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Climate Change and Sustainable Livelihoods Among Pastoralists in Isinya Sub County, Kajiado County

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Abstract: *In the 21st century, climate change has become global environmental issue of concern. The objective of the study was to evaluate the impact of climate change on sustainable livelihoods among pastoralists Isinya Sub-County, Kajiado County, Kenya. The study was guided by adaptive theory. A descriptive research design, combining qualitative and quantitative methods was used, targeting 63 pastoral community using cluster sampling, simple-random sampling, purposive sampling and snowball sampling techniques. Data was collected using a fact-sheet questionnaire, structured interview and Focus Group Discussions and analysis done using descriptive statistics. The study established that climate change has had led to increased livestock pests/diseases, land demarcations affecting livestock migration corridors, diminishing pasture fueling migration and conflicts due to competition for scarce pasture. The study concluded that climate change affected sustainable livelihoods among pastoralists in Isinya Sub-County in Kajiado County. It recommended early warning system for drought, securing pastoral land tenure and promoting inclusive approaches to natural resource management as well as strengthening pastoralists' resilience and adaptation capacities by enhancing food security, healthcare facilities and education.*

Key words: *Climate change, Pastoralism, Sustainable livelihoods, Adaptation*

1.1 Background of the study

Sustainable livelihoods play a crucial role in climate adaptation by ensuring people's access to various resources, including natural, human, social, physical, and financial assets. Livelihoods have a crucial role in climate adaption. Regarding climate change adaptation for pastoralists, their vulnerability to the impacts of climate change necessitates the implementation of solutions that may bolster both their resilience to and recovery from these impacts, while also preserving their traditional pastoral lifestyle (Fan & Feng, 2022). Climate adaptation and sustainable livelihoods provide innovative strategies and concepts for effectively managing natural resources and achieving socioeconomic sustainability. Globally, agriculture, livestock farming, water availability, plant cover, and soil fertility are heavily influenced by weather and climate. The area regularly encounters catastrophic climatic

phenomena that have profound consequences on the well-being of individuals. Climate change is universally recognized as a substantial concern that has the potential to negatively impact both food security and livelihoods. Liette and Smit (2016) highlight the need of comprehending the impacts of changing of the climate, the susceptibility to it, the capacity to adjust, ensuring access to food, and maintaining sustainable ways of living.

In order to prevent harmful human-caused interference with the climate system, the UNFCCC offers a thorough legal framework and guiding principles for international cooperation on climate change. The objective is to stabilize the amount of carbon dioxide in the atmosphere. In order to improve the efficiency of the 1992 UNFCCC, the Kyoto Protocol was officially approved in December 1997. This agreement mandated developed and transitional countries to achieve specified objectives for lowering emissions of six greenhouse gases. The Kyoto Protocol's first commitment period spanned from 2008 to 2012. The 2012 Doha Amendment introduced the second commitment period, which lasted from 2013 to 2020. The Paris Agreement, established in December 2015, requires member states to establish, strategize, and regularly disclose their nationally defined commitments towards addressing climate change (UNFCC, 2021).

The African Union's present collaborative climate response plan has placed a high priority on mitigating the effects of climate change in Africa. Due to Africa's heightened vulnerability to the impacts of climate change, the African Union has adopted the Global Change of climate and Resilient Development Strategy and Action Plan (2022-2032). This vulnerability is attributed to the region's heightened sensitivity to climate risks, dependence on climate-sensitive businesses such as agriculture, and limited capacity to adapt. According to the Sixth Assessment Report of the IPCC, several African countries are at risk of experiencing significant human fatalities, loss of biodiversity, reduced food and water security, and impeded economic development (Cooke, 2022). Although each African area has distinct climate-related consequences and response capacities, the continent as a whole has shared problems and possibilities in reducing the vulnerability of its development paths. Adapting to climate change in Africa is essential for mitigating the effects of climate change and taking advantage of emerging possibilities in light of present and projected future alterations. Multiple institutions, including governments, non-governmental organizations, donor organizations, the African Development Bank, the World Bank, and the United Nations Environment Program, have been actively offering suggestions via various policies, initiatives, and adaptations. For example, initiatives such as the United Nations' Reduction of Emissions from Deforestation and Forest Degradation (REDD+), which promotes the regrowth of forests, and financial programs for adapting to climate change created by the United Nations Framework Convention on Climate Change (UNFCCC) and at regional levels. In addition, the African Development Bank (AfDB) is spearheading the African Climate Change Fund, which seeks to improve African nations' ability to get international climate money (Epule et al., 2021). Although climate change and adaptations are important, there are still numerous uncertainties surrounding the development of adaptation attempts throughout time, particularly among pastoralist groups. The absence of information impedes the capacity to recognize crucial shortcomings in adaption methods.

Kenya has made substantial progress at the national level in improving resilience via the implementation of its National Adaptation Plan. The Kenyan government is now supporting local efforts to include adaptation into CIDPs via the establishment of CCCFs. These creative companies provide county authorities the crucial financial and technical support they need to identify, rank, and carry out projects that improve climate resilience. However, pastoralist communities residing in Kenya's ASALs persistently confront the consequences of climate change, which subject their cattle to extreme drought, leading to the loss of animals, depletion of vegetation, food insecurity, environmental degradation, and lack of water.

