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Assessing the Level of Community Resilience to Drought in Kitui County, Kenya

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ABSTRACT

In Kenya, arid and semi-arid lands are more affected by drought due to their fragile ecosystems and unfavorable climate. The main objective of this study was to determine the level of community resilience to drought in Kitui County, based on the conceptual framework of community resilience building to drought. The results indicate that social (F (860.969) =397, p = 0.000 < 0.05) and economic factors (F (5316.236) = 397, p = 0.000 < 0.05) significantly influenced community resilience to drought; however, environmental factors did not have much effect. The study recommends the need to adopt appropriate strategic policy options for enhancing community resilience to drought through capacity building on successful humanitarian aid interventions. The research findings will be beneficial to policy makers and stakeholders generally to improve strategies for enhancing community resilience to drought against the effects of climate change.

KEYWORDS

Adaptive Capacity, Climate Change, Collective Action, Disaster Risk Reduction (DRR), Food Insecurity, Households, Livelihoods, Vulnerability

1. BACKGROUND

The concept of community resilience has gained prominence in the past years in disaster risk reduction (DRR), climate change, and development policy discourse and has been widely used by disaster response professionals, policy makers, and academics (Twigg, 2015). The current resilience discourse tends to focus more on the utility of the concept, either in disaster risk management (DRM) (Twigg, 2015) or in climate change and variability (IPCC, 2022). In this study the term “community resilience” is used to mean the ability of a community to recover from a shock, as well as the degree of community preparedness to shocks.

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Patel et al., (2017) identified nine core elements of community resilience that include: local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook. Consequently, it may be more productive to focus on these individual elements than making attempts to define and study community resilience as a distinct concept. Additionally, the Communities Advancing Resilient Toolkit (CART) describes a resilient community as one that has the ability to transform the environment through deliberate, collective action and is able to cope effectively with and learn from adversity (Pfellerbaum et al., 2011). According to Frankenberger et al., (2013) resilience is the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.

As a systems-level characteristic, resilience has been described as an emergent property of complex adaptive systems (Aldune et al., 2015) and refers to the capacity of a system to sustain core functions in the face of disruption and change (van der Merwe et al., 2018). From the normative perspective, resilience is not merely the ability to sustain core functions, but the ability to sustain specific outcomes, such as continued production of specific ecosystems or essential services (Folke et al., 2016). The ability to bounce back after interruptions may entail systematic transformation and involve not only bouncing back to the original state, but also bouncing forward to a more desired and stable position (van der Merwe et al., 2018). According to Béné et al., (2014) while the ability of resilience in fostering an integrated approach across sectors is recognized, it is not a pro-poor concept since it may not be applicable to people living in persistent poverty. Thus, the objective of poverty reduction cannot be simply replaced by resilience building. It has also been argued that the discourse of disaster resilience could stigmatize individuals and communities with low levels of resilience since community resilience is a reflection of people's shared and unique capacities to manage and adaptively respond to extraordinary demands on resources and the losses associated with disasters (Norris et al., 2008).

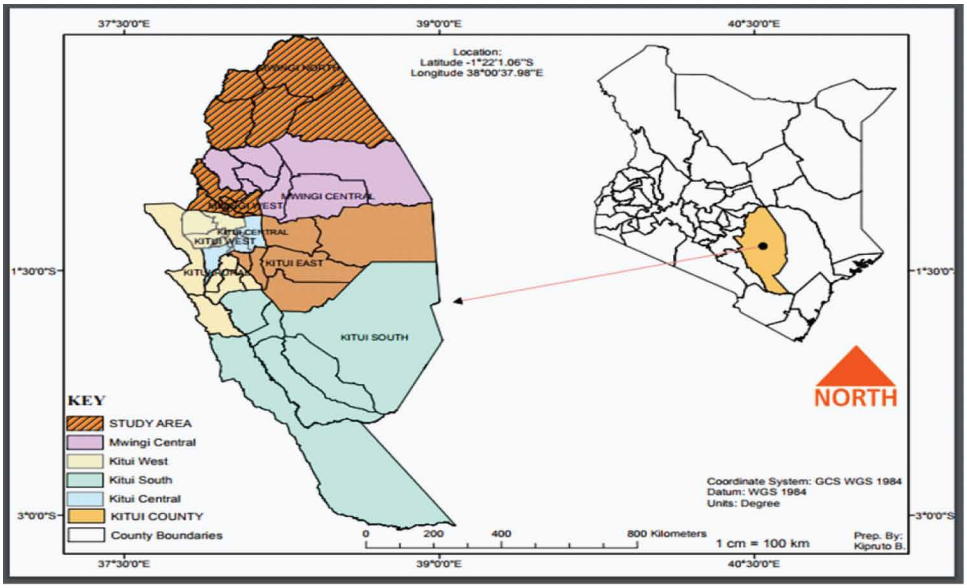
Although the conceptualization of resilience and adaptive capacity in the three dimensions of DRR, climate change and variability, and the socio-ecological perspectives has been quite informative, Nyamwenza (2012), sees a clear disconnect with the livelihood resilience and adaptive capacity perspective because the impact of DRR and climate change is perceived to be dependent on resilient and adaptive livelihoods. Murphy (2007) defines a community as a group of people in a shared geographical space with diverse characteristics and priorities, linked by social ties, interactions shaping local life, shared identity, collective action, and providing a means for accessing external resources. Nonetheless, this study assumes a definition of a community as a group of people in a shared geographical space with diverse characteristics and priorities, linked by social ties, interactions shaping local life, shared identity, collective action, and providing a means for accessing external resources. The main objective of this study was to determine the level of community resilience to drought in Kitui County.

