

Consequences of Droughts and Floods in the Semi-Arid Lands of Kenya Are Two Peas in a Pod

Moses Mwangi

South Eastern Kenya University, Kenya

ABSTRACT

The semi-arid lands of Kenya experience extreme weather events, including droughts and floods, which have significant impacts on inhabitant communities and their economy. Occurrences of the two are becoming more frequent and intense due to climate change. Therefore, understanding their impacts is of critical importance for effective mitigation and management. This paper shares findings based on a study carried out in the semi-arid Kyatune-Ikanga Ward area of Kitui County, Kenya, aimed to examine the dynamics of droughts and floods at household and community levels, and the measures in practice in management of consequences. Primary data was collected through a structured questionnaire administered on 45 randomly selected households and analyzed through descriptive statistics. The findings revealed that the consequences of the two weather events are largely similar, with an overall result of lowered resilience to vulnerability for people, livestock and the ecosystem in general. Both disrupt economic stability, destroy food security, and force displacement. Other than climate change, the problem is aggregated by population pressure, land use changes, and inadequate access to knowledge and resources on the weather. As a result, community empowerment in integrated range management is vouched for as the most viable option in controlling the negative penalties of floods and droughts, which need include embracement of early warning systems ideals, and livelihoods diversification. The findings were found to have potential to facilitate lobbying and advocating for action oriented policies to increase the resilience of households to extreme weather vagaries.

Keywords: Hazards, livelihoods, adaptation, resilience, coping strategies.

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1.0 Introduction

The semi-arid areas of Kenya are characterized by droughts and floods which form one of the greatest threats to sustainable lives and livelihood development in the regions. Despite continuous prevalent droughts, devastating floods also hit the regions, causing major impacts on the economy, human activity, and the

environment. In this regard, climate change worsens the intensity and frequency of extreme weather conditions in the regions as it leads to heavy rainfall, high temperatures, and longer periods of drought (AWC, 2009), potentially exposing the areas to greater flood damage. The problem is further amplified by population growth and human activities such as urbanization, inappropriate land use, economic development, and

missing awareness. In addition, the high diversity in climate, geography, geology, vegetation, and hydrology of the semi-arid areas poses difficulties for local flood managers. Flooding happens infrequently and over a short period of time in these regions. The response of the catchments to intense rainfall is rapid, reaching its peak in a very short time, often only a few hours (Lin, 1999); (Hersch, 1999).

Rain-fed agriculture remains the main source of nourishment for crop production and livelihoods sustenance in the semi-arid lands of Kenya. The prevailing high dependence on rains exposes households to droughts and floods which often result in agricultural losses. Over the past three decades, the semi-arid areas have witnessed several droughts and floods as a result of a changing climate. As variations in rainfall and temperature continue, annual rainfall is anticipated to increase with a likely increase in households' vulnerability to extreme weather events partly due to the region's ecological location, burgeoning population, environmental degradation, rapid deforestation, underdeveloped farming technologies, and unsustainable urbanization patterns. Cognizance is the frequency and severity of extreme weather events are pushing households, especially smallholder farmers, into poverty in Sub-Saharan Africa (Ngoma *et al.*, 2021). Notably, Kimutai *et al.*, (2023) warns that the chances of drought in the region is 100 times higher due to climate change. Therefore, in the absence of appropriate measures to lower the resultant households' vulnerability, agricultural productivity is likely to have huge long-term adverse effects (Gezie, 2019).

However, the extent to which extreme weather events affect a household is established to be dependent on its adaptive capability which revolves around the interventions and adjustments that occur in order to take advantage of the opportunities or to manage the losses (Beckline *et al.*, 2016) & (Ngoe *et al.*, 2019). In Kenya, droughts are indicated to reduce farm income per capita by 29% (Wineman *et al.*, 2017) which limits capacities to take care of vulnerabilities to weather changes. The World Drought Atlas predicts that by 2050, droughts may affect more than 75 percent of the world's population (UNCCD, 2024).

