

Negotiating Drought and Climate Uncertainty: Household Adaptation, Resilience and Livelihood Strategies in Migori County, Kenya

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Abstract

Cattle play a critical role in food security and socio-cultural life in both developed and developing regions. In sub-tropical areas, they provide meat, milk, and income and hold cultural, religious, and social significance, being used in dowries, ceremonies, and as status symbols. However, most cattle are raised under extensive systems, making them vulnerable to environmental stressors, particularly drought. This study focused on the effectiveness of household response strategies to drought hazards. This study focused on Migori County in Kenya, a region that is prone to frequent and severe drought events. Within the county, Nyatike and Kuria East sub-Counties are particularly affected due to their semi-arid conditions. The study found that household socio-economic characteristics significantly influenced drought vulnerability. Factors such as household size, income diversity, land ownership, and livestock holdings were critical. Larger families with fewer income sources and a heavy reliance on cattle were more vulnerable, while households that diversified income or practiced mixed farming were more resilient. Environmental and livestock-related stressors including declining water sources, pasture shortages, livestock disease, and reduced milk yield further compounded vulnerability. In response, households employed coping strategies like livestock sales, alternative agriculture, mixed farming, off-farm employment, and remittances. Effectiveness varied by location; while livestock sales offered short-term relief, they were often unsustainable, especially in Masaba Ward. Remittances were more effective in areas like Muhuru and Komosoko. Using a survey research design, data were collected from 383 randomly selected households via structured questionnaires and interviews. About 69.6% found livestock sales effective; 43.6% in Masaba and 40.7% in Muhuru adopted alternative agriculture. However, strategy success varied widely across wards. The study underscores the need for targeted interventions to build resilience in cattle-keeping households. Recommendations include improving water access, promoting pasture conservation, enhancing veterinary services, and encouraging income diversification. Policy gaps in drought preparedness must be addressed through coordinated action, climate-smart practices, early warning systems, and community-led contingency planning to safeguard livelihoods and food security in drought-affected regions, warning systems, and community-driven contingency plans to protect livelihoods and food security in drought-prone areas.

Keywords: Cattle Farming; Drought Vulnerability; Drought Coping Strategies; Household Resilience; Livelihoods; Climate Change.

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INTRODUCTION

Drought impacts on cattle-keeping households are shaped by an interplay of environmental, physiological, economic, and socio-cultural factors. Regional climatic variability, water and feed resource availability, and community resilience collectively dictate the severity and nature of drought outcomes. Consequently, effective adaptation and response strategies must be multifaceted, addressing water management, pasture conservation, economic diversification, and social support to bolster resilience in drought-prone areas (FAO, 2023; Mwangi *et al.*, 2022).

Households in drought-affected regions commonly employ livelihood diversification to respond to drought impacts. Diversification includes engagement in non-farm activities such as petty trade, casual labor, or migration to urban centers to supplement income and reduce dependency on rain fed agriculture and livestock (Mutunga *et al.*, 2021; Mwangi *et al.*, 2022). Livestock sales, especially of less drought-resilient animals, serve as an immediate coping mechanism to generate cash for food and essentials during drought periods (Otieno *et al.*, 2023).

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In parallel, water-efficient agricultural methods and drought-resistant crop varieties are increasingly adopted to sustain productivity under water scarcity, thereby safeguarding household food security (Ndambiri *et al.*, 2023). Adjustments to grazing and cropping patterns, such as altering planting dates and implementing rotational grazing, further help households cope with rainfall variability and pasture degradation (Muthoni *et al.*, 2022).

Social networks remain vital in drought response, with remittances from urban or international family members providing important financial buffers (Mwangi *et al.*, 2022). Community-based mutual support and resource-sharing arrangements help redistribute resources during crises; however, their sustainability is increasingly challenged by prolonged drought and socioeconomic stress (Nyambane *et al.*, 2021). Migration, both temporary and permanent, is a common adaptive strategy among pastoralist households. Livestock movement to areas with better forage or water availability and human migration to urban areas diversify livelihood options (Munyua *et al.*, 2022). Yet, migration can escalate resource competition and social tensions in destination areas, potentially increasing vulnerability (Obiero *et al.*, 2023).

Proactive drought preparedness is crucial in reducing impacts on households and livestock. Strategic water and forage management, including feed conservation through haymaking and silage, enhances resilience during dry spells (Njuguna *et al.*, 2023). Early warning systems and improved access to climate information empower households to make informed decisions about herd management and migration (Kamau *et al.*, 2021). Infrastructure investments, such as boreholes, rainwater harvesting, and water point rehabilitation, are essential for sustaining livestock during drought (WFP, 2023). Complementary health interventions, including vaccinations, parasite control, and targeted destocking, reduce livestock disease vulnerability exacerbated by drought stress (FAO, 2023).

Breed diversification and the selection of drought-tolerant cattle breeds are key strategies for increasing livestock resilience. Indigenous breeds, such as the East African Zebu, show higher tolerance to heat and water scarcity compared to exotic breeds, making them more suitable for drought-prone environments (Kiplangat *et al.*, 2022). Crossbreeding programs integrating drought-resistant traits contribute to herd sustainability under changing climates (Munyua *et al.*, 2022).

Improved feeding practices, including modification of feed composition, incorporation of drought-resistant forage species, and adjusted feeding schedules, mitigate nutritional stress during dry periods (Otieno *et al.*, 2023). Feed conservation techniques help

maintain year-round availability, preventing mortality and supporting livestock productivity despite environmental challenges (Njuguna *et al.*, 2023). Recovery after drought commonly involves restocking programs that rebuild depleted herds, integrating indigenous knowledge and community participation to ensure sustainability (Catley *et al.*, 2023). Sustainable drought response also requires peacebuilding initiatives to reduce conflicts over scarce grazing and water resources, thereby protecting both livelihoods and social cohesion (Obiero *et al.*, 2023).

Long-term resilience is best achieved through integrated approaches combining economic diversification, natural resource management, institutional support, and infrastructure development (Mwangi *et al.*, 2022). Aligning drought response strategies with broader development goals, including Sustainable Development Goal 2 (zero hunger), is critical to ensuring food security and sustainable livestock production amid increasing climatic uncertainty (FAO, 2023; United Nations, 2024).

The Role of Indigenous Knowledge in Addressing Drought Resilience

Indigenous knowledge has proven essential in enhancing drought resilience, especially among rural and agricultural communities in Africa where traditional practices have evolved over generations to cope with climatic variability. These practices are deeply rooted in local ecological understanding and social systems, enabling communities to anticipate and respond effectively to drought conditions. For example, in Uganda, agro pastoral smallholder farmers rely on indigenous indicators such as the flowering of specific plants and insect behavior to predict droughts. They complement these observations with adaptive strategies like mulching, crop rotation, and relocating livestock to wetlands during dry spells, thereby improving both crop and livestock resilience (Mfitumukiza *et al.*, 2020).

Beyond ecological indicators, indigenous knowledge encompasses community-based approaches that foster collective resilience. In South Africa's Eastern Cape, a significant proportion of communal farmers actively incorporate traditional practices in their farming systems to mitigate drought impacts. These practices include the use of drought-tolerant crop varieties and communal sharing of resources, which collectively reduce vulnerability. However, the sustainability of these knowledge systems faces challenges, as younger generations increasingly undervalue indigenous methods, posing a threat to the intergenerational transfer of these adaptive strategies (Muyambo, 2018).

