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Climate Extremes And Agricultural Resilience: Investigating The Compound Impacts Of Cyclone Idai And El Niño-Induced Drought On Subsistence Farming In Chimanimani, Zimbabwe.

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APPROVAL FORM

The undersigned certify that they have supervised, read, and recommend to the Bindura University of Science Education for acceptance of the research project titled; **CLIMATE EXTREMES AND AGRICULTURAL RESILIENCE: INVESTIGATING THE COMPOUND IMPACTS OF CYCLONE IDAI AND EL NIÑO-INDUCED DROUGHT ON SUBSISTENCE FARMING IN CHIMANIMANI, ZIMBABWE'**, submitted by ELIAS CHINGOKA (REG NUMBER: B202541B) , in partial fulfilment of the requirements for the **BACHELOR OF SCIENCE HONOURS DEGREE IN AGRICULTURAL ECONOMICS AND MANAGEMENT.**

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DECLARATION

I, ELIAS CHINGOKA, declare that this dissertation titled " CLIMATE EXTREMES AND AGRICULTURAL RESILIENCE: INVESTIGATING THE COMPOUND IMPACTS OF CYCLONE IDAI AND EL NIÑO-INDUCED DROUGHT ON SUBSISTENCE FARMING IN CHIMANIMANI, ZIMBABWE " is my original work and has not been submitted elsewhere for any degree or qualification. I acknowledge that I have received guidance and support from my supervisor, Dr. A.C. Mujeyi, and other academic staff during this research, but the intellectual content and presentation of this dissertation are entirely my own. I have followed the guidelines and regulations of the Bindura University of Science Education regarding plagiarism and academic integrity, and I have properly cited and referenced all sources of information used in this dissertation.

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DEDICATION

This research study is dedicated to

My Family, friends and the families affected by Cyclone Idai.

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ABSTRACT

Agricultural resilience is seriously threatened by climate extremes like tropical cyclones and protracted droughts, especially in subsistence farming communities that mostly depend on rain-fed agriculture. This study examines the combined effects of El Niño-induced drought in 2015–2016 and Cyclone Idai in 2019 on subsistence farming in Chimanimani, Zimbabwe. This area is extremely susceptible to climate variability. This study illustrates how successive climate shocks worsen food poverty, upend livelihoods, and pressure conventional coping mechanisms by examining meteorological data, agricultural productivity patterns, and local farmers' adaptive techniques. According to the findings, farmers use a variety of resilience techniques, such as crop diversification and soil conservation, but these are overpowered by the rising frequency and severity of extreme weather events, which results in long-term drops in agricultural productivity**.** To improve resilience in sensitive agroecological zones, the study emphasizes the critical need for integrated climate adaptation policies that incorporate community-based disaster risk reduction, sustainable agricultural methods, and early warning systems. Finally, by showing the cumulative consequences of successive disasters and promoting proactive, multi-sectoral measures to protect subsistence agriculture in a warming world, this research adds to the larger conversation on climate change adaptation.

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LIST OF ACRONYMS AND ABBREVIATIONS

- **AEM**: Agricultural Economics and Management
- **AGRA**: Alliance for a Green Revolution in Africa
- **BSc**: Bachelor of Science
- **El Niño**: A climate pattern characterized by warming of the Pacific Ocean, causing global weather extremes
- **FAO**: Food and Agriculture Organization of the United Nations
- **GDP**: Gross Domestic Product
- **GIS**: Geographic Information System
- **GOZ**: Government of Zimbabwe
- **IPCC**: Intergovernmental Panel on Climate Change
- **KIIs**: Key Informant Interviews
- **NGO**: Non-Governmental Organization
- **SADC**: Southern African Development Community
- **SDGs**: Sustainable Development Goals
- **SPSS**: Statistical Package for the Social Sciences (software for data analysis)
- **UNDP**: United Nations Development Programme
- **UNDRR**: United Nations Office for Disaster Risk Reduction
- **WFP**: World Food Programme
- **ZimVac**: Zimbabwe Vulnerability Assessment Committee
- **Zim Stats**: Zimbabwe National Statistics Agency

CHAPTER 1

INTRODUCTION 1.1

Climate change refers to long -term shifts in temperatures and weather patterns. Climate change leads to more intense and more frequent weather events such as hurricanes and floods due to increases atmospheric moisture and temperature (Greer et al., 2024). Climate-related disasters, such as cyclones and droughts, pose significant threats to agricultural productivity and food security, particularly in sub-Saharan Africa. Climate change is a widely acknowledged reality (Vermeulen et al., 2010). Its far-reaching consequences are being felt across the globe, with low- and middle-income countries being disproportionately affected due to their heavy reliance on climate-sensitive sectors such as agriculture and forestry (Bojo, 2011; Maharjan & Joshi, 2013). The unique geography and location of these countries exacerbate their vulnerability to climate extremes, which in turn undermine livelihoods, exacerbate food insecurity, and hinder progress towards sustainable development. In response, agricultural resilience – the ability of farming systems to absorb and recover from climate-related shocks – has emerged as a critical area of research and policy focus, aimed at mitigating the adverse impacts of climate change.

The Chimanimani district in south-eastern Zimbabwe is particularly susceptible to climate shocks due to its mountainous landscape and reliance on subsistence agriculture. Subsistence farmers in the region face challenges such as low inputs, limited access to technology, and poor infrastructure. The effects of Cyclone Idai and El Niño-induced drought have severely impacted subsistence farming in the region. Cyclone Idai's floods ruined fields, washed away surface soil, and broke irrigation systems, making it challenging for farmers to revive. The consequences of the cyclone left farmers with lessened seed stocks, poor yields, and increased vulnerability to hunger and poverty. This was intensified by ongoing drought conditions, which exhausted water resources and undermined efforts to rebuild agricultural livelihoods.

This study aims to investigate the separate and compound impacts of Cyclone Idai and El Niño-induced drought on subsistence farming households in Chimanimani, Zimbabwe. By examining the effects of these climate-related disasters, this research seeks to contribute to a better understanding of the challenges faced by subsistence farmers in Zimbabwe and to inform strategies for enhancing their resilience to climate-related stressors.

1.2 Statement of the problem

Despite the growing body of research on climate extremes and agricultural resilience, there is a significant knowledge gap regarding the compound impacts of cyclones and droughts on subsistence farming systems in Zimbabwe. Existing studies have primarily focused on the impacts of individual climate extreme events, neglecting the cumulative effects of multiple events on agricultural productivity and food security. Furthermore, few studies have explored the resilience of subsistence farming households in Zimbabwe to climate extremes, particularly in the context of compound events.

This study aims to address this research gap by investigating the separate and compound impacts of Cyclone Idai and El Niño-induced drought on subsistence farming households in Chimanimani, Zimbabwe. Subsistence farming communities in Chimanimani, Zimbabwe, are facing significant challenges due to the high occurrence and intensity of climate extremes. In recent years, the region has been hit by two major climate-related events: Cyclone Idai in 2019 and recurring El Niño-induced droughts.

According to Abioye et al. (2011) and Anusha and Dhrubajyoti (2021) a key approach to fostering the growth of agricultural sector is harnessing the potential of native agricultural knowledge. These climate extremes have caused the vulnerability of small-scale farmers who rely on agriculture for their livelihoods and food security. Cyclone Idai caused widespread flooding, destruction of crops, and damage to infrastructure, leaving farmers with huge losses. At the same time, El Niño-induced droughts have resulted in prolonged periods of water scarcity, further reducing crop outputs and undermining agricultural productivity. The combination of these events has exposed farmers to consecutive, severe climate shocks, leaving little time for recovery between disasters. As such, it is of crucial importance for the socio -economic resilience of rural communities to develop mechanisms that anticipate and minimise the impacts of climate -induced disasters that potentially lead to crises (de Sausmarez, 2007).

Solving this problem is crucial for developing more effective resilience and adaptation strategies for subsistence farmers in Chimanimani, ensuring that they can better withstand future climate-related challenges.

1.3 Objectives of the study

The study aims to investigate the compound impacts of climate extremes, particularly Cyclone Idai and El Niño-induced droughts, on subsistence farming in Chimanimani, Zimbabwe. The specific objectives are:

1. To investigate the impact of Cyclone Idai and El Niño-induced droughts on agricultural productivity and food security in Chimanimani.

1.3.1 Specific Objectives

1. To quantify the extent of damage to crops, livestock, and farming infrastructure caused by Cyclone Idai and El Niño-induced drought in Chimanimani.

2. To analyse the timeline and patterns of recovery among subsistence farmers after Cyclone Idai and during periods of drought, assessing how quickly they were able to resume farming activities.

3. To examine the specific adaptation strategies employed by subsistence farmers in response to Cyclone Idai and drought.

4. To assess the effectiveness of local and governmental interventions in supporting farmers' recovery and adaptation to these climate shocks.

1.4 Research Questions

1. What was the extent of damage to crops, livestock, and farming infrastructure caused by Cyclone Idai and El Niño-induced drought in Chimanimani?

2. What where the timeline and patterns of recovery among subsistence farmers after Cyclone Idai and during periods of drought, assessing how quickly they were able to resume farming activities?

3. What are the specific adaptation strategies employed by subsistence farmers, such as changes in crop types, water conservation methods, or livelihood diversification, in response to Cyclone Idai and drought?

4.What is the effectiveness of local and governmental interventions in supporting farmers' recovery and adaptation to these climate shocks?

1.6 Justification

This study is justified due to the existing knowledge gap on the compound impacts of multiple climate-related stressors on subsistence farming households. Despite the growing recognition of the impacts of climate-related disasters on agricultural productivity and food security, there is a need for more research on this critical issue. By investigating the separate and compound impacts of Cyclone Idai and El Niño-induced drought on subsistence farming households in Chimanimani, Zimbabwe, this study aims to contribute to a better understanding of the challenges faced by these vulnerable households. The study's focus on subsistence farming households in Chimanimani, Zimbabwe, ensures that the findings will be relevant and applicable to a population that is heavily reliant on rain-fed agriculture. The study's findings will also inform policy and practice in Zimbabwe, contributing to the development of evidence-based strategies for enhancing the resilience of subsistence farming households to climate-related stressors.

Furthermore, the study's use of a mixed-methods approach will provide a comprehensive understanding of the impacts of climate-related disasters on subsistence farming households. The study's focus on the compound impacts of multiple climate-related stressors will also contribute to the development of a more nuanced understanding of the relationships between climate change, agricultural productivity, and food security. Given the timeliness and relevance of the study, the findings will inform responses to current and future climate-related disasters, ultimately contributing to the enhancement of the resilience and well-being of subsistence farming households in Zimbabwe.

Chimanimani subsistence framers are very dependent on rain-fed agriculture and are extremely vulnerable to climate extremes like cyclones and droughts. Events such as this can devastate their livelihoods, disrupt food security, and reduce income sources, creating long-term economic and social challenges. The increased frequency of droughts has, however, compromised the subsistence livestock production of poor rural households in developing countries, partly due to difficulties associated with access to forage (Schreiner et al.,2018).

Understanding how these farmers are impacted, this research can help develop more useful responses and interventions.

Meanwhile there is substantial research on individual climate events, such as droughts or cyclones, there is limited knowledge of the impacts when multiple climate extremes occur in quick succession. Researching on how Cyclone Idai and El Niño-induced droughts interact and fuel agricultural vulnerabilities is of importance for identifying the full scope of risks and the challenges farmers face in recovering from these combined weather extremes.

Climate change growing the recurrence and intensity of extreme weather events, building resilience in agricultural systems is now a global priority. The study will investigate the adjustment strategies used by subsistence farmers, identifying both successful and less effective approaches. This knowledge will be valuable for strengthening resilience in farming systems, not just in Chimanimani, but in other similar regions facing climate hazards.

1.7 Delimitations and Limitations of the Study:

Geographical focus is a limitation faced in this study. This research is delimited to Chimanimani District in Zimbabwe. While Cyclone Idai affected many other regions in the country, this study will focus solely on Chimanimani due to its significant exposure to both Cyclone Idai and El Niño-induced drought. Results from this area may not be generalizable to regions without similar climatic and socio-economic conditions.

Another disadvantage of the study is targeting the population where subsistence farmers are mainly focused in this research. Larger commercial farmers, who have different resources and coping strategies, will be excluded from this study. The emphasis is on smallholder farmers who rely primarily on rain-fed agriculture for their livelihoods, as they are the very vulnerable to climate extremes.

In this study another demerit is climate events because the study is restricted to examine the combination of impacts of Cyclone Idai and El Niño-induced drought. Other climate events or long-term climate change patterns will not be the primary focus, although they may be outlined in relation to these specific events.