The semi-arid regional features and characteristics present particular difficulties to management of droughts and floods conditions. A critical challenge arises from management and organizational inadequacies which play

crucial roles in the failure and ineffectiveness of droughts and floods management strategies. Technical difficulties that include data issues, modeling problems, and warning challenges cause significant challenges to the management of the two. The floods and droughts are often interconnected by climate change, resulting in increased frequencies, causing crop and livestock deaths and disrupting communities. Droughts lead to severe water shortages, affecting agriculture and livelihoods, while floods exacerbate issues by overwhelming soil and infrastructure, leading to further water loss and ecological damage. Heavy rains that follow prolonged drought lead to flooding, which result in loss of crops, livestock deaths and disease outbreaks. The correlation between the two extreme weather events highlights the need for climate resilience and effective management of water resources to mitigate their impacts. Understanding this relationship is crucial for developing strategies to address the challenges posed by both floods and droughts in semi-arid regions

2.0 Materials and Methods

2.1 Description of the Study Area

The Kyatune-Ikanga Ward region is located to the south of Kitui County in Kenya. The area is semi-arid and prone to droughts and floods, whose frequency and severity have increased over the recent years. The setting exhibits two distinct rainfall seasons of March to June and September to December rains, the latter bearing the heaviest rains. On average, the area receives about 850 mm of precipitation annually, with 200 mm recorded in the wettest month, November. The inhabitants mainly comprise the Kamba community whose social and economic endeavors revolve around agropastoralism. As the lives and livelihoods in the area are dependent on rain-fed undertakings, droughts and floods normally cause disruptions that result in households and community vulnerabilities. Droughts create ideal conditions for floods and lead to extremely dry and hardened land, affecting soil's ability to absorb rain. Soil is most absorbent when damp, as moisture changes its porosity and creates the ideal conditions for more water to enter. In contrast, dry earth forms an impermeable layer that repels water. After extensive drought, intense rainfall washes away crops and topsoil, negating the favorable impacts of rainfall on crop conditions and agricultural livelihoods. Floods kill the animals that survive drought, bring water borne diseases and, destroys plants and the ecosystem in general.

Desertification continues to pose a challenge over the landscape that has seen unprecedented degradation often exacerbated by competition for natural resources, effects of climate change, deforestation, loss of biodiversity, overgrazing, over-use of underground water, and prolonged droughts and flooding. Increasingly, livelihoods continue to be affected as the landscapes become more vulnerable to vagaries of the weather. There has never been a concerted effort to address desertification through broad supportive policies that define management of fragile landscapes to protect biodiversity and natural resources, as well as addressing effects of climate change through both adaptation and mitigation.

Although the rains in and across the Kyatune-Ikanga Ward recharge surface water sources and offer some relief, assessments show that much more rainfall is needed to alleviate the effects of droughts. Recovery from consecutive seasons of poor rainfall performance takes time. Inhabitants assert that regardless of the performance of the rainy season, the scale, severity, and magnitude of the suffering due to the region's drought take years to fully recover from. Many households lose entire livestock herds, while others end up with no resources to invest in restoring their farmlands when rains do return. Moreover, when droughts start in the Kyatune-Ikanga Ward, many households are found still recovering from previous droughts. The high level of need among households that lose most of their resources, coupled with the severe degradation in environmental conditions, means that recovery takes several seasons, or even years of good rainfall performance.

Despite water shortages and infrequent rainfall in the Kyatune-Ikanga Ward region, flooding tends to be more severe and life-threatening. However, it brings out a poorly understood natural hazard in the area, therefore posing challenges that need addressing. The difficulties mainly result from the temporal and spatial combination of physical processes in the region, including geographical features, climatic conditions, precipitation characteristics and catchment hydrological response.

