

Drought Impacts on Community Livelihoods in the Upper Ewaso Ng'iro Basin, Kenya

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Abstract

Drought is the most common of all natural disasters in Kenya, in terms of the large areas covered, populations adversely affected and socio-economic impacts. The Upper Ewaso Ng'iro Basin of Kenya is a drought-prone zone, lying on the lee slopes of both Mt. Kenya and Aberdares range. This study sought to determine opinions of communities on drought and its impacts on their livelihoods. Baseline data were collected from published reports and literature reviews augmented with information gathered through interviews with communities and key informants. Field data were collected mainly in the three counties of Laikipia, Isiolo and Meru, utilizing semi-structured questionnaire surveys. A total of 187 respondents were interviewed of which 150 were community members and 37 were policy makers. The typologies of community respondents interviewed included small-scale farmers, large commercial farmers, pastoralists, conservancies, water user associations and conservation groups. It was found that drought is a serious disaster in the Upper Ewaso Ng'iro basin, which has been escalating. Communities experienced negative impacts of drought, with the biggest problem being water scarcity, closely followed by food and fodder shortages and poor incomes from farming. Other problems include spikes in livestock theft, loss of livestock from diseases and shortage of pasture. Conflicts over water and pasture escalate during droughts and crime increases due to lack of on-farm employment opportunities. Since drought events are natural phenomena expected to happen any time, there is need to identify how to improve local capacities in drought preparedness, adaptation and resilience.

Keywords

Drought Impacts, Communities, Livelihoods, Laikipia, Isiolo, Meru, Kenya

1. Introduction

Drought is a natural part of climate, experienced when a period of abnormally dry weather, long enough to cause a serious hydrological imbalance occurs (IPCC, 2012). Although drought characteristics vary significantly from one region to another, they generally occur across all climatic zones in the world. There are four typologies of drought, described as; meteorological, hydrological, agricultural and socio-economic drought (WMO, 2016). Meteorological droughts depict the primary causes, while agricultural and hydrological droughts are indicators. The economic, social and environmental droughts are consequences of secondary drought impacts. These are the components communities identify with and are the focus of this study. In Kenya, drought is officially recognized as “the period of deficiency of moisture in the soil such that there is inadequate water required for plants, animals and human beings” (NDMA, 2018). The importance of drought is visible through its impacts, which can be regional or local. Different drought types are effective at various stages of the same natural recurring process. The longer and the more spatially extensive this deficiency of rainfall, the higher the likelihood of other impacts of the drought (Mutua & Zaki, 2010).

Various types of disasters occur in Kenya, among them; droughts, floods, fires, accidents, diseases and epidemics (UNISDR, 2019; NDMU, 2014). However, drought is the most common and devastating of all natural disasters in the country, in terms of the large areas covered, populations adversely affected and socio-economic losses (NDMA, 2018). Drought impacts negatively on water resources, agriculture, food security, livelihoods and the economy. At least 80 percent of Kenya’s land mass is drought-prone. About 6.5 million people per year are exposed to droughts in Kenya and this number is expected to increase to 34% (more than 25 million people) by 2050 in tandem with population growth (NDMA, 2018). Generally, drought cycles in Kenya have become shorter, more frequent and intense due to global climate change and environmental degradation (Mateshe, 2011; GoK, 2018). The average incidence of serious drought has increased from around seven serious droughts during the period 1980-1990 to 10 in the period 1991 to 2003, while over the last decade, drought events occurred every two years.

Within Kenya, the Upper Ewaso Ng’iro Basin suffers frequent droughts, while the local people are major recipients of relief food due to crop failures and livestock attrition, all associated with drought. From a research perspective, a number of studies have been conducted on the occurrence and impacts of drought (Huho et al., 2010; IGAD, 2019; Wanjohi, 2010). Other studies have focused on the effects of climate change as evidence of drought on agricultural and other rural livelihoods (Koech et al., 2019). However, few studies have addressed drought impacts on people and their livelihoods. This study therefore sought to determine the impacts of drought on local people’s livelihoods and how they cope with drought risks.

2. Data Collection and Sources

This study was carried out in the Upper Ewaso Ng'iro Basin (UENB) of Kenya, to determine how communities are impacted by drought at local levels. The study utilized both secondary and primary data sources. Secondary data were obtained from published papers, reports, government records as well as review of global literature. The climate data was acquired from the Kenya Meteorological Department, comprising a database of 40-year (1981-2020) historical records of monthly rainfall and mean monthly maximum and minimum temperatures. Focusing on meteorological drought, annual rainfall data for Archers Post, which is the driest point as well as for Segera farm which lies within the central Laikipia plateau were analysed for deviation from mean annual rainfall. These data were analysed using spreadsheet trend analysis.

