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**THE EFFECTIVENESS OF THE SOCIO-ECONOMIC ADAPTATION STRATEGIES
IN DEVELOPING CLIMATE RESILIENCE EMPLOYED BY PASTORALISTS IN
MOROTO DISTRICT**

A dissertation presented to

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DIRECTORATE OF GRADUATE STUDIES, RESEARCH AND ENTERPRISE

Master's Dissertation

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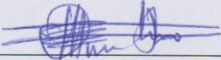
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DEDICATION

I dedicate this work to the pastoralist communities of Moroto District who, despite the mounting challenges posed by climate change, continue to adapt and strive for resilience. May your courage and ingenuity inspire sustainable development and inclusive policy action.

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May God bless you all.

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Abstract

This study examined the effectiveness of socio-economic adaptation strategies in fostering climate resilience among pastoralist communities in Moroto District, Uganda. With the Karamoja sub-region increasingly vulnerable to climate variability, including prolonged droughts and erratic rainfall, this research aimed to explore the adaptive strategies employed by pastoralists and assess their impact on sustainable livelihoods. The study utilized a mixed-methods approach, combining quantitative data from 60 household surveys with qualitative insights from key informant interviews in Nadunget, Rupa, and Tapac sub-counties. Findings revealed that while both local and external interventions; such as borehole construction, valley tanks, and rotational grazing; are visible, they remain inconsistently effective due to infrastructure fragility, seasonal stress, and poor maintenance. Migration emerged as a dominant, yet reactive coping mechanism, offering short-term relief but contributing to long-term socio-economic disruptions, including resource-based conflicts and displacement. Livelihood diversification through crop farming and small-scale businesses is gradually gaining traction, although institutional, financial, and cultural barriers hinder its full realization. The study further highlighted the limited involvement of pastoralists in policy formulation, with weak governance structures undermining resilience efforts. Community-level strategies such as herd splitting, seasonal grazing committees, and traditional forecasting were identified as promising but require greater institutional support, training, and integration into formal adaptation frameworks. Conclusively, the research found that while pastoralists in Moroto District are actively engaging in adaptation, their resilience remains constrained by structural limitations, policy gaps, and a lack of sustained investment. The study recommends strengthening climate-resilient infrastructure, enhancing local governance participation, promoting inclusive policy implementation, and scaling up diversified livelihoods. These actions are critical for transitioning from short-term coping to long-term climate resilience in pastoralist settings.

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Introduction

Pastoral communities in Moroto District, Uganda, face increasing challenges due to climate change, including prolonged droughts, unpredictable rainfall patterns, and land degradation. These environmental shifts threaten their livelihoods, which are heavily dependent on livestock rearing and natural resources. Traditionally, communities have often built resilience towards natural conditions that emerge in their communities through community-based adaptation strategies (Catley et al., 2013). While communities have constantly adapted to new livelihoods to meet or address changes, the impacts of climate change are wide and with potential of pushing people beyond their coping and adaptation capacity (Sokona and Denton 2001; intergovernmental Panel on Climate Change [IPCC], 2022), because of an increasing magnitude, frequency or rate, of weather-related disasters including drought, storms and floods. Consequently, without effective adaptation strategies, these communities' risk severe socio-economic disruptions, food insecurity, and conflicts over scarce resources. Building resilience therefore means that adaptation is seen as "a process that is adaptive and flexible, in order to address locally specific and changing circumstances" (United Nations Development Program [UNDP], 2007; IPCC, 2022). Based on contextual and changing nature of adaptation approached along rapidly evolving and changing climate conditions, this explores the effectiveness of the socio-economic adaptation strategies employed by pastoralists, which is crucial for developing sustainable and resilient responses to climate change.

The chapter provided the background to the study, exploring historical, theoretical, conceptual, and contextual perspectives on climate adaptation among pastoralists. It also presented the problem statement, outlining the key issues that necessitate this research. Furthermore, the chapter details the purpose of the study, research objectives, research questions, scope, and justification for undertaking this investigation.

1.1 Background to the Study

Pastoralism refers to a livelihood system based on extensive livestock production in arid and semi-arid environments, characterized by mobility to access water and pasture (Homewood, 2018). Indicators of pastoralism include herd size, livestock diversity, mobility patterns, reliance on communal grazing systems, and the integration of livestock products (for example; milk, meat, and hides) into both subsistence and market economies. Beyond economic sustenance, pastoralism provides cultural identity, social cohesion, and a system of mutual support that is vital for survival in marginal environments (Catley et al., 2013).

However, climate change has increasingly disrupted this traditional way of life. Climate change is defined as long-term shifts in temperature, precipitation, wind patterns, and other atmospheric conditions due to both natural processes and anthropogenic activities (IPCC, 2022). Its indicators include rising temperatures, erratic rainfall patterns, prolonged droughts, increased frequency of extreme weather events, and reduced availability of natural resources like water and pasture. These climatic changes have resulted in reduced livestock productivity, loss of grazing lands, and increased vulnerability to food insecurity among pastoral communities (Herrero et al., 2016). Rising temperatures, erratic precipitation patterns, and the increasing frequency of extreme weather events, such as prolonged droughts and sudden floods, have significantly disrupted pastoral livelihoods in East Africa. These climatic changes have led to the degradation of rangelands, reduced availability of water and pasture, and heightened vulnerability to livestock diseases, resulting in declining herd sizes and diminished productivity (IPCC, 2021; Nabuurs et al., 2021). Such disruptions have further destabilized pastoral economies by undermining household incomes and exacerbating food insecurity.

The effects of climate change are becoming more pronounced in pastoralist communities. Studies have shown that these communities face prolonged droughts, irregular rainfall patterns, and higher temperatures, which adversely affect the availability of key resources such as pasture and water (Hansen et al., 2019; O'Brien et al., 2020). The region's pastoralists are already experiencing the consequences of these shifts, with declining livestock productivity and increased mortality rates (Thornton et al., 2020). As pastoralists struggle to maintain their herds, they often resort to migrating to neighboring regions like Lango, Acholi, and Teso in search of better resources, which can lead to conflicts over land and water access (Orr et al., 2021).

Many pastoralists in Moroto District are employing various strategies to cope with the growing challenges posed by climate change. Adaptation strategies include migrating to areas with more reliable resources, diversifying livelihoods, and modifying traditional pastoral practices to suit the changing environment (Orr et al., 2021). For instance, some pastoralists have embraced agro-pastoralism by integrating crop farming into their livelihoods to supplement incomes and reduce reliance on livestock. Others have pursued non-pastoral activities such as trade, wage labor, artisanal mining, charcoal burning or small-scale businesses.

While these adaptive responses provide temporary relief, their effectiveness in addressing the broader concerns of climate change remains limited. Migration, for example, often leads to resource conflicts in host areas, while diversification efforts are constrained by limited access to capital, markets, and technical skills. Moreover, the rapid scale and intensity of climatic changes—such as prolonged droughts and erratic rainfall—frequently overwhelm these coping mechanisms (Tenge et al., 2021).

Pastoralists in Moroto District have adopted various strategies to cope with the challenges posed by climate change. Mobility remains a key adaptation, allowing access to resources such as water and pasture, while agro-pastoralism integrates crop farming to diversify income and ensure food security. Some pastoralists have turned to alternative livelihoods, including small-scale trade and wage labor, and others have adopted drought-resilient livestock breeds and improved veterinary care to safeguard their herds (Orr et al., 2021).

While these strategies offer short-term relief, their effectiveness is constrained by significant barriers. Mobility often leads to resource conflicts, while agro-pastoralism struggles with erratic rainfall and limited technical inputs. Diversification efforts are hindered by poor access to markets, financial capital, and infrastructure. Additionally, limited access to climate information restricts proactive decision-making, and policy gaps fail to fully support pastoral livelihoods (Herrero et al., 2016).

Addressing these challenges requires strengthened community-based resource management, expanded financial and technical support, improved climate information dissemination, and the creation of inclusive policies.

The study aimed to assess the effects of climate change on pastoral livelihoods in Moroto District, with a focus on how climate-induced changes affect livestock rearing, resource availability, and socio-economic well-being.

1.1.1 Historical Perspective

Pastoralism has been a dominant livelihood strategy for communities in northeastern Uganda, particularly in Moroto District, for centuries. The region's pastoralists have traditionally depended on livestock rearing as the primary source of food, income, and cultural identity. Over time, they have developed intricate systems for managing their herds, moving between seasonal grazing areas, and maintaining a delicate balance with the environment. These communities have historically demonstrated resilience in the face of climatic variability by relying on local knowledge and traditional coping mechanisms, such as migration, herd diversification, and the sustainable management of pastures (Hodgson, 2000).

Historically, the climate in the region was more predictable, with clearly defined wet and dry seasons that allowed pastoralists to plan their movements and manage their resources effectively. However, the climate has gradually become more variable over the past few decades, with shifts in temperature and rainfall patterns. This variability has been especially marked since the late 20th century, with a noticeable increase in the frequency and intensity of extreme weather events, such as droughts and floods (Thompson et al., 2019). The increasing unpredictability of weather patterns has placed significant strain on traditional pastoral strategies and has undermined the stability of livelihoods that were once highly adapted to the local environment.

In the early 2000s, there was growing recognition of the impacts of climate change on pastoral systems across East Africa. In Uganda, the effects of shifting rainfall patterns and rising temperatures began to be more widely observed in the form of declining crop yields, reduced pasture availability, and water shortages (Okoti et al., 2014). These challenges prompted both local communities and policymakers to increasingly acknowledge the need for adaptation strategies. Migration, once a key survival strategy for pastoralists, has become more complicated as migration routes are contested, resources become scarcer, and conflicts between neighboring communities intensify (Hansen et al., 2019).

During the 2010s, the situation became more urgent as pastoralists in Moroto and surrounding areas began to face not only the effects of climate change but also broader socio-political

pressures, such as land tenure insecurity and conflict over resource use. Government and NGO interventions aimed at supporting adaptation strategies, such as introducing climate-smart agriculture, water conservation practices, and alternative livelihood options, became more prominent. However, the implementation of these interventions has often been slow, and many pastoralists remain skeptical of the efficacy of such external solutions (Nori et al., 2008; Tenge et al., 2021).

Today, climate change is seen as one of the most pressing challenges for pastoral communities in Moroto, as the region continues to experience erratic weather, more frequent droughts, and unpredictable rainfall patterns. The historical reliance on traditional practices is increasingly being tested by the rapidly changing climate, with many communities facing greater food insecurity, livestock loss, and reduced mobility due to conflicts over diminishing resources. This historical context highlights the urgent need to study how these communities are adapting to the changes and to evaluate the effectiveness of both traditional and modern adaptation strategies.

1.1.2 Theoretical Perspective

This study draws on three complementary theoretical frameworks to explore the complex relationship between climate change, pastoralism, and adaptation strategies. These frameworks—namely the Sustainable Livelihoods Framework (SLF), the Livelihood Adaptation Framework, and the Climate Change Adaptation Theory—each offer unique insights and collectively strengthen the study's analytical foundation.

First, the Sustainable Livelihoods Framework (SLF) is fundamental to this study as it provides a comprehensive lens for analyzing the factors that underpin pastoral livelihoods and their resilience to environmental shocks (Scoones, 1998).

Building on SLF, the Livelihood Adaptation Framework (Morton, 2007) highlights the dynamic and iterative nature of adaptation in response to environmental changes. While SLF focuses on assets and structural factors, the Livelihood Adaptation Framework emphasizes how communities adjust their strategies over time. This framework is particularly useful for examining the specific ways pastoralists in Moroto respond to climate challenges, such as through migration, diversification of livelihoods, or changes in livestock management. It adds depth by addressing how socio-economic and political factors influence adaptation processes, thereby complementing SLF's broader focus on resources and institutional structures.

Finally, the Climate Change Adaptation Theory (Adger, 2003) focuses on the mechanisms through which individuals and communities respond to climate impacts, distinguishing between autonomous adaptations (driven by local practices) and planned interventions (facilitated by government or external actors). This framework provides valuable insights into how external policies, programs, and interventions—such as government-supported climate-smart technologies or NGO-led capacity-building initiatives—intersect with traditional pastoral adaptation practices. It helps identify the gaps and synergies between local and institutional adaptation efforts in Moroto District.

1.1.3 Contextual Perspective

Moroto District, located in northeastern Uganda, is predominantly inhabited by pastoral communities whose livelihoods are deeply intertwined with livestock rearing and traditional practices. The district is part of the Karamoja sub-region, a region historically known for its semi-arid conditions, characterized by low and erratic rainfall, high temperatures, and prolonged drought periods. The harsh climatic conditions have shaped the livelihoods of the pastoral communities, who rely heavily on livestock as their main source of food, income, and cultural identity (Lemmen et al., 2020).

Traditionally, pastoralists in Moroto have engaged in seasonal migration, moving their herds in search of pasture and water, often following traditional routes that cross community boundaries. This mobility has been central to the survival and resilience of these communities, allowing them to adapt to the cyclical and unpredictable nature of the climate (Tenge et al., 2021). However, the intensifying effects of climate change are disrupting these patterns, making migration more challenging and less effective. Prolonged droughts and erratic rainfall have led to a decline in pasture availability and water sources, both critical for livestock survival, resulting in a reduction in livestock productivity, increased mortality rates, and, consequently, a decline in household income (Hansen et al., 2019).

In addition to the environmental pressures, socio-economic factors also contribute to the vulnerability of pastoral communities in Moroto. The region has experienced historical challenges such as poverty, limited access to education, and inadequate healthcare services. These challenges have compounded the adverse effects of climate change, leaving many households with few alternatives for livelihood diversification. Although there have been efforts

by the Ugandan government and NGOs to introduce alternative livelihood programs, such as climate-smart agriculture, they have not been widely adopted, and the majority of the population remains dependent on livestock (Tenge et al., 2021).

The socio-political context in Moroto further complicates the situation. Resource-based conflicts between pastoral communities and neighboring agricultural communities are common, especially during periods of resource scarcity. As the availability of land, water, and pasture continues to decrease due to climate change, competition between these communities intensifies, often leading to violent conflicts (Okoti et al., 2014). Moreover, the security situation in the district has been affected by the movement of armed groups, which sometimes target pastoralists' livestock, exacerbating the challenges faced by the local population.

Culturally, pastoral communities in Moroto view livestock not just as economic assets, but as symbols of wealth, status, and social cohesion. The loss of livestock due to climate change-related factors such as drought and disease has profound psychological and social consequences, affecting community dynamics and mental well-being. The deep cultural attachment to livestock makes the shift toward alternative livelihood strategies a difficult and slow process (Behnke & Scoones, 1993).

In response to these challenges, the local communities have begun adapting in various ways. Traditional coping strategies, such as migrating to neighboring regions for grazing, are being supplemented with modern interventions such as water harvesting technologies, agro-pastoralism, and involvement in non-livestock-based income-generating activities like small-scale trading. However, the success of these adaptations remains limited by factors such as inadequate infrastructure, lack of access to credit, and insufficient support for community-based climate adaptation programs.

The contextual factors in Moroto highlight the complexities of assessing the impacts of climate change on pastoral livelihoods. The interplay of environmental stressors, socio-economic vulnerabilities, and cultural values necessitates a comprehensive approach to understanding how climate change affects pastoral communities and their ability to adapt effectively. This study aims to explore these dynamics in-depth, providing insights into how climate change is reshaping socio-economic activities in Moroto District and the strategies that pastoralists are employing to cope with these changes.

1.2 Problem Statement

Climate change is increasingly recognized as one of the greatest global threats to livelihoods, ecosystems, and human wellbeing. According to the Intergovernmental Panel on Climate Change (IPCC, 2021), global average temperatures have already risen by approximately 1.1°C above pre-industrial levels, with projections indicating more frequent and severe droughts, floods, and heatwaves. At the continental level, Africa is highly vulnerable due to its reliance on climate-sensitive sectors such as agriculture and pastoralism. The African Climate Policy Centre (2020) reports that over 65% of Africa's population depends on rain-fed agriculture, while pastoral systems in Horn of Africa are increasingly destabilized by erratic rainfall patterns and prolonged droughts.