The integration of indigenous knowledge with scientific approaches presents a promising avenue for enhancing drought resilience. Research in Tanzania highlights those traditional practices such as water

conservation techniques and crop diversification, when combined with modern scientific data and technologies, can significantly improve the effectiveness of climate adaptation strategies (Sospeter, Mtega, & Malekani, 2025). This integration is exemplified by innovative systems that merge indigenous indicators with sensor data to develop rule-based drought early warning systems. Such hybrid models improve forecasting accuracy and enable timely community responses to impending drought conditions (Akanbi & Masinde, 2018).

Overall, indigenous knowledge contributes vital, context-specific insights that complement scientific methods to build resilient agricultural and pastoral systems. Emphasizing the preservation and revitalization of these knowledge systems, while leveraging technology to enhance their utility, is crucial for sustainable drought management. This approach ensures that traditional wisdom continues to inform adaptive strategies in the face of increasing climate variability and water scarcity (Githinji, 2025; Akanbi, 2024).

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Drought Response Strategies in the Livestock Sector

Drought is a complex weather phenomenon characterized by its slow onset and cumulative impacts, making it particularly challenging to predict and manage (Wilhite & Pulwarty, 2021). The Horn of Africa has experienced an intensification in drought frequency and severity over recent years, with some regions suffering rainfall deficits of 50-75% below average, critically undermining agricultural and pastoral livelihoods (FEWS NET, 2023). Kenya's arid and semi-arid lands (ASALs), covering nearly 70% of the country, remain especially vulnerable, experiencing cyclic drought patterns that cause widespread socio-economic disruptions (Kenya NDMA, 2023).

Populations reliant on natural resource-based livelihoods, such as pastoralists, face significant threats from recurrent droughts. Studies highlight how communities in northern Kenya have diversified their livelihood portfolios beyond livestock to include wage labor, petty trade, and small-scale entrepreneurship as risk mitigation strategies (Little *et al.*, 2020). Livestock species composition has also shifted, with increased reliance on drought-resilient animals like camels, goats, and sheep, which demonstrate superior adaptability to arid conditions compared to cattle (Krätli *et al.*, 2023; Wasonga *et al.*, 2022).

Pastoralists employ a range of traditional strategies to mitigate drought impacts on their herds. Strategic livestock mobility remains a fundamental practice, enabling herders to access dispersed pasture and water resources during dry spells (Schilling *et al.*, 2021). Additional tactics include early destocking to prevent losses, herd splitting to reduce overgrazing, and intentional herd diversification towards drought-tolerant species (Schilling *et al.*, 2021; Yitbarek *et al.*, 2022). These indigenous knowledge-based practices reflect adaptive management grounded in local ecological understanding.

Government agencies and humanitarian organizations have intensified drought response efforts through commercial destocking programs, feed subsidies, water trucking, and enhanced veterinary services, such as vaccinations and parasite control, which are critical during drought stress periods (FAO, 2023; Kenya NDMA, 2023). While these short-term interventions help reduce immediate livestock mortality,

long-term resilience depends on investments in early warning systems, sustainable pasture and water infrastructure, and strengthening governance frameworks for resource management (USAID, 2022; WFP, 2023).

Kenya's Ending Drought Emergencies (EDE) strategy represents a holistic, multi-sectoral approach aimed at building drought resilience across ASAL communities. It focuses on sustainable livelihoods, climate-smart livestock systems, and risk-informed planning at both local and national levels (Government of Kenya, 2020). The increasing emphasis on community-based drought preparedness and response, supported by county governments and local institutions, has enhanced coordination, promoting locally tailored interventions (UNDRR, 2022).

RESEARCH METHODOLOGY

Study Area

The study was conducted in Nyatike and Kuria West sub-counties, situated within Migori County in southwestern Kenya. Migori County occupies a total area of approximately 2,613.5 square kilometers, of which about 478 square kilometers consist of water bodies, mainly Lake Victoria. The County lies between latitudes 1°06'51"S and 0°45'34"S and longitudes 34°02'24"E to 34°21'42"E, and shares international borders with Tanzania to the south, making it a strategic area for cross-border trade and cultural exchange.

Nyatike and Kuria West sub-Counties were purposively selected for this study due to their contrasting agro-ecological zones and socio-economic contexts. Nyatike is located in the Lower Midland (LM) zones LM4 and LM5, characterized by low and erratic rainfall, high temperatures, and shallow, less fertile soils. These features make it predominantly arid to semi-arid, thus more suitable for pastoralism and subsistence livestock rearing. Agricultural productivity is constrained by water scarcity and soil degradation, and communities in the region frequently experience food insecurity, particularly during prolonged dry spells.

In contrast, Kuria West lies in the Upper Midland (UM) zones UM2 and UM3, which are relatively more humid and fertile. This region receives higher and more reliable rainfall, allowing for a wider variety of agricultural activities, including intensive farming, horticulture, and dairy production. Its topography includes undulating hills and valleys, which support smallholder mixed farming systems that integrate crop cultivation and livestock keeping. Kuria West's proximity to Tanzanian markets also offers local farmers additional trade opportunities.

Migori County comprises eight sub-counties: Suna East, Suna West, Nyatike, Uriri, Awendo, Rongo, Kuria East, and Kuria West. Administratively, the

county is further subdivided into 23 divisions, 88 locations, and 202 sub-locations. According to the 2019 Kenya Population and Housing Census, the county had a population of approximately 1.1 million people, with a youthful demographic profile and a significant portion dependent on agriculture for their livelihoods. (Government of Kenya (GoK), 2017). The contrasting environmental and socio-economic conditions between Nyatike and Kuria West make them ideal for comparative analysis of household vulnerability to drought, particularly in relation to cattle keeping. Understanding how these communities adapt to and are affected by climatic variability offers valuable insights for designing region-specific resilience and adaptation strategies. Figure 3.1 illustrates the location and extent of the study area.

Description of the Study Area

Location of the Study Area

The study was conducted in Kuria East sub-County which lies in the latitude of 0°15' north and 1°45' south and longitudes of 35°15' East and 34° West, situated in Migori County, southern part of Nyanza Region (Figure 3.1). The sub-County altitude varies between 1400 metres-1887 metres above sea level.

Population Size

Kuria East sub-County covers an area of 188 square kilometer with a population density of 435 persons per square kilometer. According to the 2009 Population Census Report, the sub-County had a total population of 81,833 comprising of 40,248 males (49.2%) and 41,585 females (50.8%). The population was projected to grow to 126,337 by 2017. Density of persons covers an area of 435 per square kilometer (RoK, 2009).

Physical Features

Kuria East sub-County is characterised by undulating hills interspaced with a few stretches of flat land that cover most of the Sub-County surface area (GoK, 2008-2012). The sub-County is characterized by a rugged terrain and high surface run off making road maintenance and construction difficulty and costly. Topographically, the undulating hills have river valleys which run from the south towards the north interspersed with few stretches of flat areas.

The main rivers in the sub-County are Hibwa, Ragana, Nyangoto and Tebesi, all of which originate from the higher rainfall region of the Republic of Tanzania, and transverse the sub-County to join River Migori. Often when there is heavy rainfall, all the above rivers over flow and cause havoc in the lower parts of the sub-County. There is no lake in this sub County but there are quite a number of man-made dams distributed in the divisions to provide high potential for domestic use.