Primary data were collected between 2020 and 2022 in the study area using semi-structured questionnaires, administered as; key informant interviews targeting policy makers, County government staff, private sector actors and other stakeholders; and focus group discussions conducted with land users (farmers, pastoralists, water user associations, conservancies, self-help groups). The questionnaire surveys were conducted in areas that lie within the UENB in Laikipia, Isiolo and Meru counties. In addition, water resources users associations (WRUAs) were interviewed such as Nturukuma, Ngusishi, Nanyuki, Naomoru, Likii and Isiolo WRUAs. Field visits were made to gain insights into the impacts of drought on water resources, crops, livestock, wildlife, environment and livelihoods.

A total of 187 respondents were interviewed of which 37 were reached through key informant interviews and 150 through focus group discussions (**Table 1**). The selection of respondents was stratified to ensure that the major livelihood groups were represented. In Isiolo, respondents were mostly pastoralists and agro-pastoralists, while in Laikipia and Meru, they were small-scale farmers, practising both rainfed and irrigated mixed agriculture. Large scale farmers, conservancies, self-help and water user groups were also interviewed in all the counties.

Field visits to farms and other activities were also made to validate the farming, water management and livelihood activities, including the crops grown, livestock and irrigation on farms. This also included face-to-face interviews conducted with farmer groups, water user associations and individual farmers.

Table 1. Respondents interviewed by county.

County	Policy makers & Leaders	Community members	Total Respondents
Isiolo	10	55	65
Laikipia	19	50	69
Meru	8	45	53
Total	37	150	187

The respondents were stratified to ensure that the major livelihood groups were targeted in each county. In Isiolo, respondents were mostly pastoralists and agro-pastoralists, while in Laikipia and Meru, they were small-scale farmers, practising both rainfed and irrigated mixed agriculture. Large scale farmers, self-help and water user groups were interviewed in all the counties. The data collected from communities was the main source of insights for impacts of drought on communities. Since mostly qualitative data was collected, it was analysed through categorical clustering using spreadsheet to derive mostly qualitative findings.

3. Overview of the Study Area: The Upper Ewaso Ng'iro Basin

The Upper Ewaso Ng'iro Basin (UENB) of Kenya covers the upstream catchments of the River Ewaso Ng'iro, the largest drainage basin in Kenya (GoK, 2013). The UENB lies between latitudes $0^{\circ}15'$ south and $1^{\circ}00'$ north, and longitudes $36^{\circ}30'$ east and $37^{\circ}45'$ east (Figure 1). It covers an area of 15,200 km² varying in altitude from 5200 m a.s.l. at the top of Mt. Kenya to 862 m at Archers Post, the lowest control point. The biggest town is Nanyuki, situated within Laikipia, some 200 km north of Nairobi. The river Ewaso Ng'iro originates from the Aberdares Range but most of its flows (50%) come from tributaries which drain from Mt. Kenya (ENNDA, 2018). At higher altitudes on both Mount Kenya and the Aberdares, the topography comprises rolling slopes with deeply incised valleys, but most of the basin is occupied by the extensive gently undulating to flatter Laikipia Plateau, at an elevation averaging 1500 m. The basin straddles six administrative Counties, namely; Nyeri, Nyandarua, Laikipia, Meru, Isiolo and

