CLIMATE CHANGE ADAPTATION FOR SUSTENANCE OF RURAL LIVELIHOODS IN JOTSHOLO, LUPANE DISTRICT, ZIMBABWE

by

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submitted in accordance with the requirements

for the degree of

DOCTOR OF PHILOSOPHY

at the

UNIVERSITY OF SOUTH AFRICA

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JANUARY 2022

DECLARATION

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I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at UNISA for another qualification or at any other higher education institution.

31 January 2022

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DEDICATION

To my wonderful wife Rachel, and to my dearest parents, who have served as pillars of strength and inspiration throughout my life, I dedicate this dissertation. Your unwavering support and constant presence, both physically and spiritually, have been crucial to the success of this mission. Your love is the only reason I have made it this far. Ndinotenda.

ACKNOWLEDGEMENTS

As a token of my gratitude, I would like to recognize the individuals and organizations listed below for their contributions. Throughout the process of writing my thesis, Professor E.N. Kibuka Sebitosi was a constant source of inspiration, encouragement, counsel, and constructive criticism. I am grateful for all of the assistance Professor. Kusile Rural District also granted me access to the research participants in Jotsholo, Lupane district, so I would like to thank them for that. I would like to thank Jesus Christ for providing me with insight, strength and wisdom, above all else I am grateful to God Almighty.

ABSTRACT

Climate change is a serious challenge on a global and local scale, with severe consequences for rural livelihoods sustainability and socioeconomic well-being. The study's major objective was to examine how rural livelihoods in Jotsholo, Lupane district in Zimbabwe are adapting to climate change. With the goal of arming research participants against climate change vagaries, rural livelihood policies and rural household's knowledge levels were examined in the study. The research also examined the effects of climate change on biophysical and socioeconomic situations before evaluating adaptation approaches to climatic occurrences after examining relevant literature and collecting primary data. The study was anchored on the Conservation of Resources Theory and the Sustainable Livelihoods Approach. Incorporating features such as people-centeredness, flexibility, responsiveness, and participatory action, the frameworks that were utilized assisted in identifying the sources of strength for improving sustainability and creating resilience among rural livelihoods. This was complemented by observations and secondary data. Thematic analysis and descriptive statistics were both beneficial in presenting and analyzing data. The study's findings demonstrated that climate change's vagaries have a detrimental effect on Jotsholo's biophysical and socioeconomic situations as reflected by water shortages and few sustainable livelihoods strategies utilized. The findings also reflected that though the participants have knowledge of understanding that climate change was taking place, there was low adaptive capacity as a result of lack of adaptation knowledge. Adaptation strategies in the Jotsholo ward included cultivating drought-tolerant crops, rearing animals that like goats and sheep, livelihoods diversification, and conservation farming. A number of challenges were identified as hampering climate change adaptation thus insufficient funding, inadequate infrastructure, unfavourable market conditions and the scarcity of alternative fuels. To ensure the sustainability in climate adaptation, the study recommended properly constituted, enhanced, and monitored policies to be put in place with a bottom up approach to inculcate ownership. More capacity building and awareness campaigns should be initiated to increase the adaptive capacity for the rural households. A climate adaptation plan was developed with the study participants with the aim of enhancing the adaptive capacity in Jotsholo, Lupane district.

Key Words: Climate change, Adaptation, Sustenance, Rural livelihoods.

TABLE OF ACRONYMS AND ABBREVIATION

AEZ	Agro Ecological Zones
AGRITEX	Agriculture Technical Extension Support
AIDS	Acquired Immuno Deficiency Syndrome
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CBA	Community Based Approach
CBOs	Community Based Organisations
CEO	Chief Executive Officer
CPO	Civil Protection Organisation
DA	District Administrator
DCP	Department of Civil Protection
DCPPC	District Civil Protection and Planning Committee
DFID	Department for International Development
EMA	Environmental Management Agency
ESAP	Economic Structural Adjustment Programme
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FHH	Female – Headed Households
FTLRP	Fast Track Land Reform Programme
GMB	Grain Marketing Board
GOZ	Government of Zimbabwe

HIV	Human Immuno Deficiency Virus
IKS	Indigenous Knowledge Systems
INDC	Intended National Determined Contributions
IPCC	International Panel for Climate Change
ISDR	International Strategy for Disaster Reduction
MDC	Movement for Democratic Change
Met	Department Meteorological Services Department
NCCRS	National Climate Change Response Strategy
NGOs	Non-Governmental Organisations
PRA	Participatory Rural Appraisal
RBZ	Reserve Bank of Zimbabwe
SDG	Sustainable Development Goals
SL	Sustainable Livelihoods
SLF	Sustainable Livelihoods Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VACS	Vulnerability Assessments Committees
VIDCOs	Village Development Committees
VIDCOS	Village Development Committees
ZANU-PF	Zimbabwe African National Union-Patriotic Front
ZIMVAC	Zimbabwe Vulnerability Assessment Committee

ZNA	Zimbabwe National Army
ZNEPS	Zimbabwe's National Environmental Policy and Strategies
ZRP	Zimbabwe Republic Police

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

The Chapter sought to motivate the need for the study and to highlight the vagaries of climate change in Zimbabwe and in particular Jotsholo, Lupane district. This chapter therefore focused on the study's background, which served as a foundation for developing the study's problem statement. As the foundation of any study, the research questions and objectives that specify the approach to be taken and directing all phases of investigation, analysis, and reporting were explored. The study's justification and relevance were also examined. The chapter also reflected in-depthly on the geographic location, rainfall and temperature pattern of the study area thus Jotsholo, Lupane district. There was also a discussion of the study's limitations and delimitation.

1.1 Background of the Study

There is no doubt that climate change affects countries and communities around the world differently and with different impact. However, the current severity of climate change has triggered numerous, seemingly insurmountable problems that have in turn affected local communities to unimaginable magnitudes, despite human history of adaptability to environmental and climatic challenges. Difficulty predicting and coping with the long-term consequences of climate change and drought According to the IPCC (2007), climate change is a change in the climate's mean and/or variability that persists for an extended period of time, typically decades or longer. Variations from the mean state (and other statistics like standard deviations) involving the occurrence of extreme weather events on all time and space scales beyond that of individual weather events are referred to as "climate variability" (IPCC, 2007). Climate change manifests as an increase in Earth's temperature and a rise in sea level, while climate variability manifests as irregular rainfall patterns and significant seasonal variations. According to recent studies, the Earth is undergoing a major shift in climate due to rising global temperatures (Ondieki, 2018). Climate change alters rainfall patterns, amplifies drought cycles, increases the frequency of severe weather conditions, and increases agricultural pests and diseases, according to studies (UNDP, 2017; Gwimbi, 2015, and Chikodzi et al.; 2012).

If greenhouse gas emissions are not reduced, the global average temperature will rise by 1.4°C to 5.8°C over the period 1990 to 2100, according to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007). Climate change has had an impact on the African continent as well. With its proximity to the Equator, low adaptive capacity, and high poverty levels, the IPCC (2007) states that Africa is more vulnerable to climate change impacts. There was a decrease in rainfall over large parts of the Sahel region and an increase in rainfall in East Central Africa. Agriculture, food and water security, and economic growth are negatively impacted by climate change (Maroyi, 2019). Many of the adverse effects of climate change have a direct impact on food security in Sub-Saharan Africa (SSA).

The impact of climate change on crop production and household livelihoods have been documented by numerous researchers (Rojas, 2011; Sacikonye, 2013; Ondieki, 2018; Zhang, 2019). DFID's Sustainable Livelihoods Framework was used by Reid et al. (2006) to identify the constraints of securing livelihoods faced by small-scale farmers in the Muden area of KwaZulu-Natal. There were a number of limitations identified in their research, including the adverse effects of climate change on farmers' livelihoods. Many small-scale farmers have been affected by extreme weather events like drought and floods, as well as by unpredictable weather patterns that have impacted harvests, preventing them from being able to provide for their families (Komba et al., 2012). Due to a lack of access to capital and technology, small-scale farmers are at an even greater disadvantage. Communities, including farming communities, benefit from adaptation and coping measures because they can better deal with extreme weather conditions and their associated climatic variations (Nkala, 2016).

Climate change-induced challenges are not addressed in the long term because households are coping by working within the constraints of their current resources and expectations in order to achieve specific short-term goals (Ondieki, 2018). A society's ability to deal with an uncertain future can be increased through appropriate action as part of the process of adapting to the changing environment. In some cases, households' coping strategies evolve into adaptive strategies over time because of their long-term use. The term "adaptation" refers to the process of making changes or adjustments in response to a changing climate in order to minimize losses or maximize gains (Zikhali, 2019). The process of increasing society's ability to deal with climate change on time scales ranging from the short term to the long term was what it is understood to be (Okali, 2015).

Because of this, climate change adaptation has emerged as an answer to the problem. As climate change is expected to have the greatest negative impact on developing countries, this issue is of particular importance to these countries, whose societies and communities are already struggling to meet the challenges posed by climate variability (Rojas, 2011; Ondieki, 2018; Yeros, 2020). In the face of climate change, adaptation assists in households achieving their goals of food, income, and self-sufficiency (Nkala, 2016).

Various disciplines, including anthropology, archaeology, biology, ecology, geography, political ecology, psychology, and global environmental change science, have studied biological, cultural, and social adaptation processes over the course of several decades (Nkala, 2016). It has been going on since the beginning of human existence on Earth, when people began adapting to environmental and climatic change in order to take advantage of new opportunities and minimize the negative impacts (Okali, 2015). Climate change and variability are already having an impact on agriculture, which is why crop diversification, irrigation, water management, and disaster risk management are all common practices (Sachikonye, 2013). Households play a role in adaptation processes, which is why a growing body of research is being produced on the subject. Many studies on the impact of climate change on agriculture have highlighted the importance of adapting to climate change in order to mitigate its negative effects (Nyathi, 2013; Ncube, 2020; Yeros, 2020). The process of adapting to climate change is a two-step process that requires households to first perceive and frame climate change, and then respond to climate changes in and through adaptation afterwards (Ncube, 2020; Zhang, 2019). A person's perceptions as they go about their day-to-day activities are the first step in allowing adaptation to take place. Because perception is the starting point for all future action, farmers must have the mental capacity to understand and accept climate change. As the first step, perception necessitates a cognitive understanding of the problem that is frequently based on long-term memory of past events (Schwandt, 2017; Salvatore, 2018).

Households attitudes toward climate change play a significant role on how ready they are to change their practices and adapt to the changing climate. While it is essential for households to recognize that climate change is occurring before acting, it is not always the case that acknowledging climate change leads to the development of adaptation strategies (Nyathi, 2013). Whether or not any perceptions or adaptation strategies exist, they are subject to significant temporal and spatial variation and thus dynamic contingencies. Because of this, studies that focus on specific

populations, like this thesis's on Jotsholo, Lupane district, are critically important. Many studies have examined the perceptions of climate change in developed countries (Yeros, 2020) and developing countries in Africa (Zhang, 2019; Zikhali, 2019) as well as the perceptions of climate change in Asia (Deressa et al., 2011). Drought and flood mitigation strategies include food storage, income diversification, drainage channel digging, and tree planting, among others (Okonya et al., 2013). A farmer's first step in dealing with climate change is to recognize that it is happening, according to both studies. Understanding of climate change by households is critical to advancing adaptation options (Ondieki, 2018). Focusing on the importance of adaptability in research is essential and crucial in the process of adaptation (Ondieki, 2018). Changes in human practices, resources, and technologies are all part of the adaptive capacity of a local or national system that is capable of effectively responding to climate variability and change. It has been found that adaptive capacity is a prerequisite for the design and implementation of effective adaptation strategies (Ncube, 2020). Adaptive capacity also makes it possible for various sectors and institutions to take advantage of six potential opportunities or benefits of climate change.

In rural economies, the natural resources of countries such as Zimbabwe (Zikhali, 2018; Aboud,2015) and agriculture are mainly rainfed (Svodziwa, 2015; Agrawal,2013). Many rural households in the event of less rainfall received end up pursuing coping strategies, such as mining, which are often untenable or unsustainable in the long run and have detrimental effects on the environment. The prevalence of climate change in Zimbabwe is projected to be 63 percent, and 16 percent in extreme poverty, so the consequences of climate change are deeply felt in rural areas as opposed to urban areas (Scoones, 2012; IFAD, 2014). Ashley (2016) further alleged that 62 percent and 62.9 percent of men and women were similarly vulnerable to the vagaries of climate change. The National Strategy for Climate Change (2015) acknowledges a sudden shift in climate change but does not define sustainable coping strategies under the new climate change. While global warming has an effect on Zimbabwe, coping mechanisms lag behind and households are therefore vulnerable to climate change (Gutsa,2015).

Their findings from a number of studies are general and in Zimbabwe, the vicarious nature of climate change and adoption have not cascaded into district level, particularly Lupane district (UNDP,2019; Nhamo,2014). This study was driven by the realization that limited research on the effect of climate change upon rural households have carried out in semi - arid region of

Matabeleland North Province in Zimbabwe (Gutsa, 2017). The researcher's focus on rural livelihoods was inspired by Eriksen et al (2008) cited in Nhamo (2014), who found that rural households are more vulnerable to climate disasters. In addition, rural households are adaptive and suitable for this research with a keen knowledge of climate change and adaptation over the years (Handbook of Climate Change Reslience,2020).

The study examined climate change adaptation measures in Jotsholo, Lupane district in Zimbabwe. The research was conducted in the Lupane district to elicit participants' opinions and adaptation strategies. It was critical to present comparison examples to ensure that climate change adaptation strategies on rural livelihoods, particularly in households, were understood clearly, as they are not one-size-fits-all (Berg,2013). Climate change is evident in nature since it has resulted in temperature increases, snow melt, and flooding in some locations (Ayuke,2019)). The purpose of this study was to ascertain rural households' perceptions, explanations, experiences, and responses to continuous climate change impacts in Jotsholo, Lupane district. The language used by households in Jotsholo to explain weather and environment, as well as their explanations and understandings of climate change, were centered on their perceptions, close association, and regular, weekly, monthly, annual, and seasonal changes on climate and environment, as well as on what was happening elsewhere in Zimbabwe (Batokic,2016).

It was found that in Jotsholo, climate change includes changes in the direction of the wind from which rain falls into the ward, as well as changes in global rising temperatures. The study also focused at how households deal with climate change and the vulnerability it creates for households in the research area (Gutsa, 2017). Climate change has varied effects on urban and rural locations, and different measures are needed to adapt to those differences as well. As a result of limited rural subsistence options, rural subsistence is at greater danger than urban subsistence is. Nature and rain will have an impact on rural people's livelihoods, particularly rural households in the society. Seventy percent of people in third-world countries live in rural areas hence it is fundamental to capacitate rural livelihoods in the wake of climate change adaptation (IFAD, 2015). Rural subsistence has become extremely susceptible as a result of climate change.

Rural livelihoods in Sub-Saharan Africa vary widely by region, city, country, and even within the country (Bonn, 2018). Agriculture, which can be divided into livestock and crop farming, provides rural residents with a range of livelihoods (Ayele, 2018). Another option is to go into alluvial mining or fishing (Hawkins, 2012; Ayele, 2018; Agrawal, 2013). As a result of decreasing rainfall, some rural people are trying to protect themselves by diversifying their income streams (Ayele, 2018; Rukuni, 2006). For the most part, rural people depend on rain-fed agriculture. When regular rainfall causes precipitation patterns to vary, it affects rural areas' livelihoods (Ayele, 2018; Dhewa, 2011; Chazovachii, 2013).

As a result of global climate change, Africa's economies are already in jeopardy. Numerous adaption mechanisms have been put in place at the local and national level to reduce climate change variability due to many countries being badly affected. Sustainable Development Goal 13 focuses on climate change mitigation and adaptation (Chazovachii, 2013). Achieving Sustainable Development Goal 13 will ensure all stakeholders get involved in climate change mitigation efforts. Climate change is having a particularly severe impact in Zimbabwe (Chilisa, 2012). Rural livelihoods in Zimbabwe are a source of vulnerability for a variety of reasons. When it comes to climate change, poverty and a lack of ability to adapt are exacerbated in Zimbabwe (UN, 2010 and Bwalya,2015).

Thus, rural households' lives are at risk since their capacities are constrained and their decisions are not always enduring (FAO, 2013). Without well-defined coping strategies, rural livelihoods are uneven, especially for rural households with limited control over production methods, such as land usage and land tenure. Reliance on rain-fed agriculture has further limited options for households to cope for climate change in Sub-Saharan Africa (Elia,2013). By 2100, African countries would be increasingly vulnerable to climate change (Intergovernmental Panel on Climate Change, 2020). This will have an effect on agricultural losses as well as GDP (gross domestic product) (Scoones, 2015).

1.2 Contextualizing Climate Change in Rural Livelihoods

As Anderson et al. (2012) argues, human activity has significantly contributed to global climate change. Findings from 'Testing for the Possible Influence of Unknown Climate Forces on Global Temperature Increases from 1950 to 2000' show this (Koberg, 2019). According to Chifamba and Mashavira (2011), Zimbabwe's Save River discharge decreased by 43 percent from 1982 to 2009. There is additional evidence of climate change in the form of altered rainfall patterns, as well as elevated air temperatures and increased levels of sunshine (Dube et al., 2016; Madobi, 2014; Pinto et al., 2016). Rising sea levels, thinning Arctic and Antarctic ice sheets, and thinning Antarctic ice caps are all signs of climate change, as is the melting of Arctic sea ice and glacial retreat on Africa's Mount Kilimanjaro's summit (Goyette, 2016; IPCC, 2007, Lang and Ryder, 2016). Throughout Zimbabwe, the onset of rainy season is becoming more unpredictable, and the climate is becoming warmer and more regionally distinct as a result of these trends: (Chifamba and Mashavira, 2011; Jiri et al., 2015b).

Unganai (1996) predicts an increase in air temperature of 2 to 40 degrees Celsius with a doubling of atmospheric CO2. Two equilibrium GCMs (GFDL3 and CCCM) for Zimbabwe were used in this study. According to Unganai (1996), the average annual precipitation in the United States has decreased by 10% between 1900 and 1994. Because of this, climate change claims and perceptions are possible. Mazvimavi (2010) argues that climate change impacts have not yet been statistically significant because of the country's high inter-annual variability in rainfall. According to Mazvimavi (2010), the decline in rainfall may be due to the accumulation of years with above-average and below-average rainfall. It is imperative that the well-being of the country's rural majority (62 percent) — who rely on agriculture for the majority of their income — be regularly assessed (Brown et al., 2012). Improvements in adaptation strategies are needed. Some countries, like Zimbabwe, have yet to implement climate change policies (Government of Zimbabwe, 2013; 2015).

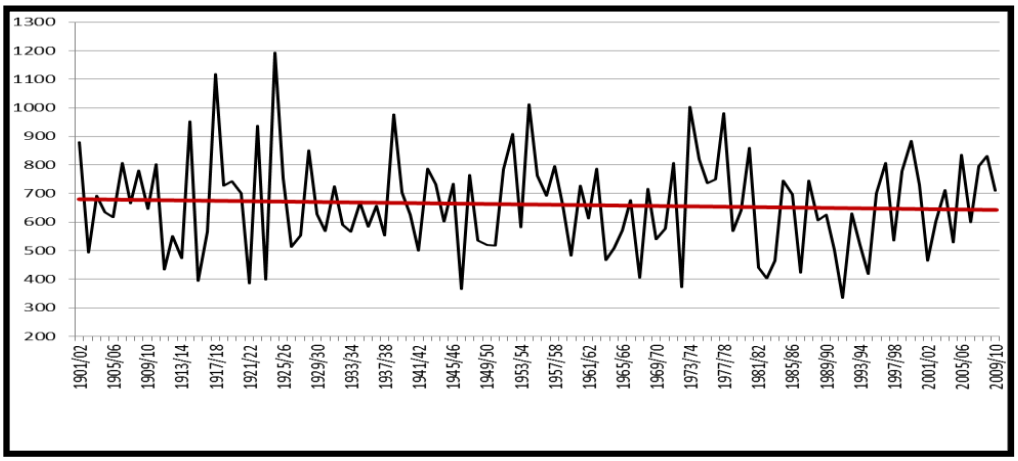


Figure 1.1: Zimbabwe Average Seasonal Rainfall (mm) 1901/02 to 2009/10 (adapted from ZMSD, 2014)

Figure 1.1 reflects Zimbabwe average seasonal rainfall from 1901 to 2009/2010 from the Zimbabwe Meteorological Service Department. It can be noted that there has been a decrease in rainfall hence this has led to a shift in the livelihoods pattern.

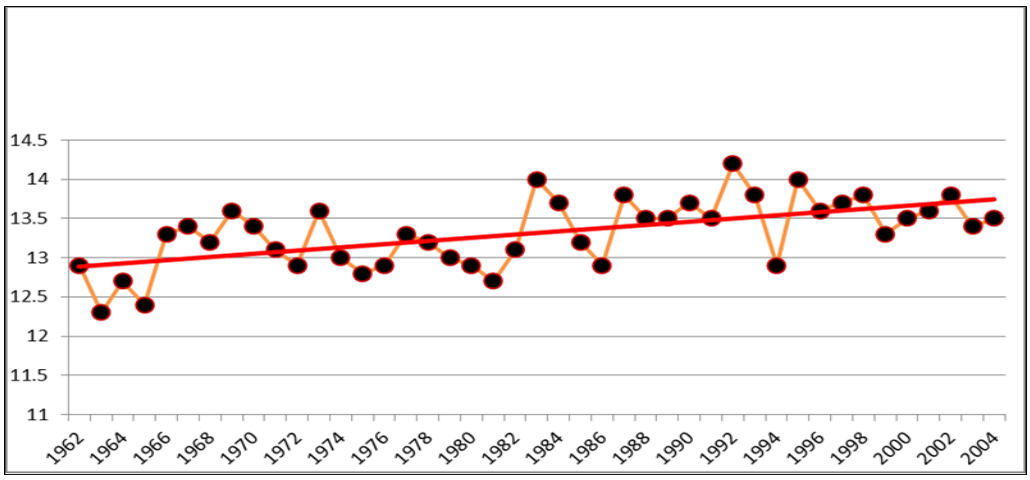


Figure 1.2 – Zimbabwe Annual Mean Minimum Temperature (1962 – 2004) Adopted from (ZMSD, 2014)

Figure 1.2 reflects the Zimbabwe Annual mean minimum temperature (1962 -2004). There has been an increase on the mean temperature that has been taking place over a long period of time. The change in the temperature pattern has in the process affected the rural livelihoods.

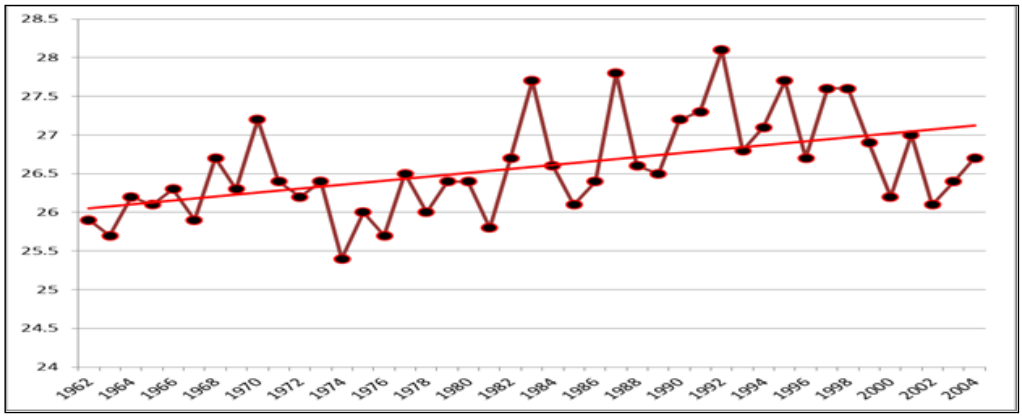


Figure 1.3 – Zimbabwe Annual Mean Maximum Temperature (1962 – 2004) (Adopted from ZSM, 2014

As the climate shifts, the country is becoming increasingly drier (Sango and Godwell, 2015b). Since such a phenomenon can have both a biophysical and socioeconomic impact, this study is looking into how to deal with it.

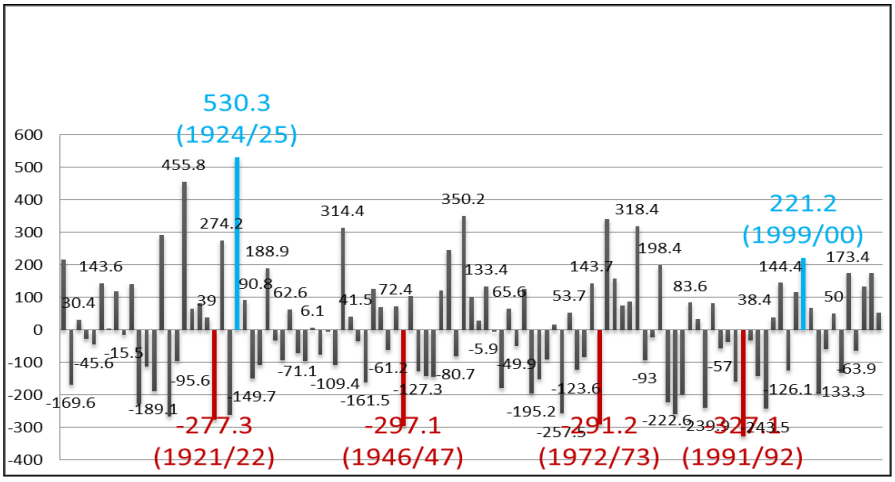


Figure 1.4 – Zimbabwe Annual Average Rainfall Deviation from Normal (mm) 1901/1902 – 2009/2010 Season (Adopted from ZMSD, 2014)

Table 1.1 – Agro- Ecological Regions of Zimbabwe in Conformity with Climate Change (Adopted from Mugandami et al, 2012)

Table 1.1 reflects the agro-ecological regions of Zimbabwe in conformity with climate change.

Natural Region	Characteristics	Previous Area Coverage (%)	Current Area Coverage (%)	% Increase or Decrease
1	High rainfall and suitable for crop cultivation	1.8%	4%	106% increase
2	Intensive crop and livestock production region. Grow maize, tobacco, cotton and wheat and experiences a mean annual temperature range of 16-19 ºC.	15%	7.6%	49% decrease
3	Semi-intensive crop and livestock production. Maize, tobacco, cotton and wheat crops are grown. Has a mean annual temperature range of 18-22 ºC.	18.7%	16.1%	13.9% decrease
4	Semi-extensive livestock production area. Some drought tolerant crops like sorghum, millet and figure millet are grown including short seasoned maize varieties. Has mean annual temperature range of 18-24ºC.	37.8%	39.9%	5.6% increase
5	Extensive production area with a mean annual temperature range of 21-25 ºC. For Game and wild life.	26.7%	32.5%	22.5% increase

Since climate variability and change has been widely discussed, Mugandani et al (2012) decided to investigate whether or not the Agro-ecological Regions of Zimbabwe had changed or evolved as a result. Rainfall, the length of the growing season (LGP), and soil group parameters were used to study Zimbabwe's Agro-ecological Regions, also known as Natural Farming Regions of Zimbabwe. Table 1.1 provides a summary of the changes and variations. Table 1.1 shows that the Agro-ecological Region 1 (1.8 percent), which receives the most rainfall, has increased its area

coverage by a factor of four. There has been a 49% decrease in maize production in Zimbabwe's bread basket, the Natural Farming Region 2. Also, a decrease of nearly 14% has been observed in Agro-ecological Region 3. (13.9 percent). Agro-ecological Regions 4 and 5 have expanded and become even more arid in their current configuration due to the worsening of arid conditions in both regions. Even as the climate shifts, the country is becoming increasingly drier (Sango and Godwell, 2015b). Since such a phenomenon can have both a biophysical and socioeconomic impact, this study focused on how to deal with climate change adaptation. The change in climate has left many households in Jotsholo, Lupane District vulnerable.

1.2 Problem Statement

In view of the expected changes in climate and the consequent severe repercussions on rural livelihoods systems, there is a pressing need for adaptation. Households should be capacitated to be aware of climate change and adjust accordingly, perhaps by changing farming seasons or diversifying into other sources of income. The Zimbabwean Government has highlighted improvements to be made in light of the dangers posed by climate change (Zimbabwe Climate Policy, 2016). That is to say, the objectives of the Government do not always match the perceptions and requirements of households to adapt to changing climate situations. When it comes to agricultural adaptation, both agrobusinesses and individual farmers must make decisions at the household, village, ward, provincial and government levels (Mkomwa, 2013). Rural livelihoods adaptations must consider climate change's numerous aspects, including variability and extreme occurrences, in order to account for each household's particular mix of climatic stimuli and circumstances while making management decisions and altering its practices (Rojas, 2011).

An average of two degrees Celsius has been recorded over the last 30 years, while precipitation patterns show a 30% drop in rainfall (ZMDS, 2010). Zimbabwe's average precipitation and the frequency of hot and cold days are both growing (Ncube, 2020), indicating that the country is becoming increasingly out of the norm. It is becoming increasingly difficult for households in the Lupane District to sustain themselves as a result of the district's already degraded agro–ecological status and low family income. Zimbabwe's national budget allocation for social services and rural development has been reduced for the past 20 years because of the country's economic difficulties

(Unganai, 2009). To keep themselves afloat in this tough economic situation, the Lupane district's rural residents have little alternative but to adopt various local methods of income generation (Nkala, 2016).

There has been a slew of ideas floated for dealing with the potential ill consequences of climate change on rural livelihoods in Zimbabwe but however the agro-ecological zones differ and hence a one size fits all cannot work. Many different types (technical, financial and managerial) and scales (global, regional, and local) are included (governments, industries, rural households). Many different phenomena (biological, economic, social, etc.) and time scales have affected their uses in the past (instantaneous, month, year, centuries, etc) (Smit and Wandel, 2006). The majority of these strategies have yet to be put into action. Adaptation is typically considered in climate change impact estimations, although the process of adaptation itself remains unknown (Mika, 2020). The kinds of adaptations that are possible and plausible, as well as who could be involved in implementing them and what could be needed to promote or encourage their growth or adoption is critical for rural livelihoods (Nkala, 2016).

There is need to know what rural livelihoods know about climate change and what they think about the effects of climate change in order to support adaptation strategies and incorporate information and views from the rural stakeholders. Rural livelihoods can be improved and climate change impacts mitigated through realistic and practical adaptation approaches suitable to local households. In terms of climate change sensitivity and rural livelihoods systems' capacity to adapt to climate change, Jotsholo situated in Lupane District in Zimbabwe is both promising and poorly understood. This study examines how poor rural livelihoods view climate change, as well as their alternatives for dealing with it and the difficulties they encounter. Rural livelihoods are also examined in this thesis, using the case study of Jotsholo as a point of reference to explore both their challenges and prospects.

1.3 Objectives of the Study

1.3.1 General Objective

The study's primary objective was to investigate measures which have been adopted by households to adaptation to climate change in Jotsholo, Lupane district, Zimbabwe.

1.3.2 Specific Objectives

The specific objectives were;

- To examine how climate change is affecting rural livelihoods in Jotsholo, Lupane District
- To determine the climate change coping strategies that are being used by households in rural livelihoods in Jotsholo, Lupane district
- To analyze the social dynamics of how rural households, communicate and share adaptation mechanisms in Jotsholo, Lupane district
- To establish the barriers to climate adaptation being faced by households in Jotsholo, Lupane district
- To make appropriate recommendations for climate change adaptation for sustenance of rural livelihoods in Jotsholo, Lupane district

1.4 Research Questions

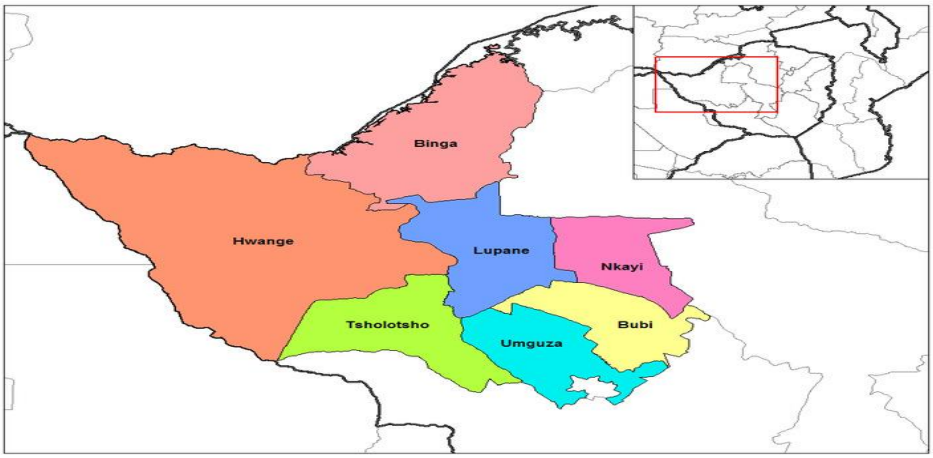
The research discussed the adaptation of climate change initiatives used by rural households for livelihood survival in Jotsholo, in Lupane district in Zimbabwe. This research seeks to address the following questions;

- How is climate change affecting rural livelihoods in Jotsholo, Lupane district?
- What are the coping strategies that are being used by rural households in Jotsholo, Lupane district?
- What barriers do households face due to climate change in Jotsholo, Lupane district?
- What are the social dynamics of how rural households, communicate and share adaptation mechanisms?
- What are the appropriate recommendations for climate change adaptation for the sustenance of rural livelihoods?

1.5 Scope and Limitations of the Study

1.5.1 Scope of the Study

Study Area



Source – Google Maps (2018)

Figure 1.5 - Map of Zimbabwe showing Lupane district

The research analysis was limited to Jotsholo, Lupane in Zimbabwe. Jotsholo is made up of seven villages where data collection took place. The thesis provided insight into the socioeconomic and environmental consequences of climate change, as well as ways for adapting to the changes, the degree of tolerance, and the social dynamics of how families interact and develop climate adaptation experiences. The areas where the study took place in Jotsholo Ward include; Jabatshala, Jibajiba, Jumbika, Kheswa, Kwarai, Gumede and Gudubhu Villages.

1.5.2 Limitations of the Study

The focus of the study was restricted to Jotsholo, Lupane district where the research took place. In several cases this thesis may have taken a lot of money and time to complete the study if it would have covered the whole of Lupane district, which is why the researcher did not pursue it. Another limitation for the study was external validation as the study process was based on a small sample of participants in Jotsholo, Lupane district observations. As the research was conducted in

Jotsholo, Lupane district, it therefore means the results cannot be generalizable to the whole of Zimbabwe or other areas which are in Region four.

A non-probability sampling technique was used in the study for a better understanding of changing climate trends. Study participants were subjected to focus group discussions and interviews. In order to ensure trust worthiness of the data collected, several groups were employed to address the focus groups in order to improve the reliability of the information gathered, and this provided participants with in-depth information.

When it comes to climate change and adaptation, Zimbabwe as a country is lagging behind in terms of preparedness and addressing the vagaries of climate implications (Government of Zimbabwe, 2000). A range of communication channels must be used to reach people of all ages, genders, and educational levels in order to build public awareness of climate adaptive capacity. This research is valuable and important because it adds to the body of knowledge by providing information on local level dynamics and adaptation methods used by rural communities.

1.6 Significance and Justification of the Study

All of humanity is at risk because of climate change. If nothing is done about climate change, the entire planet will be uninhabitable by the middle of the twenty-first century (IPCC, 2007). Adaptation and mitigation strategies for climate change are critically important. Climate change and variability have already resulted in long periods of drought, unpredictable dry spells, floods, and storms, leaving no doubt about the long-term effects that scientists expect, particularly in developing countries (Kongsager et al., 2016; Toole et al., 2016; Sango and Godwell, 2015). There is a lack of climate change awareness in Zimbabwe, and no meaningful action is taken to reduce or adapt to climate variability and change (Government of Zimbabwe, 2015). Regardless of one's age, gender, or educational background, it is necessary to use a wide variety of communication techniques in order to raise public awareness. As a result, this study contributes to the body of knowledge that is lacking in terms of local dynamics in adaptation on rural livelihoods. Adaptation strategies in rural areas can be seriously harmed by shock events (Gentle and Maraseni, 2012). The fight against global warming necessitates long-term solutions.

Climate change research has been conducted by the Zimbabwean government (Brown et al., 2012; Chagutah, 2010; Government of Zimbabwe, 2013; Madobi, 2014; Manatsa and Gadzirai, 2010; Mazvimavi, 2010; Mudavanhu et al., 2012; Muzamhindo et al., 2015; UNDP (2013); Nyamwanza and New, 2016; Nyamwanza , 2016). Also examined were climate projection models and strategies for adapting to changes in the climate. Submissions came from a wide range of industries in some cases. Extensive research on climate change adaptation has been conducted in Matabeleland South and little research has been conducted in Matabeleland North where Lupane District is located. As a result, there is a lack of research into the particularities of these outlying areas to help local policymakers make informed decisions about Zimbabwe's overall capacity to adapt to climate change. Climate change, the local adaptive capacity, as well as strategies utilized in Lupane district, are major components of this study. In some places, the effects of global warming have made their physiographic settings dangerous or advantageous (Sharma, 2015). There are many different ways to mitigate climate change and adapt to it, but the most effective approach was to focus on the case of Jotsholo Ward in Lupane District of Zimbabwe, which has a lot of rural characteristics.

Taking on the problem at the local level, particularly at the household level, increased grassroots participation and ensured that relevant and effective responses and strategies were recognized, encouraged and supported. Furthermore, top-down climate change and variability policies were also challenged. Due to Lupane District's socioeconomic and physical conditions, it was a suitable location for this research. The importance of prioritizing the development of adaptive mechanisms and capacities in a variety of community configurations were emphasized (Ziervogel and Calder, 2003).

As Swanborn (2010) points out, climate variability and change are current issues that necessitate the use of dynamic strategies compatible with various data sources. Alternatively, this study employed a case study approach to investigation. A case study is defined as a study that employs a variety of instruments in a single area (interview guides, observation guides, focus group discussion guides, and household questionnaire schedules). Climate change in rural livelihoods can be better understood by enhancing sustainable dialogue and communication mechanisms on the topic of climate change in rural communities (Zikhali,2020). Stakeholders can use climate

change adaptation to improve the lives of rural residents, according to the findings. The study's goal was to spark a discussion about climate change solutions, and it was a success.

1.7 Operationalisation of Concepts

This section defines the fundamental notions that underpin research. These factors contribute to the research's coverage of the issues. Although the phrases were subtle, it was believed that contextual knowledge or meaning was critical. The definitions of rural livelihoods, climatic change, climate variability, and adaption were critically explored. It is critical to note that the definitions provided were not exhaustive but however they were intended to guide the researcher's understanding of the phenomena examined at length in this thesis.

1.7.1 Rural Livelihoods

Rural livelihoods are defined by Kalungu (2016) and Scoones (2015) as a synthesis of all the (natural and socioeconomic) capacities, qualities, and capitals required by humans for rural existence. There is also evidence to support the idea that rural people need sustainable livelihoods in order to avoid being hungry and maintain food security and self-sufficiency (Wekesh,2019). In order for these livelihoods to be sustainable, they must be able to tolerate stress and shock (such as those produced by climate change) while maintaining or improving their capability and assets without depleting the natural resource base.

Conceptualizing the position of survival assets and processes in relation to each other is a two-in-one notion. As stated by Chambers and Conway (1992, referenced in Bhatta et al., 2015:146), "livelihoods are defined as a system of assets, capabilities, and activities that provide a means of subsistence". It's all about humans and what they can do to keep themselves alive. When it comes to basic necessities like food, income and other assets are crucial (Butt et al., 2015; Lienert and Burger, 2015). In order to sustain one's life, one must have access to resources, both natural and man-made. Climate-sensitive natural resources are considered "rural" if they are the sole source of income for a person or family (Kaushik and Sharma, 2015). Forestry resources, including food, fuel, and medicinal plants, as well as pastures for cattle, sustain rural livelihoods (Sango and Godwell, 2015). Taiy et al. (2015) notes that, agriculture in rural areas is highly dependent on rainfall. Having enough food and money to meet one's basic needs can be explained by having a means of subsistence (Acharya, 2006). Environmental resources including land, water, and forests

are critical to the rural poor's survival because of their vulnerability to weather and climate change (Kaushik and Sharma, 2015). Lupane District's climate change adaptation initiatives should be examined in light of these findings and contributions, as well as their long-term viability.

This definition of rural livelihoods is similar to that of Khanya-AICDD (1999), Scoones (1998; 2009; 2015), and others, who describe it as a combination of humankind's natural and socioeconomic resources. Scoones (2015) notes that livelihoods are the key to lifting rural people out of poverty and assuring their ability to feed themselves and their families. As long as the natural resource base is not depleted, these communities will be able to cope with and recover from stressors and shocks (in this example, climatic risks), while maintaining or increasing their skills and assets (Butt et al., 2015; Cramb and Culasero, 2003; Scoones, 1998). According to Butt et al. (2015), sustainable livelihoods are defined as those activities that improve the lives of individuals over the long term without endangering the livelihoods of others. They can withstand stress and other natural and artificial shocks, which makes them generationally durable means of subsistence (Carney, 1998 cited in Bhatta et al., 2015:146). Production-based, labor-based, exchange or market-based, and transfer-based entitlements are further subclassified by Acharya (2006) into four categories: production-based, labor-based, exchange or market-based, and transfer-based entitlements (where households depend on transfers or donations from the government or other social organizations). All of the activities or processes and the assets (natural and man-made) that sustain the lives of individuals or families are referred to as rural livelihoods. A rural community's socioeconomic foundation, like Lupane District, is dependent on agriculture in this case.

1.7.2 Climate Change

It can be referred to as the change of the weather over a period of time and it is thought to be caused by both natural variability within the climate system (including interactions among the atmosphere, hydrosphere, lithospheric, and biosphere components, as well as the solar radiation received by Earth) and human activities (mostly the burning of fossil fuels) (Butt, 2015). Increases in greenhouse gases, such as carbon dioxide, are altering the composition of Earth's atmosphere over time, resulting, for example, in rising temperatures and fluctuating rainfall patterns (Bob and Babugura, 2014). Even if this research does not focus on climate change, an understanding of how

it occurs is crucial. For example, current research is focused on survival or adaptation strategies to ensure the long-term viability of mankind.

In order to better understand the current state of climate change adaptation and the direction it is likely to follow, stakeholders will benefit from a current evaluation. Discovering and utilizing the most efficient methods is beneficial to all types of researchers, including those in the natural and social sciences. Smith (2013) agrees with the National Climate Change Response White Paper's definition of climate change as a general trend in weather element changes brought about by global warming. Changing climate is defined by UNCED (1992) as an increase or decrease in temperature or precipitation due to human activity. There will be long-term consequences for climate change as a result of human activities (Butt, 2015). Besides explaining climate change's impacts, these definitions also point to its causes.