Climatic Conditions

The study area has a modified tropical equatorial climate type. It is modified by the effect of relief which ranges between 1400 meters and 1887 meters above sea level, due to the influence of Lake Victoria, the division receives bi-modal rainfall with peaks in April and November. Dry seasons occur in the months of December, February and in September. Annual rainfall averages between 1500 mm and 2600mm. Temperatures are generally warm and rarely fall below 18°C. Annual temperatures range between 27°C and 31°C. The climate is suitable for various crops such as maize, coffee, tobacco and horticultural crops. The main economic activity in Kegonga division is farming, where tobacco, maize, beans, and sweet potatoes are the main crops (GoK, 2008-2012).

Soils

The major soils found in the sub-County are volcanic and clay-to-clay loam soils. The other types of soil are silt, loam, nitrohumic ferrasols, and nitrohumic ferrasols planosols. Volcanic soils are deep and well drained are found to the south of Ntimaru Division while nitrohumic ferrasols are found both in Kegonga and Ntimaru Divisions. Poorly drained planosols are found in valley bottoms. Regosols and lithosols are found around rock outcrops and may occur on hill tops (GoK, 2008-2012). According to the soil maps and description from the National Soil Map of the Kenya Soil Survey by Jätzold and Schmidt (1982) in the former South Nyanza Province where Kuria East Sub-County falls has some patches of phaeozems soils which are well drained, less weathered clayed soils with high organic contents of organic humic substance in top soil

Agro ecological Zones

On the basis of land use the sub-County is divided into three zones, namely; Upper Midlands (UM₂, UM₃) and Lower Midlands (LM₄). UM₂ and UM₃ are characterised by small farm size and used for intensive agricultural activity; whereas UM₄ is more suitable for livestock production. The potential of the land has, however, not been fully exploited since only about 61.53 percent of all arable land (15926 Ha) is under crop cultivation. The remaining 38.47 per cent is put under grazing and forests. Farming is mainly under small scale.

Data Sources and Sample Size

The study employed a cross-sectional survey design, which was deemed most appropriate for assessing the current status of drought impacts and household-level response strategies at a specific point in time. This approach allowed for the efficient collection of both quantitative data such as household demographics, livestock losses, and income variations and qualitative data including perceptions of drought response strategies within a clearly defined timeframe. According to Creswell and Creswell (2018), cross-sectional designs are particularly valuable for describing

patterns and relationships among variables when time and resources are limited.

A longitudinal design, which involves repeated observations of the same variables over an extended period, was not selected due to constraints related to time, funding, and the immediate need for actionable data. Additionally, longitudinal studies require sustained participant engagement and complex data management, which were not feasible within the scope of this research (Bryman, 2016).

The cross-sectional design was effective in capturing demographic variations in drought experiences across diverse agro-ecological zones in Migori County. It facilitated comparative analysis between wards revealing geographical disparities in vulnerability, adaptive capacity, and institutional support. Furthermore, the integration of mixed methods of combining household questionnaires with qualitative key informant interviews enhanced the validity of the findings by enabling triangulation of data sources (Creswell & Plano Clark, 2017). To ensure robustness and consistency, data collection instruments were pre-tested, and enumerators received thorough training to minimize bias and maintain standardization across all study sites (Kumar, 2019).

Target Population

The target population comprised 15,685 households engaged in cattle farming across four purposively selected sub-locations within Nyatike and Kuria West sub-counties. These households were considered representative of the wider cattle-keeping population in the region, particularly within Lower Midlands (LM) and Upper Midlands (UM) agro-ecological zones. Selection was based on the existence of both rain-fed and mixed farming systems, as well as varying levels of exposure to drought hazards.

In addition, six (6) key informants were purposively selected based on their expertise and roles in community leadership, livestock management, and natural resource governance. These included four (4) assistant chiefs, each representing one of the selected wards who provided essential administrative and local insights on drought patterns and household-level responses; one (1) County Livestock Officer, who offered technical perspectives on livestock-related drought impacts such as disease outbreaks, animal mortality, and mitigation strategies; and one (1) officer from the Water Resource Users Association (WRUA), who contributed valuable information on the status of water resources, seasonal variability, and water governance mechanisms during periods of drought.

The study focused on four wards: Kanyarwanda (1,818 people), Muhuru (6,184 people), Komosoko (1,098 people), and Masaba (6,584 people). These

locations were strategically chosen to reflect different socio-ecological conditions, land use patterns, and drought vulnerability profiles. By combining household and expert-level data, the study ensured a holistic understanding of the drought impacts and response strategies among cattle-keeping households in Migori County.

Sampling Procedure and Sample size

According to KNBS (2019), Nyatike sub-county had 39,358 households across 24 locations, while Kuria West had 39,723 households distributed across 14 locations (GoK, 2019). A multi-stage sampling technique was employed to select the study areas and respondents. In the first stage, two sub-counties i.e. Nyatike and Kuria West were purposively selected based on their agro-ecological variability and prominence in cattle farming within Migori County. The second stage involved simple random sampling to select four sub-locations: Kanyarwanda and Muhuru (Nyatike), and Komosoko and Masaba (Kuria West), representing diverse agro-ecological zones and vulnerability to drought. A comprehensive list of livestock-keeping households was developed using the 2019 census enumeration data, and households were used as the primary unit of analysis. Enumeration areas within each agro-ecological zone (AEZ) were selected purposively to ensure representativeness of the environmental conditions affecting cattle farming.

The sample size for the study was determined using the Krejcie & Morgan (1970) formula (Equation 1), which provides a statistically valid sample size for finite populations based on desired confidence levels and margins of error:

$$S = \frac{[X^2 NP(1-P)]}{[d^2 (N-1) + X^2 P(1-P)]} \quad (1)$$

Where:

S = required sample size

N = the population size (39,358)

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841)

P = the population proportion (0.5)

d = the degree of accuracy expressed as a proportion (0.05)

Using the formula, the required sample size was calculated to be 383 households. This sample was proportionately distributed across the four sub-locations based on household population data to ensure equitable representation. Table 3.1 shows the sample distribution per ward and respective AEZs. This sampling approach enabled the study to capture geographical, ecological, and socio-economic variations affecting drought vulnerability among cattle-keeping households. This stratified approach also helped reduce sampling bias and ensured reliability of generalizations made from the collected data.

Table 3.1: Distribution of Sampled households Head per ward

Sub-county	Wards	AEZ	Number of Households	Sample size per sub-location	Sample size
Nyatike	Kanyarwanda	LM 4	1,818	1,818/15,685 ×383	44
	Muhuru	LM 5	6,184	6,184/15,685 ×383	151
Kuria West	Komosoko	LM 2 /LM 3	1,098	1,098/15,685 ×383	27
	Masaba	UM 2-4/LM 2	6,585	6,585/15,685 ×383	161
Total			15,685		383

Source: Kenya National Bureau of Statistics (2019)

Data Collection

The study relied on both primary and secondary data sources to achieve a comprehensive understanding of drought effects on cattle-keeping households in Migori County

Primary data

Primary data was collected using a combination of structured household questionnaires and a key informant interview schedule. The household questionnaire (Appendix I) was administered to the heads of selected households, who are often responsible for key decisions regarding livestock and drought coping strategies. The questionnaire was divided into thematic sections to collect data on: household demographic and socio-economic characteristics, patterns of drought occurrence and severity, socio-economic effects of drought on cattle production and livelihoods, and household-level preparedness and adaptation strategies to drought hazards. The use of a standardized questionnaire ensured uniformity in the data collection process, allowing for reliable comparisons across different wards and agro-ecological zones.