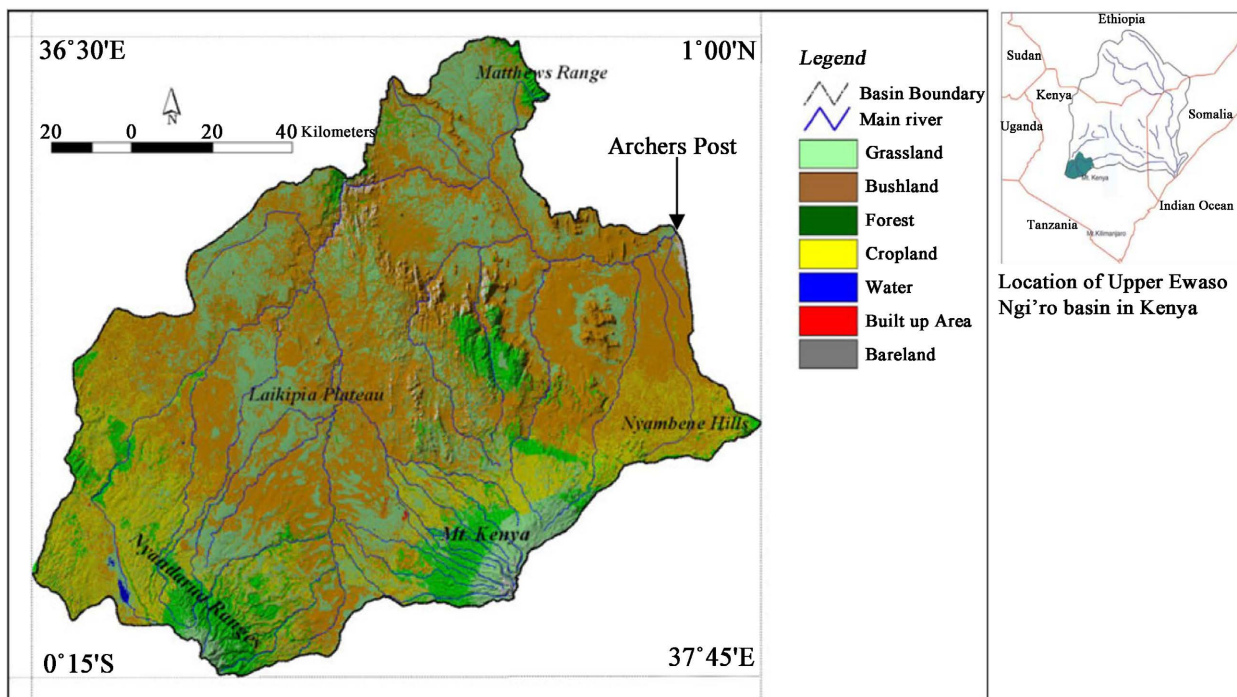


Figure 1. Extent and location of Upper Ewaso Ng'iro Basin showing land use/land cover (Source: Mutiga et al., 2010).

Samburu, all hosting multi-ethnic populations. Laikipia County occupies the largest proportion at about 50 percent of the area, followed by Isiolo and Meru. Land use varies with altitude and climate that gets drier with distance from the highlands, cascading from mountain forests to agricultural lands, then rangelands hosting both livestock and wildlife.

Due to its location on the lee slopes of Mt. Kenya, Aberdares Range and the Nyambene Hills, the UENB is basically a dry zone. Annual rainfall averages 700 mm but varies from a high of 1,500 mm on the upper mountain slopes to about 250 mm in the arid lowlands around Archers Post (Kimaiyo et al., 2023). Depending on location within the basin, seasonal rainfall pattern can be bimodal or unimodal. Most of the basin has a bimodal rainfall distribution, receiving long rains in March-April-May (MAM) and short rains in October-November-December (OND). In the drier areas in the north, rainfall is episodic and interspersed by lengthy dry spells. The mean annual temperatures in the basin range from below 10°C at the top of Mt. Kenya to over 24°C in the Laikipia Plateau and up to 30°C at Archers Post. Potential evapotranspiration ranges from less than 1000 mm at higher altitudes to over 2500 mm at the lower altitudes (Mutiga et al., 2010). Generally, low seasonal rainfall and high evaporation rates renders rainfed crop production unsuitable for most parts of the basin.

The main land use types in the UENB include; small-scale agriculture, both rainfed and irrigated, semi-nomadic pastoralism, large scale commercial estates, large scale commercial ranching, highly advanced commercial export horticulture, dairying, conservancies holding both wildlife and livestock, eco-tourism and forestry (Kiteme et al., 2008). The upper slopes of Mt. Kenya, Aberdares and the Nyambene hills are covered with forests, being protected zones as nature reserves. The vast Laikipia plateau is covered with grasslands and bushlands mainly for livestock grazing and commercial ranches. Cultivated lands, both small and large scale commercial farms, are mostly found at the footslopes of both mountains. In small-scale farms, rainfed crops are mainly for food, such as maize and beans, while irrigated crops are grown for sale, mostly potatoes, onions, cabbage, carrots and generally, exotic vegetables (Republic of Kenya, 2019). Livestock production is the most dominant land use, spread across 82% of the basin, providing livelihoods for pastoralists and commercial ranchers. The main livestock types are cattle, goats, sheep and poultry (Kimiti et al., 2017). The UENB hosts substantive wildlife to the extent that it is the second greatest wildlife abundance in Kenya after the Masai Mara National Reserve. But wildlife populations have also suffered from years of poaching and encroachment by human settlements (Frank et al., 2005). In recent years, community conservancies to protect wildlife across unfenced, communally-owned lands have been set up to benefit both wildlife and people through livestock management integrated to conservation (NRT, 2013).

The total population in the UENB is estimated at 1,179,436 spread across 326,199 households (KNBS, 2019). The basin hosts a rich heritage in multi-ethnic,

diverse peoples, cultures, traditions and indigenous knowledge. In particular, there are large proportions of bantu peoples i.e. the Meru and Kikuyu, as well as indigenous peoples (AUC, 2006) who include the Maasai and Ogiek in Laikipia, the Borana, Turkana and Somali in Isiolo and the Samburu in Samburu County. There are also smaller numbers of Caucasian settlers, Indian, urban and other ethnic groups from all over Kenya, residing and working in the UENB. In some parts of the basin, people coexist with wildlife and livestock, that share the natural resource base.