2. METHODOLOGY

2.1 Study Area

The study areas consisted of Mwingi North and Mwingi West Sub-Counties in Kitui County. Kitui County is located between Latitude $1^0$22' and $1^0$06'' South and longitudes $38^0$00' and $39^0$00'' East (Figure 1). The county has an altitude that ranges between 400-1800 meters above sea level. Kitui County is classified as an arid and semi-arid land (ASAL) county (MoALFC, 2021). Due to its semi-arid climate, the county is among the most drought-vulnerable regions in Kenya. The average annual precipitation range is 400-1000 mm, with an annual average of 750 mm. Precipitation during the long rainy season, from March to May, is erratic and unreliable. While in the short rainy season, October to December, it is more reliable in terms of its amount and distribution. Most farmers in

Figure 1. Map showing location of the Study Area Kitui County, Kenya (Source: Author, 2022)



Kitui County depend on the short rainy season for agricultural productivity which contributes 60% of the county's crop production, compared to 40% during the long rainy season. The western part of the county is nearly 10°C cooler than the eastern part.

2.2 Research Design

This study used descriptive and correlation research designs. Descriptive research included surveys and fact finding inquiries of different kinds (Kothari & Garg, 2014). Descriptive research studies are suitable for describing the characterisctics of a particular individual or a group of individuals in the study area (Okoth, 2012). This research design was applied to answer the research question: What is the level of community resilience to drought in Kitui County? However, the descriptive research design does not conclusively answer questions on why things are the way they are. Correlation research design was used to investigate the relationship between the social, economic, and environmental factors and community resilience in Kitui County.

2.3 Sampling Methods

This study adopted mixed sampling methods. Kitui County has a total of 8 Sub-Counties. The 8 Sub-Counties have similar attributes due to categorization as ASALs. Mwingi North and Mwingi West Sub-Counties were categorized as homogeneous units and were purposively selected, as they were the most typical of the population with regard to the characteristics under investigation. In the two Sub-Counties, 4 Wards of Ngomeni and Kyuso, from Mwingi North Sub-County, and Nguutani and Thaana Nzau, from Mwingi West Sub-County, were selected using simple random sampling techniques. The first level was a simple random sampling technique which was used to select at least 10% (Mugenda & Mugenda, 2003) of the two Villages from each Ward in each Sub-County as shown in Table 1. The appropriate sample size for this study was calculated from an estimated household population in each of the four study Wards informed by a population data obtained from the 2019 household survey (KNBS, 2019). Proportionate sampling as shown in Table 1 was used to distribute the samples in the Wards and Villages based on their population variations in the sample frame. Further, a simple random sampling technique was used to select the actual sample households that

formed the units of analysis, while the household heads formed the unit of observation during the data collection process undertaken by trained Research Assistants. In determining the distribution of the study sample size of 385, the formula by Fischer et al., (1983) was used:

$$n = \frac{pq\ z^2}{e^2}$$

where: n = the desired sample size if the target population is greater than 10,000; z = the standard normal variate at a required confidence level; p = the proportion in the study population estimate to have the characteristics being measured q = 1- p and e = the level of significance set. If there is no estimate available of the proportion in the study population to have the characteristics of interest, then p = 50% should be used as recommended by Fischer et al., (1983) quoted in Mugenda & Mugenda (2003).

$$n = \frac{0.5 \times 0.5 \times 1.96^2}{0.05^2} \approx 385$$

Further, a cluster sample of 385 household heads was randomly obtained from the two selected Sub-Counties as shown in Table 1.

The study also benefited from the purposively sampled key informants (KIIs), representatives of the national and county governments, and international non-governmental organizations (I/NGOs) including: six representatives from I/NGOs, community based organizations (CBOs), and faith based organizations

Table 1. Showing sample distribution of household respondents

Sub-County	Ward	Population per KNBS	Estimated HH Population	Proportionate Sample Size $nh = \left(Nh/N\right)n$
Mwingi North	Ngomeni	18447	4290	65
	Kyuso	40375	9390	143
Mwingi West	Nguutani	27265	6341	97
	Thaana Nzau	22443	5219	80
Total		**108530**	**25240**	**385**

Proportionate sampling: Where, nh = sample size of stratum; Nh = Population size of the stratum; N = Total population size; n = Total sample size

NB: Ward Population as KNBS 2019 and household population estimated using average household size of 4.3% for Kitui County as per the Kenya National Census 2019.

Source: Author, 2022

(FBOs), two from National Drought Management Authority (NDMA) and eight from the County Ministries of Agriculture, Water and Livestock. Further, four focus groups comprised of ten to twelve members were selected through quota sampling technique and were interviewed using Focus Group Discussion Guides (FGDs) as shown in Table 2. In each Ward, two focus groups, one representing youth and another representing women and men were selected using the quota sampling technique and interviewed.

2.4 Data Collection and Analysis

Primary data was collected by trained research assistants using structured questionnaires, focus group discussion guides, key informant interview guides, and observation checklists, while secondary data was obtained from desk studies. The study utilized data collected from 385 households from Ngomeni, Kyuso, Nguutani and Thaana Nzau Wards in Mwingi North and Mwingi West Sub-counties respectively. SPSS software Version 28, STATA Version 15 and Excel were used to analyze quantitative data.

3. RESULTS AND DISCUSSION

3.1 The Level of Community Resilience to Drought

This study sought to determine the level of community resilience to drought in Kitui County. Community resilience indicators were drawn from recent community resilience conceptual frameworks (Frankenberger et al., 2013; UNDP, 2013; and Kwasinski et al., 2016).

3.1.1 Economic Security

3.1.1.1 Types of Crops Grown

The study assessed the level of economic security in Kitui County by assessing the types of crops grown. The cultivation of crops plays a pivotal role in generating crucial data for economic security.