While the questionnaire was primarily administered in English, interpretation into Kiswahili was provided for respondents with limited proficiency in English to enhance clarity and response accuracy. The data collection process was conducted with sensitivity to local cultural norms and respect for community protocols, especially when accessing households' heads and engaging community leaders. Photographs of cattle conditions and grazing patterns were also used to visually document field observations, and official data on cattle assets was triangulated with household responses to enhance reliability.

Additionally, qualitative insights were gathered through key informant schedules using a structured schedule (Appendix II). These informants were selected purposively based on their roles and expertise in community leadership, livestock management, and resource governance. These included four assistant chiefs, one from each sub-location within the selected wards, one County Livestock Officer, and one officer from the Water Resource Users Association (WRUA). The interviews explored issues such as institutional responses to drought, livestock health and productivity

trends, and local water resource challenges during prolonged dry spells.

Secondary data

Secondary data was obtained through documentary review and content analysis from various credible sources to complement and validate primary findings. These included reports and records from the Ministry of Livestock and Agriculture, government databases, census data from KNBS, and scholarly literature. Specifically, the secondary data focused on livestock population statistics, drought incidence reports, common livestock diseases, market trends, and previous drought mitigation programs in Migori County.

Relevant literature was sourced from textbooks, peer-reviewed journals, government publications, theses, and policy documents. This mixed-method approach to data collection enriched the depth and breadth of the study, enabling the researcher to analyze both empirical data and contextual factors influencing household vulnerability and resilience to drought in cattle-farming communities.

Methods of Data Analysis

Descriptive statistics were used to assess the levels of preparedness and adaptation strategies adopted by households in response to drought. These included Practicing other agricultural activities, Re-allocating to other places, seeking for off-farm employment, practicing mixed farming, increasing land under grazing, herd size reduction, reliance on remittances from relatives and friends and sale of cattle during drought. The frequency and distribution of these strategies were analyzed across the four wards and compared against household socio-economic characteristics.

RESULTS AND DISCUSSION

Level of Household Response Strategies to Drought

Droughts, characterized by prolonged periods of insufficient precipitation, are influenced by various drivers such as climate variability, land-use changes, and anthropogenic global warming (Mukherjee *et al.*, 2018). These drivers not only determine the frequency and severity of drought events but also influence how communities experience and respond to them. At the household level, response strategies to drought such as migration, livelihood diversification, and water conservation vary based on socioeconomic status, access

to resources, and local knowledge systems (Below *et al.*, 2012). Understanding the interaction between drought drivers and household-level responses is essential for developing targeted adaptation strategies and enhancing resilience in vulnerable areas.

The government of Kenya has been committed to investing in reducing the drought risk vulnerability of communities in arid and semi-arid counties (NDMA, 2014; Thomas *et al.*, 2020). An important part of increasing drought resilience is adaptation at the household level. The government of Kenya, therefore, promotes climate-smart agriculture and livelihood diversification strategies (GoK, 2016). However, adaptation policies at the national level do not necessarily lead to effective implementation at the local level. To develop adaptation policies that are effective at the local level, it is important to consider the adaptation preferences and needs of rural households (Forsyth, 2013).

This section therefore, evaluate the level of household response strategies to drought in Migori County. Hazard preparedness is important for all animals, but it is particularly important to cattle because of their size and the requirements needed to keep them safe. Drought weaken the health of cattle and severely impact on food security of a given household depending on cattle as a source of their livelihood (Kahn, 2005). Consequently, drought put cattle farmers at risk; hence, there is need to be prepared as well as be in a position to manage hazards. Without serious efforts to address them, the risks of hazards will become an increasingly serious obstacle to sustainable development (Rukundo *et al.*, 2016).

In response to some of ongoing climate change impacts, farmers in Migori County have come up with a wide range of on-farm adaptation measures that increase the resilience of their production systems and livelihoods in the face of a changing and unpredictable climate. Off-farm services that could catalyze the uptake of adaptation practices include establishing demonstration training centers at the ward level; promoting group production and marketing; forming marketing groups to cushion livestock farmers against extra costs; linking value chain actors with formal financial institutions; forming cooperative societies; linking farmers to financial institutions; enhancing extension services by increasing the number of technical staff vehicles; adopting electronic extension; utilizing mass media, radio, and mobile phones; strengthening training on adaptation to climate change; and increasing access to agricultural

insurance services and socially-inclusive financial services (GoK, 2020).

Table 5.15 shows responses about practicing other agricultural activities as drought response strategy in the different wards. The study reveals that practicing other agricultural activities as a drought response strategy varies across different wards in Migori County. Masaba Ward had the highest proportion of respondents (43.6%) adopting this strategy, followed closely by Muhuru Ward (40.7%). In contrast, Kanyarwanda (10.3%) and Komosoko (5.4%) reported significantly lower engagement in alternative agricultural practices. Notably, the "NO" response rate was lower in Masaba (11.8%) and Muhuru (23.5%) than in Kanyarwanda (35.3%) and Komosoko (29.4%), suggesting that the former wards are more actively engaged in drought-response strategies. Overall, 71.0% of respondents practice alternative agricultural activities, highlighting their importance as a means of coping with drought conditions.

These findings align with previous studies that emphasize the role of livestock mobility and herd diversification as crucial drought adaptation strategies. Seasonal migration of livestock is common, with adult male herders moving with the main herd while milking cows, weak livestock, and calves remain at home to provide sustenance for women and children. Focus group discussions revealed that in past droughts, households depended on livestock products such as butter and milk for survival, but due to recurrent droughts, herd sizes have declined, reducing the effectiveness of this strategy. This pattern mirrors the findings of Lekapana (2020) and Okoti (2014), who observed similar trends among Kenya's pastoralist communities.

Herd diversification emerges as another essential strategy, with 72% of pastoralists adopting it to mitigate drought impacts. Households in the study areas keep mixed livestock species, including camels, shoats (sheep and goats), cattle, and donkeys. Respondents indicate a preference for camels and goats over cattle due to their resilience in arid conditions, ability to browse on woody plants, and adaptability to water scarcity. Furthermore, livestock off-take and the sale of animal products are crucial for economic stability during droughts. About 68.0% of pastoralists sell livestock at various drought stages to minimize losses, while 48.7% sell livestock products. Key informants highlighted that small livestock, like goats and sheep, are regularly sold to cover daily expenses, while larger livestock, such as camels and cows, are retained for milk production and major financial needs, such as weddings.

Table 5.15: Practicing other Agricultural Activities (N=366)

Wards	YES (Frequency, %)	NO (Frequency, %)
Muhuru	40.4	23.5
Kanyarwanda	10.3	35.3
Komosoko	5.4	29.4
Masaba	43.6	11.8

Source: Survey Data 2023

Table 5.16 shows the response of different wards to drought by reallocating their cattle to other places. The response of different wards to drought through cattle reallocation highlights the variations in the perceived effectiveness of this strategy. The findings indicate that reallocation is not universally effective, as seen in Muhuru Ward, where 44.1% of respondents rated it as "Not Effective." This suggests that local conditions, such as pasture availability, distance, and market accessibility, may hinder the success of reallocation efforts. Kanyarwanda Ward also exhibited some dissatisfaction, with 12.3% rating the strategy as "Not Effective," though with fewer responses overall.

On the other hand, Komosoko Ward presented a more divided perception, with 40% of respondents rating reallocation as "Most Effective" and 15.6% as "Effective." This suggests that while some households found it beneficial, others might have faced constraints that limited its success. Masaba Ward, however, had a significantly high approval of reallocation, with 77.8% of respondents considering it "Effective." This indicates that factors such as better pasture availability or effective coordination of livestock movement may have contributed to the success of the strategy in this ward.