As stated by the South African government in its National Climate Change Response White Paper, Smith (2013) defines climate change as the general trend of changing weather conditions brought on by human-caused global warming. Changes in climate caused directly or indirectly by human action, according to UNCED (1992), are referred to as "climate change." Global atmospheric composition is thought to be altered for a long time as a result of human activity. Aside from providing insight into the consequences of climate change, these definitions also hint to the underlying causes of those changes. According to the IPCC (2007) climate change can be defined as a long-term shift in atmospheric properties assessed statistically over a period of time. As a result, current research adheres to these definitions because they all point to long-term changes in the atmosphere. Aspects like as temperature and precipitation are especially important to keep in mind.

1.7.3 Climate Variability

Changes in weather elements through time and space are part of climate variability (Hansen et al., 2007). Climate variability is defined by Madobi (2014:1271) as "the way climate swings yearly above or below a long-term average value". When it comes to Australian farmers, climate variability is viewed as a natural occurrence, while climate change is a man-made one. An increase in climate variability has been linked to climate change according to Cuevas et al (2016). Climate

variability is defined by the Food and Agriculture Organization (FAO, 2007; 2010) as a climatic parameter in a region or subregion that deviates from the long-term mean. This means that the weather can change at any given moment and place, regardless of the season or year. Other characteristics such as rainfall and temperature are either below or above normal, making it difficult to determine the best possibilities for a sustainable income. Because of climate change, no one can be certain that they will receive enough rain each year (FAO, 2010). Droughts and floods are typical occurrences in Sub-Saharan Africa, where they have become the norm (Musiyiwa et al., 2014; Muzari et al., 2014).

In addition, climate variability is examined by Thornton et al. (2014) as departures from the mean values or state of climate statistics, which implies records of extreme weather occurrences. On both a temporal and a spatial scale, these can be detected. Natural processes within the climate system and anthropogenic influences are both referred to by the IPCC (2012) as sources of climate variability. Climate anomalies originating from either internal or external processes initiate the phenomenon. Dinse (2011) defined climate variability as the annual increase or decrease in the long-term mean climate score above or below the levels provided by Dinse (2011). This is a short-term variation in the weather, which Dinse (2011) refers to as a "long-term continuous change" in terms of climate change. This phenomenon is critical to the study of rural livelihoods and their ability to adapt to climatic unpredictability and change.

1.7.4 Climate Adaptation

Adaptation is a central topic in this research. Maghadam (2015) defines adaptation to climate change as "any sorts of modification or adjustment in environmental, social, or economic structures." Lee (2017) define adaptation as an array of measures intended to reduce, minimize, or eliminate the undesirable effects of an increasingly susceptible climate system while also taking use of available opportunities (Ward,2018). For this to work, there was need for creative ideas for systems, procedures, and structures that assure the least amount of harm while taking use of climate change opportunities. The research also addressed adaptation as risk-reduction methods, identifying possibilities and capabilities for resolving climate effects from macro (global or domestic) to micro (single or local) scales, including natural systems. The focus was on mobilizing capability through decisions and actions (Mango,2017).

Incremental adaptation is distinguished from transformative adaptation (Mango, 2017). In the former, no significant alterations are required. Instead, existing ideas and programs are put into action. With respect to long-term diversification, Manyani (2010) highlights the actions taken by the corporation to reduce disaster risk while also conserving water and irrigating their crops. New tools, on the other hand, are needed to capture more adaption techniques and deal with new difficulties related to current climate change and unpredictability (UNDP,2017). This called for a metamorphosis adaptation that involved a complete overhaul of one's job or way of life (Makumbe,2016). The goal was to usher in a new era of adaptation by altering the fundamental features of systems in response to real or anticipated climatic variations and the consequences of such variations. Instead of transitioning from crop to animal production or relocating to a different place with a different lifestyle, people's views on climate change and the way nature interacts with humans changed totally (Marongwe,2013). The Lupane set up serve as a testing ground for several adaptation types and how sustainable the measures are.

1.7.5 Mitigation

According to Maponga (2013), mitigation includes the management of greenhouse gasses to ensure a stable climate change to an appropriate degree following the presentations during UNFCCC. The goal is to lessen pollution while increasing the amount of greenhouse gases stored. Industrialized countries are required to assist greenhouse gas emission mitigation or eradication activities as part of the global variability and climate change dialogue (Marongwe,2013) Mika (2020) also points out that industrialized countries are held liable for adaptation because of their low mitigation capabilities and high susceptibility. There are substantial ramifications for understanding climatic variability and transition (Maroyi,2019). In this study, the term "relationship" should not be abused but rather used to aid in the development of unique, holistic responses to the events.

1.8 Structure of the Thesis

Chapter 1 - This chapter highlighted the introduction of the study. As a result, the chapter focused on the study's background, which served as a foundation for developing the study's problem

statement. As the foundation of any study, research questions and goals specify the approach to be taken and lead all phases of investigation, analysis, and reporting. The study's justification and policy relevance were both examined. The chapter also looked at the study site in Lupane, specifically Jotsholo. There was also a discussion of the study's limitations and boundaries.

Chapter 2 - The chapter focused at the literature review and theoretical framework that includes; the vulnerability framework and the sustainable livelihoods approach. Analyzed were the findings of a literature review on climate change and the measures required to combat it. The chapter further examined the context of a study on rural households' use of climate change adaptation literature from various researchers, which was the subject matter under discussion. Climate change was also covered in Zimbabwe, both as a cause and an effect. It was crucial to look at Zimbabwean households' climate change adaption plans and the challenges they confront in putting them into practice. Additionally, the researcher examined the impact of climate change and adaptability on Zimbabwean rural communities as part of this research.

Chapter 3 - This chapter discussed the research approach that was used. In this chapter, the research design and sample methodologies were discussed. The utilization of in-depth interviews, focus groups and observations was clearly highlighted as a data collection strategy, pointing out their pros and weaknesses as data collection approaches.

Chapter 4 - This chapter summarized the study's findings. Thematic analysis was utilized to analyze qualitative data. Discussions were delved at with a view to understand points of intersection and departure on the subject matter that was being pursued.

Chapter 5 - This chapter summarized the discussion and concluded the research. Recommendations were made on how in Jotsholo, Lupane district, climate change adaptation mechanisms would be successful or sustainable for rural livelihoods.

1.9 Chapter Summary

This chapter focused on the study's introduction, highlighting climate change adaptation as a means of preserving rural livelihoods in Lupane district's Jotsholo ward. In the presentation, households in Jotsholo district of Lupane have stressed climate adaptation initiatives. The chapter

further outlined the difficulties that rural livelihoods pose in dealing with climate change. The outline of the project, the problem statement, the study goals, research concerns, the nature and limits of the analysis and the significance of the study were key topics that were discussed. For the government, this research comes at a key moment, as it works to develop long-term adaptive solutions to climate variability and change. Since the adaptable livelihoods practices in the research region have been identified and evaluated, legislators and policymakers now have more options to consider when making climate change adaptation decisions. Negative socio-economic consequences of climate change can be mitigated. This will open the door to fresh research on possible solutions to the problem of local climate variation and change.

The effects of climatic unpredictability and change are already being felt by residents in rural areas far from urban centers. For climate change to be avoided or minimized, everyone must "think globally and act locally. As a result, vulnerable groups need easy access to reliable climate change information. To close the knowledge gap, this research focuses on understanding and contributing to the enhancement of capacities, as well as providing appropriate information on climate variability and change. This Chapter explored at great length about the study's significance and scope.

CHAPTER TWO

LITERATURE REVIEW AND THEORATICAL FRAMEWORK

2.0 Introduction

The chapter provides literature from different scholars regarding the impact of climate change among rural households, climate change adaptation measures used by rural households, social dynamics of how households communicate and share experiences of climate adaptation in Jotsholo, Lupane district, barriers faced by households to climate change and structures that are available to help households adopt and cope with the impact of climate change. Lastly the researcher analysed climate change and climate change adaptation in rural livelihoods from a world perspective, Sub-Saharan African perspective, Southern African perspective and Zimbabwean perspective. The chapter defined the cornerstone of the study as it framed the theoretical and conceptual framework that guided the study.

2.1 Theoretical Framework

Rural livelihoods in developing countries are closely linked to discussions about climate variability and change because of their dependence on the natural environment, especially the climate that provides water for their operation (Sharma et al., 2014). It's clear that adapting to climate variability and change is essential if we want to maintain our current way of life in this world. People's health, food security, and water availability are all directly affected by climate change regardless of where it occurs (IPCC, 2014; Bola et al., 2014; Nkomwa et al., 2014). A multidisciplinary approach that considers the socioeconomic as well as the biophysical aspects of climate change and rural livelihoods was required for this connection to be understood.

2.2 Conservation of Resources Theory

The study utilized the conservation of resources theory. Hobfoll (1988), notes that the conservation of resources (COR) model is an individual's effort to acquire, preserve and defend the things they

value. It was formerly thought that the idea primarily focused on the surroundings, ignoring one's own feelings. As a matter of fact, Hobfoll (2001) defined it as an integration of the individual, nestled in the family of the family and in the tribe of tribe, in the context of social relationships. According to him, "the self emerges from primary bonds within biological families and intimate social groups," which are defined by cultural scripts and formulations. According to this theory, people are driven by a desire to protect and maintain the things they hold dear. Previously, it was believed that the focus of the philosophy was solely on the environment, with little regard paid to one's own well-being. Individuals are integrated into a family and ethnic group within a social framework (Hobfoll, 2001).

The self-arises through primary links within biological families and intimate social groups," are defined by cultural scripts and formulations (Gumede, 2017). Abraham Maslow's theory of human motivation, which was developed in 1954, had a significant impact on the COR theory. People, according to the theory, first seek material items before moving on to social and then psychological resources. It has been noted that this theory is vague in its definition of self-actualization and also believes that when a person meets all of their desires, they are content. In Hobfoll's view, Bandura's social learning theory from 1977 is the most applicable to COR theory. In his view, resources are anything that an individual considers as valuable or as a means to acquire more valuable items, personal traits or situations, or energy that he or she finds personally important and/or useful to him or herself.

While Aspinwall and Taylor (1997) and their colleagues argue for a proactive coping theory like Greenglass, Schwarzer, Jakubiec, Fiksenbaum and Taubert (1999), they agree that stress is more than just a reaction to a loss or threat of resources. By contrast, people and organizations adapt by focusing on self-reliance, preparing ahead of time for potential problems, and positioning themselves in ways that make use of their own resources or give them an advantage over their neighbors (Hobfoll, 2001:352). According to COR theory, it is a basic human need to protect the quality and quantity of one's resources. People labor hard to build up a buffer when there is a

chance of losing resources in the future. Because of this, it is claimed that other resources such as aiding close family members will be better able to thrive.

These stakeholders also make use of other resources like money, love, and energy. Von Vacano (2014) asserted that the COR hypothesis explains how humans deal with stress. Loss, resource investment, and resource sensitivity are all presuppositions of the theory. Short-term stress is caused by sudden resource depletion rather than chronic resource insecurity. Disaster studies demonstrate that the stress effects of disasters can be explained by the loss of resources caused by fast-onset disasters, according to Zamani, Gorgievski, and Zarafshani (2006). a cross-cultural study of college students revealed a link between the signs and symptoms of Acute Stress Disorder (ASD) after Hurricane George (Sattler, Preston, Kaiser, Olivera, & Schlueter, 2002). As stated in a resource investment idea, resources are invested to protect against loss, recover from loss, and obtain resources (Hobfoll & Lilly, 1993). Climate coping strategies identified by Zamani et al. (2006) included agricultural and economic modifications. Prayer and denial, two emotional-based coping methods, were also shown to be fruitless by the researchers.

According to Hobfoll (2001), those who are short on resources take a defensive stance in order to protect the little money they have. A lot of studies show that there is a difference between a resource conservation strategy and a strategy of learned helplessness. A tentative conclusion, however, was made by Hobfoll (2001). Climate change has taken a toll on the Lupane district's most disadvantaged families. Families have no choice but to rely on resource-depleting methods of survival due to a lack of alternatives. Despite being taught about environmentally friendly technologies and ways to adapt to climate change, no attempt is made to personally change. Concerns about attitude and perception impact behavior change. Positivity toward change and a different view of oneself can be used to gauge one's level of acceptance with the status quo. Self-efficacy attitudes have an impact on how a family behaves and thinks, as noted by Bandura (1997) in his self-efficacy behavioral theory. Stakeholders who lack resources are more vulnerable to resource loss, according to the third assumption of conservation of resources theory. This causes

loss spirals. Droughts, according to Robertson, Morse, and Baird-Thomas (2009), are an example of a stressful life event that can lead to resource depletion and inadequate adjustment.

Households with more resources are better protected from resource loss and have a greater chance of resource acquisition according to the fourth principle. Kaniasty and Norris (1993) found that low-resource households perform worse than higher-resource households in terms of financial stability and the ability to replace lost assets. Men and women's ability to survive natural disasters depends on the resources they have, such as social assets, money and physical assets as well as human resources. As a result, this method proved crucial in locating resources and identifying factors that put households at risk from global warming. For countries like Zimbabwe, long-term resource conservation may be more difficult because of donor fatigue and the frequency of extreme weather events like climate change.

2.2.1 Critique of the Conservation of Resources Theory

The benefits and drawbacks of resource conservation are equally clear. According to the COR theory, resources are complete, but they may not be suitable for developing countries because of their limits. In response to criticism, Hobfoll (1992) argued that the ranking and worth of each resource varies from setting to setting, rather than the actual resources themselves. Hofbol (1992) noted that there should be greater emphasis on the importance of resources, especially for African countries that depend on a unique mix of resources for livelihoods. According to Adeola and Hobfoll (1992), while social relationships might be valuable to conserve valuable resources, they can also limit a person's ability to express themselves creatively. The majority of people in Africa are still dependent on natural resources to meet their daily needs, despite the fact that African countries have yet to fully realize their potential. Rural communities are more inclined to rely on their own resources, despite the fact that many natural resource-based businesses are struggling due to droughts and floods. It's possible to oversimplify the concept of scarcity and excess when it comes to resources. Quality, importance, and value are the most important considerations when devoting resources to livelihoods.

The idea that greater resources make one less sensitive to the loss of resources is simplistic since it neglects the significance of diversity in a community. According to the COR theory, resources

can be properly protected in every crisis scenario. However, climate change makes it clear that conserving these resources may be problematic. In light of the current global economic downturn, even those who continue to donate find that they are drained of their social capital as a result of their efforts. Furthermore, in the current political and economic climate of Zimbabwe, it may be difficult to put money to use. As a result, the theory's applicability is constrained by the circumstances. even if it's not true, the COR theory highlights important issues of vulnerability, asset base and coping that are relevant to the current investigation. Therefore, the theorem of COR concepts can and should be improved in light of the various complex situations in which they are being implemented, but this is not always possible.

2.2.2 Rationale for Utilizing Conservation of Resources Theory

The COR theory's ideas of adaptation and coping were refined by emphasizing the importance of resource investment at different stages of disasters. Households in Lupane district were examined in order to put these principles into practice. COR theory stresses the role of resources, and resources were compared to means of sustenance in this study. However, the ecological theory's premise that resources are recycled must be viewed in the perspective of a broader system, even though individuals can relocate to make money. Because of this, the theory can be used to study coping, adaptability, and livelihoods in a variety of ways. As explained by the COR hypothesis, our vulnerabilities are numerous. COR theory does not expressly address power relations, yet it is apparent that individuals who lack resources suffer while those who have more resources gain. In order to obtain access to resources, the problem of power must not be ignored.

Since Charles Darwin's theory of natural selection (Darwin, 1869) argues that "survival of the fittest" was coined by him, power affects gender relations as well. Research into the susceptibility of households to climate change can benefit from considering this idea, despite its shortcomings, proved to be incredibly valuable in our research. Despite the fact that the theory's basic formulation is sound and includes important details for this research, it nevertheless has flaws when put to the test in the real world. Several assumptions are made in this study that distort the theory's core meaning, and behaviorism's role at the individual and institutional levels is completely ignored. The study's focus on vulnerability and livelihoods led researchers to turn to the COR theory as

their go-to theory. Using the sustainable livelihoods framework, the researcher will delve indepthly to reflect on it use in this study.

2.3 Conceptual Framework

2.3.1 Understanding Sustainable Livelihoods Framework

Sustainable livelihoods framework, which reflected on important ideas pertinent to this study, was utilized in conjunction with the conservation of resources theory in this part to analyze the susceptibility of households to climate change. According to Scoones (1998) and Serrat (2008), a livelihood is sustainable if it can withstand and recover from stresses and shocks, preserve or improve its capabilities and assets without depleting the natural resource base.

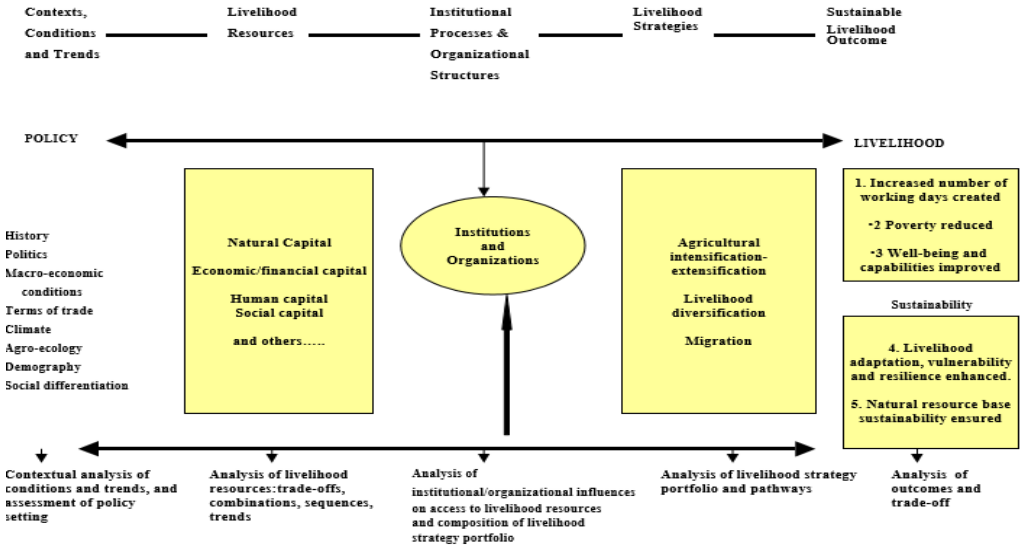


Figure 2.1 - Sustainable Livelihoods Approach
Source – (Krantz, 2001:19)

For the purpose of assessing households' susceptibility to climate change shocks, the researcher used the sustainable livelihoods framework. This study's framework is critical since it focuses on capital assets, which were used to examine households' susceptibility to climate change. Climate change-related shocks and stresses are being researched in the framework of this investigation. In addition, this study's paradigm for understanding households and their livelihoods in connection to climate change includes the question of livelihood strategies. Morse and McNamara (2013)

states that the more varied a society's economic basis, the more resilient it is to shocks to one or more of its components. Although this is a simple assumption, the worth and ranking of a household's job is essential in a given situation, therefore this is not the case. As seen in the revised Sustainable Livelihood Framework, various topics were examined. Climate change adaptation and households were added as context to this study's approach, which was revised.

2.3.2 Livelihood Assets

Livelihoods assets are critical in the analysis of rural livelihoods and poverty. DIFD (2000) posit that livelihood strategies comprise of capabilities, assets and activities required for a means of livelihoods. Central to the framework and prudent for survival in both rural and urban areas, are livelihoods assets which are seen by various scholars as building blocks of development (Mango, 2017). As indicated in the framework above, the important assets are the human, social, natural, physical and financial assets (capitals). By building on them, individuals and households develop their capacity to cope with the challenges they encounter and meet their needs on a sustained basis. Davies et al. (2008;65) alludes that "different mixes of and degrees of substitution among the different types of capital assets provide inputs to people's lives". Chambers (1995) and Ellis (2000) agree that a resilient livelihood requires flexibility and substitutability between assets so that adverse events can be withstood without compromising future rural livelihoods.

Vasta (2004) and Bauman (2002) argue that the single most important factor in understand rural livelihood strategies is to determine the ability of the poor to access assets especially land. This is concurred by Agarwal (1989) who notes that access to land, credit and the markets plays a cardinal role in determining household livelihood sustainability in Asia. Assets are therefore not simply resources, they are also the basis of agent power to act, and to reproduce challenge or changes the rules that govern the control, use and transformation of resources (Mika, 2020; Shiku, 2020). According to Petersen and Pedersen (2010), the external environment in which the poor reside is known as the vulnerability context. It must be first understood that what constitutes an event's probability distribution, which includes its size and spread as well as its frequency and distribution, as well as its previous occurrences (Alwang et al., 2001; DFID; 2000; Wisner, 2006). If an asset is identified and appraised, it is critical to examine the vulnerability in which it exists; what are the patterns (time and space), shocks, and stress? McMahon & Morte (2013). It is suggested by Allison and Horemans (2006) that because people's livelihoods are dynamic and ever-changing, a wide

range of dangers confront them. The backdrop of vulnerability shapes people's work situations (Sibanda, 2015).

There are many types of shocks that can have a direct impact on assets, including economic, health, environmental, and conflict-related ones. A shock could occur if the harvest is not successful or if the price fluctuates because of seasonality. Chambers and Conway (1992) state that shocks are frequently unexpected, sudden, and traumatizing. With the Sustainable Livelihoods Approach, it can be understood that rural livelihoods might adapt to climate change as an ongoing trend that affects vulnerability for certain populations (Elisha et al., 2005). According to Morse and McNamara, certain communities are more susceptible to shock than others (2013). Even the assets' resiliency to different types of shocks and the strength of those shocks would shift, according to the researchers' findings. In order to be safe, assets need to be managed and turned into money, food, or other essentials. Assets alone are not enough (Meikle et al., 2001).

2.3.4 Livelihood Outcomes

The framework's economic outcomes are also a critical component. The outputs of household's livelihood strategies are referred to as "livelihood outcomes" (Mazwi, 2018). "The attainment or outputs from livelihood strategies as livelihood strategies are supposed to offer a range of benefits that would promote well-being and reduce poverty in its wide sense" (DFID, 2000). The households who live in semi - arid areas are most prepared to describe these results, as they include far more than just income (Petersen and Pedersen, 2010). Visitors to a country may have difficulty understanding the beliefs, conventions, and practices of the households who live there (DFID, 2001). A household's level of vulnerability and security can be measured by their capacity to earn a living (Moser, 1998). Income, food security, and environmental sustainability can all be considered indicators of well-being in the context of livelihood outcomes (DFID, 2000). However, indicators such as a more solid asset base, decreased vulnerability, and improvements in well-being that are not directly related to material goods can also be included in the definition of livelihood outcomes.

Households, according to one notion, do not always consist of the same number of people who have the same amount of power and influence both within and beyond the house (Shiku, 2020). The results of a group's livelihood may not have the same influence on all members (Bennett, 2010; Walton, 2012). Consider the fact that a household's financial and physical well-being is

intimately tied to the male head's well-being, particularly in settings where only men have legal standing (Milder, 2019). Theory suggests certain members may be better off than others in terms of their financial situation. The sustainable livelihoods framework, according to Chambers and Conway (1992), defines a spectrum of livelihood outcomes beyond money-generating activities. As Scoones (1998) points out, sustainable livelihoods have numerous advantages, including longer working hours and a reduction in poverty.

2.3.5 Policies, Institution and Processes

The framework consists of policies, institutions, and processes. Everything from the customs of the family to the operations of the international community have an effect on how households make a living (DFID, 2000). There are several elements that affect natural and man-made resources as well as the interchangeability of those resources (Baumann, 2000). Policies and institutional frameworks also play a role in determining access to decision-making bodies and other external sources of influence. According to Morse and McNamara (2013), organizational structures have an impact on household's natural access to numerous capitals, as well as their options and choices. According to Scoones and Wolmer (2003), organizations in both the public and commercial sectors make decisions and carry out actions that have an impact on people's daily lives via implementing rules and regulations. The methods used by institutions and individuals have a significant impact on how they work and interact (DFID, 2002). There are a number of ways in which public and private sector policies, institutions, and procedures can be used to promote a wide range of alternative livelihoods and sustainable incomes, according to Bingen (2000). Studies show that regulations and institutions decide whether a supportive or encouraging environment exists, or whether one that is interfering or restricting is in place (Scoones, 2015; Silva, 2015).

2.3.6 The Strengths of the Sustainable Livelihoods Approach

The Sustainable Livelihoods Approach (SLA) is a novel approach to development and humanitarian work that was motivated by the increasing realization that the poor and their means of sustenance must be emphasized while natural resources must be protected for current and future generations (Milder, 2019). In SLA's view, it is essential to recognize and include into efforts for the benefit of the impoverished people who know their own situation and needs well" (Chambers and Conway, 1992). Additionally, the livelihoods approach to rural development provides a significant insight tool for understanding rural households' poverty and the subsequent processes and actions they engage in in order to improve their lives (Maroyi, 2019; Mango, 2010).

DFID, the Overseas Development Institute, UNICEF, and many other global aid agencies have also adopted the concept of livelihoods. Livelihood approaches take an open-ended view of the combinations of assets and activities that make a successful strategy in rural settings (Mazwi, 2018; Halady, 2010). A framework for thinking about rural development goals, scope, and priorities, as well as an evaluation framework for developing policies and practical interventions, are all essential (Gwimbi, 2015; Hansen, 2014). These approaches can help us better understand how the poor survive in various environments. It also aids in a better understanding of the root causes of poverty by looking at the numerous sectors at different levels that decide or constrain the access impoverished people have to various resources and assets (Solesbury, 2003). This technique allows for a more accurate assessment of people's living conditions than, say, a sole focus on output or money.

2.3.7 Critique of the Sustainable Livelihoods Approach

Academics have questioned Sustainable Livelihoods Approaches. McLeod (2001) has questioned the approach's utility. However, Milder (2019) adds that if the theory's conceptual framework is to be relevant to organizations, more recognition and exploration of the theory's definitional process and determination of definitional validity are required. Several critics have said that the Sustainable Livelihoods Framework Approach does not effectively address the question of how to identify the disadvantaged that one is aiming to help. Humans are considered invisible in the SLA paradigm, which prioritizes assets, vulnerabilities, actions, and capabilities. Finding out who Krantz's (2001) poor are and what poverty is are two of the most difficult aspects of his approach. In a society, social dominance and power can have a substantial impact on the distribution of resources and other livelihood opportunities (Silva, 2015). According to Baumann (2001), the political capital of the SLA is not an organic asset. By incorporating political capital into inter- and intra-household or community power networks, scholars and researchers are encouraged, according to the scholar (Matondi, 2010). This move from a descriptive to an operational framework makes it more difficult for analysts and practitioners to see their findings objectively.

2.3.8 Appropriateness to this Study

Using the Sustainable Livelihoods Framework (Hansen, 2014; Milder, 2019), this study examines the climate change adaptation for sustenance of rural livelihoods in Jotsholo, Lupane district. The

paradigm is useful because it helps identifying precisely what is preventing or constraining the households from enhancing their well-being in a given setting' (Mango, 2017). Because it recognizes that the households seek a variety of livelihood options as a means of lowering their vulnerability to poverty, this study employs this method. Understanding the fundamental causes of poverty is made easier by looking at characteristics and levels that influence household's access to different kinds of resources (Mazwi, 2018). Development and humanitarian organizations can both benefit from the sustainable livelihoods approach since it serves as a framework for addressing issues of adaptation and vulnerability. Accordingly, it has been utilized to identify the means of subsistence and income that people employ. Using a sustainable livelihood approach, households are encouraged to think about the many resources they have at their disposal while building their lives. While physical and natural resources are vital to poor households, their social and human capital is also considered in this approach (Mika, 2020).

2.4 Global Overview of Climate Change and Variability

Climate change threatens human rights and global security (Aguilar, 2009). Although natural disasters have no end, human life and livelihoods must be safeguarded. Regions like Asia, Latin America, Australasia, and Africa are highlighted in this section because of their high vulnerability to natural disasters caused by climate change. These four regions have a lot in common when it comes to the effects of climate change. But despite the fact that they have plans in place to adapt, these plans are not being implemented quickly enough to have a long-term effect. Europe and North America have been included in this discussion despite their lower vulnerability to climate-induced disasters than the other four regions.

2.4.1 El Nino and La Nino Effects on Climate Variations

The El Nio–Southern Oscillation affects all of the continents covered in this section (ENSO). In eastern Australia, the El Nino-Southern Oscillation (ENSO) phenomenon causes more flooding and long-term droughts than elsewhere in Australasia (IPCC, 1997). For example, ENSO, IOD, and PDO all have a significant impact on Asia's climate, which is why it is important to keep an eye out for them (World Bank, 2009). As a result of El Nio, flooding has occurred on the west coast of South America in the past. Climate conditions in the northeastern regions of Colombia, Brazil, and Venezuela are strongly linked to El Nios, a weather phenomenon. Internal atmospheric

variability, sea surface temperatures, and land-atmosphere interactions are to blame for recent droughts in the United States (Cook et al, 2016).

Researchers in the field have found that increased SSTs in the equatorial Pacific Ocean can affect rainfall and temperature. During La Nia, the equatorial Pacific Ocean experiences lower sea surface temperatures. The Southern Oscillation is often referred to as the "ENSO" because of the close relationship between the atmospheric and oceanic components (Singh, 2006). El Nio events are more likely to occur if SST anomalies in the region are greater than or equal to 0.5°C. Due to the low temperature anomalies, La Nia events are likely. Matondi (2010) notes that ENSO models are able to make months or years-ahead predictions. Regions must prepare in advance to deal with the consequences of ENSO.

2.4.2 The General Overview of Climate-Induced Disasters

Some countries saw death and homelessness rates 200–300 times higher than in the United States during the period 1980–2002, with over 4,000 climate disasters taking place during that time period. (Ncube, 2020). They have a much more difficult time dealing with and recovering from these kinds of disasters. There were 569 major natural disasters worldwide between 1990 and 1998; 94 percent occurred in poor countries, and 97 percent of deaths were caused by natural disasters. " (Sachikonye, 2013). In 2012, Asia was the most frequently affected continent (40.7 percent) by natural disasters, followed by the Americas (22.2 percent), Europe (18.3 percent), Africa (15.7 percent), and Oceania (3.1 percent) (Nyathi, 2013). The location of a farm and the density of its population affects agricultural output and economic losses. One of the worst-hit regions of the world by global warming is Asia (Ncube, 2020). In 2012, a total of 72.7 million people in Asia were affected by 14 disasters, which included eight floods, three storms, two droughts, and one food shortage scenario (Okali, 2015). Asia, the world's largest continent, is home to a wide range of climates, including polar, arid, semiarid, tropical, and temperate (UNFCCC) zones (UNFCC, 2007). The vastness of Asia's geography, leads to a wide range of climate conditions. Due to the region's vulnerability to climate extremes, flooding, droughts, heat waves, and storms are common occurrences (Ondieki, 2018).

2.4.3 Climate Hazards – Global focus

Prevalent climate hazards can be found in semi-arid areas such as the northeastern and southern parts of North America, Africa's northwest and south, Asia, Australia's west coast and Iberia

(Ondieki, 2018). Halady (2020) claims that because Australia is the world's driest continent, its people have always had to contend with the consequences of climate change. One of the most devastating natural disasters in Australian history, the Federation Climate (1895–1903), claimed the lives of thousands and left vast amounts of property damaged or destroyed (Garden, 2010). As if that weren't enough, the World War II climate (1939–45) wreaked havoc on the area (Yeros, 2020). Since the Millennium Climate (2001–2009) had such a negative impact on the largest river system in Australia, Victoria and the Murray–Darling Basin (2001–2009), water restrictions have been enforced, and electricity prices have increased in many cities (Zhang, 2019).

There has been a long history of droughts in Western and Central European countries as well as the British Islands, the Scandinavian region, Eastern Europe, and Russia in the past (Zikhali, 2019). While other European regions (South-East Europe and Northern Europe) have low Climate risk, these regions show increasing Climate risk with hazardous conditions (Mazwi, 2018). It is claimed that climate disasters in the United States are underappreciated because they rarely cause widespread property damage or human casualties. Silva (2015) notes that droughts are the costliest natural disasters. North American water resources, agriculture, economic activity, and rural and urban settlements have all been put under additional strain as a result of climate-related catastrophes (Romero-Lankao et al., 2014). Maroyi (2019) notes that over US$253 billion in damages resulting from climate change was lost between 1980 and 2013, and over US$50 billion in California and the central and southern Great Plains between 2011 and 2014.

2.4.4 Insurance Protection Considerations

Developing countries are more vulnerable to natural disasters because of human-caused climate change (Sibanda, 2015). Social safety nets and well-functioning financial markets in wealthy countries ensure that farmers' livelihoods are not jeopardized by adverse climate events or climate change. Famine, food insecurity, and other forms of human conflict have been exacerbated by a variety of factors, including poor governance, unstable markets, oppressive policies, and insufficient food aid, all of which have contributed to large numbers of deaths (Mika, 2020). According to Barrett et al. (2008), many poor regions do not have access to insurance because the losses incurred by all the farmers in one area are too high to cover the insurer's reserves. Ngigi (2009) reaffirmed that the risks in Africa are simply too high and frequent to commercialize crop insurance products. In countries like Zimbabwe, where the economy has been severely affected,

insurance for small-holder farmers is unthinkable unless it is widely available and easily accessible. According to Carro et al. (2016), diversifying regional economies and decreasing reliance on agriculture can help reduce the economic impact of climate change.

Yusuf and Francisco (2009) argue that transferring wealth from rich to poor countries necessitates a common vision and lengthy political processes that can be difficult to navigate. Hurricane Sandy and other extreme weather events in 2012 demonstrated that climate change's potential effects are not limited to distant shores; they are a global problem. Even if disaster relief efforts in other countries have little or no benefit, countries should work together to share and study disaster mitigation strategies and expertise (Islam & Lim, 2015). As a result of natural disasters like droughts, there has been an increase in the amount of humanitarian aid sent to developing countries. Aid organizations work together to save lives without criticizing the fact that aid has conditions. Also, it can be noted that the aid that is given is not sustainable.

2.4.5 Adaptation Strategies Across Continents

With the development of more comprehensive policies for disaster response and recovery, the European Union has shifted its focus after years of crisis management to disaster preparedness and mitigation. In their report, Stein et al. (2016) documented this shift. A country's level of climate readiness is determined by its infrastructural development, who note that infrastructure development includes things like better access to clean drinking water and better road connectivity for rural areas in general (Sibanda, 2015). European countries like the UK, Spain, France, and the Netherlands are better able to deal with drought because of this. Environmental infrastructure development in Asia has been proposed in order to reduce flooding, water salinization as well as soil erosion (Mika, 2020).

Latin American indigenous communities, despite the implementation of climate change adaptation strategies, are left frustrated and even resigned and accepting of the effects on climate change and variability with little knowledge about how to act or who can help (Maroyi, 2019). Cultivation selection and irrigation are just two of the strategies Latin American farmers employ when faced with a drought. Other methods include non-farm employment and migration (Halady, 2010). Mendelsohn and Dinar (2009), on the other hand, found that irrigation decisions were adjusted to reflect this shift in crop farming to livestock raising. According to the United Nations, there has been a shift away from crops like corn, wheat, and potatoes in Latin America (UN,

2015). Latin America has opted for more drastic measures of adaptation because of the high costs, with the primary objective of protecting coastal areas, agricultural activities, and water resources (United Nations, 2015). Kronik and Verner (2010) also point out that these strategies are too expensive for farmers due to their reliance on subsidies, water access, and investment funds, in addition to the non-farm employment implications.

Early warning systems, maps showing rice-growing regions vulnerable to drought, irrigation facilities for low-lying areas, increased planting index in suitable areas, and diversification of water sources are just a few of the measures being taken by Asia to reduce its risk of being affected by drought (Miyan, 2015). In the Asia-Pacific region, implementation of adaptation strategies is hindered by weak governance and adaptation processes (USAID, 2010). The lack of laws, policies, and regulations addressing issues other than climate change results in weak governance when subnational governments are poorly organized, coordinated, and financed. Although Pittock and Wratt (2001) echoed the importance of climate change adaptation for Australia and New Zealand, the authors pointed out that the topic has received relatively little research attention to date.

By managing the landscape in this way, they claimed, conservation could be achieved while also meeting human food and fiber demands. An Australian government report in 2008 called for better building design to withstand future natural disasters as existing stock is renewed or replaced (Milder, 2019). For many farms and ranches, diversification means having a stake in a variety of businesses and investments, both on and off the property. As a result, they've been able to cope with the effects of global warming and take advantage of price fluctuations in agricultural commodities (Scoones, 2015). Even though smaller businesses may have a limited ability to diversify geographically, Kingwell (2006) noted that local and regional responses to climate change and variability may suffice.

Despite the widespread awareness of the negative effects of climate change in North America, little is being done to implement adaptation strategies on a larger scale, according to Lonsdale et al. (2017). According to Romero-Lankao et al. (2014), planners face significant challenges and resistance during the planning and implementation stages of adaptation. Despite the obvious evidence of losses across the continent, many decision makers, particularly in the United States

and Canada, have the financial, human, and institutional capacity to invest in a resilient continent (Romero-Lankao et al., 2014). Climate change planning in the United States remains a challenge even after decades of devastating droughts that have caused ecological, economic, and social harm (Kelley, Scasta, & Derner, 2016).

In North and South America, Australia, and Europe, the percentage of people employed in agriculture is extremely low, according to Eriyagama et al. (2009). Gwimbi (2015) notes that the wealthiest regions of the world, including Western Europe, North America, and Oceania, are less vulnerable to droughts. Since all are interconnected, even though North America is less susceptible to climate-related disaster, we can't afford to be isolated. Demand and distribution of Canada's water resources create a wide range of Climate Change vulnerabilities and effects (Mango, 2017).

Water shortages has worsened across Europe as a result of climate change, with the worst effects occurring in Europe's southern and southeasterly regions. Economic trade across national borders puts Europe at greater risk of global price volatility and disruptions to its transportation networks (EEA, 2017). Ercin, Chico, and Chapagain (2016) concurred that Europe's economic dependence on the rest of the world and its vulnerability to droughts are both significant. 38% of Europe's annual 668km3 water consumption comes from outside the continent, and a large portion of Europe's food imports are sourced from water-stressed regions around the globe (Ercin et al., 2016). As reported by the National Climatic Data Center, the recent drought in the United States has resulted in significant financial losses for the country (2014).

2.4.6 Global Conferences on Climate Change and Outcomes

Since 1995, numerous global conferences (also referred to as "COPs") have been held in an attempt to force countries with large corporations to reduce their carbon emissions and use of fossil fuels, all to no avail. COPs If other countries don't act, the efforts of some countries to reduce carbon emissions could be undone (Silva, 2015). This necessitates an international effort to regulate carbon emissions and to implement incentives and sanctions on the basis of major countries that have worked well together to address climate change issues (Boyd, 2013). As a result of the annual conferences, no recent legally binding agreements on emissions reductions have been reached (Sibanda, 2015). To maximize the interests of its own corporations, particularly

those with industrial or fossil fuel assets, Milder (2019) claims that each country's national delegation attends the United Nations Conference of the Parties (COP).

The climate crisis has not been addressed at its root causes, such as "fossil-based energy production, car-based private transportation and ubiquitous air travel, sprawling urbanization, the liberalized global trade regime, industrialized agriculture, and overconsumption in the Global North (including parts of the geographical South) (Halady, 2010). In order to reduce the dangers of climate change, a global effort to alter the status quo is required. A single agreement and a shared responsibility to mitigate climate risks necessitate countries capable of cooperating, being held accountable to one another, and making joint decisions together. Mika (2020) notes that climate change deniers in the Global North and those in the Global South are in a position of power imbalance. The capitalist economic model, he argued, does not lead to plunder, waste, or pollution, and this is not accepted in the Northern Hemisphere (Mango, 2017).

When something happens in one region, it has an impact on the rest of the world, which has a ripple effect. Different regions have different capabilities when it comes to dealing with disasters like those caused by climate change and variability (Mika, 2020). Global climate change conferences have become routine as a result, but the poor nations continue to suffer as a result of differing views on the magnitude and likely consequences of climate change. Mazwi (2018) notes that households' lives and livelihoods are in jeopardy despite the interdependence of continents, some of which are weaker than others. Global leaders must treat climate change and variability as a human rights issue. Climate change affects every part of the world, so an international approach is necessary. Finding out what works in other regions can help you figure out what doesn't work in your own region. This section focuses on African climate change and variability.

2.5 African Context

ITZ, El Nino–Southern Oscillation (ENSO), and the West African Monsoon (WAM) all have an impact on the climate in Africa at a macro level (Collier, Conway, & Venables, 2008). Rainfall in eastern and southern Africa is greatly influenced by the El Nio/La Nia-Southern Oscillation (ENSO) cycle (Nicholson, 2001). ITCZ, monsoon winds, and rainfall anomalies in Sub-Saharan

Africa all have a significant impact on the ENSO event in the region (Singh, 2006). According to Mubaya et al (2012) climate change is likely to increase the frequency and intensity of extreme weather events in Africa. Floods and droughts are expected to become more frequent in Sub-Saharan Africa as a result of climate change. owing to their lack of resources, poor countries bear the brunt of global warming's effects (Nyathi, 2016). Africa is a highly vulnerable continent, but there are regional differences in the extent of vulnerability and the consequences. Africa's vulnerability to climate change is exacerbated by factors such as poverty and weak institutions, lack of financial markets, degraded ecosystems, and conflict over resources (IPCC, 2007). Mazwi (2018) further concurs by noting that Africa's vulnerability to climate change is largely due to a lack of financial, institutional, and technological capacity (2008).

Many African countries have a natural resource-based economy and trade restrictions as the foundation for their environmental policies, which were supported by the African Ministerial Conference on Environment (AMCEN) (Milder, 2019). Forty two percent of Sub-Saharan Africa's GDP comes from agriculture, which employs 65 to 80 percent of the workforce in low-income countries (Mika, 2020). Agriculture dependency is not a problem in and of itself, but the combination of factors such as low institutional capacity, a lack of or limited technology, and a lack of capital hinders the majority of small-holder farmers to adapt to weather changes. Gwimbi (2015) notes that ethnic conflict in some African regions may increase their vulnerability to climate change. Poverty and environmental degradation in Africa make it more vulnerable than any other continent and a wide range of economic, social, and environmental challenges makes Africa particularly vulnerable to natural disasters, which have a 15.7 percent record in Africa this year.

In the Sahel region, rainfall decreased and droughts occurred more frequently between 1970 and 2000, according to data compiled by the United Nations Environment Program (UNEP) (UNEP, 2020). Between 2011 and 2016, the Horn of Africa and southern Africa suffered from severe droughts that reduced agricultural output. Shiku (2020) notes that an increase in temperatures across the Sahel and tropical forests, as well as in Southern, Eastern and Northern Africa. All of Africa's regions saw an increase in temperature between 1995 and 2015 (Matondi, 2010). In places like Mozambique, Nigeria, and Guinea, the AMCEN reports an increase in the amount of

rain and flooding (Maroyi, 2019). Due to a lack of adaptive capacity and financial challenges, the African Union has drafted a long-term climate change strategy. According to the United Nations Food and Agriculture Organization (UNFCC), the majority of Africans are at risk of drought (Sibanda, 2015). An increasing number of people's livelihoods and food security depend directly on primary industries like agriculture and fishing in many African countries due to climate change-related factors such as rising sea levels and unpredictable rainfall patterns.