2.2 Data Collection

A household was the basic unit for the January 2026 research data collection undertaking. A door-to-door survey approach was employed to administer structured questionnaires. Individuals were interviewed by research assistants, who had prior knowledge of the study area. In

instances where potential participants were unable to communicate in English, the Kamba dialect, which is the widely spoken language in the study area, was used to ensure proper understanding. Before the field interviews, the research team had to consult government officials in the area for official permission. A total of 45 interviews were conducted in the survey, and collected information on household characteristics, droughts and floods features, perceptions and effects of the two weather vagaries on lives and livelihoods, and management and adaptive strategies. Descriptive statistics were used to analyze the gathered data.

3.0 Results and Discussion

3.1 Characteristics of Droughts and Floods

a) Features and perceptions

Households in the study area generally perceive droughts and floods as significant threats to lives and livelihoods. The two events are viewed as major drivers of food insecurity, income loss, and asset and livelihoods destruction. Table 1 shares on the households' perceptions about drought and flood events in the past ten years. It is shown that about 90%, 9% and 1% of the households perceive an increase, a decrease, and no changes in flood frequency. Similarly, about 70%, 20% and 10% perceive an increase, decrease, and no change in drought frequency, respectively. There is concurrence from the respondents that the droughts and floods phenomena are becoming more frequent, often with floods occurring shortly after prolonged droughts. All occurrences cause widespread disruptions and hardships at household and community levels which are diverse and multidimensional. While the droughts and floods often stem from the same underlying climate volatility and are experienced as a continuous cycle of disorder, they do not have identical effects on households and the community at large. Yet, they create distinct, yet sometimes overlapping, crises, with droughts acting as long-term, slow-onset disasters and floods acting as rapid, intense, and damaging events.

Floods are rated by 54% of the households to be a blessing to the people and their livelihoods. Despite finding the downpours to be highly ambivalent and destructive, they are also identified to be crucial sources of rejuvenation for the environment and livelihoods as they break the cycle of drought, recharge vital water resources, and boost ecological productivity. The positive

impacts in the semi-arid areas are indicated to be rejuvenation of ecosystems by 96% of the households, water harvesting opportunities (76%), economic opportunities (29%), and natural fertilizer (40%) as illustrated by Table 2. The initial impact is usually acute food insecurity, famine, and loss of assets.

Floods break long droughts, bringing fresh life to the arid landscapes, regenerating pastures for livestock, and replenishing dry rivers, pans, and aquifers. They also provide opportunities to harness water for livelihoods and human use. Techniques like sand dams' construction allow for the capture of floodwater, which can then be used to provide water during dry seasons. Following flood events, households often experience improved farming opportunities and a surplus of fodder, which can be sold in local markets. Flooding often brings nutrient-rich silt, which enhances soil fertility, supporting increased agricultural production and the cultivation of crops that can grow in flood environments. Receding flood waters leave behind nutrient-rich sediments that promote the growth of seasonal pastures which are vital for livestock breeding and rejuvenate soil fertility.

While they can offer benefits, floods also kill livestock, destroy infrastructure, and cause disease outbreaks, worsening the poverty of already vulnerable communities. However, 65% of the households indicate that in essence, whether a flood becomes a blessing or a curse depends heavily on the ability to manage the surge of water through infrastructure and the implementation of adaptation strategies, transforming a temporary hazard into for example a long-term water source for agriculture and human consumption. Whereas droughts are conventionally seen as natural disasters that destroy livelihoods in arid areas, they can act as a catalyst for long-term adaptation, innovation, and structural changes that ultimately build resilience. Although the immediate impacts include severe water scarcity, crop failure, and livestock loss, the necessity of responding to these crises can drive positive shifts in livelihoods. Table 3 shows some of the potential positive benefits to households that include livelihood diversification (51%), adoption of drought-resistant agriculture (33%) and, infrastructure innovation (51%), improved resource management (87%), revitalization of indigenous knowledge (38%), and having reduced pest population (27%).