The Kenyan government has also implemented projects such as the Financing for Locally-Led Action on Climate Change (FLLoCA) Program, as part of its initiatives and adaptation strategies. The World Bank, along with Denmark and Sweden, contribute to the FLLoCA program, which promotes a decentralized climate finance approach and encourages public-private partnerships to develop and implement climate-related solutions (World

Bank, 2021). The aim of the FLLoCA initiative is to integrate scientific and indigenous knowledge into adaptive management, offer flexible programming and learning opportunities, and invest in enhancing the capabilities of local institutions (Arnold & Soikan, 2020). Furthermore, the Climate Change Act of 2016 and the NCCAP 2018-2022, which builds on the initial action plan from 2013 to 2017, establish a framework for Kenya to fulfill its NDC commitments to the Paris Agreement (Muigua, 2021). The Climate Change Act of 2016 was enacted to enable Kenya to better address climate change, implement mechanisms and policies to achieve low-carbon climate development, and pursue other objectives (GoK, 2016).

Kenya has led the way in developing a climate change governance system to increase funding for local climate initiatives. The County Climate Change Fund (CCCF) involves climate laws passed by county governments and a fund managed by the county to support climate projects identified and prioritized by local communities (Mazza & Caenegem, 2021). The CCCF aims to enhance public involvement in the management and use of climate funding while providing subnational governments and communities with a reliable and continuous source of funding for adaptation and resilience-building efforts. The government is expanding this initiative throughout the country (Global Centre on Adaptation Report, 2022). Several county governments in Kenya have also taken the lead in enacting Climate Change Acts to establish a clear framework for mobilizing and facilitating county governments, communities, and other interested parties to successfully combat climate change by implementing suitable adaptation and mitigation strategies (Ochieng & Ogelo, 2023).

As a result of their dependence on livestock and resources that are significantly impacted by fluctuations in rainfall, pastoral communities in Kajiado County are especially susceptible to the effects of global warming. In response, pastoralists have developed a wide range of methods, organizations, and networks in order to capitalize on the unpredictability and danger contained within the situation. Despite their established value, these strategies are still not well understood and are not effectively integrated into indigenous knowledge and policy development. While these communities have demonstrated significant resilience to climate shifts in the past, there are concerns about their ability to adapt to future changes and cope with existing variability and uncertainty (Muchaki et al., 2023). Their capacity to adapt will hinge on the severity of future climate shocks and stressors, as well as their access to the necessary resources during difficult seasons and challenging years. When this is taken into consideration, it is essential to investigate local adaptation techniques to global warming in order to identify the particular assistance that is required to improve people's ability to withstand the effects of global warming.

1.2 Statement of the problem

Climate change has become a national priority due to its effect on key sectors such as agriculture, water, economy, public health, and the environment, directly impacting the livelihoods. In response, the government of Kenya has established sector-specific policy frameworks to deal with climate change effects (Government of Kenya, 2018), as well as ensure the sustainability of livelihoods. For the pastoralist community, their livelihoods are anchored on livestock as their main source of income, which depends on consistent pasture and livestock productivity, access to markets and value chains that improve livestock yields. Nevertheless, the changing climate has intensified challenges for the pastoralist community, leading to losses of livestock due to water scarcity, poverty, and food insecurity (Ateiono & Mose, 2024). In view of the foregoing effects of climate change, pastoralists have often utilized various adaptation measures, including migration to new areas and changing occupations in search of higher incomes (Wanjara, 2023). Although the pastoralist community have adopted alternative livelihood activities (such as moving livestock to better areas in search of water and grass, selling livestock and seeking alternative sources of income including agriculture), the emerging trends and extreme climate events are having greater effect on livelihoods. Studies examining these trends have been general. For example, Abdimajid (2020) analyzed the correlation between gender and how people in Kajiado and Kiambu Counties while Mudekhere et al. (2023) studied the influence of indigenous knowledge on farmers' adoption of global warming. Muchaki et al. (2023) studied how indigenous knowledge factors affect farmers' adoption of global warming adaptation strategies in the same county. However, while these studies aimed to understand the socio-economic, environmental, and

cultural aspects of pastoralist communities, as well as the challenges they face and the strategies they use for their livelihoods, none of them specifically addressed global warming and sustainable livelihoods. It is within this context that this study aims to evaluate the impact of climate change on sustainable livelihoods among pastoralists in Isinya Sub-County, Kajiado County, Kenya.

1.3 Study objective

To evaluate the effect of climate change on sustainable livelihoods among pastoralists in Isinya Sub County, Kajiado County.

1.4 Significance of the Study

It is of the utmost importance to develop an understanding of and place an emphasis on the consequences of global warming, as well as solutions for coping with those effects and the socioeconomic repercussions of global warming. This knowledge has the potential to assist communities in lowering their vulnerabilities and increasing their capacities. As a means of ensuring that pastoralists are able to independently survive and adopt improved ways to protect their livelihoods, the suggestions that were derived from the research might serve as a starting point for the Kenyan government to strengthen its policy framework on climate adaptation. It is fundamentally important for policymakers to have a comprehensive grasp of the ways in which global warming affects sustainable livelihoods and the coping techniques used by pastoralists. The findings of the study could assist stakeholders in developing best practices for other regions to ensure the sustainability of community livelihoods.