In Kenya, studies have shown that pastoralist communities in arid and semi-arid lands (ASALs), such as the Maasai in Kajiado and the Borana in Marsabit, rely heavily on livestock mobility to cope with drought stress. For instance, Opiyo, Wasonga, and Nyangito (2014) found that livestock migration is among the most effective drought adaptation strategies among pastoralists in northern Kenya, helping households' access forage and water in less affected areas. However, these strategies are often constrained by land fragmentation, ethnic conflicts, and climate variability, leading to varying levels of effectiveness similar to the ward-level disparities observed in Migori County.

In contrast to the lower perceived effectiveness of cattle reallocation in Muhuru and Kanyarwanda Wards, communities in Turkana County have shown

greater reliance and effectiveness in using livestock mobility, including formal and informal agreements with neighboring communities to access grazing lands during dry seasons (Ng'ang'a, 2016). This highlights the role of institutional arrangements and traditional governance in facilitating successful migration. The success observed in Masaba Ward could be indicative of similar mechanisms at play, though likely on a smaller scale.

Cattle reallocation and migration are also prevalent in other pastoralist regions. In the Sahel, particularly in Niger and Mali, herders practice transhumance seasonal movement of livestock as a core strategy for drought mitigation. Turner (2010) observed that the flexibility and knowledge embedded in traditional pastoral systems enabled communities in these regions to survive severe climatic shocks. However, like in Kenya, growing land competition, agricultural expansion, and political boundaries increasingly restrict movement, reducing the effectiveness of this coping strategy.

Moreover, studies from Australia, such as those by Rickards and Keating (2011), illustrate how commercial livestock farmers adapt to drought through strategies like temporary relocation of livestock, feed purchases, and early destocking. These strategies are generally more effective due to better infrastructure and market access, contrasting sharply with the logistical challenges seen in some Kenyan wards like Muhuru.

The study from Migori County contributes to a growing body of evidence that livestock reallocation or migration can be a valuable drought response strategy. However, its effectiveness is highly context-dependent. Comparisons with other Kenyan regions and international cases suggest that institutional support, infrastructure, traditional systems, and ecological conditions play critical roles in determining success. The divergence between wards in Migori mirrors broader global trends, where localized factors heavily influence how well such strategies perform.

Table 5.16: Re-allocating to other places (N=366)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	20	4.4	44.1
Kanyarwanda	20	2.2	12.3
Komosoko	40	15.5	5.2
Masaba	20	77.8	38.3

Source: Survey Data 2023

Results from Table 5.17 shows responses to the strategy of seeking off-farm employment as a way to cope with drought across different wards. This study highlighted significant variations in the effectiveness of seeking off-farm employment as a drought coping strategy across different wards in Migori County. In Kanyarwanda Ward, a majority (53.5%) of respondents found this strategy to be "Most Effective," with almost no one (0.5%) considering it "Not Effective," indicating a generally positive perception. Masaba Ward also shows a favorable view, with 82.5% rating the strategy as "Effective," though a notable 36.2% still found it "Not Effective." In contrast, Muhuru Ward had the highest percentage (55.8%) of respondents who viewed off-farm employment as "Not Effective," suggesting that opportunities outside of agriculture might be limited in this area. Similarly, in Komosoko Ward, responses were more mixed, with only 8.5% rating it as "Most Effective" and a large portion categorizing it as merely "Effective."

The study in Migori County, Kenya, views off-farm employment as an immediate coping mechanism whose effectiveness varies by ward; for example, Kanyarwanda shows strong approval while Muhuru indicates limited opportunities, making it less effective. In contrast, the study by Latamo *et al.* (2020) in Korahey Zone, Ethiopia, emphasizes education as a long-term adaptation strategy, enabling future employment and enhancing resilience to drought. Here, sending children to school is seen as an investment in future income diversification, with employment in both governmental and non-governmental sectors viewed as key to adaptation. While both studies recognize the importance of livelihood diversification, Migori focuses on reactive

measures during drought events, whereas the Ethiopian context highlights proactive strategies centered on education and future planning.

These findings suggest that the effectiveness of off-farm employment as a drought response strategy is highly dependent on local economic conditions, job availability, and community perceptions. In areas like Kanyarwanda, where off-farm employment is seen as beneficial, there may be better access to alternative income-generating opportunities. Conversely, in Muhuru and Komosoko, the limited effectiveness of this strategy could indicate a lack of viable off-farm job opportunities or challenges in accessing them. Additionally, variations in household skills, education levels, and access to markets could further influence how effective off-farm employment is perceived as a drought resilience measure.

The results of this study contrast with findings from a study conducted in Dodoma, Tanzania, on off-farm income among grape farmers by Christopher (2015). In Dodoma, off-farm employment was largely characterized by artisanal skills such as painting, craftsmanship, tailoring, masonry, and welding, with only 6.32% of farmers receiving income from remittances. Agriculture remained the dominant occupation, and few individuals were gainfully employed in the formal sector. This divergence suggests that while off-farm employment can be a crucial drought-coping strategy in some regions, its success depends on the structure of local economies, the availability of skilled labor, and access to diverse income sources.

Table 5.17: Seeking for Off-farm Employment (N=366)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	33.8	12.6	55.8
Kanyarwanda	53.5	0.0	0.5
Komosoko	8.5	4.9	17.5
Masaba	4.2	82.5	36.2

Source: Survey Data 2023

Table 5.18 shows how different wards perceive the effectiveness of mixed farming as a drought coping strategy varies across different wards in the study area. In Muhuru Ward, mixed farming is perceived as "Most Effective" by 32.0% of respondents and "Effective" by 61.8%, suggesting that while many view it as a reliable strategy, some remain skeptical. However, 46.6% consider it "Not Effective," indicating that challenges may exist in implementing this strategy successfully in Muhuru.

A similar trend was observed in Komosoko Ward, where only 4.4% of respondents find mixed farming "Most Effective," and 7.9% see it as "Effective," while 46.6% regard it as "Not Effective." This suggests that local factors may be limiting the success of mixed

farming in these two wards. Conversely, in Kanyarwanda Ward, mixed farming is perceived more positively, with 14.9% rating it as "Most Effective" and only 6.7% considering it "Not Effective." Masaba Ward stands out as the most supportive of mixed farming, with 48.7% of respondents viewing it as "Most Effective" and 29.2% as "Effective," while none rated it as "Not Effective." This suggests that mixed farming is highly successful in Masaba, potentially due to favourable environmental or socio-economic conditions.

These findings align with studies conducted in other regions of Kenya and Africa. In Kenya, Gebre *et al.* (2023) found that 34% of farmers adopted crop diversification, including mixed farming, as a climate change adaptation strategy. The study revealed that the

adoption of multiple adaptation strategies, such as planting drought-tolerant varieties and diversifying crops, positively correlated with improved food security. However, the effectiveness of these strategies varied based on factors like education level, land size, and access to extension services.

Similarly, a study in Southern Ethiopia by Kukore & Adane (2022) highlighted that smallholder farmers employed coping mechanisms such as crop diversification and planting early maturing varieties in response to climate variability. The study emphasized that perceptions of climate change and the effectiveness of adaptation strategies were influenced by local conditions and the farmers' capacity to implement these strategies. In South Africa's Karoo region, Nqolo &

Hoffman (2023) observed that livestock farmers employed strategies like destocking, income diversification, and rangeland evaluation to cope with drought. While mixed farming was not prominently featured, the emphasis on diversification aligns with the broader principle of spreading risk to enhance resilience.