Households in rural Africa have developed a variety of ways to deal with the recent extreme weather. ' For example, diversification practices in agriculture include the introduction of sheep to Sudan's western Bara Province to increase its herd diversity and the cultivation of multiple types of crops to increase one's own income (UNFCC, 2007). Padgham (2015) claims that shorter-duration crop varieties are becoming more common in Burkina Faso, Mali, Ghana, and Senegal. Pruning and fertilizing trees in semi-arid areas like Senegal and Burkina Faso was also recommended by the UNFCC to increase the density of trees (Silva, 2015). Examples of land use manipulation include Southern Africa's shift from livestock to game farming. Using small reservoirs for irrigation and household and livestock water needs is a common practice in West Africa. Land tenure security undermines the ability to use land resources to manage shocks despite conservation practices in Burkina Faso, northern Ghana, and Mali, despite conservation adaptations being practiced there (Padgham, 2015).

Sarr (2015) claims that by reducing excessive surface runoff and soil erosion and adopting soil conservation techniques such as mulch, grass strips, and earthen bunds, improved field water management can also be achieved. To deal with the dry climate, farmers in Burkina Faso are said to use water conservation techniques like Za (Halady, 2010). Digging pits in the soil to collect organic material carried by the wind, adding organic matter from animals that attracts termite activity, resulting in tunnels that can collect rain deep enough that it doesn't evaporate, and thus increasing soil fertility are some of the methods to implement this technique. Sorghum, staggered sowing, and the use of hand-dug wells for irrigation have all been used in the Sahel region during droughts (Joshua et al., 2016).

As a result, efforts to address climate change in Africa have been hampered by the lack of data and information on both cyclical and non-cyclical aspects. Cultural, traditional, and context-specific practices are ignored or undermined when national development plans are being implemented, which makes it difficult for communities to adapt to climate change (SIibanda, 2015). Strategies for adaptation in Tanzanian communities were implemented haphazardly and with little forethought (Silva, 2015). Africa's capacity to deal with climate change is negatively impacted by factors such as weak institutions; limited infrastructure; information gaps; low levels of primary education; and limited resources (UNFCC, 2007). According to Joiner et al. (2012) and Dube et al. (2013), many African countries face significant challenges in dealing with climate change due to their geographical location, reliance on rain-fed agriculture, and fragile social and political infrastructure (2016). Therefore, owing to their lack of resources, poor countries bear the brunt of global warming's effects (Dube et al., 2016).

2.6 Effects of Climate Change and Variability on Human Sustainability

Climate change has both short-term and long-term effects (Hansen, Dilley, Goddard, Ebrahimian, & Ericksen, 2004). Climate shocks can have both ex ante and ex post effects. Ex ante impacts refer to the opportunity costs associated with conservative strategies used in advance by risk-averse decision makers to protect themselves from climate shocks (Hansen, 2014). An increasing number of extreme weather events are being exacerbated by climate change (for example drought and desertification), as well as the melting of glaciers and permafrost (Hansen, 2014). Households in different parts of the country will feel the effects of these problems in different ways. These problems have significant environmental, social, and economic ramifications, and these ramifications have an effect on human sustainability. The following sections focused on biodiversity, ecology, water and sanitation, health, agriculture, and rural livelihoods. Those who are most vulnerable, those who are poor and prone to shocks and stresses, are most at risk from these consequences.

2.6.1 Biodiversity and Ecology

Those who live on the edges of unstable ecological, economic, and political systems benefit from biodiversity because it provides a buffer against change (Mika, 2020). According to Thullier (2007), a biodiversity ecologist, natural species may be extinct by 2050 because of climate change

and habitat change. UNDP (2017) further notes that if the current emissions of greenhouse gases continue unchecked, climate change will wipe out 60% of the world's mountain plant species. Changing the environment has a direct impact on human progress. Natural adaptation will be impossible in the face of climate change, and socioeconomic systems will be put to the test (UNDP, 2017).

Due to climate change, food security and agricultural ecosystems are vulnerable. Ninety percent of the world's food is provided by only 15 plant and 8 animal species (Gwimbi, 2015). If these plants and animals disappear or their production is drastically reduced, humans will go hungry. According to new research, one-quarter of all wild potato species are predicted to disappear within the next 50 years (UNDP, 2017; Melnychuk, 2013). Similarly, Dube et al. (2016) stated that specific species of plants and living organisms will either adapt or die as a result of climate patterns. If households don't learn to adapt to climate change, there will be ecological destabilization and the loss of community livelihoods. In light of the foregoing, immediate action is required to safeguard biodiversity and ecology for the foreseeable future.

2.6.2 Water and Sanitation

Africa's water supply, accessibility, and demand could be put under strain by climate change and variability (Mazwi, 2018). By 2015, AMCEN estimates that more than 800 million people in Africa will be living in areas where safe drinking water is unavailable (2Hansen, 2014). As the temperature of the water rises, the intensity of precipitation increases, and the length of low-flow periods increases, a wide range of water pollution, including sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and thermal pollution, is expected to worsen (IPCC, 2007). People's health, ecosystems, and water system costs will all be negatively impacted by the deterioration in water quality.

According to Ngaira, cash crop cultivation requires more than 1000 millimeters of rain distributed evenly over the growing season (2007). When comparing Lupane district's average rainfall of 250mm with the 1000mm needed for agricultural activities, it is clear that Lupane district receives less rainfall than is necessary. Because rain-fed agriculture is vulnerable to severe and prolonged droughts, floods, soil erosion and desertification, Scoones (2015) is of the opinion that this is a problem. While water availability decreased by 20 to 30 percent in areas with low-warming

scenarios, water availability decreased by 30 to 50 percent for regions with high-warming scenarios such as Southern Africa (Shiku, 2020). In the future, more frequent droughts and flooding will negatively affect water supplies as a result of changing weather patterns.

2.6.3 Health

A lack of safe drinking water due to droughts and rising temperatures in Africa contribute to the spread of infectious and water-borne diseases (Besaba & Sewankambo, 2009). There are many ways in which global warming can have an impact on human health, both directly (e.g. effects on heat stress, as well as deaths and injuries caused by floods and storms) and indirectly (e.g. changes in disease vectors, bacteria in water, air quality, and food supply). Health effects of reduced food yields, population displacement and conflict over depleted resources are all linked to climate change, says the World Health Organization (WHO). Direct stresses (such as heat waves, weather disasters, workplace dehydration) are also linked to climate change, as are ecological disturbances (such as altered patterns of infectious disease) (Milder, 2019). In addition to ecosystem degradation and unsafe water and poor sanitation contributing to malnutrition, cholera/diarrhoea diseases and an increase in child mortality, climate change has other health impacts in the region.

Changes in average and extreme temperatures, extreme rainfall (drought and floods), air pollution, and vector and rodent-borne diseases are all linked to poor health as a result of climate change (Maroyi, 2019). Excessive exposure to hot and cold temperatures has been linked to an increased risk of illness and death (Silva, 2015). Some of the health effects of drought include food and water shortages, waterborne and vector-borne disease outbreaks, illnesses associated with exposure to toxins (such as distress and other emotional consequences), and other environmental hazards (such as wildfires, migration effects, and damage to infrastructure facilities). Climate change and variability have a negative impact on human health.

2.6.4 Agriculture

Climate change has an impact on many aspects of food security, including investments, agricultural technology adoption, total food production, market prices, and economic development (Mango, 2017; Mika, 2020). Due to the fact that "drought impacts food availability and stability directly through impacts on production, can affect food access and can affect food use directly and indirectly through changes in water quality" (Mazwi, 2018). According to a study from the International Food Policy Institute (IFPRI), rice production in South Asia could decline

by 23%, maize by 36%, and wheat by 57% by 2050 because of climate variability (Nelson et al., 2009). As a result, yields in sub-Saharan Africa could fall by as much as 40% if climate change persists. Poor countries will be hardest hit by food shortages as a result of climate change (Halady, 2010). Between 2005 and 2008, rising rice, wheat, and maize prices pushed 100 million people into poverty. (Tadesse, 2010). As long as agricultural yields are low, households can expect high food prices to last and this increases the poverty at household level. Agriculture will be severely impacted by the combination of long-term droughts and flooding. In Ethiopia, Kenya, and along the Somali border, an increasing number of pastoralists are fleeing their homes because of the region's ongoing drought (Tadesse, 2010).

Maroyi (2019) notes that agricultural productivity can rise or fall based on a farm's location and farming methods. Because agriculture relies on near-optimal conditions for temperature and moisture during the growing season, extreme temperatures and precipitation can have a negative impact (Midgely et al., 2007). The time of year when crops can be planted safely in some areas may shift due to climate change (Silva, 2015). According to a 2010 report by the United States Agency for International Development (USAID), climate change, sea level rise, shifting precipitation patterns, glacial thawing, and other extreme weather events have an impact on agriculture in the region (Gwimbi, 2015). The spread of pests and diseases, as well as increased irrigation requirements, have a significant impact on crop and grazing seasons.

However, Lupane's rainy season may be shifted to accommodate the plant's various stages of development, but this is not always true. Agricultural losses in Africa may be offset by increased production in high-latitude regions, where temperatures rise and the risk of frost is reduced (Sibanda, 2015). Agricultural input costs and market prices are threatened by pest outbreaks, extreme weather conditions, and a lack of available water resources (Sattar, Wang, Tahir, & Caldwell, 2017). When driving agricultural innovation in 2014, Gliessman (2014) found that the focus on high yields and short-term farm profit came at the expense of environmental and social impacts. Although climate change exacerbates the problems already faced by agriculture, the OECD (2015) alludes that a significant portion of the greenhouse gas emissions responsible for driving climate change are generated by agriculture. Emissions of these gases can be attributed to a wide range of things: poor soil management, land conversion, biomass burning, livestock

production, and proper handling of manure that results from that production (Grasty, 1999; FAO, 2008; Goodland & Anhang, 2014).

In spite of the fact that the agricultural work of women contributes 35–45 percent of GDP in developing countries, women are underrepresented in agricultural decision-making (Ibrahim, 2009). Lupane district's decision-making dynamics were crucial to understand, even if households are truly sidelined in decision-making is debatable. Farmers are particularly concerned about the effects of climate change on natural resources, and women in agriculture play an important role. As noted by Sasvari (2010) in the context of agriculture and food security, rural women must be empowered to deal with the effects of climate change.

2.7 Gender and Climate Change in Sub – Saharan Africa

Climate change has an impact on gender relations, positive or negative, regardless of whether the change is positive or negative. Climate change has exacerbated already existing inequalities between men and women. Milder (2019) notes that there is also a gender dimension to poverty and climate change vulnerability. Maroyi (2019) notes that climate change does not favor men or women; rather, it will disproportionately affect those in society who are already weak or powerless. The degree of vulnerability that exists among nations, communities, and individual households varies widely (Mazwi, 2018). Droughts and flooding present a variety of issues related to gender relations that must be resolved. Because climate change has a long history, it's important to know where we've been and where we're going. It's important to mention climate variability even though the effects of climate change haven't yet been observed in this study (Maroyi, 2019).

Norms of cultural, political, and religious significance perpetuate the sexism that exists in our society. A gender-sensitive approach can help students understand the socially constructed roles and opportunities associated with being male or female and their interrelationships (Silva, 2015). As Otzelberger (2011) and Vincent et al. (2011) agreed, men and women are often held back in society because of their gender. Many countries in Africa tolerate gender segregation, including Zimbabwe, despite Chauraya (2012)'s claim that gender segregation is divinely ordained in Africa. Embedded in the country's national gender policy are the principles of inclusion and equality for all women and men. Though Zimbabwe had not yet developed a framework to address

gender inequalities in environmental conservation and climate change adaptation and mitigation, there was room for influence on the Climate Change National Response Strategy being drafted. Another demand is for equal participation by women in sustainable exploitation of natural resources for economic gains and climate negotiations at the local, national, and international levels (Mango, 2010).

Maroyi (2019) notes that men and women have different approaches to dealing with their social, economic, and environmental realities. Women's economic and social rights are directly linked to differences in natural disaster deaths. Women are more likely to die in natural disasters than men because they lack basic rights. Women aged 20 to 44 died at a rate of 71 per 1,000 in the 1991 floods and cyclone disasters in Bangladesh, whereas men died at a rate of 15 per 1000 (Mika, 2020). Because other factors must be considered, it is possible to argue that gender disparities in deaths are not solely due to unequal basic rights. For a better understanding of how droughts affect a specific group of people, such as women, it is necessary to know how men and women handle their vulnerability in different ways (Mazwi, 2018).

The location and identity of destitute households must be determined with precision. It's impossible to get an accurate picture of poverty in the most impoverished communities by using an umbrella approach. As a result, figuring out why certain people's freedoms and liberties are restricted is critical (Maroyi, 2019). Women's health is more adversely affected by climate change than men's (Halady, 2010). It has a significant impact on a person's job prospects and overall life expectancy. Because not all females face the same level of oppression, it is essential to look at women in their particular historical and cultural contexts. Women are not all vulnerable to climate change, as they are capable of protecting themselves and their families from the effects of climate change (Sibanda, 2015). Women come from all walks of life: urban or rural poor; ethnic or national backgrounds; different types of households and families—all of which have different effects (Matondi, 2010).

Inequalities in power, access to resources, and roles and positions for women make them more vulnerable to the effects of climate change than men (Shiku, 2020). In addition, poor women are particularly vulnerable to climate change because they lack resources, rights, mobility, and a say

in decision-making (UNDP, 2017). Nature is the primary source of income for the majority of rural women. Climate change has a direct impact on the livelihoods of women in developing countries, who are thought to produce 80 percent of their country's food. In addition to providing most of the family's food and other necessities, these women are also the primary caregivers (Maroyi, 2019). Changes in weather patterns and extreme weather events will disrupt the traditional growing and harvesting cycles, leaving women unable to provide for their families' basic needs (Milder, 2019).

UNDP (2017) notes that due to their social marginalization, women are less able than men to mobilize outside of their immediate communities, have less access to early warning systems for natural disasters and climate change, and have difficulty participating in training. As a result, their inability to cope with the effects of climate change is hampered. No restrictions were placed on women participating in climate smart agriculture training in Lupane district according to local stakeholders (Mika, 2020). At least 60% of the participants were female, which made it easier for more women to benefit from the educational opportunities offered through these programs. Various stakeholders are actively working to include women in the process of community development, so it's possible to make the case that they are not always excluded (Mazwi, 2018).

Rural Kenyan women are more vulnerable to climate-related disasters because they lack access to land or credit and are heavily dependent on rain-fed agriculture (Mazwi, 2018). When it comes to resources and information, Kenyan pastoralist women are less powerful and more vulnerable than other Kenyan women (Few et al., 2015). Men clear forests instead of women in Latin America, where horticultural work is traditionally done. This is more difficult, but takes less time (Kronik & Verner, 2010). Women in Shurugwi, Zimbabwe, are experiencing an increase in domestic violence and abuse as a result of turning to beer brewing as a source of income (Brown et al., 2012). Female caregivers, as well as primary food producers and providers for their own families, elderly neighbors, and the community at large, are also advocates for the health and economic well-being of their communities (Dankelman et al., 2008).

Unpaid reproductive work performed by women is generally seen as a labor of love by the general public because most women do it as family members (Silva, 2015). More women than men work

in the "survivalist" activities as most are vulnerable and exposed to low-paying sectors of the secondary labor market. Their roles put them at risk of being affected by sudden changes because they are at the forefront of household management (Mango, 2017). To supplement their income during times of drought, women must travel long distances to gather water and wild food (Few et al., 2015). There has been a significant negative impact on women's well-being due to crop failure and replanting as well as lower crop yield (Milder, 2019). Many of these households are headed by women and suffer from substandard living conditions, which is exacerbated by the fact that many of these households live in rural areas. Since women lose their means of subsistence when disaster strikes, they're pushed to the fringes of society, where they face discrimination.

A link between gender and climate change is essential for the development of effective and gender-sensitive climate change policies (Mazwi, 2018). As women are given the power to make decisions and raise their concerns about climate change, communities become more resilient. Even though research has shown that women are at the forefront of any development, it can be argued that their involvement is subtle. Most people don't recognize or appreciate their contributions to making, distributing, and managing content (Mika, 2020). More women die in disasters than men or are killed at a younger age on average (Mika, 2020). Because of a socially-created and gender-specific vulnerability, women are more vulnerable to natural disasters. Though women aren't helpless victims, they have been socially marginalized for the majority of human history. A strong link has been found between women's assets like land, knowledge, technology, and the capacity to make decisions and their vulnerability and adaptability (Milder, 2019). Women's assets can be depleted as a result of climate change, which can have a negative impact on people's lives.

The term "feminization of poverty" was coined to describe this phenomenon after numerous studies found that women make up the majority of rural residents. Both "the de jure female-headed households" and "the de facto female-headed households" can be headed by a woman. "The de facto female-headed households" can be headed by women who have never been married, but who still have a say in household decision-making (Mango, 2017). They have different levels of adaptability, making them vulnerable in different ways for families headed by a woman. As Madzwamuse (2010) points out, the poor are ill-equipped to deal with the effects of climate

change. A study conducted by Nelson (2011) found that female-led households had fewer resources to deal with and adapt to environmental stressors than male-led households. The places they live and the ways they make a living also expose them to dangers. The vast majority of rural residents are women, and the majority of them are self-sufficient farmers. Women and men in the Turkana District of Kenya suffered from the drought and subsequent famine (Shiku, 2020). An understanding of gender relations in a specific community can help researchers draw conclusions that are relevant to that community. New risks that may arise as a result of climate change affect women more than they do men.

2.8 Southern African Context

Southern Africa is a largely semi-arid region with substantial intra-seasonal and inter-annual rainfall variability, with extreme events such as droughts and floods happening often (Shiku, 2020). Chishakwe (2010) further noted that the climatic condition of the Southern Africa sub-region varies geographically from dry in the west to semi-arid and temperate areas in middle zones to semi-arid in the east, with a few sub-humid places in the center regions. The Regional Vulnerability Assessment Committee acknowledged that the Southern African Development Community (SADC) member states are sensitive to climate changes. Mubaya et al., (2012) stressed that droughts are the predominant climatic challenge in the region nevertheless; floods were reported in Malawi, Mozambique, sections of Zimbabwe, and Southern Zambia. They also referred that Zimbabwe and Zambia are the worst drought-affected countries in the region which are typified by a late start to the rainy season, lengthy mid-season droughts, and shorter growing seasons.

Zambia might be one of the worst drought-stricken countries in the region as indicated by Mubaya et al., (2012), however the Agriportal (2016) reported that the agricultural sector was booming more than the neighboring countries such as Zimbabwe due to farm subsidies, which calls for further investigation on how they are managing them. Droughts linked to ENSO warm occurrences have been found to be associated statistically with disasters in Southeast Asia/Oceania and Southern Africa (Dilley & Heyman, 1995). (Dilley & Heyman, 1995). Holloway (2000) underlined that the 1992 drought which was driven by an El Nino event compounded a range of vulnerabilities, consequently resulting in the regional maize harvest shortfall higher than 50 percent. Similarly, another drought plagued the region in 1994/5 which

resulted in a 35 percent production shortfall. In 2000, the entire region saw Cyclone Eline which caused huge damages and casualties, with Mozambique suffering the largest burden by recording more than 700 deaths and 250,000 displaced people (Holloway et al., 2013). (Holloway et al., 2013). In 2001, more than 500,000 people were affected by catastrophic flooding in Zambezi River hence the necessity for better flood risk management and coordination in numerous Southern Africa countries.

The 2015/16 El Nino led to one of the driest rainfall seasons in over 35 years in Southern Africa resulting in low agricultural production consequently increasing levels of hunger, malnutrition, and vulnerable people (SADC, 2016). (SADC, 2016). It should be noted though that although the whole region was faced with El Nino, unlike Zimbabwe and Malawi, some countries such as South Africa and Zambia did not receive external food assistance due to their internal drought management systems. This presents the challenge of contextualizing the depth of natural disasters and how different countries within the region respond. Tyson (1986) related the rainfall variability to changes in the atmospheric circulation. In concurrence, Davies (2011) and Lindesay (1988) indicated that Southern Africa inter-annual rainfall variability is linked to the El Nino Southern Oscillation phenomenon which is an interaction between the ocean and atmosphere over the tropical Pacific Ocean that has important consequences for weather patterns around the globe. Rain variability is also debatably linked to Quasi-Biennial Oscillation (Mason & Tyson, 1992; Naujokat, 1986) which refers to zonal wind in the equatorial stratosphere which changes direction from easterly to westerly and vice versa with a periodicity of 28 months (Naujokat, 1986) and Sea Surface Temperature (Folland, Palmer, & Parker, 1986; Nicholson & Entekhabi, 1987; Nyenzi, 1988) over Pacific, Indian and Atlantic oceans and topography (Ropelewski & Halpert, 1989). (Ropelewski & Halpert, 1989).

Agriculture is the principal source of sustenance, employment and income for 61 percent of the region's total population of 232 million although it has witnessed some reductions and proven highly volatile (Chilonda, Machethe, & Minde, 2007). (Chilonda, Machethe, & Minde, 2007). It should be emphasized though that within the region, some countries are more vulnerable than others due to their dependence on agriculture. Eriksen et al., (2008) observed that in Tanzania, Mozambique, and Malawi, more than 80 percent of the population is employed in agriculture, in contrast to South Africa and Mauritius, where less than 20 percent of the population is dependent

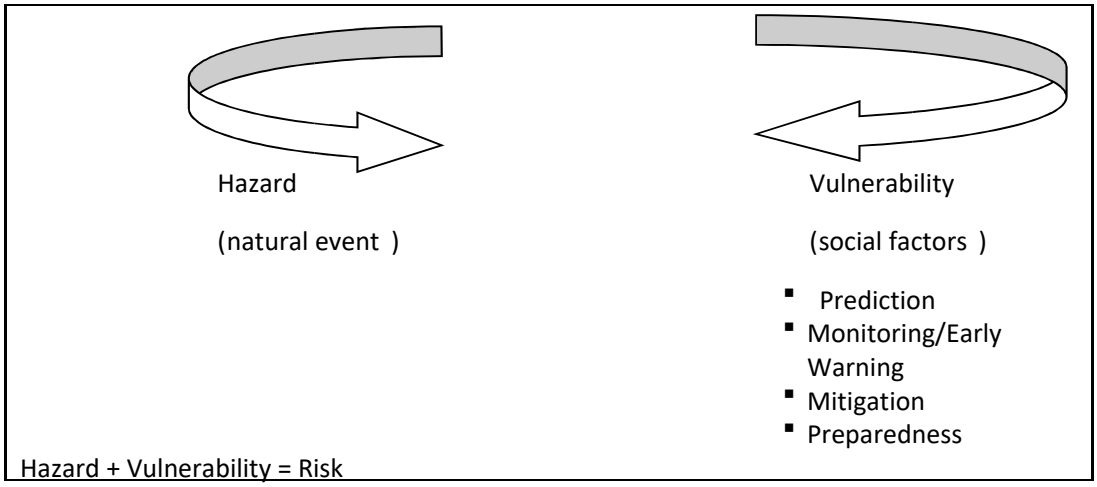
on agriculture. Furthermore, differential vulnerability could be identified by looking at the availability of services and access to alternative livelihoods which may vary substantially between villages and even within households in the same village (Eriksen et al., 2008).

(Eriksen et al., 2008). Given the rising climate variances in Southern Africa, mixed with socio-economic issues such as poverty and HIV/AIDS, the marginalised people in the region are made more vulnerable; even then, this might vary within the same region. It is so vital to understand vulnerability in context thereby addressing some of the elements that contribute to susceptibility. It is also crucial to understand the early warning systems which communities rely on in predicting droughts since this establishes a basis on which they prepare to buffer themselves from harsh repercussions of droughts. The next part examines features of droughts and the early warning systems which communities deploy.

2.8.1 Droughts and Early Warning Systems

Wilhite and Glantz categorized climate (temperature), hydrology (flow), agriculture (production), and socioeconomic (economic) (Shiku, 2020). The duration and severity of a dry spell are referred to as a "meteorological drought". When precipitation (including snowfall) falls short of demand for a long period of time, a hydrological drought can be formed (that is, stream-flow, reservoir, lake levels, and ground water). Climate and hydrological droughts are linked to agricultural droughts because of differences in actual evapotranspiration and soil water deficits, as well as lower groundwater or reservoir levels in the agricultural area. Crop susceptibilities vary from emergence to maturity, which is also considered. Due to a lack of water, demand for an economic good outpaces supply in a socioeconomic drought. In the words, climate change can occur when there is not enough water (Sibanda, 2015). Whether or not a drought will occur is determined by the region's exposure and society's susceptibility (Silva, 2015). Distinct regional effects can be seen even when droughts have the same duration and severity across the country (Singh, 2006). Early warning systems assist in determining a community's or a person's level of vulnerability. Accurate weather forecasts and early warning systems are essential for climate change mitigation and preparedness. During and after multi-year ENSO warm events (i.e., year two), many households are affected by drought disasters, possibly due to prolonged or successive droughts occurring simultaneously throughout interconnected regions all over the world (Mazwi, 2018).

Figure 2.2 - Components of Drought



Source - (Wilhite, 2000)

Variations in wind and rain patterns as well as the sounds they produce, the appearance of termites and their mounds, the presence or absence of poisonous plants, and the size and appearance of stains (Mazwi, 2018). For example, local interpretations of observed climate change are often more diverse and inclusive than scientific explanations, which have mainly focused on anthropogenic greenhouse gas emissions (Svodziwa, 2015). Though useful, they don't necessarily inspire people to act on climate adaptation (Gwimbi, 2015). Davies, Mika (2020) defined an early warning system as a data collection method that monitors food availability in order to provide timely notice of a potential food crisis and thus prompt an appropriate response. Early warning systems are interpreted differently by scholars. For effective response to beneficiary needs, governments and donor agencies must work together to conduct needs assessments. First, an assessment of risk must be conducted, which considers current rainfall trends as well as household and environmental conditions. In order to take appropriate action in a timely manner, vulnerability assessment is essential (Shiku, 2020).

Conflict mapping, climate variance mapping, and geo-spatial data are all examples of early warning information systems that can be used to help determine the nature, location, depth of penetration, and appropriateness of the response to a shock (World Bank Group, 2016). Warning of impending climate conditions and effective responses to stabilize household food consumption can prevent cyclical depletion and impoverishment (Milder, 2019). ENSO warm events in drought-prone regions may lead to periods of reduced rainfall or even hydro-meteorologically defined

droughts, but disasters are not always the result of these events (Sibanda, 2015). A disaster occurs when an event's impact is so great that it overwhelms the ability of the affected population to cope with its aftermath (Gwimbi, 2015). It is possible to limit the negative effects of ENSO years by taking appropriate measures by planners, decision-makers, and farmers in linked regions that know their countries' propensity for precipitation fluctuations (Silva, 2015).

Early warning information based on probabilities was difficult for decision makers to understand because they had to compare it to their own risk perceptions (Buchanan-Smith, 2000). As a result of inaccurate interpretations of the 1997 El Nino forecasts and predictions, more precise forecasting and predictions are now required (Mazwi, 2018). Households rely on detailed information (e.g., the start and end dates of the rainy season, the distribution of rainfall throughout the growing season) when making operational decisions; however, drought forecasts frequently fail to provide this detail (Maroyi, 2019). Due to the lack of accurate information, the implementation of plans is impeded. In Lupane district, where people can't plan ahead because of their low incomes, drought forecasts have little effect. NGOs and the government help to revive the ailing situation in these communities.

Government-run systems for early warning in Zimbabwe are administered by the Ministry of Environment, Water, and Climate, as well as Agriculture Research and Extension Services (AGRITEX) (Nangombe, 2013). FEWSNET and Zimbabwe's National Early Warning Unit (NEWU) are two other organizations that provide drought early warnings. They're both in Zimbabwe. Gwimbi (2015) on the other hand, believes that Zimbabwe's national early warning systems are ineffective and lack a clearly defined structure. Households need to be educated on how to respond to climate change, even if these warning systems are in place. Despite the abundance of weather data available in Southern Africa, it is imperative that forecasts are translated into management decisions in order to avoid crises (Shiku, 2020).

When it comes to deciding what crops to plant and when to prepare their land, households in Ghana's Afram Plains noted that that seasonal forecasts were a crucial part of their decision-making process (Gwimbi, 2015). Farmers in Uganda noted that they relied on weather forecasts from the country's Department of Meteorology, as well as their own experience and observations,

when planting slower-maturing crops or clearing, cultivating, or planting a larger area than usual (Sibanda, 2015). Early warning systems were essential for providing farmers with the information they needed to make well-informed decisions. Consequently, climate-related decisions were not made in some areas due to apathy and a lack of resources in those areas affected. seasonal forecasts were not always as useful, despite the growing evidence of their use (Silva, 2015). Predicted conditions may differ from actual conditions, so caution should be taken when forecasts conflict with reality. Rural households can benefit from early warnings if forecasts are accurate and used wisely (Mika, 2020).

2.8.2 Governance of Climate Risks

Managing a country's affairs at all levels, including the mechanisms, processes, and institutions through which that authority is directed, is what it means to "govern" (UNDP, 2017). There are three aspects of governance that climate change focuses on thus; inclusiveness, equity, and the active participation, particularly of weaker households, in decision-making. Governmentality is an important consideration when addressing climate change's challenges because of the large number of parties involved in policy development and implementation. The use of participatory tools that are gender-inclusive should be a deliberate effort to include both men and women at the grassroots level (Gwimbi, 2015).

In order to manage climate change, people and communities must be able to adapt. According to the definition, it's "the ability of a system to adapt to (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities or to deal with the consequences" of climate change. Understanding the process by which institutions of various sizes are affected by and respond to climate variability is an important part of evaluating an institution's readiness to deal with and recover from future climate change (Lemos, 2007). Slow-onset hazards do not always necessitate humanitarian intervention, according to Kronik and Verner (2010), especially if governments and communities work together to lessen the impact on affected people. Kronik and Verner (2010) notes that participating in climate change adaptation efforts requires a wide range of stakeholders from all walks of life to work together.

Climate-related suffering and environmental degradation can be reduced if leaders and other high-ranking officials commit to disseminating information and implementing policies (UNDP, 2017).

To meet the needs of various stakeholders, it is necessary to give them the ability to self-organize and share information while also encouraging strong leadership (Svodziwa, 2015). The best leaders work to ensure that everyone is treated fairly and equally, all while maintaining organizational cohesion and mediating multiple risks, in the face of disasters (Shiku, 2015). As a result of lack of learning, humanitarian systems rarely intervene until a crisis has already occurred. Even though ongoing anti-poverty programs continue to be offered in Malawi, the extent and depth of poverty suggest that they are failing (Sibanda, 2015). Because of the inability to apply the lessons learned in programming, a never-ending cycle of failed projects is created, resulting in a waste of money.

In contrast, a bottom-up approach to climate risk management is highly recommended in order to ensure that policy is put into action in real life (UNISDR, 2009). It was suggested in 1998 that local communities could be empowered to take responsibility for natural systems by using a systemic governance approach, while also increasing public trust in local authorities' ability to manage environmental resources effectively. When dealing with climate change, a bottom-up strategy will not suffice because of the numerous aspects that cannot be addressed. The use of a multi-stakeholder approach that includes input from both communities and stakeholders is highly recommended (Mazwi, 2018).

For vulnerable groups to build long-term resilience, Lemos (2007) suggested risk management approaches that create positive synergies across the state-societal divide, climate response planning or water management institutions. To empower citizens and create social change, Cooper (2015) suggested the participatory, accountable, transparent, and democratic approaches. Sub-Saharan Africa has weak institutions, lacks accountability, and has strict controls on information. In this region, all of these factors contribute to an increase in vulnerability. Public environmental governance architectures in the Caribbean Islands were reported to have silos, lack of political will, and an unwillingness to share data, unsustainable project-based funding, and a lack of accountability that hindered the coherence of climate policy (Scobie, 2016). Good governance, a precondition for fostering an environment favorable to climate change adaptation, will not be practiced by those involved. Since all parties involved benefit from good governance, as well as

the communities it serves, it is imperative to create a supportive environment. Achieving gender parity means that the plight of households is addressed on a political as well as an economic level.

An essential component of good governance is the ability of the most vulnerable and poorest households to have a direct impact on political decision-making, especially when it comes to allocating development resources (UNDP, 2017. Households must also take responsibility for their own growth if sustainable development is to be achieved. Matondi (2010) notes that, including and empowering households in public policies and programs can improve the promotion of good governance and gender equity. Despite popular belief, countries like China, Vietnam, and Cambodia have not experienced economic growth in conjunction with good governance (Rodrik, 2008). Because of their economic woes, such reforms are neither necessary nor sufficient for economic growth. Furthermore, democratic institutions' actual impact on economic growth is highly contextualized, according to Fukuyama (2013).

Most governments are dominated by a small group of people with narrow interests, and thus are unable to empower the poor especially climate affected areas (Mazwi, 2018). When the unemployment rate is high and the majority of people live in substandard conditions, the government steadfastly holds on to power and ignores the hardships of the people. Like Pons-Vignon (2011) proposed that discussions and negotiations with governments regarding the adoption of reasonable policies are always fruitless, policies exist in countries like Zimbabwe, but they either harm the economy or are not implemented. Environmental and social factors, in addition to public action, have an impact on some outcomes, according to Fukuyama (2013). Sustainable livelihoods, which emphasizes empowerment and increases access to resources, necessitates a shift in power relations according to Hoon and Hyden (2004). With its focus on those who are in peril, this approach focuses on the constitutive side of politics, which consists of governance.

Institutions can either aid or hinder community growth. The efficiency of a policy is determined by its institutional characteristics and the households in charge of putting it into practice. Institutions are defined by Goetz (1995) as a collection of formal and informal rules that influence how the public views the needs and responsibilities of its members. Acemoglu (2008) argues

instead that institutions create environments favorable to economic growth and development by offering financial incentives for businesses to invest in new technologies and the development of their employees' human capital. Having a positive attitude and a supportive environment can help in achieving set goals. Government policies and good governance are critical in reducing poverty, and this is something that Deolalikar, Brillantes, Gaiha, Pernia, and Racelis (2002) stressed when discussing the importance of political will and commitment from institutions like the federal government. However, institutions can be breeding grounds for rent-seeking, corruption, and the ruthless pursuit of personal gain at the expense of society as a whole (Mazwi, 2018). Problems in institutions can lead to dysfunction if they aren't dealt with at the root. To ensure that institutional reforms can take place, policy changes may be necessary, but the underlying constraints must still be addressed (Acemoglu, 2008). Effective policy reforms necessitate a shift in the surrounding environment as well.

There must be a major overhaul of current governance structures because climate change was not a consideration at the time they were put in place (Termeer, Dewulf, Karlsson-Vinkhuysen, Vink, & van Vliet, 2016). It may be more beneficial for social learning and building resilience and social capital to integrate risk management with sustainable use of natural resources and adaptive governance rather than top-down approaches that isolate decision making from stakeholders. In order to put stakeholder decisions into action, the community must be involved and be a part of the process. It is imperative that political institutions safeguard society's weaker segments through the decisions they make. According to Brown et al, women and children are expected to bear the brunt of climate change impacts, but they are largely excluded from decision-making processes relating to climate change adaptation and disaster risk reduction (2012). Drought and women's participation in community decision-making are intertwined as top-level decisions on climate-related issues.

It is essential that women and men have equal opportunities to participate in local decision-making, but good governance must be seen as a complementary measure to other forms of assistance (Milder, 2019). Women and men can have a voice in both micro and macro-level decisions that affect them when they participate in the development process. To put it another way, feminist political activism is needed in all social institutions as well as in individual

organizations (Gwimbi, 2015). Bracking (2014) concluded that less faith should be placed in the use of finance to prevent climate change in the absence of real governance innovation based on scientific knowledge. As a result, international efforts to adapt to and mitigate climate change rely heavily on promoting good governance. Examining disaster management in Southern Africa through a gender lens reveals a lack of gender neutrality in the existing tools.

2.8.3 Disaster Management Plans and Policies

Climate management strategies can be developed over a long period of time because they are gradual (Svodziwa, 2015). In comparison to floods, drought is more difficult to assess and alleviate (Sibanda, 2015). Disaster relief is a joint effort between government agencies, non-governmental organizations (NGOs), churches, and so on. Mazwi (2015) notes that plans for dealing with drought should include monitoring and early warning, risk assessment, and mitigation and response. Wilhite, Sivakumar, and Pulwarty (2014) identified three types of drought policy responses: preparedness plans and policies, post-impact responses (often crisis-focused), and pre-impact (often vulnerability reduction and resilient) (often focused on institutional capacity, including organisational frameworks and operational arrangements). Silva (2015) found that, aside from Botswana and South Africa, no Southern African countries had drought plans or policies. A number of countries began developing disaster preparedness strategies and plans following the year 2000. Internal policies are also used by organizations like USAID and the UN to guide their humanitarian efforts.

The issue is that many of these policies are not holistic and gender sensitive. At the national and international levels, the development of useful methodologies for measuring the participation of women and men in policy implementation and its impact on gender relations and inequalities is a major challenge for gender monitoring (Shiku, 2020). Gender mainstreaming policies exist in most bilateral and multilateral organizations, but they aren't being implemented because of a lack of leadership and clear, systematic action steps, she claims. In the World Food Program Disaster Risk Reduction Policy, women are mentioned, but the policy is unclear on how to address the issues of women's vulnerability in the face of disasters. Women are briefly mentioned in the USAID Disaster Risk Reduction Plan 2012-2014 as important contributors to community resilience, but the root causes of women's vulnerability are not addressed (Silva, 2015). Not a word is said about

them. It is not enough to establish gender-sensitive programs and allow equal participation by women in these programs to address the long-term harm that many women suffer and to transform the plight of women immediately (Mika, 2020).

Considering South Africa's history of frequent droughts, Seymour and Desmet (2009) criticized policies like the Accelerated and Shared Growth Initiative (ASGI), which proposes 12 water-intensive and unsustainable projects. A lack of institutional vision harms the intended beneficiaries of a project, as shown here. Women's vulnerability to climate hazards is rarely discussed in Horn of Africa policymaking. Gender issues must be considered in the design of development programs and in disaster management planning and operations at all stages (Mazwi, 2018). The term "gender silence," coined by Bhatt (1995:3), refers to the failure to acknowledge explicitly or implicitly that disaster management occurs in a gendered environment. Additionally, there needs to be a clear implementation plan that includes both men and women.

2.8.4 Social Protection Measures in Climate Management

In order to reduce poverty and insecurity among those who are most vulnerable to economic, social, political, or other constraints, how should we approach the various processes and policies? This is the focal point of social protection (Scoones, 2015). For both the active and passive poor, government policies aimed at protecting their interests can have a significant impact on the health of the economy and society as a whole (Milder, 2019). Aside from relief, prevention of deprivation, and or an increase in income and capabilities, Mango (2017) claims that social protection interventions can be transformative. According to Holmes and Jones (2010), social protection should not only focus on economic risks but also on social, cultural, and racial equity (which translates to narrow responses based on targeted income and consumption transfers).

All interventions by public, private, and non-profit organizations, as well as informal networks, are considered in the context of social protection systems (Sibanda, 2015). When combined with other efforts to prevent poverty and help those who have already fallen victim to it, a social protection approach can help to reduce poverty and multidimensional deprivation in the long term (Mazwi, 2018). According to the World Bank (2015) successful social protection programs rely heavily on the involvement of local communities. These organizations can perform a variety of tasks, such as verifying the criteria used to select recipients, serving as a liaison between the

government and those who benefit from the assistance, and mobilizing the local community in the event of a disaster. Interdependent systems in the community makes it easier to reach society's most vulnerable and at-risk members (Milder, 2019).

Implementation of social protection measures can increase human resilience according to World Bank Group's most recent report (World Bank, 2015). Disaster-affected households can benefit from social protection programs to avoid depleting their savings, cutting back on necessities, and decreasing human capital investments (World Bank Group, 2015). The disaster-stricken population is protected by social safety nets. Svodziwa (2015) also noted the difficulties poor people face when trying to recover solely or mostly on their own from shocks, particularly when shocks are multiple or sequential in nature. Another point made by them was that the poor are more likely to need help from the public or private sector to recover. It is possible to help those affected by natural disasters such as drought by implementing social protection programs (Maroyi, 2019). Climate change adaptation or disaster risk management and disaster risk financing and insurance systems should be linked to social protection systems, according to the World Bank Group in 2015. One system may be stronger than the others even if they coexist, or none of them may be fully developed (Milder, 2019).

2.8.5 Coping mechanisms to Climate Change

Ex ante and ex post coping strategies exist. Prior to a production shortfall occurring, strategies known as ex ante are employed, while strategies known as ex post are employed after a production shortfall has occurred (Pandey & Bhandari, 2009). It is also known as a "ex ante strategy" when it is used to smooth out the fluctuations in an individual's income. One must engage in low-reward activities despite low risk in order to implement these strategies (Sibanda, 2015). Ex ante strategies such as careful selection of crop varieties (such as drought-resistant and short-maturing varieties), cropping patterns that change over time, and changes to planting dates and crop establishment methods are already being used by many African farmers to prepare for climate change (Maroyi, 2019). Many households in drought-prone areas employ these strategies in various combinations, and some of these strategies have become an integral part of the rural livelihoods and may not be recognized as coping mechanisms (Silva, 2015).

Increasing one's sources of income or diversifying one's crop are common ante coping strategies. Dercon (2000) argued that even though different activities can be performed at different times of the year to generate income, these activities have their own costs. Drought affects crop income as well as non-farm income, as shown by Mika (2020), who found that diversification is limited. Intercropping, on the other hand, can increase profits, but it comes at a price in the form of greater risk of failure. Non-agricultural and profitable alternative agricultural activities are not easily accessible due to the capital and skill requirements (Milder, 2019). Before making any decisions, it is important to weigh the advantages and disadvantages of diversification. If the goal is long-term financial stability, then diversification is necessary. A cost-benefit analysis must be performed on each activity before deciding which ones to pursue (Silva, 2015).

Ex post strategies are also known as consumption-smoothing strategies because they help to reduce consumption volatility even when income fluctuates. Ex-post strategies can be used to mitigate the effects of income risk (Mazwi, 2018). Smoothing consumption is more difficult when there are multiple shocks (Milder, 2019). Having no other choice, the poor are forced to use coping mechanisms that harm their human capital, such as limiting their dietary intake, dropping out of school, or working long hours to make ends meet (World Bank Group, 2015). Although asset smoothing is an effort to preserve assets, Mazwi (2018) argues that consumption itself is an input into the formation and maintenance of human capital. A household's choice of capital – physical, financial, and human – when faced with an income shock is what makes the difference, he writes in the New Yorker. A devastating disaster can lead to additional hardships for the poor and near-poor families who are unable to access appropriate, timely and predictable response mechanisms (World Bank Group, 2016).