The time frame of this study is also a delimitation as the study will take a closer look into the impacts from 2019 onward, starting with the Cyclone Idai and focusing on the coming

seasons affected by drought. Historical climate events before this period will not be analysed thoroughly, as the study aims to understand recent and ongoing impacts.

The study is limited to the agricultural sector, particularly crop production and livestock keeping. Other aspects of rural livelihoods (e.g., fishing, non-agricultural businesses) are outside the scope of the study, although they may be discussed briefly when relevant to farmers' overall resilience.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Fink (2014) describes a literature review as encompassing various sources, including books and scholarly articles, that are pertinent to specific issue, research area, or theory. Consequently, it offers an account, summary and critical assessment of these works concerning the research problem under investigation. This chapter explains on how climate extremes and agricultural resilience affects subsistence farmers in Chimanimani. This chapter also would investigate the impacts of extreme weather events on agriculture, assessing existing research on how these challenges affect farming practices and crop yields. It would also evaluate strategies and innovations that enhance resilience in agricultural systems, helping to mitigate the adverse effects of climate change on food security and farming.

2.1 DEFINITION OF KEY TERMS

2.1.1 Climate Change and Agricultural Productivity

Climate change has been identified as one of the major threats to agricultural productivity worldwide (IPCC, 2013). Rising temperatures, changing precipitation patterns, and increased frequency of extreme weather events are all expected to impact agricultural productivity (Schmidhuber & Tubiello, 2007). In Africa, where agriculture is a critical sector of the economy, climate change is projected to lead to significant declines in agricultural productivity, particularly for staple crops such as maize and wheat.

The impacts of climate change on agricultural productivity are already being felt in Zimbabwe, where changes in temperature and precipitation patterns have led to reduced crop yields and decreased livestock productivity. The country's agricultural sector is highly vulnerable to climate-related stressors, including droughts, floods, and heatwaves (Citation). Climate change is also expected to alter the distribution and prevalence of crop and livestock diseases, further exacerbating the impacts on agricultural productivity (Jiri et al., 2017). The impacts of climate change on agricultural productivity in Zimbabwe are not limited to crop and livestock production. Climate-related stressors are also affecting the livelihoods of

smallholder farmers, who are highly dependent on agriculture for their income and food security (Mazvimavi et al., 2016). Climate change is expected to exacerbate poverty and food insecurity among smallholder farmers, particularly in rural areas where access to climate information and adaptation technologies is limited (Makaudze & Miranda, 2017).

2.1.2 Climate Extremes and Agricultural Resilience

Climate extremes, such as droughts and floods, are a major threat to agricultural resilience in Africa (Boko et al., 2007). These events can lead to significant losses in agricultural productivity, infrastructure, and human life (O'Brien et al., 2006). In Zimbabwe, climate extremes have been identified as a major constraint to agricultural development, particularly for smallholder farmers who lack the resources and capacity to adapt to these events.

Agricultural resilience is critical for ensuring the long-term sustainability of agricultural systems in the face of climate extremes (Tschakert et al., 2013). Resilience refers to the ability of agricultural systems to absorb and recover from climate-related stressors, such as droughts and floods (Folke et al., 2002). In Zimbabwe, agricultural resilience is critical for ensuring the livelihoods and food security of smallholder farmers, who are highly dependent on agriculture for their income and food security (Mazvimavi et al., 2016).

The concept of agricultural resilience is closely linked to the concept of climate-smart agriculture, which refers to agricultural practices and technologies that enhance the resilience of agricultural systems to climate-related stressors (Lipper et al., 2014). Climate-smart agriculture practices, such as conservation agriculture and agroforestry, have been shown to enhance the resilience of agricultural systems to climate extremes in Zimbabwe (Makaudze & Miranda, 2017).

2.1.3 Compound Impacts of Multiple Climate-Related Stressors

The compound impacts of multiple climate-related stressors, such as droughts and floods, are a major concern for agricultural productivity and resilience in Africa. These events can lead to significant losses in agricultural productivity, infrastructure, and human life (O'Brien et al., 2006). In Zimbabwe, the compound impacts of multiple climate-related stressors have been identified as a major constraint to agricultural development, particularly for smallholder

farmers who lack the resources and capacity to adapt to these events. The compound impacts of multiple climate-related stressors can be particularly devastating for smallholder farmers, who are highly dependent on agriculture for their income and food security (Mazvimavi et al., 2016). These farmers often lack the resources and capacity to adapt to climate-related stressors, making them highly vulnerable to the compound impacts of multiple climate-related stressors. The study of the compound impacts of multiple climate-related stressors on agricultural productivity and resilience is a relatively new area of research (Tschakert et al., 2013).

However, it is critical for developing effective strategies for enhancing the resilience of agricultural systems to climate-related stressors (Lipper et al., 2014). In Zimbabwe, the study of the compound impacts of multiple climate-related stressors on agricultural productivity and resilience is critical for developing effective strategies for enhancing the livelihoods and food security of smallholder farmers (Mazvimavi et al., 2016).

The disaster had significant impacts on biodiversity, natural resources, and livelihoods (Kunedzimwe et al.,2021) Climate shocks, such as severe storms, droughts, and floods, have grown increasingly prevalent due to climate change. These events may cause significant threats to agricultural systems, particularly in vulnerable regions like Sub-Saharan Africa. Studies showcase that climate shocks food production, threaten livelihoods, and exacerbate food insecurity (IPCC, 2021). Understanding the interplay between various climate events is crucial for developing effective adaptation strategies.

Cyclone Idai, which struck in March 2019, was one of the most devastating tropical cyclones to hit southern Africa. The storm resulted in substantial agricultural losses in Zimbabwe, particularly in Chimanimani, where subsistence farming is prevalent. Research by Mugabe et al. (2020) highlighted that Cyclone Idai caused significant crop damage, with estimates indicating losses of up to 70% in some areas. The cyclone also led to soil degradation, increased salinity, and the destruction of infrastructure, further impeding recovery efforts. As reported by the Chimanimani District Development Coordinator, Cyclone Idai claimed about 300 lives, more than 325 people were reported missing, and approximately 4000 people were displaced (Matsvange et al. 2020).

The El Niño phenomenon is a strong driver of climatic change, often leading to severe drought conditions in southern Africa. Droughts associated with El Niño can severely impact agricultural productivity, reduce yields and increase food insecurity. Nhamo et al. (2018)

emphasized that El Niño-induced droughts have historically led to crop failures, particularly for rain-fed subsistence crops like maize and millet in Zimbabwe. These conditions intensify the vulnerability of smallholder farmers, who rely heavily on predictable weather patterns for their livelihoods.

The concurrent occurrence of Cyclone Idai and El Niño-induced drought symbolizes a compound climate risk that worsens agricultural challenges. Mastrorillo et al. (2016) discussed how intersecting climate events can lead to collaborative effects on food systems, where the impacts of one event amplify the vulnerabilities created by another. In Chimanimani, the combination of flooding from Cyclone Idai followed by drought conditions has created a challenging environment for farmers, leading to decreased resilience and increased food insecurity.

The literature indicates that climate extremes, particularly in the form of Cyclone Idai and El Niño-induced droughts, pose significant challenges to subsistence farming in Chimanimani, Zimbabwe. While there are ongoing efforts to enhance agricultural resilience, more research is needed to understand the specific dynamics of these compound impacts. This dissertation aims to fill these gaps by investigating the experiences of local farmers and the effectiveness of adaptation strategies in the face of these climatic challenges.

2.2 Background of Cyclone Idai and EL Nino Induced Draught

An International Viewpoint

Globally, agricultural systems are increasingly at risk from climate extremes like droughts and tropical cyclones, especially in areas where subsistence farming is prevalent. Anthropogenic climate change has led to an increase in the frequency and severity of compound climate hazards worldwide, such as simultaneous droughts and floods (IPCC, 2022). For example, cyclones and El Niño-induced droughts have caused significant agricultural losses in nations like the US and Australia, disrupting food production, degrading soils, and exacerbating rural poverty (FAO, 2021). Rice and wheat harvests in Asia have been severely damaged by Cyclone Amphan (2020) and protracted droughts associated with El Niño, highlighting smallholder farmers' susceptibility to interrelated climate shocks (UNDRR, 2020). These worldwide trends draw attention to the systemic threats that compound extremes represent, making resilience-building tactics specific to agrarian economies necessary.

Regional Context: Africa and SADC Region

Agrarian livelihoods in Africa are disproportionately affected by climatic variability, as 95% of agriculture is rain-fed (AGRA, 2022). Severe droughts have affected the Southern African Development Community (SADC) region, which is known for frequent El Niño episodes. One such episode in 2015–2016 left 40 million people without food (SADC, 2020). Cyclones like Idai (2019) and Kenneth (2019) have made these problems worse by destroying infrastructure and agriculture in Malawi, Zimbabwe, and Mozambique. These occurrences reveal the area's low capacity for adaptation, pushing subsistence farmers into a state of chronic vulnerability since they frequently lack insurance, irrigation, or a variety of sources of income (Nhamo et al., 2021). The interaction of droughts and cyclones in SADC represents a "double exposure" to climatic threats, impeding the achievement of SDGs such as the eradication of poverty and zero hunger.

Local Context: Zimbabwe

With 67% of the workforce employed in Zimbabwe's agrarian sector, which accounts for 12% of GDP (Zim Stats, 2022), the country is particularly vulnerable to climate shocks. Food insecurity has increased since 2000 as a result of unpredictable rainfall and droughts associated with El Niño that have cut maize production by as much as 50% (ZimVac, 2023). The deadliest storm in Zimbabwe's history, Cyclone Idai (March 2019), destroyed 90% of the crops in Chimanimani District, uprooted 16,000 households, and caused a 270% increase in acute malnutrition (Ncube et al., 2020; ZimVac, 2019). In addition, 2.7 million Zimbabweans need food assistance due to the drought caused by El Niño in 2023–2024, with "crisis" food insecurity occurring in rural places like Chimanimani (IPC, 2024). Traditional coping strategies that are not well-suited to compound disasters, including staggered planting or communal grain stores, are put under stress by these successive shocks.

Focus on Chimanimani

Chimanimani, a hilly region in eastern Zimbabwe, is a prime example of how the effects of drought and cyclones interact. Here, subsistence farmers depend on growing vegetables, sorghum, and maize—practices that are closely linked to past rainfall trends. However, topsoil and seeds were carried away by Cyclone Idai's floodwaters, and recovery was hampered by El Niño-exacerbated droughts that followed (Mavhura et al., 2021). According to ZimVac (2023), 68% of Chimanimani households had an agricultural failure in 2023, necessitating the need for humanitarian assistance. This instance highlights the pressing need

to look into how compound extremes affect socioecological systems, weakening resilience and sustaining poverty cycles. Through its analysis of Chimanimani, this study informs policy frameworks such as the SADC Regional Agricultural Policy (2015) and Zimbabwe's National Climate Policy (2020), thereby contributing to localized strategies for climate adaptation.

2.2.1. Trends of Droughts and Cyclones from 1980

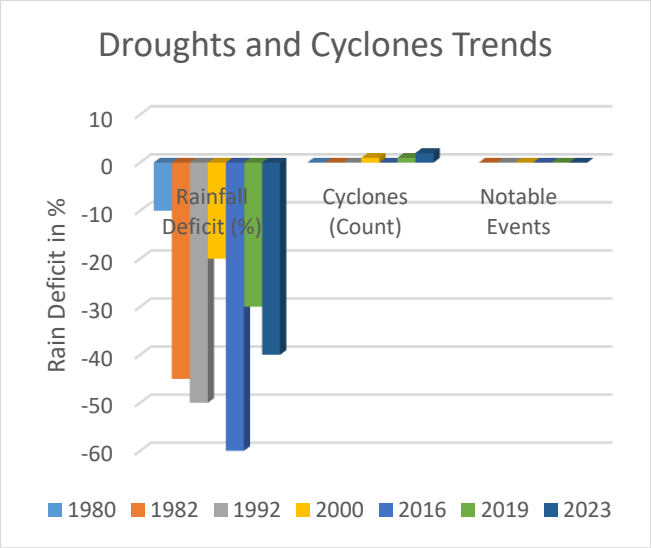


Fig. 1. Droughts vs Cyclones 1980-2025

A distinct pattern of increasing drought intensity since independence can be seen in the graphical study. Rainfall deficits during droughts in the 1980s and 1990s were usually between 10 and 20 percent, with sporadic increases to 45 to 50 percent during intense El Niño episodes (1982-84, 1991-92). The devastating 2015–16 drought, which witnessed a 60% rainfall deficit—the worst in recorded history—was the result of more harsh conditions brought about by the new millennium. This pattern is consistent with global climate models that indicate Southern Africa is becoming more susceptible to protracted dry spells as temperatures have risen by about 1°C since 1960. In addition to showing deeper deficits, the graph's drought severity line also shows shorter recovery times between occurrences, suggesting a fundamental change in Zimbabwe's climate regime.