Faced with the failure of traditional agropastoralism, households are forced to diversify into less rainfall-dependent income sources, such as formal employment,

small-scale business, or poultry-keeping. Droughts force a shift towards planting drought-resistant crops such as sorghum, millet, cassava, and pigeon peas and adopting dryland farming techniques like mulching and contour farming. Crisis drives the investment in and development of water-harvesting infrastructure, such as sand dams, shallow wells, and efficient irrigation systems which provide a more reliable water supply, reducing long-term vulnerability. The lessened rains are reputed to encourage improved resource management as droughts accelerate the adoption of communal resource management, such as community-managed conservancies, which allow for better rangeland management and livelihood opportunities through nature-based solutions.

Prolonged droughts force farmers to adopt more efficient water use, adopt drought-resistant crops and innovate with sustainable water-harvesting technologies. On the other hand, the crisis encourages the use of traditional knowledge in managing lives and livelihoods, including herds composition diversification and embracement of drought-resilient land-use systems. In some plants growing contexts, the dry, hot, and short-term, less severe drought conditions break the breeding cycles of pests and insects, reducing crop damage from infestation.

b) Characteristics of Droughts

Table 4 presents indications by households on the upshots of droughts to the semi-arid setting. Droughts are specified by 64% of the households to have slow-onsets but long-term impacts. The life and livelihood of the community are disrupted, resulting in malnutrition, psychosocial problems, economic setbacks and conflicts over resources. Consequently, the inhabitants have to adopt varied coping mechanisms. The drought related ruins lead to long-term loss of livestock, failure of crops, reduced agricultural revenue, and forced migration.

The primary and most direct impact of droughts is the acute want of water for humans, livestock, and crops as indicated by 85% of the households. 76% of respondents in the study report experiencing famine which is fueled by economic downturns as alluded to by 93% of households. According to 51% of the households, the low economic positions make prolonged droughts cause malnutrition, dehydration, and increased risks of diseases. To 42% of the respondents, the food inadequacy is worsened by environmental degradation as droughts kill vegetation, compact soil, and increase the risk of range fires.

Table.1 Household Perceptions on droughts and floods

Variable	Variability	N=45
Flood frequency	Increase	41
	Decrease	4
	No Change	1
Drought frequency	Increase	32
	Decrease	9
	No Change	4

Table.2 Fortunes of Floods

Fortune		[N=45]
1.	Ecosystems rejuvenation	43
2.	Water harvesting opportunities	34
3.	Economic opportunities	13
4.	Natural fertilizer	18

Table.3 Fortunes of Droughts

Fortune		[N=45]
1.	Livelihoods diversification	23
2.	Adoption of drought-tolerant land use	15
3.	Infrastructure innovation	23
4.	Improved resource management.	39
5.	Indigenous knowledge revitalization	17
6.	Reduced pest population	12

Table.4 Characteristic of Droughts

Characteristic		N=45
1.	Slow-onset but long-term impact	29
2.	Water scarcity	38
3.	Food insecurity	34
4.	Economic ruin	42
5.	Health issues	23
6.	Environmental degradation	19

Table.5 Effects of Floods

Characteristic		N=45
1.	Rapid-onset, catastrophic damage	44
2.	Physical destruction	36
3.	Food insecurity	12
4.	Loss of life	19
5.	Economic ruin	23
6.	Waterborne diseases	11
7.	Soil erosion and siltation	42

c) Characteristics of Floods

In the semi-arid environment, floods are not as frequent as droughts. When they occur, they often maim and kill animals that survive droughts, and bring water borne diseases. Rapid-onset of floods cause catastrophic damage to almost all (98%) of the households (Table 5). About 80% of the households state experiencing physical destruction as the intense floods destroy homes, schools, roads, and infrastructures. Despite lower annual rainfall, 42% of respondents indicate witnessing loss of life due to flash floods that often cause soil erosion and siltation (93%), creating gullies, and causing extensive, long-lasting damage to the rangeland. The response of the catchments to intense rainfall is rapid, reaching its peak in a very short time, often only a few hours. Prolonged droughts combined with shallow soils and scarce vegetation cover have a significant influence on the hydrological response of arid and semi-arid regions. The spatio-temporal variability of rainfall contributes to variability of flood responses throughout the local catchment.