Table 2. Sampling methods and sample size for the study population

Study Population Units	Sampling Method	Sample Size	Data Collection Instruments
Sub-Counties	Purposive	2	Observation
Household heads	Simple random sampling	385	Structured Questionnaires
NGOs, FBOs & CBOs	Purposive/convenient sampling	6	KII Guides
NDMA staff	Purposive sampling/ Convenient	2	KII Guides
8 County Ministries of Agriculture, water, and Livestock; Education, ICT and Youth Development; Environment and Natural Resources; Health and Sanitation; Lands, Infrastructure, and Housing and Urban Development; Tourism, Sports and Culture: Trade, Cooperatives and Investment & Office of the Governor.	Purposive sampling/ convenient	8	KII Guides
Focus Group Discussions (FGDs) For Self Help Groups and Youth Group	Quota	4 FGDs	FGD Guides
Observation Units	Purposive	2 Sub-Counties	Observation Checklists

Source: Author, 2022

This data is instrumental in determining the resilience of different crop varieties to drought conditions, offering valuable insights into their adaptability and sustainability.

Data was obtained using questionnaires which were administered by trained research assistants. Household respondents were asked if they grow the following types of crops: maize, beans, millet, sorghum, green grams, cassava, pigeon peas, cow peas, pumpkins, and fruits. Each question on crop type was independent of the other with choices of "Yes" or "No." The responses are summarized in Figure 2, indicating majority of the household respondents grew a variety of crop types and majority 93.5% (360) grew green grams, 72.7% (280) grew maize and 71.7% (276) grew cow peas among other various crops types.

The uptake of growing of green grams was high in the study area due to the Kitui County government's initiative of *Ndengu* Revolution titled "*Inua Mkulima*" food security project that was taking place during the study period. This project, launched on October 9th 2017, involved the Kenyan Red Cross Society in partnership with the County Government and targeted 200,000 small holder farmers. The launch sought to improve food security and livelihoods and enhance community resilience through reducing perennial food shortages experienced in the country due to drought through seed distribution during the short rainy season of October through December 2017 (The Red Cross, 2017). Each target household was supported with a 2Kg pack of high yielding green gram seeds comprised of KS20 and N26 seed types. Through observation, it was confirmed that green grams *(ndengu)* were extensively grown in the study areas as shown in Figure 3.

Moreover, the above findings were also confirmed through the key KIIs. During the KIIs interviews, the respondents were asked what types of crops are grown in Kitui County. One of the male respondents stated, "People in Kitui County grow crops such as green grams, maize, cow peas, sorghum, millet, white beans, black beans, *Katumani* millet, pigeon peas and early maturing sorghum. These types of crops are doing well in the county."

These findings indicate that the farming systems in Kitui County are slowly adapting to the changing climate by growing drought tolerant crops as confirmed by previous findings by Mutunga et al., (2020). A study by Mwangi et al., (2020) identified a differentiated vulnerability pattern with

Figure 2. Showing types of crops grown by household respondents (Source: Field Data, 2022)

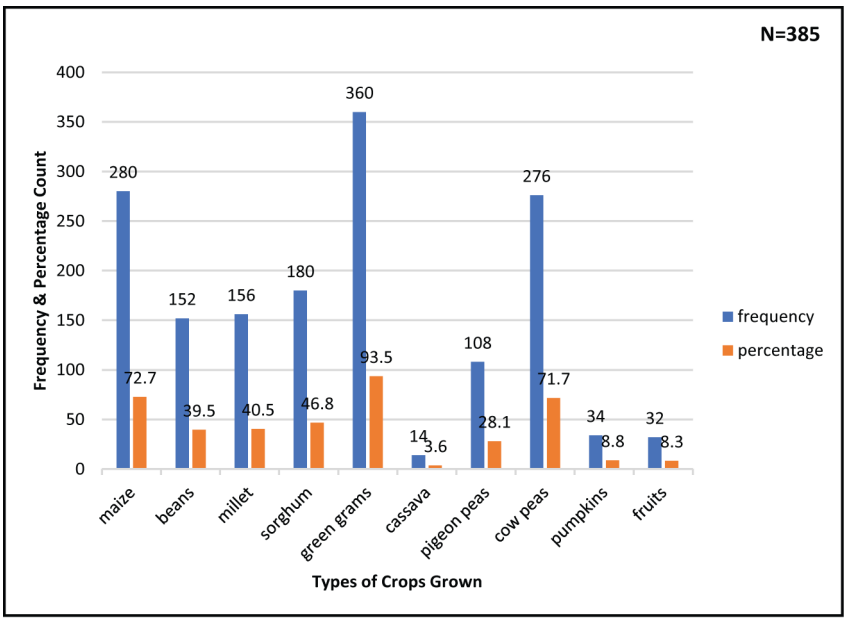
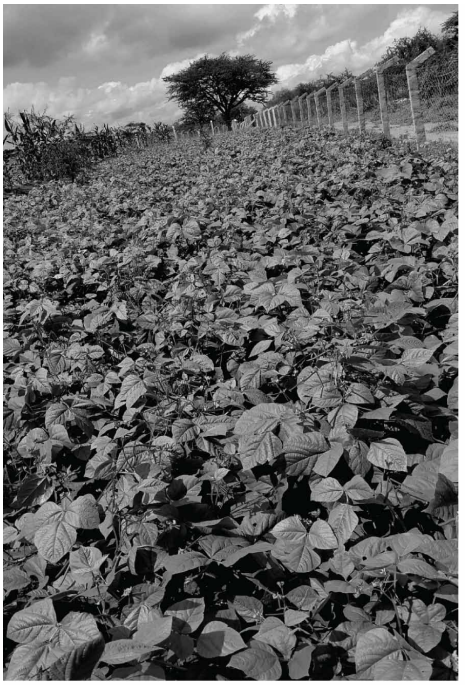


Figure 3. Green grams (Source: Field Data, 2022)



a west to east gradient across Kitui County. The pattern exhibited less vulnerability scores on the western and central parts and more vulnerability scores on the eastern and northern parts of the county where farming systems are highly exposed to climate stress, due to their high vulnerability and low adaptive capacities compared to the western parts of the county, where vulnerability is comparatively low. Vulnerability was high in Tseikuru, Kyuso, Mwingi, Ngomeni, Nguni and Nuu, the Yatta plateau, Mutito and Mwitika, Mutomo, and Ikutha areas where aridity and a more erratic rainfall pattern is experienced and border conflicts were high, increasing their sensitivity to climate risks and low adaptive capacity to cope with drought risks.

