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CLIMATE RISK MANAGEMENT

PARTICIPATORY ASSESSMENT OF CLIMATE AND DISASTER RISK AMONG PASTORAL COMMUNITIES OF AFRICA- A CASE STUDY OF KAJIADO COUNTY, KENYA

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ABSTRACT

Purpose of the Study: The main aim of this study was to assess past and present climate impacts from communities' points of view and establish community-led adaptation strategies and a roadmap for pastoralists in Kajiado County using an innovative participatory tool for climate resilience building.

Statement of the Problem: While climate-induced impacts continue to affect poor rural pastoral communities and their livelihoods, these communities are rarely involved in developing locally led adaptation roadmaps that reflect their realities. The opportunities that lie in community-led programs have never been fully explored by the scientific community, despite the promise that participatory techniques hold in climate resilience building at the grassroots level.

Methodology: This study employed an innovative participatory assessment of climate and disaster risk (PACDR) methodology to assess climate impacts among the Maasai community of Kajiado County, Kenya. Specifically, the study used ten PACDR tools to engage the community through focus group discussions formed along six gender groups, with cumulative participation of about 120 community members.

Results: The study established that communities still prefer their own indigenous/traditional strategies for combating climate change, such as migration, despite the challenges that some practices may pose on the environment. In addition, the study discovered an increased sense of ownership when communities are involved through participatory approaches in developing their own adaptation strategies, based on their perspectives and what works for them in line with their prevailing social, cultural, and environmental conditions.

Recommendation: This paper recommends the use of the innovative PACDR in future community climate risk assessments among ASAL (Arid and Semi-Arid Lands) communities in East Africa.

Keywords: *Participatory, Climate Risk, Assessment, Vulnerability, Community*

BACKGROUND TO THE STUDY

Climate change remains the most pressing challenge of our time, with historical trends and future projections indicating a situation with limited potential for reversal. The consequences of climate change are already being felt across all critical sectors of the economy (Lumborg et al., 2021). Kenya's vulnerability to climate change is significant, with current projections suggesting that its temperature will rise by 2.5ºC by 2050 (IPCC, 2021), while rainfall is likely to become more intense and less predictable (Mekuyie & Mulu, 2021). Notably, droughts, declining rainfall amounts, and reduced predictability continue to present significant challenges for water availability for crops and livestock, especially in Kenya's arid and semi-arid lands (ASALs) where nomadic pastoralism persists, such as Kajiado County (Lyon & Vigaud, 2017).

In a recent study by Waithira & Kathula (2020), droughts led to the death of 232,400 cows in Kajiado County, significantly impacting about 80% of pastoral livelihoods. Over the years, these drought-induced calamities have been on the rise. In the recent countrywide flood events that impacted Kenya in 2023 and early 2024, widespread flood-related livestock deaths were reported in Kajiado. To understand climate-related risks, recent strategies emphasize the use of community-led, bottom-up learning models where affected communities are at the center of investigations. This approach leads to favorable adaptation strategies and enhances community inclusion in decision-making and a sense of ownership of proposed adaptation strategies. In this study, climate risk assessment was undertaken using mixed approaches in the ASAL areas of Kenya, with Kajiado County as the case study. The county of Kajiado is predominantly occupied by the Maasai community, one of the outstanding pastoral communities in Kenya.

STATEMENT OF THE PROBLEM

While pastoralism remains the backbone of many communities across Africa's Arid and Semi-Arid (ASAL) regions (Chelang'a and Chesire, 2020; Nyariki and Amwata, 2019), rising climate threats continue to destabilize communities and push them beyond their ability to cope. With changing weather patterns, it is becoming more difficult to predict rainfall seasons, resulting in production cycle disruptions (Mumo et al., 2018; Amwata, 2013). As a result, access to pasture and water is becoming increasingly difficult (Larsen et al., 2016), especially for livestock keepers in ASAL

areas (Yadav & Lal, 2018), resulting in forced migrations to neighboring regions in search of pasture.

The climate disaster has also contributed to an increase in cases of insecurity among pastoral communities in ASAL communities (Kaoga et al., 2021). ASAL areas also face challenges due to ambiguity in land ownership (Seter et al., 2018), which has resulted in low incentives for using land as a factor of production (Njoka et al., 2016). Other challenges attributed to climate change impacts include resource competition, loss of livelihoods, conflicts, and instability caused by constant migration from one location to another (Lankester & Davis, 2016). In most countries, the ASAL areas are vast, remote, and frequently marginalized, which exacerbates the aforementioned challenges.

Despite the challenges described above, affected communities are rarely involved in developing their own locally led adaptation roadmaps. The scientific community has never fully explored the opportunities that exist in community-led programs, despite the promise that participatory techniques hold in climate resilience building at the grassroots level. It is also known that communities have historically built impressive local resilience mechanisms to combat climate change extremes, but this is rarely documented. This study investigates the feasibility of using an innovative Participatory Assessment of Climate and Disaster Risk (PACDR) in assessing community impacts of climate change, as well as using it as a tool for building climate resilience within Kajiado county's ASAL communities.

RESEARCH OBJECTIVES

To assess past and present climate risks and impacts and establish community-led adaptation strategies to impacts of climate in Kajiado County

Specific objectives

i. To assess historical trends of climate change and effects on the livelihood and social institutions of Maasai community in Kajiado county.
ii. To investigate past and current coping mechanisms against climate extremes by the Maasai community in Kajiado.
iii. To develop community climate risk adaptation roadmap with the help of the community

RESEARCH QUESTIONS

This research is sought to respond to the following questions:

i. To what extent have the historical climate shocks and incidences affected you as a community?
ii. Which strategies has the community employed in the past to cope and overcome the challenges presented by past climate shocks?
iii. What do you think you may do differently as a mechanism to overcome future climate shocks and how and when can these strategies be achieved?