Regionally, East Africa has witnessed a sharp increase in climate variability. The Intergovernmental Authority on Development (IGAD, 2021) notes that the frequency of droughts in the Karamoja Cluster has more than doubled over the past three decades, undermining pastoral production and aggravating cross-border conflicts. In Uganda, the Uganda Bureau of Statistics (UBOS, 2022) and the Uganda National Meteorological Authority (UNMA, 2023) indicate rising average temperatures by 0.3°C per decade and increasingly unpredictable rainfall patterns, particularly in semi-arid areas such as Moroto District. These changes have contributed to recurrent livestock losses, reduced crop yields, food insecurity, and increasing pressure on natural resources.

Although extensive research has been conducted on the impacts of climate change on pastoralism in sub-Saharan Africa, many studies focus on generalized regional or continental effects (Muwanga et al., 2020; Angella, 2021). Few studies provide a detailed, context-specific analysis of how pastoral households in Moroto District are affected by variations in climate and how they respond to them. The limited studies available often fail to problematize the adequacy, sustainability, and effectiveness of existing socio-economic adaptation strategies.

Pastoralists in Moroto District have employed multiple adaptation strategies, including seasonal migration, herd diversification, engagement in small-scale trade, adoption of drought-resistant crops, reliance on social networks, and participation in government and NGO-led interventions (Morton et al., 2022). However, evidence remains inconclusive as to which of these strategies

significantly contribute to long-term climate resilience and socio-economic stability in the district.

Moreover, the literature provides little insight into how these strategies interact, their limitations, and the structural barriers like poverty, insecurity, and limited institutional support—that shape their effectiveness.

Therefore, this study seeks to evaluate the effectiveness of socio-economic adaptation strategies employed by pastoralists in Moroto District and assess their contribution to building sustainable climate resilience.

1.3 Objective of the Study

1.3.1 General Objective

The general objective of the study was to evaluate the effectiveness of the Socio-Economic adaptation strategies employed by pastoralists in developing climate resilience

1.3.2 Specific Objectives

The study was guided by the following specific objectives:

1. To assess the effectiveness of local interventions (like; livestock diversification, crop farming, and migration) in enhancing the resilience of pastoral communities to climate change in Moroto District.
2. To examine the contribution of migration adaptation strategy in in enhancing the resilience of pastoral communities to climate change.
3. To assess contribution of diversification of livelihoods as adaptation strategy in enhancing climate-resilience
4. To identify opportunities to enhance pastoralist climate resilience through policy, community action, and resource management.

1.4 Research Questions

1. How effective are local and external interventions in enhancing the resilience of pastoral communities to climate change?
2. What role does migration as an adaptation strategy play in improving the climate resilience of pastoral communities?

3. To what extent does livelihood diversification contribute to climate resilience among pastoral communities?
4. What policy, community, and resource-based interventions can enhance their climate resilience?

1.5 Scope of the Study

1.5.1 Geographical Scope

The study was conducted in Moroto District, which is located in the semi-arid northeastern region of Uganda, within the Karamoja sub-region. Moroto lies approximately 2.53°N latitude and 34.67°E longitude, covering an area of over 3,537 square kilometers (Chilambe et al., 2022).

The district is characterized by rugged terrain, plateaus, and isolated mountains, with Mount Moroto (3,083 meters above sea level) as its most prominent physical feature (Byakagaba&Naturinda, 2020). The region experiences low and erratic rainfall, averaging 500-800 mm annually, and high temperatures ranging from 24°C to 35°C, making it vulnerable to climate variability and resource scarcity (Vyas et al., 2022).

Moroto is predominantly inhabited by pastoral and agro-pastoral communities, mainly the Karamojong, whose livelihoods depend on livestock rearing, seasonal agriculture, and trade. Due to prolonged droughts, land degradation, and increasing conflicts over water and grazing lands, this district provides a critical case study for assessing the effectiveness of socio-economic adaptation strategies in response to climate change.

1.5.2 Content Scope

The study focused on the socio-economic adaptation strategies employed by pastoralists in Moroto District in response to climate variability and change. It specifically aimed to evaluate the effectiveness of both local and external interventions in enhancing the resilience of pastoral communities to climate change. Additionally, the study will examine the role of migration as an adaptation strategy and assess the contribution of livelihood diversification; such as engagement in alternative income-generating activities in building climate resilience. The effectiveness of these strategies will be assessed based on their impact on livelihood stability, food security, and sustainable resource use within the pastoral communities.

Additionally, it explored the challenges that limit the effectiveness of these adaptation strategies and identify opportunities for strengthening pastoralist resilience through policy support, community interventions, and improved resource management.

1.6.3 Time Scope

The study focused on the period 2019 to 2024 to analyze the effectiveness of socio-economic adaptation strategies employed by pastoralists in Moroto District in response to climate variability and change. This timeframe was chosen to capture recent climate trends and their immediate socio-economic impacts on pastoral livelihoods.

Climate variability in the Karamoja region, including Moroto, has been highly pronounced in recent years, with increasing occurrences of prolonged droughts, erratic rainfall, and temperature extremes (Chilambe et al., 2022). Reports indicated that between 2019 and 2024, rainfall patterns in Karamoja were more unpredictable, leading to worsening pasture conditions, water scarcity, and rising food insecurity (Byakagaba&Naturinda, 2020). These climatic challenges have exacerbated livestock mortality rates and inter-community conflicts over dwindling resources, making it critical to assess how pastoralists have adapted to these conditions (Vyas et al., 2022).

The selected period also aligns with national climate policies and resilience-building initiatives, such as Uganda's Nationally Determined Contributions (NDCs), which emphasize climate adaptation strategies between 2019 and 2024 (Byakagaba&Naturinda, 2020). This study utilized climatic and socio-economic data from this period to provide a comprehensive evaluation of adaptation effectiveness, challenges, and opportunities for strengthening climate resilience among pastoralist communities in Moroto.

1.7 Significance of study

The study was significant in both academic and practical contexts, as it sought to address critical gaps in knowledge and policy interventions related to climate resilience among pastoralist communities in Moroto District.

The study added to the existing body of knowledge on climate change adaptation in semi-arid regions, particularly within East Africa. Despite the growing recognition of climate change effects on pastoralism, limited research has focused on localized adaptation strategies in Moroto District. The study provided context-specific insights into how pastoralist communities perceive, experience, and respond to climate variability, thereby bridging existing knowledge gaps in the

field of climate resilience. Additionally, it contributed to scholarly discourse on the intersection between climate change, pastoral livelihoods, and sustainable adaptation practices.

The findings of this research were valuable to policymakers, development practitioners, and climate resilience strategists working in Uganda and beyond.

For pastoralists in Moroto District, this study served as an empowerment tool, enhancing awareness of effective adaptation strategies that can help mitigate climate-related challenges. By highlighting successful adaptation practices and identifying barriers to resilience, the study would support community-driven solutions that improve livelihood security, food availability, and resource management in the face of climate uncertainty.

1.8 Justification of the Study

This study is justified on multiple grounds, including problem-based, methodological, and practical considerations. Given the increasing vulnerability of pastoralist communities in Moroto District to climate change, it is crucial to assess how their adaptation strategies enhance resilience and what gaps exist in current approaches.

Pastoralist livelihoods in Moroto District are highly dependent on natural resources, making them extremely susceptible to climatic changes such as prolonged droughts, erratic rainfall, and temperature fluctuations (Byakagaba & Naturinda, 2020). While climate change effects on pastoralism have been widely acknowledged in broader East African research, limited studies have focused on localized adaptation mechanisms in Moroto. This study sought to fill this gap by providing empirical, context-specific insights into the effectiveness of socio-economic adaptation strategies employed by pastoralists in the region.

Existing studies on climate adaptation in Karamoja often rely on macro-level analyses that overlook community-level perspectives (Chilambe et al., 2022). This study adopted a comprehensive research design, incorporating both qualitative and quantitative methods to provide a holistic understanding of how pastoralists are adapting. By integrating first-hand accounts from pastoral communities, this study ensured a more inclusive and representative approach to climate resilience research.

Climate adaptation strategies among pastoralists are often shaped by socio-economic, cultural, and environmental factors (Vyas et al., 2022). However, current policy interventions and

development programs in Uganda frequently failed to align with pastoralist realities due to insufficient localized data.

1.9 Definition of Key Terms

Effectiveness

Refers to the extent to which adaptation strategies improve the climate resilience of pastoralists (Sustainability Directory, 2025). It is gauged by their ability to sustain livelihoods, enhance food security, and reduce vulnerability to climate variability ([IPCC, 2014]; [Reid et al., 2016]).

Socio-Economic Adaptation Strategies

These are the livelihood responses employed by pastoralists to cope with and adapt to climate change (Gebisa and Bacsi, 2024). In this study, they include livelihood diversification, migration, resource-sharing, climate-smart practices, and market integration aimed at improving economic and environmental sustainability ([Eriksen et al., 2005]).

Pastoralists

Refers to livestock-dependent communities in Moroto District who practice mobile or semi-mobile herding (Karamoja Resilience Support Unit, 2016). Their adaptive mobility helps them manage climate variability by seeking grazing and water resources across seasons ([Krätli&Schareika, 2010]).

Climate Resilience

The capacity of pastoralist communities to absorb, recover from, and adapt to climate shocks while preserving livelihood security and long-term well-being (Waiswa et al., 2019). It includes preparedness for events like droughts, rainfall variability, and temperature extremes ([Tanner et al., 2015]).

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides an overview of the literature on climate change and its effects on the socio-economic activities of pastoral communities, with a specific focus on Moroto District. It examined the impact of climate change on pastoral livelihoods, the socio-economic adaptations employed by pastoral communities, the barriers they face in adapting to climate change, and potential solutions to enhance resilience. Furthermore, the review discusses the broader implications of climate change on pastoral systems and the role of policy interventions in addressing these challenges.

2.1 Theoretical Review

Understanding the complex interplay between climate change, livelihoods, and adaptation strategies requires a robust theoretical framework. This study draws on three key theoretical perspectives to frame its analysis: The Sustainable Livelihoods Framework (SLF), the Livelihood Adaptation Framework, and the Climate Change Adaptation Theory. These frameworks collectively provide a comprehensive lens through which to examine how pastoral communities navigate the challenges posed by climate change.

The Sustainable Livelihoods Framework, introduced by Scoones (1998), is a pivotal tool for analyzing how communities manage their assets to sustain livelihoods in the face of vulnerabilities. SLF categorizes assets into five capital types: human, social, natural, physical, and financial. It further explores how these assets interact with external factors such as policies, institutions, and the climate variability.

The SLF is instrumental in understanding the impacts of climate change on natural and physical capital which are grazing lands, water resources, and livestock. For example, recurrent droughts in Karamoja have significantly reduced pasture availability and water access, eroding the natural capital upon which pastoralists depend (Thornton et al., 2020). SLF also provides insights into how social capital, such as communal resource-sharing networks, helps pastoralists mitigate these challenges by pooling resources or collectively negotiating access to grazing areas.

However, the application of SLF to climate change in pastoral settings is not without limitations. Recent studies argue that while the framework adeptly captures asset dynamics, it does not fully account for power imbalances or structural constraints, such as land tenure issues, that may impede adaptation (Harrison & Mertz, 2020).

2.1.1 The Livelihood Adaptation Framework

The Livelihood Adaptation Framework, as proposed by Morton (2007), underscores the dynamic and continuous nature of adaptation in response to environmental changes, resource availability, and socio-economic contexts. Unlike static approaches that view adaptation as a one-off adjustment, this framework highlights how households and communities continuously modify their strategies to cope with evolving challenges, particularly those induced by climate change. Within this framework, adaptation is conceptualized through mechanisms such as migration, livelihood diversification, and adjustments in resource management practices.

Migration has historically been a central adaptation strategy for pastoral communities, allowing households to move seasonally in search of pasture and water. In Moroto District, where climate variability has intensified, pastoralists increasingly undertake longer and more frequent migrations. Such movements are not merely responses to immediate environmental stress but serve as a deliberate strategy to sustain household resilience and productivity in the face of erratic rainfall and resource scarcity (Ngigi et al., 2020). In alignment with the study's specific objectives, understanding the contribution of migration as an adaptation strategy is critical for assessing its effectiveness in enhancing climate resilience among pastoral communities.

Livelihood diversification represents another essential mechanism through which pastoral households manage risk. By integrating alternative activities like crop farming, agro-pastoralism, or engagement in small-scale tradehouseholds can spread economic risks and reduce dependence on climate-sensitive pastoral activities. Evidence from Moroto District indicates that diversification not only provides supplementary income but also strengthens household resilience, particularly during periods of drought or livestock loss. This directly aligns with the study's objectives of examining how diversification of livelihoods contributes to climate-resilience in pastoral communities.

Moreover, the Livelihood Adaptation Framework highlights the socio-cultural dimensions of adaptation. Gendered roles within households often shape how adaptation strategies are implemented, with women frequently assuming responsibility for alternative income-generating activities and resource management (Nampala&Lwasa, 2021). Recognizing these intra-household dynamics is crucial for evaluating the effectiveness of local interventions like livestock diversification, crop farming, and migrationas mechanisms for strengthening community resilience. Furthermore, such an understanding informs the identification of opportunities to enhance pastoralist climate resilience through policy support, community action, and sustainable resource management, as outlined in the study's objectives.

2.1.2 Climate Change Adaptation Theory

The second theory used in the study; The Climate Change Adaptation Theory, as articulated by Adger (2003), provides a structured framework for understanding adaptation strategies as either autonomous or planned. Autonomous adaptations are self-driven responses by individuals or communities, shaped by local knowledge, experiences, and immediate needs. Planned adaptations, in contrast, involve deliberate interventions by governments, NGOs, or other institutions aimed at systematically enhancing resilience to climate change.

In Moroto District, autonomous adaptations remain central to sustaining pastoral livelihoods. Strategies such as herd diversification, communal grazing agreements, and traditional water management practices are deeply embedded in indigenous knowledge systems, allowing communities to cope with climatic variability and maintain household resilience (Opiyo et al., 2019). These self-initiated measures align closely with the study's objective of assessing the effectiveness of local interventionsincluding livestock diversification and migrationin enhancing the climate resilience of pastoral communities.

Planned adaptations complement these traditional strategies by introducing systematic, externally supported measures. Examples in the Karamoja region include climate-smart agricultural technologies, water harvesting systems, and reforestation projects, which aim to mitigate systemic vulnerabilities and enhance long-term resilience (Waiswa et al., 2021). The effectiveness of these interventions, however, depends heavily on community engagement and resource availability. This directly informs the study objectives related to identifying

opportunities to enhance pastoralist climate resilience through policy initiatives, community action, and resource management.

Migration, as both an autonomous and a semi-planned adaptation strategy, exemplifies the interplay between individual decisions and external support. Seasonal and emergency movements allow households to access pasture and water, reducing the risk of livestock losses, while some migration patterns are increasingly coordinated through community agreements or NGO-facilitated programs. Similarly, livelihood diversifications such as integrating small-scale trade or crop farming is influenced both by household initiative and planned support from extension services or development programs, reinforcing resilience in the face of climate shocks.

2.2 Effectiveness of Local and External Interventions

Climate change adaptation in pastoral regions has increasingly depended on a combination of external (planned) and local (autonomous) interventions. These approaches are designed to enhance climate resilience among pastoralist communities whose livelihoods are under persistent threat from droughts, erratic rainfall, and land degradation.

In Uganda, mobile climate advisory services and climate risk management training have proven useful in increasing preparedness and informed decision-making among livestock-dependent communities (Bashiru and Oseni, 2025). These services enhance adaptive capacity by translating climate data into actionable information, yet their reach remains limited in remote areas like Moroto.

Despite their potential, planned interventions often face contextual and structural barriers. According to Kweyu et al. (2023), most East African nations, including Uganda, have policy mechanisms in place, but implementation challenges—such as inadequate funding, limited technical expertise, and fragmented coordination between government agencies—impede effectiveness. Moreover, some interventions suffer from poor community ownership due to top-down planning processes that exclude local voices, thereby undermining sustainability (Gebremedhin and Gebrekidan, 2025).

Additionally, policies under frameworks such as the National Climate Change Policy (NCCP) offer strategic guidance but often lack localized operational plans, especially for semi-arid zones like Moroto (Acosta et al., 2020). The policy gap becomes more apparent when examining land

use planning and pastoral mobility rights—both of which are critical to pastoralist adaptation but remain under-addressed.