24% of the households loathe floods because of the waterborne diseases caused by stagnant waters, the most cited being diarrhea (75%) and malaria (82%). Floods are however reputed to bring out some good tidings in food provision to households. Pastures blossom and some crops including wild foods are experienced. However, 27% of the people complain of food markets and, food relief centers inaccessibility due to floods.

d) Drought-Flood Interplay

Droughts and floods in semi-arid areas are not just similar in their destructive impact as they are fundamentally interconnected, often behaving as a two-headed crisis where one directly causes or intensifies the other. Over 90% of the households report experiencing prolonged, dry conditions (drought) hardening the soil and removing vegetation, ensuring that when intense rain finally arrives, the land cannot absorb it.

This leads to flash floods. Droughts kill vegetation that would otherwise stabilize soil and aid water infiltration, worsening runoff during rain events. The inhabitant communities often experience drought in one season and floods in the next, destroying any resilience built up to cope with the previous disaster. Climate change is intensifying this cycle, making dry periods longer and rainy periods more violent.

Both drought and flood events result in the loss of livelihoods, cause food insecurity, displacement, destruction of infrastructure and a heavy reliance on food aid. The situations lead to a lack of safe water. Droughts dry up water sources, while floods contaminate them. While drought weakens bodies through malnutrition, making populations more susceptible to diseases, floods lead to outbreaks of waterborne diseases. Droughts and floods force families to flee their homes, either to seek water and pasture during droughts or to escape rising floodwaters. The consequences are exacerbated by shared vulnerabilities, including poor infrastructure, high poverty levels, and reliance on climate-sensitive livelihoods. Sometimes, the impacts result in permanent abandonment of traditional livelihoods. Furthermore, adaptation measures for one can increase vulnerability to the other such as planting drought-resistant crops that are ruined by waterlogging. The destruction caused by a flood often compounds the previous, and still existing, damage caused by a preceding drought. Prolonged droughts harden the ground, making it impermeable. When the infrequent rains finally, the water cannot infiltrate the soil, resulting in intense, destructive flash floods, turning even moderate rainfall into devastating flash floods. While both cause hunger, livestock losses, and displacement, droughts are generally more destructive to long-term wealth such as livestock and land productivity, whereas floods are more immediately destructive to life and infrastructure. Floods cause major concerns through harmful water abundance that destroy harvests and infrastructures or cause loss of life, whereas droughts cause water scarcity.

15% of the households report experiencing droughts and floods being a threat multiplier that exacerbates existing socio-economic and political tensions, leading to various conflicts, rather than being the sole direct cause. The primary mechanism is heightened competition for dwindling or damaged vital resources like water, pasture, and arable land. In drought periods, herders travel longer distances in search of pasture and water, which pits them against other herders and owners of crop farms and water sources.

3.2 Households Resilience Characteristics

Resilience provides households with the capacity to absorb disturbance and retain basic function and structures. The two main aims of building resilience are to prevent the existing system from moving to an undesired, alternative regime in the face of change, and

to nurture and preserve the components of the system that build resilience and allow the system to renew and reorganize after a disturbance. The study found households' resilience to droughts and floods to hinge on a number of factors that include embracement of irrigation practices, income generation capacity, access to credit, education levels, age of household head and dependents size. These factors mean that a single disaster can devastate livelihoods, driving households into deeper poverty.