Households respond in a specific order when faced with climate change. Public assistance, safety net programs, and environmentally exploitative practices are increasingly common after families have cut back on non-essentials like clothing, entertainment, food and medical care (Gwimbi, 2015). Households are unable to adapt to even minor changes in production conditions due to the depletion of assets and the weakening of post-adaptation options caused by frequent distress from climate shocks (Shiferaw et al., 2014). Commodity bundles and entitlements are directly linked to consumption in the face of adversity (Milder, 2019). Women in poor households bear the brunt of

adverse shocks because their husbands do not participate in risk-sharing (Svodziwa, 2015). It was found that the trend of specialization among household members manifested itself as coping patterns and thus levels of adversity in Kenya and Tanzania (Hansen, 2014). For example, because of their many responsibilities at home, households found it more difficult to engage in non-farm activities. Petty trade and handicraft brought in pitiful earnings for them. When compared to women, men generally enjoyed greater levels of independence, as well as less domestic responsibility and easier access to financial resources (Gwimbi, 2015). Because of unequal access to labor, capital, natural resources, and skills, many women are unable to specialize in primary coping strategies (Maroyi, 2019). Because of gender stereotypes, women are more likely than men were to resort to less-profitable coping mechanisms in this study. Women couldn't make as much money selling grass or doing casual labor as men did because they had less bargaining power and produced inferior work (Milder, 2019).

Factors such as annual income and family labor as well as the educational level of the household head and social support may help farmers avoid consumption smoothing, asset depletion and migration (Matondi, 2010). Many Zimbabweans are going through hard times, making it difficult to find others to lean on for support. Many families in Zimbabwe have reaped the financial benefits of family members who have relocated to other countries. Because so many Zimbabwean graduates can't find work, the country's educational system is in danger of collapsing. Graduates may not be able to get a job in many countries because of immigration laws that are not favorable. There are numerous coping mechanisms available, and each has its own set of advantages and disadvantages that must be considered when deciding (Miker, 2020).

2.9 Adaptation Strategies to Climate Change

There have been a number of attempts to examine the various climate adaptation strategies used in various communities. To achieve local food sovereignty and dignity, Biowatch South Africa (2016:3) advocated "a multifaceted approach utilizing principles of farming methods built on traditional knowledge and connecting producers to consumers." Unified adaption strategies are more effective when they are used in conjunction with a variety of strategies. Securing long-term

production is possible by tailoring production methods to the local environment, economics, and cultural preferences of a region (Silici, 2014).

Mika (2020) notes that human adaptation and response to drought is primarily through evasion or endurance. The severity, frequency, and duration of drought affect how people respond to it (Maroyi, 2019). Livestock migrations known as "evasions," or transhumances or seasonal migrations, can be limited by land, animal health, and social issues. Drought recovery can be aided by maintaining the dynamics of the ecosystem. Seymour and Desmet (2009) listed a number of strategies to help with endurance, such as managing forage, changing livestock types and numbers, conserving water and finding new income sources. Households' responses to climate variability can be divided into two broad categories: ex ante measures and ex post responses (Burke & Lobell, 2010). Extreme weather events can transform coping strategies (such as migration and livestock dependence) into long-term adaptations for households (Bhatta & Aggarwal, 2015).

For this reason, it's crucial to understand your context before making any recommendations about how you might adapt your approach. The results of the research should also be used to assess the relative merits of various adaptation strategies, as well as the extent to which they can be applied elsewhere. In Zimbabwean rural areas, water harvesting, conservation agriculture, and irrigation are among the methods used to adapt to climate change.

2.9.1 Water-harvesting

According to Reij, Mulder, and Begemann (1988), water harvesting is defined as the collection and concentration of various runoff types from various sources (such as precipitation or dew) and for various purposes (such as irrigation) (agricultural, livestock, domestic and other purposes). Armitage (1985) suggested that Mediterranean climates would be better suited for water harvesting because of the erratic rainfall in semi-arid areas.

For water harvesting to work, Reij et al. (1988) concluded that rainfall must be large, long-lasting, and intense enough to produce runoff. The amount of rain that falls should be greater than the rate at which it can be absorbed by the soil, or both. Rainfall and soil relief data, along with cropping systems and local socioeconomic conditions, are all important inputs to a successful water harvesting implementation. If households live in a semi-arid area with a low average annual

rainfall, rainwater harvesting may not be a reliable source of water (Mika, 2020). The ability to double food production by 100 percent with rain harvesting techniques has been demonstrated for more than 4,000 years (Kibassa, 2013). When water harvesting for wheat and barley in Pakistani highlands Balochistan was tested over six years, it was discovered that wheat yield increased by 180 percent and barley by 80 percent under seasonal rainfalls of 102 and 282 millimeters, showing that water harvesting practices produced more in years with lower rainfall (Shiku, 2020).

Stopping land degradation and rural-to-urban migration are two additional environmental and social advantages of water harvesting. It also creates jobs in rural areas (Oweis & Hachum, 2009). Due to various factors, such as incomplete data on rainfall, evapotranspiration, and soil properties and the potential for crop failure in drought years — which could be especially devastating for low-income populations — this technology is not widely used (Kumar et al., 2006; Oweis & Hachum, 2009). Kumar et al. (2006) identified a high evaporation threat to surface storage structures. Communities must be involved in the selection of the best water harvesting method if those techniques are to remain viable. This necessitates a constant awareness of the surrounding environment. Thus, households that are vulnerable to climate change can reap the benefits of this strategy if their community accepts its contribution to agricultural production. The area's semi-aridity means that it may not yield positive results, but the rainy season is still a good time to give it a try.

2.9.2 Conservation Agriculture

The following are the three cornerstones of conservation agriculture (CA): As a starting point the soil must be disturbed minimally or not at all; a long-term organic soil cover is essential; and crop rotations must be varied and diverse (Giller, Witter, Corbeels, & Tittonell, 2009; Kaumbutho & Kienzle, 2007; Knowler & Bradshaw, 2007). Conservation farming is a combination of various techniques, including reduced tillage, in situ rainwater harvesting, soil fertility management, and erosion control, which when combined produce cropping systems that are expected to improve farming practices. Biowatch South Africa (2021) argued that mechanized tilling and the use of petrochemical fertilizers of destroying the soil's fertility and water-holding capacity, and of releasing carbon dioxide into the atmosphere. In contrast to conventional farming methods, conservation agriculture preserves the soil while still delivering high yields.

Table 2.1- Benefits and Costs of Conservation Agriculture

Benefits	Costs
Reduction in on-farm costs: savings in time, labor and mechanized machinery	Purchase of specialized planting equipment
Increase in soil fertility and moisture retention, resulting in long-term yield increase, decreasing yield variations and greater food security	Short-term pest problems due to the change in crop management
	Acquiring of new management skills
	Application of additional herbicides
	Formation and operation of farmers' groups
	High perceived risk to farmers due to technological uncertainty

Sources: Adapted from FAO (2001); Kertész and Madarász (2014)

Even though conservation agriculture conserves water and improves the structure of the soil, rural households are reluctant to implement it. All of the CA's components must be implemented at the same time due to bio-physical (soil, climate, and topography) as well as socio-economic (Baudron, et al., 2007; Kaumbutho & Kienzle, 2007) characteristics (Chiputwa et al., 2011). There are both advantages and disadvantages to conservation agriculture. In Table 2.3, FAO (2001) found that the costs of CA implementation outweighed the benefits for households. Due to their primary focus on increasing agricultural yields while minimizing associated costs, households find it difficult to invest in CA.

Using conservation tillage techniques can also reduce water evaporation and improve pest, disease, and weed control. Conservation agriculture's requirement for specialized planting equipment and sprayers is prohibitively expensive for many households. As a result, there is no guarantee that immediate positive results can be achieved (Gwimbi, 2015). Trying to persuade households to invest in expensive equipment that doesn't meet their immediate food security needs may not get the buy-in they need to adapt to climate change. In order to control weeds on a small scale, households' resort to conventional weeding, shallow weeding and weed uprooting, rather than using modern methods of herbicide application (Kaumbutho & Kienzle, 2007).

Plants are grown in pits filled with crop residues, compost and manure or dried green manure in conservation agriculture known as Muyamba pit farming in Zambia (Mazwi, 2018). Households plant early, weed early, harvest early, and gain food security early in the dry season to take advantage of the effective early rains (Baudron et al., 2007). Kaumbutho and Kienzle (2007) argue, however, that it will be difficult for households to implement conservation agriculture because of the unpredictability of and inability to predict rainfall. The competition between livestock feeding and soil mulching for crop residues is one of the reasons for the low and slow adoption of conservation agriculture. Crop residues are essential to soil fertility, but livestock also rely on this feed source.

Conservative agriculture is not suitable for most resource-constrained small-scale farmers and farming systems (Silva, 2015). Even though conservation agriculture is widely promoted as a climate-adaptation strategy, it is still under-implemented. The search for more affordable and viable options for households still continues. Altering the strategy while keeping its advantages is another option.

2.9.3 Irrigation

Irrigation aids agricultural production by providing soil moisture through the use of technology. Households that have access to groundwater irrigation may be less vulnerable to deficient, unpredictable, and variable rainfall (Milder, 2019). "Surface irrigation" is defined by Ngigi (2009) as "the practice of diverting water either by gravity or pumping from streams and rivers and dams" and "the conveyance of groundwater" When used in dry regions, drip irrigation reduces water consumption by 30% to 70% while increasing yields by 20% to 90%. This method is better suited for water-scarce regions. High-pressure sprinkler and gravity irrigation systems will become less effective as temperatures rise, according to Schaible and Aillery (2012). Due to a rise in demand and a decrease in precipitation, irrigation may be restricted in the future (Dube et al., 2016). Droughts necessitate the use of efficient and appropriate irrigation systems.

After conducting surveys, drawing up plans, and building irrigation systems for the country's use in the 1930s, the Zimbabwean government did so without consulting the farmers (UNDP, 2001). Because they were chosen by the government, these programs, which became increasingly costly and unsustainable as their number increased, were the responsibility of the government (UNDP, 2001). New irrigation schemes were implemented and maintained by farmers at the time. During

the 2003 Fast Track Land Reform Program, thefts, dilapidation, and vandalism reduced irrigation schemes from 200,000 ha to 120,000 ha (Nhundu and Mushunje 2010).

World Bank (2018) notes that irrigation can help alleviate food insecurity and malnutrition in Africa. Although governments, non-governmental organizations, and private companies have attempted to implement farmer-managed smallholder irrigation systems, World Bank (2018) reports that there are only a few successful examples. Researchers Mutambara and Munodawafa (2014) found that Zimbabwe's small-holder irrigation schemes could not be sustained because of irregular irrigation water supply, limited access to agricultural inputs, low levels of education or training in appropriate farming skills, and a lack of collateral for working capital or loans. Farmers in the Nazareno region face increased energy costs as a result of climate change and the dry climate (Milder, 2019). Groundwater is becoming increasingly scarce and unreliable. As a result of the lack of support mechanisms, it is difficult for the poor to maintain irrigation systems and thus show that water is not always readily available. According to the reports examined for this study, more than half of the irrigation systems in Lupane district were operational because of a lack of service.

According to Ngigi (2009), there are numerous reasons why irrigation schemes are inefficient, from infrastructure decomposition to governance issues, to political interference in the distribution of inputs, to households' reluctance to adopt new technologies in favor of indigenous technologies. Mutambara and Munodawafa (2014) and Ngigi (2009) had similar views on the capacity of irrigators and resistance to new technology adoption. Contrary to this, Eakin (2003) found that irrigated vegetable production in Mexico was not associated with significant wealth, stable livelihoods, or low exposure to climate-related risks in 1996 and 2000. Due to their inability to simultaneously diversify their economic activities and remain competitive in the vegetable market, the Nazareno vegetable farmers did not amass a fortune.

Many smallholder schemes have been established due to wrong approaches to development and poor technology choices, according to United Nations Development Program (UNDP) 2001. So long as farmers are given a period of financial grace during which they can contribute financially to the schemes, UNDP (2017) argues that farmer participation in development is always important

in order to achieve the desired results. Households' willpower, availability of farm inputs, and system upkeep all play a role in whether or not irrigation works. It is important to ensure the long-term viability of farming schemes by drafting more favorable constitutions to govern them.

Table 2.2 - Benefits and Challenges of Social Protection for Adaptation and DRR

Social protection measure	**Benefits for adaptation and DRR**	**Challenges**
Cash transfers	Targeting of most vulnerable to climate shocks Smoothing consumption allowing adaptive risktaking and investment Flexibility enhanced to cope with climate shocks	Ensuring adequate size and predictability of transfers Long term focus to reduce risk over extended timeframes Demonstrating economic case for cash transfers related to climate shocks Use of socio-ecological vulnerability indices for targeting
Weather based crop insurance	Rapid pay-outs possible Guards against the adverse selection and moral hazard Frees up assets for investment in adaptive capacity Easily linked to trends and projections for climate change	Targeting marginal farmers Tackling differentiated gender impacts Affordable premiums for poor Subsidizing capital costs

	Supports adaptive flexibility and risk taking	Integrating climate change projections into financial risk assessment Guarantee mechanisms for reinsurance
Employment guarantee scheme	Provides potential off-farm employment in rural areas Public works can used as a physical response for building resilience against climate change impacts Provides a guaranteed income to combat seasonal variation	One job card per household may not be sufficient to support vulnerable and marginalized individuals Can negatively impact on agricultural real wages Lack of awareness means low enrolment rates Inefficient compared to direct cash transfers
Asset transfers	Ability to target most vulnerable people Easily integrated in livelihoods programmes	Ensuring local appropriateness of assets Integrating changing nature environmental stresses in asset selection
Social Pensions	Addressing the dualism of old people being unable to provide for themselves, and high levels of unemployment and very low incomes limiting the ability of the poor to care for their elderly	Cost inefficiencies (arising from inclusion errors) Perverse redistribution of income', as rich people outliving the poor people

	Targeting most vulnerable to climate change shocks. Providing a guaranteed household income.	High transaction costs

Source: Davis et al., (2009)

Low-income countries lack the political will to provide social protection because they believe wealthy countries can afford it, which is a misunderstanding. Simply put, the government of Zimbabwe is unable to meet the basic needs of the country's most disadvantaged citizens. The economy is so bad that implementing social safety net programs is difficult, making it difficult to pay civil servants' salaries on time (Mazwi, 2018). Civil society organizations may be able to help implement social protection measures, but the unstable and unpredictable nature of the environment makes it difficult for them (Halady, 2010).

Beneficiaries' ability to bounce back from setbacks and adapt to new situations should be a primary goal of all programs. Many social protection policies are needed so that an appropriate strategy can be developed to deal with the various sources of risk and vulnerability (Shepherd et al., 2004). It will protect vulnerable families and prevent future generations from falling into poverty (Milder, 2019). For example, many programs that help low-income families to invest in their children's well-being and education are helping to reduce poverty levels (Carter & Janzen, 2015). Vulnerable households benefit greatly from insurance, but they are also among the most cash-strapped in society (Janzen, Carter, & Ikegami, 2013). It is possible that the insurance demand of vulnerable people could be highly elastic and responsive to partial subsidization of insurance (Mango, 2017). Responding to a reduction in insurance premiums by half, those who are most vulnerable reduce their own exposure (Hansen, 2014). Poor economic growth and a large economy based on subsistence make it difficult for developing countries to establish adequate social safety nets (Shiku, 2020).

If social protection measures are to be effective, they must consider that shocks can have different effects on men and women (Maroyi, 2019). Social protection policies and programs must take gender and life cycle differences into account when determining who is most vulnerable and at risk." (Gwimbi, 2015). Uniformity in risk and vulnerability assessment can be helpful but does no necessitate an appropriate policy response that is also unified (or focused) (Mango, 2017). Many programs are assumed to be addressing gender inequality by focusing on women (Holmes & Jones, 2010). Patel and Hochfeld (2011) claim that social protection programs fall short in addressing social barriers that prevent households from participating in the economy equally and from receiving an equitable share of resources. Matondi (2010) noted that women's unpaid work was exploited to compensate for state failures. Institutions that aimed to promote gender equality instead promote exploitation, which fed into the already established dynamics between men and women, rather than equality. When it comes to risk management, gender dynamics play a significant role. Social protection programs rarely address gender inequalities in the workplace, and some even serve to exacerbate them (Luttrell & Moser, 2004). A reduction in the amount of time needed to collect water by female workers can be achieved through irrigation or well construction (Farrington, Slater & Holmes) (2004). The ability of social protection programs to reinforce or transform gender roles and responsibilities in the economic and social realms should be considered when evaluating programs in rural households (Holmes & Jones, 2010).

Because of gender-specific constraints, the intervention fails to address the reasons why women collect water rather than men. To make significant progress in reducing gender inequality, program designers must pay close attention to empowerment when developing new products (Shiku, 2020). Following an understanding of the multiple constraints faced by households, it becomes imperative to implement social protection measures (Gwimbi, 2015). Poor people are more vulnerable to shocks of all kinds, and eliminating poverty will be difficult unless there is creation of social protection systems that are inclusive and equitable (World Bank Group, 2016). Priority for many countries' strategic plans should be to invest domestic resources in social protection systems that increase the resilience of households to disasters before they occur and increase their capacity to respond to disasters when they occur (World Bank Group, 2016).

2.10 Adaptation Strategies to Climate Change in Zimbabwe

By focusing on individual sectors including agriculture, biodiversity conservation, water management, health, and human settlements, Zimbabwe's adaptation measures for climate change can be evaluated in detail (Government of Zimbabwe, 2015). As a result of these discussions, additional work on the subject was begun. Zimbabwe and other southern African countries have conducted numerous national studies on agricultural productivity threats resulting from climate change and variability, as well as the significance of adaptation (Downing, 1992; Matarira et al., 1995; Kinuthia, 1997; Mano and Nhemachena, 2007; Buckland, 1997; Mendelsohn, 2000). The UNFCCC's planning process has included comprehensive study into important sectors of Zimbabwe, although this research has tended to minimize the importance of micro-level vulnerability to climate change processes (Chagutah, 2010). Despite the fact that climate change and adaptation are global processes, the signs and symptoms of climate change, as well as climate change perceptions and adaptation choices and practices, are completely local.

As such, climate change is a worldwide issue, while adaptation is a local one (Zimbabwe NCCRS, 2015). Therefore, as mentioned earlier and as emphasized by Simatele et al. (2012), specific parts of Zimbabwe's countryside and certain types of farmers are more vulnerable to the wide-ranging impacts of climate change, making it necessary to grasp adaptation challenges at local levels (Hellmuth et al., 2007). Adaptation studies to climate change must be localized since varied forms and levels of susceptibility exist, with major consequences for the adaptation techniques most appropriate for individual places, according to Brazier 2015. In addition, according to Chagutah (2010), there is a paucity of research on actual Zimbabwean adaption strategies compared to more generic studies on climate change. Examining household-level adaption strategies follows the same pattern (Mtisi, 2012). Climate change has altered rainfall patterns, intensified drought cycles, increased the frequency of extreme weather events, and increased agricultural pests and illnesses in Zimbabwe, according to studies investigating climate change and variability at localized levels (Makhadho, 1996; Unganai, 1996; Hewitson, 2010; Chikova et al., 2013).

According to a study conducted in Zimbabwe's Matobo District by Dube et al. (2013), climate change has altered the ecological features of the area, leading, for example, to the disappearance of certain flora and fauna and specific natural habitats that had previously contributed to the livelihoods of the local people – the result was increased food insecurity. Understanding the link

between climate change and localized forms of adaptation, such as those implemented by community farmers, is a result of an effort to discover climate change specificities at the local level (Brazier, 2015). Furthermore, as noted by Chikodzi et al. (2012), farmers' perspectives on climate change and their ability (and willingness) to adapt must be considered. In this regard, Zimbabwean literature on small-scale farmers' attitudes and perceptions of climate change and how their adaptation practices are affected by conceptions arising from a deep historical knowledge and experience of their localised existence pays only a modest attention (Mazvimavi, 2010). Life histories (such as those used in this thesis) are essential to understanding the complexity of climate change concepts and vulnerabilities, as well as adaptation resources and capacities and actions, as this thesis aims to demonstrate (Hassan and Nhemachena, 2008; Deressa et al., 2011).

This necessitates a look at how small-scale farmers might best adapt to the effects of climate change (Mutekwa, 2009; Nhemachena and Hassan, 2007). Small-scale farmers' views on climate change are important, but that doesn't mean that these views (which are based in large part on personal experience) convey the full scope of climate change, let alone the many facets of its causes. The weather patterns observed by Zimbabwean farmers, for example, may be interpreted as short-term oscillations rather than long-term trends in local climate (Moyo et al., 2012; Chikodzi et al., 2012). The consequences of climate change on farmers may therefore be viewed through the prism of typical seasonal climate variability (Chagutah, 2010). Farmers' efforts to adapt in part rely on local knowledge, hence the importance of their localized conceptions must be considered when discussing local-level adaptation (Chikodzi et al, 2012). Analytically, it is immaterial whether or not these beliefs are true and whether or not they lead to incorrect decisions on farming practices and crop and seed kinds. Farmers' adaptation tactics to climate change have been examined by some researchers in Zimbabwe by looking at how they use weather knowledge (such as rainfall, thunderstorms, windstorms, and sunshine) to plan for the agricultural season.

For example, farmers in Munyawiri ward in Domboshawa were found to perceive exceptionally cold winter seasons as a sign that the coming rainy season will be proper. To predict how a season would pan out, older farmers in the area referred to a variety of natural phenomena such as wild fruit blooms or birds' nests, and animal mating as indicators. There would be insufficient rain if birds built their nests close to the ground; if they constructed their nests high above the ground, there would be ample rain. These aspects were considered when they planned their farming efforts.

Another study by Mushore et al. (2013) found that drought was a serious problem in Ward 2 of Bikita and that local farmers were pursuing a variety of drought mitigation strategies, including with the assistance of government and non-governmental organizations through the provision of food aid and food for work. This is all just short-term measures to help communal farmers deal with their climate-related vulnerabilities, but other options (such as remittances and irrigation) were even less important. As Masika (2002) points out, communal farmers' ability to adapt on their own, without outside help, becomes critical in this context.

Communal farmers face a critical issue in Zimbabwe's lack of institutional competence within appropriate governmental institutions. They frequently rely on their own initiative and capacity because of this. In other circumstances, however, NGOs play a significant role in farmers' efforts to adapt to climate change. The Chivi district in Zimbabwe was used as a case study in an impact evaluation conducted by Burns et al. (2007). The NGO Care in Masvingo Province has developed the Zimbabwe dams and gardens project as a community-based famine prevention measure. In drought-prone regions, it is critical to increase the yield and quality of food produced by low-income households. Repairing dams, developing irrigated gardens, conducting crop management training programs, and building savings and loan cooperatives are all part of the project's integrated community-based approach. Among other things, the project is believed to have improved household food security and increased access to water for cattle. This NGO project also led to local tensions since marginalized communities felt left out and occasionally stole the project's produce as it was being implemented (Burns et al. 2007).

Tensions might arise for a variety of additional causes. There are many ways to cope and adapt to droughts, such as producing drought-resistant crops and harvesting rainwater on rooftops, according to Zvigadza et al. (2010) in their study of Munyawiri. It is also worth noting the efforts of traditional leaders in the area to promote resource management methods, such as the protection of riverine vegetation and forests, and the prevention of wildfires (perhaps under government directions). These instructions were generally ignored by the communal farmers, in part because they got in the way of their income-generating activities. Possibly more often than not, communal farmers pursue adaptation strategies or their own or without significant outside interventions. Droughts and floods are prevalent in Muzarabani, Zimbabwe's northern border with Mozambique,

and the land is becoming dryer. Short-term and long-term solutions based on indigenous knowledge are being implemented in this region, according to a research (Chanza, 2015).

The collection of wild fruit, dry planting, conservation agriculture, and the planting of drought-tolerant small grains are all examples of drought-coping practices. Traditional food storage and processing methods are another option. Traditional flood-proof building designs, dual-season crops, and temporary relocation are all being used by farmers as flood-coping strategies. A wide range of solutions for managing and adapting to climate change have been documented in other research (Mano et al., 2007; Chikodzi et al., 2007; Tshuma et al., 2012) concentrating on specific communal areas (such as in Mangwe). At least ten years ago, Nhemachena and co-authors found that communal areas across the country were taking steps to adapt to climate change, including crop diversification, varying planting and harvesting dates, irrigation and different crop varieties; diversifying from farming to non-farming activities; reducing the growing season; using zero fertilizer; minimum tillage; multiple cropping; and shortening the growing season by planting earlier and earlier in the dry season. Climate change and small-scale farmer adaptation in Zimbabwe's literature are understudied, especially by sociologists, which raises a number of important questions. Only one study on Zimbabwe has attempted to explicitly apply ideas gleaned from sociological perspectives in this regard. For her research in the Mutoko district, Bhatasara drew on Archer's work and studied how communal farmers framed, analyzed, and responded to local climate change.

2.10.1 Agricultural Sector

Agriculture is the primary source of income in more than half of the world's developing countries (Katanha and Chigunwe, 2014; Mugi-Ngenga et al., 2016, Sango and Godwell, 2015b; Suckall et al., 2015). Rainfall-dependent activities are the most vulnerable to climate change and unpredictability (Government of Zimbabwe, 2015). Jiri et al. (2015) and Muzamhindo et al. (2015), one of Zimbabwe's adaptation strategies is to develop moisture conservation technologies. Planting short-season maize varieties and moisture deficit-tolerant crops like micrograins (pearl millet, finger millet, and sorghum) is critical for agricultural growth (Shiku, 2020). Zimbabwe is encouraging dam construction for irrigation purposes, particularly in the country's driest regions (Government of Zimbabwe, 2015). Traditional mixed crop and livestock production should also encourage to adopt to climate change (Ncube, 2016).

2.10.2 Biodiversity Sector

Biodiversity management strategies are being pushed hard in Southern, Western, and extreme Northern Zimbabwe since climate change is predicted to have a major detrimental impact on Zimbabwe's biophysical sector in these regions (Government of Zimbabwe, 2015; Mafongoya et al., 2016). One example is to reduce human extraction of resources such as land, vegetation, and water by setting controlled veld fires and other means. Many of these outlying areas have been set aside for animal preservation and now feature game parks, sanctuaries, and safaris (Madobi, 2014; Musiyiwa et al., 2014). However, as the population of the country continues to grow, some of these areas have begun to be changed into residential areas (Muzari et al., 2014; Rurinda et al., 2014). According to Bhatta et al. (2015) and Kupika and Nhamo (2017), rules and regulations are needed to strengthen the conservation and reservation of biodiversity regions. In locations where carbon sequestration is done appropriately, it reduces and mitigates the effects of climate change (Dube et al., 2016).

Mango (2017) notes that the health of the country's livestock and wildlife systems is an essential indicator of its rangeland health. As the effects of climate change and variability continue unabated, the carrying capacity of rangelands is decreasing (Dube et al., 2016). Smaller animals, such as goats, are used as part of the adaptation strategy, which includes reducing the number of animals, providing additional forage, and integrating livestock with wildlife on the range area (Otieno and Muchapondwa, 2016). Climate variability and change, according to both Oxfarm (2015) needs new approaches to disease surveillance. Sectoral planning must embrace adaptation as an adaptable strategy (Niang et al., 2014). Ecosystems have only a few options for adapting to climate uncertainty and change, which also indicates that the success of those options is unpredictable. Rehabilitating degraded areas (planting vegetation and mechanically clearing silt from silted waterways) and ecosystem movement corridors are some of the viable strategies for biodiversity conservation (Nhamo, 2016).

2.10.3 Water Sector

When rain falls, the soil takes it in and part of it finds its way into natural river systems. Zimbabwe, a landlocked country, can only rely on this precipitation (Government of Zimbabwe, 2015). Mazwi (2018) notes that just a few dams and underground reservoirs are constructed across the country while the rainy season isn't in full swing. Because of water shortages, Zimbabwe is supporting the

development of larger dams and more effective water use in the agriculture sector (Muzari et al., 2014).

2.10.4 Health Sector

Human and cattle illness incidence rates are widely used to assess the impact of climate variability and change on agriculture (Filho et al., 2016; Mellor et al., 2016; Rurinda et al., 2014). As a result of their limited financial means and political influence, people in underdeveloped countries frequently look to government agencies for assistance in adapting to climate change. As a result, the majority of programs are funded by the federal government. It has been shown that temperature and rainfall have a significant impact on the dispersion and transmission of disease vectors such as malaria in several studies, including those by the Government of Zimbabwe in 2015, and Muzari et al. in 2016. The research location is located in the hot southern and northern lowveld where malaria is most prevalent. Consequently, this is the conclusion (Dodman and Mitlin, 2015). Thereby encouraging and supporting collaboration between governments and non-government groups on disease management initiatives.

Improved drainage, reforestation, desalination, and other infrastructure-related measures can also help mitigate the consequences of climate change. Adaptation initiatives in Zimbabwe, including spraying programs and malaria campaigns, are supported by the WHO, which is based in Geneva (Brown et al., 2012; Chagutah, 2010). Water conservation and sustainable development are being integrated into national programs to combat water-borne diseases like cholera, typhoid, and bilharzia (Government of Zimbabwe, 2015; Muzari et al., 2016). More clinics and roads linked to health care facilities should be developed as well (Government of Zimbabwe, 2015).

2.10.5 Human Settlement and Tourism Sector

Climate change and variability have reduced agricultural production in Zimbabwe, which is heavily dependent on agriculture (Muzari et al., 2016; Government of Zimbabwe, 2015). Reduced agricultural output is a major factor in increasing rural-to-urban migration in nations like Peru (Dodman and Mitlin, 2015). As a result, in places like Harare and Bulawayo, where water, shelter, and other necessities are in short supply (Adger et al., 2015; Angula and Kaundjua, 2016; Suckall et al., 2015). The human settlements discussion must address the health effects of climate variability and change on rural people and their livelihoods (Kongsager et al., 2016; Martin and

colleagues, 2016; Muzari and colleagues, 2016; Sango and Godwell, 2015b). Malaria is prevalent in Zimbabwe's rural low veld areas, according to the above text.

This section focuses on adaptation measures in rural settlements with insufficient adaptive capacity (Government of Zimbabwe, 2015). In rural areas, climate change can be alleviated through drought-resistant agricultural kinds and dam construction to support irrigation schemes (Chagutah, 2010). It is important to incorporate natural resources into settlements as well as trade in wild products in drought and flood-prone areas, according to Dube et al (2016) and Muzari et al (2016). (2016). Zimbabwe's government mentions drought and flood warning systems, as well as water recycling (2015a). Irrigation engines should be fueled by solar energy to limit the use of fuelwood and the overreliance on nonrenewable energy sources, such as diesel (Kaya and Chinsamy, 2016; Nyamadzawo et al., 2015). This and other adaption methods need to be thoroughly evaluated in the Jotsholo, Lupane district case. Also deserving of inquiry are policies and regulations affecting settlement site, design, and construction standards (Government of Zimbabwe, 2015).

Zimbabwean climate change adaptation techniques include managing crops and livestock, controlling water resources, and diversifying sources of income (Chikodzi and Mutowo, 2014; Gukurume, 2013; Jiri et al., 2015a; Muzamhindo et al., 2015; Rurinda et al., 2014; UNDP, 2013). Conservation farming, hiring workers, contributions, and local weather forecasting systems are also common practices in most regions of the country. Natural hazards, such as disease and pests and the inability to access financial facilities, as well as a lack of expertise and extension services are among the key constraints identified in this study (Chatutah, 2010; Chikodzi and Mutowo, 2014; Gukurume, 2013; Jiri et al., 2015a; Rurinda et al., 2014; UNDP, 2013). Lupane District in Jotsholo, South Africa, is undergoing an assessment of these adaptation alternatives and challenges.

2.11 Constraints in Adaptation to Climate Change

Due to the short-term nature of climate change adaptation in developing countries, it is highly constrained, resulting in a wide range of current development challenges (Hansen, 2014).

Communities' resources (environmental, social, financial, human, and physical) limit their ability to adapt to climate change (Rurinda et al., 2014). According to Klein et al., constrictions are conditions or processes that make it more difficult to carry out any desired action (2014). Climate change and adaptation planning and implementation encounter a wide range of challenges. They can be categorized as restricting the number of options, raising the cost of adaptation, or decreasing the efficacy of selected solutions in achieving the adaptation goals (Klein et al., 2014). Restrictions on access to resources (financial or otherwise), lack of support from the government, and inadequate environmental management are all instances cited by the writers. A wide range of stakeholders, sectors, and geographic areas are able to cope with climatic uncertainty and change in diverse ways (Adger et al., 2003; Alfieri et al., 2016; IPCC, 2014; Kneil et al., 2014; Kaushik and Sharma, 2015). In the wake of this, there are a number of restrictions that are put in place. Social, political, and biological barriers may also be encountered.

2.11.1 Biophysical Constraints in Adaptation to Climate Change

Nature tends to revert to its original state with the least amount of human influence (Muzari et al., 2016). For the natural environment to exist today, it must be extremely difficult for humans to reach (Ashley and Hussein, 2000; Bhatta et al., 2015; Muzari et al., 2016). Advances in technology have made it possible to access virtually any location and any resource. As a result, human-made constraints rule the biophysical systems. Conway and Schipper (2010), Rurinda et al. (2014), and Niles et al. (2015) all pointed to an increase in pest and disease incidences as a constraint on cattle production in drought-affected regions (2016). Non-climatic physical restrictions commonly hinder the ability of natural systems in underdeveloped countries to respond to climate fluctuation and change. Examples include animals and plants that cannot move uphill because of natural characteristics like rivers or beaches and a lack of appropriate height, for example (Kneil et al., 2014). According to Mafongoya et al. (2016), soil conditions also hamper adaptation.

This is made worse by the dreadful quantity and quality of water caused by climate change and fluctuation (Rurinda et al., 2014). Many communities, particularly those in developing countries, have inadequate soil and water management, which means that agricultural adaptation solutions to climate change are primarily theoretical. The biological characteristics of some animals determine their climatic adaptability, acclimatization, and behavior (Otieno and Muchapondwa, 2016). An adaptation technique used by nonhuman species is interspecific migration, which is linked to

biological features like fertilty and dispersal rates as well as interspecific interactions like phenotypic and genotypic variability (Kneil et al., 2014). Thereby increasing their susceptibility to climate variability and change. The rate of environmental degradation also imposes biophysical restrictions. Environmental systems are becoming less robust to climate change, which is a worry for sustainable livelihoods, according to Brown et al. (2012) and Goulden et al. (2013).

Depletion is occurring at worrisome rates throughout a wide range of marine ecosystems, tropical forests, coastal wetlands, and even the groundwater table (Hobday et al., 2016, Huq et al., 2015; Liu et al., 2015; Phiri et al. 2014). All of this is affected by human activity (Alfieri et al., 2016). It's seen as a new roadblock in the way of one's ability to adapt and change (Goulden et al., 2013). Consequently, the biophysical limits in the Lupane district of Jotsholo cannot be understated because of their enormous consequences.

2.11.2 Socio-Economic Constraints in Adaptation to Climate Change

In addition to human population expansion, urbanization, land and water consumption, rural-urban mobility, and biodiversity loss, climate change is taking place against a backdrop of several global concerns (Onyekuru and Marchant, 2016; Rurinda et al., 2014). Water scarcity, inadequate infrastructure, weak marketing, natural calamities, and a lack of accessibility are all linked to these problems (Enete and Amusa, 2010; Enete, 2013). Adaptation to climate change is difficult, as both Ofuoku (2011) and Gentle and Maraseni (2012) note. Because of this, it is imperative that we address the effects of climate change in a way that is consistent with these broader development concerns (Qin et al., 2016). Land deterioration, rehabilitating degraded lands, and ensuring the optimal use of land resources for the present and future generations are all critical goals of sustainable land management, according to Qin et al. (2016) and Mugi-Ngenga et al. (2015). In some cases, households lack the required resources, such as seeds and fertilizers (Diiro et al., 2016; Dube et al., 2016; Shisanya and Mafongoya, 2016).

The lack of information about climate change is one of the social barriers to climate change adaptation (Anandhi et al., 2016; Shemdoe et al., 2015). Climate change adaptation necessitates the use of both conventional wisdom and cutting-edge scientific research (Chanza, 2014; Gerlitz et al., 2016; Kneil et al., 2014). Education and understanding about climate change have a direct impact on household's views of the risks posed by the phenomenon (Muzari et al., 2016). According to Muzari and colleagues (2016), adapting to climate change necessitates an ability to

build and apply the four types of technology (biotechnology; hard technology; soft technology; and organizational technology) that they describe. According to Kamwamba-Mtethiwa et al. (2016), Kneil et al. (2014), and Sonwa et al. (2016), civilizations' varying levels of technical development explain the temporal variety in their adaptive capacity. Adaptation capacity by different countries depends on the availability, accessibility (capacity to fund, operate, repair, and transport), acceptability to users and affected stakeholders, and finally, the efficiency of technology in controlling climate risk (Akhtar, 2016; Iglesias and Garrote, 2015; Jones et al., 2010).

Weaknesses in social' safety nets' due to extreme poverty have been recognized as another social limitation (Shiku, 2020). The shortage of human resources for climate change adaptation is alleviated by involving the local community (Furness and Nelson, 2016). What Klein et al. (2014:914) term "entitlements of actors to economic resources" combined with economic development and globalization tendencies have a significant impact on the ability to adapt to climate variability (Amjath-Babu et al., 2016). Climate-sensitive industries including agriculture, forestry, and fisheries, according to Kongsager et al. (2016) and Weatherdon et al. (2016), are more susceptible to the effects of climate change, making adaptation more challenging. Human encroachment on hazardous landscapes through urbanization are considered as a threat to human life since they expose them to climate fluctuation and change (Hanna and Oliva, 2016; Kneil et al., 2014).

Financial capital, which includes loans, insurance, tax revenues, and the earnings of individuals and private businesses, is a major restriction in developing countries, particularly in countries where the economy is still developing (Shisanya and Mafongoya, 2016). This deepens the chasm between industrialized and developing countries in terms of their ability to adapt (Nguyen et al., 2016). For the year 2050, Kneil et al. (2014:914) found recent studies to predict a US$75 billion to $100 billion annual cost of adaption. NAPAs have been developed for Least Developed Countries (LDCs) with the aid of the Least Developed Country Fund. In order to access the UNFCCC's adaptation fund, carbon credits, which are CDM-certified emissions reductions, must be sold (Banerjee, 2015; Kneil et al., 2014). Right now, demand exceeds supply, making it difficult to meet climate change adaptation goals (Arfanuzzaman et al., 2016; Dietz et al., 2016; Nguyen et al., 2016).

Adaptation to climatic variability and change around the world is heavily dependent on money, according to a number of studies (Dietz et al., 2016; Donner et al., 2016; Shisanya and Mafongoya, 2016). Bangladeshi fishing communities face difficulties in receiving financial support from banks as well as an increase in aquatic salinity (Dasgupta et al., 2016). Insurance is seen as an expensive option and has no takers, especially in developing nations, to mitigate climate risks and address financial adaptation issues. "The effectiveness of societal attempts to adapt to climate change is dependent on humans who are the major agents of change," write Kneil et al. (2014:915). It has been suggested that human resources, such as local residents, can hinder an area's ability to adapt to climate change and variability when they lack technological knowledge and the ability to prioritize which adaptation strategies should be prioritized. in the formulation and execution of plans for adaptation, people are essential (Brown et al., 2016). Social and cultural factors can limit an individual's ability to adapt, and they go hand in hand with human resources (Bongo et al., 2015). Research in Jotsholo, Lupane region, therefore aims to further investigate the socioeconomic restrictions that limit adaptability mechanisms.

2.11.3 Political/ Institutional Constraints in Adaptation to Climate Change

When political or institutional constraints are taken into consideration, climate variability and change adaptability can be fully understood (Milder et al., 2011). According to Shackleton et al. (2015), political and other socio-psychological or religious constraints on climate variability and change adaptation have received too little attention. As a result of this revealed gap, the Jotsholo district, Lupane district, was included in the current investigation. The incapacity of government institutions to fully commit to climate change adaptation difficulties is one example of political restraint (Milder et al., 2011). Conflict or post-conflict circumstances, which restrict communications, learning, and innovation, can limit adaptation in some African locations (Sonwa et al., 2016:12). Mazwi (2018) notes that adaptation to climate change is hampered by a lack of physical capital like infrastructure. Since social institutions, including religious organizations, must collect resources, take part in decision-making, design policies that are put into practice in order to adapt to climate uncertainty and change, political will is essential" (de Leon and Pittock, 2016; Keskitalo et al., 2016; Milder et al., 2011).

In the words of Kneil et al. (2014), the value of adaptability is intimately tied to institutional capacity. Abid et al. (2016) points out that local government's participation in the delivery of

infrastructure is insufficient and limited in dealing with climate change adaptation concerns. A government's ability to allocate resources effectively and determine who has legal and regulatory power and duty are two of the most critical functions of politics or governance (Keskitalo et al., 2016). The complexity of governance networks necessitates a variety of viewpoints on the necessity of adaptation and the factors that obstruct or enable it, such as government agencies, market actors, non-profit organizations, community-based groups, and social networks (Matthew et al., 2015). There are institutional mandates that focus on maintaining the status quo rather than anticipating and preparing for the future, as Perry (2015:1) pointed out. Climate change and variability adaptation is hampered by a lack of political will to accept new ideas. In order for official and informal sectors to conduct adaptation activities, a favorable political climate is required (Nhemachena, 2014). Lack of political makes it impossible to confront any substantial climate change threat (Government of Zimbabwe, 2013; 2015). Thus, the question needs further debate in light of recent studies in Jotsholo, Lupane. Climate change is addressed in Zimbabwe's National Environmental Policy and Strategies, although the government does not have a separate climate change policy.

2.12 Chapter Summary

There is still a lot of focus on the link between rural livelihoods and climate change adaptation in national and international forums. Climate change and unpredictability have compelled the world community to focus on new methods for making human life on Earth more sustainable (Shiku, 2020; Silva, 2015). Climate change and unpredictability have the potential to disrupt natural and human systems on a large scale if they are not checked and mitigated (Mika, 2020). Climate change and climate variability adaptation programs are underway at all levels (Maroyi, 2019; Shiku, 2020). Contextualization of adaptation approaches is necessary because there are so many different socioeconomic, political, and biophysical situations around the world. (Silvas, 2015) The research of Jotsholo, Lupane district, for example, aimed to improve public awareness of the phenomenon (climate fluctuation and change), investigate current activities, and encourage sustainable living. Climate-friendly researchers, educators, and other stakeholders should be given priority in policy and institutional development networks as well as networks for curricular innovation and capacity building (Mazwi, 2018). All stakeholders must work together to combat climate change and variability. The study objectives were used in Chapter 2 to guide a literature review. For this

reason, the current investigation is legitimate. The IPCC (2014) claims that the poor are particularly vulnerable to climate change because their traditional and natural ways of life have been altered by human activities. In light of this study, policymakers have the information they need to make smarter decisions in these underserved communities.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

Chapter Three was the anchor of the study and it reflected the research methodology which was used in conducting the study in Jotsholo, Lupane district. Chapter three focused on research paradigm, research design, research approach, research site, population, sample frame and sample size, data collection process, data collection techniques, data analysis, credibility and trustworthiness, validity and reliability, ethical considerations, COVID 19 protocols and limitations.