THEORETICAL FRAMEWORK

This study is based on Bohle's model of vulnerability, which was formulated by Bohle in 2001 (Bohle, 2001). The theory asserts that the analysis of vulnerabilities must be defined within the framework of a comprehensive evaluation of human well-being that encompasses economic, social, environmental, and political susceptibility to a range of negative issues. Furthermore, he contended that vulnerabilities arise from a complex and interconnected system of both internal and external factors. The external factor refers to vulnerabilities to changes and pressures, while the internal component refers to the inability of individuals in a society to cope with challenges (Bohle, 2001). The second vulnerability is social vulnerability, which refers to the inherent susceptibility of a network that is primarily influenced by the economic, social, and cultural aspects of a society. The concept primarily includes access to credit and insurance, the right to food, marginalization, deprivation, and inequality. Moreover, according to Bohle (2007), vulnerabilities can be classified as the result of specific physical events that are hazardous, severe, and have certain characteristics such as likelihood, intensity, and prevalence. This primarily highlights the inclination of hazardous situations and the vulnerability of human networks to such hazards.

Bohle's theory is corroborated by the ideas put forth by O Malley (2010) and Füssel and Klein (2006). O'Malley (2010) states that the ability to utilize uncertainty in order to create a new and improved future is a key characteristic of a resilient individual who is adaptable, flexible, and enterprising. This perspective suggests that climate change is currently considered a global crisis in the field of security. It directly affects two fundamental systems that provide for human needs: food and energy. This has the potential to greatly impact human well-being and the ability to

sustain ourselves. Füssel and Klein (2006) argued that human networks must adopt adaptation strategies to climate change, which are contingent upon their adaptive capacity. The susceptibility of the internal socio-economic elements of a human system to climate change is determined by its ability to adapt to external stresses (Bobadoye, 2016).

Based on the aforementioned claims, this study aims to investigate the correlation between climate change and its effects on the livelihoods and resources of pastoralists. Additionally, it seeks to establish any links between the impact of climate change and the socio-economic vulnerabilities of pastoralists. Furthermore, it aims to determine whether local pastoral communities are actively implementing their own adaptation strategies to enhance their resilience.

EMPIRICAL LITERATURE REVIEW

Climate Risk assessment and community engagement

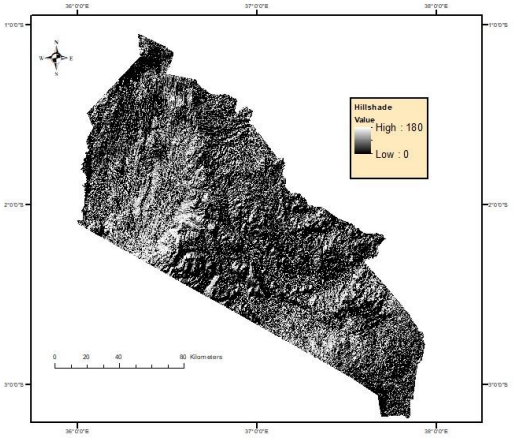
Climate change is the most serious environmental threat humanity has ever faced (IPCC, 2021). Climate change is attributed to negative anthropogenic activities on Earth, such as deforestation, industrialization, and urbanization, which have undergone significant transformation in recent years (IPCC, 2021). Climate change risks are increasingly manifesting themselves in rural poor households whose sole source of income is subsistence farming, disproportionately affecting the most vulnerable members of the community, including women, children, the elderly, and people with disabilities. Kenya's vulnerability to climate change cannot be overstated, as current projections suggest that its temperature will rise to 2.5ºC by 2050 (IPCC, 2021), and rainfall will become more intense and unpredictable. Notably, declining rainfall and drought will pose significant challenges to pasture and water availability, particularly in Kenya's ASAL areas (Lyon B. & Vigaud N., 2017). Unfortunately, communities with low economic empowerment, resource endowment, or weaker institutions have weaker coping strategies, making them more vulnerable to climate change risks. Building community resilience to climate change must first address factors that contribute to the community's ability to withstand climate impacts, such as increasing adaptive capacity through capacity building, increasing income and resource availability, and improving institutional systems and networking (IPCC, 2019).

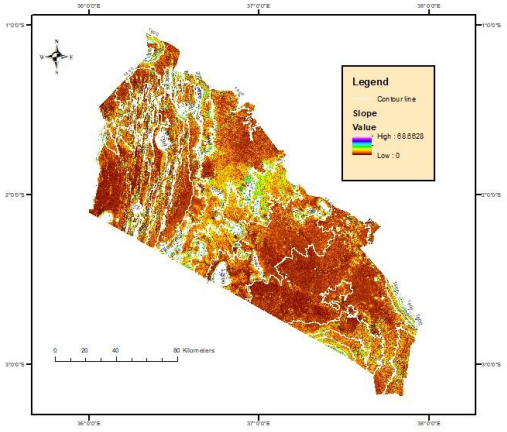
In addition, climate extremes may force communities to adapt and mitigate in order to survive. Wang et al. (2014) found that, despite the significant negative impact of climate change on pastoralism, local pastoral communities in China's Tibetan Plateau had taken significant steps to adopt adaptation strategies. Specifically, it was observed that these pastoral communities failed to implement recommendations from global and local governmental policies, instead opting for traditional coping mechanisms such as extending migration durations and varying approaches to pasture utilization (Wang et al. 2014). Similar studies in Turkana Kenya (Imana & Zenda, 2023) and India (Maiti et al., 2014) discovered that local pastoral communities would continue to rely on traditional adaptation strategies to mitigate the effects of climate change, despite obvious challenges and often-tricky implementation strategies. However, Zampaligre et al. (2022) discovered that, because of the negative impact of climate change on pastoralism, pastoral communities in Burkina Faso had adopted locally led adaptation strategies to address their local plight. They observed that local pastoral communities had adopted adaptation strategies such as cereal cropping, the introduction of hardy goats and cattle breeds, and some had even chosen permanent migration (Zampaligre et al., 2022). In their study in Turkana, Kenya, Imana and Zenda (2023) found that livestock keepers preferred to graze their livestock on mountains or hillsides and had adopted a variety of strategies to cope with climatic changes, including diverse livestock product utilization, controlled grazing, herd diversification, and labour distribution among household members. It is thus concluded that adverse climate impact has a unique way of informing local pastoral communities' adaptation strategies to counter.