1.5 The conceptual framework

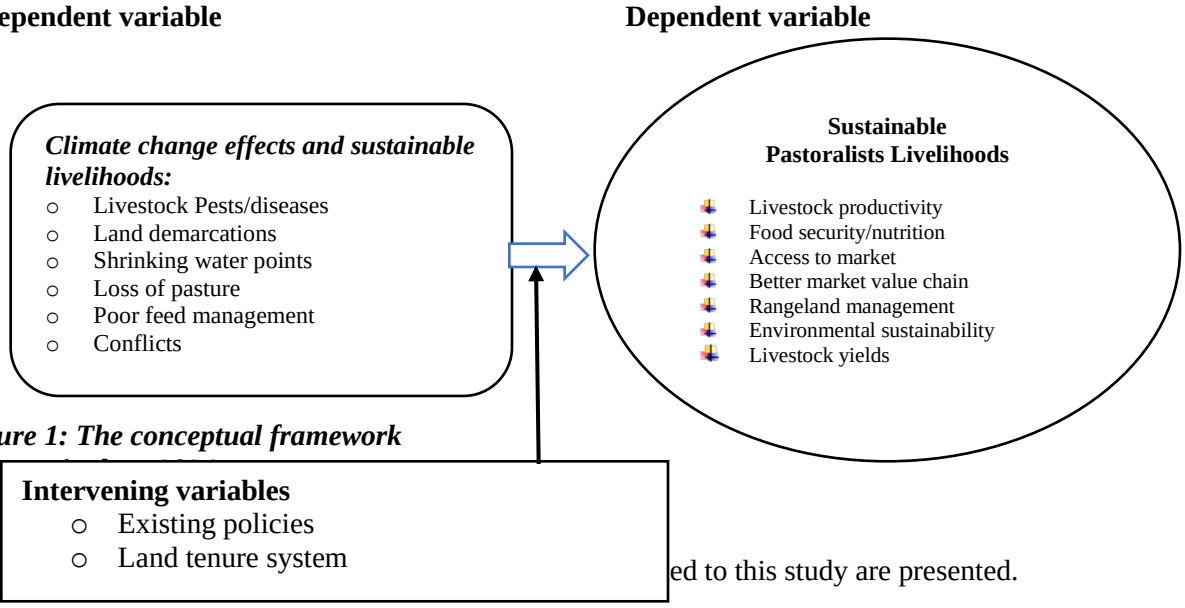

Figure 1: The conceptual framework

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1.6.1 Theoretical review

Adaptive Theory

Adaptive theory was postulated by Hubbard (2023). The theory argues that each person has unique experiences and thus their decisions may differ from those of others. In this view, adaptive theory explains individuals makes the decisions they choose. The theory underscores three key assumptions. First, everyone's life history is different, which means that people's preferences are likely be different as well. Secondly, people adjust to their surroundings. Third, people don't just make economic decisions as a group based on what they know now; they

also take into account their hopes and fears for the future, which are shaped by their prior experiences (Kingsford, 2017).

In view of these assumptions, the theory has been applied to various scenarios. The UK Department for International Development (DfID) used adaptive theory to examine the livelihood activities and options of rural households in Africa. For instance, the DfID employed adaptive theory to assess the livelihood activities and options of rural households in Africa. Moreover, scholars such as Osumanu (2022) have explored the theory in analyzing global warming adaptation and agricultural livelihoods of smallholder farmers in the global south. Adaptations can be defined as actions, either individual or collective, that are explicitly or implicitly aimed at influencing the units affected by global warming, or that indirectly accomplish this objective. The ability of a system to change in response to new information is the subject of adaptive theory, which may be found in many scientific fields. In some fields, the system has consciousness and theoretical explanations are made for its decisions. The non-self-aware adaptive mechanism is nonetheless selected for in other models of adaptation. Pastoralists are able to make long-term adjustments to their way of life by adapting to the weather (Kirkby et al., 2018). response to drought relies significantly on the capacity of individuals and communities to adjust to changing conditions. enhancing the ability of pastoralist livelihoods to adapt to droughts can be achieved by raising awareness about the link between ability to adapt and well-being.

Knowing how to employ adaptive techniques is the primary means by which they can lessen their susceptibility to the stressors brought on by global warming and get ready for potential future extreme climate events. Thus, there is a connection between adaptive theory and the discussion of resilience, as well as the processes and behaviors that lead to increased adaptable capacity. Resilience includes the ability to adapt, which also includes the means through which change might occur. Multiple adaptation techniques are pursued by households in pastoralist communities because adaptation necessitates changes in long-term livelihood strategies (Hubbard, 2023).

The theory presented by Hubbard (2023) has been deemed appropriate, as it connects adaptation to the discourse on resilience. In this context, adaptation is defined as the processes and actions involved in making decisions that enhance adaptive capacity. This theory is particularly useful for making specific assertions about the adaptations considered in a given context. It is relevant to the study as it illustrates how the sustainable livelihood framework aligns with the ways in which pastoralists utilize their available resources to build capacity and adapt to global warming for their well-being. The primary question that is addressed by sustainable livelihoods is how low-income pastoralists in rural regions may better their lives by coping with, securing, and overcoming the stress that is caused by shocks. Additionally, a livelihood is considered sustainable when individuals are able to effectively adjust their assets (such as natural, physical, social, financial, and human resources) and extend their decisions beyond economic considerations in order to create viable employment opportunities that are not related to agriculture and would ensure the survival of their households over the long term (Wamsler, 2017).

In spite of the fact that it is relevant, adaptive theory is not sufficient, and as a result, it shows certain shortcomings in terms of anchoring this research in completeness. To begin, it does not identify significant players and it does not indicate a desire to explore steps intended to mitigate the effects of global warming. In the second place, while it does provide mechanisms for adaptation, it does not make it clear how resources are to be used in order to accomplish the goals that are intended. This is due to the fact that the operator need resources, which are understood to be the means, in order to successfully perform the adaptation. In the third place, the mechanism of adaptation theory seems to be rather complicated. Considering that global warming has a wide range of impacts that are significant for a large number of exposure units in a variety of ways, it is highly probable that there will be a great deal of decisional conflicts. There is a possibility that these will be exacerbated by institutional systems that are not suitable for addressing the new difficulties that are brought about by global warming. It is possible to utilize a supporting theory, in this instance the action theory, to be extremely particular about additional barriers

to adaptation, such as those that emerge from differing interests of operators and receivers, or specific combinations of indirect and facilitating adaptations. These three flaws provide an example of how this might be done.