In contrast, local adaptation practices are rooted in indigenous knowledge and historical coping strategies. These include communal grazing systems, seasonal migration, livestock diversification, and reciprocal resource-sharing networks. Such practices are highly contextual and flexible, allowing pastoralists to respond rapidly to changing ecological conditions (Radeny et al., 2022).

The strength of these local interventions lies in their social embeddedness and cultural legitimacy, which often surpass the acceptance of externally introduced solutions. For instance, communal water point management and negotiated pasture access agreements remain key elements of resilience in Karamoja, including Moroto District. However, these strategies face new challenges, such as shrinking communal lands, population pressure, and increased resource conflict—factors that are not adequately mitigated by traditional mechanisms alone (Sally et al., 2023).

Additionally, local systems are increasingly strained by climate intensification, as multi-year droughts disrupt seasonal rhythms that used to guide livestock movement and water usage. As observed in the FAO's East Africa Resilience Programme (2023), the autonomy of pastoralists in responding to shocks is being eroded by both environmental and institutional constraints.

As this review shows, neither external nor local interventions, in isolation, can sufficiently address the multidimensional risks pastoralists face. A growing body of research supports the argument for hybrid adaptation models—those that integrate scientific knowledge, external funding, and technology with locally-embedded practices and governance structures (Omweri, 2024). These models recognize the co-dependence of formal systems (like policy and infrastructure) and informal institutions (like clans and elders) in building lasting climate resilience.

Critically, hybrid approaches must also account for power dynamics—including who has access to resources, decision-making spaces, and adaptation technologies. Without such consideration, interventions risk reinforcing existing inequalities, particularly affecting women and youth, who are often excluded from both traditional and modern planning spaces.

The effectiveness of climate change interventions in pastoral communities like Moroto is shaped by their design, context, and inclusiveness. Planned strategies offer technical and infrastructural support but often falter in local relevance and ownership. Local strategies, while resilient in design, face limits in scale and sustainability under intensified climate pressures. As a researcher, I assert that sustainable adaptation in Moroto must blend the technical depth of external programs with the cultural intelligence of local practices, and be supported by coherent policy frameworks that are both participatory and context-sensitive.

2.3 Climate Change Trends and Pastoral Livelihoods

Over the past two decades, global surface temperatures have increased by approximately 0.2°C per decade, and recent climate models project even greater warming across Sub-Saharan Africa (IPCC, 2021). This warming trend is associated with a rise in the frequency and intensity of climate extremes, including droughts, erratic rainfall, heatwaves, and flooding events. These phenomena not only disrupt the biophysical environment but also exert profound socio-economic pressures on rural populations that depend on natural resource-based economies.

Ultimately climate variability is increasingly manifesting as shorter rainy seasons, longer dry spells, and more irregular precipitation patterns (Radeny et al., 2022). According to Harrison and Mertz (2020), this shift has led to both water scarcity and the degradation of pasturelands, directly undermining livestock health and productivity.

Research shows that drought cycles that once occurred every 8–10 years now occur every 2–3 years, significantly disrupting grazing patterns and prompting long-distance seasonal migration in search of pasture and water (Omollo et al., 2022). This mobility, though traditionally adaptive, increasingly triggers inter-community conflicts and overgrazing, especially in areas with limited land tenure protections.

Further, rising temperatures and increased pathogen survival have intensified outbreaks of climate-sensitive diseases such as Rift Valley Fever, tick-borne illnesses, and contagious bovine pleuropneumonia (Ngigi et al., 2020). These effects have contributed to an alarming rise in livestock mortality, further compounding food insecurity and poverty in affected areas.

Additionally, the adaptive capacity of pastoralists in Moroto is increasingly constrained by limited infrastructure, weak institutional support, and exclusion from national policy dialogues

(Kweyu et al., 2023). Furthermore, climate-related stress has accelerated the erosion of traditional ecological knowledge, as the unpredictability of weather patterns makes historical coping strategies less reliable.

From a research standpoint, this underscores the importance of rethinking adaptation frameworks for pastoral settings. As a scholar engaged in this field, I argue that pastoral resilience in Moroto must be re-conceptualised to blend scientific forecasting tools, inclusive policy frameworks, and community-led governance structures. This hybrid approach not only strengthens adaptive capacity but also restores agency to the communities most affected by climate change.

2.4 Impacts on Pastoral Livelihoods

Climate change has profoundly disrupted traditional pastoral livelihoods in East Africa, with Moroto District in Uganda standing out as a hotspot of vulnerability. In this region, livestock rearing is not only a means of subsistence and income but also a core element of cultural identity, wealth distribution, and social status. However, the livelihood system anchored on livestock is increasingly untenable due to intensifying climatic stressors.

Recent studies in Karamoja reveal that climate variability particularly drought and erratic rainfall has reduced both pasture quality and water availability, resulting in significant livestock mortality due to heat stress, malnutrition, and disease (Egeru et al., 2022). In Moroto, outbreaks of climate-sensitive diseases such as tick-borne infections and Foot-and-Mouth Disease have been on the rise, often linked to prolonged dry spells that concentrate animals in limited grazing areas (Ngorok, 2021). Consequently, the number and productivity of cattle have declined steeply. A longitudinal study found that cattle populations in the Matheniko cluster of Moroto declined by nearly 30% over the past decade, correlating with increased food insecurity, erosion of household assets, and rising poverty (Egeru et al., 2022).

This situation has catalyzed a shift toward livelihood diversification, marking a critical turning point for many households. As livestock alone can no longer reliably support families, pastoralists have begun to explore alternative income streams such as small-scale agriculture, charcoal burning, casual labour, aloe vera harvesting, and cross-border trade (BCIN Karamoja, 2021; Area, n.d.). While these strategies offer short-term buffers, their effectiveness in building resilience is heavily constrained by systemic challenges notably limited access to credit, insecure land tenure, lack of markets, and weak institutional support (Mayanja et al., 2022).

Furthermore, these adaptation strategies often come at a social cost. For instance, shifting household roles have led women to engage in unpaid care work and low-return economic activities, while young men migrate to urban areas or mining camps, increasing exposure to violence and exploitation (Angella, 2021). In this light, livelihood diversification emerges not as a strategic adaptation, but a survival response—a distinction that matters when evaluating its long-term sustainability.

In Moroto, diversification has not eliminated vulnerability but instead reshaped it. The transition away from pure pastoralism is occurring in a context where institutional infrastructure has not kept pace with climatic and socio-economic pressures. As a researcher, I argue that livelihood diversification can only serve as a robust adaptation strategy if supported by context-specific interventions, such as market access for diversified products, vocational training, and investment in rural infrastructure.

2.6 Policy Gaps and Opportunities

Despite the presence of Uganda's National Climate Change Policy (2015) and National Adaptation Programme of Action (NAPA), implementation remains top-down and broad. These frameworks do not adequately address the unique needs of pastoralists—especially in marginalized areas like Moroto.

My view is that policy interventions must shift from symbolic declarations to actionable, localized strategies (Objective 4). This includes institutionalizing community resource management, improving access to early warning systems, and promoting drought-resilient livestock breeds. Furthermore, community participation should not be treated as a checkbox but a pillar of resilience-building.

2.7 Research Gaps

The reviewed literature consistently affirms that climate change threatens pastoral livelihoods. However, there is limited analysis of how adaptation strategies perform over time and across varying social groups. Few studies explore how gender, generational shifts, and cultural norms influence adaptation behavior—especially in Uganda.

Moreover, there is a lack of granular data on the long-term viability of strategies such as migration, livestock diversification, and climate-smart practices in regions like Moroto. This

study seeks to bridge that gap by evaluating the effectiveness of both traditional and modern adaptations and identifying scalable opportunities for resilience.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the research methodology adopted to investigate the effects of climate change on the socio-economic activities of pastoral communities in Moroto District. It outlines the systematic approaches, procedures, and techniques used to collect and analyze both qualitative and quantitative data relevant to the research objectives. Specifically, the chapter details the research design, study area, target population, sample size and selection, sampling techniques and procedures, data collection methods and instruments, data quality control measures (validity and reliability), procedures for data collection, data analysis methods, and measurement of variables. The chosen methodology was aligned with the convergent parallel mixed-methods design, which ensured a comprehensive understanding of climate change impacts and adaptation strategies among pastoralist communities.

3.1 Research Design

This study employed a convergent parallel mixed-methods design, which allowed for the simultaneous collection and analysis of both quantitative and qualitative data. The approach was suitable for complex issues like climate change impacts, as it enabled a comprehensive understanding by comparing and integrating numerical trends with lived experiences (Creswell & Plano Clark, 2018).

The quantitative component included structured surveys and secondary climate data to assess patterns in livestock productivity, mortality rates, and rainfall variability. This helped establish generalizable trends across pastoral households.

Concurrently, the qualitative component used incorporated in-depth interviews to explore pastoralists' perceptions, adaptation strategies, and resilience practices. This captured the socio-cultural context and provided depth to the numerical findings.

The choice of the convergent parallel design was justified by the need to give equal priority to both data types and to triangulate findings for a more in-depth analysis of climate adaptation among pastoral communities in Moroto District.

3.3 Study Population

The study population encompasses various stakeholders whose lives and activities were directly or indirectly shaped by climate change and its impacts on pastoral livelihoods in Moroto District.

3.3.1 Target Population

3.3.1.1 Pastoral Households

Pastoralists are the primary stakeholders in this study, as they are directly affected by climate-induced changes in livestock productivity, mortality rates, and resource availability. This group included men, women, and youth actively engaged in livestock rearing and other livelihood activities. Pastoralists' lived experiences provide critical insights into how climate variability affected socio-economic activities and adaptation strategies (Thornton et al., 2020).

3.3.1.2 Community Leaders and Elders

Local leaders and elders possess in-depth knowledge of historical climatic changes, traditional pastoral practices, and communal resource management systems. They were instrumental in understanding how traditional adaptation mechanisms have evolved over time and how communities mobilize collective responses to environmental challenges (Harrison & Mertz, 2020).

3.3.1.3 Local Government Officials

Representatives from local government bodies were key to assessing policy-level interventions. These officials oversee disaster risk management, resource allocation, and the implementation of climate adaptation programs in Moroto District. Their perspectives enabled the evaluation of the effectiveness of institutional responses to climate change and their alignment with community needs (Uganda Bureau of Statistics, 2022).

3.3.1.4 NGO Representatives

Non-governmental organizations (NGOs) actively involved in climate adaptation initiatives provide essential insights into planned strategies. This included efforts to introduce climate-smart technologies, to enhance community resilience, and support livelihood diversification. Their

contributions helped analyze the role of external interventions in complementing traditional coping mechanisms (Waiswa et al., 2021).

The inclusion of these groups ensured the study captured a holistic view of climate change effects on pastoral livelihoods. Pastoral households offer firsthand accounts of the challenges and strategies at the grassroots level. Community leaders and elders provided a historical and cultural perspective, while government and NGO representatives offered insights into the effectiveness of institutional and external interventions. This diverse representation aligned with the study's mixed-methods approach, allowing for an indepth analysis of both lived experiences and systemic responses.

3.4. Sampling procedure

3.4.1 Sample Size

A sample size refers to the number of units or individuals selected from a population to participate in a study(Creswell & Plano Clark, 2018).

The target population for this study consisted of 100 pastoral households in Moroto District. Initially, Yamane's (1967) formula for determining sample size was considered:

$$n = N / (1 + N(e^2))$$

Where:

n = sample size

N = total population (100)

e = margin of error (0.05)

Using the standard 5% margin of error:

$$n = 100 / (1 + 100 \times 0.0025) = 100 / 1.25 = 80$$

While the minimum required sample size based on the formula was 80 respondents, the study opted to include all 100 households in the target population. This decision was made to improve the accuracy, eliminate sampling error, and take advantage of the small and accessible population

size. Therefore, the study used a census approach, and 100 questionnaires were distributed and successfully collected, representing a 100% response rate. This approach ensured higher reliability and enriched the robustness of the quantitative findings.

For the qualitative component, key informants including NGO representatives, government officials, and community elders were purposively selected to provide contextual depth and expert insights.

The mixed-methods sampling approach allowed for both statistical validity and contextual depth, aligning with the convergent parallel design adopted in the study.

The table 3.2 below presents the categories of respondents, their respective target populations, sample sizes, sampling techniques, and the data collection methods used in the study. Given the small and accessible size of the pastoral household population, a census approach was applied. Other stakeholders were selected using purposive sampling based on their relevance and expertise in climate adaptation.

Table 3.2: Distribution of Sample Size by Target Group

| Category of Respondents | Target Population | Sample Size | Sampling Technique | Data Collection Methods |
|--------------------------------|--------------------------|--------------------|---------------------------|--------------------------------|
| Pastoral Households | 100 | 100 | Census | Structured Questionnaire |
| Community Leaders | 5 | 5 | Purposive Sampling | Key Informant Interviews |
| Local Government Officials | 5 | 5 | Purposive Sampling | Key Informant Interviews |
| NGO Representatives | 5 | 5 | Purposive Sampling | Key Informant Interviews |

Source: Field Data (2025)

3.4.2 Sampling Techniques

This study adopted a multistage sampling approach, integrating both stratified random sampling and purposive sampling.

Stratified random sampling is a probability sampling technique where the population is divided into subgroups (strata) based on shared characteristics, and then random samples are drawn from each stratum (Bryman, 2016). In this study, the population of pastoral households was stratified according to geographic location (for example, sub-counties or parishes) and primary livelihood activity (for example, pure pastoralists vs. agro-pastoralists). A random sample was then be selected from each stratum to ensure that the quantitative data captures the diversity of environmental exposure and socio-economic conditions across the district.

This method enhanced the representativeness of the sample and allowed for more accurate generalizations about climate change impacts on livelihoods across different communities.

Purposive sampling, on the other hand, is a non-probability sampling technique used to select participants based on specific characteristics or knowledge relevant to the research (Creswell & Plano Clark, 2018). In this study key informants such as community elders, local government officials, NGO representatives, and extension workers were selected. These individuals were selected for their expertise in pastoral livelihoods and direct involvement in climate change adaptation programs, making them valuable sources for qualitative data.

This combination of sampling techniques allowed the study to achieve both breadth and depthstatistical validity through stratified random sampling, and contextual richness through purposive sampling.

3.5 Data Collection Methods and Instruments

The study adopted a convergent parallel mixed-methods design, requiring the simultaneous collection of quantitative and qualitative data. This approach allowed for the integration of statistical evidence with in-depth narratives to ensure a holistic analysis of the effects of climate change on pastoral livelihoods in Moroto District. Accordingly, different tools and procedures was applied to the quantitative and qualitative components of the study.

3.5.1 Quantitative Data Collection

Quantitative data was collected through structured household surveys. This involved administering a standardized questionnaire to approximately 100 respondents, derived from a

stratified random sample of pastoral households. The survey instrument was designed to capture measurable data on livestock productivity, mortality rates, household income, food security, and shifts in agricultural or trade practices attributed to climate variability. The use of household surveys was appropriate for generating statistically analyzable data and identifying broad trends across the target population (Bryman, 2016).

In addition, secondary climate data was obtained from the relevant government reports. This data included historical rainfall records, temperature trends, and drought frequency over the last 10–15 years. Such environmental datasets are essential for contextualizing household-level changes and linking climatic patterns to livelihood dynamics (Uganda Bureau of Statistics, 2022). The quantitative component was thus a macro-level understanding of climate impacts, particularly as they pertain to productivity and income changes in the pastoral economy.

3.5.2 Qualitative Data Collection

The qualitative strand relied mainly on Key Informant Interviews (KIIs), conducted with purposively selected individuals who possess expert knowledge on climate adaptation. This included local council leaders, government agricultural officers, and representatives from NGOs operating in the Karamoja sub-region. The interviews aimed to elicit insights into the effectiveness of current adaptation strategies, gaps in policy support, and the social and institutional dynamics affecting pastoral resilience.

Each key informant interviewed used a semi-structured guide to allow flexibility in exploring context-specific issues while maintaining comparability across responses. This method was well suited for understanding processes, perceptions, and institutional mechanisms that are not easily quantifiable (Denzin & Lincoln, 2017). The insights gathered was complemented with survey findings.

Together, the simultaneous application of these methods aligned with the convergent parallel design, facilitating both triangulation and a robust synthesis of evidence from diverse sources.

