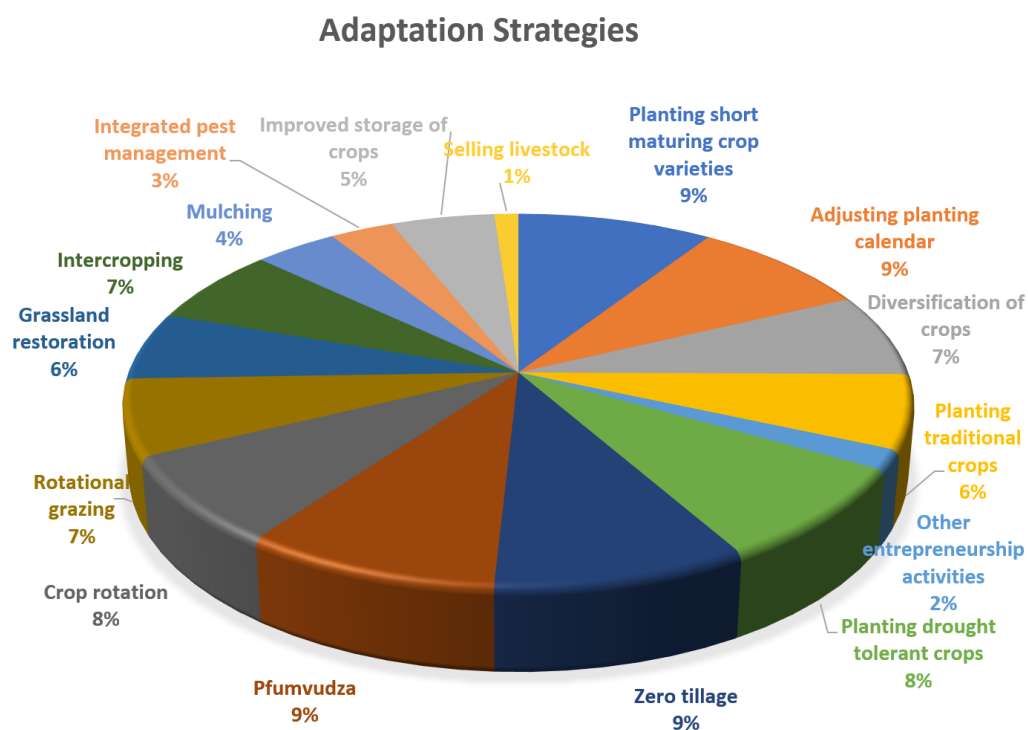


Figure 4. Climate change adaptation strategies.

Findings from the study show that farmers are using a variety of climate change adaptation strategies to improve their crop production. A greater percentage of farmers in Chirumanzu are practising pfumvudza and zero tillage as encouraged by the Agricultural extension officers. Others have resorted to crop rotation and planting drought-tolerant crops that can withstand high temperatures. Some, however, see diversification of crops as a better option because if one crop fails, one may do well. With the help of AEOs, they adjust their planting calendars and plant short-season seeds like Tsuru (555), which takes about 90-110 days to mature, or Mbizi (513), a medium variety that takes about 145 days to mature, according to farmers. Some are practising intercropping and rotational grazing; others are selling their livestock and keeping only a few because the animals may die of disease. Some prefer mulching and others try to control diseases. The results support previous studies showing that climate adaptation is a process in which farmers develop their perceptions and then use them to implement strategies to cope with change. Thus, the results suggest that perceptions of climate variability may influence farmers' decision-making in

Chirumanzu Ward 21 regarding the adaptability of agricultural livelihoods. Despite these efforts, adaptation remain uneven across the district

5.5. Constraints to Climate Adaptation

Study participants noted that, much as they want to implement adaptation strategies to cope with climate change, there are some challenges that hinder them.

5.5.1. Lack of Resources

One of the major constraints reported by participants was the lack of financial and material resources required to implement adaptation measures. Many farmers said they had challenges accessing agricultural inputs such as improved seed varieties, fertilisers, pesticides and farming equipment.

My child, we all want to farm; that is what we have been doing before you were even born, but at times we do not have seeds and fertiliser. The government gives us, yes, but we are too many; it cannot give all of us all the time, so we end up planting seed from our granaries, which may not do well (FGD2)

We do not have money to buy seeds, fertilizer and pesticides in time because we no longer produce much to be able to sell (FGD4).

These findings suggest that poverty and a lack of money to buy inputs lead other farmers to rely on traditional farming methods that are at times ineffective under changing conditions. This is consistent with studies by [Chatsiwa \(2025\)](#) who noted that financial assets determine the adaptive capacity of smallholder farmers and poorer households, both of which are vulnerable to climate change.

5.5.2. Limited Extension Support

Farmers reported inadequate technical guidance and support from Agricultural Extension Officers. They argued that they lack the knowledge that they need about climate change, adaptation strategies and livestock management. They therefore rely on personal experience or information from fellow farmers, which is not always sufficient and correct. One Farmer said;

“Our extension officers really try to teach us what we need to know about these weather changes, but they cover a big area and they cannot cover all areas in time. Maybe if we could get more of them, it would assist.” (FGD3)

Our AEOs try their best to educate us but they have so much to do and therefore can not teach us everything that we need to know in one season. (FGD1)

At times we miss information because we might have failed to attend meetings; maybe if they also write and give us papers with information on how best we can manage these changes in weather patterns, it may help (FGD2)

Findings indicate that insufficient support limits knowledge and reduces the adoption of climate-smart agricultural practices that could improve productivity. This corroborates previous studies by [Zamasiya, Nyikahadzo, and Mukamuri \(2017\)](#) conducted in Hwedza, which found that access to extension services positively influences farmers' willingness and ability to adapt to climate change strategies