3.1 Research Paradigm

A research paradigm can be characterized as a body of knowledge or concepts that guide future study and research activity (Sibanda, 2015). The research followed the interpretive paradigm design. The importance of philosophical conceptions on research practice is evident, as noted by Crotty (1998). Based on philosophical assumptions, research might be classed as positivist, critical, or interpretivist (Myer et al., 1998).

3.1.1 Interpretive Research Design

It was necessary to use an interpretive technique because of the study's focus on climate adaptation strategies. It is via social constructions such as language, culture and shared meaning that stakeholders gain an understanding of reality (Walshman; 1993). Instead of focusing on a specific set of variables, an interpretive study focuses on rural livelihoods are contextualized in the semi-arid regions like Lupane district (Mazwi,2018). It is important to understand social activity in terms of the meaning that social actors attach to rural livelihoods (Mika, 2020). It is possible for interpretive researchers to adopt intersubjective epistemology and the ontological premise that reality is socially generated. Mazwi (2018) notes that interpretivists believe that there is no one right way to gain knowledge.

Milder (2019) notes that there are no "proper" or "incorrect" theories in the interpretive paradigm and in this study a number of stakeholders took part in the study in order to get various views on the subject matter. The Interpretive approach delves to derive constructs from the real world by

conducting a thorough research of the subject matter. Gonese (2017) states that interpretivists believe in the premise that information and meaning are interpreted, and that there is no objective knowledge independent of human thinking or reasoning. The difference between observing and interpreting is that observing gathers information about what's going on, while interpreting makes sense of that information by drawing inferences or evaluating the match between the information and an abstract pattern (Kuona, 2019). The most significant words in this strategy are involvement, collaboration, and engagement (Hammar, 2013). For the interpretive researcher (Dube, 2015), rather than observing from afar, they join the action themselves and determine the underlying meanings of the behaviors in various social contexts. Interpretive methodology was used because of its ability to explain climate change adaptation for rural livelihood preservation in Zimbabwe's Jotsholo, Lupane District.

3.2 Research Approach

This research relied on qualitative methodologies to gather information and have open, in-depth discussions about the topic at hand. Because of the importance of analyzing and understanding the values, beliefs, and assumptions that people develop in their daily lives, a qualitative technique was the best choice for this investigation. To gain a deeper knowledge of social phenomena from the perspectives of those who are experiencing them, qualitative researchers focus on the larger social environment in which they take place (Milder, 2019; Kuona, 2019; Gonese, 2017). Gumede (2017) notes that qualitative research is interpretive in nature and necessitates careful observation and explanation, thus the conclusions it draws consider both general and specific elements. Qualitative research's originality is found in the context-specific details. The goal of this study was to develop new theories on the sensitivity of women to droughts. It was found that analyzing the qualitative data not only validated the theories put forth but also expanded upon them, leading to a new view of climate change and the challenges they present (Stephen, 20221). For this investigation, researchers used interviews, observations, and an examination of records. Textual data was obtained because this was a qualitative study. The researcher used a single case study of households in Lupane District to help them answer their research questions, focus on social interactions related to the susceptibility of household climate change, and gain a better understanding of the problems.

3.3 Utilisation of a Case Study for the Research Design

A single case was the subject of this investigation, which gathered data at two different levels. The households served as the study's unit of analysis. It was possible to gain a more comprehensive picture of this particular group among the households they represented by performing various levels of research on a single case. Households that had resided in Lupane district for more than ten years and had been affected by climate change were the only ones eligible for the study. "How" and "why" questions and an emphasis on current phenomena in a real-life environment were all cited by Yin (2019) as three situations in which a case study is appropriate. The goal of this research was to determine why and how climate change influences the livelihoods of households in Lupane district notwithstanding their use of various coping mechanisms and adaptation techniques. Droughts are a modern occurrence that has garnered attention from scholars because of climate unpredictability. There was no control over climate dynamics in the district. Drought in Lupane District was mis understood and the voices of households were captured through the inclusion of females, males, government officials, and NGO personnel in the study through analyzing gender dynamics in the district.

As Merriam (1998) notes, case studies can be used to develop conceptual categories and to illustrate, support, and/or challenge theoretical assumptions made prior to data collection if they are done correctly. Climate change adaptation in rural communities was studied using the conservation of resources theory and the sustainable livelihoods approach. Those who lack resources, according to the COR theory, are more vulnerable, while those who do have resources are better protected. This theory led to the discovery of a variety of food sources. Studying Lupane District climate change adaptation and coping was based on principles of sustainable livelihoods. Although case studies have many advantages, there are some drawbacks that must be considered. Data from individual cases cannot be extrapolated to the entire population, as pointed out by Yin (2009). Using the "analytic generalization" method, a case study's findings are compared to a theoretical framework that has been previously established. A single case can either confirm, challenge, or extend a theory's propositions, depending on whether or not the theory is correct (Yin, 1994).

Using the theories of resource conservation and sustainable livelihoods, this study examined the assets owned by households, their means of subsistence, their coping mechanisms, and their

strategies for adapting to changes in the environment. According to the theory's premise, one should invest more resources to gain more resources, it was argued that this was flawed. On the other hand, because of the role attitudes and perceptions played in behavior change, the theory of sustainable livelihoods' succession presumption was called into question. Having a long-term perspective on climate change and understanding the historical context of the problem did not always lead to women planning for a preferred future. Replication of this study should therefore be based on an understanding of the theories used and how they can be applied in similar situations. According to Guba and Lincoln (1981), the reader may be misled by a case study if it oversimplifies or exaggerates the actual state of affairs.

Qualitative case studies have limitations due to the researcher's inherent sensitivity and integrity, as the researcher must rely on these for the majority of the research process (Merriam, 1998). The study's limitations include bias, ethics, reliability, and validity (Johnson, 1994; Merriam, 1998). It was necessary to identify and address ethical issues so that the study adhered to ethical standards. Validity and reliability were also discussed extensively in relation to questions of credibility and validity, as well as questions of reliability and validity. Yin (2009) cited interviews, focus groups, direct observation, documentation, participant observation, and so on as examples of these techniques. Researchers conducted interviews, focus groups, observations, and a review of documents in order to gather data for this study. Data from focus groups, observations, and document reviews were used to supplement data from interviews with a small number of households and government and non-profit officials. Focus groups, in-depth interviews, and observational data as well as secondary data all contributed to the study's success when they were combined to form a more complete picture.

3.4 Design thinking approach

To direct the study, a design thinking approach was utilized. The approach was designed to consider or appreciate the questions and concerns facing the households as a result of climate change and how they are adopting to it.

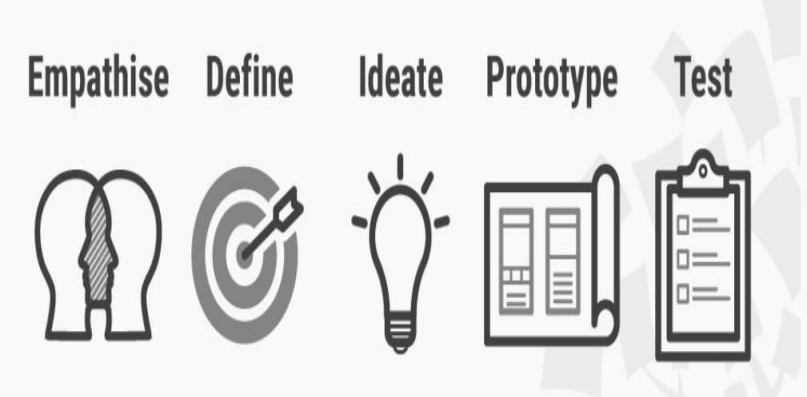


Figure 3. 1: Principles Underpinning Design Thinking.
Source: Dam and Siang (2018:3)

3.4.1 Empathy

Interviews and focus groups allowed the researcher to get a better understanding of what rural livelihoods are like for households that were studied. To counteract the top-down approach to development, the principle of empathy was developed. No one can truly understand a problem until they hear it from the perspective of the people who are actually impacted, and only then can they offer meaningful solutions (Dam and Siang, 2018). An empathy-based approach to solving community problems recognizes that different stakeholders in the community have a significant impact (Mootte, 2013). Understanding empathy, according to Joosten (2017), necessitates an assessment of the degree to which various community stakeholders are actively involved in establishing the problems that society faces. In order to understand a community, a researcher must get to know the households who live there on a day to day basis. In order to fully implement this concept, it is crucial to understand and evaluate an intervention from the perspective of the respondent. (Mootte, 2013). Climate change adaption plans necessitate the involvement of a number of key stakeholders. Using the term "persona" can help researchers better understand the phenomenon they are studying and generate new ideas for possible solutions (Joosten, 2017). An Agricultural Extension Officer's perspective helped researchers identify factors that might affect the study's goals.

3.4.2 Defining

Defining means making sure that the research's focus and purpose are clearly defined (Mootte, 2013). With this concept, one of the most important aspects is to provide the audience with an

actionable problem statement (Dam and Siang, 2018). Wyatt and Brown (2010) hope to find long-term solutions to the challenges they face by defining the challenge to the households and getting them involved in solving their problems. Research participants were informed of their roles and responsibilities before any data was gathered. The researcher then asked the participants, "How can we better adapt to climate change for the sustenance of rural livelihoods?" after giving them this definition. The researcher was able to solve this conundrum by clearly explaining to study participants what the study was trying to accomplish, and why the research was conducted, and the challenges and opportunities they would face as they tried to make use of the climate change systems.

3.4.3 Ideation

A problem must be identified before a solution can be developed, according to Dam and Siang (2018). Ideation emphasizes this point. In this case, it emphasizes the importance of considering a variety of options before making a final decision (Joosten, 2017). In order to develop a solution-based approach to dealing with the difficulties the community faces, Mootte (2013) argues that it is critical to bring together the various points of view of the respondents and have them actively participate. Using a variety of perspectives, the ideation process aims to delve into previously unexplored territory in order to foster an innovative culture among those directly affected by the problem (Dam and Siang, 2018). In order to get a wide range of perspectives on how to improve climate change adaptation effectiveness, focus group discussions were held. Recommendations highlighted in this study would not have been possible without the contributions of the various viewpoints and perspectives highlighted in the recommendations.

3.4.4 Prototyping

As stated by Dam and Siang (2018), there is a wide range of applications for prototypes. The model's presentation makes it possible to conduct cost-effective research (Joosten, 2017). Wyatt and Brown (2010) state that prototyping is a process in which the participants are actively involved in designing a model that they believe is critical in solving their problems. The idea acknowledges the significance of including a wide range of perspectives in the creation of a prototype model (Dam and Siang, 2018). Preliminary prototypes can be used to bring ideas to life and allow for continuous learning in the search for a sustainable solution-based model, according to Wyatt and Brown (2010). Incorporating the prototyping concept, the researcher was able to create a working prototype for the implementation of climate change adaptation systems. The prototype for

implementing climate change adaptation mechanisms was an important first step in allowing households to participate in the development of a model that is tailored to their specific context. Climate change adaptation systems in Jotsholo, Lupane district, need to be based on the participation theory in order to be owned and sustainable.

3.4.5 Testing

Once a prototype model has been developed, the testing principle assumes that the model must be tested in order to determine if it is effective in achieving the desired results (Dam and Siang, 2018). In order to customize the model based on what has been learned, it is critical to learn and understand what works in this concept (Wyatt and Brown, 2010). The scientific literature is now devoid of an evaluation of the prototype's effectiveness in improving rural livelihoods as a result of its creation as a climate change adaptation prototype model. If the model works, it can be scaled up or remodeled to be more effective if the research space is available.

3.5 Research Site – Jotsholo, Lupane District

The research was conducted in Jotsholo, Lupane district. The researcher chose Lupane for its agro-ecological characteristics, which reflected a drought-prone region with extremely high temperatures and low rainfall patterns and poor soil. Droughts occur on an annual basis in the agro-ecosystem of Lupane district, which is located in zone 4. With such harsh climatic conditions, the district is at high risk of being reclassified as agro-ecological zone 5, which has poor soils and highly variable rainfall and is therefore unsuitable for crop production, as authors like Kawadza (2014) have already claimed. It was through the Office of the Provincial Development Coordinator that the researcher was able to gain access to the district in question. Because the district had been hard-hit by climate change and remained vulnerable due to the recurrences of drought, it was selected for food assistance.

The study of this population met the criteria for selecting research participants, making it an appropriate source of information for the investigation. Since there had previously been no research on the Lupane district's vulnerability to climate change in light of the area's recurrent droughts, this study provided an entirely new perspective on the area. The researcher chose Lupane district, a semi-arid area prone to climate change, because it is rain-fed, despite the fact that the area is semiarid and the researcher wanted to understand indepthly the dynamics of how the

households are adopting. That's why this research location provided a unique opportunity to examine the vulnerability of households to climate change in an uninviting and unsupportive environment. The responses of the households highlight the importance of researching how households adopt new behaviors in response to climate change. The research in Jotsholo Ward focused on seven specific villages thus Jabatshala, Jibajiba, Jumbika, Kheswa, Kwarai, Gumede, and Gudubhu.

Lupane is the provincial capital of Matabeleland North Province. Selected villages can be found along the Gwayi river (Dube, 2015). According to the Jotsholo extension officer, the Bubi River used to provide enough water for people and livestock alike throughout the year but with time this has since changed. It was further noted that households have turned to stream bank cultivation due to the increasing frequency of droughts and dry spells, which has resulted in soil erosion and river siltation. As a result, the river only flows during the rainy season and quickly dries up afterward. In Jotsholo ward, the vast majority of households given up cultivating their fields in favor of tending their gardens on the banks of the Bubi River. A lack of water retention prevents plant growth in these fields and affects rural livelihoods, which are situated on dry sandy soils (Makumbe, 2016).

In Zimbabwe, stream bank cultivation is illegal, but traditional leaders are unable to control households due to the recent climate change spells that have affected the communities. Small plots were located 30 meters from the river in the past, as advised by agricultural extension services (Tankou, 2020). The St Luke Hospital, located within the ward, bought the vegetables that residents grew on these small plots, which required constant irrigation. Households along the river have increased the size of their plots and moved closer to the river in recent years, with some households even planting in the river during the dry season. For food security reasons, the plots are now cultivated during the cropping season for maize production. Drought-resistant crops like sorghum and millet are often planted in large dry land crop fields that are not located near a river. Households in this ward raise livestock that are rarely slaughtered and rarely sold to buy food for their families (Siziba, 2018). As a means of raising money for their children's school fees or medical bills, livestock are often sold. The majority of the household's food needs are met by growing its own maize, sorghum, and millet, which is not uncommon at the study site (Chimhowu, 2010).

3.6 Population

There are 26 wards with a population of 159 662 in the district of Lupane (Gould, 2010)). In 2006, 160 000 people were confirmed to be living in Lupane district (ZIMVAC,2020). The population for this study was comprised of rural households. Creswell (2009) considers that the public is the community that the researchers want to hear more. The population is also identified by Babbie and Mouton (2005) as a sample group and, in most cases, groups surveyed may be disproportionately large to all the participants. The objective population in this sample consisted of 92 households, 2 traditional leaders, 4 agricultural extension staff, 2 NGO officials serving in Jotsholo and 2 Civil Protection Unit.

The World Food Programme (WFP) defines a household as a social and economic unit consisting of a number of people who live together in one place. A household's structure and organization must be assumed in order to identify the activities, relationships, and processes needed to improve income and well-being across the board (FAO, 2000). Decisions made by the family as a whole cannot be attributed to a single person. As a result of this, most households have a variety of roles that are based on gender, such as those that are productive, entrepreneurial, and individual in nature.

3.7 Sample Frame and Sample Size

3.7.1 Sample Frame

The sampling system comprised of households in Jotsholo, district of Lupane. A sampling panel was conceptualized as a collection of households within a population (Zhang, 2019). According to Moser and Korstjens (2018), the most essential factor in determining sample size is the availability of sufficient in-depth data revealing the patterns, classifications and diversity of the phenomenon under investigation. Qualitative research should take these factors into account when determining the appropriate number of participants to include in its sample, including the richness and diversity of data collected, the breadth of the study's research question and phenomenon, as well as the method used to collect the data and its sampling strategy. The foregoing scientific foundation led to the conclusion that the sample size was adequate to produce the evidence required for this study. Climate change experts comprised the vast majority of those who took the time to answer our

questions. For this study, a representative sample was drawn from government officials, non-profit officials, and households in Lupane district.

3.7.2 Sample Technique and Sample Size

Jotsholo Ward has 920 households (ZIMVAC, 2020). The sample size for the analysis was made up of 92 household members, as determined by the sample size calculator with a margin of error of ten percent. Additionally, key informants participated in the study and these included the agricultural extension officers, NGO officials and traditional leaders participated in the study, who are crucial in providing households with technological know-how and expertise on climate change adaptation.

Participants in this study were selected through the use of purposive sampling. Choosing participants based on their ability to provide the data needed for a study is known as "purposeful sampling." Participant selection is critical, but so too are the contexts, events, and activities that are part of the study. In order to find the best sources of information on climate change adaptation, this study used purposive sampling to gather data. The research questions led to the selection of government officials and other NGO stakeholders with practical experience and knowledge in climate change adaptation. Participants selection was done by focusing on households who had relevant work experience and were familiar with the study's research questions. Only those participants in the study who would be most harmed by adaptation to climate change were selected for this investigation because of the wealth of information they possessed. Agriculture Extension officials in the Lupane district identified some of the Lupane district's most vulnerable households, and some of the homesteads were visited to verify the level vulnerability.

3.8 Data Collection Process

The researcher applied and got permission fron the Secretary of Provincial Affairs and Devolution – Matabeleland North Province to conduct the study. The Lupane District's District Development Coordinator received authorization in writing from the Province which in a way unlocked researching space for the researcher in Jotsholo ward. The District Development Coordinator's role was to introduce the researcher to the agricultural extension department, councillors, and traditional chief in the ward. Getting local authorities on board with the survey was important in order to ensure they would be buy in and local ownership. Participant recruitment in qualitative

investigations were based on participants' prior exposure to or involvement with the topic under investigation (Mika, 2020). Also, purposeful sampling was used to choose those who would be best suited for the focus group discussions.

According to Tankou (2020) notes that, a focus group should comprise people who share a common attribute. For this reason, Sugden (2014) further asserts that in focus groups members must be homogeneous in terms of one or two desired qualities such race, gender, place of residence, and socioeconomic position to accurately depict the group's collective perspective. FGD participants in this study came from the same district. There were between 8 and 12 participants and a researcher (moderator) in each of the four focus group talks. There was a purpose to include enough variance to allow for different viewpoints but not so much that participants were restricted and deferred to those they perceived to be better informed or experienced.

A pilot test of the interview and focus group discussion guide in English and IsiNdebele was conducted as the first step in the process. This was critical for determining whether or not participants had a common understanding of the issues by tracking the time and understanding the participants had. As a result of participant feedback from the instruments, the researcher was able to modify some of the questions and even add more alternatives. It is however imperative to denote the fact that the participants that took part in the standardisation process were not part of the actual sample for the study.

According to the research, the agricultural extension department's registers of Jotsholo contained households which were key for sampling purposes. After that, FGDs were conducted on the rural households with the help of a Research Assistant and Agricultural Extension Officers, who also carried out follow-up visits. In order to ensure that the problems were understood, and all ethical concerns were addressed, the researcher discussed the research objectives with the Research Assistant and Agricultural Extension Officers. As part of the FGD administration system, rural households were visited at their residences using the addresses provided in the household extension registers. Each member of the research team was given an opportunity to introduce themselves and

explain the purpose of the project to each household, emphasizing how the study's results would be critical to helping the household improve its localized food security model.

Purposive or judgmental sampling was used to select participants for the focus group. Seven focus group discussions were conducted over one month in seven villages. Eight key in-depth interviews were conducted will stakeholders which include the District Development Administrator, NGO officials, and agricultural extension staff in the field of crop and livestock production. When conducting focus groups, nonverbal signals such as body language and facial expressions were considered because they helped corroborate what participants said. A series of interviews were conducted in tandem with focus group meetings. The collected data was cleaned, reviewed, and evaluated to generate themes.

3.9 Data Collection Techniques

3.9.1 Focus Group Discussions

Focus group discussions, according to Parker and Tritter (2006), are often equated with interviews, particularly semi-structured 'one to one' and 'group interviews.' The value of focus groups in social science research has been demonstrated by a variety of definitions in the literature, but aspects such as a structured conversation (Rahman, 2017). When it comes to research, focus groups are defined as a group of people who have been chosen and brought together by researchers to debate and remark on the topic at hand. As stated by Pelling (2012), focus groups gather qualitative information through an organized discussion with selected participants on an assigned topic and it can be noted that the area of focus in this study was climate change adaptation in Lupane district.

The researcher utilized focus groups in this study because they are flexible, low-cost, and rapid to produce data. With a minimal time, commitment from both participants and the researcher, focus groups can provide rich data in a fair amount of time. When compared to alternatives like surveys and one-on-one interviews, data collection and analysis is comparatively inexpensive (Ndhlovu, 2016; Neuman,2000). This method of gathering information was also chosen by the researcher because it allows access to data and insights that would otherwise be unavailable without the group interaction present in a group environment (Nyathi, 2013). However, it is vital to keep in mind that focus groups are unable to generalize their findings to the wider population because of the small

number of participants (Posel, 2012). Seven focus group discussions were held in Jotsholo, Lupane region, as part of this research.

Gathering data from various sources, such as surveys and interviews, necessitated the use of the focus group discussions. Approximately 8 to 12 women and men participated in each focus group session. Questions were used to guide with participants selected for their gender and socioeconomic status by the researcher and the research assistants. The focus groups were held at community centers that were easily accessible to the participants in the study locations. The participants gave their permission to have their conversations recorded. In the focus group discussions, participants were asked to share their thoughts about the impact of climate change, the determinants, limits and the influence of livelihood diversification on household's well-being.

3.9.2 In-depth Interviews

The researcher decided to conduct in-depth interviews because of their unique advantages. Ondieki (2018) notes that the interviewer has the ability to clarify questions that appear to be ambiguous or misinterpreted by participants. Eight primary players, including the District Development Coordinator, NGOs and Agritex staff, were interviewed in detail. Eight main participants were involved. Project goals included verifying data collected from rural households and obtaining objective, usable information on climate change and adaptation from professionals with more experience working in the Lupane district's rural households. Interviews are a way of acquiring data by having conversations with people (Pelling, 2012). The approach to interviews allowed the researcher to collect and analyze evidence over time. In the interviews that were conducted the Agricultural Extension Officers were authorized to make their own recommendations on climate change adaptation strategies in the district. The detailed form of interview provides many rewards, since it generates a great deal of expertise. In addition to asking questions, the interviewer also observed the behavior of people being researched. According to Ritchie and Louis (2000), in-depth interviews help researchers to gain additional information about the subject of study by probing interviewees. Interviews was place at venues where participants believed their privacy was completely safeguarded. Participants were asked to use pseudonyms rather than their real addresses in the study. Attempt were taken to ensure the privacy of the participants.

3.9.3 Secondary Sources

Data was also gathered through the use of secondary sources which included documents and registers from agricultural extension service workers. In the COVID -19 period they were of immense help. Useful information was supplied by secondary information on methods of climate adaptation in the Lupane district. Compiling a review of research findings published on a specific issue can reveal inconsistencies and gaps that may call for additional investigation (Welman et al., 2005). For researchers, a review like this enables them to show how their proposed research relates to their subject matter (Mucheri, 2016). Various sources of knowledge and documentation on climate change and climate adaptation were used in this study. The researchers also considered government reports on the study that was conducted. Reviewing secondary sources helped the researcher gain a better understanding of key climate change topics, which helped him develop his research strategy and identify research gaps. The internet provided a wealth of secondary data, particularly from the websites of various international development organizations.

3.9.4 Observations

As a supplement to other instruments, the researcher utilized an observation approach to gain additional data. It served as a backdrop for the creation of sample protocols and interviewing protocols (Mukodzongi, 2013). For Denzin and Lincolyn (2008), the observation method is a useful and relevant way for collecting data. The instrument allows researchers to observe the behavior of respondents in their natural environment. A few of history's greatest significant scientific breakthroughs have stemmed from simple observations (Mushango, 2017). The researcher employed the observation strategy to complement in-depth interviews and focus groups discussions that were conducted. Using the tool is effective in cases where people are unable to reply to interviews or surveys, and if the responses of prospective proxies are not likely to be sufficiently reliable (Mjaya, 2014). In order to better comprehend the context of the data, the observation list included a brief explanation of the setting in which the respondents operate and provided information about how interviews and focus groups were conducted.

3.10 Translation

To ensure that participants who had issues with the English language are thoroughly involved without language gaps, the data collection instruments were converted to IsiNdebele. This included the translation of the interview guide and the Focus Group Discussion guide. A lecturer from

United College of Education translated documents to IsiNdebele. During the pilot process the investigators performed the pre-test of the data collection which meant that the required changes were made before data collection began.

3.11 Data in Analysis

The study questions necessitated the integration of data from interviews, focus groups, group discussions, observation, and documents. What's known as data braiding is the process of combining data from several sources into a cohesive whole. By combining data from many sources, Vatne and Fagermoen (2008) say that their braiding process results in a single, cohesive piece of information that can be studied and comprehended. Data from diverse methodologies should be kept, according to Cronin et al., (2008), so that each dataset or method's findings can equally help answer the study objectives. Some type of planned and deliberate juxtaposition is used to connect the methods (Cronin et al., 2008). Households' livelihood methods, coping mechanisms, adaptation techniques, and their vulnerability to climate adaptation were the most important findings from this study. These features were dissected by grouping them together according to reoccurring themes. In order to conduct a comprehensive analysis, it was necessary to retain the original data, which consisted of the individual records from various sources. It became easy to do a variety of studies once all the data had been arranged as depicted, including a holistic analysis of each level of abstraction, a targeted study of each element in each level, and an analysis of all villages together (Vatne & Fagemoen, 2008). Analyzing the data on an individual level was done first, followed by a comprehensive examination, and finally, a compilation of findings.

3.12 Credibility and Trustworthiness

To ensure thorough research, the principle of trustworthiness was developed. The researcher focused at accumulated knowledge to view if could help explain, classify, and interpret the end goal. The study achieved trustworthiness by combining the qualities of integrity, transferability, reliability, conformity, and honesty (Marshall & Ross, 2006, Trochim, 2006).

3.12.1 Credibility

According to Yin (2003), the term 'credibility' refers to the perfect proof and depiction of the study topic. As a result, qualitative analysis' impact on research is undeniable from the researchers' point

of view (Mika, 2020). The study earned rigor for its unique data collection methods, which included focus groups, interviews, observations and secondary data. The method of triangulation was developed to obtain data by combining several different procedures. Using a variety of data collection methods to mix the replies collected, the goal was to adjust for any human inadequacies that may have existed (Churi, 2015).

3.12.2 Transferability

The ability to summarize or explain results under a variety of different contexts is referred to as transferability of qualitative analysis (Mazuri, 2018). Achieving transferability was accomplished through the responses of research subjects using a context for delineating study boundaries and participants together with data collection methods and findings.

3.12.3 Dependability

As Trochim (2006) indicates,' dependability' refers to the ability of a research sample to represent the continuously shifting world in which the analysis takes place. The main challenge was "the way research was directed which means it should be cross-reliable to researchers and research systems over time" (Gasson, 2004:94). In order to achieve reliability, the researchers used focus group conversations, interviews and review of records thus in the process triangulation was achieved.

3.12.4 Conformability

Conformity suggests that knowledge and perception are not fantasies of the researcher's imaginative powers" (Mertens, 2005), and addresses the question that "discoveries should be addressed as much as practicable (human) imaginable (Gasson, 2004). The qualitative evidence from the participants' comments can be tracked back to their initial source in order to validate conformability, the researcher conducted interviews with key informants in this analysis and also conducted focus group discussions. The gathered data was documented in verbatim format.

3.12.5 Authenticity

Authenticity provides effective methods that genuinely report the viewpoints of the researchers in order for an analysis to be authentic (Daymon &Holloway, 2010). For Mahlo (2011:99), authenticity "alludes to the genuine portrayals of individuals, occasions and places." The methods of data collection used as part of the study were chosen in such a way that data from participants in the research was gathered. Bearing in mind the overall aim of gaining legitimacy, the researcher

demonstrated the responses of participants to interviews and focus group conversations verbatim. The data collection methods used created an atmosphere in which the participants were free to air their opinions and assumptions uninhibitedly with regard to the problems under consideration. The data collection approaches used were focused on the sense in which the participants could openly share their viewpoints and beliefs regarding the topics that will be discussed.

3.13 Validity and Reliability

In order to establish the study's validity and reliability, the researcher and participants worked together to gather data from various sources. The sources were all used to ensure the data's validity and reliability. The data collection process involved households, government officials from various departments, and NGO officials. Interviewing a wide range of stakeholders made it easier to verify data collected. Challenges that could arise during interviews and focus group discussions were confirmed through observation and document review. During the analysis phase, the collected data was sorted and categorized according to the research questions. Data was analysed and interpreted in accordance with the theories and research questions. The researcher worked to verify any contradictory information in order to obtain the truth on data collected. In order for a study to be credible, it was imperative that the setting, participants, and themes were described in great detail (Creswell & Miller, 2000).

3.14 Ethical Considerations

Some ethical considerations were considered while conducting this research. As the researcher drew data from the Lupane District's households, the participants needed to be protected from harm. Science, society, the subjects of science, and the environment all have a responsibility to consider ethical issues when conducting research (Mika, 2020). The following ethical considerations were considered while conducting this research;

3.14.1 Informed Consent

Participants were given as much information as possible about this study so that they could give their consent based on complete knowledge. This made the respondents feel more comfortable and allowed them to decide whether or not to participate in the study. All participants were interviewed in their native language, IsiNdebele, to ensure that no one had any misinterpretations or misconceptions about the study's purpose. The research participants were not required to sign

consent forms but were instead given a thorough explanation of the study in person. In this study, no one was tricked into participating in order to obtain data, and nothing was withheld to entice them to do so.

3.14.2 Confidentiality

During data processing, secrecy had to be preserved. Therefore, the data collected was kept safe and the identities of the participants remained secret. The anonymity of the study subjects was emphasized by ensuring that their identities are not used in any of the data collection methods. This was done to ensure there was no direct connection between data collected and research participants.

3.14.3 Anonymity

It was important to preserve the anonymity of individuals and/or organizations in the study, and the researcher avoided dominating participants at all costs. Pseudonyms were used in the study to protect all of the research subjects, and the respondents were informed that their names would not be used in any document when they gave permission to collect data. All participants were assured that the information they provided would be kept strictly confidential and would not be used for any other purpose than academic research.

3.14.4 Beneficence

The researcher allowed the participants of the research to benefit from the gathered findings. The invasion of the issue of privacy was important because the use of data collection tools that actually invade the privacy of respondents can result in either suspicious data or the withdrawal of study participants. This was done by ensuring that the study was clarified by the Lupane District Development Coordinator.

3.14.5 Management of Information

Participants' names were not included in the transcribed notes. While taking part in the focus groups and interviews, participants used pseudo names. To protect the privacy of the test subjects, several steps were taken. Each piece of information gleaned from the study was locked away, out of reach for everyone but the researcher.

3.14.6 Debriefing of Participants

The investigator briefed the participants on how and why they were participating in the research. This was critical in communicating the study's intent to the participants and enhancing their perception of climate change adaptation in Jotsholo, Lupane district. The study's title and findings were highlighted in a debriefing form, according to the researcher.

3.15 COVID – 19 Protocols

In order to collect data, researcher took extra precautions to keep virus from disrupting work, and protecting himself and the study participants. COVID 19 protocols were considered in data collection. The researcher read the permission form to participants, informing them that participation was voluntary, and they had the right to withdraw at any time. Participants were given the right to withdraw anytime from the study. Besides emphasizing anonymity, they were allowed say that whatever information they transmit is kept private and only used for the research (Van Koppen,2015). No monetary rewards were availed. The research participants were sanitized, and physical distancing was conducted. The chairs utilized in carrying out interviews and focus group discussions were sanitized and the researcher made sure that masks were worn to protect himself, research assistant and the study participants.

3.16 Limitations

Gumede (2017) described the limitations of a study as those characteristics of design or methodology that impacted or influenced the interpretation of the findings from one's research. According to Simon and Goes (2013), limitations are matters and occurrences that arise in a study, which are out of the researcher's control. They further stated that limitations affect the extent to which a study can go, and sometimes the end result and conclusions that can be drawn. Limitations are the shortcomings, conditions, or influences that cannot be controlled by the researcher; that place restrictions on methodology and conclusions (Informed Services, 2017). The research focused on a case study on households in Lupane District thus the findings might not be applicable to the whole of Matabeleland North or Zimbabwe. However, much effort was taken to ensure that issues that are presented in Lupane district be tackled in the study area and find commonalities with the other studies that were undertaken in Zimbabwe.

Resurrección (2013) argued that households are connected to their environment hence adapt well in times of natural disasters. Given that climate change has been occurring frequently in Lupane District, some households did not perceive themselves as vulnerable. The researcher set a criterion of the selected research participants independently. Hence, the data might be different in areas where there is no NGO presence and no assistance programmes for vulnerable households. Accessing government officials was a challenge which the researcher tackled by making use of non-governmental contact people. It was not possible to interview all the government officials hence the researcher had to leave the interview schedules for the respondents to be interviewed in their own free time by the research assistant. The positive thing is that the guidelines were very comprehensive hence this did not restrict the data collected although the narrations were not as detailed as the recordings. Follow ups were made to clarify some issues.

3.17 Chapter Summary

A lot of attention was paid to the research methodology in this chapter. An explanation was given of the study's location and the methods it employed. The study relied on interviews, focus group discussions, observation, and document analysis in order to gather information. The tools provided common themes, and the data gathered was unified in the analysis. An investigation into the study's validity and reliability was conducted. Ethics and the way the community deals with them were also discussed. The researcher's duties and restrictions were clearly defined. The research methodology employed in this study was explained in detail. Each step of the study's research process was broken down into its own section. It was also noted how the study paradigm and research method highlight both strength and vulnerabilities. The research design was anchored in a case study. Its strengths and shortcomings were demonstrated and the subsequent factors for adoption. The population and sampling protocols that were implemented in this study were also addressed in this Chapter. The sampling methods were well specified and their preference for the analysis were clarified by the sampling techniques. Interviews, focus groups, and document analysis were among the data collection methods considered. Throughout the chapter, the legitimacy and trustworthiness of the study as well as ethical concerns were examined.

Chapter Four

Results and Discussions

4.0 Introduction

The chapter highlighted the results of the study based on the topic, "Climate Change Adaptation for Sustenance of Rural Livelihoods in Jotsholo, Lupane district, Zimbabwe". The data was gathered using in-depth interviews, focus group discussions and secondary sources focusing on the following research objectives;

- To examine the socio-economic and environmental impact of climate change on rural households in Jotsholo, Lupane district
- To determine the climate change coping strategies that are being used by households in Jotsholo, Lupane district
- To analyze the social dynamics of how households, communicate and share experiences of climate change adaptation in Jotsholo, Lupane district
- To establish the barriers to climate adaptation being faced by households in Jotsholo, Lupane district

4.1 Biographical Data of Participants

When it came to understand how climate change impacts rural livelihoods in Jotsholo, Lupane, Zimbabwe, the researcher needed biographic information to identify with the participants' understanding. For example, determining the average age of the participants was critical in determining the dynamics of the groups that were involved in the study, as well as which age groups were most vulnerable to the effects of climate change.

4.1.1 Age of Study Participants

Table 4.1 reflects the age of the study participants.

Table 4.1 - Age of Study Participants

Age (Years)	Frequency	Percentage
26-35	4	4
36-45	15	16
46-55	20	22
56-65	33	36
66+	20	22
Total	**92**	**100**

n- 92

The age distribution of the study participants is shown in Table 4.1. The majority of study participants (36% (33) were between the ages of 56 and 65. This was followed by 22% (20) which had participants in the 46-55 years and another which had 66+ years age group. The least percentage was in the category of 26-35 years which had 4% (4) each. Therefore, most of the study participants were from mature rural households who were above the ages of forty-six years of age. All of the rural households that took part in the study in Jotsholo, Lupane district were actively involved in the household economy.

4.1.2 Sex of the Study Participants

Figure 4.1 reflects the sex of the study participants.

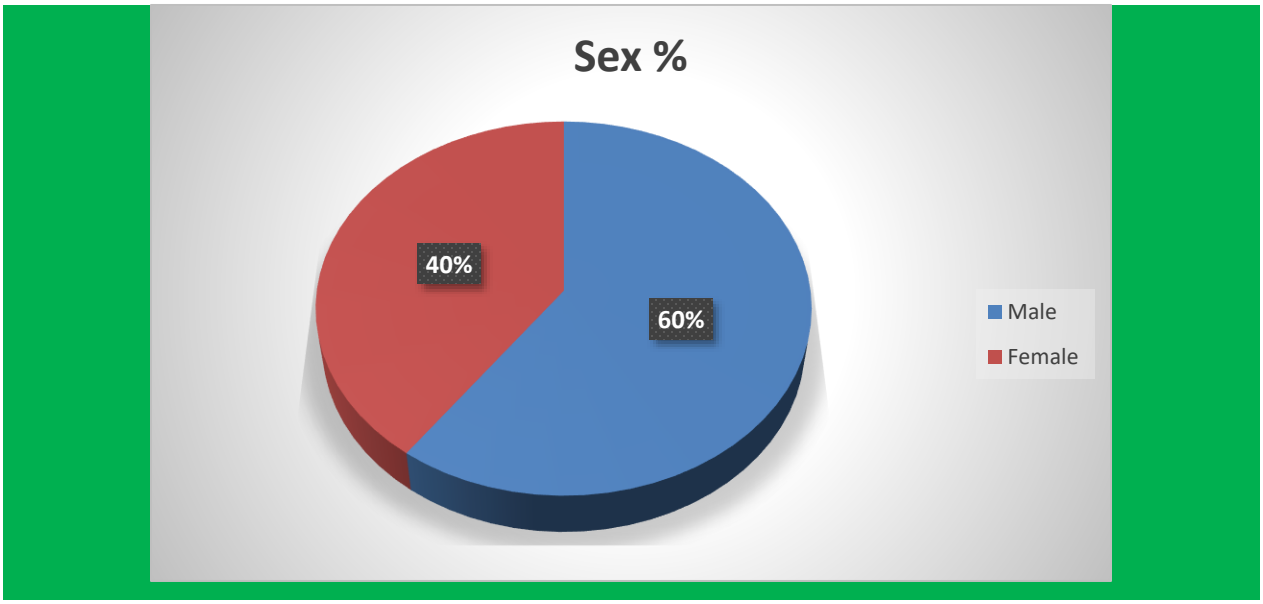


Figure 4.1 – The distribution of the Participants by Gender

In accordance with the findings shown in Figure 4.1, 62% of the study's participants were female, while 40% were male. While this may be the case, Mutopo (2016) believes that women play an important role in agriculture in as much as they also play an important role in climate change adaptation.

4.1.3 Academic Professional Qualifications

Table 4.2 highlights the academic and professional qualifications of the participants that took part in the study.

Table 4.2 - Academic and Professional Qualifications of Participants

Qualifications	Frequency	Percentage %
No education	30	33
Primary Education	39	42
ZJC Level	10	12
Ordinary level	5	5
Certificate level	-	-
Diploma level	2	2
Degree	4	4
Masters	2	2
Total	**92**	**100**

n- 92

Table 4.2 reflects the educational qualifications of the participants at the study area. The majority of the respondents 42% (39) had primary education. This was followed by 30% (33) who had no education attained. The study notes that 12% (10) participants had ZJC education. Interesting to note was that in all focus group discussions their education ranged from no education to certificate level. For the key informants' interviews; the qualifications ranged from diploma level to master's level. At degree level there were four participants and at diploma and master's level there were two apiece that took part in the study. Interestingly it was observed by the researcher that education in a way shaped the nature of adaptation as well as the impact that is faced by the participants in Jotsholo, Lupane district.

4.2 Households Understanding of Climate Change in Jotsholo, Lupane District

According to Ban and Hawkins (2000), a person's mental and psychological awareness is formed through a process in which they receive information or stimuli from the environment. Families may derive or interpret a scenario (such as a facet of climate change) in different ways, despite the fact that seemingly same data is presented to them (Ban and Hawkins, 2000). In part, this is due to the fact that people's prior experiences and current circumstances have an impact on their perceptions of the world around them. Furthermore, it is necessary to focus on the elements that lead Lupane households to notice local climatic patterns changing. Climate change perceptions and concerns can be divided into three major categories, namely rainfall, temperature, and extreme weather occurrences. Within each of the three basic categories, concerns about vegetation cover, land sustainability, and water sources are addressed A primary goal of this research is to explore the various ways in which Lupane comprehend and respond to climate change. Concerns like these, if any exist, could serve as the basis for local livelihood-based adaptation efforts.

They are undoubtedly noticing climate shifts over an extended period of time in their Lupane homes (literally, decades). There are many people who have lived in Lupane for decades, including those who were born and raised there. The researcher relied heavily on their life histories. Such individuals are well-versed in the alterations that have occurred. He needed to see what had been happening over a long period of time, including fluctuations in temperature and precipitation. The recollections of elderly persons (who ranged in age from 70 to 93) were critical in this regard, as were their life histories. In-depth interviews with key informants and focus group discussions provided further evidence to help flesh out the households' concerns about climate change in greater depth.

Households’ lived experiences and everyday perceptions (past and present) enabled them to discern that climate-related phenomena were undergoing important changes as manifested in their livelihood options, even though many households had difficulty describing and conceptualizing what climate change was. Because of this, Lupane district households were shown to be able to grasp the concept of climate change, as opposed to how it is best conceptualized or argued for and against. Chikodzi et al. (2012), Moyo et al. (2012), and Chaguta (2010) all note that rural households have an experiential understanding of climate change rooted in their locality, and not necessarily a 'higher-level intellectual understanding abstracted from local experiences and with

cross-spatial reference. As illustrated by a household participant who completed her secondary education, the lucidity of local climate change thinking should not be overlooked. Weather patterns and temperatures are changing as a result of climate change. Crop yields, particularly for maize and tomatoes, have been adversely affected in Lupane district. False alarms caused by climate change are now affecting households. Households are planting at the incorrect time because of early rains that lead them to believe that the rains have arrived, only to find out later that they won't come back. When one plants and it continues to rain, the seeds rot before they can germinate, which is the exact reverse of what happens most of the time.

It's also worth noting that in Lupane district, residents believed that rainfall patterns were more significant to agricultural productivity than temperature fluctuations when it came to climate change. According to one participant;

> "If it becomes hot, it doesn't matter since it will definitely rain." Rain is just what we need."