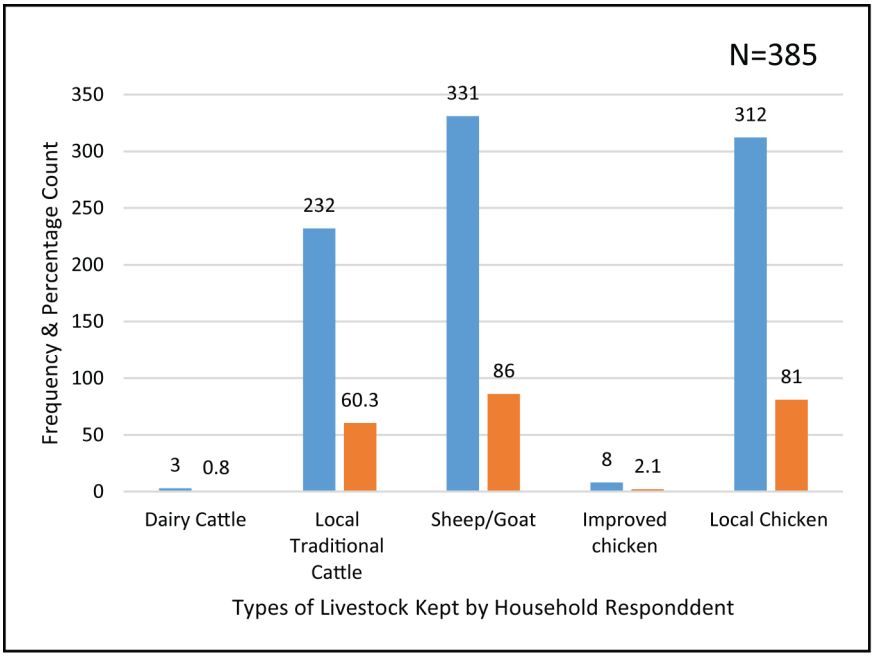
3.1.1.2 Types of Livestock Kept

Data was collected using household questionnaires administered by trained research assistants. Household respondents were asked if they kept the following types of livestock: dairy cattle, local traditional cattle, sheep/goats, improved chicken, and local chicken. Each question on type of livestock kept was independent of the other with choices of "Yes" or "No." The responses are summarized in Figure 4 which indicates majority of the household respondents kept more than one type of livestock and majority 86% (331) kept sheep/goat, 81% (312) local breed chickens and 60.3% (232) local cattle while only 2.1% (8) kept improved chickens and 0.8% (3) dairy cattle.

The above findings were triangulated through FGDs. During the FGDs, participants were asked what type of livestock they keep. One of the male respondents answered: "The main livestock kept are goats, sheep, cattle, donkeys, and local or traditional chicken. We prefer keeping local livestock that are tolerant to drought conditions experienced in this area."

Previous studies indicate the types of livestock breeds kept in the county are indigenous and are resilient to ASAL conditions. According to MoALFC (2021), the Zebu breed accounts for 97% of cattle, while Boran and Sahiwal account for 3%, while indigenous chicken is reared by over 90% of the households in the county. Indigenous livestock species are more tolerant to

Figure 4. Showing types of livestock kept by household respondents (Source: Field Data, 2022)



drought conditions due to their ability to adapt and survive (Chanamuto & Hall, 2015). However, livestock keeping in Kitui County remains a drought sensitive economic activity as recurrent drought results in successive depletion of pasture and water resources, causing livestock losses (Nyandiko et al., 2015).

3.1.1.3 Challenges in Crop and Livestock Farming Systems

Each household respondent was asked to state the challenges they face in livestock and crop farming. The majority of the household respondents stated they face more than one challenge and the majority indicated the challenge of drought 93.8% (361) was the most severe, followed by pest infestation 87.3% (336), lack of forage 87% (335), water shortage 85.7% (330), crop and livestock losses 75.8% (292), poor prices of produce 61.3% (236), and inadequate agricultural services 31.4% (121) among others. During the FGDs, participants were asked what type of challenges they face in crop and livestock farming. One of the participants stated: "We face challenges related to water and pasture shortages during drought situations, poor agricultural extension services, infestation by weevils, lack of adequate land, and poor storage facilities."

Existing studies indicate that Kitui County has the potential of feeding its population and selling surplus products to other counties and beyond (MoALFC, 2021). However, recurring challenges in accessing inputs, climatic risks, inadequate infrastructure, low adoption of input use in crop production and livestock rearing, and high poverty levels impede the county's efforts in achieving self-sufficiency in food access (MoALFC, 2021). Use of poor farming techniques and equipment is a major stumbling block to achieving optimum farming outcomes. Although previous studies indicate that the farming systems in Kitui County are highly sensitive to drought conditions (Nyandiko et al., 2015), this study found that households in the county have started adapting to the changing climate through growing more drought resilient crops and keeping drought tolerant livestock, and thereby, enhancing their resilience to drought conditions.

3.2.1 Existing Irrigation Systems

The study sought to determine the number of households irrigating their crops and found that out of the 385 household respondents who were interviewed only 4% (17) said they irrigate their farms, while the rest 96% (368) stated that they did not irrigate their farms. For those who said they did not irrigate their crops, when asked why they did not irrigate their crops, majority 60% (221) said lack of sustainable sources of water was the main challenge followed by lack of irrigation services 36% (131) while 2% (8) perceived rain-fed agriculture was sufficient for their agricultural activities among other reasons as shown in Figure 5.

This information was triangulated using information gathered through FGDs. During one of the FGDs, participants were asked why they don't irrigate their farms. A male participant said, "During drought situations we experience severe shortage of water as wells dry up and we are left with inadequate water to irrigate our farms."