Situational analysis of Kajiado County

Kajiado County is predominantly semi-arid (Kisangau *et al.,* 2021) and pastoral activities dominate. The geography, soils and vegetation characteristics of Kajiado are shown in figure 1. Traditional to the Maasai culture, "*cattle are what make the good life"*, and milk and meat are the best foods (Kyejo, 2007; Leal Filho *et al.,* 2017). Cattle keeping is the iconic mark of Maasai culture (Sharp & Twati, 2017). Crop farming is mainly in the southern and western parts of the county along rivers and springs (MoALF, 2018). The main climatic challenge facing the agricultural sector in Kajiado is drought (MoALF, 2018). The occurrence of drought in Kajiado has been widely reported. Mutsotso et al. (2018) identified drought years in the model. country as

1987, 1998, 2000, 2001, 2005, 2006, 2008, 2009, 2010, 2011 and 2015, results which are also in agreement with the works reported in Achola (2021); Kaoga *et al.,* (2019, 2021) and even the County integrated Development Plan (CIDP) of Kajiado county (CIDP, 2018). That the period of 1961-2022 recorded over 150 droughts of different categories in Kajiado is testament to fact that Kajiado is hardest hit, and it is apparent that 19 of these drought events were extreme. These statistics point to a probability of a drought event recurring every 2 years in Kajiado, with frequency projected to increase owing to the increasing severity of climate change. Amwata, (2013) confirms that Kajiado has a history of devastating droughts since the 1900s with the trends observed showing 2-3 years return period. The frequency and severity of droughts in the county have resulted in crop failure and livestock losses and triggered severe food shortages in the past (Huho and Kosonei, 2014; Achola, 2021; Kaoga *et al.,* 2018). In the drought years of 2009 and 2016, records indicate that crop failure in the county was more than 90%, while livestock losses were in excess of 70% in most areas within the county according to the Kajiado District Environmental Action plan, (KDEAP, 2009), and the National Climate Change Action Plan of Kneya 2018- 2022. The drought events resulted in the drying up of water sources with an associated increase in the distance to watering points in the pastoral livelihood zone, loss of livestock, crop failures, school dropouts and escalated human wildlife conflicts (Gikaba *et al.,* 2014; Mugambi, 2022); factors that have made the county dependent on food relief.





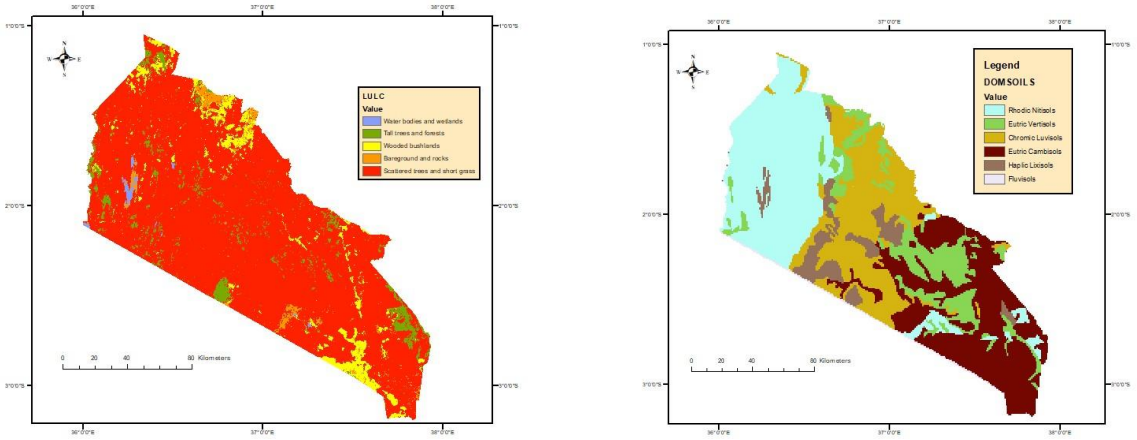


Figure 1: Map of Kajiado county showing (a) Kajiado Hillslope, (b) slope and contours, (c) land use and cover characteristics, and (d) dominant soil characteristics.

Mean annual rainfall and temperature trends seem to have been on the increase in Kajiado (figure 2). Temperature appears to have increased by an approximate 0.03 degree in annual averages. The projections for rainfall and heat days above 35 degrees show that rainfall will slightly continue increasing for Kajiado into the year 2110 under all scenarios SSP1 2.6 and SSP5 8.5 (Figure 2). The number of days with heat exceeding 35-degree mark is also projected to increase. This means that certain areas within Kajiado may experience higher than this average.

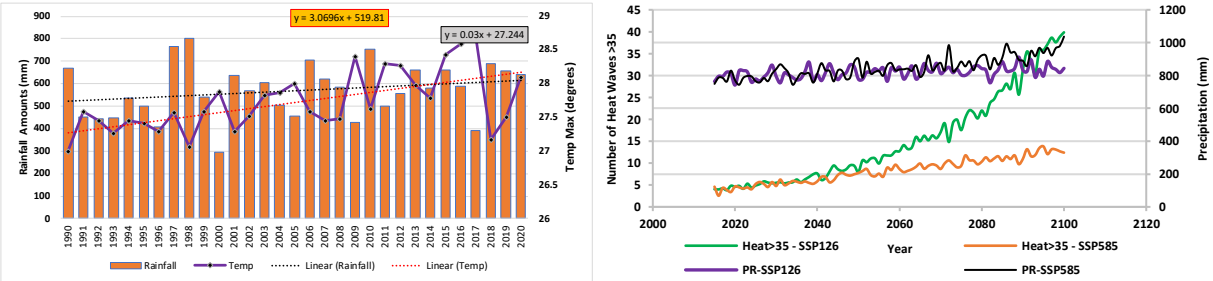


Figure 2: Observed precipitation and temperature trend for Kajiado over 30-year period 1990-2020, and analysis of the heat days exceeding 30 degrees and precipitation for the period 100 years from 2010 to 2110.