The households were better able to detect and speak about climate patterns and tendencies in time because of their extensive livelihood experience in Lupane district (i.e., 50-69, 70-79, 80-89, and 89-99), as evidenced by their age. The researcher also wanted to know how Lupane households came to their opinions regarding climate change, beyond their daily living experiences. Numerous residents, young and old, stated that they had heard about the effects of climate change on television or radio from organizations like AGRITEX, World Vision, Care, and the Zimbabwean Meteorological Services. These evidence sources were "filtered" by and via their individual experiences and no doubt in some way and to some extent became part of their collective understanding of climate change in Lupane. Aside from eyewitness accounts, some locals claimed that their own bodies can foresee the weather. For example, they could determine what season it was by the way their bodies felt: this was a literal awareness of weather patterns that was embodied. It was cold, thus some people felt discomfort in their bodies, such as (leg ache). As one of the participants put it, "When my body aches, I know that it will be cold." To get an idea of what to expect from future farming seasons, several families looked to nature for guidance. Villagers were quick to notice the profusion of wild fruits as a sign of drought, for example. Villagers, on the whole, rely on local knowledge to understand the effects of climate change.

4.2.1 Households Understanding of Rainfall Patterns in Jotsholo, Lupane District

Lupane district relies heavily on agriculture as a primary source of income, with the majority of people employing "traditional" farming methods that rely on seasonal rainfall. However, as already suggested, crop and livestock output have been significantly influenced by climate change. In order to gain a better understanding of household perceptions of rainfall patterns, the study relied on the experiences of the households in the FGDs that were conducted. When confronted with a rapidly changing reality, households engage in internal discussions and reflexive monitoring, resulting in the identification of problems and worries and maybe practical undertakings. Observations of rainfall in Lupane district, acquired at a specific point in time through research, reveal the continual outworking of internal discourses, no matter how ambiguous they may look at times.

Significant numbers of households feared that the changing rainfall patterns will ruin their farming season. The rainy season used to start in the middle of October, but that is no longer the case. In the past, nature would tell them that it was about to be planting time. According to one of the participants,

> “A sign that it's going to start pouring soon would be migratory birds. We haven't seen them in a while. When was the last time you saw them?"

Environmental Software and Services (2002) claims that rainfall patterns influence the migration patterns of wild species, including birds and mammals. Migrations are disturbed and wildlife populations are reduced in the event of drought. The lack of migratory birds in the Lupane district is a sign of the area's frequent droughts. Additionally, a FGD participant reported of other rain indicators that no longer appear; "The Mountain would exhibit a burning flame at its peak announcing that the rains are approaching; the rains would then put out the Flame. However, it only happens once in a while, and most of us don't see the "flame" at all. The study noted that households were worried about the advent of the rainy season, which had grown so unpredictable in recent years. In an in-depth interview, one respondent expressed her concern about the changing rainfall patterns and how they were harming the primary livelihood strategy of crop production;

> "Last year was one of the most challenging for me because of the bad rains," she said. There was a lot of rain in December, but it wasn't until the 27th to the 2nd of January that it started to pour like a water tap had been opened. This had the benefit of filling rivers and wells, but it was detrimental to our crops because the rains didn't return until early March

> after this. But the clouds dissipate and the searing sun returns with a vengeance. Just two houses away, a neighbor of mine had superior yields because she planted early and had manure on hand. The lack of harvests was due to my reluctance to plant during the initial rains because I didn't know when the rain would return”

The early arrival of rain and the early cessation of rain have confused households so much that they no longer know when the planting season begins, distorting their agricultural calendar which under normal conditions should begin in mid-October. As a result, uncertainty has become the new normal, as crop production have been severely impacted. According to the FGDs, "rainfall comes late and ends early," as stated by the majority of participants. Mutekwa et al. (2006) conducted a study in which they found that households become disoriented owing to the fluctuating patterns of rainfall. According to the researcher, the unpredictable nature of precipitation was the most difficult aspect of climate change to deal with for the households. Another study by Simba et al. (2012), which looked at Masvingo households' views of climate change, showed that the seasons are changing, with rains beginning later and ceasing earlier than normal. According to the Lupane study, rainfall in the 1990s began in October and was evenly distributed until February, when it ended, with harvesting time then beginning in April. A participant noted that;

> “This isn't the case any longer. It takes around six months for a maize crop to be harvested after planting; however, as maize is currently commonly planted in January, this means that the harvesting time would be June, a usually cold month.”

Due to its lack of winter hardiness, maize is not able to thrive in the winter months. Poor quality and yields are the result of this situation. "Farming is now like playing poker," one of the participants noted. Farming has become a zero-sum game for many households in Lupane district. When it comes to sports, winning and losing are both possible. It's not about being a successful household like in earlier decades, but more about luck in predicting the timing of a certain year's rains. For example, in 2014/15, there was unpredictable rainfall; in 2015/16, there was the ElNino-induced drought, which led to erratic rainfall. Floods in 2016/17, on the other hand, resulted in strong harvests for those who planted early, while those who planted late (as they did in previous years of drought) lost out since their fields and crops were inundated as a result. In an in-depth discussion with an AGRITEX officer, he noted that farmers planted their fields in December

2014/15 season and in January 2015/16 season. At that time, the Meteorological Services advised certain households that there was a risk of flooding, so they were urged to plant their crops early. People did not plant as early as recommended by the Meteorological Services, which meant that when the floods came, their crops would be harmed. When it comes to maize cultivation, AGRITEX's officer noted that the distribution of rain is a concern because it isn't evenly spread as required by maize production. Precipitation has become more erratic (affecting farmers' crop yields) in terms of timing, but the officer also observes a reduction in total rainfall volume. For example, the area should receive 500-600ml of rain during a "normal" season, but only 281ml has fallen in the past month, which has also been unevenly distributed, according to the narrator. The residents of Lupane district are still wary of following the recommendations of the Meteorological Services since they have previously gotten incorrect information from the official meteorological offices.

4.2.2 Households' Perceptions and Concerns on Temperature Patterns in Lupane District

Temperatures in Zimbabwe have been rising at a rate of about 0.1 °C every decade, according to a study conducted by the Government of Zimbabwe (GoZ). Increasing temperatures of roughly 2.50 degrees Celsius are expected by 2050 (UNICEF, 2014). Compared to prior decades, Lupane residents expressed concern about the rise in temperatures. While the majority of households reported that temperatures had risen, a small number of those who participated in the study reported no change in temperatures. There was no local record of temperature variations that the households themselves could use to back up their statements. However, their impressions and fears were real, and they in large part concurred with findings from other research and records from meteorological centers that demonstrate temperature rises in locations like Lupane district (Baseline Report of Zimbabwe, 2012). One participant was of the view that;

> "It was not that hot in the 1990s"

Because of rising temperatures, soil moisture levels are directly impacted. As a result, the intensity and timing of rainfall and the occurrences of extreme weather events are affected by increasing rates of evapotranspiration. Lupane's crop yields have also been impacted by this. Increasing temperatures have a negative impact on local water resources in the Lupane district, resulting in dwindling supplies of water for both human use and cattle. The soaring temperatures have dried up most of the rivers, posing a serious threat to cattle. In order to get a better understanding of

household concerns concerning water supplies, the researchers conducted this study, in which they polled households to view if they had any. There was a noticeable decline in water availability, with only a few participants reporting an increase and others reporting no change in their water supply. It is obvious from the data that a considerable number of households had the same belief that water outputs from water sources had dropped due to high temperatures. With the high rate of wetlands depletion, residents are alarmed. Water for animals and gardening can be found in wetlands in the Lupane district of the province of Cameroon. One female participant opined that;

> "Long ago, we had multiple wetlands, but those are now extinct. Wetlands that were critical to our survival have been obliterated by these severe temperatures."

As a result, many of these gardens have been abandoned. In general, these figures show that the temperature in Lupane has risen over the past decade, with the most drastic changes occurring since 2000. Overall precipitation levels appear to be declining, indicating that the region will gradually transition to drier conditions. According to Gukurume (2013)'s research in Bikita, consecutive heat waves and low rainfall have made it difficult for sown seeds to germinate, which in turn has led to the wilting of grown crops. Temperature increases have also had an effect on the amount of flora on the planet. A substantial number of households in the Lupane district reported an increase in vegetation degradation and a decline in vegetation stability, according to the data gathered. In Lupane district, the soils has become sandier as a result of reduced plant cover contributing to land degradation and depleting soil fertility. Land previously used for crop cultivation is now better suited for grazing, as was noted by many of the participants. Households have had to downsize their operations due to gully development, and the loss of wetlands has harmed nearby cattle and plants. As a result of decreasing plant cover and soil erosion, grazing land has been diminished as well. Land degradation is increasing as a result of increased competition for limited grassland resources. Lupane district has a different grass or vegetation cover than it did in the past. According to one participant;

> "the grass we used to have is very different from the weeds that are currently flourishing in our fields."

Environmental Software and Services (2002) points out that a few years of low rainfall in dry locations can permanently kill flora, and that bad land management techniques exacerbate the situation. Droughts in the Lupane district are so frequent that there is no time for vegetation to recover. The availability of high-quality pasture for animals has been severely restricted, making it difficult for them to recover. More bushfires have been sparked as a result of the rising temperatures. Burning bushland due to extreme heat has resulted in mass extinctions, forced animal migration, and reduced plant and animal biodiversity across the region (Vorsah, 2015). Households have also expressed concern over recent cold and dry spells and the resulting consequences. Lupane's rainy season crop productivity depends on the frequency and length of dry spells, and these have increased in both frequency and length over the last few decades. June, which used to be cold and the beginning of the winter season, is no longer cold. Cold snaps can occur at any time of year, even in the middle of summer. Historically, October has been a warm month for Lupane households, but in recent years, it has become even hotter. "Things have certainly changed," said one participant in a FGD.

4.2.3 Extreme Weather Events Being Experienced in Jotsholo, Lupane District

This has become an everyday occurrence, with drought and floods becoming the norm. Extreme weather occurrences, such as tropical cyclones and drought, are becoming more common (Mutasa, 2008). Droughts in Zimbabwe that occurred with El Nino episodes (for example, 1982-83 and 1991-1992) reduced total rainfall to as little as 30 percent of the yearly average (Orlove and Tosteson,1999). La Nina-related flooding and heavy rains are also common occurrences in Zimbabwe. Several Southern African countries were affected by the 2007 floods, which resulted in major flooding in portions of Zimbabwe and neighboring countries. Lupane households are more prone to droughts than floods. Droughts have been more frequent and more severe in the area. Households ranked the 1992 drought as the most severe when questioned about the worst droughts they had ever experienced. There was a complete lack of food and water throughout this drought. In addition, it was the scene of numerous animal fatalities (including both cattle and goats), which left many sad memories. According to a female peasant, 1992 was the worst year of her life. All the seasonal shifts that we are currently experiencing began with this.

As a result of the 1992 drought in Lupane region, NGOs such as Care and World Vision were sent in to help those in need. There were also references to the droughts of 2002 and 2008. Despite the fact that the 2008 drought was less severe, the Zimbabwean economic crisis made it worse. Besides the length, intensity, and geographic breadth of a particular drought episode, the severity is also influenced by the demands made by human activities and vegetation on an area's water resources. Dry spells may be seen as purely physical, but they can have significant social consequences as well. No matter where you live, there's always a risk of drought because of how exposed you are to it and how vulnerable you are as a society are to it (Wisner et al., 2003). A flood warning has been issued for parts of the Lupane district because of excessive rainfall, according to local residents. Most of them remembered the 2000/2001 Cyclone Eline as the most recent flood they could remember. They were aware that floods have escalated during the past decade.

Cyclone Eline's floodwaters have left a lasting impression on the minds of many Zimbabweans. There were widespread effects across most of Zimbabwe, but it particularly wreaked havoc on Lupane district in the north. The crops were completely destroyed by water logging. Again, in 2002/2003, Cyclone Japhet wreaked havoc, killing cattle, and reducing crop output in the area. Cyclone Ernest, which occurred in 2004/2005, was another cyclone. Also, in 2017, Cyclone Dineo reduced agriculture production. As a result of torrential rains, 132 of the households' crops were destroyed. Groundnuts and Bambara nuts are particularly vulnerable to flooding, with farmers in the Lupane district of Madagascar reporting reduced yields during floods. Groundnut distribution has decreased dramatically since the 1990s, when one participant reported receiving 8 bags of groundnuts. In the 2016/17 season, she received only 4 buckets (1bag and 1bucket).

Due to a lack of pasture and depleting water supplies, households in Lupane district have had to sell their animals during droughts since the condition of their livestock does not allow for reliable market values. If these distress sales are not carried out, cattle deaths may be imminent. Zimbabwe's 1991/92 drought claimed the lives of more than a million livestock (Environmental Software and Services, 2002). Lack of pasture and its poor quality can have severe impacts on

livestock health and death, according to a study by Gukurume (2013) in Bikita. Furthermore, Giridhar et al. (2015) found that droughts have a direct and indirect impact on livestock productivity by generating heat stress directly and indirectly by reducing the availability of feed crops and forages. The mortality and morbidity rates of livestock are directly affected by cyclones, floods, and drought as well as other extreme weather events, according to Nardone and colleagues (2010). In addition to the droughts, Lupane district were also concerned about the floods that have happened over the past few years, with the most recent one mostly prompted by Cyclone Dineo in 2016 and 2017. The fact that goats are particularly vulnerable to the effects of flooding was brought up often by commenters. Floods are the most common cause of goat deaths in the area, according to a number of responders. A participant noted that;

> "I had 16 goats in 2013/14, but most of them died in the floods in 2016/17. As a result, my herd has shrunk from 16 goats to only 2"

This respondent was in a sombre mood when she mentioned this, and it showed me how severe the floods in the area can be and how they impair cattle output, which is an important source of income for the residents. Due to the increasing frequency of extreme weather events, the majority of the villagers expressed their concern about pests and diseases. A participant pointed out that most locals in the 1950s and 1960s didn't dip their cattle since it wasn't necessary. This was largely due to the high quality and abundance of grass. Today's cattle are vulnerable to diseases like anthrax, ulcers, and foot and mouth, to name just a few. Disease outbreaks in Lupane's cattle have been blamed on droughts and floods and have also contributed to the deaths of livestock, according to the households. In the 1960s, one participant noted that, it used to rain a lot more here than it does now. As a result, there was no risk of a disease epidemic in the cow herd. Dryness and flooding are now recurring occurrences due to global warming. A drought or a flood occurs every year. It's only one year where there's no drought or flood. So, what are the chances of our livestock surviving? What can we do to eradicate these dreadful diseases? As a result, we are now instructed to dip our livestock multiple times, yet the infections can be tenacious at times.

Rain-fed agriculture is the primary source of rural livelihoods in Zimbabwe, particularly in communal areas, as various experts have shown (Unganai 2009; Mano and Nhemachena 2006;

Mubvuma 2013; Chikodzi et al. 2012). This chapter clearly demonstrates the manner in which local households are aware of the changes and how they have affected local agriculture in terms of both crops and cattle in the Lupane district. Changes in precipitation and temperature patterns and extreme weather occurrences were used to demonstrate this. Some occurrences (such as the 1992 drought) have become continuous discussion topics and points of reference for events in people's personal histories in Lupane as a result of the changes along these three dimensions. When it comes to the vulnerability of communal farmers like those in Lupane district, climate change is a factor in and of itself Due to Lupane households' high reliance on rainfall, they are particularly vulnerable to the effects of climate change.

Because of this, it is essential to understand the lives and livelihoods of Lupane households by examining the SL framework. Water-related hazards such as floods or drought can have a significant impact on the vulnerability of a certain population. This includes both the size of the exposure and the frequency of the exposure. An examination of Lupane households' knowledge of the area's ecological past has revealed that they are acutely aware of their vulnerabilities. Household responses also reveal the real-life consequences that come with climate change, such as uncertainty about when to grow crops, decreased production from the crops, livestock losses, and, ultimately, increased levels of food insecurity. It's worth noting that these findings are comparable to those found in the Matobo District by Dube et al (2013). The presence or absence of mitigating factors, such as technical interventions, policy platforms, and local resources, affects vulnerability, or at least the effects of vulnerability. As a result, rural livelihoods will be adversely affected by climate change if these issues are not taken into consideration. Consideration should be given to the methods in which households have attempted to deal with the impacts of global warming, frequently by building their own local capacity and resources, and repositioning themselves to at least weather the storm.

4.3 Overview of Adoptive and Coping Strategies in Jotsholo, Lupane District

Lupane district's climate change challenge has prompted households to question their own ability to adapt to and cope with this shift. Households' daily actions and practices that focus on self-

reflection are referred to as "agency" in this broad sense of the term. When climate change-related difficulties and hazards (such as drought) are viewed and recognized as significant, as Chenje and Solar (1998) point out, they will compel and condition a mitigating response in order to minimize the negative effects of this change. Lupane households' adapting and coping techniques are key to this thesis's examination, which typically takes place at many spatial levels and through various organizations and processes. Localized reactions, on the other hand, are often linked to larger local and national structures and processes. As a result, it has become difficult to distinguish between adaptive and copying techniques. There is a school of thought that considers adaptive and coping strategies to be interchangeable, reasoning that a coping strategy might evolve into an adaptable strategy depending on how widely it is used by the people in the research study. Coping, as previously said, can be defined as a person's behavior within the constraints of available resources and the range of expectations they face in order to attain a variety of goals (Wisner et al., 2003).

As soon as a household realizes that an occurrence is likely to happen again, they begin to prepare for it. It is assumed that the event will follow an established pattern, and so, household's past behavior can be used as a guide for future behaviors. In order to better cope with an unpredictable future, society and communities must take appropriate action and make adaptations and modifications to mitigate the negative effects of climate change. Adaptation (UNFCC, 2007). Coping is a method for surviving a current shock, whereas adaptation shows a situation where people are attempting to control possible repercussions in advance through a more straightforward means. Adaptation can also be separated into two types, i.e., reactive and proactive, and both are necessary. As a method of dealing with these terminological concerns, the researcher categorized those tactics that households employed as survival measures during a given shock as coping strategies, and those strategies that the families implemented yearly as adaptable. Even though they may appear to be coping mechanisms, many of the Lupane families' tactics have evolved into adaptive ones. The researcher became aware of the widespread adoption of this method after noticing the large number of households who have done so and the length of time they have been doing so. There should be a focus on and reduction of the vulnerabilities that impoverished households suffer now, as these vulnerabilities are only going to get worse as the climate changes (Task Force on Climate Change, Vulnerable Communities and Adaptation, 2003).

4.4 Coping Mechanisms Utilised in Jotsholo, Lupane District

Coping methods are often short-term and reactive to droughts (Vincent et al., 2011). Households in Lupane district relied on vegetable sales and informal work to make ends meet. Additionally, the households that took part in the study changed their diets and relied on food help as a means of coping with the crisis. Masendeke and Shoko (2014) observed that short-term drought relief initiatives such as food handouts, food for labor, and supplemental feeding programs were beneficial in the short term, but did not provide households with the resources necessary to weather climate change taking place in the district (Shiku, 2020). Many factors, including an individual's wealth, income distribution, and ability to keep up with production in good years, influence a household coping mechanism to climate change. So, households' vulnerability to climate change is influenced by their level of vulnerability prior to droughts, and this has an impact on their future ability to respond (Zhang, 2019). It is impossible for families to change for the better in a lasting way using coping skills. Because of the district's history of drought, these are merely temporary fixes that cannot be relied upon year after year. Households are particularly vulnerable to droughts because of their short-term, unsustainable, and resource-damaging coping methods (Gumede, 2017).

4.4.1 Religion as a Coping Strategy

Source – Survey Photo

Figure 4.2 - Photo Showing Praying for Rains in Lupane District

Religion was noted as a preferred coping strategy in the face of climate change in Jotsholo, Lupane district. This ranges from traditional religion in the form of *chipwa* to Christianity as seen in the increasing use and assurance through prophecy in Independent African Churches to cope with the impact of climate change. With traditional religion, households called for the return of *chipwa* (rain) ceremonies despite the last ceremony having been held in the village in 1985. From the FGDs it was gathered no one was prepared to directly take part in *chipwa* (rain making) ceremonies. However, in the face of climatic uncertainty villagers increasingly view it as a preferred option to plead for rains as those who were familiar with it in Jotsholo fondly reminisced on the powers of the late rain-maker.

In discussions with various inhabitants who are individuals from different Independent African Churches either in the town or outside it was recognized that as of late prediction has turned out

to be critical in informing them on the nature concerning the coming agricultural season. The relevance of religion in the study area is rich and the finding is similar to studies carried (De Herrerra, 2015). In the studies they reflected that religion is a guide on people seeking for intervention on people's misdemeanors in society. For those in churches or those who practice Christianity they believe that repentance and praying is the way to seek God's favor so that rains can be realized.

4.4.2 Casual Labour

Grain from the households' casual work place gave immediate coping through informal employment. To find work, the household members had to spend a significant amount of time away from their families. As compensation, they were given a grain bucket (5litres) on a daily basis. In order to meet their fundamental nutritional needs, they couldn't use the grains to manufacture other non-food products. The salaries are so low that they can only feed a large family for one day during a drought when it is difficult to get casual labor. Informal employment is on the decline in Malawi, according to a study by Devereux (2006), but real incomes are either flat or declining. Residents of Lupane district had to travel considerable distances because of climate change, which indicated a lack of employment opportunities in the area. It is uncommon for households to be compensated with food (Holmes & Jones, 2010). As observed by Eriksen (2005), the households own land preparation may be ignored if temporary labor takes up a lot of time.

Stehlik (2003) and Deveurex (2006), in their own words, expressed the views of temporary employees quitting household land farming. Participants noted that harvesting wild foods cannot make up for crops realized from farming that if rains would be there in the district (Eriksen et al., 2008). According to households, a bucket of maize costs from $5 to $9 in Lupane district which is beyond the reach of many people in the district. Although casual labor gave fast grains to the households, it didn't meet all of their dietary needs. It was also noted from the study that the money earned from casual labor was insufficient to meet the household's needs, and this finding was corroborated by Goverah (2017) reiterated that casual labor income was not sufficient. Casual labor on farms was only but a stop gate measure to reduce the likelihood of livestock sales. The households in Lupane District turned to livestock sales and seasonal jobs as they battled to make ends meet in the wake of climate change.

4.4.3 Gardening

Source – Survey Photo

Figure 4.3 – Photo of a Nutritional Garden

Gardening is also used as a coping mechanism by Lupane district households. It appears that the majority of the households in the area use irrigated land or communal boreholes for gardening in some capacity, according to the information gathered. Tomatoes, rape seed, spinach and cabbage are among the vegetables grown in the gardens. Having a good supply of vegetables in the area is essential since they go hand-in-hand with Isitshwala. To save money, individuals avoid buying meat, which is expensive. Isitshwala without veggies is called locally as 'Ukutshaya Isitshwala' for those who don't grow their own food or can't afford to buy it. Boreholes, rivers, dams, and wetlands are all good places to plant gardens because they all have water nearby. There are only a small proportion of participants who had wells on their properties who had gardens there. In order to preserve water, these gardens were mostly used to grow vegetables for a single home, as the water levels were so shallow. There is a growing trend in Lupane area to create community gardens around local boreholes. Households were be able to water their vegetables more easily because they were closer to water sources.

Gardens provide a source of food for families and help them save money by eliminating the need to purchase veggies. Village gardeners, on the other hand, need to water their gardens frequently (nearly three times a week), weed their plants, and apply manure in order to always have fresh veggies. To water the veggies, some older ladies had difficulty carrying buckets to and from the

water source because of the distance to the common boreholes. Women who live in polygamous households benefit from this since more individuals can tend to the garden. Additionally, the researcher was informed that, following the rainy season, the households remove the veggies and dry them to create 'umfushwa', which is a local term for dried vegetables. They may be cooked at any time and last for lengthy durations, saving households money on fresh produce purchases. Dried veggies can be sold if there is an excess in the home. NGOs have also seen the value of household gardens and have become involved in gardening initiatives to help empower the locals. Gardening has been promoted in the Lupane district by Care International and AGRITEX, who helped implement a nutritional garden. The villages gave the name to the project, and it means "you have been left out of the benefits."

Despite having their own gardens, the residents of Lupane district wished for an irrigated garden that would be easier to maintain and provide a return on their investment. To begin the garden's construction, Care teamed up with households and worked with them throughout. While the garden was being built, AGRITEX staff provided extension services and Care supplied building materials. The project's implementation relied heavily on the labor contributed by the households. Poverty alleviation is achieved by the provision of work for the underprivileged. Within a five-kilometer radius of the 'Ungasaleli' garden, those who contributed labor were selected. The 5-kilometer restriction is in place to prevent rural laborers from arriving at 'Ungasaleli' exhausted or having to travel late into the night at the conclusion of a long day. Only the households that were willing and physically capable were selected to work in households that needed food assistance; one person from each of these households were selected to give labor. Residents of food-insecure households were identified through a procedure called community ranking. Villagers were given the duty of identifying the most vulnerable members of their community because they are considered to know their community better than anybody else.

The number of households in a community determined the number of people who were be selected for consideration. After working four hours a day for 20 days, those selected would receive 50 kilograms of cereal (maize). There is a big number of people who wanted to join the garden project, thus an entry fee was necessary to avoid problems that arise when people want to join. The garden has 96 beneficiaries, each of whom received a plot of land from the garden's 1.8 hectares, which they split amongst themselves. Sweet potatoes and maize are sometimes cultivated in the garden

along with more traditional vegetables like rape, cabbage, carrots, and buttercups. In addition to providing food security for the beneficiaries' families, the garden also improved nutrition and generates revenue for them. In addition to villages, vegetables were also sold in marketplaces. Participation in the program was found to be high in all villages where the study was conducted. Households participating in the program were able to increase their food production thanks to the gardens' productivity, which was viewed as an asset.

The researcher notes that households in Jotsholo, Lupane district used to negatively look down on the nutritional gardens and did not see their benefit when they were initiated. In the area of study, developing vegetable gardens was primarily done during the rainy season. As water levels in the nutrition gardens enclosures of households are continuously getting lower and lower during the dry months of August to October (and now to the extent December) households are compelled to adjust by lessening their produce in the on-nutrition gardening. The vegetable markets for the fresh produce are Hwange or Victoria Falls which are a far away distance and resources were needed to carry their produce. Restoration of water sources and availability of natural capital, such as land and water, have rekindled interest in gardening as a means of subsistence.

According to the findings of the study, these externally promoted livelihood strategies produced multiple livelihood outcomes and increased opportunities for the development of livelihood assets. As interventions were carried out, various social actors became involved in negotiations over resource access and control as they sought greater freedom in pursuing their livelihoods (Zhang,2019). Because this strategy concentrated on dry season vegetable production, it served as a complementary food source to that produced during the rainy season. A decrease in this livelihood activity was observed early on in the study period due to a vulnerable context. Its resurgence demonstrates the return of a traditional source of income. As a result, during the re-agrarianizing process, it was widely adopted by households of all income levels (Mhlanga,2015).

Making a little money by selling vegetables was a common means of subsistence. There was fierce competition for customers among the vendors, the majority of whom were female reflecting that climate change impact women more than men. Researchers found that women's organizations in Ethiopia and Mali are making a significant amount of money by cultivating vegetables (Vincent, 2017). Clubs, cooperatives, and farming associations for households in Lupane district could have helped them sell their products to supermarkets and wholesalers more effectively. Due to a lack of

knowledge and skills in identifying markets and negotiating contracts, it is difficult for the populace in Lupane district to market their produce and have a livelihood of the vegetables they grow.

4.4.4 Petty Trade

As Masendeke and Shoko (2014) pointed out, the development of non-farm rural activities can help alleviate poverty in climate affected areas by boosting income and enable households to survive on their own. As a household response to drought, the United Nations Environment Program (UNEP) identified the practice of small-scale petty trade as beneficial if practiced. The study noted that in Lupane district, some households resorted to selling grass for thatching huts as a livelihood though it was noted that it was seasonal. However, though they engaged in home construction and renovation, it did not generate a consistent income. Few households could afford to buy grass because it was so readily available in the forest. Households were struggling to make ends meet because of the country's economic collapse, so payments were irregular thus making those having a livelihood in petty trade have a insecure livelihood. Lack of communication has resulted in limited market information for households, limiting them to short-distance mobility and small-scale trading of low-value goods (Duguma, 2015).

In a study carried out in Kenya and Tanzania, Eriksen et al. (2005) found that historically, households especially women were excluded from more reliable income-earning activities because they were traditionally carried out by men. Even married women in Lupane district opted to work in low-paying jobs because of their status as single and unmarried women. The work of the husbands, such as selling grass or thatching houses, allowed the married women to support their families and provide for their children. Ethiopian women, according to a study by Steglich and Bekele (2009), began petty trading in groups before taking out loans to start their own small businesses. Households in Lupane district noted that they had very little hope of getting a loan because of the area's dire economic conditions and also it would also be difficult for them to pay back. Due to the current economic climate, the households interviewed had decided to stop selling their products. Due to a lack of funds, customers were also unable to pay their debts. It was also noted that a lack of market knowledge and connections led to household’s failure to generate income outside Jotsholo. According to Dhewa (2011) small businesses or skilled work with a local market, such as tailoring, are unreliable in times of drought when people have little money. The

Ministry of Small and Medium Enterprises lacks resources to support small and medium-sized enterprises is climate affected areas like Lupane district, despite the fact that opportunities exist. Hungwe (2017) emphasized the importance of education, information, and exposure for Ethiopian women in achieving economic independence and success. The right information and resources can help a small business succeed.

4.4.5 Selling Livestock

The study found out that some households resorted to selling their livestock because of the climate change in the district. However, the households were unable to get a better price for their livestock during droughts because of the urgency of the sales. Davis (2015) found that households headed by women were more likely to sell livestock as a means of coping with food insecurity than households headed by men. In spite of owning fewer animals on average, women were more vulnerable to climate change due to the fact that their herds were below the survival threshold. This suggests that those who have lower endowments in labor and land are more vulnerable to income loss in the cattle-rearing industry because they are unable to generate enough resources to get into the business" (Dan, 2018). In contrast to the wealthier families, those who are less fortunate may struggle to hold on to the money they make from selling livestock (Bryan et al., 2013).

This strategy can be compared to withdrawing cash from the bank, but the timing is just as critical in order to reap a substantial financial benefit from it. Poverty-stricken household tend to hold onto their livestock and sell it when it is too late to make a significant profit. Because of the timing and price at which livestock were sold, the households became enmeshed in a cycle of poverty. Drought-induced low-quality livestock further depressed livestock prices. Prices fell as households scrambled to get rid of their livestock before the animals died. Yaffa (2013) emphasized that households who sold their livestock had a smaller asset base and a smaller buffer capacity. It was also gathered that households can lose money if their livestock was sold too late in the season as a form of insurance as asset price depreciated immensely and this led to less goods and services that could be purchased with asset sales. Goats were a major part of the wealth that Lupane district households believed would shield them from the effects of the climate, so losing all of their livestock left them vulnerable. Because of climate change, the households purchase livestock at a higher cost than they could recoup by selling it, which further entrenches their plight.

Adaptive and coping methods have also been employed by households with regard to animals. Because of the threat posed by climate change to cattle, some households are taking precautionary measures. As a result of drought, livestock owners tend to group their animals near dams and trees so that they can prevent heat exhaustion. "I heard my cattle in the mountain where there are trees if it's a drought year," said one participant. Since the trees provide cover for my cattle, they will be cooler as a result.

While herding their cattle, some ranchers simply use dishes to hold water for the cattle. For the sake of comfort, a few households have planted trees near their kraals. Stover is also saved for feeding the cattle if the pastures run out. It's been tough to put tactics in place that rescue their cattle during really severe droughts, and this has contributed greatly to the death of significant numbers of livestock. Some people said cows are fed Bauhinia thonningii (Ihabahaba) during drought years since the tree is plentiful in the district.

4.4.6 Dietary Changes

The households noted that as a coping mechanism they had resorted to eating fewer meals a day. During droughts, people tend to eat less and rely more on foraged foods like leaves, rodents, and berries, according to a study (Mazendeke and Shoko 2014). Evidence suggests that Ethiopians begin by reducing the amount of food they eat at each meal before gradually cutting back on the number of meals they eat each day. For households, eating less or eating food that is of lower quality can have an adverse effect on both their health and nutrition. As the majority of households are made up of children, it is imperative that they receive the proper nutrition to ensure their growth and development. Nutritional programs implemented in early childhood have the potential to improve children's academic performance and cognitive abilities for years to come, according to Afridi (2010a).

It is as a result of this that malnutrition continues into adulthood. Poor nutrition worsens poverty maps, which, according to Carter and Janzen (2015), results in declining long-term human capital for children and grandchildren of impoverished and vulnerable households. Because harvest season fell right in the middle of the hunger crisis, households were unable to do their jobs effectively even though they were well fed. Households who are experiencing food insecurity are looking for short-term solutions. women often face greater restrictions on the amount and quality of food they eat than men do (Holmes & Jones, 2010). Because of climate change, Lupane District

households are forced to resort to negative coping mechanisms, such as changing their diets. Their long-term health is jeopardized as a result of this.

As a result of extreme weather occurrences like droughts, crop production is severely hindered, which has a direct impact on food security, resulting in hunger. It happened in Lupane, where the poorest people live in the district (The Food Poverty Atlas, 2016). Food insecurity in the ward is at crisis levels, even worse by lower crop yields. This is an eye-opener. When there are drought years, many farmers and their families will become food insecure because they are unable to produce a sufficient amount of maize to feed themselves and their families. As a result, their food intake will be restricted during this time period. Some households in Lupane district have had to cut back on the amount of meals they eat each day in order to conserve the few resources they have available to them. It is possible for people to choose to starve themselves in order to maintain their productive assets and future employment, according to Corbett (1988). In drought years, families employ this as a means of extending the shelf life of their food granaries.

It is impossible for households to end the year, till the next agricultural year, with their existing yields for home consumption if they receive low crop yields on their farms. When it comes to drought years, some homes say they only get one bag of maize that would last for a month. When harvests are great, they will cease eating Isitshwala twice a day and only eat Isitshwala in the evening in order to save maize. As a result, the daily consumption of maize by the household will be lowered, and the grain will last slightly longer. They also have to buy mealie meal from the shops when their maize and other agricultural produce runs out, which is expensive because they don't have consistent earnings they depend on. As a result, they are once again forced to eat only when absolutely required.

4.4.7 Food Assistance

Source – Survey Photo

Figure 4.3 – Food Aid Distribution by Care Zimbabwe in Jotsholo

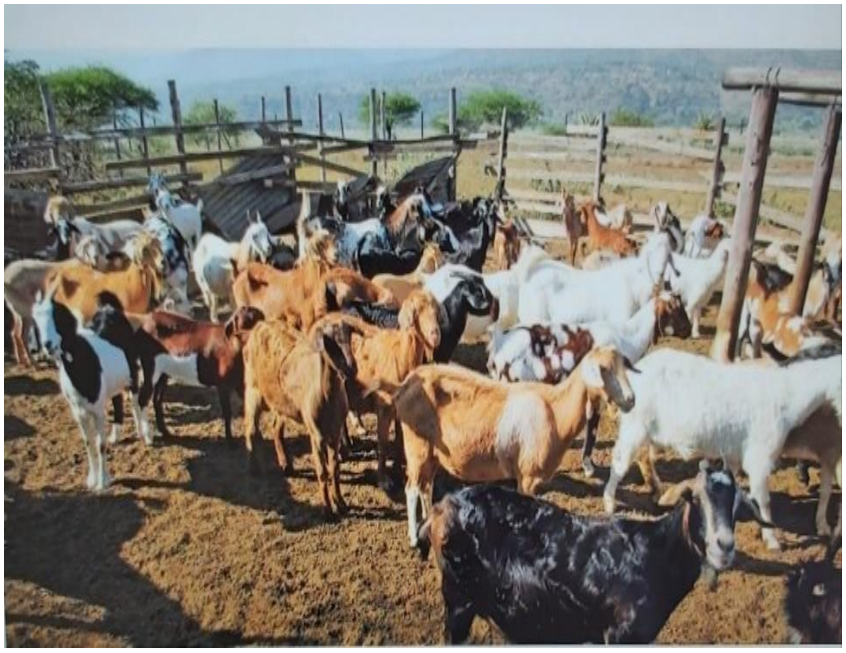
In four of the seven villages, food aid was one of the most popular coping mechanisms. Such an option is unsustainable and promotes dependence and humiliation rather than human dignity and independence. It was gathered in the FGDs that some households were categorically clear that they were forced to accept food aid because they had no choice. Households noted that they prefer assistance so that they can produce enough food to feed themselves rather than relying on government food assistance. Food aid was criticized by households who noted that it was inadequate and failed to meet their needs. Most households who received food aid were dependent on it, and they had limited opportunity to establish long-term assets for their livelihood. In the absence of long-term livelihood diversification measures, food handouts did not provide a viable long-term survival strategy.

From interviews conducted it was gathered that households were vulnerable and were obtaining cash from World Vision as a way of coping with climate change. The cash that the households were obtaining was only $55 and in return they were working to build bridges in the communities. It was found that the money obtained was utilised for purchasing grain but the grains lasted three to four weeks depending on the size of the family. In cases where there were larger families such

as nine people and above, grain only lasted for two weeks. Receiving cash from NGOs was another strategy noted but it is imperative to note that it is not a sustainable as a way of surviving droughts as it meets the immediate needs only. According to Dercon (2000), a new safety net may benefit household actions, such as reducing self-insurance as well as increasing overall risk in the income activities portfolio. Bryan et al., (2013) emphasised that food aid appears to enable poorer households to make more moderate risks, such as changing planting dates or adopting new crop varieties. Lai (2007) noted that food aid is a positive coping mechanism when it is short term and targeted towards vulnerable populations at appropriate times. Lai (2007) further stated that it is considered a negative coping mechanism when it develops dependency syndrome in communities.

In Gambia, Yaffa (2013) reported that the amount of aid received from donors was insufficient hence there was need for extra income. Siyoum, Hillhorst, and van Uffelen (2012) echoed the same sentiments after their research in Ethiopia that found that the majority of the households interviewed did not rely on food aid alone due to the small quantities of food distributed compared to their household needs, moreover the food aid arrived so late that they would have temporarily employed other means to survive. In contrast to the study undertaken by Siyoum et al., (2012), a study conducted by Harvey and Lind (2005) found that there were complaints among community members that some people in Turkana district in Kenya had developed a dependency syndrome to a point that they would “eat and wait” for assistance to come. In a book entitled Enough with Famine in Ethiopia by Kiros (2005), dependency syndrome manifested at both national and household levels. However, communities should not be deprived of humanitarian aid when in need; neither should continuous dependence be cultivated in communities thereby handicapping them. Thus, food assistance in Lupane district met an emergency need whilst resilience projects were implemented to promote sustainability.

4.4.8 Small Livestock Production



Source – Survey Photo

Figure 4.4 – Goat Production in Jotsholo

Participants in FGDs asserted that small livestock is better at withstanding climate shocks than cattle rearing. To build long-term sustainability in climate change taking place, small livestock became the foundation. Households with no assets were given a number of options for generating income as a result of the intervention. Households' ability to achieve long-term financial security was influenced by numerous elements that intervening organizations recognized and considered. With respect to cattle, FGDs suggested that when there was water shortage in the river hence they had to search for water especially in September and October for their cattle which was proving to be a burden for them. Some participants noted that they boil cooking oil, to allow their cattle to drink and this would reduce the animal from getting thirsty or being affected greatly by climate change. As a method boiling cooking oil was noted to be costly and was done by few households. Moreover, in an attempt to guarantee the survival of animals, it was noted that some participants were investing in their domesticated animal vitamins by buying fodder. However; as a method it was noted that this was expensive as at the end the price of the cattle when sold would not be recovered.

4.4.9 Wild Fruits

Lupane families have long relied on wild fruits as a means of coping with the effects of drought. Drought-stressed populations rely on wild fruit trees to produce an abundance of food as a complement to their regular diets and as a means of survival. Ndlovu (2010) backs this up, pointing out that strychnos madagasca-rensis trees produce a lot of fruit. Households turn to indigenous wild fruits in times of drought and starvation as a valuable source of nutrition. As a matter of fact, more than two-thirds of households prepare these fruits during times of drought. Cooking oil, butter, and beer can be made from wild fruits like Marulas, Muchakatas (Parinari curatelifolia), and Mukwakwas. The study noted that it was a terrific way for families to make extra money, and also be used as a coping mechanism.

Lupane district's most beloved tree was the Marula tree. The existence of legislation aimed at safeguarding the tree demonstrates its significance. The tree cannot be taken down without the consent of the Chief, who would impose a fine on those found in violation. Fruits from the Marula tree, which have a sweet and sour flavor, can be harvested. Lupane district residents don't like the taste of the tree, although it has a long list of benefits. Flowering begins in October and lasts through February, with ripening occurring in January and February. After the fruits have ripened, they are used to manufacture beer, which is the primary use for them. Older women in the villages process the fruit juice-based beer. The beer cannot be sold because of its high level of intoxicating properties. The beer is enjoyed by households and is used in traditional celebrations. The Marula tree is unique in that every portion of the fruit can be used, and nothing is wasted. The fruit's seeds, for example, can be used to make a variety of items. Peanut butter, cooking oil, and body oil can all be made at home using the dried and squished seeds. The Marula tree's home-made goods are currently being employed as an income-based coping technique in this difficult era of climate change.

Households in the Lupane district make and sell Marula oil. For their own self-help, they have organized a group called "Escalss," a non-profit that helps them and buys their cooking oil for distribution in other towns. Muchakata, also known as Muhacha, is a wild fruit tree that becomes popular during dry years. Drought-resistant populations rely on the fruits, which can also be used to manufacture peanut butter. The Marula tree's flavor is superior to that of peanut butter, which

is why it is sold. Cattle and donkeys also grow more dependent on the tree during drought years, therefore it is employed as a means of coping. Muchakata is a legally protected species, much as the Marula tree. A drought encourages the tree's fruit production, which is available from August through December. As soon as the fruits are ready, they can be eaten right away, or they can be dried and kept for later consumption. When food and money are scarce due to a drought, dried fruits can be sold in the market to supplement household income.

4.5 Climate Adaptation Strategies in Jotsholo, Lupane District

Communities that are unable to cope with or adapt to environmental changes will never be able to have sustainable livelihoods (Scoones, 1998). When it comes to reducing poverty and inequality, adaptation interventions may actually make things worse (Eriksen et al., 2011). Adaptation to climate change is common in drought-prone areas for a short period of time. In order to succeed in the long term, however, one must adopt a different mindset, one that believes in the necessity of making long-term adjustments. As a result, there must be a synergistic relationship between external and internal resources. Households in Lupane district have not fully adopted and implemented adaptation strategies as a result of frequent droughts. The study took closer look at some of the creative ways' households in Jotsholo, Lupane district were utilizing in adapting to the changing climate. Although some of the strategies identified were found to have flaws that cannot be ignored because they increased the vulnerability of the households to climate change.