Although Zimbabwe had previously experienced cyclones infrequently (averaging fewer than one per decade prior to 2000), the graphical data demonstrates a sharp rise in both frequency and intensity from the year 2000. Up until 2000, when Cyclone Eline signalled the start of a new era, the bars showing cyclone events are scant. Cyclone Idai in 2019 is the most notable

feature, and several other occurrences in the 2020s follow. There is a clear correlation between this surge and the observed rise in Indian Ocean surface temperatures (0.5–1°C over 20th century averages), which gives storm development additional energy. The graph is noteworthy because it shows how cyclone tracks have moved inland, impacting places like Chimanimani that were formerly outside of conventional risk zones.

2.2.2 Metric and Trends on the extent of damage within Chimanimani District and Zimbabwe caused by Cyclone Idai and El Niño induced drought.

Zimbabwe as a whole and Chimanimani were heavily affected by these two natural disasters and the metrics and the trends will be discussed below. Cyclone Idai which struck Zimbabwe in March 2019, caused severe devastation in Chimanimani and Chipinge districts, affecting 270,000 people and resulting in 340 deaths (Chatiza,2019). In Chimanimani they were extensive damage to roads, bridges, and schools, and loss of electricity and water supply systems. In Chimanimani many families were left food insecure as agriculture was heavily impacted by Chimanimani were crops such as maize and tobacco. The cyclone significantly impacted biodiversity and natural resources, with decreased forest cover and increased bare land observed between 2010 and 2019 (Kunedzimwe et al., 2021).

The El Nino Induced drought brought one of the worst droughts in Zimbabwe and Chimanimani district. Food availability in the district of Chimanimani was affected big time as maize production yields decreased by 50% compared to the previous years. Climate change has exacerbated drought severity and frequency in Zimbabwe, threatening rural development and food security (Mukwada & Manatsa, 2018). The drought also brought huge water shortages as there were shortages in drinking water and water for irrigation due to shortages of water in rivers and dams. In Chimanimani and Zimbabwe at large, the drought caused huge losses economically which led to increased food prices and inflation. Therefore, a drought such as the one induced by El Niño can be devastating for maize production and may expose households to the risk of food insecurity (Guthiga, P. M., K. Dia, and A. Ndoye. 2024).

Analysis of historical storm tracks revealed that the Eastern Highlands of Zimbabwe experienced 5 out of 865 cyclones in the Southwest Indian Ocean between 1945 and 2022 (Hungwe et al., 2024)

2.3 IMPACTS OF CYCLONE IDAI AND EL NINO INDUCED DROUGHT IMPACTS ON FARMERS

Climate-related events have caused many challenges in Southern African countries such as Malawi, Mozambique, and Madagascar. Cyclone Idai caused a lot of challenges, in their food sufficiency, ways of life and damage to their farm operations to these countries. Cyclone Idai which happened in 2019 was devastating to most parts of the Southern Africa. Cyclones are some the most devastating natural disasters that cause major losses of life and poverty (Phiri, D., Simwanda., and Nyirenda, V. (2020). A lot of crop distraction happened to crops that were still in the fields which led to the scarcity of food.

Many farmers experienced the loss of livestock as many animals were killed and swept away by heavy floods which left farmers in lack of their livestock for food and farming purposes. Also, they were a lot of infrastructure damage which includes roads, schools, hospitals and social amenities this resulted in farmers being able to reach their markets, receiving aid and getting essential services for their operations. In Zimbabwe, Chipinge and Chimanimani districts recorded horrendous impacts of the torrential rains because of their proximity to Mozambique where the cyclone wreaked havoc (Chanza et al., 2020)

However, the El Nino Induced drought disrupted weather patterns which in turn caused serious. Subsistence Farmers who rely with rainfalls suffered the most with El Nino as insufficient rains led to crop failures including staple foods such as maize and wheat. El Nino also caused severe water shortage for crops and for livestock which led to death of crops and livestock which led to many subsistence farmers to rely on food aid sometimes which wasn't enough for large families.

Impacts of Cyclone Idai and El Nino induced drought left a lot of damage on the livelihood farmers and food shortage. These events showcased how agriculture is vulnerable to natural disasters therefore strategic solutions for these events need to planned to reduce the damage of this events. The cyclone's impact underscores the importance of protected areas in safeguarding biodiversity and buffering against climate change effects (Kunedzimwe et al.,2021

Government Aid assistance

Aid assistance from the government is the support provided to individuals, communities and organisations so these people can have basic necessities and need for their normal lives. Government Aid does not only come from the country's government but also to any government of any nation which would want to help. For example, In April 2019, the World

Bank and the government of Zimbabwe (GOZ) undertook a joint exercise to assess the losses and damages caused by Cyclone Idai in Zimbabwe (World Group Bank, 2020).

In April 2024, the government of Zimbabwe declared an emergency, identifying 7.1 million people at risk of food insecurity. A Drought Response Flash Appeal was launched targeting 3.1 million people (Global Humanitarian Overview 2025). After cyclone Idai and the El Nino Induced draught the government and the humanitarian organisations implemented measures to assist affected population

In summary the government of the country with a disaster is provides the aid to its people but in cases as this one they can be overwhelmed requiring humanitarian assistance, local government and international community.

2.4 Theoretical framework

Theoretical framework is a structure that can hold or support a theory of a research study. It consists of concepts together with their definitions and theories that are used for your particular study. The mixture of impacts of Cyclone Idai and El Niño-induced drought on subsistence farming in Chimanimani, Zimbabwe, will be realistic in several key theories that explain weakness, endurance, and adaptation in the context of climate change and agriculture. These theories provide a basis for knowledge on how subsistence farmers are affected by climate extremes and how they respond to such challenges.

Vulnerability theory is a theory that focuses on the exposure, sensitivity, and adaptive capacity of individuals or communities to external stresses, such as climate extremes. In the context of your research: Exposure refers to the degree to which Chimanimani's subsistence farmers are subject to climate hazards, such as Cyclone Idai and drought. According to Chapungu (2020) referring to cyclone Idai, the huge devastation and displacement brought about the cyclone undermine the vulnerability of individuals and communities to climate change-related disasters

The sensitivity theory refers to how dependent these farmers are on climate-sensitive resources, such as rain-fed agriculture. Adaptive Capacity refers to the ability of farmers to adjust, recover, or cope with the impacts of these climate shocks. This theory showcases why some farmers and communities are more affected by climate extremes than others, taking into considerations the socio-economic factors, access to resources, and institutional support.

Still on theories they are the resilience theory in socio-ecological systems study the ability of a system (in this case, subsistence farming systems) to solve disturbances, adapt to change, and retain essential functions. For your research, resilience is key to understanding. Resilience theory will guide your exploration of the adaptation strategies used by farmers and how these strategies either improve or weaken their ability to cope with future climate shocks.

For subsistence farmers in Chimanimani, the framework helps explain:

- How these assets are affected by Cyclone Idai and drought.
- How farmers use and mobilize these assets to recover from shocks and improve their agricultural resilience.
- How do external factors, such as government policies or aid programs, influence the availability and use of these assets.
- This framework is particularly useful for understanding the multi-dimensional impacts of climate extremes on rural livelihoods and the role of both formal and informal support systems in adaptation.

Table 1: Theoretical Framework for the effects of Climate Extremes

Theory	Key Concepts	Definitions	Application in Research
Vulnerability Theory	Exposure	The level to which farmers are vulnerable to Cyclone Idai and drought as climate extremes.	Examination of how climate extremes affect farmers livelihoods.
	Sensitivity	Dependence on climate-sensitive resources, such as rain-fed agriculture.	Perception on the dependence of specific agriculture practices
	Adaptive Capacity	Capacity to cope with climate shocks, recover and adjust from farmers.	Assessing how socio-economic factors and resource access affect recovery
Resilience Theory	Disturbance Recovery	Functionality of farming methods to solve disruption and adapt to change while maintaining essential function.	Analysing how farmers adjust and implement strategies for resilience.
	Coping Strategies	Measures taken by farmers to manage and reduce the effects of climate shocks.	Modifying effective adaptation strategies among subsistence farmers.
External Influences	Government Policies	Influences from policies and aid programs that affect resource accessibility and farmer support.	Examining the function of formal and informal assistance in recovery efforts.

Theory	Key Concepts	Definitions	Application in Research
	Institutional Support	Assistance and resources from organisations that aid farmers adjust to climate changes.	Assessing the effects of institutional support on adaptation.

CHAPTER 3

METHODOLOGY

3.1 Introduction

A methodology is the structure of research study, including the sample methods, data collection techniques, and data analysis process (Bowling 2002). The description of the study area that is, location, climate and an overview of the district where the study was conducted is outlined. Both subjective and objective perspectives were applied practically to integrate the views needed to assist in the data interpretation (Hallebone and Priest 2009, Lincoln et al 2011).

3.2 Study Area and Population

The research was done in Chimanimani District, Manicaland Province. Chimanimani is a mountainous region situated in the eastern part of Zimbabwe near border with Mozambique, known for its rich ecological variety and distinct environmental. Mount Binga which is the second highest peak hails from this mountainous eastern place, the mountain rises to 2440m above sea level and experiences high rainfall of up to 1,400mm per year (Government of Zimbabwe 2016; Chingombe and Musarandega 2021). The district is dived into 23 wards. The research was conducted in Chikukwa, Ngorima A, Nyahode, Chimanimani urban, Gwindingwi Martin, Biriri, and Til bury.

The climate in Chimanimani is warm and temperate. The area attributed a mix of rugged terrain, forests, and agricultural land, primarily assisting subsistence farming. The local economy is extremely reliant on agriculture, with many families occupied in small-scale farming of crops such as maize, sorghum, and various vegetables. The farmers in Chimanimani are able plough and grow crops on slopes and hilly place as their soil particles are well graded and consolidated making them less vulnerable to erosion.

Chimanimani is lies in the overland path of the cyclones from Mozambique and the Indian ocean leaving the place being vulnerable to cyclones. The area is described by its terraneous landscapes, which can impact local climates and agricultural productivity. The altitude contributes to varying rainfall patterns and temperature changes. Also, Chimanimani experiences a temperate climate, with a clear rainy season. However, it is also susceptible to climate shocks, such as heavy rainfall from cyclones and prolonged droughts during El Niño events.

The population of Chimanimani majority relies on subsistence farming for their livelihoods. Economic challenges, mixed with climate-induced shocks, can impact food security and household incomes. In Chimanimani they are now highly vulnerable and the community faces to climate change impacts, including increased frequency and severity of extreme weather hazards. This vulnerability is fuelled by scarcity of resources and support systems for adaptation.

This summary gives a significant backdrop for the research on weather hazards and agricultural resilience, showcasing the advantage of understanding the local dynamics in the face of climate change. Below is the Map of Chimanimani our study area the part in green being the most affected and also the Map of Zimbabwe.