The standard precipitation and evapotranspiration indices (SPEI) are indices that show periods of extreme drought and floods as can be reviewed from recent literature (Bachmair et al., 2018;

Labudov´a et al., 2017). SPEI variates can be used to represents periods of extreme floods and droughts. Similar studies have been carried by the works of Ayugi et al. (2020), Bobadoye et al. (2014), and Tefera et al. (2019) among others. Figure 3 shows that Kajiado has experienced droughts and extreme flooding in most parts as evidenced by the extreme positive SPEI and negative SPEIs. Generally, there has been increased cycle of droughts, and increasing intensity, but floods have also shown increasing trends lately.

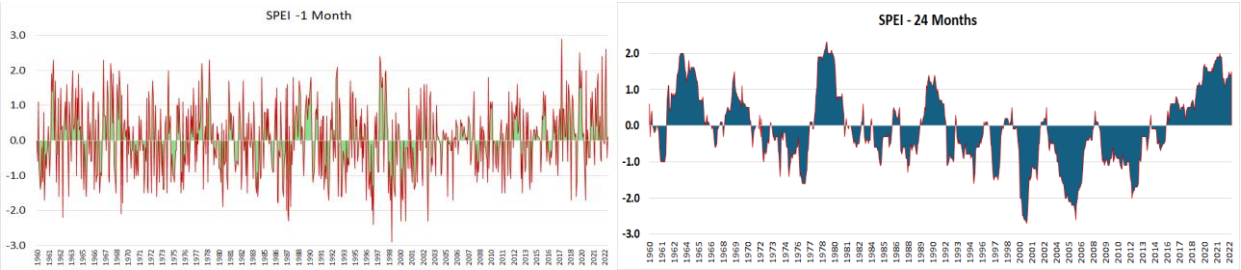


Figure 3: Standard Precipitation and Evapotranspiration Index (SPEI) for Kajiado analyzed for one month and 24 months, respectively.

Participatory assessment of climate and disaster risk

Climate risk assessment aims to determine what assets, resources, or communities' livelihoods are vulnerable to climate change through analysis of impacts and probabilities to determine "what can happen", "how likely is an impact" and "what are the consequences" (Keller & Künzler, 2014). Climate change risk assessment involves formal analysis of the consequences, likelihoods, and responses to the impacts of climate change and the options for addressing these under societal constraints (Adger et al., 2018). While various risk assessment approaches exist among scientific community, and the choice of application largely dependent upon factors such as availability of data and models, as well as the intended purpose of assessment. The Intergovernmental Panel on Climate Change (IPCC), for example, typically divides its assessment into three separate working groups focused on (1) physical climate change; (2) climate impacts, vulnerability, and adaptation responses (by sector and region); and (3) emissions mitigation (by sector) (van der Greek at al., 2019; IPCC, 2019).

Participatory assessment is the involvement of community members in an interactive session to establish the history and impacts of climate risk faced and the copying strategies employed in the past. Participatory assessment of climate and disaster risk (PACDR) tools (available at https://pacdr.net/) have been developed to assist in the process of PACDR processes (Keller & Künzler, 2014). Participatory processes allow free information and data flow from the focus group participants as the primary source of information as opposed to the conventional approach where the facilitator drives the process (Tariq et al., 2021). In PACDR session the community identifies climate risk based on what they have experienced and narrate and document their own experiences with climate change and outline the coping strategies applied in the past and that which may work in the future. PACDR is followed by identifying future opportunities associated with climate change before formulation of adaptation pathway.

METHODOLOGY

The study used participatory techniques for data collection and analysis, which were supplemented by simple desktop models to raise community awareness of their actual scenarios. Participatory approaches included six focus group discussions (FGDs) and ten key informant surveys with community leaders, administrative chiefs, religious leaders, and select elderly members of the community. In each FGD, gender groups (men, women, and youths) were divided into smaller focus groups. Following the subgroup discussions, the groups convened in a consensus group meeting to reach an agreement on the key issues under consideration. The community's perspectives on the topics under discussion were gathered based on the consensus outcomes. Table 1 depicts a typical PACDR framework and tools, including an assessment of climate hazards on different gender roles and decision-making roles in the community. The climate models used in this study were created using desktop modeling with data obtained from global databases such as the CMIP 6 0.25-degree timeseries for the 2015–2100-year period under scenarios SSP 126 and SSP585. In addition, the study relied on observed climate data (temperature and precipitation) from Kenya Meteorological Services (KMD).

Table 1: Modified Participatory Assessment of Climate and Disaster Risk (PACDR) Tool

Module	Exercise	Tool	Tools administered	
			Community	Consensus
Module 1	Review and climate analysis	N/A		
Module 2: Climate Change and Hazard analysis	Exercise 1: Livelihood Mapping and Ranking Exercise 2: Resource mapping Exercise 3: Hazard Identification and Ranking Exercise 4: Seasonal Calendar Exercise 5: Historical Timeline	Tool 1 Tool 2 Tool 3 Tool 4 Tool 5	All	All
Module 3: Vulnerability Assessment	Exercise 6.1: Hazard - Impact Analysis Exercise 6.2: Hazard – Livelihood Impact Analysis Exercise 6.3: Hazard – Gender Impact Analysis	Tool 6 Tool 7 Tool 8	All	
Module 4: Responses to the impacts of hazards	Exercise 7.1: Exercise Decision Making Change Pathway Exercise 7.2: Community Role Play Change	Tool 9 Tool 10	All	
Module 5: Adaptation pathways	Exercise 8: Community adaptation goals	Tool 11	All	All
Module 6: Community adaptation planning	Exercise 9: Development of an Action plan Community presentation	Tool 12		All

RESULTS

Demographic and Livelihood Characteristics

The respondents were analysed according to their age and educational level. Youths made up approximately 24% of total respondents, with 44% being between the ages of 35 and 50, and 32% being over the age of 50. Livelihood analysis revealed that 53% of all respondents were livestock keepers; however, closer examination revealed that 81% of respondents from remote rural areas

(nonresidents near major trading centres such as Saikeri) were engaged in livestock keeping or pastoralism. In shopping malls, a significant number of people were engaged in business activities (38%), while those from rural areas were engaged in agriculture (10% versus 4%). Of those who were in business, 66% were involved in beadwork and handicraft production. It was reported that more and more people are getting into business activities due to extreme drought events in recent decades, pushing people away from livestock.