4.5.1 Conservation Farming

Despite the fact that conservation farming has been hailed by stakeholders as a successful strategy for surviving droughts, the households that took part in FGDs did not appreciate it. Despite the fact that few households were practicing conservation farming, agronomists did not recommend the full package. It was discovered that households that ventured into conservation farming did not follow through on all of its components hence they did not realize the desired results. For conservation farming to be successful, all of the components of 1) minimal or no mechanical soil disturbance; 2) permanent organic soil cover; and 3) diversified crop rotations had to be fully implemented (Giller, Witter, Corbeels, & Tittonell, 2009; Kaumbutho & Kienzle, 2007; Knowler & Bradshaw, 2007). But conservation farming was seen as prohibitively expensive for smallholder farmers because of the need for so many specialized tools and techniques (Knowler & Bradshaw, 2007). Furthermore, the crops needed rain to sprout or not be distressed at the most critical stages

of their development in order for it to be a success. Lupane district conservation farmers had to embrace the practice in full and devise ways to alleviate the effects of rainfall stress at this critical stage of the crop's life cycle. It is largely a matter of taking a chance on seasonal conditions, but certain controllable conditions of soil and seed often determine the success or failure of a crop planted in drought. The practice's high cost necessitated the assistance of the local government and donors. This left local households at risk of drought because their government had no money to assist them.

Areas in Zimbabwe's Natural Agro-Ecological Regions IV and V, where annual rainfall is less than 650 millimeters, like Lupane district, are already experiencing water stress. Even if the total amount of rain falls over a short period of time, it will not be sufficient to support sufficient crop development over the growing season due to the short duration of the rain. When there is a prolonged dry spell, crops are more likely to experience crop failure due to a reduced moisture content inside the soil (Marongwe et al., 2012). Conservation Agriculture (CA) has become necessary in this situation to preserve soil fertility and water moisture. CA promotes for soil and water conservation by utilizing mulch to reduce runoff and erosion, which in turn improves the conditions for plant establishment and growth. The primary component of CA farming is the conservation of moisture and the management of natural resources like soil in order to achieve sustainable agriculture with the goal of enhancing yields, as the name suggests. Food insecurity plagues Zimbabwe's drought-prone regions year after year, and CA has been widely adopted as a solution. When it comes to increasing agricultural yields, CA has been viewed as an ideal technology option for resource-poor farmers, even in areas with low rainfall (Mika, 2020).

Marongwe et al. (2012) notes that CA addresses a wide range of agricultural production challenges, including declining soil fertility, rising production costs, climate-induced irregular rainfall patterns, and rising food demand in the face of severely reduced agricultural land production capacities. In order to be effective, CA relies on a set of guiding principles. Minimum tillage to zero tillage, preservation of soil organic cover, and crop rotation are the guiding concepts. To conserve water, improve soil fertility, and prevent soil erosion, diseases, and pests are the goals of all these techniques. As a result, CA promotes soil fertility-improving practices like mulching and manuring, which both increase organic matter in the soil and enhance its structure. In Zimbabwe, CA is aimed at improving food security, increasing agricultural profitability, and

enhancing the economic well-being of farming communities (Marongwe et al., 2012). Aside from households, CA is said to be good for the environment and wider society. AGRITEX and Care in Lupane are two of the most prominent organizations in the area that advocate for CA. households in Lupane district have been advised by AGRITEX officials to implement CA because of the many benefits it offers. Minimal or no tillage is necessary to restore the fertility of the soil in this area. When it comes to teaching farmers how to improve soil fertility, one of the most important concepts is Gebha Udle (dig and survive).

Mulching, use of manure, crop rotation, crop diversification, mixed cropping, and minimal or zero tillage were some of the CA methods used in Lupane district. The vast majority of hoouseholds in the Lupane district were using CA methods in one manner or another. ' CA, however, is not a new phenomenon in Lupane district, as some of its practices were previously in use there. When it comes to preserving soil and reducing soil erosion, households in Lupane have long used practices such as employing manure, crop rotation and crop diversity in their "traditional" conventional farming. Due to factors such as a lack of organic manure and small lot sizes, such as those brought on by climate change, residents of Lupane district are continually being urged to adopt these practices on a regular basis. During the research in Lupane families, the researcher heard a lot about the CA methods, and it is proof that they are being used more and more because of climate change's impact on agricultural productivity. The Lupane people's agricultural heritage does not include Gebha Udle and minimal or zero tillage practices, for example. Households in Lupane still adhere to the "traditional ways" of farming, which explains in part why they have been reluctant to adopt Gebha Udle, which is also seen as overly labor-intensive by these same households.

Because it lowers soil erosion, enhances water infiltration, and so conserves soil moisture, zero- and minimal-tillage farming is supported in Lupane. Harford et al. (2009:3) state that "natural drainage channels were interrupted" when soil layers were disturbed by ploughing or turning the soil, making it more difficult for precipitation to permeate into the soil. Some households know the advantages of using this strategy in a time of climate change, but it was only used by a small percentage of the population. One participant noted that;

> “Households have a hard time grasping the concepts of zero tillage and minimal tillage because their current farming methods necessitate thorough clearing and tilling of the land before to planting. For those without draught power, weeds can be cleared with hoes, while for those who do, they can be removed with ploughs. After the land has been cleaned,

> planting can begin. Farmers have been using this strategy for so long that they have forgotten what it means to plant crops on a field that is already overrun with weeds."

As CA requires so much time and effort for only a small percentage of households, the technique nevertheless has its drawbacks. Households find that digging the basin is a burdensome task, with many women and the elderly particularly vocal about their dissatisfaction. Households in Lupane district use mulching as a form of CA. As a result of climate change, households were being encouraged to apply mulch on a regular basis. Soil erosion can be minimized by slowing down the rate at which water evaporates, storing it in the soil, and boosting soil fertility, all at the same time. When it comes to mulching, Marongwe et al. (2010) explain how mulching can help alleviate issues related to low and erratic rainfall by using technologies that reduce water losses from runoff and soil evaporation as well as increase infiltration capacity, and improve low soil nutrient status by using organic soil cover. Tilling the soil reduces soil fertility and, as a result, decreases agricultural yields. In this way, mulching restores the soil's fertility and traps in moisture by covering the crops. Enhancing water infiltration is also critical to increasing agricultural yields. Households employ agriculture wastes, such as grass and stover, to mulch their lawns.

Manuring is another CA approach that households were urged to employ or at least continue to utilize by the Agricultural Extension workers. CA stands for conservation agriculture. Households choose manuring in particular because it is inexpensive and mostly dependent on the availability of sufficient materials. Termitaria from anthills and cow dung are two common sources of manure used in this method. Especially in sandy soils, this promotes soil fertility. One participant noted that;

> "In light of the fact that we are unable to obtain inorganic fertilizer and that the soil has lost nutrients, we used termitaria from anthills as a substitute. According to one of the other respondents: This soil needs feeding. It was reaffirmed by another villager that I dump chicken poop that I gather from the coop into the water basins. This manure also helps me conserve water"

Many of the residents of Lupane district engage in agricultural diversification and mixed cropping as a way of life. Crop diversification refers to the practice of growing a variety of crops on the same piece of land, but doing so in various plots or sections. Planting them far apart has the advantage of allowing for crop rotation throughout the seasons, which improves soil fertility and

reduces pest and disease pressure. In addition, it allows homes to harvest a variety of crops, such as maize and groundnuts, which improves the diet of the family members. If the crops fail in one area, it doesn't indicate they will fail in the other area as well. Households have long practiced crop diversification and consider it one of the most environmentally feasible, cost-effective, and reasonable solutions to reduce agricultural uncertainty, particularly for smallholder farmers (Makate, 2016). Due of the modest size of most people's farms, it is only performed by a very small minority. One participant in a FGD noted that;

> "My field is small, therefore if I plant my crops individually and divide my field into planting other crops, it means that my maize portion would become smaller, reducing my maize yields. As a staple meal, I prefer to grow only maize."

The research revealed that households have been disoriented about what to grow as a result of the frequent occurrence of droughts. As a result, they have to settle with maize because of their little knowledge they have. Crop diversification, even in the face of climate change, would be an option for these households because it would ensure that none of their crops would be impacted by drought. Multiple crops can be planted in the same field at the same time, intertwining them so that they all grow together. Mixed cropping is a common practice in Lupane, according to participants in FGDs. Maize is often planted with other crops including beans, groundnuts, and Bambara nuts. As a result, more crops can be grown on a smaller plot of land thanks to this method. "Life mulch," according to the official from Care, refers to a sort of mulching that includes mixed crops. Groundnuts do not detract from my maize crops in any way, but they do add nutrients to them. As a result of nitrogen fixation, maize is able to acquire the most possible nutrition from legumes (Hirst, 2017). Thus, the advantages of mixed cropping include a balance between soil nutrient intake and output, increased soil fertility, suppression of weeds and insect pests, tolerance to temperature extremes, suppression of plant diseases, and an increase in total productivity.

The Lupane district has a limited supply of farmland, therefore mixed cropping maximizes the use and management of that land. Inputs such as fertilizers and pesticides are also reduced with mixed cropping. In the end, the purpose of mixed cropping is to lessen competition for light, nutrients, and water among the many crops. If one crop fails owing to a lack of water or nutrients, the other can offset the danger of total failure. Given the restricted amount of land available to other farmers, we find that growing a variety of crops is a huge help to us. The same plot of land can be used to cultivate maize, groundnuts, and Bambara nuts. They can grow as many crops as other farmers in

the village with large plots of land. If yields are to be compared, monocropping is inferior than those obtained through mixed cropping.

4.5.2 Productive Asset Creation

In rehabilitation programs, food aid should be used more explicitly to rebuild household and community assets and local organizational capacity, as stated by Swift (2006). Food aid should not only be used to save lives, but also to protect assets, as stated. A Productive Asset Creation project was being carried out by World Vision in order to improve the community's resilience to natural disasters. They had $55 a month to spend on grains and other non-food items when interviewed because the project was still in its early stages and they had yet to reap the benefits of their hard work and investments. Even if well-managed, this project could aid in the development of more resilient households in the community. In addition, Bryan et al. (2013) state that more needs to be done to help these communities be more resilient in the face of future climate shocks. Cash-for-work after a harvest, inputs for planting, and food-for-work in the hungry season are all examples of different types of payments that need to be provided at different times of the year. The ability of a community to adapt to climate change will be heavily influenced by the beliefs, attitudes, and perceptions of its members.

People who benefited from these projects, as noted by Gukurume (2016) mostly cared about the money they got in return for their labor. Some of the Lupane district's beneficiaries could only work for four hours allotted to them by their employer. In spite of the fact that the community was urged to continue working in their homes after the Project Managers had left, the community was concerned about whether or not it could manage and own the project after the Project Managers had gone away. According to Ndlovu (2011), food-for-work programs undermine people's ability to manage their household needs and prepare their lands, so less physical labor should be expected. Although this recommendation may be well-intentioned, it is imperative to seek outside assistance in developing community resilience projects in the face of repeated droughts. Contrary to popular belief, there are still concerns about the quality of the work accomplished by food-for-work programs, no matter how well-meaning they may be. Heavy rains, for example, have washed away some of the roads that were built. Although the work done is of the highest quality, there must be mechanisms in place to ensure that the Lupane community's needs are met for the long term.

Women may not be able to fully benefit from such resilient projects because of the dynamics of power and gender. Men were responsible for the most physically demanding jobs, such as digging fish ponds and dip tanks. Transporting sand and stone was given to women who had the physical stamina for the job. Elderly women looked after the young children. Women's long-term benefit from the project's income might be affected by this clearly defined division of labor. It would be helpful if there was a clear constitution that governs profit sharing after the donor has finished supporting the project. But community, power, and gender dynamics still exist. According to Mutasa (2010), despite calls for increased funding for development activities, the donor community does not adequately invest in development work. The 2008 Community Action Plan reveals that only 2% (US$95,000) of the US$5,482,000 budgeted and requested for community-based sustainable livelihoods initiatives had been pledged by donors. Communities in drought-prone areas benefit from asset creation projects by supplementing the meager income they receive from their local economies. Communities must be involved in the selection of projects as soon as funds are allocated for their implementation.

4.5.3 Communal grain storage – "Isiphala Senkosi"

Isiphala Senkosi according to Mararike (2001), is a large gathering of people engaged in a common activity or a community's grain stockpile. This organization's primary goal for the elderly, disabled and orphaned members of the community is to provide them with food (Stathers, Sibanda, & Chigariro, 2000). Households in communities would store grain at the chief's homestead in the event of a drought. According to Masendeke and Shoko (2014) Isiphala Senkosi was found to be ineffective due to the kraal heads' failure to provide timely inputs and poor community organization. Participants in the study noted that traditional leaders should be depoliticized in order for the concept to realize the desired outcomes. Although some participants disagreed, this is a serious issue in Zimbabwe because politics tends to obscure such matters. Authorities say that the chiefs blew through the community's agricultural reserves after abusing the "Isiphala SeNkosi" concept and thus losing the trust of their constituents in their decisions. In addition, the communities called for an end to grain distribution corruption.

Changing the way people live necessitates a level of openness and accountability that cannot be ignored in community projects. Droughts, on the other hand, made Lupane district unsustainable because it had a limited supply of grain. It is not uncommon for climate change to have a negative

impact on local chiefs and leaders, especially if the drought is severe and long-lasting. Because of their influence in the communities they live in, they are vulnerable to corruption and abuse of power. According to the context in which it is implemented, communal grain storage can have both advantages and disadvantages. Non-governmental organizations and the central government have gradually eroded Isiphala Senkosi over time by providing food relief and aid (Chikowo, 2010). Repeated droughts, economic collapse, and political unrest have weakened social cohesion in a large number of rural communities. While a collective effort to address local issues might have been appropriate, the events in Zimbabwe left the majority of people vulnerable, necessitating outside assistance to ensure food security in communities. in those.

4.5.4 Small Grains Production

Planting millet (rapoko), rapoko, and bulrush millet (mhunga) is one of Zimbabwe's most effective weapons against food shortages (Dekker, 2014). Small grains like sorghum and millet were the crops that households in Lupane district were cultivating though there was resistance from other households which continued to resort to maize cultivation. Although they had a good harvest from these small grains, they couldn't make it through the agricultural season or last the entire year. Because the region is semi-arid, mass plantings of maize hampered the region's agricultural output. Households were particularly at-risk during times of drought, which occurred frequently due to the region's unpredictable rainfall. Dhewa (2011) noted that small-grain crops benefit from early rains and late droughts on some years, while maize crops fail. Their conclusion was that reversing dry and wet conditions could cause small grains to fail. In addition to requiring high temperatures for good germination and growth, sorghum crops are grown in areas with an annual rainfall range of 300 to 750 mm that are too dry for maize production.

Only a few households use small grains as a substitute for maize or as a complementary crop in semi-arid areas. It was found that small grains were less preferred in Zimbabwe because of bird attacks, labor intensiveness, and an unfamiliar taste. Risk-reducing adaptation measures like drought-resistant crops can't be implemented by low-income households because they don't have the resources or expertise, according to Eriksen and O'Brien (2007). Plants grown under shorter, medium, and long-term conditions are more likely to succeed (Manzungu, Senzane, & van der Zaag, 1999). If you don't know that sorghum comes in various forms, you won't be able to take advantage of all of its benefits. Mixing seed varieties from the same plant species has also been

suggested to reduce crop failure because some varieties mature early and others mature late and respond differently to drought. Households will remain at risk of drought as long as they believe rainfall patterns will change in their favor and ignore the advice of agronomists, which necessitates a shift in mindset and behavior.

One of the challenges to sorghum production was the labor-intensive nature of small grain production, which was cited by respondents. It is more time-consuming to weed and harvest small grains than it is to grow corn. It takes a person with experience and skill to remove the weeds from small grains like finger millet. An inexperienced eye will be unable to tell the difference between the weed (Eleusine Indica) that grows in finger millet fields and finger millet itself. Attention must be paid to avoid weeding out the finger millet while leaving the weed behind. Households in Lupane are finding this to be a challenge. Sorghum and millet harvesting are also arduous because the seeds are so small and require so much manual effort. Harvesting small grain stocks necessitates manual harvesting and threshing, which is time-consuming. This was followed by the arduous task of winnowing, which the villagers do again. As a result of the introduction of maize, the households stated that they were hesitant to produce small grains on a large scale as they had done before. Small grain production in the seven villages was limited, with only a few households cultivating them on a large scale and the majority not growing them at all.

There were a few households in the area who were willing to deal with the issues of birds and taste associated with small grain production because they had a large area of land to work with. Small-grain farming was found to be more popular in households headed by the elderly because it was a practice that they had been doing for a long time. In their drought-prone region, they knew that small grains were better for growing than maize because they ate Isitshwala made from these small grains as children growing up. Participants who had eaten Isitshwala made from maize as children were wary of planting small grains because they disliked the taste. They also complained about the small size of their land because their parents had given it to them after the land was divided. The few young people who grew small grains had large land areas and the manpower to chase away the birds, allowing them to succeed. They pointed out that the risk of zero yields was low compared to maize if they were able to keep birds away from their crops, so they decided to grow small grains.

A participant in a FGD noted that;

> "They want to be pampered so that they grow small grains," one participant said. The problem here is that young people don't understand the seriousness of the issues we face. There is skepticism about our claim that this area was once home to a small-grain farm. Birds were also present at the time. Those were the days when I was just a kid. We would try to keep the birds away until the harvest season came around. What else can you do in rural areas when you're not working? You chase birds away. To my surprise, these young people have decided against it at this time. That's because they're used to receiving handouts. We were let down by these non-profits. Everybody is dependent on them now that they've stopped providing food. When I saw the declining yields of corn in 2010, I re-started planting small grains. My property measures two hectares. My rule of thumb is to plant small grains on half of every plot of land I have. As far as I can remember, it's always worked for me. My grandchildren are attempting to scare away the birds with their bare hands. Then again, I'm sorry for my kids. Due to the fact that most farmers do not plant small grains, chasing away birds is now a laborious task. Since my grandchildren are still young and not as stubborn as those other kids, they do their best to keep birds away from my field. Since I get better yields than with corn in this situation, I'm overjoyed. It's a taste that we [him and his family] have grown accustomed to in this area. In this area, the youth have been affected by the Isitshwala gangs. Small grains are compared to Isitshwala by these people, and they don't like the taste."

Due to frequent droughts in the area, however, it is possible that households will be forced to return to planting small grains on a larger scale in the future. Additionally, nongovernmental organizations (NGOs) such as Care and World Vision have advocated for households in drought-prone areas like Lupane district to return to growing small grains on a larger scale. Care provided households with small grain seeds and AGRITEX provided information on the advantages of growing small grains at some point. Due to their drought-resistant properties and potential for stabilizing food security, small grains like pearl and finger millet are being promoted. The drought-resistant varieties of these crops can be grown in areas where maize cannot, and they do well in high temperatures (Taylor et al., 2006). When droughts occur frequently, the Lupane district is located in regions IV and V, which necessitates the farmers returning to small grain production. In an area where the average rainfall is less than 650mm, extreme weather events like drought have had a negative impact on maize yields, highlighting the need for small grain production.

According to FAO (2008), sorghum and millet are important crops in the driest regions of Southern Africa, where rural farm households have limited production capacity and low incomes, while maize is the primary staple crop. These findings are bolstered by Leuschner and Manthe (1996), who notes that sorghum and millets are among Zimbabwe's most important cereal crops for

communal farmers living in Zimbabwe's Natural Regions IV and V. Drought in Lupane district, which began in 1990, has reduced maize yields. Small grain production is therefore an adaptive strategy that would prevent many farmers in the area from experiencing crop failure. Additionally, small grains have the ability to provide a wide range of nutritional benefits. They are praised for their ability to strengthen the body's defenses. As a source of nutrients that can help maintain a healthy diet and ward off diseases like kwashiorkor, they are recommended for young children. They are also suggested for those who have HIV and AIDS or are at risk for it. Small grains, in contrast to maize, are less susceptible to disease during harvest and have a longer storage life. In contrast to maize, they don't need pesticides during storage, saving you money. Some households noted that they store small grains for up to 20 years, which is confirmed by Mazwi (2018). In most cases, maize is not able to be stored for more than eight months (unless pesticides are continuously used). Lupane district has very little production of small grains, but the majority of those polled knew that small grains have several advantages, the most important of which is that they thrive in hot climates and require very little rainfall.

One participant noted that;

> "Sorghum does not require a lot of rainfall and can ripen even in hot and rainless conditions".

Although she was the only person with this particular knowledge, an overwhelming majority of the respondents, even those who did not grow small grains, were aware that small grains were an appropriate adaptive strategy. Reverting to small-scale grain production made sense to them because they were aware that their maize yields were declining due to frequent droughts and shifting seasons. As a result, small grain production as an adaptive strategy is well-known in the region, but implementation is difficult due to issues with crop production. A ward-level breakdown of maize and small grain crop yields in Zimbabwe is difficult to come by.

4.5.5 Soil Management and Water Harvesting

Because the soil fertility in Lupane district has declined, effective soil management is necessary. For increased productivity, the soil in Lupane district needs manure and fertilizer, due to its deteriorating condition. This means that soil management is essential in the ward in order to boost crop yields. In addition to conservation agricultural efforts, soil management is being pushed as a

means of restoring soils and reinvigorating their fertility. In order to reduce soil erosion and disruption, old practices such as avoiding cutting down trees are now being advocated. To avoid deforestation, only specific species, such as the Mopane tree (brachystegia spiciformis), can be used for firewood, although this must be done on a very limited basis. People in rural areas of South Africa are also being urged to cultivate their land by planting trees known locally as mubvumira (a species of Marula tree). Many of the responders had these trees in their homes and farms, which helped keep the soil in place. AGRITEX has assisted Care in the promotion of this type of agroforestry. Agroforesting is the practice of cultivating trees and agricultural or ornamental plants side by side on the same parcel (Brazier, 2015).

Trees may produce a broad variety of items, including food, cattle feed, firewood, and timber. Producer groups, an initiative launched by non-governmental organizations, have been instrumental in encouraging agroforestry. Small groups of members of the "Ukhozi" garden collective are participating in "Maphehla" (income cooperatives) in order to purchase trees for planting. Community gardeners came up with the idea as a method to boost the quality of their harvest. In addition to indigenous trees, exotic trees are also being planted because they grow more quickly than indigenous trees. The locals will gain from this as these trees will produce fruit, such as orange, mango, and guava. As long as they don't interfere with the growth of the crops, the trees planted around the garden are fine. According to Brazier (2015), planting these trees leads to soil management since they can improve the soil, protect it from erosion, and increase the water content in the soil.

Many studies, such as Zoysa (2014), have noted the advantages of agroforestry, including the fact that it increases farming systems' resistance to climate change impacts, which is a key part of climate change adaptation. Additionally, Lupane residents have planted vetiver grass for vegetation reclamation, which was performed by Care. A related procedure known as "gulley reclamation" sees homeowners seal off gullies that have formed as a result of severe weather events such as floods. Caring provides them with food in exchange for the labor they undertake. This has helped to revive the soil and allow it to restore its original texture. Gulley reclamation was found to be minimal, as households noted the laborious labor necessary in filling the gullies with dirt as their reason for avoiding it. Trees and grass can help prevent gullies produced by land degradation by being grown properly by the Forestry Commission. Given that purchasing trees to plant is a

financial burden on Lupane households, this has been an enormous help to them in their efforts to improve their gardens. The Forestry Commission has helped households in a number of ways, one participant noted that they had been assisted with information on how to plant trees and the importance of trees in preserving our soil. The households had also been advised that It was illegal to burn forests, and the practice of clearing land for development was discouraged as a means of conservation.

The Traditional Leaders Act of 1998 in Zimbabwe is one of several pieces of law in Zimbabwe aimed at reducing veld fires. Chiefs are expected to prohibit veld fires in their communities. Lupane has always relied on flames to clean its crops. A strong probability exists that these fires will become veld fires, which are uncontrollable. As a result, residents are being urged not to start fires unless absolutely essential, and those who do are being held accountable by their local chief. A veld fire's impact on soil fertility is due to the destruction of soil microorganisms, which reduces the amount of nutrients in the soil and increases soil erosion. Rainwater collection is one of the most effective ways for community farmers to combat intra-seasonal dry spells and increase rain-fed agriculture's water yield. (Kahinda et al., 2011).

The Lupane households are being urged to adopt rainwater gathering as an adaptive approach in an effort to store water for later usage. Rainwater collection has been lauded for its ability to supplement rainfall and hence boost crop yields and lessen the risk of crop failure (Oweis et al., 2001; Critchley et al., 1991). Through the use of infiltration pits, water harvesting has become more commonplace in Lupane. Residents are encouraged to dig infiltration pits along the contours of their plots. During the rainy season, water collects in the pits; however, if the rain stops sooner than planned or wanted, the captured water will move underground and be utilized by plants. For as long as it takes for additional rain to fall, the crops can progress to a mature stage and wait for more rain. Infiltration pits are being employed by a large number of houses due to their success in this regard. They've been implemented by farmers to try to boost yields, even though they're labor- and time-intensive. To others, infiltration pits are physically demanding since they involve so much labor. – It's not uncommon for families to join together and help each other dig them in one area before moving to the next.

4.5.6 Capacity Building

Researchers Rocha and Christoplos (2001) emphasized the significance of bolstering community resilience to natural disasters while also addressing climate change. The process of building capacity was identified by Allen (2006) as having four areas: the dissemination of technical information and training, the raising of risk and vulnerability awareness, the access to local expertise and resources, and the mobilization of households. Despite government claims that households had been trained in drought-resistant techniques, the households that took part in the study noted that they continued to farm using the traditional methods they had learned as children. The households noted that even if fertilizer and manure would be utilized it would not make much change considering the semi-arid regions like Lupane district had an unpredictable climate.

Non-governmental organizations and government agencies spend a lot of time and money helping communities get ready for a drought, but they rarely follow-up activities to put the skills and knowledge gained to good use after the initial effort is complete. Bhatt's (1998) theory of disempowerment relies on undervaluing local perspectives in favor of those offered by outside experts. Households who receive community-based knowledge and skills should be able to use it in their own lives. As much as possible, community leaders should refrain from prescribing how others should go about learning and growing. Dekker (2014) notes that the community's ability to identify problems, make decisions, act on them, and allocate resources is the most important. As a result, the households who live in these areas may see a change in their circumstances. As a result, the information and abilities shared must be relevant to the household's culture, be accepted, and empower them in order to be useful. One-off training programs run by NGOs or the government will not meet the adaptation needs of households unless they can clearly demonstrate the feasibility of implementation and the resources required.

On the other hand, ongoing training programs are ineffective because they leave accumulated knowledge and skills lying around in communities with no one taking advantage of them. In order to help these communities, NGOs and governments must change their attitudes and perceptions about capacity building. Building the capacity of households to deal with drought is critical, but this alone will not suffice, as issues of resources and how recipients are received in a given context are equally important.

4.5.7 Early Planting of Crops

According to the survey, households started planting maize in November or December in anticipation of late rains. As a result, they went hungry for longer periods of time due to the shorter growing season. In Kenya, farmer research groups or common interest groups have been found to be the most influential factor for households who depend on social safety nets (such as food subsidies, food relief, or other forms of farm support) (Bryan et al., 2013). Remittance-rich farmers in 2017 were more likely to change planting dates than those who did not belong to a group, a study by Boansi, Tambo, and Müller (2017) found. Because planting dates and times are linked to crop phenological phases, rainfall variability affects maize yields, according to Tadross et al. (2009).

Dehydration during germination and growth is exacerbated by prolonged periods of hot, dry weather, and fungal infections and rot are common during ripening. When it comes to the growth of maize, the weather has a significant impact. Planting rain-fed crops at the appropriate time is critical (Dube, 2015). If the households plant their seeds too early or too late, they may not germinate. In order to avoid prolonged periods of dry weather during the germination stage, the planting dates had to be moved. Using early warning systems to assist the households in planning their crops in order to maximize yields is advantageous because rain can arrive when no one expects it or stop in the middle of critical growth stages because it is unpredictable. Fisher, Abate, Lunduka, Asnake, Alemayehu, and Madulu (2015) all agree that accurate and easily accessible climate forecasts are a valuable addition to traditional knowledge. Adaptation strategies that do not rely on natural resources are needed to ensure that droughts in the Southern Africa region caused by El Nino do not negatively impact households.

4.5.8 Irrigation Scheme

Irrigation projects in Zimbabwe's arid regions, particularly in semi-arid ones like Lupane, are critical and urgently required. Due to the lack of water in Zimbabwe's regions IV and V, the majority of irrigation schemes are located here. Small-scale irrigation systems were put in place in the country as a preventative measure against the area's variable rainfall and as a way to allow year-round farming, according to Chazovachii (2012). To put it simply, irrigation is the process of moving water over land in order to feed plants. Mutsvangwa et al. (2006) define irrigation as the artificial application of water to ensure double cropping as well as a regular supply of water in locations where rainfall is inconsistent, which is why they call it irrigation. When it comes to

irrigation, households can choose when to plant their crops, what kinds of crops to plant, how long to let them grow, and how many seasons they want to let them grow, according to Burke and Lobell (2010). Irrigation systems may be a viable choice for households in Lupane area, given their worries about rainfall. The Lupane district has a number of irrigation projects, including the Jotsholo irrigation scheme, which includes households of the ward. It is the primary irrigation system for the majority of houses in Lupane, and it has proven to be an effective approach for coping with droughts. Individual plots are part of the irrigation system, which is well-maintained by its members, who individually contribute labor and take responsibility for their own portion.

A new fence given by NGOs and the construction of sanitary toilets haven't reduced the scheme's total size, but the garden has been revitalized. Beneficiaries are sometimes willing to volunteer their time to keep an eye on the fence, keep an eye on the pipes, and make sure the gate is closed to keep cattle away from the crops. 360 people benefit from the irrigation. When the irrigation plan was inaugurated, the Chiefs were responsible with identifying beneficiaries, and those who signed up did so at that time. Compared to now, there were fewer people living in Jotsholo during the time, which is why most of the houses that were near the irrigation system were included. Those who living more than 5 kilometers away from the scheme decided not to enroll due to distance. One of the participants mentioned that the Chief was instructed to invite any interested households. Many of the new members are the great-grandchildren of the original members who have either retired or died, leaving their land to their heirs.

Households may be forced to relinquish their plots in the Jotsholo irrigation system as a result of retirement, illness, or death, opening up new opportunities. Due to the fact that the irrigation system cannot accommodate everyone, a fee has been set to limit participation. Households who will be wanting to join the program agree that, in order to minimize any potential strife, interested household should furnish the councillor with their names and, if a vacancy arises, they can join on a first-come, first-serve basis. Individual recipients have reaped the benefits of the program since it provides them with the means to survive in times of drought. Many of the recipients make money by selling their extra produce from the scheme. Irrigation-related excess crops are sold by the farmers who benefit from them. As a result, the plan was developed to help farmers increase their yields. Droughts in the middle of the season can be especially difficult for farmers to deal with when using this method. A participant noted that;

> "I have been fortunate enough to be part of the Jotsholo Irrigation Scheme, which has allowed me to keep my family fed and clothed in difficult times"

4.6 Social Dynamics of How Households Communicate and Share Information on Climate Adaptation Strategies

In this section, findings explain rural households' access to, and use of, climate change adaptation information in Jotsholo, Lupane district. Information is power, and it plays a big role in shaping adaptive capacity in rural livelihoods. The study gathered that the rural households in Jotsholo, Lupane district have access to information on climate adaptation measures from a variety of sources, including researchers, non-governmental organizations (NGOs), agricultural and extension staff, and share information among themselves.

4.6.1 Source of Information Households Use to Access Information in Jotsholo, Lupane District

Participants in FGDs were asked to reflect on how they got access to information regarding strategies for climate adaptation in Jotsholo, Lupane district. The results in focus groups highlighted that households get access to climate change and adaptation information on radio, cell phones messages, fliers, magazines, brochures and TV. Participants in FGDs concurred with the key informants in noting that radio and mobile telephones played a key role in accessing adaptation information. The results of the study suggested that radio was the preferred medium for disseminating climate change adaptation information. Mass media plays a key role in reaching a big audience especially in Lupane district. In FGDs that were conducted few households noted that they got climate change and adaptation information from internet and television sources. It can thus be noted that on accessing climate change adaptation information from internet and television is limited by finances as well as education. The households are not financially secure to have resources to buy data bundles or computers so that they can access information on climate change in their area.

In-depth interviews with key informants thus Agricultural Extension workers concurred that radio and mobile phones are the most often used electronic media by rural households. According to other key stakeholders in in-depth interviews, it was highlighted that rural households in Jotsholo, Lupane district prefer and rely mostly on interpersonal sources that are either directly or physically

available. According to the results, participants had no trouble locating and utilizing these resources, and the information they provided was reliable. Participants prefer interpersonal networks to mass media for knowledge or input on climate adaptation coping mechanisms. According to Rogers (2013), interpersonal networks can persuade a person to change their mindset and embrace innovation on climate adaptation.

World Vision, Care International, and Lupane State University are among the institutions that were identified as playing a key role on disseminating climate change adaptation mechanisms to rural households. Sustainable cultivation, access and use of hybrid seeds, education and knowledge about climate change, and variability, as well as food protection and livestock management, entrepreneurship, planting, and livestock and crop disease, are all covered by the information resources dispersed through these channels. In addition, the results reflected that rural households' communities play an important role in creating adaptation mechanism which are sustainable to them. FGDs conducted were of the view that hybrid seeds, drought-resistant crops are all empowering but enough information is needed to empower the communities. Information empowerment is important in ensuring rural households become aware and change their attitudes. Communication networks are considered crucial in the innovative decision-making process. Aside from providing access to and using household equipment, rural households also play roles in spreading information about new rural household practices and educating members about the best crop varieties to cultivate at a certain time of year to maximize agricultural production.

4.6.2 Use of Information Change in the Lupane District

Participants were asked to explain whether they can use expert climate change adaptation information to adapt to climate change and the key informants were of the view that;

> "local management approaches can be tailored to address the challenges posed by climate change in Jotsholo, Lupane district".

The results of the in-depth interviews and focus group discussions, reflected that most rural households have adapted early planting, utilization of early maturity crops and drought tolerant plants and shifting cultivation. The result of this study denotes that information got has greatly worked on empowering the rural livelihoods in Jotsholo, Lupane district. According to the findings of the research, rural households have embraced water conservation methods such as tiered lines, effective land cultivation, proper manure and fertilizer use, as well as grain preservation.

Participants expectations of innovations determine whether a product is accepted as an innovation (Rogers 2003). The more the benefits associated with adaptation mechanism, and the greater the usability an invention has, the more likely it is to be adopted by rural households in Jotsholo, Lupane district.

Two district agricultural extension officials were interviewed, and the results show that rural households have benefited greatly from having and using knowledge about climate change adaptation. Enhancing annual harvests, improving food security at the village level, increasing the number and variety of plants that may be sown, and increasing seed and fertilizer use are all advantages. The knowledge of plant disease information and knowledge about bird control would work greatly in curbing climate shocks in Jotsholo, Lupane district.

4.6.3 Factors Affecting Access and Use of Information of Adaptation

There are still several obstacles rural households must overcome to improve their ability to adapt to climate change, even having access to and making use of creative variables. Identifying and removing barriers to climate change adaptation and usage was explored by the researcher. According to results from interviews and focus groups, rural households face numerous challenges when it comes to learning about climate change and putting information accessed to good use. Improperly planned weather forecast compilation and storage means that timely access to improved seeds is impossible. There are also high grain costs and imprecise seasonal forecasts because of insufficient information transmission abilities.

Furthermore, research conducted with rural households highlighted that information such as wages, wealth, inefficient and underdeveloped extension facilities as well as a low literacy level affected access and usage, as does a lack of knowledge about climate change and problems related to heterogeneity among rural households. Opinion leaders were accused of spreading false information about government initiatives on climate change adaptation to rural households in Lupane district. Cultural hurdles and a low level of education, as well as a lack of access to seed banks and information centres, further limit access to and application of adaptation knowledge and variability in rural households. Culture and misinformation were shown to be important impediments to climate change adaptation availability and use, according to the research. Young people's reluctance to listen to radio programs was also identified as an impediment to learning about and implementing climate change adaptation strategies. In the study, it was discovered that

teenagers and young adults prefer to listen to music on other types of radio than educative programs like those focusing on climate change occurring in their vicinity. According to results, most young rural families prefer to spend their time on other economic pursuits instead of identifying sustainable mechanisms that can uplift their lives positively.

4.7 Barriers Faced by Households on Climate Change in Jotsholo, Lupane District

A less-explored area of adaptive research is identifying and assessing household adaptation obstacles to climate change (Scoones, 2009). To better understand how vulnerable households are to climate change, this section identifies and assesses key barriers to the implementation of local-level household adaptation strategies. In this way, better guidance on appropriate measures to improve agricultural communities' resilience was provided. "Concerted effort, creative management, change of opinion, prioritizing and related resources, land usages and institutions" are described as hindrances that can be overcome to adapt to change but that may reduce the effectiveness of adaptation strategies (Moyo, 2011).

4.7.1 Institutional and financial support challenges

The study results denote lack of institutional and financial support as an impediment to adapting to climate change. When it comes to climate change, the Zimbabwean Government created a ministry dedicated to deal with climate change and adaptation. But that ministry's department for climate change management, which is tasked with planning policies and strategies, as well as conducting research, is underfunded and heavily reliant on external activities. The participants confirmed a lack of institutional support for proposed adaptation strategies to climate change adaptation. However, the assistance provided, which was primarily in the form of donations, was usually only a small part of the overall policy plans, given that this type of assistance was only given on occasions. Household participants confirmed that financial constraints severely affected the adaptation methods they would desire to be implemented. Shifting the agricultural calendar was the only strategy with a lower percentage of capital needed. The drilling of boreholes though viable was noted as a mechanism which was difficult to implement.

As a result, the majority of rural household participants reported having financial difficulties. And to make matters worse, climate research is underfunded, particularly in Zimbabwe and elsewhere in the developing world. Climate adaptation cannot place too without much emphasis on financial

capital. For rural households in the research communities, lack of financial support is a major roadblock to successfully implementing climate adaptation strategies. Participants in FGDs described the difficulties posed by a lack of financial resources for climate adaptation by noting that;

> "There are many fertilizers we use in our household activities, and these are very expensive for most rural households in this village but obtaining credit to buy fertilizers and other household inputs is extremely difficult. In the 1960s, when I was growing up in this village, my parents didn't have to use fertilizer on their crops and they didn't use tractors for household chores. This reduced the financial stress of running a household. If you don't fertilize your crops these days, you'll get insufficient yield to feed your own household. Although housekeeping has become more capital intensive, rural households still face challenges in obtaining credit".

Financial services are primarily associated with agricultural production, but the lack of them in economically disadvantaged areas exacerbate the adverse effects of climate change on the livelihoods of those communities' households. Resilient households, for example, found difficulties in accessing bank credit facilities for household activities as noted in the FGDs. Participants claimed that banks are reluctant to provide farming loans to households because they are concerned that households will not be able to repay the loans given the high risk of rainfed agriculture serving as a source of income. A key informant was of the view that;

> "Many households in this community cannot afford to provide the collateral banks require, such as land title registration or ownership of assets like a building, making it difficult to get loans for adaptation strategies"

The study discovered that the rural households in Jotsholo could not borrow because they couldn't provide the banks with enough collateral. According to one participant response, the problem was quite severe;

> "For some reason, loan application procedures are time-consuming. Although loans are given to households, they are often late and arrive after the main householding season has ended, and the money is used for other purposes, making it difficult to get money for repayment. Non-payment has led to banks pursuing some rural households, and life has become unbearable for them."

These findings are connected to the seasonal calendars in these societies. The resilient communities, for example, have a seasonal calendar that shows household planting in September

and October during the FGDs. The study noted that the first rains must be used in conjunction with the availability of planting materials and other household inputs during those times. Failure to plant at the correct time meant plants would be subjected to seasonal drought during the most critical stages of growth. As a result, households had difficulty planning their land and household inputs from the start of the household season because they couldn't get loans in time. As a result, they missed important deadlines for household activities, increasing their vulnerability to seasonal drought.

4.7.2 Poor Access to Information on Adaptation and Institutional Support

Salvatore (2018) notes that more rural household participants indicated that such adaptation choices are not being followed due to a lack of awareness. Few households were aware of climate risk insurance due to a lack of awareness about insurance plans. The majority of participants noted that there was lack of institutional support. One of the participants was of the view that;

> "When it comes to knowing when the rains will start, we don't have reliable access to the weather information. We rely on our traditional knowledge, but as the climate changes, it is becoming increasingly unreliable. Rural households cannot plan their householding activities because of a lack of reliable rainfall distribution information during the householding season."

Although there is a general perception that there is no climate-related information, the findings are critical to show that substantial differences exist in resilience to vulnerable households because of the limited access to climate information (especially in vulnerable areas). Implementing better climate adaptation strategies and, more broadly, utilizing agricultural technology can influence climate knowledge accessibility.

Extension officers' lacked refresher courses to update information they had learnt at colleges. When it comes to climate adaptation strategies, it's critical to provide information in local languages and to use terminology that's familiar with the idea of climate adaptation strategies (Maponga, 2013). In this regard, Makumbe (2013) argued that households and the general population have a clear control over climate change adaptation measures to ensure that such policies are effectively enforced when the messages are given in vernacular. As a result, it's critical to combine household-based indigenous climate adaptation knowledge with scientific information

on climate change so that households can take ownership of and adopt adaptation and coping strategies on their own terms.

4.7.3 Infrastructural challenges

The majority of the participants in FGDs cited infrastructural challenges in the fight against climate change and mechanisms in which the rural households can cope to climate change. Some of the adaptation strategies that were identified by the participants in the study called for the use of a well-serviced electrical grid, and improved water supplies which was an impeding factor for the participants in the district. Malaba (2016); Okali (2016), and Nkala (2015) note that poor roads and damaged bridges linking the villages in Jotsholo was a challenge. Some of the areas were not reachable by cars which made it difficult for awareness campaigns to be held in capacitating the rural households in climate adaptation strategies. Every rainy season, the destruction of road facilities has led to coping mechanisms being difficult. A connection to the national power grid link would have allowed the ward's household to diversify their income sources, but it was difficult to diversify as the necessary infrastructure was not in place. The study also notes most of the infrastructure from the colonial era was not serviced from time to time and some of it was dilapidated hence making coping mechanisms difficult. During the rainy season, the condition of the clinic's roads and bridges made it difficult to get diesel there. Boreholes were not maintained hence making it difficult for water to be available and accessible to the rural households. Participants to the focus groups in Jotsholo, Lupane district indicated that infrastructure was a major roadblock to any development initiative in the district.

4.7.4 Social-cultural barriers to climate change adaptation

Household belief systems are a major roadblock to implementing climate adaptation strategies. There is a lot of attention paid by rural households to how they perceive climate change and how they will respond to it (Ondieko, 2018). According to the findings, households in fragile and resilient societies, including those headed by men and women, believe that traditional values and expectations will make it difficult to effectively adapt to the environment. A participant in a FGD noted that one may find himself or herself in "unpleasant situation," such as meeting a "goblin," if they were disobedient to the Gods. Precipitation and drought are considered to be natural events that are controlled by Gods as noted in the FGDs hence enhancing the relations between men and the God plays a key role in the society. The scientific approach to climate change is not considered by the households in Lupane district.

According to results from FGDs the rural households' provision of scientifically sound climate change information has no effect on policy adjustments. The adoption of proactive measures for climate change and variability adaptation is heavily influenced by social belief and cultural structures (Pelling, 2012; Posel, 2012). The cultural barriers in northern Burkina Faso, for example, discouraged cultural groups from using these subsistence methods to lessen their exposure to climate change (Zikhali, 2019). And the failure to infuse subsistence methods in a way led to the people being exposed in the process as is the case in Lupane district.