A **B**

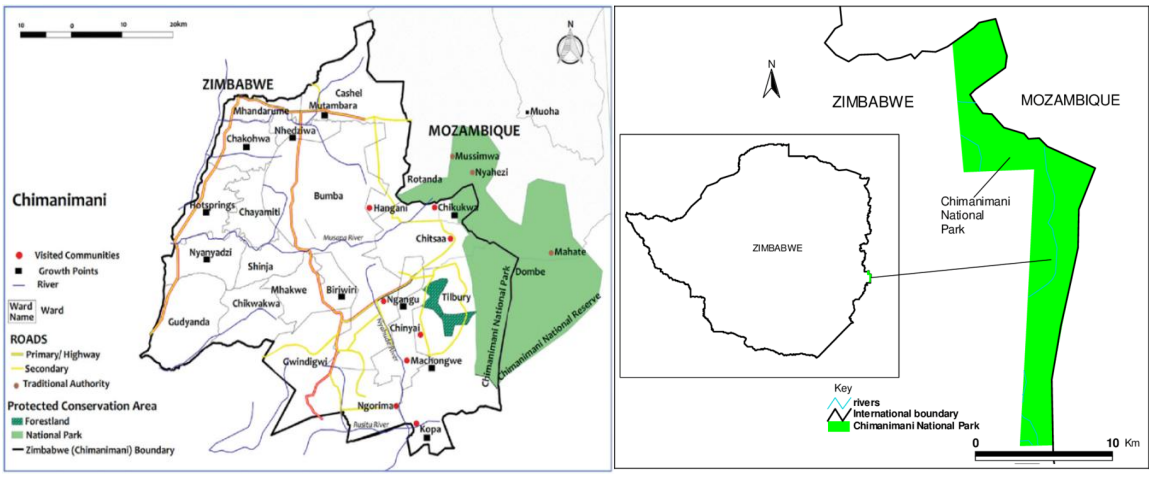


Figure 1: A Chimanimani Map and B Zimbabwe Map indicating Chimanimani

Source.www.researchgate.net

3.3 Research Design

According to Jenkins-Smith, et al. (2017), a research design is the set of steps you take to collect and analyse your research data, in other words it is the general plan to answer your research topic or question. This study employed a mixed-methods approach, combining both quantitative and qualitative data collection and analysis methods. The study used a case study design, focusing on Chimanimani East and West district in south eastern Zimbabwe. The researcher used a multi-stage sampling approach to select the study participants. First, a simple random sampling technique was used to select 1 ward from the wards in Chimanimani district. Three villages will then be randomly chosen and 17 households will be randomly selected from each village. Six wards out of 23 was where the research was conducted selected wards were Chikukwa, Ngorima A, Nyahode, Chimanimani urban, Gwindingwi Martin, Biriri, and Til bury.

The study analysed the data using a combination of descriptive statistics, inferential statistics, and thematic analysis. Descriptive statistics such as means, medians, and standard deviations was used by the researcher to summarize the quantitative data. Inferential statistics such as regression analysis examined the relationships between the variables. Thematic analysis analysed the qualitative data from the focus group discussions and key informant interviews. The analysis involves identifying, coding, and categorizing themes and patterns in the data. The study used SPSS software for quantitative data analysis.

3.4 Data Collection Methods

3.5.1 Key Informant Interviews (KIIs)

According to Ucla Center for Health Policy Research Key informant interviews are qualitative in-depth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people. The interviews were done to explore the farmers experience and perceptions on Cyclone Idai and El Nino Induced drought and how they how they overcome its impacts. A total of 13 key informants participated in the exercise as, a rural district council officer, three chiefs, five village heads, and Ministry of Youth Empowerment representative, the district school’s inspector, two representatives from the nongovernmental organization (NGO) sector conducted the key informant interviews and their participation was very insightful.

3.5.2 Survey

A survey was conducted in a bid to examine duration, cost, and possible adverse events, as well as to enhance the study design prior to conducting the full -scale research project. To

administer the functionality of the research instruments, and suitability of the uploaded questionnaire and train enumerators for the best possible results to avoid biased information a pilot testing was conducted. The pilot testing was done before the main survey.

A structured household questionnaire was used to collect quantitative data. The questionnaire was administered to a total of 50 sampled households. The questionnaire collected a variety of information key to the compound impacts of Cyclone Idai and El Niño-Induced Drought on Subsistence Farming in Chimanimani. Among the information collected included demographic characteristics, size of family, livestock affected, years involved in farming, education level, Government interventions/assistance and the utilization behaviour of resources/input provided by the Government/donors. The survey used a cellular phone for the validity of the research method. On using this machine, a software application i.e., Kobo-Collect was installed and structured questionnaires were uploaded.

3.6. Data Analysis Methods

Data analysis methods are the tools and processes which can be used to interpret information from data. Econometric data analysis tools and models were used to analyse the collected data during the data analysis procedure. A very comprehensive data analysis which combined qualitative and quantitative was used for this project.

3.6.1. Descriptive Statistical Analysis

By using descriptive analysis, a better understanding of the impacts of Cyclone Idai and EL Nino induced draught can be gained. This directly addresses the first research question through the use of statistical software for calculating means, modes, median and standard deviations.

3.6.2. Qualitative Approach

Qualitative approach can provide with a deeper understanding of difficult and contextual impacts of the Cyclone and El Nino on the subsistence farmers. Through informant key interviews, questionnaires it allowed researchers to generate descriptions of Cyclone Idai and El Nino drought. A thematic analysis was used to identify, categorise and code patterns and themes within the data. By the use of questionnaires, the farmers views and problems were identified through some of the questions as how they were affected, how long they recovered the damage and how their coping mechanisms where. Upon the data analysis descriptive data statistics were used to find the means and frequencies for each statement for a better

understanding on central tendencies. Below is table 2 for the data collection and the analysis method.

3.7. Table 2. Primary Data Collection Methods and Tools

Specific Research Objective	Data concepts and variables/indicators	Data collection methods/tools	Respondents/subjects
To quantify the extent of damage to crops, livestock, and farming infrastructure caused by Cyclone Idai and El Niño-induced drought in Chimanimani	Damage assessment, agricultural impact.	Crop yield loss, livestock mortality, infrastructure damage levels.	Descriptive statistics, GIS mapping, spatial analysis
To analyse the timeline and patterns of recovery among subsistence farmers after Cyclone Idai and during periods of drought, assessing how quickly they were able to resume farming activities.	Recovery timeline, farming activity resumption	Time to recovery, farming activity levels, changes in household income	Time series analysis, regression analysis, survival analysis
To examine the specific adaptation strategies employed by subsistence farmers, such as changes in crop types, water conservation methods, or livelihood diversification, in response to Cyclone Idai and drought.	Time series analysis, regression analysis, survival analysis	Types of crops cultivated, water conservation techniques, livelihood diversification metrics	Qualitative analysis, thematic coding, focus group discussions

3.8 Sampling

The study collected data through a combination of questionnaire surveys, discussions, and key informant interviews. A questionnaire survey was used to collect quantitative data from the 50 randomly selected subsistence farming households from the village heads lists. The questionnaire covered topics such as household characteristics, agricultural practices, climate-related stressors, and coping strategies. Two Focus group discussions and a key informant interview was used to collect qualitative data.

Table 3: Household Sample Data

PROVINCE	SAMPLED DISTRICTS	TOTAL NUMBER OF WARDS IN THE DISTRICT	TOTAL NUMBER OF HOUSEHOLD INTERVIEWED PER DISTRICT
MANICALAND	CHIMANIMANI	23	50

3.9. Table 4. Data Analysis Methods

Specific Research Objective	Data concepts	Data Variables/indicators	Data analysis tools
To quantify the extent of damage to crops, livestock, and farming infrastructure caused by Cyclone Idai and El Niño-induced drought in Chimanimani.	Evaluation of damage and influence on Agriculture	Crop yield reductions, livestock losses, damage to infrastructure	Descriptive statistics,
To analyse the timeline and patterns of recovery among subsistence farmers after Cyclone Idai and during periods of drought, assessing how quickly they were able to resume farming activities.	Recovery timeline, resumption of farming activities	Duration of recovery, levels of farming activity, changes in income	Time series analysis, regression analysis
To examine the specific adaptation strategies employed by subsistence farmers, such as changes in crop types, water conservation methods, or livelihood diversification, in response to Cyclone Idai and drought	Adaptation strategies, building resilience	Types of crops grown, water usage patterns, diversification metrics	Qualitative analysis

3.10. Detailed descriptions

Firstly, on the first objective, they will be measuring crop, livestock, and farming Infrastructure Damage Techniques. Characteristic Statistics such as the mean, median, and standard deviation are used to quantify the amount of infrastructure damage, livestock deaths, and crop yield losses. To classify the degree of damage (e.g., mild, moderate, severe), frequency distributions are used. Compare the agricultural outputs before and after the disaster using comparative analysis. For policymakers, descriptive statistics offer a concise, numerical overview of losses.

Crop losses with a high standard deviation could be a sign of uneven disaster impact. Low-lying areas close to rivers may have sustained the worst damage, according to GIS maps. Analysis of time series will be monitoring the return of farming activities (e.g., months to refill animals, replant crops). Compare the rates of recovery for farmers afflicted by drought and floods.

Analysis of Regression:

Use linear regression to determine whether the recovery pace is influenced by variables such as soil quality, aid availability, or credit availability. Use logistic regression to forecast the chance of a complete recovery depending on socioeconomic factors. Time series show tendencies, such as a sluggish recovery brought on by a lack of seeds. Regression helps prioritize interventions by identifying important drivers of recovery.

Effective help distribution may be indicated by steeper recovery curves. Farmers that had irrigation may have recovered more quickly, according to regression. It took more than two years to fully recover; farmers impacted by drought recovered more slowly than those affected by floods.

Common themes include increased irrigation use and the switch to cassava/sorghum. Anticipation is that farmers in arid regions depend more on diversification, such as raising chickens.

In conclusion, damage assessment uses statistics to measure losses to target relief.

Key bottlenecks, such as a shortage of seeds, are identified by regression. Adaptation Strategies are that policy regarding resilience-building is informed by qualitative insights.

The general conclusion was as anticipated: Farmers who had many sources of income and outside assistance recovered more quickly.

3.11. Specific Ethical Considerations

According to (Qualee), ethical consideration refers to the process of evaluating the moral implications of a decision, action, or policy. It involves identifying, analysing, and addressing the potential ethical issues that may arise in various contexts. In a case like this case of compound impacts of Cyclone Idai and El Niño-induced drought on subsistence farming. Farmers or local community members need to fully understand the purpose of the research and voluntarily agree to participate. Informing participants with clear, understandable information about the research, including the aims, procedures, potential risks, and their right to withdraw at any time without consequences.

The research should be conducted with confidentiality and anonymity, as to safe guarding the identities and information that is crucial of participants, especially since the research might involve sensitive information about their livelihoods, experiences, or vulnerabilities. All data need to be (e.g., interviews, surveys) anonymized, and that any identifying information is either removed or kept secure.

Upon this investigation minimizing harm is crucial provided the sensitive nature of the topic, which involves climate disasters, it is important to ensure that the research does not re-traumatize participants or exacerbate their vulnerabilities. Being mindful of the emotional effects of discussing their experiences of disasters and climate shocks. Offer support or referral information and knowledge for participants who may be distressed by the discussions.

Cultural sensitivity is also required upon investigation as carrying out the research in a way that respects the local culture, customs, and norms of the Chimanimani community. Encountering the community with respect, and aware of any local traditions, and seek approval from local Chimanimani leaders or relevant authorities before conducting research in the area. The research will contribute positively to the community and the broader scientific understanding of resilience in the face of climate change.

The findings will aim to benefit the community by giving insights that can inform policy, support local agricultural resilience strategies, and aid in disaster preparedness. However, the

research findings must be presented truthfully, without manipulation, and disclose any potential conflicts of interest. Be honest and transparent about the methodology, sources of funding, and any limitations in your study to maintain the credibility and integrity of your work.

In conclusion, the chosen techniques and resources for gathering data are intended to guarantee a thorough comprehension of the effects of El Niño-induced drought and Cyclone Idai on Chimanimani's subsistence farmers. The research will capture a comprehensive view of harm, recovery, and adaption mechanisms by utilizing a combination of quantitative and qualitative methodologies. In addition to increasing the findings' dependability, this multifaceted approach offers practitioners and policymakers practical advice on how to strengthen farming communities' resilience.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the estimated results and their remarkable interpretation. This chapter intricate the final data authentication and describes the presentation and analytical facts.

4.2 Characteristics of Sampled Households

The demographic characteristics of the data we collected in Chimanimani will be showcased in diagrams as per each category. The total number of people who participated in the study was 50. Of the 50 sampled households, the research was conducted in consideration of gender inclusivity, age group range for participation, education standards, household size, household's socio-economic status, and fair/equal total number of participants within the survey in Chimanimani.