These studies collectively suggest that while mixed farming can be an effective drought adaptation strategy, its success is contingent upon local environmental conditions, resource availability, and socio-economic factors. Tailored approaches that consider these variables are essential for the effective implementation of mixed farming as a climate adaptation measure.

Table 5.17: Practicing Mixed Farming (N=379)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	32.0	61.8	46.6
Kanyarwanda	14.9	1.1	6.7
Komosoko	4.4	7.9	46.6
Masaba	48.7	29.2	0.0

Source: Survey Data 2023

Results from Table 5.19 shows responses to the strategy of increasing land under grazing as a way to cope with drought across different wards. Muhuru ward reported high percentage (59.9%) considers increasing land under grazing as "Most Effective" for drought response, which indicates strong support for this strategy. 52.9% view it as "Effective," though it seems that the effectiveness is more marginal for some, as not everyone agrees on its effectiveness. 16.2% find it "Not Effective," which is relatively low compared to other wards, suggesting that the strategy is generally seen as beneficial in Muhuru.

In Kanyarwanda ward the strategy of increasing land under grazing was viewed positively, with 29.9% considering it "Most Effective." Very few respondents viewed it as "Not Effective" (2.7%), with just one respondent seeing it as "Effective." This suggests a strong but limited acceptance of the strategy. In Komosoko Ward the strategy was less regarded with only 4.4% considering it "Most Effective" and 6.1% finding it "Effective." However, a notable 35.1% rated it as "Not Effective," suggesting a significant degree of dissatisfaction or challenges in implementing this strategy in Komosoko.

Masaba ward reported a smaller percentage (5.8%) who considered increasing land under grazing "Most Effective," while 39.1% found it "Effective." A relatively high 45.9% viewed it as "Not Effective," showing that a significant portion of the population in Masaba did not believe in this strategy helps. Muhuru had the most positive response to increasing land under grazing, with the highest proportion of respondents

(59.9%) finding it "Most Effective." The strategy was viewed as relatively effective, with only a small percentage (16.2%) considering it ineffective.

Kanyarwanda shows moderate support for the strategy, with most respondents finding it as effective strategy, though not as strongly as in Muhuru. Komosoko and Masaba show a more mixed or negative response, especially Komosoko, where a significant portion (35.1%) found it "Not Effective." Masaba also shows a considerable percentage (45.9%) viewing it as ineffective. The effectiveness of increasing land under grazing varies significantly between wards. Muhuru had the highest positive view of the strategy, while Komosoko and Masaba showed considerable dissatisfaction, especially in terms of its effectiveness in drought management.

In Laikipia County, Kenya, Ndiritu (2021) examined pastoralists' adaptation strategies to climate change and found that increased mobility and water management practices were prioritized over the expansion of grazing land. This indicates a shift towards optimizing existing resources rather than expanding them. Similarly, a study conducted in Marsabit County by Galgalo *et al.* (2022) explored the impacts of climate variability on livestock production. The research identified mobility, fodder storage, and livelihood diversification as prominent coping mechanisms. Again, expanding grazing land was not among the primary strategies, likely due to land tenure complexities and ecological constraints.

According to a study carried out in Karoo region of South Africa by Nqolo & Hoffman (2023) investigated livestock farmers' responses to recurring droughts. The study underscored the importance of destocking, income diversification, and rangeland monitoring, aligning with trends seen in the Kenyan studies. The expansion of grazing land was not emphasized, suggesting that it may not be a feasible option in ecologically sensitive or fragmented landscapes.

However, contrasting findings emerged from a study that was carried out around Lake Baringo in Kenya, where Wairore *et al.* (2022) evaluated the use of reseeded fields as an adaptive response to drought. The

study showed that reseeded and rehabilitating degraded grazing lands contributed significantly to sustaining livestock during dry periods. This reflects a localized form of expanding grazing capacity and suggests that the strategy can be effective when integrated with land restoration initiatives.

These findings collectively suggest that while increasing land under grazing may be seen as effective in some contexts such as Muhuru Ward in Migori County its broader applicability varies depending on environmental, institutional, and socio-economic factors. Adaptation strategies such as herd mobility, diversification, and land rehabilitation often emerge as more viable across diverse pastoral landscapes.

Table 5.19: Increasing Land under Grazing (N=343)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	59.9	52.9	16.2
Kanyarwanda	29.9	0.9	2.7
Komosoko	4.4	6.1	35.1
Masaba	5.8	39.1	45.9

Source: Survey Data 2023

The results from Table 5.20 shows that herd size reduction as a drought response strategy is perceived differently across various wards in Migori County. In Muhuru, the strategy is widely supported, with 33.7% of respondents rating it as the "Most Effective" and 58.3% considering it "Effective," leading to over 90% acceptance. However, 31.6% still found it "Not Effective," indicating that its success is not universal. In contrast, Kanyarwanda exhibits mixed opinions, with only 15.3% viewing herd size reduction as "Most Effective," 1% considering it "Effective," and 10.5% deeming it "Not Effective." The overall perception in Kanyarwanda appears limited in scope, with minimal support for herd size reduction as a viable drought response strategy.

Komosoko, on the other hand, presents a largely negative perspective on herd size reduction. Only 1.5% of respondents viewed it as the "Most Effective" strategy, while a significant 52.6% found it "Not Effective," highlighting a strong dissatisfaction with this approach. Although 11.5% considered it "Effective," the prevailing sentiment in Komosoko is that herd size reduction is not a feasible drought management strategy. Masaba, however, showed the most favourable perception, with 49.4% rating it as "Most Effective" and 29.2% as "Effective." Despite this, 36.2% still viewed it as "Not Effective," though this percentage remains lower compared to Komosoko.

Overall, herd size reduction appears to be a relatively effective strategy in Masaba and Muhuru, with broad acceptance, while in Komosoko and Kanyarwanda, the strategy faces significant resistance. Komosoko, in particular, demonstrates strong

dissatisfaction, with over half of the respondents rejecting herd size reduction as a viable solution. Kanyarwanda also shows limited support, with only a small fraction viewing it as "Most Effective." These variations suggest that the effectiveness of herd size reduction as a drought response strategy is highly dependent on local conditions, household characteristics, and community perceptions.

The current study, which explores the perceived effectiveness of herd size reduction as a drought response strategy across wards in Migori County, reveals notable spatial variation in perceptions. In Masaba and Muhuru, a majority of respondents found the strategy to be either "Most Effective" or "Effective," suggesting a general acceptance of destocking as a rational response to drought. On the contrary, Komosoko and Kanyarwanda reported limited support for the strategy, with a significant proportion of respondents rating it as "Not Effective." These findings point to the context-specific nature of drought coping mechanisms, influenced by local environmental conditions, cultural attitudes towards livestock, and possibly access to alternative livelihood options.

When compared to other studies conducted within Kenya, similar trends have been observed regarding the heterogeneity of drought coping strategies. For example, a study by Ngaina & Mutua (2015) in Turkana County found that while herd size reduction was practiced, it was not uniformly embraced, especially among pastoralist communities with strong cultural attachments to livestock. Instead, strategies such as migration and reliance on external aid were more favored. This aligns with the current study's findings in

Komosoko and Kanyarwanda, where the cultural or economic value of livestock might outweigh the benefits of destocking, leading to a resistance against herd reduction despite drought stress.