The results of resilience to droughts and floods suggest that households are more vulnerable to related shocks due to inadequate preparedness, a lack of income, food insecurity, limited assets, lack of livelihood strategies, climatic variability, shortage of water, lack of access to public services, and lowered social capital. Over 90% of the people indicated that, assets, natural disasters, climatic variability, access to public services, income, and food access should be given high priority to increase household resilience to droughts and floods. Hence, the absorptive capacity is the leading contributing factor to resilience followed by adaptive and transformative capacities. About 80% of the households vouch for enhancement of resilience capacities with strong attention being given to the following inadequacies:

a) Absence of sustainable planning

Less than 5% of the households plan for droughts and floods, a practice that raises their vulnerability. 75% of the residents associate the circumstance to the majority of the households continuing to live in poverty. This is because the majority of households frequently experience the effects of the drought and floods related hazards which make their degree of poverty worse. Limited investment in disaster preparedness and poor, vulnerable structures in the drought and flood-prone or stricken areas increase exposure to risks.

b) Inadequate Mitigation Knowledge and Skills

Over 60% of the households indicate not having the right skills and knowledge to diversify livelihoods in order to have alternatives that would see them through the calamities that come with droughts and floods. Households are vulnerable to droughts and floods primarily due to their heavy dependence on rain-fed agriculture and natural resources, coupled with low income, limited infrastructure, and weak adaptive capacity. These climate-related hazards cause severe

income loss, destroy assets, and disrupt food security, often forcing reliance on unsustainable coping strategies. The rise in temperatures and change in rainfall patterns and quantities are stated by 70% of the households to be detrimental to agricultural production and income. With rainfalls not meeting crop moisture and soil water requirements, crop yields and value are reduced. The 12% of the households who practice crops irrigation systems attest that agricultural production losses can be reduced during a drought with application of water to crops.

On the other hand, floods have a negative influence on farm income when they destroy and wash away plants for human, livestock and the ecosystem, with 62% of the households observing that excessive rainfall causes soil erosion and crop damage in the fields. Moderate rains are reputed to lead to good harvests and sustainability of the ecosystem.

c) Low Access to Finance Support

It is realized by about 45% of households that have access to credit improves a household's financial capacity to expand agricultural production and raised capacity to fight the consequences of droughts and floods. The credits facilitate households to purchase and apply crop production inputs as well as to timely implement farm management decisions.

Other than credits, income from non-farm employment are used to purchase farm inputs such as fertilizer, seedlings and irrigation systems during droughts to augment agricultural production which boost crop yields, thus bringing higher returns to households.

Low-income households lack the financial resources to prepare for or recover from shocks, resulting in greater losses compared to wealthier households. The relationship between poverty and susceptibility to droughts and floods is multifaceted, something that was also established by (Haughton & Khandker, 2009) and Zeleke *et al.*, (2021). Therefore, poverty seems to enhance a household's susceptibility to climate change. The responses, however, also demonstrate that not all non-poor households and not all poor households are vulnerable to the shocks brought by the weather vagaries. It is evident that smallholder farmers are typically more sensitive to the weather change due to a variety of factors rather than just being poor, something consistent with the findings of Zeleke *et al.*, (2021).

d) Household Status

Assessment of the homesteads education levels show that the number of years of schooling has a positive correlation with farm income. The 35% of the households that have members who have received at least a secondary school level of education seem to have more ability in searching for information on droughts and floods and application of new techniques of land use and livelihood diversification. The households are more inclined towards moving out in times of harsh climatic conditions to seek help for households. 36% of the respondents indicate that an increase in the household size and composition has a negative impact on the farm income. When a household is largely composed of dependents, the production input may be outweighed by other household expenses. This is due to the dependents inadequately assisting in agricultural activities.

An increase in the age of a farmer has a positive impact on living in drought and flood periods. household heads above the age of 45 years (62%) seem to have the urge to cultivate a more variety of crops and adapt to the effects of droughts and floods. Household farm sizes have an effect on farm household vulnerability to weather changes. 56% of the responses are of the view that the probability of being vulnerable to droughts and floods decreases as the household cultivated land size increases. Larger farms are found to enable farmers to employ a variety of adaptation methods that decrease the level of vulnerability of households to the weather related shocks. Similar to this, farmers with large farms can earn more income, allowing them to deploy better technologies to adapt to the negative effects of climate change. [Bedeke et al., \(2020\)](#), [Tessema & Simane \(2019\)](#) and [Zelege et al., \(2021\)](#) have similar findings on farmers' vulnerability to climate change.