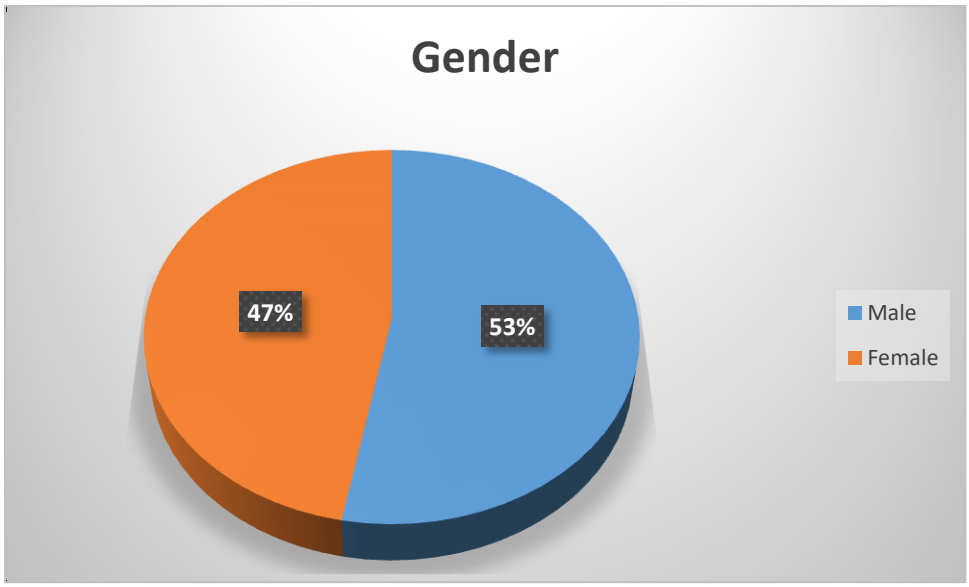
Table 5: Demographic Table

Demographic variable	Category	Percentage Frequency %
Age	20-35	22
	36 - 45	32
	46 -56	26
	57 -68	20
Sex	Male	56
	Female	44
Farming Duration	Less than 5 years	28
	10-20 years	30
	5-10 years	32
	More than 20 years	10
Education level	Primary	18
	Secondary	24
	High School	34
	Tertiary	16
	none	12

4.2.1 Gender Inclusivity

The study shows that men are actively involved in the surveys than women, the table shows a percentage of man being 52.94 and women have a percentage of 47.06 respectively. This explores that all the 50 sampled households participated in the surveys in *fig 1.0.* Farming is a field that is undeniably dominated by men ,and even masculine ,and could therefore harbour the very same dynamics of exclusion.

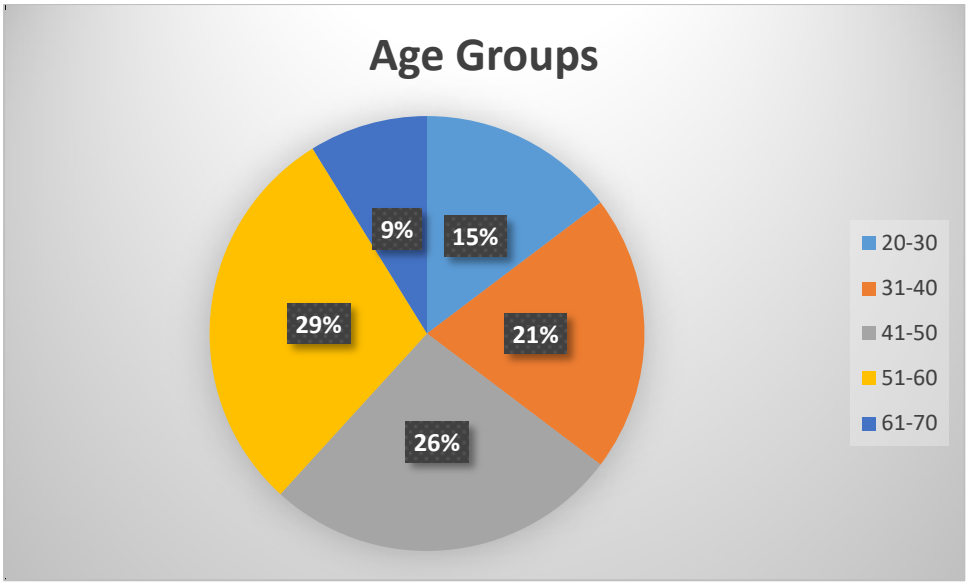
Figure 1.0 Gender for the study



4.2.2 Age Group under Survey

Upon the age, findings indicate that a large number of people are between 51-60 followed by the group between 41-50, followed by another group between 31-40 being followed by another group from 20-30, and lastly the group 61-70. Most of the farmers are aged 51-60 showing that people near retirement choose farming to sustain them on their retirement. Also, the data in *fig2.0* showcased that even young people are now interested in subsistence farming to sustain them. Only farmers above 18 were interviewed to produce unbiased data.

Figure 2.0 A Percentage of Age Groups of Participants in the Survey



4.2.3 Education Level

According to the interviewed farmers in *Fig 3.0* about 15% of them did not have any formal education. Those who only attained primary education were only 16% indicating basic literacy and numeracy.29% of these farmers attained their secondary school education, showcasing that many farmers are gaining more advanced skills and knowledge compared to those in primary education. Farmers who attended school up to High school were 20% which includes more advanced subjects and prepares them in better decision making and managing of their subsistence farming. The farmers with tertiary education being 17% indicates that colleges and universities are providing better advancement in understanding more in their subsistence farming.

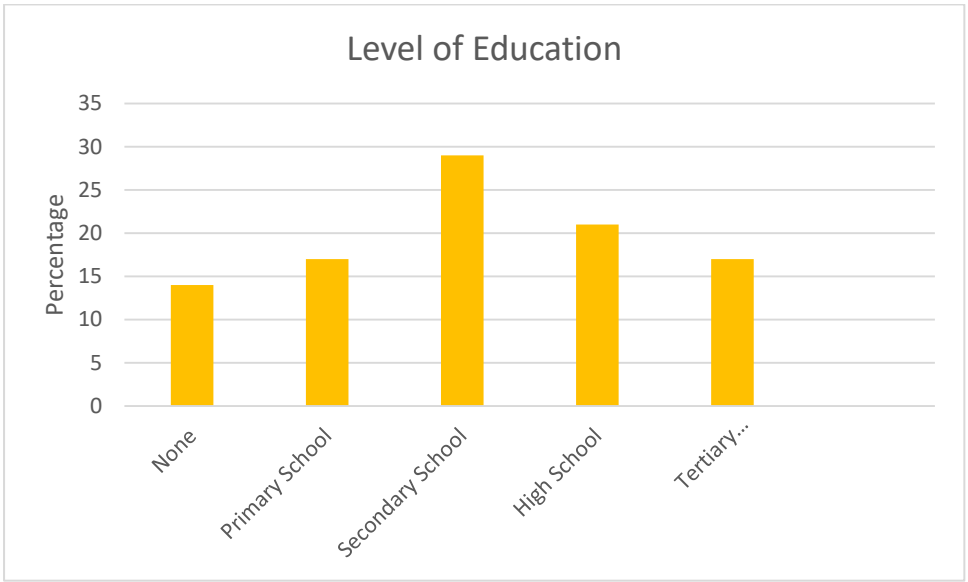


Fig 3.0 Summary of the Education Level of the Selected Smallholder Farmers in Mashonaland Central

The importance of the demographics is due to targeted support. Understanding these demographic variables allows policymakers and NGOs to design targeted support programs that address the specific needs and capacities of different groups. For example, providing training programs that offer women or younger farmers to enhance resilience so they can feed their families in times of drought as El Nino. Demographics also makes it easier on resource allocation

pointing out which demographic groups are most vulnerable enables more effective allocation of resources and assistance in the event of natural disasters. For example, communities with a higher number of older farmers may require different forms of aid compared to those with younger populations. Engaging with different demographic groups ensures that all voices are heard in planning recovery efforts especially aftermath of cyclones, creating more comprehensive and inclusive strategies.

In conclusion, analysing demographic variables is important for understanding the different impacts of disasters like Cyclone Idai and the El Niño drought, enabling better strategies for resilience-building and recovery.

4.3 Analysis of Objectives

4.3.1 Quantifying the effects of El Nino and Cyclone Idai on Agriculture and Rural Infrastructure.

To analyze the timeline and patterns of recovery among subsistence farmers after Cyclone Idai and during periods of drought, assessing how quickly they were able to resume farming activities. The first step in analyzing this objective is on collection of data on the extent of damage to crops, livestock, and infrastructure. Survey responses or reports detailing. The level of damage experienced by farmers will be determined through survey responses and other interviews. Rural infrastructure lost in financial cost in farm property as irrigation and other essential properties might also be considered in assessing the damage. The damage could be measured in crops percent loss of crop yield, types of crops lost, and number of crops affected. Livestock loss might also be used as a measure through the number of livestock lost and its percentage.

Table 6: Crops and Livestock lost due to Cyclone

Damage experienced due to Cyclone Idai	Percentage % of Cyclone damage	Range of damaged Crops	Percentage % of farmers
Crop loss (e.g., maize, vegetables) loss	44	10%-20%	12
Destruction of infrastructure (e.g., irrigation systems, storage sheds)	36	20%-40%	14
Soil erosion or landslides	13	40%-60%	36
Damage to access roads	7	60%-80%	38
TOTAL	100		100

Crop loss was also experienced as many crops were destroyed in this region as the above table 6 is indicating that 44% of the crops were destroyed according to the respondents and a huge impact on crop losses was experienced with about half of the farmers. The loss of crops is big problem after a natural disaster as it affects food sufficiency.

They were also destruction of infrastructure in Chimanimani as shown by the numbers in the table above as 36.0% of the respondents. Many irrigations and other farming infrastructure were destroyed in addition to other infrastructure causing a huge constraint financially for these subsistence farmers to purchase other farming infrastructure shortly. 6% of respondents indicated that road distraction hinders farmers from accessing essential services such as resources for crucial recovery. Soil erosion and landslides also occurred in Chimanimani as 12.0% of respondents indicated this type of damage. This type of damage can have long-term effects on land productivity and its sustainability.

Another 2% of the respondents highlighted about other forms of damage which indicates less common or minor forms of damaged which might not fit into the predefined categories.

The cumulative percentages amount of farmers who faced damage as 44% of crop was lost showcasing that many of the farmers dealt with the damage early on. When the percentage of destruction of infrastructure is added the percentage reaches to 80% indicating that four fifths of respondents faced one of the two first significant types of damage which shows the high intensity of the impact.

In conclusion the data collected implies that crop loss was the major form of damage which occurred to the Chimanimani subsistence farmers. The loss of crops and damage cause a huge problem to food security which in turn will affect the country economy at large. A destruction of infrastructure is an also a big threat to Chimanimani as it hinders farm production due to the lack of farm equipment and suitable facility. Soil erosion and road damage poses also a

threat as they have long term disadvantages to the accessibility of farmers to certain resources.

Table 7: Livestock lost per family

Number of livestock lost per family	Frequency Percentage%
0-3	24
4-7	40
8-10	16
12-15	14
16-20	6

Table 7 shows many livestock was lost in Chimanimani by farmers Higher Losses (6-10 Livestock). Losses of 6 to 10 livestock were noted among several farmers 6 Livestock: 3 farmers (6.0%),7 Livestock: 6 farmers (12.0%),8 Livestock: 3 farmers (6.0%),9 Livestock: 2 farmers (4.0%),10 Livestock: 3 farmers (6.0%). And cumulatively, 80% of farmers reported losses of 10 or fewer. A huge impact on livestock losses was experienced in Chimanimani by the subsistence farmers as the mode (6.80) indicates that on average and farmers in the area lost and got injured animals up to 7 which negatively impacted them. Many families lost 4 to 6 animals as our standard deviation is (4.982) and it shows how many farmers were impacted and also some farmers faced a bigger loss.

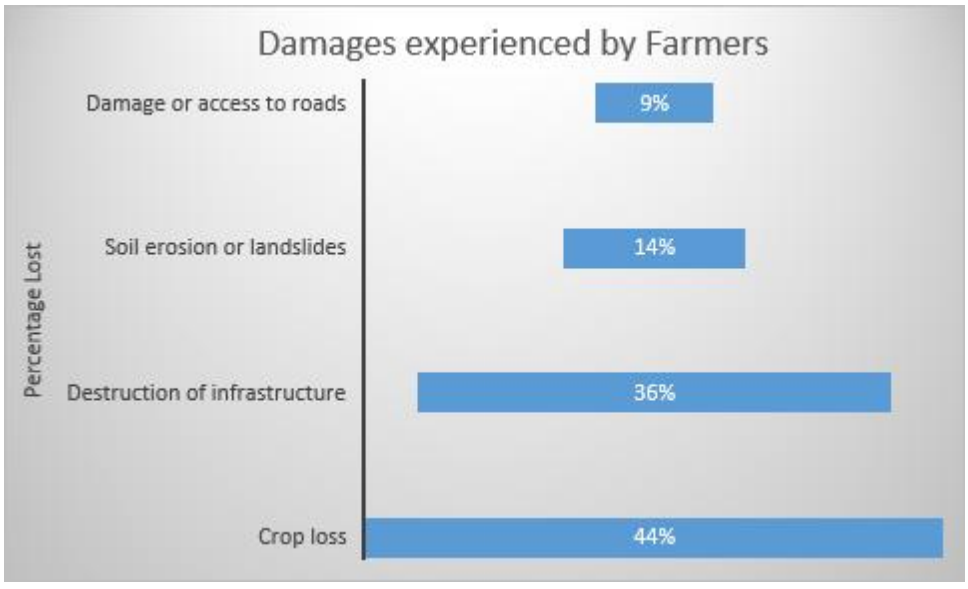


Fig 4. Damages experienced by farmers due to Cyclone Idai

4.4. Patterns to recovery

Farmers implemented emergency survival techniques in the early aftermath of Cyclone Idai and the ensuing droughts. Many households were forced to rely on government, non-governmental, and international humanitarian relief after losing their food and seed supplies. Temporary respite was given by food supplies and seed contributions, but logistical difficulties meant that shortages continued. Families dealt with food insecurity by, reduced serving sizes or complete meal skipping, depleted their assets by selling livestock for low prices in order to purchase food, worked informally to make money, such as through artisanal mining or casual labour. gathered wild things to add to diets and like edible leaves and roots. These tactics were temporary fixes that weren't enough for a sustained recovery.