Globally, studies in other drought-prone regions such as South Africa provide both supporting and contrasting perspectives. For instance, Negassa *et al.* (2012), Duba, Solomon, & Tegegne (2021) found that the decision to reduce herd sizes during drought was significantly influenced by socio-economic variables such as household size, gender, off-farm income, and access to fodder. These studies highlighted a positive association between fodder purchase and herd size reduction, suggesting that households that invest in fodder are more inclined to manage their herd sizes actively. Conversely, they observed a negative relationship between household size and destocking, as larger households often had more resources to cope without resorting to livestock reduction. These results contrast with the current study's focus on perceptions of effectiveness rather than the decision-making factors,

but both emphasize that household-level dynamics critically shape drought responses.

Moreover, international studies such as those conducted in Ethiopia (GebreMichael & Kebede, 2018) also reflect varying levels of acceptance of destocking. In some regions, destocking was considered the last resort, particularly where livestock represented not just an economic asset but also a status symbol and a form of savings. This mirrors the likely sentiment in areas like Komosoko, where herd reduction is perceived as less viable. Ultimately, while herd size reduction is recognized globally and nationally as a drought coping strategy, its effectiveness and acceptance vary widely depending on local contexts. The current study adds to the growing body of literature that emphasizes the importance of localized approaches to drought risk management. The disparities across Migori County wards underline that blanket policies may not yield uniform results, and that community-level factors must be considered when promoting adaptive strategies.

Table 5.20: Herd Size Reduction (N=376)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	33.7	58.3	31.6
Kanyarwanda	15.3	1.0	10.5
Komosoko	1.5	11.5	52.6
Masaba	49.4	29.2	36.2

Source: Survey Data 2023

Table 5.21 shows responses to the reliance on remittances from relatives and friends as a drought coping strategy which varies across different wards. In Muhuru, 62.2% of respondents found this strategy "Effective," with an additional 28.6% viewing it as the "Most Effective," highlighting widespread acceptance of remittances as a key support mechanism. Only 13.1% deemed it "Not Effective," suggesting minimal resistance to this approach. In contrast, Kanyarwanda Ward shows a more moderate level of support, with just 14.3% regarding remittances as the "Most Effective" and 19.8% considering them "Effective." However, very few (1.2%) found this strategy ineffective, implying a general acknowledgment of its benefits, with less enthusiasm compared to Muhuru.

Komosoko Ward presents a unique perspective, with 42.9% of respondents viewing reliance on remittances as the "Most Effective" strategy. This strong support indicates that remittances play a crucial role in drought mitigation within this ward. However, a notable 7.1% of respondents rated it as "Not Effective," reflecting some challenges in its application. Interestingly, only 4.5% considered it merely "Effective," suggesting a tendency to view remittances in extremes. In stark contrast, Masaba Ward had the least favorable response, with 78.6% of respondents considering remittances "Not Effective." Only 14.2%

saw it as the "Most Effective," while 13.3% found it "Effective," indicating that remittances are not a widely accepted or viable drought response strategy in this ward.

In Kenya, recent research mirrors some of these intra-county differences. For instance, a study by Ng'ang'a *et al.* (2021) in Kitui and Makueni counties found that while remittances played a stabilizing role in household food security during dry spells, their effectiveness was highly contingent on the frequency and size of transfers. In Kitui, remittances were viewed as "moderately effective" by a majority (similar to Kanyarwanda), largely due to irregular flows and high dependency ratios. However, in Makueni, where family ties with urban migrants were stronger and more consistent, remittances were a crucial buffer against drought impacts, echoing the stronger support observed in Komosoko and Muhuru Wards.

Similarly, Mwangi & Omollo (2022) in Turkana County reported mixed perceptions of remittance effectiveness. In urban-adjacent areas like Lodwar, households were more likely to receive frequent remittances and thus considered them highly effective. Conversely, in remote sub-counties, where access to mobile money services was limited, households rated remittances as less effective. This finding resonates with the situation in Masaba Ward, where over three-quarters

of households dismissed remittances as ineffective, possibly due to poor network connectivity, lack of diaspora support, or limited digital literacy.

Comparing globally, the study by Banerjee *et al.* (2019) in South-West China and North-East India offers insightful contrasts. In Baoshan and Upper Assam, remittance-receiving households demonstrated long-term adaptation through behavioral and structural changes, such as reducing crop land and livestock, and securing loans and alternative livelihoods. These households showed superior adaptive capacities, suggesting that consistent remittance flows can foster deeper resilience, not just temporary relief. This differs markedly from Migori, where remittance effectiveness appears fragmented and ward-dependent, possibly due to variability in diaspora engagement, remittance volumes, or differing levels of household financial management capacity.

Additionally, Ghebru & Holden (2020) in Ethiopia found that remittances significantly reduced the vulnerability of rural households by enabling

investments in drought-resilient infrastructure like water storage and irrigation. However, these effects were more pronounced where institutional support systems, such as cooperative societies or agricultural extension services, complemented remittance inflows. Such a coordinated model seems less evident in Migori, where the absence of supportive structures may limit the transformative potential of remittances, especially in wards like Masaba.

This study reveals that Migori County has a patchwork of remittance effectiveness, reflecting local social and economic dynamics, findings from Kenya and beyond underscore the critical importance of consistency in remittance flows, complementary support systems, and community infrastructure. Global experiences also highlight that long-term remittance support can catalyze deeper adaptive strategies, a shift yet to be fully realized in the Migori context. These comparisons suggest that enhancing the reliability of remittance channels, coupled with local institutional strengthening, and could significantly improve the role of remittances in drought resilience.

Table 5.21: Reliance on Remittances from Relatives and friends (N=377)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	28.6	62.2	13.1
Kanyarwanda	14.3	19.8	1.2
Komosoko	42.9	4.5	7.1
Masaba	14.2	13.3	78.6

Source: Survey Data 2023

Results from Table 5.22 shows information about the effectiveness of selling cattle as a response strategy to drought varies across different wards, as evidenced by survey data collected in 2023 from 383 respondents. The findings reveal distinct patterns in household perceptions regarding the effectiveness of this strategy. In Muhuru Ward, a significant portion (69.6%) of respondents found selling cattle to be an effective strategy, but only 10% considered it the most effective, while 17.4% deemed it not effective. Kanyarwanda Ward showed minimal support for this strategy, 2.9% finding it effective, and 21.5% perceiving it as not effective. Meanwhile, Komosoko Ward exhibited a mixed response, with 27.5% considering it the most effective, 2.9% finding it effective, and 5.8% regarding it as ineffective. In contrast, Masaba Ward displayed a high level of support, with 62.5% categorizing selling cattle as the most effective strategy, 24.6% finding it effective, and over half (55.2%) considering it ineffective. These variations highlight the differences in drought response strategies among households in different regions.

A comparative analysis across the wards indicates notable variations in household reliance on selling cattle as a drought mitigation strategy. While Masaba Ward had the highest proportion of respondents

viewing it as the most effective response, Kanyarwanda had the least support for its effectiveness. Muhuru Ward showed a more balanced distribution, with a significant number considering it effective but not the most effective. The overall pattern suggests that although many respondents across all wards viewed selling cattle as an effective response, a considerable portion, especially in Masaba and Muhuru did not find it effective. This diversity in perception could be attributed to factors such as herd size, market conditions, and alternative coping strategies available to households in different wards.