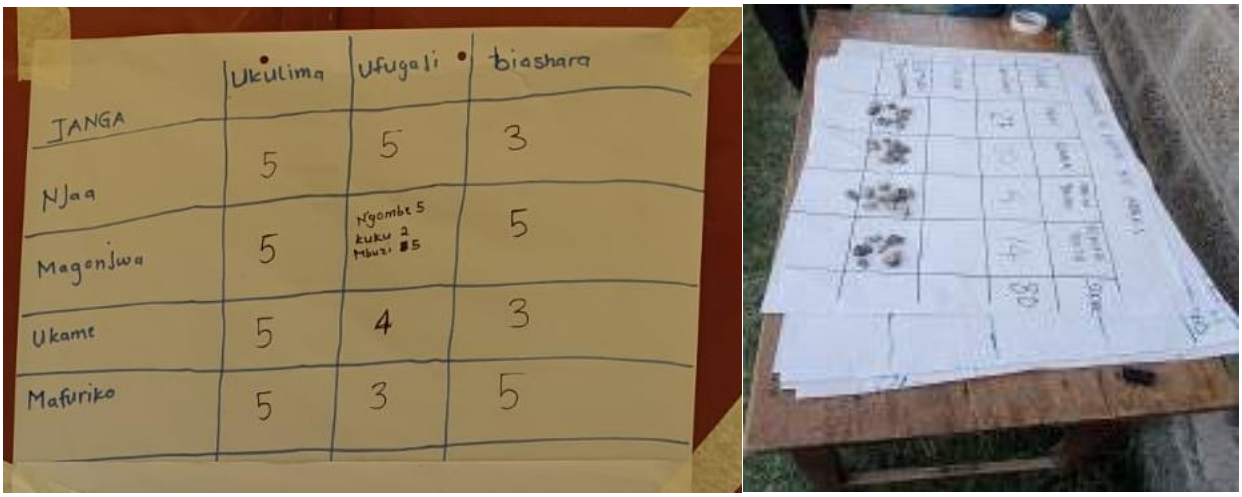


Figure 4: Typical PACDR assessment to identify livelihoods and impacts of climate change

Historical timeline for key climate hazards using indigenous knowledge

Knowledge of climate change was assessed, and the results revealed that about 93%, of respondents were aware of climate change, while 7% indicated lack of knowledge. The community identified major climate events considered evidence or effects of climate change, and which they have witnessed in their lifetime. Drought (52%), extreme temperature (30%), storm rainfall (10%), and pest and diseases (5%), were among the leading hazards identified. The climatic events/hazards were identified in the local language and related to certain activities or events that were happening around that time. The historical timelines included vivid memories of droughts, referred as “kiroi” in Maasai Language, in the years 1960, 1976, 1980/81, 1984, 1990/91, 1994-1996, 1997, 2000, 2005, 2008/09, 2011, 2014, 2016-18, 2021. Extreme floods have been witnessed in the years 1978, 1997, much recently in the year 2019. The language “emperi” was used in the context of drought that triggered famine. It was reported that most drought events have resulted in

extreme hunger and famine. The community were able to draw a timeline listing events against the years they happened.

Table 2: Historical Timelines of past disaster and climate hazard events in Kajiado county

Year	Events	Local name of drought	Memorable effects of the events
2021/22	Drought	Empiri	Losses of livestock, Cattle invaded Nairobi
2020	Drought	Emperi	Death of livestock and starvation
2019	floods	Olobone	Flash floods swept homes and animals. Death of livestock and starvation
2016/17	Drought	Emperi	Death of livestock and starvation
2014	Drought	Emperi	Death of livestock and starvation
2011	Drought	Emperi	Loss of animals and migration of animals to national park and loitoktok
2009	Drought	Emperi	Death of livestock and wild animals. People move their livestock as far as Tanzania
2005	Drought and famine	Emperi	Death of livestock and wildlife. Lack of grains for human
2000	Drought	Emperi	Maasai were given yellow maize for food aid. Loss of animals
1997	Heavy rains (El Nino)	olokii	Bumper harvest of maize. Livestock suffered from bloat
1994-1996	Drought	Emperi	Livestock taken to Nairobi in search of pasture for the first time
1990-1991	Drought	Emperi	Not enough grazing for livestock, Maasai women started diversifying sources of income
1978	Heavy rains	olopone	Sufficient pasture for animals and floods
1984	Drought	Engunememasi Kiroi	East Coast Fever (Oldikana) outbreak. Maasai were given yellow maize for the first time as food aid. The drought was called the drought of the yellow maize
1980-1981	Drought	Emperi	People starved and livestock died
1976	Drought	Oloik	Starvation and death of animals

Livelihood vulnerability assessment

Livestock keeping was identified as the most affected livelihood activity in the region while, drought leading to famine, and pests and diseases, were, respectively listed in order of prevalence (Figure 5). The community revealed an increasing destabilization of pastoral lifestyle by drought, and other extreme events, which force the community to migrate from time to time, often at unexpected patterns. Besides drought, the community further identified extreme temperature and delayed rainfall as the second and third most important climate hazards of concern. Indeed, the climate records already show that Kajiado county is water stressed and the high temperatures may be contributing to this existent water stress and eventual pasture stress (Kemboi et al., 2018). Droughts disrupts farming activities and food supply cycle. During droughts, extreme temperature "burn grass" leading to reduced livestock pastures, the hot sun also "burns crops" in the eyes of some respondents. As already highlighted in section 2.2, Kajiado county receives low rainfalls of between 700mm-850mm annually and in most cases the county suffers moisture deficit in most

months of the year (7-9 months) (KDEAP, 2009). In the recent past, flooding has also become an issue, causing a significant share of harm and impact as well. Other impacts of climate change of community's livelihoods include scarcity of water and pasture, resulting in widespread livestock deaths due to dehydration and starvation.