Farmers started reconstructing their agricultural systems as the first rescue efforts faded. Among the important recovery patterns were replanting drought-resistant and fast-Maturing Crops. In order to promptly replenish food supply, farmers gave priority to short-duration crops (such as sweet potatoes, cowpeas, and green vegetables). In order to reduce the likelihood of frequent dry spells, some people switched to drought-resistant types of millet, sorghum, and maize.

Reliance on Outside Assistance and Remittances**:**

Many households relied on remittances from family members who moved to cities or neighbouring countries (like South Africa) because farming yields were remained low. Furthermore, seeds, fertiliser, and instruction in conservation farming methods were supplied by NGOs and government initiatives.

Limited Recuperation Because of Residual Difficulties many farmers suffered in spite of their efforts because of: poor soil quality following topsoil erosion caused by Cyclone Idai's floods, inadequate irrigation systems, making them susceptible to drought, reinvestment is challenging due of the high prices of seed and fertiliser.

Recovery in the Medium Term (3–5 Years Following the Disasters) some farmers switched from survival to more sustainable adaption techniques over time. Rehabilitation of soils and land farmers took the following actions to stop erosion and replenish fertility. Crop rotation,

mulching, and minimal tillage are all examples of conservation agriculture. Planting trees that fix nitrogen, such as Faidherbia albida, is known as agroforestry. Terracing and contour farming can help stop future flood damage.

Restocking Livestock

Through government and non-profit livestock initiatives, some farmers gradually restored their herds, but many stayed below pre-disaster levels because of the hefty expenses.

Diversification of Income

Aware of the dangers of depending only on farming, many households began to diversify into, offering produce and handcrafted goods on a small scale, artisanal mining, despite the harm to the environment, movement of labour by season.

4.3.2 Timeline and patterns of recovery among subsistence farmers after Cyclone Idai and during periods of drought

Subsistence farmers found ways of adaptation after Cyclone Idai and the El Nino drought for them to continue with their day to day lives. Interviews and survey usually derive collected data from farmers which comprise of change in crop types such as new crops introduced, percentage of land dedicated to different crops. Also, livelihood diversification strategies are implemented using introduction of non -farming income sources.

Another way used in data collection is water conservation methods as irrigation techniques and rainwater harvesting. The part chart below illustrates that they reduced farming area as water conservation when they were affected by the drought. Another reason for reduced farming area is some was filled with stones rolling from Hills during cyclone Idai so the land now is no longer arable. Ways such as switching to another rain water harvesting and switching to drought resistant crops was also done by many farmers as way of adaptation. Livestock restoration and increased use of fertilisers had the least number of farmers choosing these ways an adaptation way.

Table 8: Frequency data for adaptation Methods

Frequency data

Mean	3.18
Median	3.00
Mode	3
St. Deviation	.800

As shown in table 8 the mean is 3.18 and it suggests a slightly above average experience, indicating a general positive outcome. The median is 3.00, which translates that half of the respondents rated their experience or opinion at 3 or lower. This also shows that the distribution is centred around a middle rating. The most frequently selected response is 3, which is line with the median, suggesting a common viewpoint among respondents. The standard deviation is 0.800, which says that responses vary moderately around the mean. The value shows some different views in opinions or experiences among participants but still close to the average. A lower standard deviation might suggest that most responses are close to the mean, while a higher value would show more variability.

In an overview the mean being slightly above the median shows that while most respondents are around the midpoint (3), some are slightly more positive (above 3). The data highlights a consensus around the value of 3, suggesting a moderate opinion or experience commonly felt among respondents. The standard deviation shows that while there is general agreement, there is still a reasonable spread in responses, reflecting differing opinions or experiences among farmers.

Table 9: Recovery time for farmers

Months	Percentage Frequency %
Less than 3 months	4
3-6 months	12
6-12 months	46
More than 1 year	38
TOTAL	100

As illustrated in Table 9 the farmers affected by cyclone Idai faced different time periods in trying to recover as 4 % of respondents quickly recovered from the cyclone Idai effects. 12 % the respondents indicated that they recovered 3-6 months after the cyclone has hit them. These two groups may recover quickly suggesting that they might have faced less damages or they quickly received the right support they needed. Another 46% of the respondents indicated that their recovery was between 6-12 months and this group of respondents was the largest showcasing that many farmers took 6 and more months to recover.38 % of respondents took them one year plus to recover from the effects of Cyclone Idai highlighting the long-term demerits of the cyclone.

In wrapping up a larger number of farmers 38% took who took more than a year for them to recover shows that these people need help and assistance in building their farms and their lives as well. They are also another need of some policy considerations which will need for the government and other stakeholders to implement policies and assistance programs that will support farmers in case of similar disasters in the future. The data collected reflect hurdles the subsistence farmers face when disasters like cyclone hit these farmers how they affect crops, livestock and infrastructure.

4.3.3. Adaptations strategies used by Subsistence farmers.

The government play a greater role in intervening where a natural disaster had occurred. Government intervention is essential in provision of needs to the victims. Effectiveness varies with interventions as type of interventions as aid amounts, timing of interventions, farmers perception and recovery metrics.

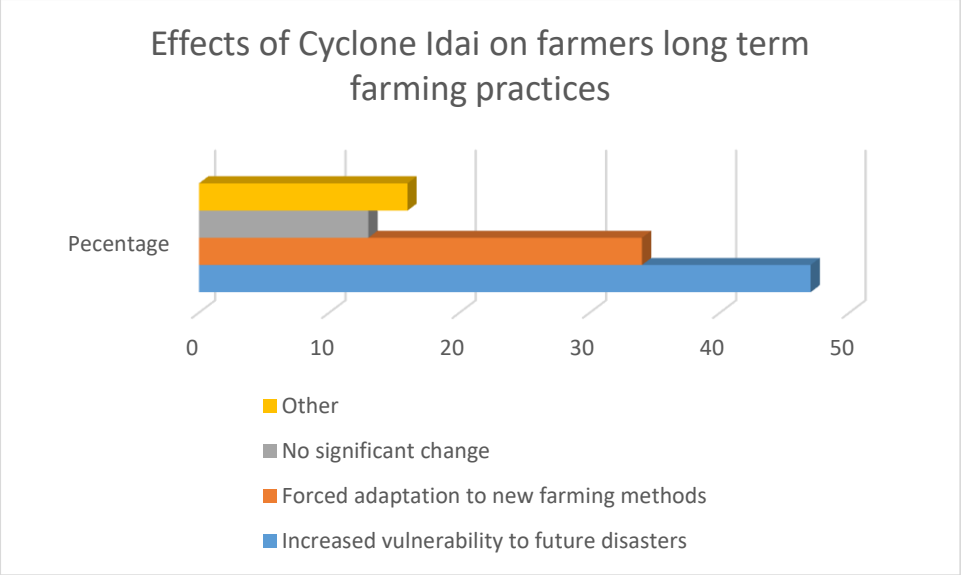


Figure 5:Cyclone Idai effects on farmers long term practices

Fig 5 showcases how farmers perceive the long-term impact of Cyclone Idai on their farming practices, divided into four distinct categories. Below is an overview of each of the category. The first category is about increased vulnerability to future disasters this farmer indicates challenges they encounter. The farmers in this category think that they were made vulnerable by the cyclone and it will make them more vulnerable to other future weather events. They also get to showcase the problem they are facing.

Another category is about forced adaptation to new farming methods. These farmers believe their farming ways was changed because of cyclones effects. This set of farmers include farmers who believe that for them to adapt climate change they have to adapt the climate change by force so that they can recover cyclone damage. No significant change this type of farmers in this segment believe that their farming practices have not been changed by the cyclone indicating some resistance to the impact.

Other is the last category responses encompasses responses that are unique and less common experienced by farmers.

On the bar chart 48% showcases responses with a higher percentage of agreement. Farmers negatively affected by the cyclone are the ones with the highest percentage and indicating a need to adapt new farming methods. A ‘No significant change' category farmers show a smaller percentage of 12%, suggesting fewer farmers believe their long-term practices were

unchanged. The 'Other' category with 13%, shows that additional drivers or unique impacts not captured by the other categories.

To sum up need for support is essential as the high percentage of farmers felt increased vulnerability and showcases the importance of resources and support to strengthen resilience for future disasters. They are also a greater need for adaptation strategies to withstand climate-related challenges many farmers so the need for farmers to adapt their practices which emphasizes the importance of providing education. Understanding the variety of impact indicated as 'Other' category, suggests that the effects of Cyclone Idai were not the same for all farmers, requiring tailored support for different needs as the diversity was also shown in response.

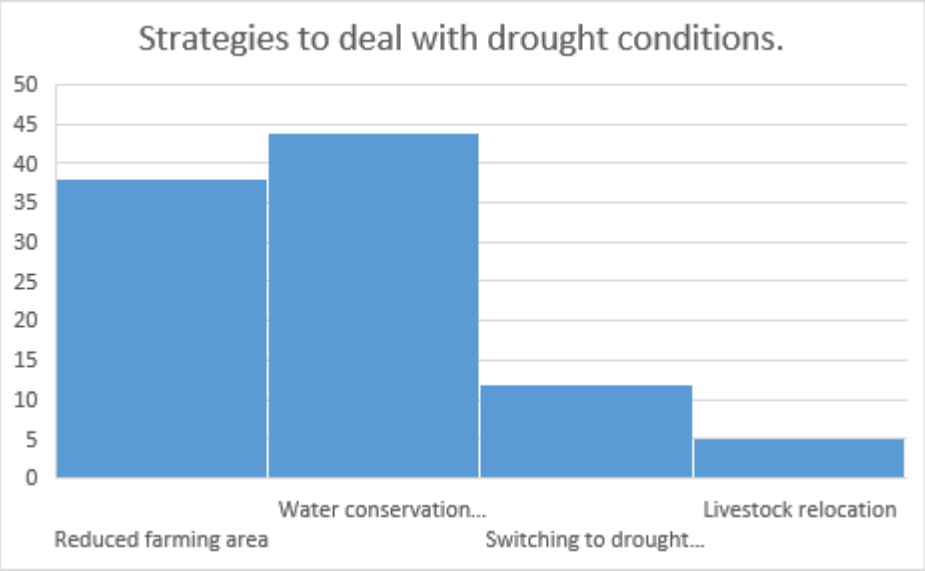


Figure 6: Strategies to deal with drought conditions

The height of *fig 6* bar showcases the percentage of farmers who selected that particular coping strategy. Taller bars represent a larger proportion of respondents using that strategy. The highest percentage of farmers indicated that they used water conservation techniques and it appeared to be the most commonly employed strategy. This highlights an approach among

farmers to manage water resources wisely. Reduced farming area is also significant, suggesting that many farmers chose to focus their efforts on a smaller area, likely to better manage resources during tough conditions. Moderate support was received from drought resistant crops**,** indicating that while this is a useful strategy, it may not be as widely adopted as the other two. A few farmers had to allocate their livestock indicating it may be because of logistical challenges or few options livestock relocations has the lowest percentage.

4.3.4 Local and government interventions in support of farmers recovery from Cyclone Idai and El Nino

They are need for the assessment of the effectiveness of local and governmental interventions (e.g., aid, relief programs, or agricultural extension services) in supporting farmers' recovery and adaptation to these climate shocks as further illustrated in fig 7.