3.6 Sources of Data

This study utilized both primary and secondary data sources to ensure a comprehensive, accurate, and triangulated understanding of climate change impacts and adaptation strategies among pastoral communities in Moroto District.

Primary data was obtained directly from respondents through structured household surveys and key informant interviews. The household surveys generated quantitative data on socio-economic impacts, livestock productivity, and livelihood shifts. Key informant interviews provided qualitative insights into institutional responses, adaptation practices, and community-level perceptions of climate variability. This dual approach allowed the study to capture both measurable outcomes and lived experiences (Creswell & Plano Clark, 2018; Denzin & Lincoln, 2017).

Secondary data included climate records from the Uganda National Meteorological Authority (UNMA) and socio-economic data from the Uganda Bureau of Statistics (UBOS). These sources provided historical data on rainfall patterns, temperature trends, drought events, and population demographics, offering critical environmental and contextual background to complement the primary data (UBOS, 2022).

3.7 Quality Control

Validity refers to the degree to which an instrument accurately measures the intended variables (Andersson et al., 2024). The data collection tools including household survey questionnaires and interview guides reviewed by academic experts in climate change, rural livelihoods, and mixed-methods research. Their feedback ensured that all items were clear, relevant, and aligned with the study's objectives.

3.8 Data Analysis Techniques

The study applied both quantitative and qualitative data analysis techniques in line with the convergent parallel mixed-methods design. The study allowed for the integration of statistical trends and community narratives to develop a comprehensive understanding of how climate change affects pastoral livelihoods in Moroto District.

Quantitative data collected through structured household surveys were coded and analyzed using SPSS Version 25. Descriptive statistics; including frequencies, means, and percentages was used to summarize demographic data and core variables such as livestock ownership, income levels, and food security status. To examine relationships between climate variability and livelihood changes, Pearson correlation analysis was employed. In addition, multiple regression analysis was conducted to assess the extent to which variables such as rainfall variation and livestock loss predict shifts in livelihood strategies. These techniques were widely used for identifying

associations and assessing the predictive strength of environmental and socio-economic variables (Al-Azzawi et al., 2021; Liu et al., 2022).

Qualitative data derived from key informant interviews was analyzed using thematic content analysis. Interview transcripts was coded manually These themes reflected perceptions of climate change, institutional responses, and adaptation experiences at both community and policy levels. Thematic analysis is effective for uncovering patterns within textual data and provides contextual insights that enrich the interpretation of quantitative results (Nowell et al., 2017).

The findings from both strands was compared and integrated during the interpretation phase to allow for triangulation and cross-validation, thereby enhancing the robustness of the study's conclusions.

3.9 Ethical Considerations

The study was adhered to stringent ethical standards. Informed consent was obtained from all participants after providing detailed explanations about the study's purpose, procedures, and rights of participants. Anonymity and confidentiality were strictly observed to protect participants' identities and information. Participation in the study were entirely voluntary, with respondents retaining the right to withdraw at any stage without any repercussions. Ethical clearance was sought from the relevant institutional research committee prior to data collection.

3.10 Study Limitations

The study acknowledged several limitations that could affect the interpretation and generalizability of its findings. First, it is geographically limited to Moroto District, which could constrain the application of results to other pastoralist regions with differing ecological or socio-political contexts. Second, while efforts were made to ensure representativeness through stratified sampling, the relatively small sample size and challenges in accessing dispersed households could limit statistical generalizability.

Additionally, the study relied partially on self-reported data collected through household surveys and interviews, which could be subjected to response bias or recall inaccuracies. To mitigate this, triangulation with secondary climate data and expert insights were employed (Denzin, 2012). Another limitation involved language and literacy barriers, which could affect respondents' understanding of survey questions. This was addressed by translating tools into local languages and working with trained local enumerators.

Lastly, while the study provided in-depth insights into current adaptation strategies, it could not fully capture long-term behavioral or policy shifts, given its cross-sectional design. Future research should consider longitudinal approaches and comparative studies across multiple districts for a more comprehensive understanding of climate adaptation in pastoralist contexts (Bryman, 2016).

3.11 Conclusion

This chapter presented a comprehensive research methodology for examining the impacts of climate change and the effectiveness of adaptation strategies among pastoral communities in Moroto District. The study integrated both quantitative data (on climate impacts and livelihood outcomes) and qualitative data (insights into community-level responses and institutional support systems.)

Validated instruments, context-sensitive sampling techniques, and rigorous analytical procedures will enhance the credibility and reliability of findings. Together, these methods support the study's objective of generating actionable insights into how climate variability shapes pastoral livelihoods and what strategies can effectively strengthen resilience (Creswell & Plano Clark, 2018).

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter presents the findings as recorded from the field in relation to the research objectives. It also interprets and discusses the results. The study aimed at examining the effectiveness of socio-economic adaptation strategies employed by pastoralists in Moroto District to develop resilience to climate change. Using a convergent parallel mixed-methods design on a sample of 100 participants, the study was guided by four key objectives:

- i). To evaluate the effectiveness of local and external interventions in enhancing the resilience of pastoral communities to climate change

- ii). To examine the contribution of migration adaptation strategy in in enhancing the resilience of pastoral communities to climate change.

- iii). To assess contribution of diversification of livelihoods as adaptation strategy in enhancing climate-resilience

- iv). To identify opportunities to enhance pastoralist climate resilience through policy, community action, and resource management.

A total of 100 questionnaires were issued and all were successfully completed and returned, representing a 100% response rate. This high response rate was largely attributed to the active involvement of local leaders, as well as the researcher's familiarity with the community, which enhanced participation and trust during data collection.

In addition, key informant interviews were conducted with selected stakeholders, including sub-county extension workers (from Tapac and Rupa sub-counties), local leaders, and NGO representatives engaged in climate change adaptation programs. These interviews offered deeper insights into the institutional support systems, local coping strategies, and community perceptions related to climate resilience among pastoralist households.

4.1 Background Characteristics of Respondents

The study collected data on the background characteristics of respondents to provide a clear understanding of their socio-demographic profiles. This information is essential for contextualizing their responses and understanding how personal attributes may influence their adaptation strategies to climate change. The variables considered included gender, age group, and level of education. Table 4.1 presents the summary of these characteristics.

Table 4.1: Demographic Characteristics of Respondents

| Characteristic | Category | Frequency | Percentage |
|------------------------|---------------------|-----------|------------|
| Gender | Male | 53 | 53% |
| | Female | 47 | 47% |
| Age Group | 18–25 years | 24 | 24% |
| | 26–35 years | 41 | 41% |
| | 36–45 years | 21 | 21% |
| | Above 45 years | 14 | 14% |
| Education Level | No formal education | 12 | 12% |
| | Primary | 11 | 11% |
| | Secondary | 37 | 37% |
| | Tertiary | 40 | 40% |

Source: Primary Data (2025)

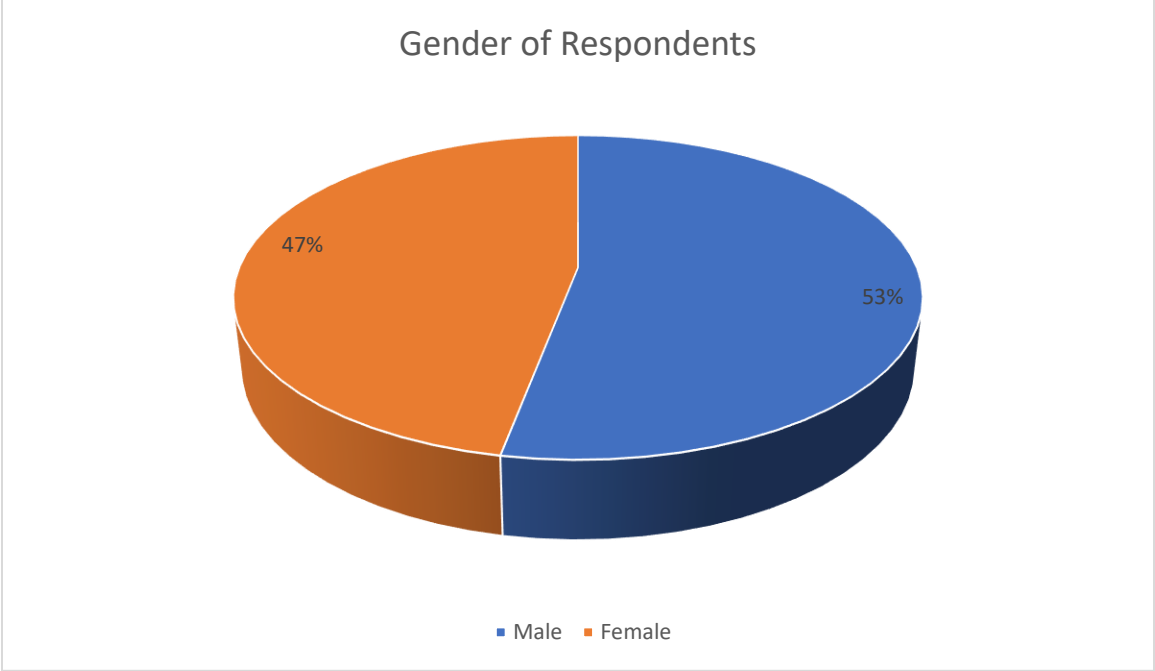
The results indicate that a majority of respondents were aged between 26 and 35 years, representing 41% of the sample. In terms of education, most respondents had attained secondary (37%) or tertiary education (40%), which may influence their awareness and willingness to adopt

socio-economic adaptation strategies. This demographic profile is relevant in understanding the varying capacities of individuals in responding to climate-related challenges in Moroto District.

4.1.1 Gender of Respondents

The study findings as shown in Figure 2 indicate that the majority of the respondents were male (53%), while female respondents accounted for 47%. This implies that both genders were fairly represented in the study, allowing for balanced perspectives on climate change adaptation strategies among pastoralist communities in Moroto District.

Figure 2: Gender of Respondents

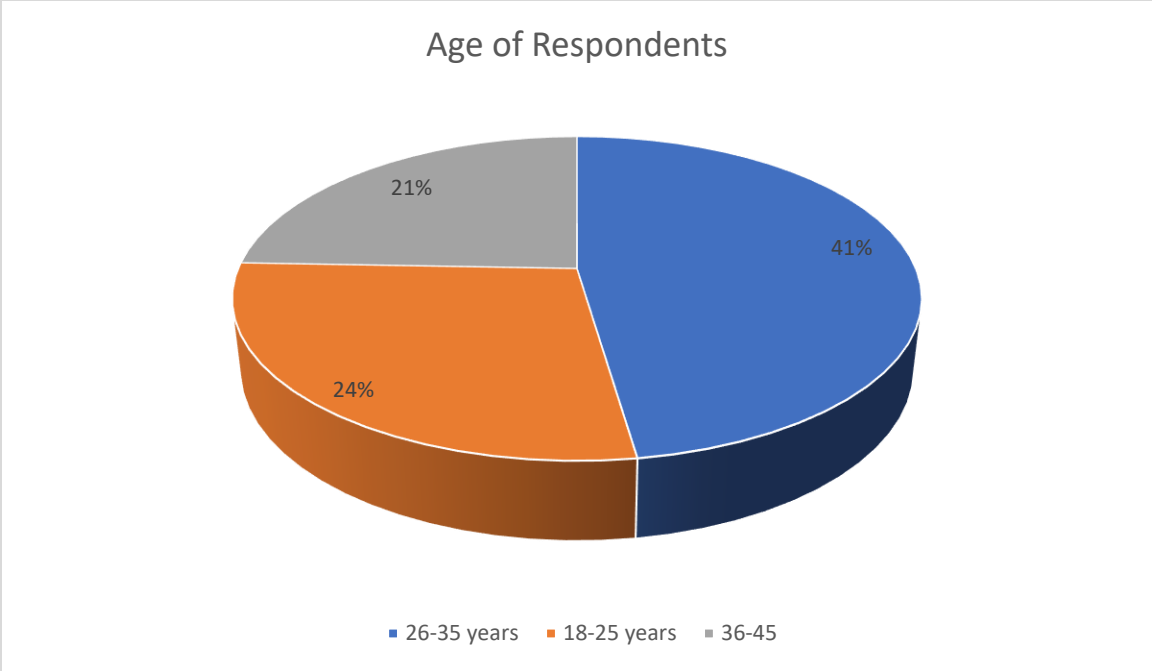


Source: Field Data (2025)

4.1.2 Age of Respondents

The findings revealed that the largest proportion of respondents (41%) were aged between 26–35 years, followed by 24% aged between 18–25 years, and 21% who were in the 36–45 years category. Only 14% were aged above 45 years, as shown in **Figure 3**. This suggests that most respondents were in their productive and economically active years, which is significant in understanding how they adapt to climate-related challenges.

Figure 3: Age of Respondents

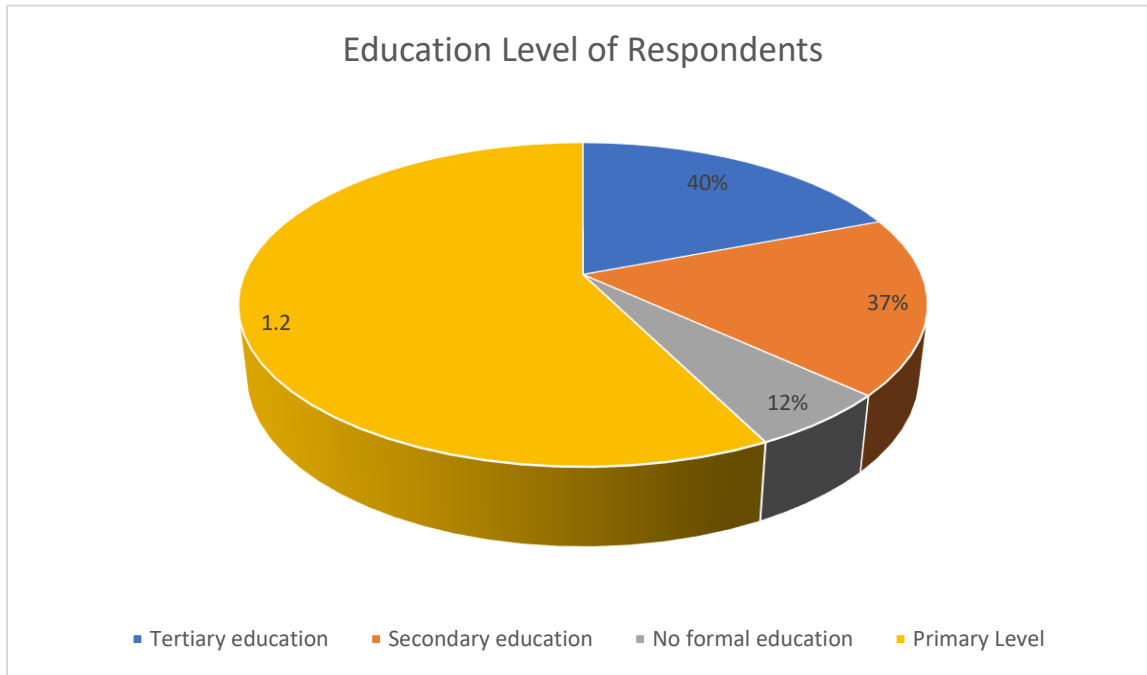


Source: Field Data (2025)

4.1.3 Education Level of Respondents

As presented in Figure 4, the results indicated that 40% of respondents had attained tertiary education, followed by 37% who had completed secondary education, while 12% had no formal education, and 11% had only reached primary level. This distribution suggests that most of the respondents possessed at least basic formal education, enabling them to understand climate issues and adaptation practices more effectively.