Interestingly, animals have developed stress tendencies which lead to reduced productivity in terms of milk, meat, and wool. This reduces the income derived from livestock and exacerbates poverty within pastoral communities. Moreover, frequent and climate-forced migration, may lead to "intense" or frequent interactions of wild animals and cattle, this phenomenon maybe a precursor for disease and pest transfers. The community reported that they feel more exposed during harsh climate to wild animals and sometimes experience regular attacks. This concern is in line with the reports pointed in Nthiwa et al. (2019) who identified disease spread as a critical risk from traditional pastoralism activities. In addition, drought conditions and extreme temperatures may challenge the traditional knowledge and coping mechanisms of pastoralists. Traditional methods of predicting weather patterns and managing livestock may become less effective, leading to increased vulnerability among communities. One report from men-subgroup during the PACDR indicated that "their power to predict what might happen has gone down" or future climate forecast has gone down owing to the unpredictability of the climate situation nowadays.

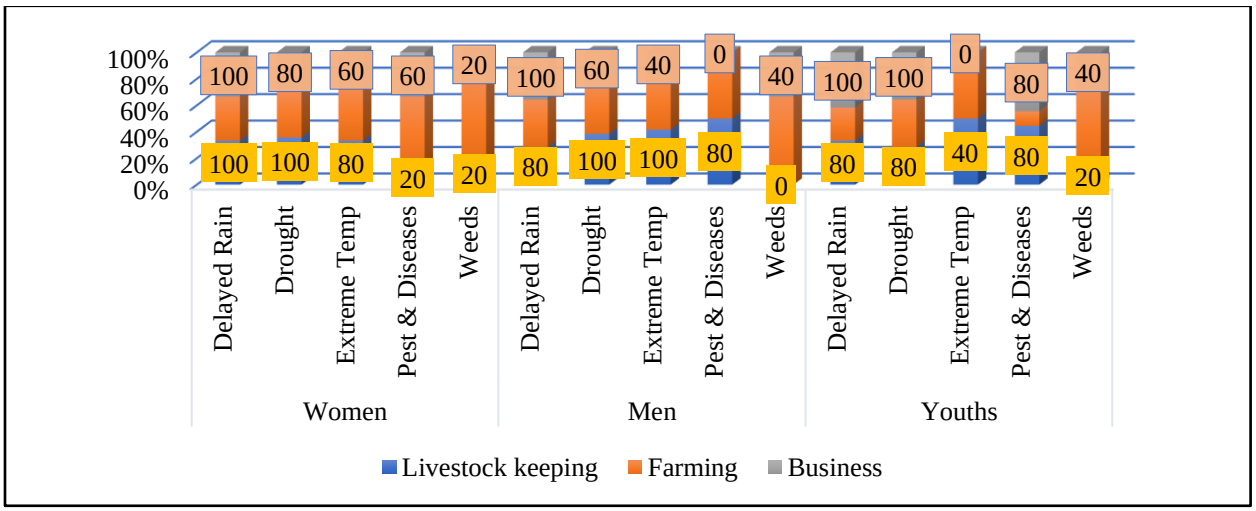


Figure 5: Results showing how identified climate hazards affects key livelihoods.

Impacts on Migratory behaviour

Figure 6 on illustrates migration destination during extreme drought conditions in Kajiado. The community identified old and emerging migration routes owing to the increased climate threats. Naivasha and Nairobi counties account for over half of the migratory routes (34% and 28%, respectively) for the pastoral communities. Other migratory destinations include in Ngong Hills (5%), Namanga (10%), and Maasai Mara (2%). Whereas migration has been an distinctive aspect of pastoral life, the changing migratory routes and discovery of new ones – on account of frequent climate shocks - seems to be an interesting finding of this research.

Some traditional migratory areas are facing increasing pressure from overgrazing and decreased grass/vegetation which often result in resource related conflict (Chelang'a & Chesire, 2020; Kemboi et al., 2018). Consequently, pastoralist have had to look for alternative migratory corridors (Wafula et al. 2022). Such new migration destinations have in the recent past included urban centres and unprecedented altitudes higher in the mountains. The participatory findings already indicate that pastoralist from Kajiado consider Naivasha county and Nairobi city county as the latest targeted destination for migration. Often, the movement of cattle into cities such as Nairobi, has led to increasing concerns on urban pastoralism, consequently leading to increasing political and social overtones in the urban environments. A case narrated by a community elder revealed that about 200 of the estimated 2000 alleged to have migrated into the Nairobi metropolitan area in 2019 were impounded by the Nairobi City administrators, a situation that, not only angered the community, but also attracted significant political nuances. Moreover, the migration to Naivasha in Nakuru county has in the past led to heightened inter-community conflicts over limited resources within the receiving areas which are largely agrarian. Muchiri (2014) earlier expressed that the agriculture communities of Naivasha and the pastoral community have counter-accused each other of encroachment, where the pastoral community feel that agriculture communities are infringing into their traditional grazing lands. While the claims by pastoralist maybe true that agriculture has invaded rangelands, the growth of agricultural spaces into newer territories may not be easily reversed owing to compelling human population growth that pushes communities to expand farmlands. The writings of Abdi (2020) and Smith, (2021) do agree that environmental conditions have indeed driven pastoralist to the limits of movement, and amplified the frequency of migrations. The challenge with the frequent migrations perhaps remains inter-communal

competition/conflict, overexploitation and diminishing options for migratory routes. Promoting a more stable and resilient pastoral system devoid of frequent migration is the recommendation of this research.