4. Drought Occurrence

This study made use of long-term data obtained from Segera Farm and Archers post from 1981 to 2020. Segera farm has higher rainfall as it is situated in the sub-humid Laikipia Plateau, while that for Archers post has low rainfall, being situated in the dry north of the basin. It was found that annual rainfall at both Segera farm and Archers post depicted high frequency of drought (Figure 2 and Figure 3). The 40-year rainfall records for both stations show that there were 23 years when annual rainfall was below long-term average compared to 17 years of above average rains, depicting a 58% drought prevalence. The plot of deviation from mean annual rainfall for both Segera and Archers post (Figure 4) indicated a declining trend showing rainfall had reduced.

These results are in line with findings of other studies, which indicated that drought incidences have been increasing in both frequency and magnitude (Viela & Bruner, 2017). The average duration of drought-months increased from a low of 1.4 months in the 1960s to a high of 4.8 months in the 2000s. In essence, droughts occur every 2-3 years, bearing impacts on agriculture, livestock, wildlife, water availability and livelihoods. In addition, other studies in the basin (Huho et al., 2010; Thenya et al., 2011) showed that droughts occurred in 1976,

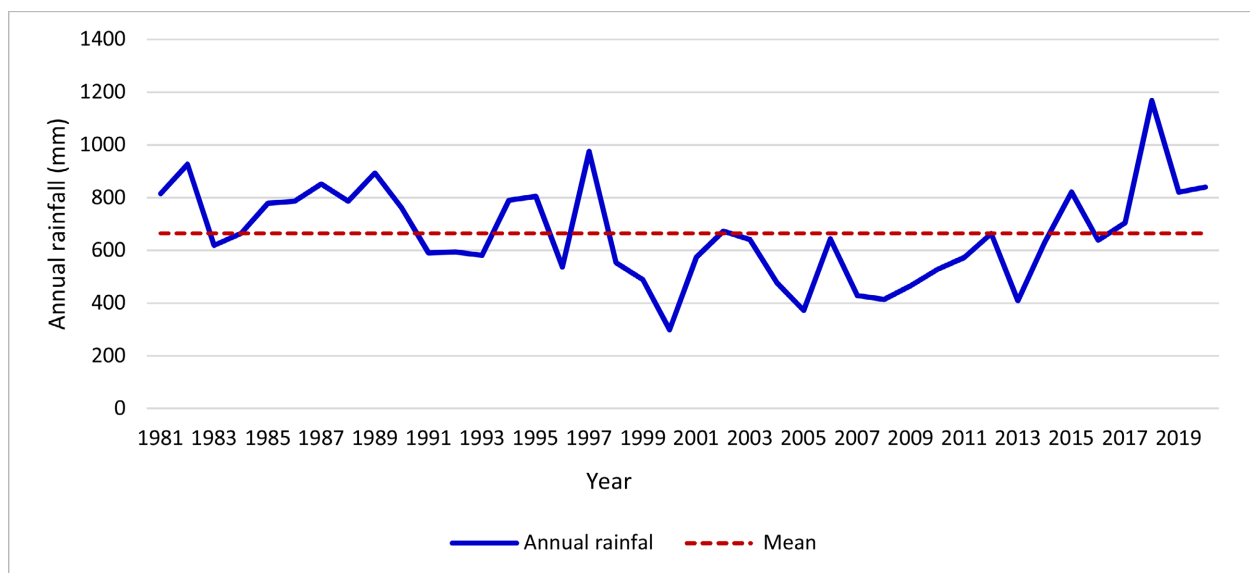


Figure 2. Annual rainfall trends at Segera farm.