Despite Kitui County having a huge potential for developing irrigation infrastructure due to the suitable topography and presence of rivers, earth dams, sand dams and water pans well spread across the county, there are only five irrigation schemes in the county comprising of Yatta/Kwavonza, Tseikuru, Zombe/Mwitika, Kitui Rural and Kyangwithya West Wards, and 31 irrigation clusters which cover a total of 40.6 hectares (County Government of Kitui CIDP, 2018). Due to inadequate irrigation services, households in Kitui County are forced to rely heavily on rain-fed agriculture, a farming system which is highly sensitive to drought disaster (Nyandiko et al., 2015). A study by Makau et al., (2014) in Kitui County had found that limited irrigation services created a barrier to achieving optimum farming outcomes.

3.2.2 Food Availability and Community Resilience

The study sought to establish the status of food availability in the county. The household respondents were asked how long the food they had in store could last. The results were summarized in Figure 6, which shows the majority of the household respondents 63% (241) indicated that they had no food in store and only 4% (16) had enough food to last for one year.

Further, the study sought to understand the periods (seasons) when household respondents sell their crop produce. Majority of household respondents 53% (177) said they sell their produce immediately after harvest, and only 21% (70) stated they sell their produce when the markets are favorable. Selling crop produce immediately after harvest indicates households get minimal financial proceeds from the produce because prices of farm produce are low during the harvesting time and

Figure 5. Showing why irrigation is not practiced (Source: Field Data, 2022)

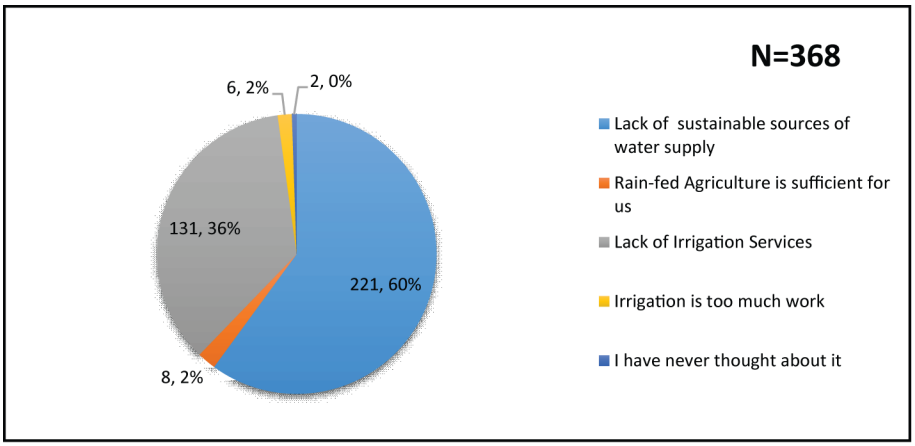
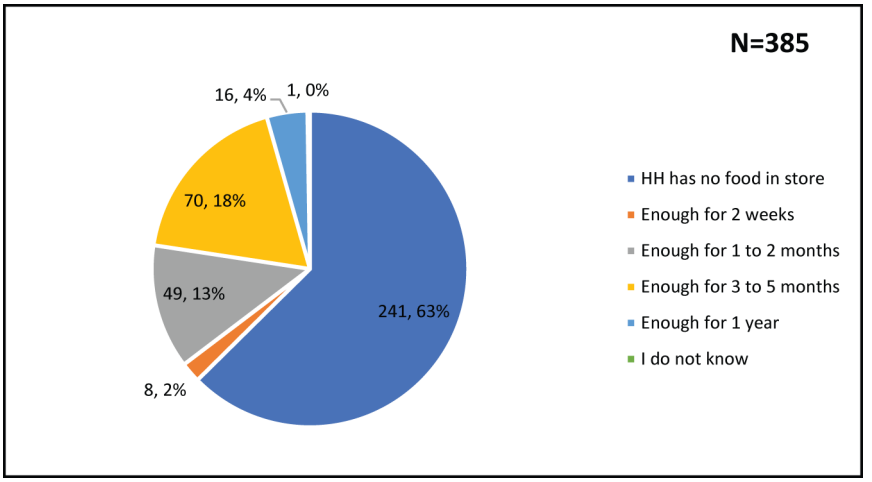


Figure 6. Showing duration food can last in store (Source: Field Data, 2022)



immediately after harvest. When asked why they sell crop produce immediately after harvest, majority of the respondents 48% (85) stated that they sell food immediately after harvest to pay school fees, 37.85% (67) to meet household needs, 3.95% (7) due to lack of storage facilities, 9.04% (16) due to fear of infestation by weevils and 1.16% (2) other reasons. These findings affirm an earlier report by KNBS (2016) which had indicated that the level of food poverty in Kitui County stood at 39.4% compared to the national average of 32%. These high rates of nutritional deficit are as result of prolonged periods of drought induced food scarcity in the county (MoALFC, 2021). Moreover, recurrent droughts erode the local coping capacities, resulting in chronic food insecurity and reliance on famine relief among the drought prone communities (Huho & Mugalavai, 2010). According to Frankenberger et al., (2013), resilient communities are able to meet the household food security needs while vulnerable communities experience deficits or a high risk of deficits in these aspects.

3.2.3 Household Land Management Systems

Household respondents were asked what soil and water conservation methods they practice on their farms. Their responses were summarized in Table 3 which indicates that majority 83.9% (323) of the household respondents use more than one type of soil and water conservation methods and the

Table 3. Showing soil and water conservation methods practiced

Soil and water conservation Methods	Frequency	Percent
None	40	10.4
Terraces	323	83.9
Animal Manure	242	62.9
Grass lines	15	3.9
Contour bunds	4	1.1
Mulching	4	1.1
Compost Manure	4	1.1
Others	11	2.9

Source: Field Data, 2022

majority construct terraces in their farms 83.9% (323), 62.9% (242) apply animal manure while 10.4% (40) did not practice any form of soil and water conservation methods.