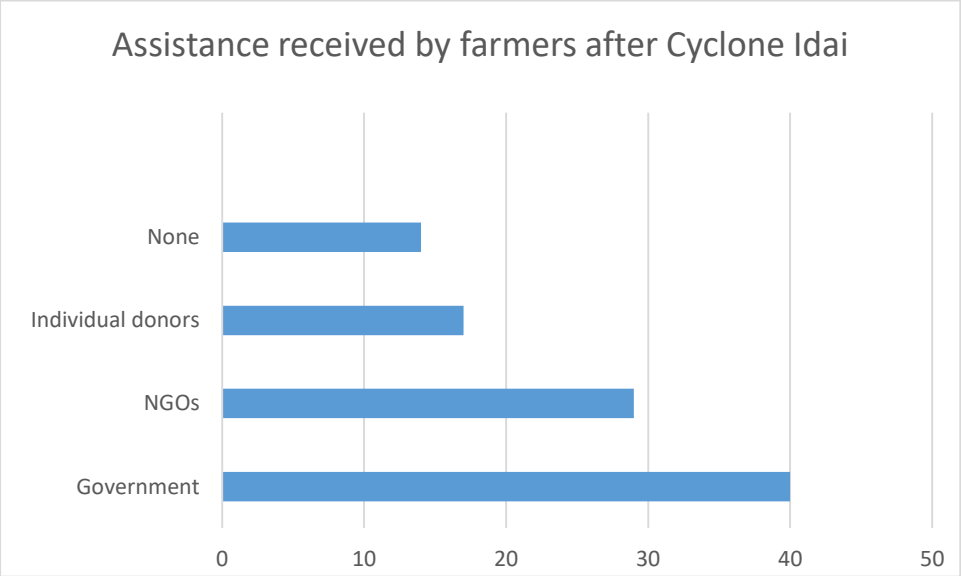


Figure 7: Assistance received by farmers from different stakeholders after Cyclone Idai

On *fig 7* the bar chart illustrates the assistance received by farmers from various sources in the aftermath of a disaster. Government usually this is the most significant source of support, encompassing subsidies, aid programs, resources for recovery, etc. This segment is the percentage of farmers who received assistance from governmental organizations.

NGOs (Non-Governmental Organizations) on this category it showcases the assistance provided by various NGOs, which usually play a crucial role in disaster relief and recovery, offering resources, guidance, and support to communities affected.

Individual donors this category includes assistance received from private individuals or small donor groups. This support can often be more informal and may include direct donations or volunteer efforts. This segment includes assistance which came from private individuals or small donor groups. Our last option which is None it represents farmers who did not receive assistance from any of these sources, indicating self-reliance or lack of access to external aid.

The height of each bar shows the percentage of farmers who reported receiving assistance from that category. The chart shows respondents that are accessing support. Government assistance dominates as it stands out as the most source of support, with the highest percentage of 40% respondents highlighting they received assistance from governmental organisations and bodies. This suggests that the government played a big role in recovery efforts. NGOs received moderate representation of 38%, it shows that many farmers also got assistance from non-governmental organizations, although to a less than the government support.

Individual donors have 17%, highlighting to low reliance on this source of assistance, which may highlight the limited capacity of individuals to provide significant support compared to organized bodies. Another segment showed that they were 12% with no **assistance** at all, which may show gaps in the support system and the need for more inclusive aid strategies.

However, reliance the predominance of government assistance points out that t farmers may be reliant on public institutions for support during disasters, highlighting a need for effective and sustained government programs to aid recovery. The presence of NGOs as a significant resource shows their positive impact in providing additional support and resources which can increase efforts. The number of farmers receiving no assistance shows potential areas for improvement in disaster recovery and support systems. This highlights to the need for better outreach, awareness, and accessibility of support for all farmers, so that no one is left without assistance.

4.4. Conclusion of the objectives

The main purpose of this research was to quantify the damage caused by cyclone Idai and El Nino induced drought, analyse recovery patterns among subsistence farming, examine adaptation strategies and assess the effectiveness of interventions. The findings according to this research highlighted that they were a huge crop loss accompanied by the loss of

livestock. Infrastructure damage was also significant as it also hindered quick recovery efforts. Through water conservation methods, diversifying crops, and other various adaptation methods where some of the solutions implemented by farmers showcasing their resilience.

The damage of cyclone Idai did not affect Zimbabwe alone but also other Southern African countries as Mozambique .In Mozambique Cyclone Idai led to significant loss in agricultural productivity with dense vegetation decreasing by 59% and wetland vegetation by 57% in affected areas (Charrua et al.,2021).In Mozambique the cyclone expose vulnerabilities in local food systems exercabarating food insecurity and undermining efforts to achieve sustainable development goals related to hunger eradication(Tevera et al.,2020).

Malawi was also not spared from the wrath of cyclone Idai as the total damages in Malawi contributed to a broader economic loss across Southern Africa with estimates indicating that the cyclones overall economic costs exceeded 2 billion in the region (Nhundu et al.,2020). In Madagascar the cyclone caused extensive flooding and destruction of crops, particularly in the eastern regions of Madagascar, which are crucial for food production (Nhamo and Chikodzi,2020).

In Zimbabwe the government and local interventions response was varied. Zimbabwe's disaster management system is proactive and more of reactive system according to various scholars and from people's observation. According to Chatiza (2019) the survivors of cyclone Idai were inadequately informed and supported. Also, Zimbabwe risk management system lacks adequate technical, financial, and logistical capacities.

These insights point out areas which need timely support for subsistence farmers facing these natural disasters. It is recommended that the government improve its risk management system so it can be efficient and fast during these disasters which needs quick recovery. In conclusion these research shows the quick need for adaptive strategies and effective interventions to support marginalised communities such as the subsistence farmers of Chimanimani.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary of the Key Findings

According to the study, subsistence farmers in Chimanimani, Zimbabwe, experienced severe agricultural disruptions as a result of the compounding effects of Cyclone Idai (2019) and a subsequent El Niño-induced drought (2019–2020). The devastating floods and landslides caused by Cyclone Idai destroyed crops, eroded topsoil, and drowned livestock, while the prolonged drought that followed resulted in water shortages, stunted crop growth, and further livestock losses. These two disasters left farmers without a recovery period, increasing food insecurity and forcing households to rely on food aid or distress sales of assets. Traditional coping strategies, such as staggered planting, proved ineffective against such extreme and sequential shocks, exposing the vulnerability of farmers who lacked irrigation, drought-resistant seeds, or financial safety nets.

Women and children were disproportionately affected due to gendered roles in agriculture and food provision. Institutional support, including early warning systems and post-disaster recovery programs, was insufficient, leaving communities struggling to adapt. While some farmers adopted limited resilience measures such as crop diversification or off-farm income activities the scale of these efforts was inadequate without external support. The study underscores the urgent need for integrated climate adaptation policies, including investments in irrigation, weather-indexed insurance, and community-based disaster risk reduction strategies, to enhance long-term resilience against future compound climate shocks.

5.2. Conclusions

Several important findings regarding climate vulnerability and agricultural resilience are revealed by the study's investigation into the compound impacts of El Niño-induced drought and Cyclone Idai on subsistence farming in Chimanimani, Zimbabwe. The study shows how successive climate disasters create cascading effects that overwhelm traditional coping mechanisms, with drought conditions preventing recovery and leading to complete crop

failures after floods destroyed crops, eroding soils, and killing livestock. These two events revealed fundamental systemic vulnerabilities in the region's rain-fed agricultural systems, such as near-total reliance on rainfall (affecting 95% of farms), insufficient early warning systems, and virtually nonexistent financial safety nets like climate insurance (available to only 2% of farmers).

Women and girls were disproportionately affected by the crises, facing increased labor burdens for gathering food and water, asset depletion from distress sales, and interrupted educational opportunities. Although the study documented some promising local adaptation strategies, such as 25% of farmers adopting drought-tolerant crops and community-led irrigation schemes, these grassroots efforts proved insufficient against disasters of this magnitude without institutional support. The findings highlight the need for integrated, multi-scale approaches that combine household-level adaptations with community-based risk management and national policy reforms. The recovery period offers a critical chance to make transformative changes, such as investing in small-scale water infrastructure, gender-responsive social protection programs, and climate-smart agricultural extension services.

Finally, the study emphasizes that preparedness for individual disasters is no longer sufficient in a time of growing climate variability. The experience of Chimanimani highlights the pressing need to create agricultural systems that can withstand, adjust to, and change in response to extremes in the compound climate. This will require coordinated action across technological, institutional, financial and social dimensions, with particular attention to protecting the most vulnerable groups. The study's findings have significant implications for climate adaptation policy not just in Zimbabwe, but for rain-fed agricultural systems throughout Southern Africa facing similar climate challenges. Future resilience-building efforts must address both immediate recovery needs and long-term systemic vulnerabilities to prevent such compound disasters from causing irreversible damage to food security and rural livelihoods.

5.3. Recommendations

At the farm level, climate-smart agricultural practices should be prioritized, including scaling up drought-resistant crop varieties like millet and sorghum, implementing conservation agriculture techniques, and establishing farmer field schools for knowledge sharing. Water management infrastructure needs urgent attention through small-scale irrigation schemes using solar-powered pumps, water harvesting structures, and watershed rehabilitation. First

and foremost, strengthening early warning systems is crucial, especially by developing integrated forecasting that addresses compound climate risks and implementing community-based monitoring networks with mobile technology dissemination.

Reduction in dependence on rain-fed agriculture, livelihood diversification through alternative income sources such as beekeeping and poultry farming should be encouraged, along with developing value-added processing for drought-resistant crops.

Institutional support systems need strengthening by mainstreaming climate adaptation into agricultural extension services and developing localized climate risk management plans. Social protection mechanisms must be enhanced through targeted cash transfers, school feeding programs using resilient crops, and community grain banks. Ecosystem-based adaptation approaches should be promoted, including agroforestry systems with native species and land restoration through farmer-managed natural regeneration. Financial risk management tools like weather-indexed insurance and emergency revolving funds should be developed to help farmers manage climate shocks. Research and knowledge sharing should be prioritized through documenting indigenous coping strategies and establishing participatory action research programs.

Mainstreaming climate adaptation into agricultural extension services and creating localized climate risk management plans are two ways to strengthen institutional support systems; promoting ecosystem-based adaptation approaches, such as agroforestry systems with native species and land restoration through farmer-managed natural regeneration; enhancing social protection mechanisms through targeted cash transfers, school feeding programs using resilient crops, and community grain banks; developing financial risk management tools, such as weather-indexed insurance and emergency revolving funds, to assist farmers in managing climate shocks; and prioritizing research and knowledge sharing by recording indigenous coping mechanisms and establishing participatory action research programs.

Critically, all interventions must adopt a gender-sensitive approach by providing targeted support for female-headed households, developing women-led cooperatives, and ensuring equal access to resources. Implementation should follow a phased approach, beginning with emergency recovery (0-2 years), moving to systemic capacity strengthening (2-5 years), and ultimately achieving sustainable transformation of agricultural systems (5+ years). Success will depend on strong community participation, adequate funding mechanisms, and

integration with national climate policies, with regular monitoring and evaluation built into all programs to ensure adaptive management. These comprehensive measures offer a pathway to build resilience against future climate extremes while addressing the multidimensional vulnerabilities exposed by the compound disasters in Chimanimani.

5.4. Study Limitations and Suggestions for Future Research

Limitations of the study

Although this study offers important insights into the compound effects of El Niño-induced drought and Cyclone Idai on subsistence farming in Chimanimani, it must be noted that it relied heavily on farmer self-reported data, which may be biased by recall, especially considering the traumatic nature of the disasters; the study's short-term scope (2019–2020) limited the ability to assess long-term recovery and adaptation trajectories; the study focused primarily on crop and livestock losses, with less attention to broader socio-ecological impacts, such as biodiversity loss or mental health effects; and logistical challenges, such as restricted access to remote areas after the disaster, which may have excluded some of the most vulnerable households. Finally, while the study identified adaptation strategies, it did not quantitatively evaluate their effectiveness in mitigating future climate risks.

Suggestions for future research

To build on these findings, future research should adopt a longitudinal approach to track recovery and resilience-building efforts over a 5–10-year period. Comparative research across different agro-ecological zones in Zimbabwe could assist discover context-specific vulnerabilities and successful adaptation solutions. There is also a need for interdisciplinary study integrating hydrology, soil science, and socio-economic analysis to better understand the cascading effects of compound catastrophes on food systems. Co-designing and testing resilience treatments with farmers through participatory action research may result in more workable and expandable solutions. Future research should also examine how digital tools like mobile apps and remote sensing might improve early warning systems and agricultural decision-making. Lastly, studies should look into the gaps in policy implementation and how well governance structures promote climate-resilient agriculture, with an emphasis on inclusive development and gender equity. Filling in these gaps will give us a more thorough knowledge of how communities engaged in subsistence farming might adjust to a time when climate extremes are becoming more frequent.