3.3 Drought and Flood Mitigation Challenge

a) Early warning challenges

Droughts and floods alerts are frequently issued based on meteorological information, and warning. However, over 80% of the households indicate not to understand the provided messages well. Furthermore, multi-dimensional meanings and different interpretations of flood alerts provide explicit challenges to the effectiveness of warnings. Another main challenge is the difficulty in reaching the households. On one hand, the inhabitant

population is without adequate access to communication technologies to be informed about flooding. On the other, dissemination of warnings to at-risk organizations and people faces problems, due to the failure of communication systems. The low level of flood risk awareness is even evident in their historical development where no considerations have been made in modernization, internal migration, and urbanization, neither by public sectors nor by residents.

b) Inadequacies in empowerment communication

The semi-arid regions suffer from inappropriate infrastructures that cannot cope with droughts and large amounts of flood waters entering the system. 58% of the households state lacking knowledge concerning well-defined flood structural measures. The absence of mitigation measures makes the region not only highly vulnerable but also contributes to low awareness among both authorities and the public. The households associate the challenge to lack of stakeholder action oriented disaster education and local community engagement, forming a barrier to active involvement of the society in taking loss reduction measures. 65% of the households report that poor social preparedness is strongly connected to weak institutional frameworks, lack of management plans, and poor risk communication. The resultant poor awareness leads to ignorance of warnings, and in turn emerging high-risk behaviors. Lack of appropriate risk communication is stated by about 60% of the households to limit opportunities for knowledge sharing and risk mitigation. Another underlying factor is historically inaccurate risk communications, which destroy societal trust as well as sensitivity to future flood risks.

c) Lack of action plans

The local governance systems do not have defined action oriented framework towards droughts and floods. Over 70% of the households feel that the related calamities receive little attention among the authorities. Local experts are found not to broaden their knowledge about droughts and flooding and the specific characteristics in the semi-arid regions. The low knowledge and experience cause neglect by authorities therefore making it not seen as a top priority in disaster management considerations. Instead of a predefined systematic management plan, local public administrations often adopt crisis management protocols.

Table.6 Household Coping Strategies

Coping Strategies		[N=45]
1.	casual labor	14
2.	planting drought-tolerant crops	5
3.	crop diversification	5
4.	planting crops early	3
5.	changing eating habits	4
6.	received remittances	4
7.	borrowing money	6
8.	informal credit	3

Table.7 Strategies to address drought and flood risks

Strategy		[N=45]
1.	Setting institutional framework	14
2.	Developing hazard and risk maps	9
3.	Building capacity through participation	34
4.	Establishing integrated early warning system	9
5.	Monitoring of droughts and flood events	11
6.	Adopting sustainable land use practices	21
7.	Embracing integrated water resource management	16
8.	Establishing drought and flood action plan	14

The reliance of the government on emergency responses without public training also presents considerable challenges.

3.4 Household Coping Strategies

About 95% of the households do not adopt concrete strategies before the occurrence of droughts or floods. Majority (72%) associate the problem to limited warning information other than the local knowledge. 52% of the households blame lack of finance to restrict them from taking action in advance on the occurrence of drought and flood events. A common ex-ante practice is that of keeping livestock feeds in trees and stores which is not advertently done as a drought and floods adaptation measure but as a routine domestic animals sustenance degree. Planting crops adapted to waterlogging is a key ex-ante adaptation strategy to reduce the negative effects of flood events.

Ex-post adaptation strategies to droughts and floods risks are indicated in Table 6. The adaption of the coping strategies after the occurrence of extreme weather events are satiated to include casual labour (31%), borrowing money (13%), crop diversification (11%), changing

eating patterns (9%), receiving remittances from friends and family (9%), planting drought-tolerant crops (11%), informal credit (7%) and early planting of crops (7%). Casual labour is an important household buffering mechanism in response to low farming household income, especially in the case of low crop yields. It aids in protecting crops from extreme weather events and preparing for crop recoveries. The practice ensures a constant flow in a household's off-farm income, which buffers the impacts of droughts and floods.