According to Kioli et al., (2017), Kitui County is faced by a major problem of land degradation due to soil erosion and other unsustainable land management practices, such as uncontrolled sand harvesting in most rivers, overgrazing, reduction of forest cover, high rates of deforestation for wood fuel for domestic use, charcoal, and firewood production. MoALFC (2021), asserts that environmental degradation has resulted in deforestation and destruction of watershed areas, decline in soil fertility, loss of biodiversity and the resultant low farm yields. This study found that although some environmental management practices are in place, more effort is still needed to improve the level of environmental protection in the county.

3.3. Household Main Sources of Cooking Fuel

The study sought to understand the household main source of cooking fuel in the study area. Household respondents were asked to state their main source of cooking fuel. Majority 84% (322) of household respondents stated that they use wood fuel, 12% (47) charcoal, 1% (5) kerosene, while only 3% (11) use gas as shown in Figure 7.

During FGDs, participants were asked what the main sources of cooking fuel in their villages are. A female respondent from Mivukoni Village stated,"The main source of cooking fuel in this village is wood fuel. It is the same source of fuel used in Mivukoni Market where I normally sell wood fuel to earn an income to buy food especially during a dry period like this one when food is very scarce."

The findings confirm those of KNBS (2019), which showed that the main sources of cooking fuel for majority of people in Kitui County is firewood used by 81.3% of the households compared to the national average of 55.1%. According to Kioli et al., (2017), overreliance on biomass for supply of wood energy poses a threat to the national forest cover and is a key driver for environmental degradation.

3.4 Access of Water and Sanitation Facilities

This study attempted to determine the level of access to water and sanitation services in Kitui County. The household respondents were asked to state the main source of drinking water in their household. Results summarized in Figure 8 indicates that 30.4% (117) of household respondents rely on boreholes to access drinking water, 15.3% (59) shallow wells, 12.7% (49) tap water, while 13.2% (51) rely on earth dams, 11.7% (45) sand dams, 11.2% (43) unprotected shall wells, 2.1% (8) perennial rivers, among others.

Figure 7. Showing main sources of fuel for cooking (Source: Field Data, 2022)

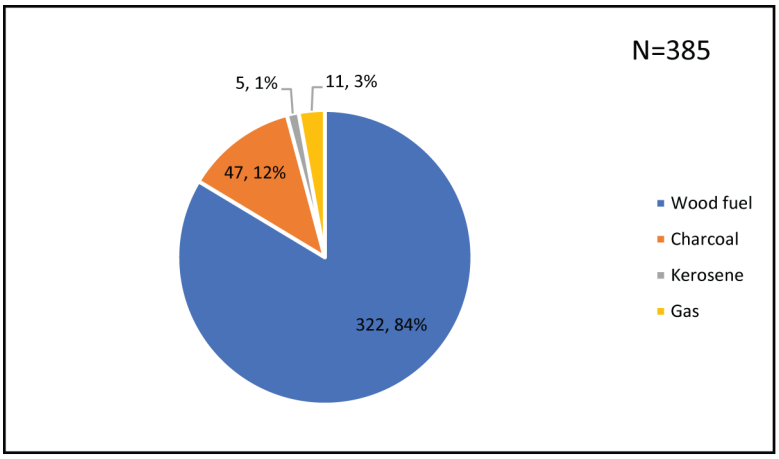
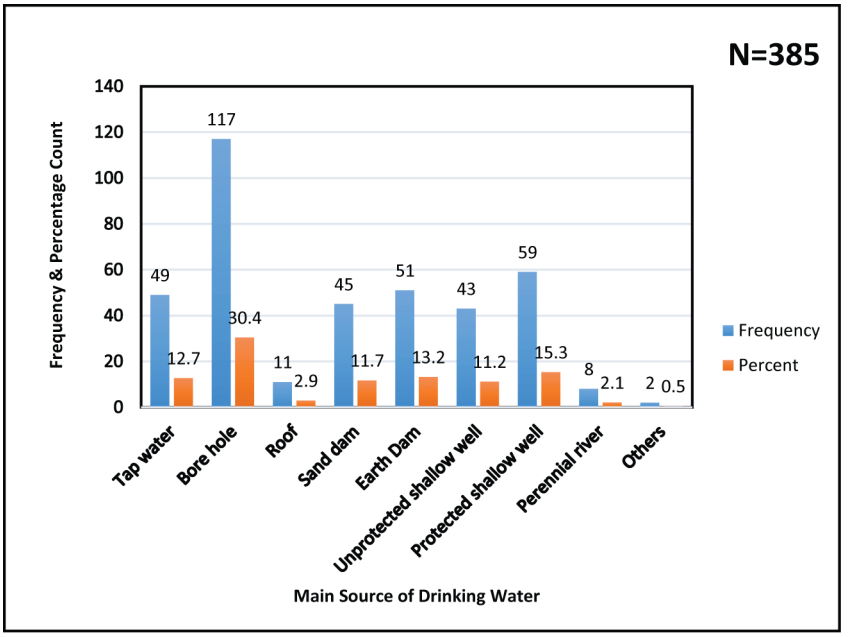


Figure 8. Showing the main sources of drinking water (Source: Field Data, 2022)



The study also sought to establish the distance travelled by households in the study areas to get water for livestock. Household respondents were asked to state the distances they cover when accessing water for livestock. Majority of the household respondents 46% (177) stated they travel less than 2 kms to get water for livestock, 26.8% 2-3km, while 13.5% (52) travel a distance of 4-5 km, and 13.8% (53) more than 6 km.

According to existing studies, access to water is a major problem in Kitui county. The main sources of drinking water include ponds, streams, protected springs and wells, boreholes, water pipes, and harvested rainwater, among others (KNBS, 2019). However, during a drought situation, the walking distance to water points increases, during which 58% of households spend thirty minutes or more to fetch drinking water. According to Population Action International (2015), communities living in Kitui County are faced with chronic water scarcity as recurring droughts result in reduced water supply due to drying of water sources. A study conducted by Makau et al., (2014), in Kitui West Sub-County, established that water pans are the main sources of water in the study area with only 67.2% able to access it, and only 55.2% of the respondent households could access water of above 200 liters daily. It is evident that there is lack of adaptive capacities to water access in Kitui County MoALFC (2021).