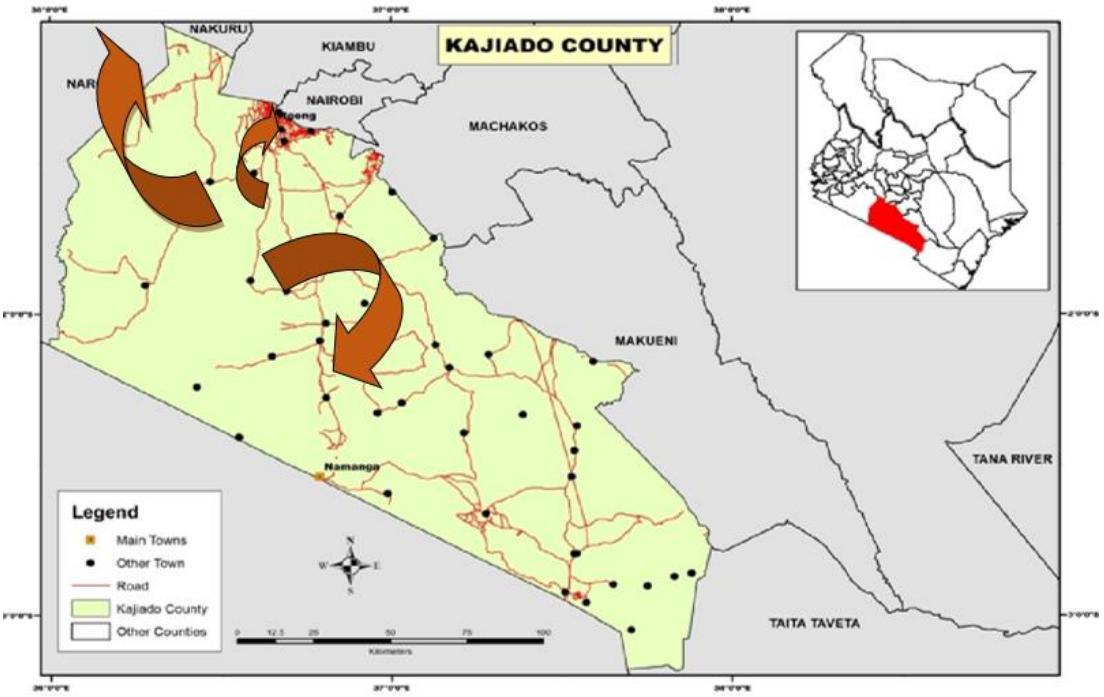


Figure 6: Migratory routes for pastoralist in Kajiado North sub county.

Decision making pathway

Individuals and communities must make critical decisions in the face of unexpected climate shocks. The participants listed the typical household decisions made during times of extreme danger. Some decisions included destocking, selling animals, digging water wells and boreholes, avoiding bathing, migration, and sending children to relatives. Men prefer to make most of their own decisions. Out of the 27 decisions listed, approximately 35% were made entirely by men, while 28% were made entirely by women. Men and women made approximately 24% of the decisions together, while youths and children participated in less than 10% of the decisions. As can be seen, the involvement of youth and children is limited, whereas women are primarily involved in domestic decision making, particularly when men have gone out with animals. Women were found to make unique decisions such as "deciding to seek help from local chiefs or

government administrations," "religious interventions," and other decisions such as "reducing meal ratio" and "choosing which meal to eat at home." Men frequently sent spies to check for pasture availability in neighbouring regions and communities as a means of gathering intelligence. Sometimes men make the decision to "seek employment" in towns while leaving their wives and children at home.

Climate change impact on communities' social institutions – gender, access to, control and ownership of resources

The study established the gendered impact of climate change; different social groups are affected differently during extreme weather events, as previous research has shown (Omolo & Mafongoya, 2019). Gender dimensions to climate impact analysis were particularly evident during event ranking, where extreme temperature was identified by both youth men and youth women, whereas drought was at the top of the list for both. Interestingly, the differences were informed by the different interests attached to the gender groups; for example, for young men, extreme heat is just a "nuisance that prevents them from realizing their ambitions, including going out for leisure". Furthermore, women, who are culturally aligned with specific culturally defined feminine responsibilities such as fetching water and cooking, rated drought higher because it already results in diminishing water resources and requires them to walk long distances in search of a rare commodity (Abdi, 2020). Men, on the other hand, who must spend most of their time outside tending cattle and providing for their families, are subjected to extreme weather conditions and long periods of separation from family.

Further, the PACDR study found that family institutions were also at risk from climate change. In one subgroup, it was reported that migration has contributed to increased "moral degradation and unfaithfulness in marriages" because couples sometimes must stay away from each other for longer periods of time, which often provides an opportunity for extramarital affairs. Another factor established by the project was the impact of climate extremes on resource management and other aspects such as control, access, and ownership at the household level. Figure 7 depicts the changing social dynamics of households due to climate change.