1.6.2 Empirical review

Climate change adaptation and sustainable livelihoods

The escalating severity and scale of global warming have heightened the global necessity for immediate adaptation actions. Global warming adaptation denotes "adjustments in environmental, societal, or economic systems in reaction to real or anticipated climate-related stimuli and their impacts" United Nations Framework Convention on Climate Change (UNFCC), [2023]. In contrast to mitigation, traditional adaptation strategies primarily rely on the accumulation of scientific knowledge and insights that offer prospects for climatic conditions, and downsizing global climate prediction. Up to this point, human and social factors have not been adequately taken into account, despite the fact that the well-being of inhabitants, primary stakeholders, and those most directly impacted by future policies is of utmost importance Intergovernmental Panel on Climate Change (IPCC), [2022].

The IPCC has predicted that Africa's rural people would experience less rainfall, longer dry seasons, increasing strain on water resources, more frequent floods, and increased vulnerability of agricultural and pastoralist livelihoods. The consequences of global warming are worsened by the low capacity of people in these regions to adapt, since both organizations and families typically lack enough resources to mitigate and cope with these impacts (Smit & Pilifosova, 2003). Rural communities have always adapted to the dangers and effects of a changing environment. However, the present changes are happening rapidly and are more severe than ever before, which is putting a pressure on their capacity to adapt (Warren, 2016). The ongoing discourse on global warming and development today underscores the significance of advancing and enhancing global warming adaptation via the endorsement of established indigenous knowledge in response to rapid transformations (Patnaik, 2021).

Through the U.N. Framework Convention (UNFC) on Global Warming, significant financial commitments have been made to support climate action in developing nations (IPCC, 2020). This has presented a chance for substantial financing of adaptation initiatives, namely those focused on aiding the most susceptible areas. Furthermore, social safety nets that were originally designed for rural communities depending on natural resources are now being refocused to emphasize the ability to withstand and adapt to the impacts of global warming. However, despite this change in emphasis, it is still unclear whether approaches and solutions for adapting to global warming are successful in guaranteeing the resilience of all population segments (IPCC, 2022).

The capacity of families and communities to adjust and build resilience to global warming is contingent upon their socio-economic attributes, particularly their access to financial, human, physical, and social resources (Paul, 2016). Sustainable livelihoods draw attention to the reality that those who are most at risk from the effects of climate change also often have the least ability to adapt to changing conditions. Local communities and Indigenous Peoples are disproportionately impacted by the effects of global warming since their livelihoods rely on the environment. However, their knowledge, experiences, and demands are not sufficiently included in climate research and policy. In Pakistan, experiences demonstrate that sustainable livelihood resources can reduce global warming hazards and vulnerabilities, through five essential types of resources (human, social, natural, physical, and financial) that individuals require to sustain their livelihoods. In the Indus plain, resources are the most critical factor in the adaptation strategies of pastoralists (Mobeen et al., 2023).

The capacity of the rural poor to adapt to climatic fluctuation and change has been the primary focus of programs in India that have been carried out with the intention of responding to global warming. Gavali and Patil (2023) state that the goal is to ensure that the impoverished can continue to live in a standard of living through the execution of community-driven projects in the fields of agriculture, fisheries, livestock, and other financial and institutional measures, as well as land and water management. Stakeholders who represent the rural poor,

including individuals and institutions, make up the majority. Most of these individuals and organizations are directly reliant on climate-sensitive sectors like fishing, cattle raising, and agriculture, and they lack the necessary skills to adjust to changing weather patterns. More specifically, this effort aims to support women farmers, small-scale and marginal farmers, tribal farmers, and community leaders who belong to underprivileged socioeconomic groups. Members of Self-Help Groups, Common Interest/Producer Groups (such Farmers' Groups and Livestock Raising Groups), and Producer Companies must be included to ensure that a diverse variety of individuals are reached (Gavali & Patil, 2023).

The already existent disparities in sub-Saharan Africa are being exacerbated by the effects of global warming. It is estimated that around half of the population lives in poverty and makes their living via weather-dependent activities like as rain-fed agriculture, herding, and fishing. It is challenging for sub-Saharan African governments with little budgetary room to include financial adaptation, despite the fact that it is advantageous. As a result, nations are required to take into account competing development demands prior to taking on more debt responsibilities (despite the fact that there is considerable overlap across plans). However, despite the fact that countries are actively working on reforms to produce greater revenues (particularly via environmental taxes) and better expenditure efficiency, their capacity to do so is limited, and progress is gradual (IMF, 2020).

The fact that activities that are required to build resilience to climate variability and change often also advance development goals is a significant factor that highlights the need of including adaptation into development plans and practices in Africa. At the moment, several organizations in Sub-Saharan Africa, in addition to the numerous financial bodies that provide assistance for these organizations, are engaged in activities that are targeted at adapting rain-fed agriculture to the effects of global warming. On the other hand, this raises a number of substantial and complex difficulties in terms of research and policy (Owen, 2020). In order to preserve and enhance the hard-earned gains in incomes, education, and health outcomes that have been made throughout sub-Saharan Africa over the course of the last thirty years, it is essential to include global warming adaptation strategies. In spite of this, adaptation will be especially challenging due to the limited ability and financial resources that governments possess. According to Hallegatte (2017), a number of research have unequivocally proved the relevance of improving economic growth in order to strengthen coping mechanisms and increase resilience to the effects of global warming.

Both the economy and the ecology of South Africa are facing severe problems as a result of global warming. The government of South Africa has launched a number of different initiatives and policies at various levels of governance in order to combat the effects of global warming. These measures are being taken with the intention of reducing the negative impact that global warming will have on natural resources, health, infrastructure, and biodiversity (Ziervogel, 2020). Kavhagali and Reckien (2024) state that adaptation is one of the key policy foci that should be prioritized. As a consequence of this, there has been an increase in the number of adaption techniques that have been developed in response to the inherent consequences of global warming. A significant step forward in the global global warming framework that was formed under the UNFCCC is the ratification of the PA by South Africa (Mutambisi & Chanza, 2021).