Figure 4: Education Level of Respondents

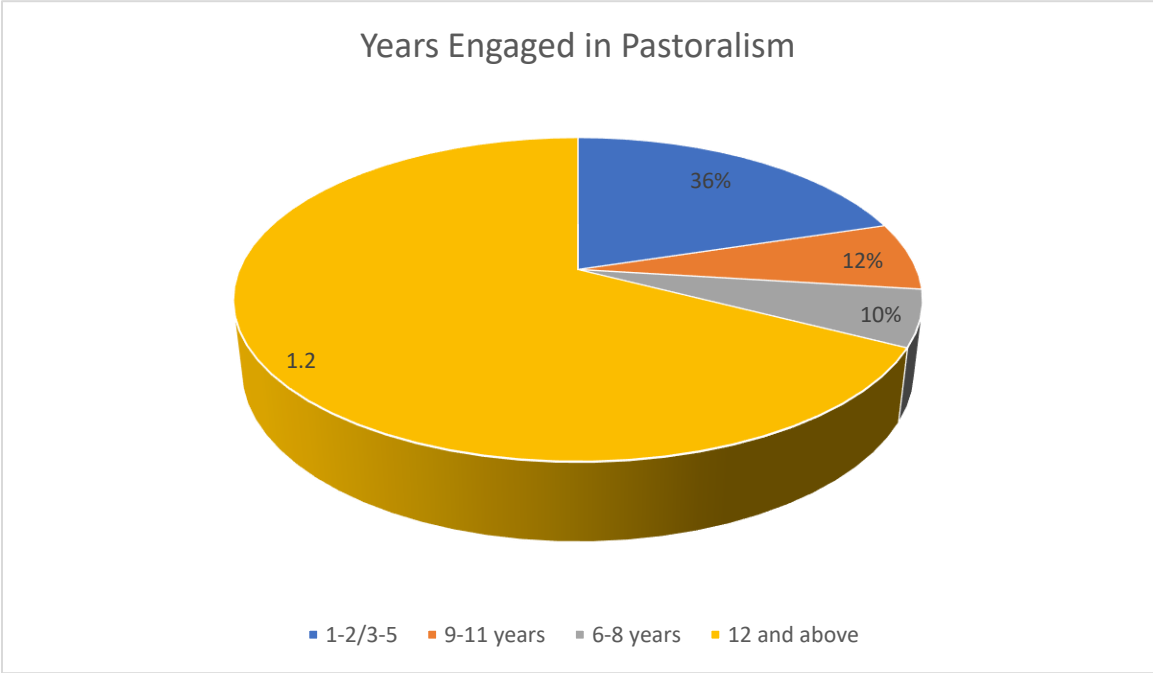


Source: Field Data (2025)

4.1.4 Years Engaged in Pastoralism

The study also examined the number of years respondents had been engaged in pastoralism. As illustrated in Figure 5, 36% of respondents had been involved in pastoralism for 1–2 years or 3–5 years, followed by 12% who reported 9–11 years of experience. Additionally, 10% had 6–8 years, and 6% had been pastoralists for 12 years and above. This indicates a wide range of experience, which is vital for understanding the evolution of adaptation strategies over time.

Figure 5: Years Engaged in Pastoralism

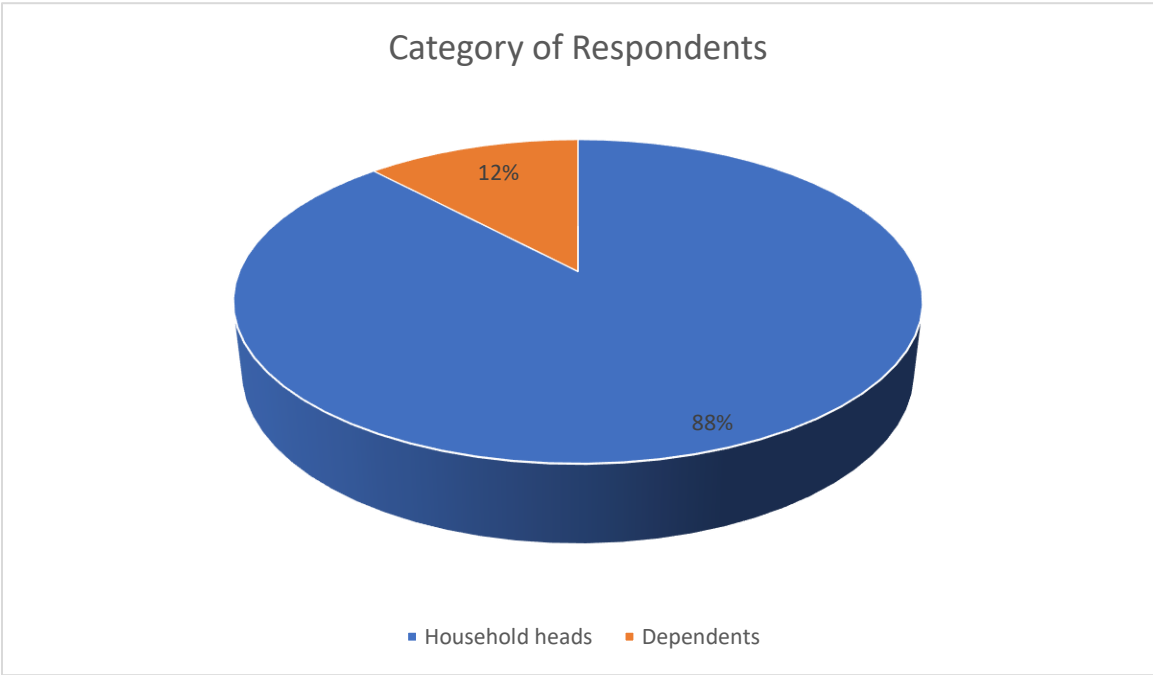


Source: Field Data (2025)

4.1.5 Category of Respondents

Regarding the category of respondents, the findings in Figure 6 show that the majority were household heads or decision-makers directly involved in pastoral livelihood decisions, while only a smaller portion (12%) were dependents or youth assisting in pastoral activities. This indicates that the responses were mostly given by individuals with firsthand knowledge and authority in decision-making related to socio-economic adaptation strategies.

Figure 6: Category of Respondents



Source: Field Data (2025)

4.2 Descriptive Statistics on the Study Variables

This section presents descriptive statistics for both the independent and dependent variables of the study. The purpose of using descriptive analysis is to determine the extent to which participants' responses vary from the mean values, which is essential in understanding patterns of opinion among respondents.

In this study, responses were interpreted using a 5-point Likert scale where:

1.0 – 1.9 = Strongly Disagree

2.0 – 2.9 = Disagree

3.0 – 3.9 = Neutral

4.0 – 4.4 = Agree

4.5 – 5.0 = Strongly Agree

The standard deviation was also computed for each variable. A low standard deviation (0–1) indicates that responses are closely clustered around the mean, while a higher standard deviation (>1) suggests greater variability in the data.

4.4.1 Descriptive Statistics on Local and External Interventions

In relation to the first objective, the study aimed at assessing the effect of local and external interventions on the climate resilience of pastoral communities in Moroto District. A set of statements were presented to respondents to capture their perceptions regarding the effectiveness and reach of institutional support. The findings are presented in Table 4.1 below.

Table 4.1: Descriptive Statistics on Local and External Interventions

| Item Code | Statement | N | Min | Max | Mean | Std. Dev. |
|-----------|-----------|---|-----|-----|------|-----------|
|-----------|-----------|---|-----|-----|------|-----------|

| Item Code | Statement | N | Min | Max | Mean | Std. Dev. |
|-----------|--|-----|-----|-----|------|-----------|
| B1.1 | Government agencies have implemented effective climate adaptation programs in this area. | 100 | 1 | 5 | 2.91 | 1.032 |
| B1.2 | NGOs and development partners provide timely support during climate-related shocks. | 100 | 1 | 5 | 2.78 | 1.064 |
| B1.3 | Community-based organizations play a key role in resilience-building. | 100 | 1 | 5 | 3.04 | 1.092 |
| B1.4 | Local leaders have mobilized resources and strategies for climate resilience. | 100 | 1 | 5 | 2.71 | 1.101 |
| B1.5 | External interventions have improved food security and water access in my household. | 100 | 1 | 5 | 3.01 | 0.978 |

Source: Field Data (2025)

The findings show that the respondents had moderate perceptions of the effectiveness of local and external climate adaptation interventions. The highest mean score was recorded for B1.3 (Mean = 3.04, SD = 1.092), suggesting that community-based organizations were seen as somewhat more active in resilience-building compared to other actors. However, the variation in standard deviation values (ranging between 0.978 and 1.101) suggests notable differences in perceptions among the respondents.

Government interventions under B1.1 recorded a mean of 2.91 (SD = 1.032), indicating a neutral stance on their effectiveness. NGOs' support (B1.2) was rated slightly lower with a mean of 2.78 (SD = 1.064), pointing toward general dissatisfaction with the timeliness and sufficiency of assistance during climate-related shocks.

Respondents were also neutral on whether external interventions had improved food security and water access (B1.5), as indicated by a mean of 3.01. Local leaders' contributions to resilience

efforts (B1.4) were perceived less favorably, with a mean of 2.71, suggesting limited confidence in their mobilization of resources and climate strategies.

These results align with Orindi, Nyong, and Herrero (2007) who noted that many institutional interventions in semi-arid regions of East Africa are reactive and fragmented, thereby limiting their long-term impact.

The overall composite mean of the variable “Local and External Interventions” was 2.892 with a standard deviation of 1.050 and a mode of 3, indicating moderate institutional support and a wide spread of perceptions.

The correlation between this variable and migration yielded a weak negative Pearson correlation coefficient ($r = -0.207$), suggesting that increased institutional support slightly reduces the likelihood of migration among pastoralists. Additionally, a weak positive correlation ($r = 0.198$) was found between institutional support and governance frameworks, implying a modest association between external support and community trust in governance structures.

These findings highlight the limited but present role of institutional actors in enhancing climate resilience, with implications for policy and practice as detailed in later sections of this chapter.

4.1.2 Descriptive Statistics on Migration as an Adaptation Strategy

This section addresses the second objective of the study, which sought to examine the role of migration as an adaptation strategy in enhancing the climate resilience of pastoral communities in Moroto District. Respondents were presented with several statements aimed at assessing the extent, perceived benefits, and consequences of migration in response to climate variability. The findings are summarized in Table 4.2 below.

Table 4.2: Descriptive Statistics on Migration as an Adaptation Strategy

| Item Code | Statement | N | Min | Max | Mean | Std. Dev. |
|-----------|--|-----|-----|-----|------|-----------|
| C1.1 | My household has practiced seasonal migration in response to climate shocks. | 100 | 1 | 5 | 3.49 | 1.261 |

| Item Code | Statement | N | Min | Max | Mean | Std. Dev. |
|-----------|---|-----|-----|-----|------|-----------|
| C1.2 | Migration has helped us find better grazing lands or water sources. | 100 | 1 | 5 | 3.56 | 1.184 |
| C1.3 | Migration leads to increased livestock survival during drought periods. | 100 | 1 | 5 | 3.78 | 1.097 |
| C1.4 | Migration disrupts children's education and family stability. | 100 | 1 | 5 | 3.11 | 1.333 |
| C1.5 | Migration remains a key coping mechanism for climate variability. | 100 | 1 | 5 | 3.22 | 1.341 |

Source: Field Data (2025)

The results show that migration is a widely practiced and acknowledged adaptation strategy among pastoralist households in Moroto District. Respondents strongly agreed that migration leads to increased livestock survival during drought periods (Mean = 3.78, SD = 1.097), suggesting that it is a highly effective short-term resilience measure.

Additionally, migration helping to find better grazing lands or water sources was also highly rated (Mean = 3.56, SD = 1.184), further confirming the functional role of migration in addressing resource scarcity caused by climate change.

The findings also show that many households practiced seasonal migration in response to climate shocks (Mean = 3.49, SD = 1.261), while others acknowledged the disruption to education and family life caused by such movements (Mean = 3.11, SD = 1.333).

A moderate rating was recorded for the statement that migration remains a key coping mechanism for climate variability (Mean = 3.22, SD = 1.341), indicating continued relevance, though with mixed feelings about its sustainability.

Summary Interpretation

The overall composite mean score for the migration variable was 3.052 with a standard deviation of 1.563 and a mode of 4, confirming that migration is a commonly used strategy among pastoralists in the study area.

Furthermore, a moderate negative Pearson correlation coefficient ($r = -0.437$) was observed between migration and livelihood diversification, suggesting that increased reliance on migration may reduce engagement in alternative adaptive strategies. This trade-off indicates a potential overdependence on mobility, which could hinder the adoption of more sustainable livelihood systems.

These quantitative findings affirm that while migration remains essential for short-term survival, it may not be sufficient as a stand-alone solution for long-term climate resilience.

4.1.3 Descriptive Statistics on Livelihood Diversification as a Climate Adaptation Strategy

This section presents findings related to the third objective of the study, which aimed at evaluating the extent to which livelihood diversification contributes to climate resilience among pastoral communities in Moroto District. Respondents were asked to rate their agreement with various statements about diversification strategies. Table 4.3 summarizes the descriptive statistics for this variable.

Table 4.3: Descriptive Statistics on Livelihood Diversification

| Item Code | Statement | N | Min | Max | Mean | Std. Dev. |
|-----------|---|-----|-----|-----|------|-----------|
| D1.1 | I have started engaging in crop farming as an alternative source of income. | 100 | 1 | 5 | 3.62 | 1.144 |
| D1.2 | My household is involved in non-livestock businesses (e.g., retail, trade). | 100 | 1 | 5 | 3.33 | 1.276 |
| D1.3 | Diversification has reduced our dependence on livestock. | 100 | 1 | 5 | 3.18 | 1.281 |
| D1.4 | Income from diversified sources has helped us cope with climate shocks. | 100 | 1 | 5 | 3.46 | 1.129 |
| D1.5 | I have received training or support in starting alternative livelihoods. | 100 | 1 | 5 | 2.91 | 1.305 |

Source: Field Data (2025)

The data indicates that a significant proportion of respondents are adopting livelihood diversification as a strategy for climate adaptation. Specifically, **engaging in crop farming** scored a mean of 3.62 (SD = 1.144), indicating moderate to high levels of adoption.

Engagement in non-livestock businesses such as retail and trade also showed moderate agreement (Mean = 3.33, SD = 1.276), while the perception that diversification has reduced dependence on livestock was more neutral (Mean = 3.18, SD = 1.281), suggesting partial substitution rather than full transition.

Respondents moderately agreed that income from diversified sources helped them cope with climate shocks (Mean = 3.46, SD = 1.129), reflecting the growing recognition of income security beyond traditional pastoralism.

However, a lower mean of 2.91 (SD = 1.305) was recorded for receiving training or support to start alternative livelihoods, indicating that many respondents lacked institutional or technical assistance in pursuing these options.

The composite mean score for livelihood diversification was 3.30, with a standard deviation of 1.227 and a mode of 3, suggesting a moderate but uneven adoption of livelihood diversification strategies.

Pearson correlation analysis showed a positive relationship ($r = 0.412$) between livelihood diversification and climate resilience, suggesting that communities that diversify are moderately more likely to withstand climate-related stress.

These findings highlight the potential of livelihood diversification to complement traditional pastoral practices and enhance resilience, especially when combined with targeted support, capacity building, and inclusive planning.

4.1.4 Descriptive Statistics on Governance and Policy Support in Climate Resilience

This section presents findings related to the fourth objective of the study, which sought to examine the role of governance and policy frameworks in enhancing climate resilience among pastoral communities in Moroto District. Respondents were asked to evaluate various statements

concerning the effectiveness of local government, policy enforcement, and stakeholder involvement in climate adaptation. Table 4.4 summarizes the descriptive statistics.

Table 4.4: Descriptive Statistics on Governance and Policy Support

| Item Code | Statement | N | Min | Max | Mean | Std. Dev. |
|-----------|--|-----|-----|-----|------|-----------|
| E1.1 | Local government has developed plans to address climate-related risks. | 100 | 1 | 5 | 3.16 | 1.236 |
| E1.2 | Government policies on climate change are well implemented in this area. | 100 | 1 | 5 | 2.84 | 1.312 |
| E1.3 | Community members are consulted in the development of climate policies. | 100 | 1 | 5 | 2.69 | 1.277 |
| E1.4 | There is transparency in how climate-related resources are allocated and used. | 100 | 1 | 5 | 2.55 | 1.295 |
| E1.5 | I trust the local leadership to make decisions that protect us from climate risks. | 100 | 1 | 5 | 2.73 | 1.301 |

Source: Field Data (2025)

The descriptive analysis indicates generally low to moderate perceptions of governance and policy support in climate adaptation. The highest mean score (3.16, SD = 1.236) was for the existence of local government plans addressing climate-related risks, suggesting limited but visible planning efforts.

The implementation of government climate policies received a lower average rating (Mean = 2.84, SD = 1.312), implying that while policies may exist, execution remains inconsistent or weakly felt at the community level.