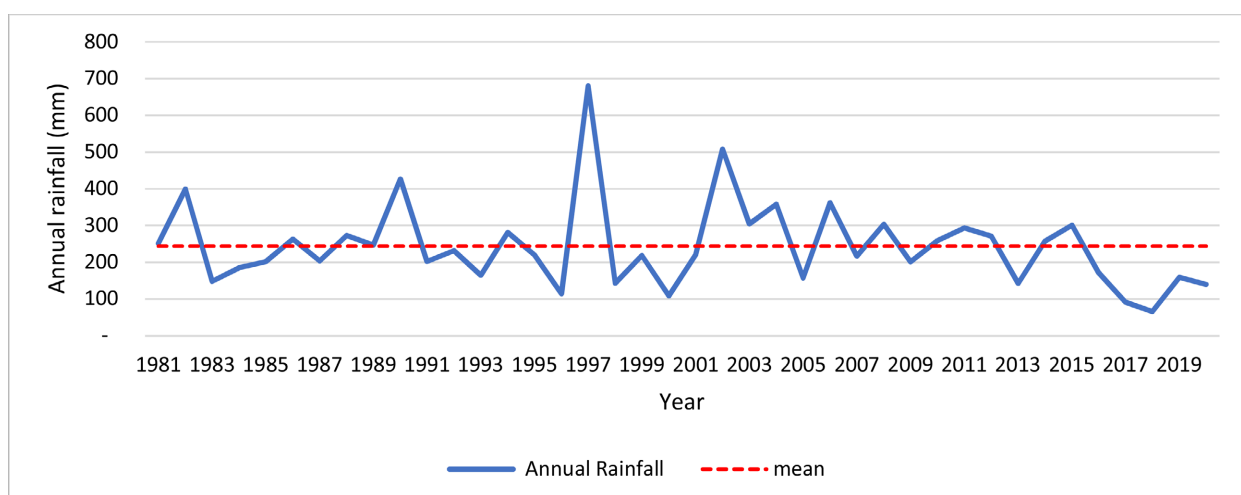


Figure 3. Annual rainfall trends at archers post.

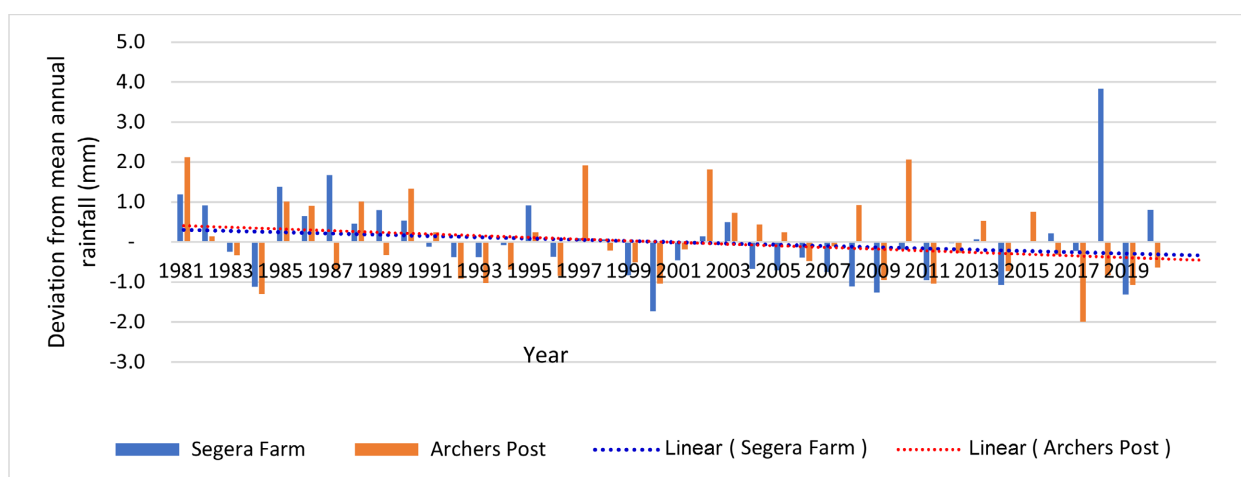


Figure 4. Deviation from mean for annual rainfall at segera farm and archers post.

1980, 1982, 1983, 1984, 1985, 1987, 1991, 1992, 1993, 1994, 1995, 1996, 1999, 2000, 2002, 2005, 2006, 2008 and 2009 in the UENB. Also, over the last decade, droughts were also recorded in 2011, 2014, 2017, 2019 and 2021-2023 (Muchiri et al., 2020). The most recent drought running for five crop seasons from 2021 to 2023 has been the most severe in 40 years (OCHA, 2023). These trends indicate climate variability with declining rainfall and thus aridification of the basin. Other indicators of escalating drought include drying out of rivers which used to be perennial. The Ewaso Ng'iro River suffers frequent hydrological droughts, even completely drying out (Muchiri et al., 2020). During this study, the Ewaso Ng'iro River had dried out during the 2021-2023 prolonged drought.

5. Community Characterization by Main Economic Activity

Focusing at community levels, the 150 grassroots respondents interviewed were characterized by consideration of land use and economic activities as shown in **Table 2**. The majority of communities (67%) practice small-scale farming as

Table 2. Characteristics of land users by main economic activities.

Cluster type	Isiolo	Laikipia	Meru	Total	% of total
Small-scale farmers, rainfed	15	7	23	44	30
Agro-pastoralists, rainfed	14	7	4	24	16
Small scale farmers, irrigated	2	21	8	31	21
Large-scale commercial farmers	-	3	-	3	2
Pastoralists (livestock keeping)	15	6	5	25	17
Water user groups/leaders	3	3	2	8	5
Conservancy/ecotourism/forest, leaders	5	2	3	10	6
Community mobilizers (leaders)	2	1	1	4	3
Total	55	50	45	150	100

either rainfed (30%), agro-pastoralists (16%) or irrigated (21%). Although nearly all farmers in the UENB keep some livestock, there are difference between small-scale farmers in rainfed systems who focus mostly on crops, and keep stall fed animals. These are settled mostly in the humid and sub-humid zones. Agro-pastoralist is small-scale farmers who grow crops, but they keep livestock that are extensively grazed. These are found in the marginal rainfall areas, where livestock are considered more precious. Pastoralists, comprising 17% of the respondents, are predominantly livestock keepers inhabiting the driest zones of the UENB. They are normally the most affected when drought strikes and water conflicts. Water user groups are very active in the UENB and some of them do river monitoring and keeping of hydrological data. They hold valuable knowledge on water availability and scarcity issues. Community leaders are also important as they are sometimes engaged in drought early warning and preparedness, and provide the link to policy makers. All these groups interact across the basin regardless of county boundaries, connected by the common need for water, pastures, food and the socio-economic activities that link them.