Rural households in Kenya participate in various livelihoods, which include both agricultural and non-agricultural activities. However, these livelihoods are at risk due to the changing climate, which increases the likelihood of clearing forests for new farmland as reliance on forest resources becomes essential for survival. It is paradoxical that despite global warming being a prevalent topic in global environmental discussions, some studies have found that certain communities still do not fully understand what global warming entails. Livelihoods are the means by which people make a living, and rural livelihoods vary based on capabilities and assets. They often face numerous challenges, such as population growth, poverty, political instability, over-exploitation, development, and inadequate governance (Onyekuru et al., 2014). Nonetheless, global warming is acknowledged as the primary challenge to livelihoods, especially in the 21st century and in developing countries, where it can disrupt long-

standing development (Connolly-Boutin & Smit, 2015).

Korir (2022) noted that the pastoral community employs various adaptation strategies in response to global warming, which differ depending on the region. For instance, in Narok County, the pastoral community utilizes adaptation strategies such as crop cultivation, diversifying their livestock, destocking, harvesting water, conserving soil, planting trees, and practicing irrigation farming, among other methods. Therefore, in order to strengthen the resilience of pastoral communities to the effects of global warming, it is essential to develop policies that incorporate indigenous knowledge, support community-driven adaptation, effectively disseminate information related to global warming at the local level, and provide access to relevant institutions at the local level (Korir, 2022).

Supporting sustainable livelihoods involves the ability to withstand and bounce back from shocks and pressures while preserving livelihoods now and in the future without depleting the natural resources. According to the livelihood framework by DfID (2000), communities' means of making a living are backed by five types of resources, including natural, human, financial, physical, and social resources, which communities utilize to protect their livelihoods from stressors (Korir, 2022). Global warming is defined as variations in the climate system that are produced by large shifts in greenhouse gas concentrations due to human activity. This definition excludes natural global warming that has been documented over a long period of time. The Global warming Act of Kenya (2016) defines global warming as described above. It is the responsibility of the National Global warming Council, which is established by this act, to coordinate the efforts that the government is making to combat global warming. Similar to many other regions around the world, global warming has impacted numerous areas in Kenya, leading to repercussions for national food security. Rural livelihoods, in particular, have been affected by consecutive crop failures, water scarcities, and livestock losses. As a result, abrupt floods, triggered by abnormal rainy season onsets, destroy infrastructure, hinder mobility, increase disease outbreaks, harm crop fields, lead to livestock deaths, cause soil erosion, and subsequently impact livelihoods (Gitau, 2024).

1.7 Study design and methods

This research employed a cross-sectional survey design, using a descriptive research approach that combined qualitative and quantitative methods. Employing a cross-sectional survey was essential in enabling the researcher to measure outcomes and gauge participants' perspectives simultaneously. Additionally, the cross-sectional design provided the opportunity to investigate the effects of climate change on sustainable livelihoods. This design was beneficial in elucidating specific population or sub-group outcomes and allowed for comprehensive data collection from both qualitative and quantitative sources.

Study Area

This study was conducted in the Isinya Sub-County, which is located inside Kajiado County. The Kajiado East Sub-County may be found in the eastern part of the Kajiado County local government region. Kajiado County is home to a total population of 1,117,840 people, including 557,098 men, 560,704 females, and 38 individuals who describe themselves as intersex. The population density is 51 people per square kilometer, and there are 316,179 households. The average number of people living in each home is 3.5, while the average number of households is 3.5. There are 18 sub-locations that make up Isinya Sub-County, which has a total population of 210,473 people. The major urban centers in this sub-county are Kitengela and Isinya. Isinya Sub-County is positioned to the south of Nairobi and to the north of Kajiado, approximately 19 kilometers away. It is home to Isinya town, which is located on the main road between Nairobi and Arusha. This area has witnessed a reduction in its pastoral land and changes in climate in recent years (KIPPRA, 2022). Kajiado County is characterized by its semi-arid climate, and the principal economic activity in the county is cattle husbandry. In the southern and western areas of the county, along rivers and springs, in addition to private landowners who employ drip irrigation with private boreholes, the majority of the county's agricultural production is concentrated. Droughts in the county have caused crop failure, livestock losses, and food shortages in the past. The high illiteracy rate among pastoralists in Kajiado County

limits access to information, hinders recovery from climatic events, and restricts livelihood diversification options. The primary agricultural activity in the region is livestock production, particularly pastoralism, which is practiced by the Maasai in rural regions. The Sahiwal, Zebu, Borans, and exotic kinds of cattle are the most prominent breeds in the region. The most common breeds of sheep are the Red Maasai and the Dorper, while the most common kinds of goats are the Galla, the Small East African, and the German Alpine.

Throughout history, the Maasai pastoralists who have made their home in Kajiado County have been recognized for the rich cultural values that have enabled them to maintain their livelihoods. On the other hand, these cultural traditions are undergoing a transformation as a result of the rapid growth that is taking place, with private land ownership becoming more prominent. Up to the time of these conflicts, Maasai pastoralists have always had access to customary land, which allows them to continue out their traditional production methods. The disruption that occurred in their social and cultural practices as a result of the fragmentation of their land has made their old form of government unsustainable. In addition to this, the Maasai pastoralists have been deprived of their traditional territory and the social structures that have played a significant role in the formation of their traditions. It is for this reason that questions have been expressed about the continuation of pastoralism, taking into consideration the fact that the necessary resources are either unavailable or insufficient. The target population for the proposed study were pastoralist households within Isinya Sub-County. These include both men, women and youth, identified through Sub-County Office with respect to land size and ownership of livestock data from conservancy grazing and management records. Thus, a total of 525 from; pastoralist men, women, youth, experts drawn from local NGOs working in Isinya, conservancy managers and local administration. In addition, lead officials in key national institutions and media were considered, as illustrated in Table 1.