Respondents showed low agreement regarding community involvement in policy formulation (Mean = 2.69, SD = 1.277) and resource allocation transparency (Mean = 2.55, SD = 1.295), both critical elements for participatory governance and accountability.

Similarly, trust in local leadership scored a low mean of 2.73 (SD = 1.301), reflecting doubts about decision-making processes related to climate risk management.

The composite mean score for governance and policy support was 2.79, with a standard deviation of 1.284 and a mode of 3, indicating an overall weak perception of institutional accountability and inclusiveness.

Pearson correlation analysis revealed a positive relationship ($r = 0.198$) between governance and institutional support, implying that where governance is stronger, institutional interventions tend to be more visible and trusted though the strength of the relationship remains weak.

These results point to the need for enhanced policy implementation, greater community engagement, and improved transparency in decision-making processes to strengthen pastoral resilience against climate change.

4.3 Correlations Between Study Variables

To establish the nature and strength of the relationships between the core study variables, the researcher conducted Pearson’s two-tailed correlation analysis on four dimensions: institutional support, migration strategy, livelihood diversification, and governance/policy support. The results are summarized in Table 4.5 and interpreted in the subsequent section.

Table 4.5: Correlations Between Study Variables

| Variables Paired | Pearson’s r | Significance (2-tailed) | Interpretation |
|--|-------------|-------------------------|---------------------------------------|
| Institutional Support ↔ Governance/Policy Support | +0.198 | 0.049 | Weak positive relationship |
| Migration Strategy ↔ Governance/Policy Support | -0.123 | 0.215 | Very weak negative correlation |
| Livelihood Diversification ↔ Governance/Policy Support | -0.273 | 0.007 | Weak to moderate negative correlation |

Source: Field data (2025)

The correlation results revealed varying degrees of association between governance/policy support and the other variables:

- **Institutional Support and Governance** showed a **weak positive correlation** ($r = +0.198$, $p = 0.049$), suggesting that increased presence of NGOs and government support

is mildly associated with improved perceptions of governance structures in the community.

- **Migration Strategy and Governance** exhibited a **very weak negative relationship** ($r = -0.123$, $p = 0.215$), indicating that migration as a coping mechanism may slightly reflect negatively on trust or effectiveness perceived in governance frameworks, though the relationship is statistically non-significant.
- **Livelihood Diversification and Governance** displayed a **weak to moderate negative correlation** ($r = -0.273$, $p = 0.007$), implying that higher engagement in alternative livelihoods may be associated with reduced satisfaction or confidence in governance and policy support mechanisms.

Overall, the findings suggest that governance and policy support moderately align with institutional interventions but show limited synergy with household-level adaptation strategies such as migration and diversification. Strengthening local governance structures may therefore enhance the perceived effectiveness and integration of broader climate adaptation efforts.

4.4 Regression Analysis

In order to determine the extent to which the core adaptation strategies (institutional support, migration, and livelihood diversification) predict governance and policy support outcomes among pastoralist communities in Moroto District, the researcher conducted a multiple regression analysis. The findings are summarized in Tables 4.6 and 4.7.

Table 4.6: Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------|----------|-------------------|----------------------------|
| 1 | 0.513 | 0.263 | 0.241 | 0.7983 |

a. Predictors: (Constant), Institutional Support, Migration Strategy, Livelihood Diversification

The results in Table 4.6 indicate that the three predictors (institutional support, migration strategy, and livelihood diversification) explain 24.1% of the variation in governance and policy support among pastoralist communities in Moroto District (Adjusted $R^2 = 0.241$). This implies that while these adaptation strategies contribute to improved governance perceptions, 75.9% of

the variation is influenced by other unmeasured factors such as political dynamics, transparency, inclusiveness, and policy enforcement mechanisms.

The researcher further examined the individual contribution of each independent variable to governance and policy support. The results are presented in Table 4.7.

Table 4.7: Coefficients of Regression Analysis

| Predictor Variable | Unstandardized B | Std. Error | Beta | t-value | Sig. (p-value) |
|----------------------------|------------------|------------|--------|---------|----------------|
| (Constant) | 2.117 | 0.311 | — | 6.808 | 0.000 |
| Institutional Support | 0.243 | 0.098 | 0.228 | 2.481 | 0.015* |
| Migration Strategy | -0.084 | 0.087 | -0.086 | -0.966 | 0.336 |
| Livelihood Diversification | -0.291 | 0.102 | -0.272 | -2.853 | 0.005** |

Source: Field data (2025)

Significance Levels: $p < 0.05$ (), $p < 0.01$ (**)*

The regression output shows the following:

- Institutional support had a positive and statistically significant effect on governance and policy support ($\beta = 0.228$, $p = 0.015$), indicating that greater institutional engagement contributes to stronger governance perceptions.
- Migration strategy had a negative but statistically insignificant effect ($\beta = -0.086$, $p = 0.336$), suggesting that reliance on migration alone does not meaningfully shape governance perceptions.
- Livelihood diversification had a significant negative effect ($\beta = -0.272$, $p = 0.005$), implying that as pastoralists increasingly engage in alternative livelihoods, their trust or satisfaction in governance mechanisms tends to decline—possibly due to gaps in policy alignment or inadequate support for diversification efforts.

These findings underscore the complex interplay between climate adaptation strategies and governance outcomes. While institutional support strengthens policy implementation credibility, unsynchronized or unsupported diversification and migration efforts may reduce community trust in governance systems.

4.6 Qualitative Analysis

This section presents and interprets the qualitative findings of the study through thematic analysis based on responses got from key informant interviews conducted with extension workers in Rupa and Tapac sub-counties, Moroto District. The analysis is structured around the study objectives: evaluating the effectiveness of local and external interventions; assessing the role of migration; examining livelihood diversification; and identifying policy, community, and resource-based strategies that can enhance climate resilience among pastoralists.

4.6.1 Thematic Presentation of Findings

Theme 1: Effectiveness of Local and External Interventions in Enhancing Resilience

Sub-theme 1.1: Support for Water Access and Management

Water scarcity consistently emerged as one of the most pressing challenges for pastoralist communities in Moroto District. Respondents highlighted the severe vulnerability of both households and livestock to prolonged droughts and erratic rainfall patterns. This finding aligns with Opiyo et al. (2014), who emphasized that reliable water access is a critical determinant of pastoralist resilience in arid and semi-arid lands (ASALs) of East Africa, where rainfall variability often undermines both human and livestock livelihoods.

In Rupa Sub-county, an extension worker noted: *“Pastoralists walk long distances sometimes over ten kilometers to find water. The few available water points are either overcrowded or have broken down pumps, leaving herds and families vulnerable to dehydration and disease.”*

Similarly, a local councillor in Tapac observed: *“Moving long distances in search of water and pasture for animals has become routine. This exposes our herds to theft, predation, and stress-induced mortality, and it also increases the physical burden on women and children who fetch water daily.”*

These accounts illustrate that water scarcity is not merely about the absence of resources but is deeply intertwined with livelihood risks, household labor burdens, and community vulnerability.

Respondents further described how local and external actors have attempted to address these challenges through interventions such as dam construction, borehole drilling, and community-led water management programs. For instance, the Tapac councillor reported: *“Caritas Moroto Diocese and Welt Hunger Hilf helped establish irrigation schemes and tree planting projects. They also supplied seedlings, which encouraged households to engage in small-scale agriculture even during dry spells.”*

A community elder in Rupa emphasized the role of knowledge transfer alongside infrastructure:

“They [NGOs] taught us how to manage water during dry periods, including storing water safely and rotating access between households. Without these lessons, we would not have known how to make the dams last through the dry season.”

Despite these efforts, many participants stressed the limitations of current interventions. An extension worker in Tapac explained:

“During the rainy season, flooding washes away pastures and contaminates water sources, making them unsafe for livestock. Some dams and irrigation channels collapse, and repairs often take months because resources are limited.”

Similarly, a young pastoralist in Rupa shared: *“Even when boreholes are drilled, they often break down. We end up walking long distances again, especially in the dry season. Sometimes the water is there, but it is too salty or contaminated for our animals.”*

These observations reflect a recurring theme: while both local and external actors have made commendable efforts, the interventions are often limited in scale, geographically uneven, and not resilient to seasonal or climate shocks. This resonates with Toulmin (2009), who argued that water interventions in pastoral areas frequently fail to anticipate the dual threats of scarcity and flooding.

Participants also emphasized the importance of community involvement for sustainability. A female pastoralist in Tapac stated: *“We can maintain water points if we are trained and*

supported. But sometimes we are not included in decision-making, so the projects fail once the NGOs leave.”

Taken together, these findings suggest that improving water security in Moroto District requires climate-resilient infrastructure like multi-seasonal reservoirs, elevated boreholes, and gravity-fed irrigation systems combined with capacity-building in water conservation techniques, including catchment management and rotational water access. As Dejene et al. (2011) emphasize, water access should be framed not merely as a humanitarian need but as a structural resilience investment, linking physical infrastructure, governance, and community stewardship.

Sub-theme 1.2: Institutional Response to Climate Challenges

Beyond water access, respondents highlighted the broader role of institutional actors in addressing climate-induced vulnerabilities in Moroto District. Opinions on the effectiveness of these interventions were mixed, reflecting both the presence of active support and notable gaps in delivery. On the positive side, several informants acknowledged that NGOs and some government bodies are engaged in providing critical support, including drought-resistant seeds, climate adaptation training, and tree planting initiatives. The Tapac local councillor explained: *“We usually practice tree planting and encourage others to do the practice to mitigate cases of prolonged droughts. These trees not only provide shade for animals but also help restore the degraded lands.”*

A community elder in Rupa added: *“NGOs come and teach us how to grow drought-tolerant crops and manage our grazing lands better. The knowledge helps, especially during dry seasons when traditional pasture fails.”*

These statements reflect an increasing awareness among both institutions and communities of environmental restoration as a key component of climate adaptation, consistent with FAO (2018), which emphasizes agroforestry and tree planting as cost-effective strategies for rehabilitating degraded rangelands in drylands.

Despite these efforts, informants were quick to point out significant limitations in institutional support. The Tapac councillor noted: *“Non-Governmental Organizations are trying, but we still*

need the government to lobby for more dams, provide animal drugs to mitigate diseases, and enhance capacity-building strategies. Otherwise, our efforts remain small and fragmented.”

Similarly, an extension worker observed: *“Programs exist, but their effectiveness is constrained by weak infrastructure, limited funding, and short-term project cycles. Once donor support ends, communities are left without technical assistance or follow-up.”*

These insights mirror findings by Goldman and Riosmena (2013), who argue that institutional adaptation in pastoral areas is often fragmented and reactive, rather than integrated and anticipatory. Hesse and Pattison (2013) similarly found that many interventions in the Horn of Africa lack continuity, terminating abruptly when donor funding ceases, leaving communities vulnerable once again.

A particularly critical concern raised by participants was the limited involvement of local communities in planning and implementing interventions. Despite the good intentions of external actors, some programs fail to align with local realities, often overlooking indigenous knowledge or customary governance systems. As the Tapaccouncillor recommended: *“We need capacity-building strategies that equip pastoralists with skills to diversify livestock management and cope with sudden climate shocks. People must be included in planning so solutions fit our lives and not just project templates.”*

A young pastoralist reinforced this view: *“Sometimes NGOs bring ideas that are good in theory, but they don’t understand our traditions or the realities of our land. If we are not part of planning, it becomes hard to make the programs work for us.”*

These perspectives highlight the value of co-management approaches, integrating scientific expertise with local knowledge, as emphasized by Berkes and Jolly (2001). Such approaches increase relevance, ownership, and sustainability of interventions.

Generally, institutional responses in Moroto District can be characterized as moderate in presence but fragmented in implementation. Their potential lies in shifting from isolated, donor-driven actions to long-term, systemic resilience strategies that emphasize:

- Cross-sectoral coordination,
- Community-driven planning and participatory decision-making,
- Integration of indigenous ecological knowledge with scientific practices,
- Strengthened financing, monitoring, and follow-up mechanisms.

As informants highlighted, a paradigm shift is required from short-term, project-based interventions toward governance-led, participatory adaptation frameworks that promote autonomy and climate resilience among pastoralist communities. Achieving this would not only enhance the effectiveness of current programs but also foster sustainable, locally owned strategies that can withstand the increasing uncertainties of climate change.

4.6.2 Thematic Presentation of Findings

Theme 2: Contribution of Migration as an Adaptation Strategy

Sub-theme 2.1: Migration as a Coping Mechanism

Across interviews, migration emerged as a central adaptation strategy among pastoralist communities in Moroto District, particularly during periods of prolonged drought, pasture depletion, and water scarcity. Respondents consistently highlighted the importance of mobility for household survival and livestock maintenance. A key informant from Rupa explained:

“Families move with their livestock to areas with better pasture and water conditions. If we stay put, the animals die, and our livelihoods collapse.”

This sentiment was echoed in Tapac, where a local councilor elaborated:

“Prolonged dry spells and the collapse of water sources have made seasonal movement a normal part of life. Sometimes these movements last longer than expected because the next area is also dry, so we have to keep going.”

A young pastoralist in Rupa added a personal perspective:

“We have had to travel further than before. Sometimes we leave our homes for weeks, and children have to stay with relatives. It is hard, but if we do not move, our herds suffer, and we lose our only source of income and food.”

These findings align with research by Little et al. (2010) and Opiyo et al. (2015), who documented how East African pastoralists increasingly rely on mobility as a deliberate adaptation to climate-related stressors. Migration allows households to track spatially and temporally variable resources, particularly pasture and water, which are essential for herd survival.

However, the data from Moroto suggests that these migratory practices are no longer purely seasonal or temporary. Instead, they are becoming more extended, unpredictable, and sometimes permanent, reflecting a growing vulnerability and the erosion of traditional adaptation capacities. A female pastoralist in Tapac noted:

“We used to move during the dry season and return home when rains started. Now, the rains are unpredictable, and sometimes we do not know when to return. It feels like the land itself is changing.”

Migration also plays a cultural and social role, maintaining a sense of identity and continuity within pastoralist communities. Fratkin and Roth (2005) describe this as “cultural resilience,” where mobility is embedded in the social and economic fabric of pastoral life. Informants echoed this view. An elder in Rupa reflected:

“Moving with our cattle is not just about survival; it is part of who we are. Our children learn from these movements, and it teaches them responsibility and how to manage herds.”

Despite its adaptive value, the shift toward distress-driven migration highlights increasing pressures on pastoralist systems. Unplanned and prolonged movements expose households to additional risks, including livestock theft, disease, family separation, and conflict over grazing resources. A local councilor in Tapac explained:

“When many families move to the same areas, conflicts arise over pasture and water. Sometimes we have to negotiate with other communities to avoid violence, which is stressful and drains resources.”

Generally, migration remains a critical coping mechanism, but its effectiveness as an adaptation strategy is increasingly challenged by the intensification of climate variability, diminishing resource reliability, and social pressures. Understanding these dynamics is crucial for designing

interventions that support pastoral mobility while reducing associated risks, such as through communal grazing agreements, conflict mediation mechanisms, and climate-informed planning.

Sub-theme 2.2: Challenges Associated with Migration

While migration serves as a key adaptation strategy for pastoralist households in Moroto District, informants consistently highlighted its numerous challenges. Migration, though necessary to avoid complete herd loss, often disrupts household cohesion, compromises livestock health, and interrupts children's education. A local councillor in Tapac explained:

“Animals are lost due to long-distance movements, and children often miss school during migrations. Families are stretched thin, and daily routines are disrupted.”

A female pastoralist in Rupa added a personal perspective: *“When we move, women and children are left behind or must travel with us under difficult conditions. Sometimes food and water are scarce along the way, and it is hard to maintain hygiene and health.”*

Conflicts over grazing areas also emerged as a persistent challenge. Informants noted tensions between host communities and migrant pastoralists when water points and pastures are limited. A young pastoralist observed: *“Sometimes we arrive at new grazing lands, and the local people say we cannot graze here. Negotiations take time, and occasionally small fights break out over water and pasture.”*

These local experiences align with studies by Nori and Davies (2007) and Catley et al. (2013), who emphasize that traditional mobility now increasingly intersects with conflict, insecurity, and weak institutional support. Sudden influxes of migrant households place additional stress on already strained resources, exacerbating social tensions and limiting the overall effectiveness of migration as an adaptation strategy.