6. Constraints Faced by Communities Normally

Rural communities in the UENB face several challenges with or without drought. The constraints described by respondents included; crop failure and/or poor yields especially from rainfed agriculture and consequently shortage of food. Also, shortage of pastures/fodder causing livestock attrition, water scarcity affecting households, livestock, and crops including in irrigated systems. Water scarcity is another problem faced especially by women and girls, not only in the study area but in most drylands of Kenya (UNDRR, 2021). In the rangelands and conservancies, wildlife suffers as a result of shortages human encroachment on their habitats. In the drier zones people are always in need of relief food. Respondents stated that the over-arching constraint faced by small-scale farmers (Figure 5) is poverty and lack of money to meet livelihood needs.

These constraints are more pertinent among resource poor small-scale farmers reliant on rainfed agriculture and pastoralists who inhabit the lower and driest zones of the basin. These communities lack alternative water sources for crops, pasture and livestock watering. Due to pressure from increasing population and high immigration rates, small-scale agriculture has been expanding into the drier zones previously occupied by pastoralists, with consequent challenges of poor crop productivity. The expansion of commercial horticultural farms on the upper slopes of Mt. Kenya is associated with excessive water abstractions resulting in drying up of rivers and streams (Lanari et al., 2016). Pastoralists occupy the driest downstream parts of the basin, where shortage of pasture and water scarcity occur, especially during the dry season (Notter et al., 2007; Mati et al., 2005). Due to land use changes and expansion of cultivation, livestock herd sizes have been reducing especially among the pastoralists (Mwangi et al., 2020), while natural grasslands have become denuded. As a result, the UENB faces numerous conflicts. These conflicts take the form of upstream-downstream water users, pastoralists-ranchers over grazing resources and trespass issues, pastoralists-cultivators, human-wildlife encroachment and general conflicts over water (Kiteme et al., 2008). Generally, all these constraints are exacerbated by drought, adversely affecting community livelihoods.

7. Drought Impacts on Community Livelihoods

Drought impacts people, livestock, wildlife and ecosystems in various ways in the UENB. The types of impacts and how people were affected locally by drought as described by respondents slightly differs in Isiolo, Laikipia and Meru Counties. Overall, communities in all three counties agreed that shortage of water, food and fodder as well as poor incomes from farming, were the major impacts of drought experienced (Figure 6). Other problems include a spike in livestock rustling/theft, loss of livestock from diseases and lack of food. From the foregoing,

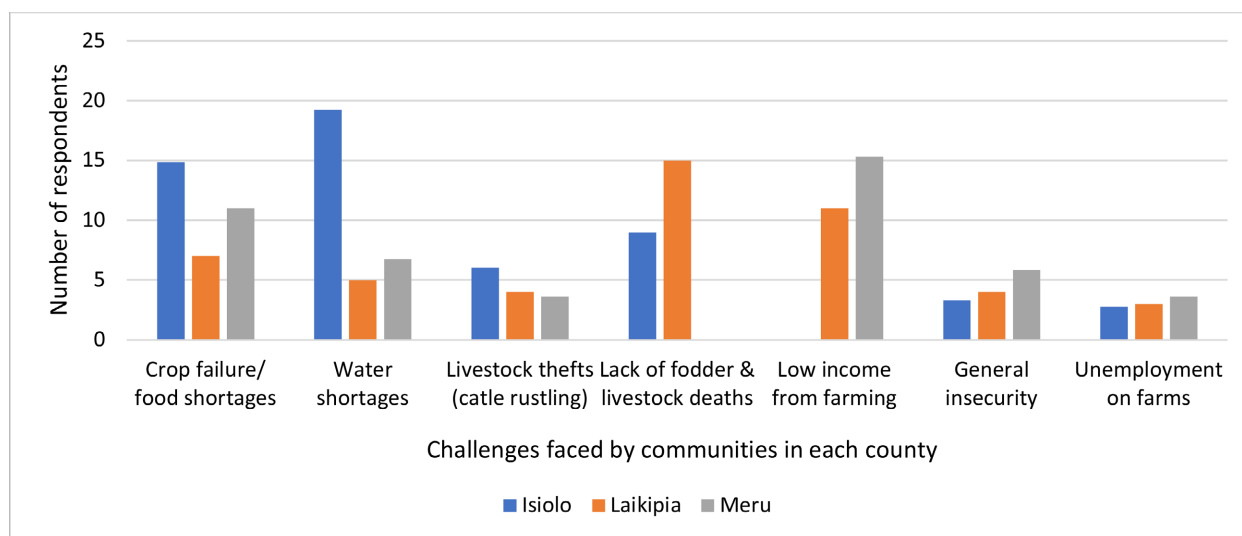


Figure 5. Major constraints faced by communities in UENB.