Table 1: Sampling Frame

No.	Identified population	Total target
a)	Men	100
b)	Women	150
c)	Youth	180
d)	Conservancy leaders	30
e)	Local NGO leaders	20
f)	County administration officers	15
g)	Religious institutions leaders	15
h)	National government agencies	10
i)	Local media	5
	TOTAL	**525**

Source: ***Olosira Conservancy data (2023)***

Sample and Sampling Procedures

Sample Size

Obtaining a good probability sample is essential in order to ensure the research represents the population. It thus helps a researcher determine a set of elements from the target population. For an effective generalizability and repeatability of research findings, identification of a good sample size is essential. To guarantee that the research is representative of the population at large, a good probability sample must be obtained. As a result, it facilitates the identification of variables within the study population. Finding the right size of a sample is crucial for the generalizability and reproducibility of a study's results.

The sample size for the study was calculated using a sample statistical formular (Krejcie & Morgan, 1970), as follows:

$N = (ZS)^2/E$

Where;

N= Sample size

Z = Standard value corresponding to a confidence level.
S = Sample standard deviation or an estimate of the population
E = Acceptable magnitude of error (Sampling Error).
Thus,
$N = (0.05x500)^2/0.001$ (at 95% confidence level).
With these factors in mind, a sample size of 63 was considered, as shown in Table 2.

Table 2: Sample Population Distribution

No.	Target group	Total target
1.	Men	10
2.	Women	15
3.	Youth	18
4.	Conservancy leaders	5
5.	Local NGO leaders	4
6.	County administration officers	3
7.	Religious institutions leaders	3
8.	National government agencies	2
9.	Local media	3
	TOTAL	**63**

Source: ***Field data, 2024***

The sample size was justified based on the basis that the researcher targeted pastoralists with large livestock (150 and more) and with huge tracts of land. Thus, the sample of 63 against a total target of 525 was appropriate to provide valuable information given the inferential goals of the researcher.

Sampling Procedures

Sampling is a method for selecting subsets of a population in order to generate statistically valid results. This method guarantees that all aspects of the cluster as a whole are considered. According to Mason (2006), sampling is a method that involves selecting groups within a population to acquire a sample that is representative. This process ensures that the features on of the entire cluster are taken into account. Mason (2006) emphasizes that the selection and grouping criteria form part of the principles utilized in classifying and obtaining key information. This study employed cluster sampling, purposive sampling techniques and snowball sampling to choose the sample population for the study. The study population in Isinya Sub-County was divided into four clusters. This ensures that the population in each cluster remained diverse and possible traits of all the individuals included in every cluster. From each cluster, probability sampling method (simple random sampling) was used to select the actual participant for the study. Probability sampling involves randomly selecting a sample, or a part of the population intended for investigation. Simple random sampling ensured that each participant stands a chance in taking part in the study and hence eliminate biasness (Cresswell, 2014). In addition, purposive sampling was used to select key personnel, such as NGO officials and conservancy managers to enrich the study. The researcher chose this approach to have a greater opportunity to investigate and delve into various aspects of the research on adapting to global warming and maintaining sustainable livelihoods.

Data Collection Instruments

The gathering of information involved the use of both primary and secondary sources. Essential tools utilized encompassed a fact-sheet questionnaire, structured interview, and a Focus Group Discussion (FGD) guide. Pastoralists were surveyed using questionnaires as a means of gathering information. The fact-sheet questionnaire

proved to be effective in reaching a substantial number of participants throughout the area. During data collection, 37 questionnaires were issued pastoralists (comprising men, youth and conservancy managers and local NGO leaders). Eleven (11) interviews undertaken targeting representatives from local media, national government, county officials and religious leaders. Interviews are ideal as they generate participant's personal experiences, emotions, views and ideas. Semi-structured discussions aided the researcher to acquire detailed information that validated the data gathered from the questionnaires. Focus group discussion was carried out targeting 15 women. The researcher adopted both English language and in other cases vernacular language for those who do not understand English. The responses from vernacular language were translated with the help of translators and responses analysed during data analysis.

Data Analysis Techniques

The research employed qualitative and quantitative methods. SPSS Version 20.0 was primarily used to perform descriptive statistical analysis on the quantitative data obtained from the fact-sheet questionnaire. The data underwent pre-coding, coding, and entry into the software for descriptive analysis, which included frequency, percentages, and standard deviation. For the purpose of presenting the findings of the research, graphs, tables, and charts were used. In accordance with the goals of the research, a theme analysis was performed on the qualitative sources of information. An explanation inquiry analysis was performed on the data that was gathered via discussion groups and interviews. Following the categorization of the qualitative data into thematic units by the researcher, the data was then synthesized in order to find trends. It was the intention of the researchers to make certain that the research questions were answered by the key themes that were associated with the study. These topics included the consequences of global warming, coping mechanisms, impediments, and socio-economic implications for sustainable lifestyles. To be more specific, this technique involves using a thematic approach in order to construct themes or descriptions prior to analyzing or providing meaning to the data. The study utilized both content analysis and narrative analysis to categorize the most crucial themes arising from the data, which were subsequently included in the findings as narrative or direct quotes. Integration of both qualitative and quantitative outputs in the analysis were presented with first the quantitative data, reporting, discussion and followed by direct narratives (in form of quotes) from qualitative data to draw comparisons and gain meaningful conclusions regarding the specific objectives. The research adhered to best practices to ensure the conclusions capture both quantitative and qualitative responses in a robust, and reliable manner to avoid biases. The overall purpose of the study was also linked with this analysis, which finally contributed to a full comprehension of the function that the research subject plays.