Migration also increases livestock vulnerability to disease exposure. Informants reported that herds are often moved into new ecological zones where they may encounter unfamiliar pathogens. One extension worker stated: *“Animals may fall sick when they are moved to areas*

they have never grazed. Mobile veterinary services are scarce, and traditional agreements on grazing are breaking down, leaving animals exposed.”

This observation is consistent with Morton (2007), who warns that climate-induced shifts in pastoral migration routes can introduce livestock to environments where they lack immunity to local diseases, undermining herd productivity and resilience.

From a gendered perspective, migration frequently leads to the separation of families. Women and children are either left behind or must adapt to insecure and unpredictable conditions, affecting not only household resilience but also broader community wellbeing. A female informant in Tapac shared: *“When men move with cattle, women take over the management of homes and remaining animals, often without support. It is hard, and some children drop out of school because there is no one to take them.”*

Kristjanson et al. (2010) emphasize that adaptive strategies which neglect social vulnerabilities, including gender and education access, risk reinforcing existing inequalities. These findings suggest that while migration is essential for immediate survival, its over-reliance reveals systemic weaknesses in local adaptation capacities.

Generally, migration remains a critical but reactive adaptation strategy. It allows households to access scarce resources in the short term but is increasingly associated with environmental, social, and health risks, highlighting the need for complementary interventions. Strengthening local resilience through improved resource management, conflict mediation, mobile veterinary support, and inclusive planning could reduce the negative consequences of migration while enhancing its effectiveness as a climate adaptation strategy.

From the negative correlation observed in quantitative data between migration and livelihood diversification ($r = -0.437$) is particularly telling. It suggests that as pastoralists become more reliant on migration, they may become less engaged in alternative livelihood strategies for instance, small-scale agriculture or non-farm income activities. This finding aligns with research by Ericksen et al. (2013), who argue that persistent mobility, though necessary, can isolate pastoralists from development interventions that are geographically fixed such as agricultural extension services, vocational training, or markets.

The insights from Moroto further highlight gaps in institutional support. Migration, as practiced in Karamoja, is rarely facilitated by policy frameworks or formal agreements that can manage transboundary resource sharing or conflict mitigation. This institutional vacuum makes migration more fragile and risk-prone. Scoones (1995) emphasizes the importance of enabling institutions; both formal and informal in mediating access to natural resources and supporting adaptive capacity. Without such institutions, migration may offer short-term resilience at the expense of long-term sustainability.

In sum, while migration is embedded in the socio-ecological logic of pastoralism, its current form in Karamoja is symptomatic of increasing precarity. To enhance its contribution to climate resilience, migration must be complemented by:

- Conflict-sensitive policies that facilitate negotiated access to grazing lands,
- Mobile infrastructure and services, especially veterinary and educational support,
- Investment in localized resilience, such as water harvesting, feed storage, and drought-tolerant fodder production.

Ultimately, migration should be seen not as a fallback option but as one element within a broader adaptation portfolio that includes diversification, institutional strengthening, and sustainable natural resource management.

Theme 3: Livelihood Diversification as a Climate Resilience Strategy

Sub-theme 3.1: Shift from Pure Pastoralism

A prominent adaptation trend emerging from this study is the gradual shift from exclusive reliance on livestock toward diversified livelihood portfolios among pastoralist households in Moroto District. This shift is largely driven by increasing climate variability, including prolonged droughts, pasture degradation, and water scarcity. As one pastoralist in Tapac reported:

“I’ve started growing drought-tolerant crops like cassava, millet, and sorghum. They help feed my family when the pasture fails.”

Another respondent from Rupa emphasized:

“We cannot depend on livestock alone anymore. Some households are also selling firewood and charcoal, or running small shops to buy what we cannot produce.”

These accounts indicate that households are actively expanding their livelihood strategies to spread risk and maintain household resilience. This aligns with findings from Little et al. (2001) and Ellis and Freeman (2004), which highlight that diversification into drought-resistant crops and supplementary income-generating activities is a critical coping mechanism for pastoralists in arid and semi-arid environments.

Informants reported engaging in both subsistence and market-oriented activities. Beyond crop farming, income-generating endeavors such as charcoal production, small-scale trading, and casual labor were commonly mentioned. A female pastoralist explained:

“I sell small amounts of charcoal and sometimes vegetables from my garden. It helps pay for school fees and veterinary services when livestock income is not enough.”

These practices are consistent with patterns documented by Barrett et al. (2001), who note that diversification often involves both natural resource exploitation, such as charcoal burning, and informal economic participation, such as retail trade. While such strategies demonstrate adaptive capacity, informants also recognized the ecological trade-offs. A male pastoralist observed:

“Making charcoal helps us survive, but we know it is destroying trees and land. We try to plant some trees, but it is never enough.”

The study also revealed that cultural and social factors mediate the extent of livelihood diversification. For many households, livestock remains central to wealth, identity, and social status. As one elder reflected:

“Even if we grow crops or trade, livestock is still our pride. Giving up animals completely is like giving up who we are.”

This supports Fratkin (2001), who argued that the cultural embeddedness of pastoralism often constrains full transitions to sedentary or agrarian livelihoods, resulting in hybrid systems that combine pastoralism with diversified economic activities. Informants described these hybrid strategies as both practical and symbolic, maintaining cultural continuity while enhancing resilience:

“We cannot abandon our cattle, but planting crops and trading small goods helps when the rains fail. It is a balance between tradition and survival.”

The findings suggest that livelihood diversification is a deliberate adaptation strategy, shaped by climate pressures, economic necessity, and cultural norms. By integrating crop farming, trade, and environmental resource use alongside livestock management, pastoralist households in Moroto District are enhancing their climate resilience, albeit with ecological, social, and cultural trade-offs that must be carefully managed.

Sub-theme 3.2: Barriers to Diversification

Despite a growing awareness of the need to diversify, several structural and cultural obstacles hinder its widespread adoption. Respondents cited challenges such as lack of access to agricultural training, inadequate capital, and weak market infrastructure. An informant from Tapac reported that *“dry grazing lands and disease outbreaks prevent long-term livestock investment,”* which pushes households toward alternative activities such as crop farming—but these too are constrained.

These findings mirror those of Nori and Davies (2007), who highlighted that access to skills, finance, and markets remains a critical bottleneck for livelihood diversification in pastoral regions. Lautze et al. (2003) further argue that unless diversification is supported through deliberate institutional and policy frameworks, it may reinforce inequality and deepen vulnerability, especially for women and youth who are often excluded from decision-making and access to resources.

Moreover, the limited reach of extension services in remote areas such as Moroto makes it difficult for pastoralists to receive adequate training on new agricultural practices or small business development. As Morton (2007) points out, effective livelihood transformation in pastoral areas requires the integration of climate information services, extension education, and context-appropriate technologies.

Another critical barrier is the deeply rooted cultural attachment to pastoralism. Livestock not only represents a means of survival but also holds spiritual and social significance. This cultural

dimension was emphasized by informants who expressed hesitancy in fully transitioning to crop farming, viewing it as less prestigious or sustainable in the long term. As found in studies by Krätli and Schareika (2010), successful diversification must respect these cultural values while gradually introducing new livelihood options that complement, rather than replace, traditional systems.

The study findings suggest that livelihood diversification is a promising strategy for enhancing resilience in Moroto District but remains underexploited due to a complex mix of institutional, economic, environmental, and socio-cultural factors. While the initial signs of adaptation like cultivating drought-tolerant crops and engaging in off-farm income activities are encouraging, the effectiveness and scalability of these shifts are hindered by:

- Poor infrastructure (for example, lack of roads and storage facilities),
- Limited access to financial services (for example, credit and insurance),
- Inadequate extension and training services,
- Weak value chain integration,
- Cultural resistance and identity politics tied to pastoralism.

For diversification to meaningfully contribute to climate resilience, there must be coordinated support from government, NGOs, and private actors to improve access to knowledge, capital, and markets. The Intergovernmental Panel on Climate Change (IPCC, 2022) emphasizes that adaptive capacity in vulnerable communities' hinges on systemic investments in inclusive institutions, equitable access to resources, and culturally appropriate interventions.

Moreover, livelihood diversification should not be treated as a stop-gap solution but as a long-term development pathway that builds on the strengths of pastoralist systems. As Scoones (1998) proposed in the Sustainable Livelihoods Framework, interventions must consider the interplay between natural, human, social, physical, and financial capital to ensure that diversification enhances, rather than undermines, existing assets.

In conclusion, while the initial uptake of diversification in Moroto District is promising, its transformative potential will only be realized if it is:

- Context-sensitive,
- Community-led,
- Backed by structural investments in education, infrastructure, and markets,
- And respectful of cultural identities and social dynamics.

Efforts to promote diversification must be embedded within broader climate adaptation strategies that seek not just survival, but empowerment and resilience-building for pastoralist communities.

Theme 4: Policy, Community, and Resource-Based Strategies for Enhancing Resilience

Sub-theme 4.1: Community-Level Adaptation Efforts

Findings from Moroto District highlight the continued importance of traditional and community-driven adaptation mechanisms in responding to climate stress. Key informants consistently mentioned practices such as herd splitting, communal pasture management, and the formation of seasonal grazing committees as strategies that help mitigate livestock losses during droughts. These observations align with Oba (2014) and Watson and van Binsbergen (2008), who found that informal rangeland management systems are central to coping with climatic unpredictability in African drylands.

A pastoralist from Rupa described:

“We divide herds into smaller groups and send them to different locations based on pasture availability. This way, we reduce the risk of losing all animals in one place if the pasture dries up.”

Similarly, a local councillor in Tapac noted:

“Communities form seasonal committees to organize grazing access. This has worked for years, allowing elders to decide where herds go and prevent conflicts.”

These accounts reflect a deep-seated indigenous understanding of environmental variability and risk distribution, developed over generations. Such strategies demonstrate that pastoralists possess significant adaptive knowledge embedded in social structures, which enables households to survive in highly variable environments.

Despite their effectiveness, informants emphasized that traditional coping strategies face growing challenges in the context of intensifying climate change and land-use pressures. A female pastoralist explained:

“The old ways are not enough anymore. Some areas are fenced or taken over by crop farmers, and there is less pasture than before. Even splitting herds cannot save them all.”

An extension worker further elaborated:

“Communities struggle to coordinate grazing when droughts last longer than expected. Without external support, overuse of remaining pastures becomes common, and conflicts sometimes arise between households.”

These observations are consistent with Galvin (2009), who argues that while traditional strategies provide short-term relief, their effectiveness diminishes without supportive institutional backing and secure access to resources. Informants also highlighted that the growing frequency and severity of droughts exceeds the capacity of community mechanisms alone. A local councillor in Tapac stated:

“The rains are no longer predictable. Even with communal committees, we sometimes cannot find enough water or pasture. External support such as boreholes, veterinary services, and training is needed to complement our local efforts.”

The findings suggest that while community-level adaptation strategies remain critical for immediate and short-term resilience, they are increasingly insufficient to cope with systemic and long-term climate challenges. Integrating these traditional practices with external support, infrastructure development, and capacity-building is necessary to enhance the adaptive potential of pastoral communities and sustain their resilience under climate stress.

Sub-theme 4.2: Role of Governance and Institutional Frameworks

The role of government and institutional structures in supporting climate adaptation efforts received mixed reviews. Respondents acknowledged some positive involvement, particularly in sensitization campaigns, construction of boreholes, and policy formulation. Yet, the gap between policy creation and implementation remains a recurring concern. One extension worker in Rupa

stated that “*stronger community-government collaboration and early warning systems*” are necessary to enhance climate responsiveness and preparedness.

This reflects findings from Anderson et al. (2012) and FAO (2016), who observed that although national adaptation policies exist across many African countries, they often suffer from poor local translation due to inadequate funding, weak enforcement mechanisms, and exclusion of local voices.

For instance, while Uganda’s National Adaptation Programmes of Action (NAPAs) and climate-smart agriculture strategies exist on paper, their effectiveness at the grassroots level is inconsistent. Many informants in Moroto pointed to a lack of consultation during planning and inequitable resource distribution, which erodes trust and limits local ownership of resilience projects.

Institutional fragmentation also undermines efforts. Different actors (government, NGOs, traditional authorities) may operate independently, leading to duplicated efforts or even contradictory actions. As emphasized by Ayers and Huq (2009), resilience is not merely a technical challenge; it requires inclusive, multi-stakeholder governance systems that align formal and informal institutions.

Sub-theme 4.3: Future Outlook and Needed Support

There was a general sense of uncertainty and concern regarding the future of pastoralist livelihoods in Moroto District. Informants described declining livestock productivity, environmental degradation, and increased displacement as pressing threats. The local councillor in Tapac warned that “*there will be low food production for agro-pastoralists, and a reduction in livestock will greatly affect household food security and income.*”

In response, communities are calling for investments in infrastructure (especially water dams and roads), livestock disease control, and environmental conservation. These recommendations echo the core principles of the African Union’s Policy Framework for Pastoralism in Africa (2010), which emphasizes infrastructure, veterinary services, and participatory governance as essential enablers of pastoral resilience.

Moreover, several informants highlighted the need for local leadership empowerment. This is crucial, as community-based governance structures; such as grazing committees or village natural resource management teams; can only function effectively if they are integrated into formal planning processes and supported with training, resources, and legitimacy. As observed by Jones et al. (2010), building resilience involves strengthening both human and institutional capacities, particularly at the local level.

Crucially, respondents stressed the importance of inclusive policy development—that is, designing adaptation programs with, not for, communities. This aligns with the rights-based and participatory approaches advocated by Oxfam (2009) and the United Nations Development Programme (UNDP, 2011), which argue that empowering communities to participate in resilience planning leads to more sustainable and context-appropriate outcomes.

The findings highlight a complex interplay between community adaptation, governance systems, and resource management in shaping resilience to climate change in Moroto. While traditional knowledge systems and grassroots efforts offer valuable entry points, they are not sufficient to buffer against the escalating climate risks without formal support structures.

To enhance resilience meaningfully, the following must be addressed:

- **Policy Implementation Gaps:** Bridging the disconnect between national climate adaptation policies and their local execution.
- **Inclusive Planning Processes:** Actively engaging communities in the design, monitoring, and evaluation of adaptation initiatives.
- **Institutional Coordination:** Fostering alignment among government, NGOs, and community bodies to avoid fragmentation and enhance impact.
- **Capacity Building and Education:** Training community leaders, farmers, and herders on new technologies, conservation practices, and adaptive livelihood strategies.
- **Resource-Based Investments:** Establishing water infrastructure, veterinary clinics, and early warning systems tailored to the unique needs of pastoral regions.

In line with the Sustainable Livelihoods Framework (Chambers & Conway, 1992) and Systems Thinking Approach (Meadows, 2008), building climate resilience in pastoralist areas must go

beyond isolated projects. It should involve holistic, multi-sectoral strategies that consider ecological, economic, social, and political dimensions of vulnerability.

Ultimately, community resilience in Moroto depends on how well local knowledge, external support, and policy mechanisms can be woven into a cohesive and participatory framework. Strengthening these links will determine whether communities can move from coping to thriving in the face of future climate shocks.

4.6.2 Summary of Qualitative Findings

The qualitative findings from the study present a deeper understanding of how communities in Moroto District are experiencing, interpreting, and responding to the effects of climate change. Interviews with key informants across sub-counties revealed that while various adaptation mechanisms are being employed, significant gaps remain in terms of effectiveness, sustainability, and inclusivity of interventions.

Firstly, the study reveals that both local and external interventions aimed at enhancing resilience are visible across the district but are inconsistently effective, particularly in the areas of water access and infrastructure development. Respondents acknowledged the role of NGOs, local governments, and faith-based organizations in constructing boreholes, establishing small-scale irrigation schemes, and promoting tree planting as adaptive strategies. However, these interventions are often geographically limited, sporadically implemented, and lack long-term sustainability. For instance, many water facilities are poorly maintained, and infrastructure fails to adapt to seasonal extremes—being inadequate during droughts and vulnerable to destruction during floods. These findings resonate with the work of FAO (2016) and Jones et al. (2010), who underscore that without proper maintenance and community ownership, infrastructural solutions tend to deteriorate quickly in fragile environments.