it is apparent that negative impacts of drought are felt by all land user categories, albeit differently. For instance, water shortage lack of food and conflicts over pasture loom large in Isiolo, where respondents were pastoralists and agro-pastoralist. In Meru, which is mostly agrarian, the main challenge during drought is water, food and fodder shortage and water scarcity. Laikipia has all types of land users hence the problems there are the same as both Isiolo and Meru. Another observation was that conflicts also erupt across various fronts including invasion of ranches and smallholder farms by livestock driven by pastoralists from neighbouring drier zones. The human-wildlife conflicts escalate during droughts, pitting pastoralists against both crop farmers and ranchers.

The compounding effects of drought, as expressed by land users is that it disrupts the productive assets, resources and sources of income associated with rural livelihoods. In particular, drought affects small-scale rainfed crop farming and livestock enterprises, which are the main income streams for local people. Pastoralists, especially those in Isiolo and northern Laikipia, inhabit the driest parts of the basin and thus are the most vulnerable. Drought damages the social safety nets of land users, thus escalating poverty. For pastoralists, it demeans their social standing as they become environmental refugees, moving to other areas or urban centres in search of menial jobs. Droughts also brings along increases in the cost of food and communities have to rely on relief food, mostly from the Government and relief agencies, thereby incurring extra cost in the national budget (Wanjohi, 2010). These findings agree with other studies as for instance, Quandt and Kimathi (2017) observed that drought is a major livelihood stressor affecting communities who rely on rain-fed agriculture or pastoralism for their livelihoods. The fact that droughts lead to conflicts in the UENB has been noted in other studies. Mwangi et al. (2020) observed that in semi-arid zones, intra and inter communal conflicts occur during drought periods and pastoralists compete for scarce resources mainly grass and water for their

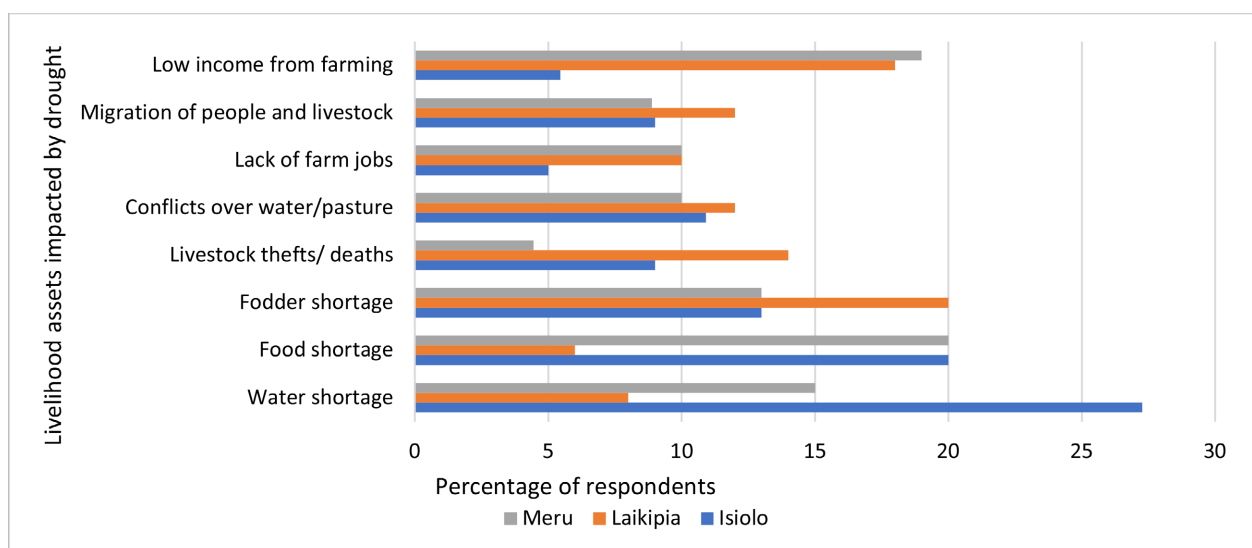


Figure 6. Impacts of drought on community livelihoods at local levels.

animals. This happens in areas shared by farmers and pastoralist, particularly when livestock encroach on farmlands. Human wildlife conflict incidences also tend to increase during the dry season in most semi-arid areas where wild animals especially elephants enter farms in search of water and pasture (Kamau, 2017).