According to a study that was carried out by Muthini *et al.* (2024) in Kitui and Isiolo counties, found that 23% of agro pastoral households resorted to selling livestock as a primary coping strategy during droughts. However, the study also highlighted that while this approach provides immediate financial relief, it may lead to increased vulnerability in the long term due to the depletion of essential household assets. This finding aligns with observations in Masaba and Muhuru wards, where a significant portion of respondents did not find selling cattle to be the most effective strategy.

These findings contrast with the study conducted by Janzen & Carter (2019) in northern Kenya,

which found that pastoralists' decisions to sell livestock or reduce household consumption during drought were influenced by a critical herd size threshold. According to their research, asset-rich households above the threshold coped with drought by selling livestock, whereas asset-poor households below the threshold opted to reduce food consumption instead. However, existing literature remains inconclusive regarding a definitive herd size threshold for determining long-term impacts of drought on livestock and household wellbeing (Berhanu & Fayissa, 2009; Lybbert *et al.*, 2004). Further, Iritani (2018) highlighted that the decision to sell livestock is influenced by species type, with smaller stock such as goats and sheep more likely to be sold off before larger animals like cattle. This indicates that selling cattle as a drought mitigation strategy is shaped by various socio-economic and environmental factors, underscoring the need for localized strategies tailored to different household and regional dynamics.

Conversely, research by Githu *et al.* (2022) near Lake Baringo emphasized the importance of alternative strategies, such as reseeded degraded lands, to maintain herd sizes during droughts. The study concluded that households with access to reseeded fields were better positioned to preserve their livestock, thereby reducing the need to sell cattle during drought periods. This

approach offers a sustainable solution that mitigates the immediate need for asset liquidation. In Turkana County, Mawaa (2022) identified credit access, collective action, and food relief interventions as significant coping strategies that positively influence the socio-ecological well-being of pastoral households during droughts. These strategies provide alternative means of sustenance, potentially reducing the reliance on selling livestock as a primary response.

Furthermore, a study by Ngigi *et al.* (2021) highlighted that livestock diversification, including the incorporation of more drought-resilient species like camels, enhances household resilience to climate risks. This diversification strategy offers a viable alternative to selling cattle, as it allows pastoralists to maintain productive assets that are better suited to withstand drought conditions. These studies collectively suggest that while selling cattle is a common immediate response to drought among Kenyan pastoralists, its effectiveness varies across regions and is influenced by the availability of alternative coping strategies. Implementing sustainable practices such as land rehabilitation, diversifying livestock species, and improving access to financial resources can enhance resilience and reduce the need for asset liquidation during drought periods.

Table 5.22: Sale of Cattle during Drought (N=383)

Wards	Most Effective (Frequency, %)	Effective (Frequency, %)	Not Effective (Frequency, %)
Muhuru	10.0	69.6	17.4
Kanyarwanda	0.0	2.9	21.5
Komosoko	27.5	2.9	5.8
Masaba	62.5	24.6	55.2

Source: Survey Data 2023

The above findings highlight key factors influencing household vulnerability to drought and the effectiveness of coping strategies among cattle-keeping households. Environmental and livestock-related stressors such as declining water sources, reduced pasture, livestock diseases, and decreased milk production emerged as significant contributors to household vulnerability. In terms of drought response, households adopted a range of strategies, including alternative agriculture, mixed farming, off-farm employment, and livestock sales. However, the success of these strategies varied by ward and local conditions. While selling cattle offered immediate relief, it was often unsustainable in the long term due to the loss of key assets, particularly in Masaba Ward. Remittances played a crucial role in some areas like Muhuru and Komosoko, but their impact was less consistent in others. These findings underscore the need for integrated drought mitigation approaches focusing on water infrastructure, pasture management, and sustainable livelihood options tailored to local realities.

Higher exposure and sensitivity to drought imply increased vulnerability; however, adaptive capacity plays a moderating role by influencing a system's exposure and sensitivity. Therefore, enhancing the adaptive capacity of rural farmers is critical in reducing their vulnerability to drought. The adoption of effective adaptation strategies by farmers is essential for mitigating the adverse effects of drought. Farmers with higher adaptive capacity are better equipped to adjust to rapidly changing climatic conditions (Datta & Behera, 2022).

Findings from key informants indicate that respondents had been significantly affected by drought. In Migori County, based on insights related to support systems, preparedness, and adaptation strategies among cattle farmers, administrators, livestock officers, and representatives from the Water Resource Users Association (WRUA) reported that:

Masaba Sub-Chief

To safeguard water resources, I actively discourage ploughing along riparian zones and promote

the responsible use of dams, boreholes, and other water sources. Some cattle farmers have drilled boreholes, planted trees, and regularly apply acaricides to control ticks. They also adopt practices such as pasture planning and preservation, maintaining manageable herd sizes, purchasing livestock insurance, and attending short agricultural seminars. In addition, donations of farm inputs have played a key role in helping farmers adapt to the effects of drought.

Kanyarwanda Sub-chief

As an administrator, I sensitize farmers during public forums (barazas) and encourage regular consultations with livestock officers. I emphasize the importance of self-preparedness, particularly in maintaining cattle health. Some farmers store maize stalks after harvest for use as fodder during drought and frequently take cattle to dips. Support from the Ministry of Livestock through seminars, regular public awareness efforts, and increasing the number of livestock officers are vital. During droughts, the government occasionally buys livestock to prevent losses, and at times slaughters older cattle to provide food for the community. Organizations like Child Fund and Nuru Kenya also assist by buying milk for yogurt production, offering farmers an alternative income source.

Muhuru Sub-Chief

Farmers are encouraged to plant drought-resilient fodder like Napier grass. In response to the harsh conditions, many have begun keeping hardier animals such as goats. However, government support is essential and timely advice, resources, and engagement from both county and national levels should not be left solely to the farmers.

Kanyarwanda Sub-Chief

I advise farmers to plant Napier grass and regularly spray their cattle against ticks, especially during dry periods. The County Government has supported farmers in areas like Mikey by drilling boreholes for irrigation to support Napier grass growing. Due to challenges like tick infestation and drought, many residents have shifted from cattle rearing to alternative livelihoods such as gold mining. Maintaining functional cattle dips and supporting training through NGOs and CBOs are crucial for improving cattle farming practices.

Livestock Officer

Our team deploys livestock officers during field days to train farmers on fodder irrigation and conservation, livestock insurance, and disease control through regular vaccinations. We raise awareness about drought impacts and encourage proper grazing practices, feed conservation, and the use of hardy breeds. Farmers are also encouraged to avoid overgrazing and embrace sustainable methods like pasture irrigation. Through programs such as 'One

Dairy Cow per Sugarcane or Tobacco Farmer', the Migori County Government promotes dairy farming over less sustainable crops like tobacco. This initiative provides in-calf heifers and Sahiwal bulls to improve milk production and household income.

WRUA Officer:

Community-Based Organizations (CBOs) and NGOs play a crucial role by raising awareness and constructing water infrastructure like dams and water pans, which support cattle farmers during drought periods.

CONCLUSION AND RECOMMENDATION

Environmental and livestock-related stressors, such as declining water sources, reduced pasture availability, livestock diseases, and decreased milk production, also contribute to household vulnerability. In response to drought, households adopted various coping strategies, including alternative agriculture, mixed farming, off-farm employment, and livestock sales. The effectiveness of these strategies varied by ward and local conditions. While selling livestock provided short-term relief, it was often unsustainable in the long term, especially in Masaba Ward. Remittances were important in areas like Muhuru and Komosoko but had inconsistent impacts elsewhere.

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