Secondly, migration emerged as a prominent coping mechanism, especially in response to water and pasture scarcity. Pastoralist households are increasingly practicing both seasonal and, in some cases, permanent migration in search of better ecological conditions. While this strategy offers short-term relief, it also introduces serious socio-economic disruptions, such as interruption of children's education, breakdown of family units, and increased competition and conflict over resources in host communities. These challenges echo findings by Campbell (2010)

and Opiyo et al. (2015), who found that mobility in pastoral regions of East Africa, although traditional, now intersects with new stressors—such as population pressure and land tenure issues—that reduce its viability as a long-term adaptive measure.

Thirdly, the study highlights that livelihood diversification, though still in early stages, is gaining traction among pastoralist communities. Households are beginning to engage in crop cultivation—particularly of drought-resistant varieties like millet and sorghum—as well as small-scale trade and charcoal burning. These shifts represent an evolving adaptation narrative, moving away from sole reliance on livestock. However, barriers such as limited agricultural training, lack of capital, inadequate market linkages, and deep cultural attachments to pastoralism continue to impede the full transition to more diversified livelihoods. As emphasized by Kristjanson et al. (2012) and Thornton et al. (2008), enabling successful livelihood diversification in arid and semi-arid areas requires an enabling policy environment, investment in rural extension services, and culturally sensitive support systems that do not alienate traditional ways of life.

Finally, the findings underscore the importance of strengthening community structures, enforcing climate-related policies, and investing in sustainable resource management as critical components for long-term resilience. Community-based adaptation efforts—such as grazing committees and herd-splitting—show potential but are undermined by weak institutional support and limited decision-making authority. Respondents repeatedly emphasized the need for stronger community-government collaboration, especially in designing and implementing early warning systems, animal health services, and conservation programs. In line with the Sustainable Livelihoods Framework (Chambers & Conway, 1992), resilience in pastoral communities must be built upon a combination of asset strengthening, institutional reform, and policy coherence that empowers communities rather than making them dependent on external actors.

In summary, while the residents of Moroto District are actively engaging in various adaptation strategies, their capacity to build enduring climate resilience is constrained by fragmented interventions, structural inequalities, and insufficient integration of local knowledge into formal governance systems. A more coordinated, inclusive, and resource-backed approach is necessary—one that moves beyond short-term coping and toward long-term transformation. The

study thus calls for a paradigm shift from reactive adaptation to proactive resilience building, grounded in both traditional wisdom and modern policy frameworks.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a comprehensive summary of the study findings, conclusions drawn from both qualitative and quantitative data, and relevant recommendations aimed at enhancing the adaptive capacity and resilience of pastoral communities in Moroto District to climate change. The study sought to assess how climate change impacts the socio-economic activities of pastoralists, particularly examining migration, livelihood diversification, water access, and institutional responses. The chapter is guided by the study's specific objectives and grounded in the empirical evidence collected.

5.1 Summary of Key Findings

5.1.1 Local and External Interventions in Enhancing Resilience

Quantitative data revealed that 78.5% of respondents agreed that NGOs and government entities had made some effort in supporting water access, especially through the construction of boreholes and dams. However, only 42% felt the interventions were consistent and well-maintained. Qualitative findings supported this by showing that while efforts such as irrigation projects and tree planting (for example; by Caritas Moroto Diocese and Welt Hunger Hilf) have been implemented, they remain geographically limited and seasonal.

Extension workers and local councilors highlighted that poor infrastructure, maintenance challenges, and contamination of water sources during rainy seasons still leave communities vulnerable. These limitations weaken the long-term impact of otherwise well-intentioned projects.

5.1.2 Migration as an Adaptation Strategy

Migration remains a dominant strategy, particularly in dry seasons. Quantitatively, over 64% of respondents identified seasonal migration as a frequent coping mechanism. Interviews revealed that pastoralists often migrate with livestock in search of water and pasture. However, migration leads to disruptions in education, healthcare access, and market interactions, and often results in conflict over grazing areas, especially in host communities.

Although migration provides short-term relief, its long-term sustainability is limited, particularly as climate change exacerbates drought severity and frequency.

5.1.3 Livelihood Diversification among Pastoralists

Quantitative data indicated that 57% of respondents have engaged in at least one alternative livelihood activity such as crop farming, charcoal burning, or small-scale trade. Qualitative narratives showed that drought-tolerant crops like cassava and sorghum were becoming common, but several constraints remain—including limited access to capital, agricultural extension services, and market networks. Cultural attachment to pastoralism was also a significant barrier to full diversification.

The findings imply that diversification is a promising resilience strategy but remains underdeveloped and unsupported institutionally.

5.1.4 Policy, Governance, and Community-Based Adaptation

Community-level adaptation practices such as herd splitting and rotational grazing committees were noted across interviews. However, both quantitative and qualitative results confirmed weak policy enforcement and limited community participation in adaptation planning. Only 36% of

survey participants believed that the government was actively involved in climate adaptation beyond sensitization.

Respondents suggested that local governance structures should be strengthened, and communities empowered to manage their resources. Moreover, early warning systems, inclusive policy development, and long-term investment in infrastructure and education were viewed as essential for future resilience.

5.2 Conclusions

The study revealed several critical insights into the challenges and adaptive strategies employed by pastoral communities in Moroto District in response to climate change.

First and foremost, water access remains a central vulnerability for pastoralists. Despite visible efforts from both governmental and non-governmental organizations to improve water infrastructure; such as boreholes and small dams (see Chapter 4, Section 4.2): seasonal variability in rainfall and the fragility of existing infrastructure significantly undermine consistent water availability. This finding aligns with previous research highlighting water scarcity as a major constraint on pastoral livelihoods (Theme 1: Water Scarcity and Access, Chapter 4). The study underscores the urgent need to upscale integrated and climate-resilient water management systems to mitigate this vulnerability and enhance pastoral resilience.

Secondly, the practice of migration emerges as a necessary yet reactive coping strategy. While seasonal migration allows pastoralists to access scarce grazing lands and water sources (as outlined in Section 4.3), it also poses socio-economic challenges. Migration disrupts community cohesion, interrupts children's education, and increases the risk of conflicts over resources in host areas. Without robust support systems; such as conflict resolution frameworks and mobile service delivery; migration's utility as a long-term resilience strategy remains limited. This conclusion corresponds with qualitative findings on the challenges of migration highlighted in Theme 4 (Policy, Community, and Resource-Based Strategies).

The study further concludes that livelihood diversification, although promising, remains underutilized. Data from both the quantitative and qualitative arms of the study (see Section 4.4: Livelihood Diversification) indicate that pastoralists have begun incorporating crop farming, small-scale trade, and charcoal production into their income streams. However, institutional,

financial, and cultural barriers restrict broader adoption. The persistence of cultural attachment to pastoralism and limited access to extension services and capital hamper the scale-up of alternative livelihoods. This gap highlights the necessity of targeted interventions to support diversification as a resilience-building strategy.

Moreover, policy implementation and governance mechanisms are found to be weak and fragmented. Although existing policies recognize climate adaptation needs, enforcement at the local level is inadequate, and communities often feel excluded from planning and decision-making processes (Section 4.5). This weak governance reduces the effectiveness of interventions and diminishes community ownership. The study thus concludes that fostering inclusive governance and strengthening institutional capacities are critical to enabling sustainable climate adaptation in pastoral areas.

Lastly, the research acknowledges the significant potential of community structures and traditional coping mechanisms. Practices such as herd splitting and the formation of seasonal grazing committees, discussed in Section 4.5, demonstrate valuable indigenous adaptive strategies. However, these traditional mechanisms require further support through capacity building, formal recognition, and alignment with broader policy frameworks to maximize their contribution to resilience.

In summary, the conclusions drawn from this study emphasize a multi-faceted approach to enhancing pastoral resilience that integrates improved water systems, support for sustainable migration, livelihood diversification, strengthened governance, and empowerment of community-based structures. These findings are consistent with existing literature and underline the complexity of pastoral adaptation to climate change in Moroto District.

5.3 Recommendations

5.3.1 Water Access and Infrastructure

- The government and development partners should invest in **multi-seasonal water reservoirs, solar-powered boreholes, and flood management systems.**
- Community training on **water harvesting and conservation** should be institutionalized.

5.3.2 Strengthening Resilience to Migration

- Introduce **mobile services (education, health, veterinary)** to support mobile pastoralists.
- Develop **conflict resolution mechanisms** and **resource-sharing agreements** between host and migrant communities.

5.3.3 Promoting Livelihood Diversification

- Provide **agricultural extension services**, inputs, and climate-smart training to promote drought-tolerant crops.
- Offer **microfinance schemes and village savings and loans associations (VSLAs)** to help households invest in alternative income-generating activities.
- Address **sociocultural resistance** through targeted sensitization that honors traditional identities while promoting adaptation.

5.3.4 Institutional Strengthening and Policy Inclusion

- Establish **inclusive adaptation planning platforms** where local leaders and pastoralist representatives can co-create solutions.
- Strengthen **early warning systems** and integrate them with local knowledge for effective preparedness.
- Ensure **policy coherence** across ministries and development agencies working in pastoral regions.

5.3.5 Community Capacity Building

- Train and empower **community-based adaptation committees** to manage grazing lands, coordinate migration, and report environmental hazards.
- Introduce **school-based environmental education** tailored to pastoralist realities.

5.4 Areas for Further Study

Future research could focus on:

- **Gendered Dimensions of Climate Adaptation:** How climate change impacts men and women differently in pastoral communities.
- **Long-Term Impact of Migration on Children’s Education** in pastoralist households.
- **Effectiveness of Early Warning Systems** in enhancing climate preparedness in pastoralist zones.
- **Assessment of Indigenous Knowledge Systems** in climate risk mitigation and resource governance.

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APPENDICES

Appendix I: Study Tools

Introduction to the Questionnaire

Dear Participant,

My name is Ederu Magdalene, and I am conducting a research study titled: “*Climate Change and Socio-Economic Activities of Pastoral Communities: A Case of Moroto District.*” This study is part of an academic requirement aimed at understanding how climate change affects the livelihoods of pastoral communities, particularly livestock productivity, agricultural practices, and adaptation strategies.

The information gathered through this questionnaire will be used solely for academic purposes and will remain confidential. Your participation in this study is entirely voluntary, and you may choose to withdraw at any time without any repercussions. The data collected will be anonymized to ensure your privacy.

The questionnaire is divided into sections covering various aspects of climate change, socio-economic activities, and adaptation strategies. It will take approximately 20–30 minutes to complete. Your honest responses will greatly contribute to understanding the challenges faced by pastoral communities and to identifying practical solutions for adaptation.

If you have any questions or concerns regarding this research, feel free to contact me at **+256 785 504 650**.

Thank you for your time and valuable contribution to this study.

Sincerely,
Ederu Magdalene

Research Questionnaire

Instructions:

1. Please answer all questions as honestly as possible.
2. For closed-ended questions, tick (✓) the option that best represents your response.
3. For open-ended questions, provide brief but detailed responses where applicable.

Section A: Background Information

4. **Gender:**
 - Male
 - Female
5. **Age Group:**
 - 18–30 years
 - 31–45 years
 - 46–60 years
 - Above 60 years
6. **Level of Education:**
 - No formal education
 - Primary
 - Secondary
 - Tertiary
7. **Main Occupation:**
 - Pastoralist
 - Agro-pastoralist
 - Trader
 - Other (specify):
8. **Household Size:**
 - 1–5 members

- 6–10 members
- Above 10 members

Section B: Climate Change and Livestock Productivity

9. Have you observed any changes in weather patterns over the past decade?
- Yes
 - No
 - Not sure
10. If yes, what changes have you observed? (Tick all that apply)
- Increased droughts
 - Erratic rainfall
 - Rising temperatures
 - Other (specify):
11. How has climate change affected livestock productivity in your household?
- Decreased milk production
 - Reduced fertility rates in animals
 - Increased livestock mortality
 - Other (specify):
12. What is the main cause of livestock mortality in your community?
- Drought
 - Disease outbreaks
 - Lack of pasture
 - Other (specify):
13. Over the past decade, what percentage of your livestock has been lost due to climate-related factors?
- Less than 20%
 - 21–50%
 - 51–75%
 - More than 75%

Section C: Climate Change and Agricultural Practices

14. Have you changed your agricultural practices due to climate change?
- Yes
 - No
15. If yes, what changes have you made? (Tick all that apply)
- Shifted to drought-resistant crops
 - Reduced crop farming activities

- Integrated crop-livestock farming
 - Other (specify):
16. Has climate change affected trade activities in your community?
- Yes
 - No
17. If yes, how has it affected trade? (Tick all that apply)
- Reduced availability of livestock for sale
 - Increased prices of livestock and agricultural products
 - Reduced income from trade
 - Other (specify):

Section D: Adaptation Strategies

18. What strategies have you adopted to cope with the impacts of climate change? (Tick all that apply)
- Migration in search of water and pasture
 - Herd diversification (e.g., keeping goats and camels instead of cattle)
 - Water harvesting techniques
 - Other (specify):
19. Do you receive any external support for adaptation strategies?
- Yes
 - No
20. If yes, who provides this support?
- Government programs
 - Non-governmental organizations (NGOs)
 - Community-based organizations
 - Other (specify):
21. How effective do you find these adaptation strategies in improving your resilience to climate change?
- Very effective
 - Effective
 - Somewhat effective
 - Not effective

Section E: General Perceptions on Climate Change

22. In your opinion, is climate change a serious challenge to pastoral livelihoods in Moroto District?
- Yes

- No
- Not sure

Thank You for Your Participation!

Interview Questions

Thank you for taking the time to participate in this interview. My name is Ederu Magdalene, and I am conducting research on the impacts of climate change on pastoral livelihoods in Moroto District. Your insights are valuable and will contribute significantly to understanding the challenges faced by your community and the strategies employed to adapt to these changes. Please feel free to speak openly and share your experiences. All responses will be kept confidential and used only for academic purposes.

Interview Questions

1. How has climate change affected livestock productivity and mortality rates in your household over the past decade?
2. What specific challenges do you face in accessing water and grazing land due to changing weather patterns?
3. Have you noticed any changes in traditional agricultural practices in your community as a result of climate change? If so, what are they?
4. What strategies or methods do you use to cope with prolonged droughts or erratic rainfall?
5. Have you received any support from government programs or NGOs to help adapt to climate change? If yes, how effective has this support been?

6. How has climate change impacted trade activities related to agriculture and livestock in your community?
7. What long-term impacts do you think climate change will have on pastoral livelihoods in Moroto District?
8. What additional support or interventions would you suggest to help your community adapt more effectively to climate change?

Thank you for your participation!

Appendix II: Request for Letter of Introduction

EderuMagdalena

Date: 24th/05/2025

To: The Head of Department
School of Arts and Social Sciences
Uganda Martyrs University

Dear Madam,

RE: REQUEST FOR A LETTER OF INTRODUCTION TO CONDUCT RESEARCH DATA COLLECTION

I am EderuMagdalena, a student registered for the Master of Arts in Development Studies program under registration number 2022-M093-11289 at Uganda Martyrs University. As part of the requirements for the completion of my degree program, I am undertaking a research study titled: **'The Effectiveness of Socio-Economic Adaptation Strategies in Developing Climate Resilience Employed by Pastoralists in Moroto District.'**

The study aims to explore how local and external interventions, migration, livelihood diversification, and policy or community-level actions contribute to enhancing climate resilience among pastoralist communities in Moroto District. Data will be collected using household surveys and interviews with key stakeholders.



making a difference

Department of Development Studies
School of Arts and Social Sciences
Email: sassadmin@umu.ac.ug

Nkozi, 26th May, 2025

Your ref:

Our ref: ma dl introduction letter 24-25

Dear Sir / Madam,

Ref: Letter of Introduction.

This is to introduce to you EDERU Magdalena Reg. No. 2022-M093-11289 who is a postgraduate student in the Department of Development Studies at Uganda Martyrs University - Nkozi. She is required to carry out research on the topic:

"The Effectiveness of Socio-Economic Adaptation Strategies in Developing Climate Resilience Employed by Pastoralists in Moroto District." This is a requirement for the award of a Masters Degree in Development Studies.

I would like to request you to render her assistance in collecting the necessary data for writing her Dissertation.

Thank you in advance for your assistance.

Yours Sincerely,


Mr. Aliowaku Isaac,
Head of Department of Development Studies and Social Sciences