When asked who maintains the sources of water, majority of the household respondents 45% (172) said the local community maintains the water sources, 23% (89) by government, 11% (44) by NGOs/CBOs/FBOs, while 21% (80) indicated their water sources are not maintained. Existing studies indicate that the ability by drought prone communities to access water infrastructure and maintain it is critical to human wellbeing and also demonstrates the ability for self-organization for collective action, which is critical in helping the community to prepare, cope with, and recover from a drought shock (Béné et al., 2014).

Further, this study tried to assess the level of hygiene and sanitation situation in Kitui County by assessing the quality of water used for drinking and access to sanitation facilities. The study did this by determining the number of households that boil water for drinking. The household respondents were asked whether they boil or treat water for drinking. The results showed that 50.6% (195) of

household respondents said that they do not boil water for drinking while 49.4% (190) said they boil or treat water for drinking. When asked why they did not boil water, the majority of the household respondents 54.4% (106) indicated they did not boil water because they perceived the water they were using to be safe for drinking since it is drawn from safe sources, 22.6% (44) said boiling/treating water is too much work, 13.3% (26) stated chemicals for treating water are costly while 9.7% (19) said they don't boil or treat water because boiled or treated water does not taste nice. Inability to boil or treat drinking water exposes the community to a risk of water borne diseases. Existing studies indicate that sustainable access to adequate quantities of water is critical in achieving sustainable livelihoods and socio-economic development, and thereby, building community resilience (Béné et al., 2014) while lack of access to safe human waste disposal facilities results in poor health.

3.5 Household Access to Transport Systems and Resilience

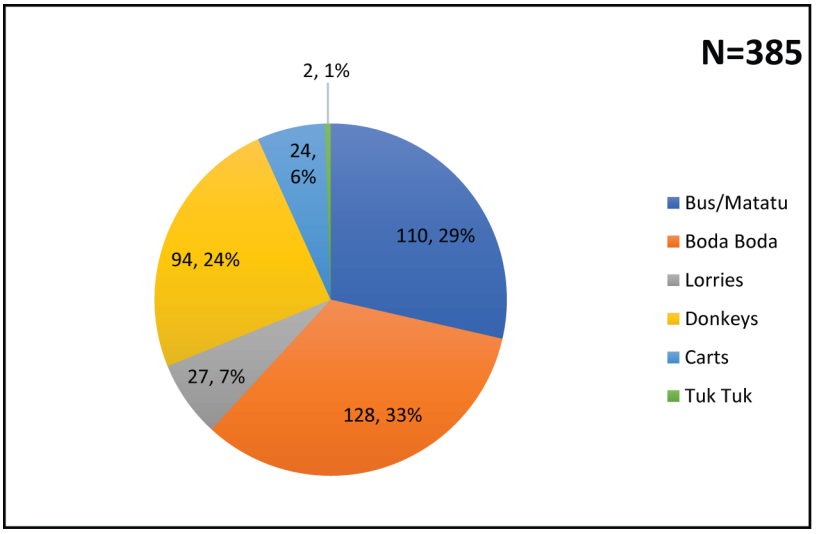
The study sought to establish the type of transport systems in Kitui County. Household respondents were asked what types of transport they use. Results are summarized in Figure 9, showing that 33% (128) of household respondents use *boda boda* (motor bikes) as the main means of transport, 29% (110) buses and *Matatus* (mini-buses) while 24% (94) use donkeys, 7% (27) lorries, 6% (24) carts and 1% (2) Tuk Tuk.

Road and transport infrastructure facilities are critical in ensuring quick and timely access to essential supplies and services during disaster situations. Lack of improved road infrastructure in Kitui County affects service delivery and the transportation of produce to markets. According to MoALFC (2021), poor secondary and tertiary roads in the county reduce rural farmers' access to markets and leads to contamination of supplies transported through the dusty roads during the dry periods. The transport system is critical to the welfare of modern societies and is a critical indicator of a resilient community (Patel et al., 2017).

3.6 Factors Affecting Community Resilience to Drought

The study examined the social, economic, and environmental factors that affect building of community resilience to drought in Kitui County by examining several social factors such as food availability, access and management of water and sanitation facilities, and access to health care services. It also

Figure 9. Showing main means of transport for household transport (Source: Field data, 2022)



examined economic factors such as crop and farming systems, access to transport systems and environmental factors including patterns of natural resource management and sources of cooking fuel.

3.6.1 Community Resilience to Drought and Social Factors

3.6.1.1 Results on Normality Test

Analysis of normality tests between community resilience to drought (dependent variable) and social factors (independent variable) as shown in Table 4 show that the data sets were non-normally distributed, a violation of normality assumption. This is because the Kolmogorov - Smirnov and the Shapiro - Wilk tests, performed on the data sets for the two variables gave p-values less than 0.05 at 5% level of significance, implying that the data values for the dependent variable were skewed. However, the larger the sample size, the more extreme the distribution of the observation of the means can be without compromising the validity of the t-test.

3.6.1.2 Results on Linearity Test

The results of the plot of social factors versus community resilience to drought factors showed a linear relationship between the two variables ($y=1.17+0.24*x$; $R^2=0.684$). The results reveal that community resilience to drought and social factors are positively related with the line of the best fit, showing a rising trend.

3.6.1.3 Results on Regression Analysis

Analysis of regression results show that the effect of social factors on building community resilience to drought was significant ($F(860.969) =397$, $p = 0.000 < 0.05$). From ANOVA, since $p = 0.000$ and was lower than $p = 0.05$, then the contribution of social factors to community resilience to drought was significant. The conclusion was that social factors had a positive impact on community resilience to drought.