5.5.3. Limited Climate Information

Participants said that the lack of reliable localised climate information is another challenge. Some farmers said they hear weather forecasts on the radio or television, but the information is too general and does not adequately reflect local conditions. As a result, they fail to know the proper planting dates, leading to poor agricultural decisions and losses or reduced crop yields. One farmer said

“We hear forecasts on the radio sometimes, but they are not specific to our area. We just guess when to plant.” (FGD 2)

Because we do not know when proper rains for planting will come, we plant as soon as the rain starts. Sometimes it works, but sometimes the rains go, and the crops wilt and we start afresh. (FGD 1)

Findings suggest that the absence of localised, timely climate information undermines farmers' ability to make informed decisions. This aligns with studies done by [Zamasiya et al. \(2017\)](#) which found that access to climate information positively influences farmers' attitudes towards climate adaptation and enhances their willingness to adopt adaptive strategies.

6. CONCLUSIONS

The study concludes that farmers in Chirumanzu District are highly aware of climate change and experience severe agricultural and livelihood impacts. Climate change has changed agricultural production and livelihoods in Chirumanzu. Maize, which has traditionally been the dominant crop in the area, is no longer performing well due to changing climatic conditions characterised by erratic rainfall patterns and rising temperatures. Despite these challenges, most farmers continue to depend heavily on rain-fed agriculture in both dryland and wetland areas, making them vulnerable to climate variability. The study further concluded that climate change has contributed to the prevalence of livestock diseases, causing the death of cattle and other livestock, which are sources of wealth for farmers in Chirumanzu. Grazing lands have also been affected by reduced rainfall and extreme temperatures, resulting in insufficient pasture. To cope with declining crop production and food shortages, farmers have adopted various strategies to adapt to climate change. These have not been very effective due to underlying challenges. Since many can no longer produce a surplus for sale, household incomes have declined and the capacity to meet basic needs has diminished.

7. RECOMMENDATIONS

Aware of the impact of climate change, participants also offered clear recommendations to strengthen resilience within their communities.

Participants noted the need for timely, accurate weather forecasts and seasonal predictions, which would help farmers to make informed decisions about planting dates, seed selection, livestock management and water conservation. This could be done through radio broadcasts, Agricultural extension officers, mobile messages or community meetings. Timely provision of climate-smart agriculture inputs could significantly enhance farmers' ability to cope with erratic rainfall patterns and prolonged dry spells. Farmers also noted the importance of Agricultural extension officers in providing knowledge and they felt that the current level of support needs to improve. They therefore recommended increasing the number of AEOs in the area and having important information written down. AEOs should provide them with climate change information and regular training programs on climate-smart agricultural practices to equip them with the knowledge needed to adapt to changing environmental conditions and improve agricultural productivity. Agricultural extension programs (e.g., Agritex) should continue to expand training in climate-smart conservation agriculture (*Pfumvudza/Intwasa*), while local authorities and non-governmental partners prioritize the provision of mechanized post-harvest processing equipment to relieve labor burdens associated with small grains.

Participants also identified investment in water infrastructure as an important opportunity for strengthening community resilience. They said borehole and water-harvesting initiatives could help address water shortages, reduce dependence on unpredictable rainfall and enable year-round agricultural production. Another recommendation from participants was to promote fish farming by constructing community and household fishponds to diversify livelihoods and reduce vulnerability to climate change. They suggested that fishponds could be established using water from boreholes or nearby rivers and dams. This could provide them with food security and income through fish sales, alleviate poverty and strengthen resilience by reducing dependence on rain-fed agriculture.

The study also recommends promotion of livelihood diversification as a strategy for reducing dependence on climate-sensitive agriculture. Farmers are encouraged to do alternative income-generating activities such as poultry farming, fish farming, beekeeping, or rabbit keeping. Diversified income would reduce household vulnerability to crop failures and livestock losses, thereby improving economic stability. The study also notes that local communities have valuable indigenous knowledge regarding weather prediction, crop management and resource conservation, which are often overlooked in formal climate adaptation programs. Collaboration with universities, agricultural research institutions, government departments and farming communities is important to ensure that research outputs address local needs and benefit rural farmers. Integrating indigenous knowledge systems with scientific approaches can result in more effective, locally appropriate and sustainable adaptation strategies. Development agencies and policymakers should promote approaches that involve local communities in the design, implementation and monitoring of adaptation interventions

FUNDING

This research was funded by the Midlands State University Research Board in Zimbabwe. (MSU-RB169-2025-EC-01R)

INSTITUTIONAL REVIEW BOARD STATEMENT

This study was approved by the Institutional Review Board of Midlands State University, Gweru, Zimbabwe. Dated, 22 May 2026. Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.

TRANSPARENCY

The author confirm that the manuscript is an honest, accurate and transparent account of the study; that no vital features of the study have been omitted and that any discrepancies from the study as planned have been explained. This study adhered to all ethical practices throughout the writing process.

COMPETING INTERESTS

The author declares that there are no conflicts of interest regarding the publication of this paper

ACKNOWLEDGEMENT

My sincere appreciation goes to Midlands State University for funding this research project. I would also want to thank the Chirumanzu Member of Parliament and Rural District Development Coordinator for permitting me to conduct research in the Chirumanzu area. My sincere gratitude goes to all community leaders, ward officials, Agriculture extension officers and farmers in Chirumanzu for welcoming me in their area and taking the time to participate in this study. I also want to thank journal editors and reviewers for making this publication a success. Thank you.

ARTICLE HISTORY

Received: 11 August 2026/ Revised: 10 September 2026/ Accepted: 26 September 2026/ Published: 14 October 2026

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