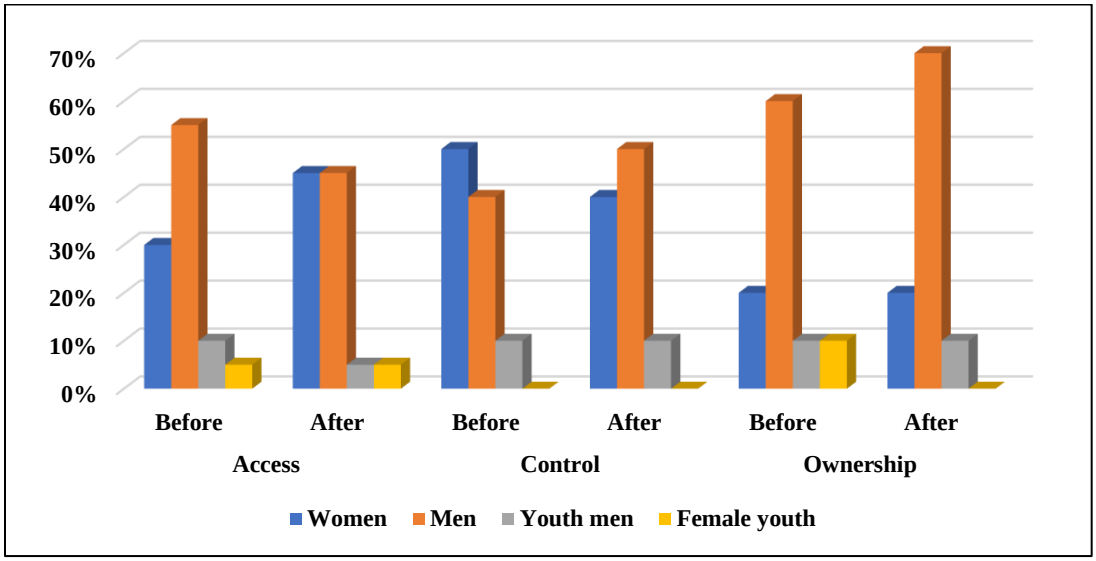


Figure 7: Climate change effects on access to, control and ownership of resources in the study area.

The community further reported that climate extremes have progressively changed long established role-play in the community. This is due to the occasional livelihood disruptions that pushes the community members to act out of pressure (Nunow et al., 2019). The PACDR exercise established that, during migrations induced by harsh climatic conditions, some animals, are either lost through natural death or are sold, this affects access and ownership rights, especially majority of men who happen to have control of large animals such as cattle, while women and youths who have ownership of mostly small animals like sheep and goat will tend to retain greater access as some of these smaller animals have greater resilience. Some studies such as Omolo & Mafongoya (2019) opine that "women may lose some control of the said small animals after climate events since most resources in women possessions are left in the hands of men during harsh periods" and some of them never return after migration. Essentially, women may give out their cattle and small animals to join other herds as they migrate in search of pasture, at this point, possession as well as control is surrendered to the groups taking them out. Sometimes upon coming back, some of the animals are unaccounted for, while others are presumably dead. And since women have lower voices in the social structure, they will be ignored or shy away from making strong follow-ups. Generally, youths have little access, ownership and even control of most resources in the community.

Adaptation and Coping Strategies to Climate Change and Variabilities

Key adaptation strategies were identified during a plenary session where all the community group were assembled for consensus building. Migration (78%), destocking (68%), diversification of herds (65%), selling land (60%), and buying hey (58%), were identified as the key adaptation strategies for the Kajiado pastoralists. In addition, seeking food aid and rain harvesting at home were identified as additional adaptation methods practiced, both accounting for 48% and 30% respectively. Some of the identified adaptation options were also mentioned as possible strategies to avoiding or copping with conflicts that arise from climate change. While migration has its social and economic challenges, it still presents hope among pastoralist who believe that relocating to new geographic locality presents hope of opportunities for pasture. It is however known that migration only increases pressure and competition on the receiving localities often resulting in conflicts. On average, it was reported that each household reduces their cattle herds by about 200 herds of stock in every single drought event. When it comes to diversification, majority opt to venture in business activities within the local towns and shopping centres. A considerable number are also opting to seek formal employment as a way of diversifying from cattle dependency. Some members of the community gave evidence to how they have joined the motorbike sector as riders or mechanics as an alternative to cattle keeping which is facing increased challenges. These findings agree with findings from Mudekhere et al., (2023), who noted that, many pastoral communities in the horn of Africa adapted to climate change effects differently, following regional variances of prevailing ecological and climatic conditions. The same findings also align with Ndiritu, (2021, 2019) and Kaoga et al. (2018) who noted that, drought was most important climate drivers for pastoralist and a principal cause of loss of livestock and livelihoods, while observing that pastoralist have applied the triple strategies of early selling (destocking), access to private ranch grazing and early warning systems. Other key adaptation strategies identified by the community include; sharing responsibilities between men and women during hardship seasons, prioritization of family feeding, digging boreholes, cultivation of early-maturing crops such as onions, construction of traditional land boundaries to avoid conflict where livestock encroach personal property, beadmaking for women as a way income generation, promotion of indigenous food products and herbs like meat, milk and medicinal herbs due to their rich nutrition and medical

benefits and ease of availability, and wearing of light clothes, sitting under trees to look for shade. It is noteworthy that the county government of Kajiado already identified some of the identified adaptation strategies under the Kajiado County climate change action plan (KCCAP, 2023), which is a step in the right direction to making policy makers align actions based on locally-identified solutions.

Figure 8:Ccommunity consensus group meetings during the adaptation roadmap development.

CONCLUSION

Using Kajiado Kenya as a case study, this study used a mixed approach that included scientific modelling and participatory assessment of climate and disaster risk (PACDR) techniques to assess climate impacts and adaptation mechanisms among pastoral communities in Kenya's arid and semi-arid areas. The study used ten PACDR tools to engage the community through focus group discussions (FGDs) organized by gender groups within the community. The study found that, while drought remains a critical challenge for pastoral communities in Kajiado and other ASAL areas, the severity and frequency of drought risk continue to have a significant impact on livelihoods, social and cultural activities, as well as the degradation of social cohesion and peaceful coexistence among neighbouring communities, which includes, among other things, an increase in urban pastoralism and city encroachment. Nonetheless, the community used the PACDR tool to build a climate adaptation roadmap, which included key adaptation strategies such as migration, destocking, and diversification, among others.

RECOMMENDATION

The study makes the following recommendations, the first of which is that adaptation policies be developed to support pastoralists' own adaptation strategies rather than implementing the same universal top-down solutions across the country. Second, adoption of more localized adaptation policies and plans that addressed differentiate gender needs amplified by climate extremes in ASAL areas. Finally, the study recommends the application of the innovative PACDR technique by the community because it encourages community participation and enhanced immersion into the development of the adaptation roadmap.

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