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ANNEXURE 1: SURVEY TOOLS.

QUESTIONNAIRE GUIDE

All information provided by interviewee will be treated as STRICTLY CONFIDENTIAL for mutual benefit of both the researcher and the respondents.

Introduction

I am Elias Chingoka, a student at the Bindura University of Science Education (BUSE), conducting a research project on the impacts of Cyclone Idai and El Niño-induced drought on subsistence farming in Chimanimani. Your household has been randomly selected to participate in this study. Please be assured that all information provided will be kept confidential and stored securely. The data collected will be used solely for the purposes of this research, and individual names will not be used in the analysis. Your participation is voluntary, and your responses will be anonymous. Thank you for taking the time to participate in this study.

Section 1: Demographic Information

Age: _____

Gender:

1=Male

2=Female

3=Other: _____

Household Size:…….

Number of adults: _____

Number of children: _____

Education Level: tick where applicable

0=None

1=Primary School

2=Secondary School

3=high school

4=Tertiary Education (College/University)

Other: _____

How long have you been involved in farming?

1=Less than 5 years

2= 5-10 years

3=10-20 years

4=More than 20 years

. What is your primary source of income?

1= Farming

2=Employment

3=Remittances

99=Other (specify)

Climate Extreme Events

1. Were you affected by Cyclone Idai in 2019?

1=Yes 0=No

2. Were you affected by the El Niño-induced drought in 2023/24?

1=Yes 0=No

3. How often do you experience droughts in your area?

1= Often

2= Sometimes

3=Rarely

Section 2: Impact of Cyclone Idai (2019)

Did your farm experience direct impacts from Cyclone Idai?

1=Yes

0=No

What kind of damage did you experience due to the cyclone? (Check all that apply)

1. Crop loss (e.g., maize, vegetables) loss

2. Destruction of infrastructure (e.g., irrigation systems, storage sheds)
3. Soil erosion or landslides
4. Damage to access roads
5. Other: _____

How long did it take for you to recover from the damage caused by the cyclone?

1. Less than 3 months
2. 3-6 months
3. 6-12 months
4. More than 1 year

In your opinion, how has Cyclone Idai affected your long-term farming practices?

1. Increased vulnerability to future disasters
2. Forced adaptation to new farming methods

3. No significant change
4. Other: _____

What support or aid did you receive after Cyclone Idai?

1. Government assistance
2. NGO or community-based support
3. No support received
4. Other: _____

Section 3: Impact of El Niño-Induced Drought

Did your farm experience significant drought conditions due to the El Niño phenomenon?

1. Yes
2. No

How did the drought affect your crops and agricultural production?

1. Reduced crop yields (e.g., maize, sorghum)
2. Increased crop failure
3. Reduced quality of crops
4. Livestock water shortages
5. No significant impact
6. Other: _____

What coping strategies did you use to deal with the drought conditions? (Check all that apply)

1. Reduced farming area
2. Water conservation techniques (e.g., rainwater harvesting)
3. Switching to drought-resistant crops
4. Livestock relocation
5. Increased use of fertilizers or irrigation

How effective do you think these coping mechanisms are in helping you recover from climate-related stressors?

1= Very effective

2= Somewhat effective

3= Not very effective

4= Not at all effective

Assistance from government or NGOs

Other: _____

In your opinion, how did the drought affect your farming sustainability?

1. Decreased resilience to future droughts
2. Forced the adoption of more resilient agricultural techniques
3. No long-term effects
4. Other: _____

Section 4: Compound Impact of Cyclone Idai and El Niño-Induced Drought

1. How would you describe the combined effect of Cyclone Idai and the El Niño drought on your farm and livelihood?
2. Very damaging (both events severely impacted my farm)
3. Moderately damaging (one event caused more damage than the other)
4. Minimal impact (one event had little to no effect)
5. No effect at all

How did the combination of these two climate events affect your food security?

1. Greatly reduced food security
2. Slightly reduced food security
3. No effect on food security
4. Increased food security (through adaptation efforts)

What kind of support would help you increase your resilience to such compound climate shocks? (Check all that apply)

1. Improved access to early warning systems

2. More sustainable farming techniques or training
3. Better infrastructure (e.g., irrigation, storage facilities)
4. Government financial support or insurance
5. Community-based disaster response systems
6. Other: _____

Have you adopted any climate adaptation practices as a result of these extreme events?

1. Yes
2. No
3. If yes, please specify the practices: _____

Section 5: General Perceptions and Future Outlook

Do you believe that climate change is increasing the frequency of extreme weather events in your area?

1. Yes
2. No

What are your main concerns for the future of farming in your community? (Check all that apply)

1. Increasing frequency of droughts
2. More intense cyclones or storms
3. Soil degradation
4. Loss of agricultural biodiversity
5. Economic instability
6. Other: _____

What do you think can be done to improve the resilience of subsistence farmers to future climate extremes?

1. Government policies on climate adaptation

2. Community-based climate education and training
3. Access to affordable technology and inputs
4. Strengthening local and regional infrastructure
5. Other: _____

Food security

How would you rate your household's current food security situation before cyclone Idai?

(Scale: 1 = Very secure, 2 = Secure, 3 = Neutral, 4 = Insecure, 5 = Very insecure)

How would you rate your household's current food security situation before the induced drought?

(Scale: 1 = Very secure, 2 = Secure, 3 = Neutral, 4 = Insecure, 5 = Very insecure)

1. In the past 30 days, how often did you or your household members go to bed hungry because there was not enough food?

(Scale: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Almost always)

2. In the past 30 days, how often did you or your household members have to reduce the number of meals eaten in a day because there was not enough food?

(Scale: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Almost always)

3. Since the Cyclone Idai/El Niño-induced drought, have you or your household members experienced any of the following:

a. Reduced food intake? 1=yes 0=n0

b. Reduced number of meals eaten in a day? 1=yes 0=n0

c. Increased reliance on less preferred or less nutritious foods? 1=yes 0=n0

d. Increased borrowing of food or money to buy food?1=yes 0=n0

4. How would you rate your household's current food security situation?

(Scale: 1 = Very secure, 2 = Secure, 3 = Neutral, 4 = Insecure, 5 = Very insecure)

Crop Productivity

1. How has the disaster affected your household's agricultural productivity?
2. (Scale: 1 = No impact, 2 = Minor impact, 3 = Moderate impact, 4 = Major impact, 5 = Total loss)
3. 2. What percentage of your crops were damaged or destroyed by the disaster?
4. 3. How many livestock were lost or injured due to the disaster?
5. 4. How has the disaster affected your household's access to agricultural inputs such as seeds, fertilizers, and equipment?
6. (Scale: 1 = No impact, 2 = Minor impact, 3 = Moderate impact, 4 = Major impact,
7. 5. What are your plans for rebuilding or recovering your agricultural productivity after the disaster?

Key Interview Guide

All information provided by interviewee will be treated as STRICTLY CONFIDENTIAL for mutual benefit of both the researcher and the respondents.

Topic: Climate Extremes and Agricultural Resilience in Chimanimani, Zimbabwe

Section 1: Background and Role

1.1 What is your community/organization role?

1.2 How long have you worked with Chimanimani farmers?

Section 2: Impacts of Climate Extremes

Cyclone Idai (2019):

2.1 What were the most damaging impacts on crops, animals, and infrastructure?

2.2 How was the ability of farmers to recover prior to the drought reduced by what the cyclone did?

El Niño-Induced Drought (2023–2024):

2.3 How did dry spells worsen the impact left by Cyclone Idai?

2.4 Which farming practices or crops were most vulnerable?

Section 3: Adaptation and Coping Strategies

3.1 What coping mechanisms have farmers adopted to respond to these climate shocks?

(Probe: diversification of crops, water conservation, livelihood transformation.)

3.2 Are there traditional or indigenous practices used to build resilience?

Section 4: Institutional Support and Gaps

4.1 What assistance was provided by government/NGOs after these disasters?

4.2 Were their delays or gaps in support?

4.3 How effective were early warning systems for Cyclone Idai and drought?

Section 5: Recommendations

9.What policies or programs are needed to improve long-term resilience?

10.How can local knowledge be integrated into climate adaptation plans?

Focus Group Discussion (FGD) Guide

All information provided by interviewee will be treated as STRICTLY CONFIDENTIAL for mutual benefit of both the researcher and the respondents.

Discussion Themes

1.Shared Experience

- In what ways did Cyclone Idai and the drought affect your household's food security and income?

2.Recovery Challenges:

- What were some challenges that made it difficult for you to recover (e.g., no seeds, damaged infrastructure)?

3.Adaptation Strategies:

- What changes have you made to farming practices since these disasters?
- Are some more effective than others?

4.Community and External Support:

- What support was most helpful? What was missing?

- How can the community be made more resilient to future climate shocks?

5.Gender Dynamics:

- Were these disasters differently experienced by women/men? (Probe: labour, access to resources.)

ANNEXURE 2: VISUALS OF THE DAMAGE CAUSED BY CYCLONE IDAI AND ITS PATH

Damages caused by Cyclone Idai:





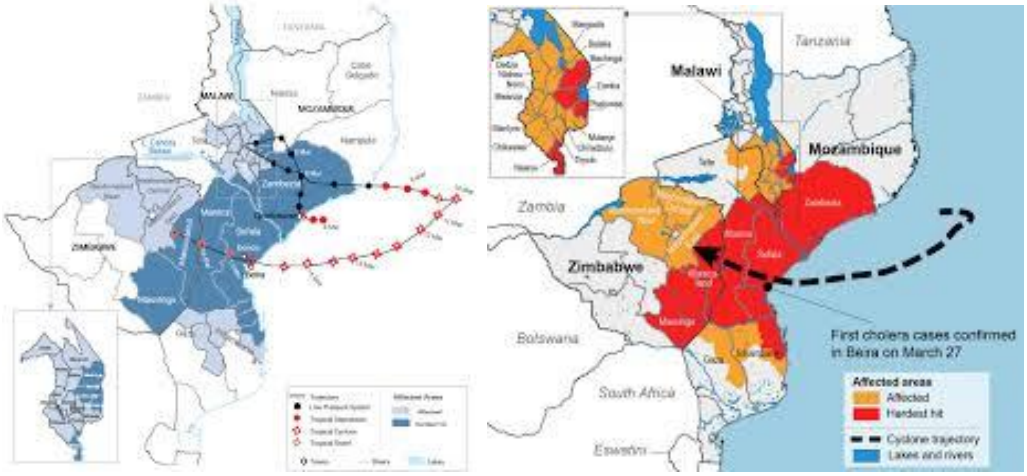








Cyclone Idai Path:



ANNEXURE 3: LOCAL TERMS

Glossary of Local Terms by Chimanimani Farmers in Zimbabwe:

1. Chimanimani – An upland district in eastern Zimbabwe, which is especially exposed to climate extremes such as cyclones and droughts.

2. Subsistence Farming – Small-scale cultivation in which farmers grow crops and raise stock for household consumption primarily, with little surplus to sell.

3. Cyclone Idai – A devastating tropical cyclone that struck Chimanimani in March 2019, causing floods, landslides, and widespread agricultural destruction.

4. El Niño Drought – A prolonged drought caused by the El Niño climatic phenomenon, leading to water shortage and crop failure (e.g., the 2023–2024 Zimbabwean drought).

5. Topsoil Erosion – Loss of fertile topsoil through intense rain or flooding, lowering the land's fertility.

6. Rain-Fed Agriculture – Rain-fed agriculture relying solely on rain as the source of irrigation, extremely vulnerable to drought.

7. Drought-Resistant Crops – Millet, sorghum, and cowpeas that can grow with low water levels.

8. Conservation Agriculture – Farming methods (e.g., reduced tillage, mulching) to save soil and water.

9. Grain Banks – Community-managed storage facilities for seeds and grain to act as a buffer against shortage.

10. Faidherbia albida – Nitrogen-fixing tree used in agroforestry to enrich the soil.

11. Artisanal Mining – Informal, small-scale mining (e.g., panning for gold) occasionally adopted as a secondary livelihood activity during agricultural calamities.

12. Distress Sales – Disposal of livestock or assets at discounted prices during crisis situations to buy food.

13. Early Warning Systems – Pre-disaster alerts (e.g., weather forecasting) to anticipate cyclones or droughts.

14. Village Heads – Local leaders mobilizing community efforts against disasters.

15. NGOs (Non-Governmental Organizations) – Organizations providing help (e.g., seeds, training) to farmers post-disasters.

16. These are terms that encapsulate Chimanimani farmers' coping strategies and lived experiences with compound climate shocks.