The issue of water scarcity exacerbated by drought periods, has been linked to increased water abstraction in the upper and middle catchments of Ewaso Ng'iro river and its tributaries, especially those flowing from Mt. Kenya. Irrigated agriculture is the biggest water user in the upper slopes of Mt. Kenya, consuming as much as 60 to 80 % of available river flows, a substantial part of which is unauthorized (ADF, 2005). The dry season water flows of the Ewaso Ng'iro River and its tributaries dwindle to the extent that during drought periods, the river sometimes dries up for more than half of its 650 km length, resulting in water scarcity and devastating economic, social and environmental losses. Surface and ground-water sources such as river intakes, shallow wells and seasonal rivers are the most affected. Nomadic pastoralists and their livestock, as well as wildlife in the lowlands, are particularly affected. They endure long distances for people and animals to reach water points (Mati et al., 2005). They also move to upstream areas in the search of water and pasture. Moreover, large commercial farmers also face water scarcity, and have to reduce production. Small-scale irrigators have to adopt water rationing, and sometimes, completely lack water for irrigation, impacting on crop productivity. Ranches and conservancies face water shortages and lack of grazing resources for wildlife which sometimes die. The Government also faces challenges as it has to allocate resources for drought relief and this sometimes curtails other development projects. As a result, conflicts with crop farmers and ranchers escalate during drought, while increased competition for scarce grazing and water resources often leads to inter-community conflicts, insecurity, overgrazing, thus compounding an already precarious situation. There is also the increased destruction of natural ecosystems during droughts (Mutiga et al., 2011).

At the household level, fetching water and fuel wood is the responsibility of women and girls. During drought they, are forced to travel long distances in search of water for domestic use, especially in the drier zones (Mati et al., 2005). This increases the labour burden of women and girls, as well as exposing them to the risks of gender based violence and abuse (Koech et al., 2019). Moreover, women's subordinate position in society means that their access to information, training and participation in decision-making is less. This is associated with customary practices such as early marriage and lack of a voice in decisions on land ownership and access to productive resources. This escalates their vulnerability to drought, being also burdened with household chores. Despite numerous challenges, women are effective at collective action at the local level, organizing themselves in women groups and contributing in a big way to rural development (Coppock et al., 2013). In addition, drought reduces employment

opportunities especially for youth who work on farms (Notter et al., 2007), thus impacting on sources of incomes and escalating poverty. Generally, droughts increase the suffering of people, livestock, wildlife and destruction of ecosystems and results in economic losses which have not been holistically quantified, implying a research gap that requires attention.

8. Impacts on Natural Ecosystems

The policy makers and communities interviewed observed that natural ecologies in the UENB are adversely affected by drought, with water points drying up and vegetation depletion. This affects wildlife, sometimes more precariously than livestock. As a result, wildlife moves out of their natural habitats in search of water and pasture, posing human-wildlife conflicts (Western, 2010). These movements expose wildlife to poachers and hunters thereby endangering them. As a result, wildlife populations drastically reduce during drought. The basin has a large number of species threatened with extinction, such as the northern white rhino, elephant, lion, leopard, Somali ostrich, bongo, the Grevy's zebra, beisa oryx, Grant's gazelle and gerenuk (Frank et al., 2005). Tourism, which is largely driven by wildlife viewing also gets derailed by drought. Drought causes river flows to reduce to a trickle or even dry out in places. Wildlife is forced to move upstream and the number of tourists visiting game reserves in the lower parts of the basin declines. In essence, drought affects the entire tourism sector and income streams, including loss of jobs.

9. Conclusion and Recommendations

This study utilized data from published sources and questionnaire surveys at community levels to determine the impacts of drought on community livelihoods in the Upper Ewaso Ng'iro Basin of Kenya. The community members comprised stakeholders drawn from among; small-scale farmers in rainfed and irrigated systems, agro-pastoralists, large-scale commercial farmers, pastoralists who keep open grazed livestock, water user groups, conservancies and forest action groups, as well as community mobilizers.

Communities across all land use categories had experienced negative impacts of drought. The major impacts affected shortages of water, food and fodder as well as poor incomes from farming. Other problems include spikes in livestock rustling/theft and loss of livestock from diseases and lack of pasture. Conflicts over water and pasture also increase during droughts and crime increases due to lack of employment opportunities.

Further studies are recommended to capture the full economic cost of drought impacts at household levels which should be cascaded for macro-scale planning. Water scarcity featured prominently as a major problem during droughts. Thus, further studies are needed to advice on how to facilitate sustainable water supplies during drought in the UENB. Since drought events are natural phenomena, expected to happen any time, there is need for studies that identify how to im-

prove local capacities in drought preparedness and resilience.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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