Ethical Considerations

The research was conducted in accordance with all current ethical norms. Prior to initiating the study, the investigator made an effort to get approval and a letter of authorization from the Department of Social Sciences and Development Studies (CUEA). Additional consultation was conducted with the National Council on Science, Technology, and Innovation (NACOSTI) in order to get its consent. Participants' identities were concealed using codes rather than their real names to ensure privacy. Participation was completely voluntary, and respected any cultural norms that arose as a result of the research.

1.8 Study findings and discussion

Questionnaire Return Rate

The responders that were targeted were 63. In addition to conducting two focus group discussions with a total of fifteen women, the researcher also distributed 37 questionnaires and conducted interviews with 11 key informants. A total of 37 questionnaires were distributed, and 34 of them were completed and returned. As can be seen in Figure 4.1, the overall response rate was 92 percent for the whole survey.

Demographic presentation of gender

The study targeted key informants representing different groups, with a majority (485) men, 24% youth and 28%

women. Gender, climate and livelihoods represents a growing aspect in global warming adaptation outcomes. The involvement of women in livestock livelihoods and their ownership and control of assets, particularly land and livestock, has not been thoroughly researched. Therefore, shifts in gender roles, changes related to global warming, the effects and ways of dealing with these changes adopted by women, youth, and men, and their individual roles in developing resilience have direct consequences on their social and economic standing. A gendered perspective has been investigated in recent research (Najar & Baruah, 2021) to assess the dynamic relationships between livelihoods in poor nations and global warming. Accordingly, the researcher believes that looking at how global warming adaptation affects pastoralists' sustainable livelihoods has different effects on men and women. These effects include how they affect men and women's ability to earn a living and obtain the natural, social, political, and economic resources that they need to survive and thrive. Given these results, it is crucial that governments consider gender when developing their climate advocacy tactics, as well as how gender affects climate coping and adaption mechanisms and policies that determine gendered vulnerabilities and consequences.

Effects of climate change on sustainable livelihoods among pastoralists

The initial goal was to assess how the changing climate will affect pastoralists in Kajiado County's Isinya Sub County and their ability to make a sustainable livelihood. FGD and interview answers, as well as fact sheet data, were the main sources of analysis for this goal. These data were then cross-referenced with existing literature sources. The replies' outcomes are shown as follows in Figure 4.1:

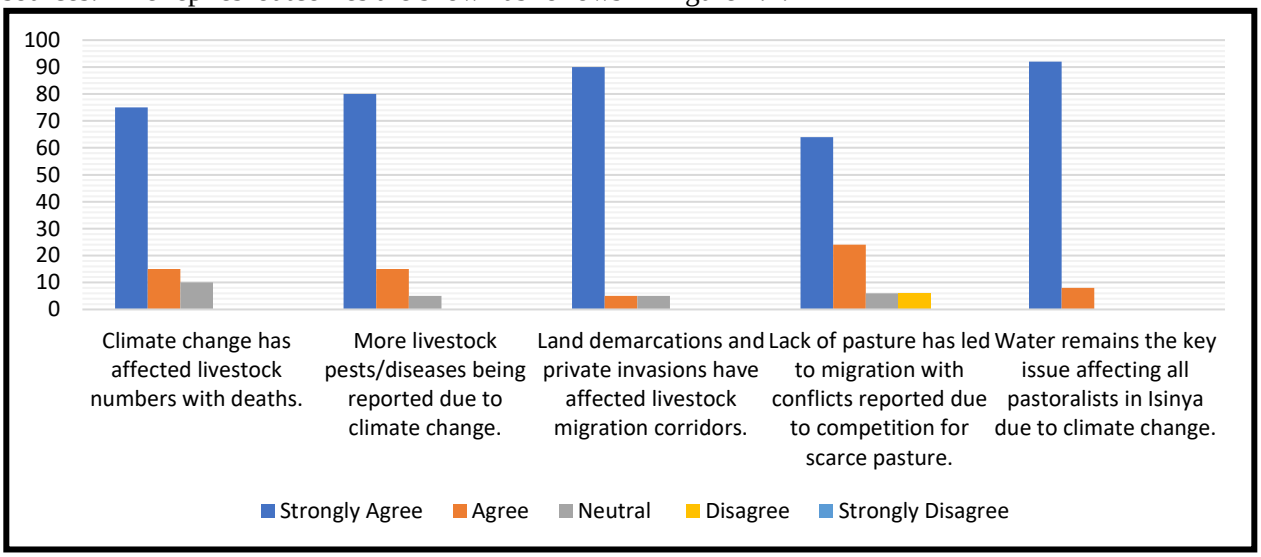

Figure 2: Impact of climate change on sustainable livelihoods

Figure 2 shows various responses on the effects of climate change on sustainable livelihoods. On whether Global warming has affected livestock numbers with deaths, 75% strongly agreed, 15% agreed while 10% remained neutral. Regarding the statement on whether pastoralists had experienced increased livestock pests/diseases being reported due to global warming, 80% cited strongly agree, 15% agree and 5% neutral. Regarding the question on whether land demarcations and private invasions had affected livestock migration corridors, 90% strongly agreed, 5% agreed while 5% remained neutral. Regarding the statement on whether lack of pasture has led to migration with conflicts reported due to competition for scarce pasture, 64% strongly agreed, 24% agreed, 6% were neutral while 6% disagreed. When it came to the statement on whether water remains the key issue affecting all pastoralists in Isinya due to climate change, 92% strongly agreed with another 8% agreeing to the statement.