3.6.2 Community Resilience to Drought and Economic Factors

3.6.2.1 Results on Normality Test

Analysis of normality tests between community resilience to drought (dependent variable) and economic factors (independent variable) as shown in Table 5 show that the data sets were non-normally distributed, a violation of normality assumption. This is because the Kolmogorov-Smirnov and the Shapiro-Wilk tests, performed on the data sets for the two variables gave p-values less than 0.05 at 5% level of significance, implying that the data values for the dependent variable were skewed. However, the larger the sample size, the more extreme the distribution of the observation of the means can be without compromising the validity of the t-test.

Table 4. Normality test social factors and community resilience

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Community resilience to drought	.262	384	.000	.858	384	.000
Socio factors	.341	384	.000	.692	384	.000

a. Lilliefors Significance Correction
Source: Field Data, 2022

3.6.2.2 Results on Linearity Test

The results of the plot of economic factors versus community resilience to drought showed a linear relationship between the two variables ($y=-0.24+1.11*x$; $R^2=0.931$). The relationship indicates that community resilience to drought and economic factors are positively related with the line of the best fit showing a rising trend. Thus, the linearity test shows that there is a cause - effect relationship between the forces affecting the distribution of the items in the economic factors and community resilience to drought.

3.6.2.3 Results on Regression Analysis

Results based on regression analysis show that the effect of economic factors on building community resilience to drought was significant ($F(5316.236) = 397$, $p = 0.000 < 0.05$). From ANOVA, since $p = 0.000$ and was lower than $p = 0.05$, then the contribution of economic factors to community resilience to drought was significant, and the conclusion was that economic factors had a positive impact on community resilience.

3.6.3 Community Resilience and Environmental Factors

3.6.3.1 Results on Normality Test

Analysis of results on normality tests for data sets for community resilience to drought against environmental factors, as shown in Table 6, show that the data sets were non-normally distributed, a violation of normality assumption as the Kolmogorov-Smirnov and the Shapiro-Wilk tests, performed on the data sets for the two variables, gave p - values less than 0.05 at 5% level of significance, implying that the data values for the dependent variable were skewed. However, the larger the sample size, the more extreme the distribution of the observation of the means can be without compromising the validity of the t - test.

Table 5. Normality test community resilience and economic factors

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Community resilience to drought	.262	384	.000	.858	384	.000
Economic factors	.240	384	.000	.895	384	.000

a. Lilliefors Significance Correction
Source: Field Data, 2022

Table 6. Normality test community resilience and environmental factors

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Comm resilience to drought	.262	384	.000	.858	384	.000
Environmental factors	.142	384	.000	.944	384	.000

a. Lilliefors Significance Correction
Source: Field Data, 2022

3.6.3.2 Results on Linearity Test

The test for linearity of environmental factors and community resilience to drought ($y=1.65+0.04*x$; $R^2=7.486E-4$) indicated an almost constant trend. In conclusion, mixed findings exist on the association between environmental factors and community resilience to drought.

3.6.3.3 Results on Regression Analysis

Surprisingly, the regression results showed that the effect of environmental factors on building community resilience to drought were insignificant ($F(0.297) = 397$, $p = 0.586 > 0.05$). From ANOVA, since p value $p = 0.586$ and was greater than $p = 0.05$, then the contribution of environmental factors to community resilience to drought was insignificant. The conclusion was that environmental factors had an exceptionally minimal impact on community resilience.

3.7 Other Factors Influencing Community Resilience

Other factors, such as lack of county disaster management policy and adaptation plans, influence the current level of community resilience to drought in Kitui County. Despite the existence of the National Disaster Management policy (GoK, 2017), the 2010 National Climate Change Response Strategy (GoK, 2010) and the National Climate Change Action Plan (GoK, 2013), these policies are yet to be domesticated or integrated into the County Integrated Development Plans, resulting in inadequate adaptation planning and lack of sound partnerships involving the national and the county governments and the INGOs, CBOs and the local communities. This impedes community resilience building to drought in the county (MoALFC, 2021). According to Shiferaw et al., (2014), the overall impact of drought in each region and the communities' ability to recover from the resulting impacts depends on social, economic, and environmental factors which undermine the wider economic and development gains made in the past decades.

4. CONCLUSION

Based on indicator variables, the study found that there was low to medium level of community resilience to drought in Kitui County. Low community resilience, evidenced by the fact that majority of the households are living below the international poverty line; earn their income from crop and livestock production systems which are highly sensitive and exposed to drought; are faced by numerous risks including pest infestation, forage, and water shortages, crop and livestock losses, poor prices of produce, and inadequate agricultural services; rely on rain-fed agriculture; and do not use safe drinking water. On the other hand, some level of community resilience was evidenced through adoption of drought resilient crops and livestock production systems, and the majority of the households are engaged in soil and water conservation practices, are able to access and maintain their water sources, and have adequate access to sanitation facilities. However, access to water to support crop production through small scale irrigation systems remains a major challenge.

5. RECOMMENDATION

The study recommends that future humanitarian aid interventions should be planned in a way that addresses the multidimensional features of poverty through wealth creation, asset building, and diversification of income sources for purposes of reducing income inequalities. There is need to shift from supporting short-term and reactive humanitarian efforts to focusing more on long-term plans, while addressing the underlying causes of vulnerability, protecting livelihood assets, saving lives, and reducing drought risks in order to enhance community resilience to drought. Strengthening of DRR planning, diversification from farming to non-farming livelihood options, and more engagement in community drought risk assessments are vital in effectively managing drought ex ante and reducing

the ex post negative effects on vulnerable communities in drought prone areas. The humanitarian aid system needs to invest more in supporting the local communities in establishing local drought management committees, developing and implementing disaster management policies and climate change adaptation policies and plans in order to enhance drought preparedness and build community resilience to drought. A study is recommended to further investigate the association between environmental factors and community resilience to drought in Kitui County.

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