4.7.5 Lack of readily available markets

Some climate adaptation policies, such as planting drought-tolerant seed crops and diversifying crops, was identified to be difficult to implement if rural households in the district. Rural households' inability to meet credit repayment obligations was also highlighted by participants in FGDs as a barrier to climate adaptation. If rural households are unable to find good markets for their goods, they will be unable to pay back their loans and will therefore be unable to obtain potential loans for the implementation of adaptation strategies.

The absence of market conditions is linked to a scarcity of storage facilities for rural household produce. The study also noted that the lack of storage facilities reduced the negotiating power of the rural household farmer producers when it came to settling household price disputes. As a result, most of them were forced to accept the price set by the market people because they have nowhere to store their produce. Value addition and beneficiation is the way to go in order to empower the rural livelihoods but however there were no investments identified in this regard to empower the rural livelihoods. In Jibajiba there was investment in production machines but after the raw materials were used the project died a natural death as the NGOs which came with the project had exited the Village. Thus, sustainability is not considered in the process of initiatives which would have been launched in the district. Also, the initiatives are not well coordinated thus in the process of assisting the rural livelihoods they end up causing more confusing in the process.

4.7.6 Contributions of Attitudes and Perceptions Towards Vulnerability

Climate change has been researched from several angles, including socioeconomics, weather patterns, and the underlying structural causes. There is a link between drought-related attitudes and beliefs held by men, women, and non-governmental organizations (NGOs). There are a

number of different types of attitudes that households have, and they are specified in Tesser (1995). On the subject of how one's actions might influence one's attitude, Tesser (1995) notes that that one's sentiments, ideas, and facts all play an important role as attitudes are a person's inclination to act in specific ways as a result of their prior experiences and temperament. It is entirely up to the individual to decide on his or her mental state. It's the process of interpreting and organizing sensations to generate a meaningful world experience that is described by Lindsay and Norman (1977). Information is filtered and prioritized according to one's beliefs, experiences, and attitudes (Pickens, 2005). Adaptability to change depends on whether or not an individual recognizes an influence as a risk and whether or not he or she is able to act.

According to these experts, perception affects individual decision-making but also restrains group action. Households in the study expressed a sense of helplessness over having no other means of subsistence than farming their land. Only a few households kept the money they earned, which was used solely for day-to-day expenses and was not intended to be invested. Although the economy had collapsed and there had been several droughts, some households were able to embrace the opportunity that came with the climate change taking place. The household's coping techniques made little money, they were the only alternatives they saw as a way to complement their failures in agricultural production. Teaching households, a variety of skills would better prepare them to deal with the consequences of natural catastrophes.

4.8 Implications of Climate Change Adaptation on Rural Livelihoods

Diversification has been found to be hampered by a wide range of policies and factors. A sustainable livelihood based institutional analysis identifies policy areas for which initiatives are feasible, but only if sufficient resources, particularly financial resources, are available. The sustainable livelihoods approach criticizes top-down policy formulation and implementation, noting that local groups should actively participate in formulating and implementing policies that affect them in accordance with its own development objectives. While policies are focused on rural development, they are increasingly prepared to protect those in power at the expense of livelihood and long-term viability as is the case in Lupane district.

Institutional structures influence livelihood diversification and construction at the district level in a positive and negative way. Rural resource access and rural household diversification were also

explored, with results showing who had access and how rural households did so. The findings of this research show how rural households can maintain access to the services they need in order to build long-term financial security for their families. The SLF's structural orientation makes it possible for members to participate in important policy debates. According to the findings of this research, rural households' ability to diversify and maintain their political strategies has been influenced by both formal and informal institutional factors. Every day, local micro-institutions work to make essential services available to the people who depend on them for their livelihoods.

The ability of rural households to build sustainable livelihoods was identified to be influenced by a wide range of factors, including natural resources and other properties like technology, skills, health status, and social networking. Households' access to capital is partly determined by their vulnerability context, which considers external and domestic economic developments as well as shocks like floods and epidemic disease outbreaks. Semi-arid fields have continued to play an important role in agricultural development throughout history despite a clear trend away from agrarianism, according to the findings. From a different angle, the continued dominance can be attributed to numerous external interventions that aid agriculture. Droughts, diseases, and the economic downturn have all harmed agriculture's ability to feed district population, while organizations have reaped the benefits of these trends.

4.9 Chapter Summary

The chapter concluded by looking at climate adaption measures in Jotsholo, Lupane district. Due to its location in an adverse agro-natural environment, climate change is widely regarded as a reality in Jotsholo, Lupane district. There were some common responses to climate change in Lupane area, but they lacked sustainability, as they did not provide enough income to maintain the households. Despite the fact that several stakeholders reported supporting various adaptation techniques in the study area, it was discovered that only a few households were actually implementing them. When it came to selecting interventions and promoting new ones, it is important to involve members of the community in the process. On the other hand, there was a question of how cultural practices, religious beliefs, and educational levels influence behavior change. Focus group discussions and interviews revealed a paucity of alternatives to rain-fed agriculture. However, despite the transfer of skills and knowledge, the attitudes and beliefs of the

households impeded any change in behavior. The majority of households stated that they had not received any early warning information regarding climate change, and even if they had, little could be done to protect themselves because they were unsure of where to begin. The difficulties that households face during climate change are largely due to their use of negative coping mechanisms, insufficient adaption techniques, and a lack of viable income options.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

In this chapter, the results of the study were used to summarize the; "Climate Change Adaptation for Sustenance of Rural Livelihoods in Jotsholo, Lupane District, Zimbabwe". Thus, this chapter concentrated on summarizing the findings and making recommendations, as well as outlining potential directions for future study. Long-term interventions are more effective when rural households are at the centre of the development process. This chapter summarizes the findings of the research and discusses the study's goals considering them.

5.1 Summary of Key Findings

The summary of the study findings were summarized in accordance with the research questions. Top priorities were identified and explored on. To get at the results, which were deemed relevant and required, researchers employed a combination of livelihoods and risk mechanisms. In the age of climate adaption, human-environment relationships are more crucial than ever for building resilience, well-being, and biodiversity. The analysis and discussion of rural sustainability in this report were built on human relationships. No matter how much financial assistance households received for implementing sustainable adaptation strategies, the danger of climate variability remained. As a result, there is need for robust policy frameworks to be put in place. To better comprehend the knowledge gap, the following study summarized the study findings based on the objectives;

5.1.1 Socio – Economic and Environmental Impact of Climate Change in Jotsholo, Lupane District

The primary goal of this study was to examine how climate change has an impact on the study area. Also recognized in Jotsholo, Lupane district were the effects of climatic change on natural resources. Land, vegetation, and water were all rated as "degraded and significantly degraded" by the household respondents in the study. Efforts to ensure the long-term viability of these resources were unsuccessful. Droughts and floods are the climatic variables that have influenced the rural livelihoods of households in the Ward for the previous ten or more years.

- Climate change affects rural livelihoods at the household level. The majority of households that took part in the survey agreed that the number and range of options available to those living in rural areas had steadily declined. Research undertaken by Balama et al. (2015), Dube et al. (2016), Jiri et al. (2015), Zimmerer and Vanek (2015) and Zimmerer and Vanek (2015) supported this conclusion. A combination of climate change, as well as other factors, influenced the number of crops and cattle reared. As an example, the yields of crops were reported to be so low that households were unable to use them for more than one season at a time.
- Sorghum, a drought-resistant crop, was found to be preferred by the households to cope to climate change though there low uptake . In Jotsholo, Lupane district, whose livelihoods had diminished owing to climatic change, supporting and strengthening the marketing circumstances for sorghum production could be an essential solution. According to the household respondents, crop production has fallen over the past ten or more years. Due to its rain-fed nature, agricultural production was generally seen as unsustainable.
- Raising small animals like chickens or guinea fowls was viewed favorably in the ward as a viable source of income by the residents. There were also small herds of cattle, goats, and sheep, although the average number of animals per household was low. The amount of cattle is regarded low since it is sold to meet other financial or food needs, a remark similarly made by Chikodzi et al. (2013) and Msomba et al. (2012). As a result, if this practice is not carefully managed, it could enhance the vulnerability of homes. This means that the sale times for various types of animals differ.
- There were higher sales of smaller livestock like goats compared to larger livestock like cattle. Arid places like Jotsholo, Lupane district were found to be appropriate for livestock production, whereas crops often failed owing to water constraint. The ward's socio-economic situations are being impacted greatly by climate fluctuation and change. The lack of financial resources has a significant impact on the long-term viability of the people's livelihood plans. There was, however, an abundance of untrained workers in the ward. Innovations in livelihood diversification could lead to long-term sustainability. Creating policies that encourage collaboration and partnership could help.

5.1.2 Livelihoods Coping Strategies used in Jotsholo

The goal was to examine adaptation methods in Jotsholo, Lupane district to minimize climate change livelihoods.

- Drought-tolerant animals were widely accepted as an effective coping strategy by most rural households that participated in the survey. Crop calendars and patterns might also use conservation and enhancement, according to the recommendations.
- Survey participants believed that crop diversification played a role enhancing coping strategies in Jotsholo, Lupane district. Jotsholo's adaptation techniques to climatic variability and change were found to have a substantial association with the practice's longevity. That is, the more time an adaptation technique is put into use, the more sustainable it is. It was noticed that drought-resistant crops and animals have been beneficial in keeping most household's livelihoods going in the ward even as their productivity has been falling recently. There were large numbers of households who noted that they had been in the ward for a short time and were still assessing the tactics' long-term viability. Long-term residents were able to demonstrate that they have adopted several different tactics, including flood recession cultivation. Increased siltation and decreased water holding capacity of local rivers due to practices like flood recession cultivation have made the ward more vulnerable to climate change. Such malpractices are causing the ecology to deteriorate, resulting in a loss of vegetation cover.
- It was also discussed how to adapt to major climate variables (drought and floods) in the ward. Households members who participated in the survey noted that they were able to cope by growing drought tolerant crops and rearing tolerant livestock, receiving grants or donations from the government or non-governmental organizations, cutting back on their food intake, and selling off household assets.
- To some extent, these short-term strategies evolve into long-term adaptations, as demonstrated by Dube and Ansell (2016) and Ansell and Ansell (2016). Climate change in underdeveloped countries and peripheral places like Jotsholo necessitates the development of effective coping and adaptation measures. The lack of efficient management in the implementation of multiple coping and adapting measures only serves to increase the level of insecurity in the ward's households.

5.1.3 Social Dynamics of how Households Communicate and Share Experiences of Climate Change Adaptation

- The study noted that climate change information was not widely disseminated in the Ward, despite the efforts of numerous non-governmental organizations (NGOs). It was discovered that no information on temperature fluctuation and change was typically collected from rural household respondents in the Ward. It was noted that the Chief and Councillors regularly attended meetings and conferences in cities and towns to discuss climate change issues but they did not report back. Despite the efforts of numerous non-governmental organizations, climate change information was not widely disseminated in Ward. This ended in the rural households resorting to listening from radios and sharing information on what they believe would be occurring among themselves.
- Furthermore, most of them had no idea of climate change because they had never heard of it from anyone. However, Agritex officers, teachers, EMA and CPU officers, and ZMSD officers all acknowledged that they had received climate change information. Some people make use of data from non-governmental organizations (NGOs). Households did not have access to or purchase newspapers, so the media did not serve as a source of production. Clearly, distance from the area hampered climatic data's distribution, resulting in a sample size that was tiny and focused on household members.

5.1.4 Barriers to Climate Change Adaptation in Jotsholo, Lupane district

- Households in Jotsholo, Lupane district identified natural disasters, a scarcity of capital, a lack of institutional support, a lack of alternate fuel sources, poor infrastructure, an undeveloped market for locally produced alternatives to fossil fuels, and a labor shortage as the biggest obstacles to climate change adaptation. There are varied degrees of impact on the studied area's ability to respond to these problems. For example, while natural disasters, knowledge level, fuel sources, institutional and financial challenges were highly influential on nearly all identified adaptation strategies, poor infrastructure and marketing issues were other setbacks to long-term adaptation to climate change in Jotsholo, Lupane district.
- Climate change adaptation in Lupane district relied heavily on the availability of knowledge. Climate change concerns require practical answers, even though most household participants have a minimum education in primary and secondary education.

Household respondents in the research area had seen an imbalance in local petty trade, particularly in cattle. They had been taken advantage of by traders. As an example, the marketing of cotton, a good crop for the area, had been a major influence. Some people have stopped producing the commodity since the cost of manufacturing has reached the price at which it can be sold. Because of these institutional issues, the solution lies in better management of livelihoods at both the national and local levels. It is important to focus on rural development because it is the primary source of raw materials for manufacturing activities that take place in cities and towns. Rural areas should be made more accessible and energy sources that don't harm the environment should be used, such as fire wood, instead of fossil fuels. The promotion of resource efficiency should also be encouraged.

5.2 Reflections in Relation to the Theoretical Framework Used

The Sustainable livelihoods method was utilized by the researcher to examine rural livelihoods and climate change adaptation. It is imperative to note that the framework aided the rural livelihoods of Jotsholo, Lupane district in better understanding and articulating the important factors and determinants of sustainable livelihoods (Masud, 2016). Knowing how natural resources affect climate was critical for rural household livelihoods. The majority of participants who took part in the study noted that Jotsholo, Lupane district is vulnerable to climate change. By utilizing the approach, the research managed to explore on the livelihoods structure of Jotsholo, Lupane district by focusing on studied people's difficulties in relation to capital of livelihood to understand the Ward's survival (natural, physical, financial, social and human).

As well as capitals, the researcher focused on shocks and stresses to better understand why rural households vulnerable and why different rural households had access to resources and income from different types of livelihoods. In order to be effective, the researcher needed to grasp the link between population dynamics and climate change. Households in rural areas are increasingly living and earning their living away from their land, according to the vulnerability and sustainable livelihoods approaches. The approaches uncovered certain long-held beliefs about livelihood diversification and farming that were previously held in the ward. Contrary to popular belief, migration and other economic factors are not decreasing the living standards of rural households. As a result, increasing one's sources of income speeds up the re-agrarianizing process.

The SL approach also considers capabilities, such as assets, as part of the mix in their analysis. It is important to remember that certain capabilities (such as access to resources like land and labor) are just potential capabilities. There must be concerns in order to draw on potential capacities and put them to use in projects. A household's use of its available resources is determined by the priorities it sets, and this, in turn, is dependent on the capacities that are even available to a given household, which are determined by structural factors like vulnerabilities, constraints, and enablements. Climate adaptation projects in rural areas like Lupane district are affected by the unique concerns, capacities, and enablement-constraints of each agricultural household (such as those in Lupane). One explanation for the wide variety among Ngundu farmers' adaption tactics is that of this. In the words of Archer (2007:6), "the heterogeneity in the activities [projects] of people similarly socially positioned" must be examined afresh.

As a result, household livelihood paths are unlikely to be predetermined in a linear fashion. Instead, they are likely to be dynamic and subject to change depending on the unique characteristics of each home. That's why we took a long-term look at how people of a certain age are dealing with the effects of climate change in this thesis. Finally, I address the issue of morphogenesis. Lupane households' climate change adaptation efforts appear to be reiterating rather than reversing the current state of affairs. In the face of climate change and variability, Lupane households have made some adjustments to their way of life through adaptation, but their increased vulnerability makes it difficult for them to make significant alterations. Climate change and variability appear to have re-enforced the vulnerability of Lupane households over time, and this trend is expected to continue in light of these changes. Rural households in this study relied on rainfed agriculture for the majority of their sustenance. It was employed in Jotsholo to keep track of all the food and water supplies. According to their findings, household stability and climate change adaptation are intertwined when focsing at the features of various commodities. Indicators used for all of the research objectives are listed in Table 5.1 and the process was the same for all of them (see figure 5.1).

Table 5.1 – Prototype of Livelihood Indicators in Jotsholo, Lupane District

Dimension of sustainability	Livelihood capital	Indicators assessed
The biological and the physical (Environmental)	Natural capital	Land features, vegetation features, water features, wild animal features, mineral features, and natural disaster features.
Economic	Physical capital	Household housing characteristics, kitchen appliances, and infrastructure conditions (roads and bridges).
	Financial capital	Financial resources available, crop and animal production values, livelihood portfolio value and labor value, adaptation choices selected and market characteristics
Social	Social capital	Social amenities, stakeholder roles and their effectiveness, as well as household perceptions of sustainability, all have scientific and IKS evidence to support them.
	Human capital	Characteristics of the labor market and the population, such as education and skill levels.
Governance	Institutional processes	There is climate change laws, livelihood management systems, institutional characteristics and governance structures in Zimbabwe.

Svubure et al. (2016) notes that the combined history of this study allowed households to engage in the sustainable adaptation mechanisms because of sustainability characteristics and indicator status. This study by Sharma et al. (2014) shows that transferring one household's capital affects the stability of the city as a whole, both directly and indirectly. In terms of sustainable livelihoods, it improved adaptability, accessibility, and comprehensiveness of data collection (Huai, 2016).

The sustainable livelihoods paradigm was used to build the most functioning and climate-change-resilient rural livelihood systems. As an example, NGOs, like Wright et al. (2016) have an important and perhaps viable point of view. Households benefit from the system because it places

a strong emphasis on assisting them in resolving issues that come from their assets and duties. The development of climate adaptation strategies in Jotsholo, Lupane district is therefore critical to achieving the sustainable development objective, as has been indicated.

Non-governmental organisations complement governments, yet they have little say in what they require. The lack of resources, infrastructure, structural integrity, and utility limit the effectiveness of adaptation techniques recommended in places like Jotsholo, Lupane where the climate change threat is greatest. As a result, rural subsistence research must be appropriately considered in terms of biophysical, social, and political adaptation to climate change. Geographic information systems-based methods for discovering geographic differences within the ward are more effective when dealing with livelihoods and climate change adaptation plans, according to the research.

5.3 Action Plan of Climate Adaptation in Jotsholo, Lupane District

A climate adaptation action plan was developed in collaboration with participants in Jotsholo, Lupane district based on the study's recommendations. The action plan's goal is to improve the efficiency with which climate adaptation systems are implemented in rural livelihoods like Jotsholo, Lupane district. The stakeholder engagement conducted in a way was meant to create ownership and inculcating skills to improve of climate adoptive strategies.

Table 5.2 - Action Plan of Climate Adaptation in Jotsholo, Lupane Disitrict

	Action	Partners	Time Frame	Indicator
1.	Strengthen local organizations to support individual (male and female) and community adaptation	Ministries and Non-Governmental Organizations (NGOs)	2 meetings per year	Number of individual and community adaptation programmes implemented
2.	Identify individuals (male and female) and communities at most risk from climate change within municipalities and deliver targeted climate change vulnerability reduction programmes for these individuals and communities	District Development Coordinator (DDC), Social Welfare, NGOs	Throughout the year	Number of vulnerability reduction programmes implemented
3.	Develop a list of resiliencebuilding projects that can easily be replicated	DDC, NGOs	2 times per year	List of successful resilient building programmes and projects that can be replicated
4.	Knowledge and capacity building for the public, especially vulnerable groups (male and female), to prepare and adapt to climate change	DDCs,NGOs	4 times per year	Capacity building conducted
5.	Capacity building climate change diversification (Farming and business)	Ministries, DDC. NGOs	Though out the year	Capacity building conducted

6.	Educate both informal and formal businesses on the potential economic implications of climate change risks and provide support on how to better prepare for these risks in advance	Ministries, NGOs	Throughout the year	Trainings conducted
7.	Information sharing on climate change and climate change adaptation in Lupane district	Local residents in Jotsholo	Throughout the year	Information shared amongst the rural households in Lupane district
8.	Monitoring and Evaluation	The Researcher and Rural Households	Quarterly	Monitoring and Evaluation Conducted

5.4 Recommendations

This section contains policy ideas for the Zimbabwean government on how to deal with climate change issues related to rural livelihoods. The proposed recommendations were based on what was explored in this thesis. In general, the goal was to uncover additional techniques and policies that may be explored in order to lessen or eliminate the vulnerability of low-income groups like Jotsholo, Lupane district to the detrimental consequences of climate change. The data gathered was used to develop a more comprehensive understanding of rural adaption techniques and their associated difficulties and solutions in the future.

5.4.1 Reducing the impacts of Climate Change on Biophysical and Socioeconomic Conditions in Lupane District

In order to lessen the negative effects of climate change on the socioeconomic environment, residents of the Ward reaffirmed the adaption methods they had already implemented. Additionally, the cultivation of drought-resistant crops and livestock, as well as a wide range of other measures, such as agricultural diversification, irrigation, agroforestry (carbon projects), climate insurance, and food rationing are all included in these measures. Households should also be aware of the shifting commencement of rainfall, which has an impact on the crop calendar and pattern, in addition to what has been discussed previously.

Their IKS and weather forecasts from the ZMSD should be integrated into Lupane district farming activities. Irrigation, conservation farming, and mulching, on the other hand, necessitate a plenty of water, which is in short supply in the Ward. All stakeholders, however, should work harder to improve the systems in place to ensure the availability of water. The need of water collection is undeniable. Publicity about climate insurance and the specifics of how it works still need to be disseminated throughout the community. In order to receive compensation for the sequestration of carbon, agroforestry and the maintenance of forested areas are highly recommended. Deterrent measures should be taken against any practices that enhance river siltation or reduce vegetation cover. The promotion of coping strategies in the ward is also necessary, since these may develop into adaptive techniques, as has already been demonstrated.

Food security in Jotsholo, Lupane area was found to be threatened by this study's assessment of the production levels of chosen commodities. For example, crop output has fallen or considerably decreased during the past 10 or more years, according to household respondents. Due to the fact that most of the output is rain-fed, this problem has been exacerbated. As a result, non-farm activities such as petty trade and the selling of labor in low-income areas are recommended by the study as a way to diversify livelihoods. Protecting forests that store carbon and reduce climate change can also generate revenue for the community through the sale of carbon credits generated by this effort. Once the area's accessibility is improved, it can be turned into a tourist destination.

During the rainy season, market gardening for the production of vegetables flourishes because there is little or no surface water for most of the year. During the eight months of little or minimal

rainfall and extended drought, it is recommended that households preserve their vegetables and wild fruits by drying them for later consumption. The drying of crops and fruits for off-season consumption is therefore suggested. They could also use the commodities to trade with other regions or cities and generate much-needed cash.

5.4.2 Enhancing high awareness levels to climate change in Jotsholo, Lupane District

Due to the lack of scientific knowledge about climate dynamics and climate change problems among Jotsholo's households, the report suggests diversifying information distribution approaches to ensure a better understanding of the situation and to promote better responses to climate variability and change in the region. Mobile phones, TVs, print media, and other types of ICT can supplement the ICS in terms of climatic and shifting knowledge among families, thanks to their size and widespread use. Climate change and development may have an impact on students at all educational levels, including elementary, secondary, and tertiary.

Universities and other relevant organizations must establish their own systems to address this problem, prepare in climate technology and hire their own weather trainers. Because of this, climate change information should not be held back because of the district's isolation. Content should be generated in a transparent and effective way. Information generated should be disseminated in vernacular languages. More capacity building initiatives should be conducted and both scientific and indigenous knowledge management systems should be made available to the local people. The study further recommends a bottom – up approach to be put in place to capacitate the rural households in information dissemination.

5.4.3 Enhancing rural livelihoods through sound and appropriate natural resource governance

Even though agriculture has emerged as Lupane's primary rural source of income, concerns about the region's natural resources have reportedly undermined agriculture's governance and performance. The Shangani and Gwayi rivers have both been deforested and silted up as a result of increasing levels of land erosion. Because of this, water shortage has grown to be a major problem worldwide. The demands of the region should take precedence over water harvesting and management technology. With a competent management team and lands all the way to the river donated to senior people, we're well-positioned. Government inspections and awareness seminars

with Ward families should be expanded to address the long-term repercussions of such accidents and their management by agencies like the EMA, CPU, and Agritex officials. During these cycles of climate change and unpredictability, a range of tactics can be used to transmit information about good management practices and the repercussions of poor management. For example, ICT and other mass media can be used to create flyers and other household access methods that benefit from climate change adaptation.

A training center might be developed in the Jotsholo, as well as in other rural communities, to assist in training school leavers and improving livelihoods systems. Rural households can be empowered to make jelly, wine, and natural soft drinks from fruits like Ziziphus mauritiana and adansonia digitata berries instead of eating them raw. Youth who are unemployed can be empowered through additional job possibilities. When local natural resources become more important, preserving, restoring, and maintaining the households economically. With their increased ability to sequester carbon dioxide, wild fruit trees could help reduce greenhouse gas emissions. There would be less soil erosion due to the increased plant coverage.

Due to the Jotsholo, Lupane's remoteness and inaccessibility, a strong commitment to technological development (including network connections) must be made. Most issues arise as a result of inadequate attention being paid to communication networks. A development committee could be established in partnership with the government and other organizations such as civil society, non-governmental organizations (NGOs), and the commercial sector to assist in infrastructural development.

5.4.4 Enhancing stakeholder participation in sustainable rural livelihood adaptation to climate change in Lupane District

The government should continue lobbying for the easing of the conditions for the global climate change funds in order to qualify as a country to access and benefit meaningfully from the development and implementation of adaptation strategies like other developing countries, in order to strengthen adaptation efforts among the local community. As soon as funding becomes available, the government should make sure that it is used for projects that help those in need.

Climate change data should be generated by educators and academics in order to facilitate relevant debates in international fora, according to this research. Researchers have bemoaned the lack of financing for climate change research in underserved areas (Donner et al., 2016; Shisanya and

Mafongoya, 2016). As a result of this research, it is recommended that the government, as well as the business sector and non-governmental organizations (NGOs), devise new ways of funding climate research. Climate change is a complex subject that requires a wide range of stakeholders to work together in order to ensure a long-term, sustainable response.

The local community's protracted and delayed execution of planned services contributed to the broader public's perception of government participation as ineffectual. Cyclone Elena's devastation to infrastructure (such as bridges and roads) is an illustration of this. According to this study, the government should take care of the vulnerable communities like Jotsholo, Lupane district in order to protect households. Those most harmed by climate change, both socially and economically, should receive special attention. Self-help value-added projects could also be a means of empowering the local population. As a result, they would be less reliant on donations and more likely to nurture new ideas and approaches.

5.4.5 Management of challenges encountered by the households in Jotsholo, Lupane District

Household participants in Jotsholo stated that the problems of climate change adaptation include natural disasters, inadequate funding, lack of administrative support, an inability to supply renewables, poor utilities, business shortages, expertise shortages and labor shortages. The paucity of financial capital has been cited by household participant as a roadblock to long-term climate change adaptation. Studies show that household-designed micro-finance programs like micro-loans are a good way to help people make ends meet on a daily basis. Additionally, you can form non-profit community marketing organizations to assist those who are being exploited to sell their products. Their involvement in local livestock enterprises may lead to cheaper production costs and a pooling of resources for such activities.

Due to a shortage of institutional funding, this report recommended that the Zimbabwean government enhance development initiatives in outlying areas such as the Lupane district. In order to alert the public and educate them on how to effectively respond to climate change variability, qualified and relevant workers should be provided. Officers who want to serve in outlying areas may be able to get assistance. The universities in the region should be encouraged to set up research centers in the region to investigate city problems and then come up with answers, on the other hand.

5.5 The Study's Policy Implications and Rural Livelihoods Development in Zimbabwe

Policy planning in Zimbabwe and the development sector, in general, has been affected by the conceptual framework for climate adaptation to rural livelihoods. It is built on the notion of starting with a clean slate and working backwards. Multiple rural household livelihood sectors or the numerous economic segments of a nation's economy are regarded as interrelated. It's important to incorporate flexibility into the policy-planning process when multi-sectoral planning has been put in place, according to vulnerability theory and the sustainable livelihoods approach hypothesis. Because of unidirectional trends like rising population, diminishing land availability, and increasing urbanization, flexible policy planning is typically required to address these problems (Adger et al., 2009). Flexible policy planning is essential to address cyclical patterns such as the intrinsic seasonality of Zimbabwe's farming cycle in addition to responding to unidirectional trends (Care,2016). Containment or minimization of risk should be second priority to risk management. Take-on-a-moderate-risk strategy is beneficial, according to the study's findings. The implication is that public policies should work to maintain a legal environment while also lowering other dangers like political upheaval, war, floods and diseases to the minimum extent possible (Svodziwa,2020). The advantages of minimizing idiosyncratic risk are, however, diminishing over time.

The development of policies that are relevant and customized to the local context has also been noted as a crucial function for participation (Chambers 1983). Instead of combining these disparate ideas, resilience theory does so as a single theoretical framework. Other than that, the thesis provides policymakers with minimum requirements for developing resilience in the form of three measurable resilience indicators: diversity, resource control (adaptability), and learning (transformability). There has been little attention paid to mechanisms that facilitate change, such as securing access and control over assets and establishing learning capacity, until now in risk management strategy (Chazovachii, 2013)

Households are well-known for their role in stabilizing food prices and ensuring food security (WB, 2007). In order to diffuse risk and provide resilience in households' rural livelihoods, agricultural policy must foster diversity instead of specialization, as well as flexibility and learning (to manage risk). Agriculture in Zimbabwe comes with many risks, so it is vital to promote a wide range of livelihood options for the people living there. Agriculture harvests are highly erratic even

during the wet season due to irregular water supplies, which makes food production unreliable year-round. The regional aquifers may not be able to support broad irrigation, even though drip irrigation is a solution in some cases. Low levels of fertilizers and automation also lead to low hectare-level yields.

However, depending on the size of the farm, blending crops with varying water and nutrient requirements may be preferable to mono-cropping. Some cutting-edge methods include integrated nutrient cycling (UNEP 2008) and integrated pest management (ICRISAT 2002), which incorporate several components of a farm while saving money on fertilizer and pesticides. Increase natural food availability while simultaneously providing animal fodder and shade for crops by integrating trees into a farm. For this reason, rural inhabitants in Zimbabwe have been able to successfully include trees by conserving native wild trees that grew on their own instead of planting them. It will improve the adaptive livelihood cycle's central learning process if you promote social cohesiveness and communication (Bwalya,2015). Government policies that promote both. Increased mobile phone ownership creates new avenues for the transmission of information, such as market pricing and flood warnings.

The fact that development organizations and governments are often organized along sectoral lines is a major hurdle in implementing a multisectoral strategy to combat climate change's impact on rural livelihoods (Hussein 2002:55). A framework similar to the CGIAR is needed in Zimbabwe's food security policy to coordinate the policies of the Environment, Agriculture, Livestock, Decentralisation, Health and National Solidarity Ministries. It is essential that ministries work together to ensure that their policies are in sync and to find the right balance between allowing for both persistence and change so that interministerial coordination can be successful.

The predicament of rural children must be considered by both government and non-state entities. Low-income households often hire day laborers to supplement their income. So, in places like Lupane district, where the population is primarily rural, child safety programs must be greatly extended. Parks and Wildlife officials must build eco-tourism initiatives and enhance the fence around the Game Reserve. Eco-tourism money may boost socioeconomic growth as well as animal protection, making it a long-term solution for rural livelihood diversification. Governments and non-state actors must broaden their understanding of de-agrarianizing and social differentiation in

order to reduce rural poverty. It's imperative that rural poverty reduction strategies begin with a focus on diversifying rural livelihoods as soon as possible.

5.6 Major Contributions of the Study

These findings have important policy implications because they show that climate change, natural resources management policies and strategies must be integrated with efforts at increasing rural livelihoods production, access to markets as well as providing rural farmers with high-quality technological, technical, and support services so they can better cope with the adverse effects of climate change. According to the data gathered, the government intervenes less to help rural livelihoods in Jotsholo, Lupane district adapt to climate change. This is a common occurrence throughout Zimbabwe and other countries. Rural households in the majority of developing nations, particularly developing countries, face finance constraints, and the international adaptation framework has yet to show significant results in helping them as it’s a top down approach and has no buy in from the stakeholders in the rural areas that are most affected. There is minimal help from extension personnel or non-governmental players for farmers' efforts to ensure their survival in the face of changing and variable environmental conditions. Several policy and strategic measures are outlined in this research to help rural livelihoods adjust and become more resilient in the long run.

However, while it is crucial and required to integrate or otherwise link these adaptation methods and policies to ongoing and planned interventions to help households raise agricultural productivity in the future, initiatives to help farmers improve their adaptive ability are already underway. In order to develop synergies and generate complementarity on adaptation support for farmers, such activities must be linked to current policy and strategic discussions on climate change and natural resource management. While accomplishing rural livelihoods goals, this will help to assist initiatives to reduce poverty. This includes reducing emissions, managing natural resources sustainably, and increasing farm output.

Crop insurance to assist farmers in overcoming climate change-related risks through a loss and damage mechanism should also be an issue of policy interest and significance, as should exploring improved possibilities for its introduction. This topic has yet to be resolved at the UNFCCC, but the development of a Warsaw International Mechanism for Loss and Damage under the Cancun

Adaptation Framework is an encouraging move. Assessing appropriate techniques for putting this into practice so that farmers are supported in the face of climate change while integrating poverty reduction goals and sustainable development variables can be done at national level assessments. In order to provide a starting point on how future crop insurance arrangements can be successful, it is vital to analyze the experiences on providing subsidies, including both successes and failures. More research and development are needed to help rural households in the district produce crops that are drought-tolerant, water-efficient, shorter-cycle, higher-yielding, and have attractive markets.

5.7 Recommendations for further study

This research examined the survival of rural livelihoods in Jotsholo, Lupane district and how they adapted to climate change. The conclusions of the analysis necessitate more research in the margins in order to obtain the additional data required for national planning. All people are affected by climate change, thus it's critical to raise awareness in semi- arid districts like Lupane. There is need to collect statistical data to assist to complement the qualitative data available.

The effects of climate change must therefore be scientifically authenticated and addressed, as well as sectoral responses through research in all economic sectors. However, only publications can show how this topic affects people's lives in various situations by providing studies that support climate change research around the world. It is the country's responsibility to accurately reflect the information and ideas included in the report to achieve the 13th and final goal of sustainable growth. Anybody who is participating in the management of climate change has these qualities: they're available and responsible; they're innovative; and they're cohesive no matter who they are or what their background is.

Moreover, the findings of this study suggest that a possible research gap is the effect of rural livelihood diversification on rural child development. A focus on how varied rural household livelihood choices affect children's well-being is essential for researchers. A lot more research is needed to figure out exactly how small-scale mining affects smallholder agriculture, according to the findings. When looking at household livelihood sustainability, one of the most critical questions to ask is whether or not these two options compete or complement one another. Researchers should also look into how rural development policies might be redesigned to consider

the importance of a diverse rural income mix. Academics in Zimbabwe are also required to review and evaluate post-land-support initiatives on a regular basis. There is a good chance that this will have a considerable influence on their ability to improve the lives and livelihoods of rural people.

Moreover, this research adds to our understanding of climate change and aids politicians in making better choices. In this study, neither climatic factors nor crop production were modelled to determine how much local climate fluctuations affect smallholder farmers' productivity and earnings economically. Various economic activities and revenue sources that farmers depend on, such as crop production, remittance, charcoal manufacturing, animal husbandry, small-scale fisheries, small companies and tourism, were not examined for their contributions. Another omission was to look at how much each of these activities and income sources contributed to the overall picture.

Crop production's role in creating household and community income in comparison to other sources and activities is a major economic study gap. According to the findings of the current study, farmers engage in a wide range of income-generating activities aside from crop farming. The contribution of each economic activity, as well as the origin and long-term sustainability of each of these activities, is, nevertheless, little understood. This is a research gap that must be filled. These findings should be thoroughly analysed to determine which alternative income-generating activities have the most potential to help farmers make money while adjusting farming practices and decreasing pressure on the planet's natural resources over the long term. As part of its conclusions, the study will identify economic activities that might be fostered at the regional and policy levels to aid farmers in adapting.

5.8 Conclusion

This research evaluated the rural livelihoods in Lupane district in terms of survival and adaptation to climate change. It explained rural livelihoods and helped households comprehend climate change issues and how they affect the ward's biophysical and socioeconomic climate, among other things. Although the thesis discussed actual techniques of climate change adaptation, it also looked at obstacles that households experience when trying to deal with the problem. The rural households have also measured stakeholder involvement in climate variability and transition for healthy rural livelihoods. Agriculture, wild fruit harvesting and processing, mining are only a few examples of

rural livelihoods that were studied in this study All conventional subsistence strategies point to climate change as a grave threat to their survival. Remittances from emigrant families, honey extraction, brick moulding, firewood and grass sales, and painting are examples of other sources of revenue that require further attention.

Environmental policies that guide industry resource usage should be able to successfully impose a significant demand in the sector with the help of this research. It is imperative that the district organize and direct effective initiatives and tactics within the district in order to warn of the implications of natural occurrences. Adaptation plans for climate change and instability cannot be put in place without this. In the ward, there is disagreement on stream bank cultivation. In order to have top priority in the Ward, these procedures must be regularized and managed effectively. Rural households should be worried about global warming because of the findings. Even though they are still workable, alternative approaches are essential. Rural households in Jotsholo, Lupane district are under a lot of pressure to live under climate-appropriate laws that also include regularisation of using indigenous knowledge systems. Considering growing challenges such as climatic change, analysis is crucial since it encourages the union of scientific study and social consciousness. The study filled the knowledge gaps on climatic change and adaptation on rural livelihoods in low-income areas like Lupane district which are in the semi-arid areas. Additionally, the study raised and emphasized on the need for multiple organizations to fund climate-related research and capacity-building efforts.

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APPENDIX 1 – LETTER TO CARRY OUT A STUDY IN LUPANE DISTRICT

Correspondences should be addressed

Tel: 09-67261-3
Fax: 09-883790

ZIMBABWE

Ministry of Local Government,
Public Works and National Housing
Matabeleland North Provincial Office
P O Box 1496
Bulawayo
6th Floor, Block G
Mhlahlandlela Government Complex
10th Avenue&Bach Street

10 September 2018

District Administrators
LUPANE

RE: RESEARCH BY SVODZIWA MATTHEW : UNISA

This letter serves to grant authority to the above named to do a research in your District on "**Climate change Adaption for substance of Rural Livelihoods in Jotsholo in Lupane District, Zimbabwe.** He will be visiting wards 9 and 12 .the aim f the study is to explore climate change adaption measures used in the sustenance of rural livelihoods in Lupane District.

May you assist were possible

Your usual assistance is greatly appreciated

Yours faithfully

G. Roundi
For: Provincial Administrator
Matabeleland North

Prov. Administrator–Mat. North
Min. of Rural Dev., Promotion
Preservation of Nat. Culture & Heritage
10 SEP 2018
P.O. BOX 1496, BULAWAYO
TEL: 09-66209/0898/67261-4

APPENDIX 2 - INTERVIEW GUIDE

My name is Mathew Svodziwa, a student at the University of South Africa (UNISA) doing a Doctor of Philosophy in Development Studies (90040). You are invited to participate in this research by providing your views on the, **"Climate Change Adaptation for Sustenance of Rural Livelihoods in Jotsholo in Lupane District, Zimbabwe".** Your help will make this investigation a success. Please be assured that the information you supply will only be used for scholarly purposes. Your participation in this study is completely optional, and your privacy will be protected because the analysis will only look at trends in the data collected from several informants. There will be no publication of any personal information, including names. The study's conclusions are strictly academic, but it is truly hoped that they will reach local, national, and regional policymakers as a body of knowledge that helped them make their decisions, plan, and manage climate change adaptation strategies for the survival of rural livelihoods.

INTERVIEW QUESTIONS

1. What is your understanding of climate change in Jotsholo, Lupane district?

2. If there is climate change, are there any indications or yardsticks in the following areas;

a) Rainfall amounts

b) Rainfall distribution

c) Temperatures

3. Are there any bio-physical changes taking place in Jotsholo, Lupane district on;

a) Forest or natural vegetation cover

b) Water resources

c) Animal resources

d) Soil resources

4. How is climate change manifesting in Jotsholo, Lupane district in the following areas;

a) Social

b) Economic

c) Environmental

5. What type of information on climate change adaptation is disseminated amongst households in Jotsholo, Lupane district?

6. What are the social dynamics of how households communicate and share experiences of climate change adaptation in Jotsholo, Lupane district?

7. How is information on climate change adaptation assessed and used by households in Jotsholo, Lupane district?

8. What structures are available are available to help households adopt to and cope with the impact of climate change adaptation in Jotsholo, Lupane district?

9. To what extent are households coping with climate change in Jotsholo, Lupane district?

10. Are the methods sustainable for households?

11. Are there any elements of maladaptation in households in Jotsholo, Lupane district?

12. Are the interventions enough to support households in rural livelihoods in the wake of climate change and non-climatic shocks?

13. What barriers do female headed households face due to climate change in Jotsholo, Lupane district?

14. What would you suggest towards enhancing climate adaptive capacity in Jotsholo, Lupane district?

THANK YOU FOR YOUR PARTICIPATION

APPENDIX 3 - FOCUS GROUP DISCUSSION GUIDE

My name is Mathew Svodziwa, a student at the University of South Africa (UNISA) doing a Doctor of Philosophy in Development Studies (90040). You are invited to participate in this research by providing your views on the, **"Climate Change Adaptation for Sustenance of Rural Livelihoods in Jotsholo in Lupane District, Zimbabwe".** Your help will make this investigation a success. Please be assured that the information you supply will only be used for scholarly purposes. Your participation in this study is completely optional, and your privacy will be protected because the analysis will only look at trends in the data collected from several informants. There will be no publication of any personal information, including names. The study's conclusions are strictly academic, but it is truly hoped that they will reach local, national, and regional policymakers as a body of knowledge that helped them make their decisions, plan, and manage climate change adaptation strategies for the survival of rural livelihoods.

FOCUS GROUP DISCUSSION QUESTIONS

1. What is your understanding of climate change in Jotsholo, Lupane district?

2. If there is climate change, are there any indications or yardsticks in the following areas;

a) Rainfall amounts

b) Rainfall distribution

c) Temperatures

3. Are there any bio-physical changes taking place in Jotsholo, Lupane district on;

a) Forest or natural vegetation cover

b) Water resources

c) Animal resources

d) Soil resources

4. How is climate change manifesting in households in Jotsholo, Lupane district in the following areas;

a) Social

b) Economic

c) Environmental

5. What type of information on climate change adaptation is disseminated amongst households in Jotsholo, Lupane district?

6. What are the social dynamics of how households communicate and share experiences of climate change adaptation in Jotsholo, Lupane district?

7. How is information on climate change adaptation assessed and used by households in Jotsholo, Lupane district?

8. What structures are available are available to help households adopt to and cope with the impact of climate change adaptation in Jotsholo, Lupane district?

9. To what extent are households coping with climate change in Jotsholo, Lupane district?

10. Are the methods sustainable for households?

11. Are there any elements of maladaptation in households in Jotsholo, Lupane district?

12. Are the interventions enough to support households in rural livelihoods in the wake of climate change and non-climatic shocks?

13. What barriers do households face due to climate change in Jotsholo, Lupane district?

14. What would you suggest towards enhancing climate adaptive capacity in Jotsholo, Lupane district?

THANK YOU FOR YOUR PARTICIPATION