Households that forecast drought based on their previous experiences select drought-tolerant crops, positing that the varieties have a positive impact on their crop yields. Farmers who have access to conventional weather forecasting often adjust to early planting of crops. Households explain changing eating habits through either reducing the frequency of mealtimes. Some attest to reducing the quantity of each meal and skipping meals. The source of borrowing money as a coping strategy is mostly informal and entails relying on family members and friends. The use of informal credit is common due to limited access to formal credit facilities at the local level. Crop diversification expands production-related activities on various crops, reduces the possible risk of climate

variations, and permits farmers to change crop types that are better suited to the prevailing climate regimes.

3.5 Strategies to address challenges

Table 7 shows measures vouched for to address the drought and floods menace in the semi-arid regions. 31% of the households prescribe participatory setting up of a sustainable institutional framework for droughts and flood management that can be capacity built to spearhead community mobilization for planning and action-taking against drought and floods. The development is found to assist in making informed decisions concerning adequate resources mobilization, plans and infrastructures interventions as well as responses. Joint training and education tools, which allow the exchange of knowledge and experience as well as providing better involvement of target groups, are in demand. 75% of the households are for building of capacity through participation to help make the public familiar with droughts and floods and inspire local people to become involved in every step of the management process.

About 20% of the households vouch for establishing integrated early warning systems, 25% for regular monitoring and observing droughts and flood events while 45% are for adopting sustainable land use practices. Practices such as soil erosion control measures, reforestation, and watershed management are foreseen to help improve soil structure and restore vegetation cover in these regions.

Furthermore, floodplain management are indicated to require paying attention due to flood damage resulting from dry during periods of heavy rainfall. Consequently, 36% of the households front the desire for embracement of integrated water resource management ideals in droughts and floods management to help balance competing demands for water in the semi-arid areas and diminish the associated risks. Flood water can be harvested to provide sources of water through groundwater recharge or water storage, especially for dry periods when the area suffers from water shortage.

Household small stock quantity ownership is shown to improve the strength towards vulnerability reduction. 65% of households indicate probability of being better in meeting their droughts and floods vulnerability needs as ownership of livestock increases. This is explained as due to the fact that households with larger herds can increase their income by processing and selling the

animals' products, giving them a greater capacity to respond to jolts. This outcome is in line with what (Tessema & Simane 2019) and Zeleke *et al.*, (2021) established in their studies.

Founding of a systematic drought and flood action plan is stated by 31% of the households to be a crucial strategy in the cycle of preparedness, response, and recovery to deal with related problems before, during, and after. In this regard, well-defined structural measures are recognized to play central roles which should be combined with non-structural measures appropriate for semi-arid regions. About 78% of the households point out that participation in social institutions as a proxy for social capital significantly reduces vulnerability to droughts and floods.

This is mostly a result of its resources contributions and improvement of information flow that encourage households, group, and community discussions that help achieve coordinated actions before shocks and a collective response following shocks. Similarly, participating in social organizations serves as a valuable resource that can be employed during shocks, helping impoverished households to obtain quick access to means that lower their susceptibility. This result resonates with those of Zeleke *et al.*, (2021).

4.0 Conclusion and Recommendations

Most of the droughts and floods challenges in the semi-arid areas are related to lack of planning at household, community and support institutional levels. The research recommends a multifaceted and integrated approach characterized by stakeholder collaboration to provide befitting knowledge and skills to concoct communities to reduce the vulnerability of their households and ecosystems. Conservation efforts that promote restoration and regeneration of natural resources should go alongside strengthening the capacities of residents on appropriate land use systems that fuse indigenous knowledge and modern technologies, as well as implementing strategies to effectively address household empowerment. Part of the efforts needs to be directed towards education on livelihoods diversification and financial strengthening for improved productivity to buttress resilience building.

4.1 Conflict of Interest

The authors declare no competing interests.

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