From Figure 2, there is strong indication for effects ranging from livestock pests/diseases and deaths, land demarcations driven by the pressure by rising urbanization, limited water and pasture leading to conflicts. Based on the findings, it is possible that the already disadvantaged pastoral and agro-pastoral families would continue to

suffer greatly from severe and protracted droughts.

Results from one key informant was quoted a follow:

> *"My opinion on this question is highly subjective, however, large scale land acquisitions have fundamentally altered pastoralist migration in two main ways. First, people from Nairobi are now buying land and the annexation of large, land is denying us pastoralists important grazing space. Second, those buying land and fencing it are also affecting pastoralists' mobility by blocking movement between our usual grazing territories" (KII3, 2024).*

Taking into consideration the information presented above, it is evident that climate change has a broad range of effects on livestock systems. These effects include a reduction in grass cover, which leads to increased competition for fodder among grazing animals.

Another FGD respondent was quoted as follows:

> *"Climate change has really affected us as women. Extreme weather conditions in the form of floods have been experienced recently. But after the floods, we also have long droughts that lead to loss of vegetation. We are forced to travel for long distance to look for water. Those engaging in industrial production also release chemicals and these also harm our health and livestock, as we have new livestock diseases" (FGD04, 2024).*

The response above reflects the increasing worry among community members regarding alterations in weather patterns, such as shifts in temperature and rainfall levels, in comparison to historical records. Consequently, traditional methods of weather prediction have evolved to the point where their forecasts are no longer accurate. In addition, the loss of biodiversity is being exacerbated by climate change, the combined effects of soil erosion and reduced vegetation cover as a result of deforestation. These factors have long-term effects, including the dwindling of indigenous knowledge and information systems pertaining to weather forecasting, natural resource management, pastoral production, and ethno-veterinary practices.

These results suggest that environmental governance is being disrupted by climate change, leading to environmental degradation and an increase in disputes, especially those involving land. The fierce rivalry for few resources leads to confrontations between animals, charcoal makers, and herders. The manner of life of pastoralists is changing significantly as a result of climate change, leaving them more susceptible to droughts, poverty, and disengagement from pastoral ism. The natural resources that the pastoral production system depends on are quite vulnerable to climate change. The absence of a variety of resources on which to depend increases the vulnerability of pastoralists, further aggravating their condition.

These results are consistent with research by Kemal and Lelamo (2022), which found that water supplies, livelihood resources, agriculture, and people's health and nutrition are all directly impacted negatively by climate change. Pastoral communities are more vulnerable due to the increasing frequency and severity of droughts, which result in a substantial loss of cattle. Pastoralism may have positive environmental effects, however the presumptions of overstocking and dryland degradation in pastoral regions are often taken for granted. Because of this, a lot of environmentalists have used this justification to defend seizing pastoral lands and keeping pastoral populations out in the name of protecting species.

Similarly, research by Ng'ang'a and Crane (2020) and others has shown that the effects of climate change have caused pastoralists to experience chronic poverty, migration, and land degradation. This involves changes to the systems of land tenure as well as a rise in the population of people and animals. Consequently, severe food and nutrition insecurity has resulted from these communities' high dependence on climate-sensitive systems for their livelihood, which is made worse by the growing difficulties associated with movement. The upshot of these data is that the repercussions of climate change present a significant danger to the overall welfare of mankind, particularly for pastoralists. The economic consequences associated with these climatic phenomena, especially for migratory pastoralists who are particularly vulnerable to climate change, need policy advice that aligns with

their coping mechanisms. Pastoral adaptation has several problems, among which climatic change is only one. However, the difficulty of climate change seems trivial to many pastoralists who confront severe political, social, and economic marginalization.

Upon analyzing these findings, it can be inferred that the ability to adjust and change is an inherent characteristic of pastoralism. For pastoral development to be sustainable, it is crucial to recognize that the success of pastoralism relies on its adaptive capacity. Consequently, the restoration and improvement of adaptive capacities should be a primary focus in development strategies. Pastoralism's ability to provide sustainable livelihoods is due to its flexibility, mobility, and low-intensity use of natural resources. These results have significant implications for the full socio-economic assessment of future climate change consequences on pastoralists and other sectors. Therefore, an all-encompassing climate policy approach is needed to address both the reduction of greenhouse gas emissions and the adaptation to climate change. This approach should focus on gaining a deeper understanding of the obstacles, socio-economic risks, and coping mechanisms faced by pastoralist societies, as well as the wide-ranging impacts on food security, health, financial incomes, and vulnerability. The findings have shown that a dynamic and adaptable integration of cultural practices and national policy is crucial for the effective adjustment of pastoral communities.

1.9 Conclusions

The results of this research have investigated how climate change has affected sustainable livelihoods in Isinya Sub-County in Kajiado County – Kenya. Livestock, land, pasture, and the general dynamics of communities are all directly impacted by climate change, which is linked to patterns of movement in search of pasture and water. The resilience of pastoralists' sustainable livelihoods in the face of climate change and other uncertainties is limited by important barriers such as land tenure systems, cultural aspects, and inadequate climate information. Food security, access to healthcare, and education are socioeconomic factors that are crucial in determining how pastoralists can maintain sustainable lifestyles in the face of climate change. In general, the consequences of climate change, obstacles to adapting to climate change, the types of coping mechanisms used by pastoralists, and socioeconomic indicators may all have an impact on the pastoralists in Kajiado County's Isinya Sub-County achieving sustainable livelihoods.

1.10 Recommendations

The research concludes with the following advice in light of its findings:

Policy Recommendations

Given how climate change affects sustainable livelihoods, the government ought to make use of the early warning system for drought that has the potential to be successful. When combined with prompt market interventions and the creation of financial institutions, this can help herders convert livestock that is unable to withstand the stress of the drought into other assets like money, fodder, or food grain.

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