The Prevalence of Flood risk by farmers in Western Region Kenya

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Abstract- Flooding continues to be a common environmental hazard in both developed and developing countries. Crops, settlement and infrastructure are usually impaired wherever flooding occur. The severity of damage as a result of floods has been documented to have a relationship with the flood magnitude, flood frequency and settlement of population on flood prone areas. Whereas various intervention measures have been put in place to address this problem, the problem persists. Presently, floods are the most common hazards with the highest death toll economic misfortunes because of floods being higher than other hazards; Poor groups are more at risk because their livelihoods are vulnerable due to limited access to services and infrastructure. The need of studying people's risk perception levels in order to adopt effective flood risk management and disaster reduction programs cannot be overstated since prevalence of flood disaster risks by farmers in western region Kenya has been the issue throughout the study area. This has affected efforts to design and plan for proper intervention measures. Descriptive design was employed and Data collected using Questionnaires, interview schedules and Focus group discussion guide. Data analyzed using Scientific Package for Social Scientists (SPSS). Descriptive statistics was in the form of percentages and frequencies. Out of the 384 households sampled (49.0%) Nyando (50), Busia (238) indicated that the prevalence was moderate on flood risk control, (35.3%) Nyando (23), Busia (113) was slightly prevalent, (9.8%) Nyando (7) Busia (31) felt highly prevalence and (5.9%) Nyando (4), Busia (19) said no prevalence in any way. The Chi-square test conducted on opinion if SLMT has influenced flood risk in the various household gave ($X^3_{0.000}$= 26.10) which showed that there was three times highly significant (P < 0.01) variation on Flood risk prevalence. The area required more attention on Nature based approach methods that required providing Nature based solutions on flood risk. Policy makers are required to enforce the laws on Sustainable Land Management Technologies along the Flood prone areas to reduce impacts of flooding.

Index Terms- SLMT, Nature based approaches, Nature based solutions, Flood risks and flood prevalence

I. INTRODUCTION

Flooding has been recognized as one of the worst disasters (Chan et al., 2019). Hundreds of millions of people around the world have been affected by floods leading to social and physical losses and may have significant impact on the economic condition of a nation (Changnon *et al.*,2000). The worldwide distribution of natural hazards in the last decade, categorized by disaster type, was depicted in this study. It was noticeable that flooding was the most chronic natural hazards in terms of the number of occurrences and the impact on humans,(Ogie *et al*.,2020). There has been a dramatic increment of floods all over the world, both in developed and developing nations due climate change (Berndtsson *et al*.,2019). Presently, floods are the most common hazards with the highest death toll economic misfortunes because of floods being higher than other hazards, (Cornia *et al*.,2016). Poor groups are more at risk due to vulnerability of their livelihoods as a result of limited access to services and infrastructure (Richmond *et al*.,2018). Disaster Risk Reduction (DRR) strategies being cornerstone of formalized acts in reducing natural hazard-related disaster risk and giving the strategic direction for a sub counties, country or region to become more resilient to disasters (Peters *et al*.,2019). The substantial reduction of disaster loss and damage and the increase of local Disaster Risk Reduction strategies by 2030 has become a target of the Sendai Framework for Disaster Risk Reduction Vision 2015-2030, (Aitsi-Selmi et al.,2015).

However, the number of strategies in place did not guarantee a reduction of risk at local scale. Yields for African countries for example are well below the global average, and are almost one third of the yield levels of Asia and half that of South America due to flood risks. Displacing poor farmers and pastoralists from their traditional sources of water and land, thus forcing them to move to more fragile environments prone to Land and Resource Degradation (Bhattarai, 2019).

The literature in this study depicted that effective flood risk management and disaster reduction strategies could be implemented if farmers in flood-prone areas adopted sustainable land management technology at a higher rate as a nature based approach. The ecosystem based-adaptation being a strategy for adapting to climate change harnessing nature based solutions according to united nation Environmental program 2016.

Adoption rates of sustainable land management technologies by farmers at the flood risk prone area and understanding flood risk perception was conducive to the implementation of effective flood risk management and disaster reduction policies.

According to World Conference on Disaster Risk (WCDR) all states were called upon to adopt and requests the international community to continue assisting developing countries in mitigating effects of natural disasters and integrate Disaster Risk Reduction strategies into development planning. With Sustainable Land Management Technologies integrated into DRR and properly constituted into comprehensive development plan may help reduce flooding and enhance food security in the flood prone area.

Since its inception in the early 1970s, FAO has worked to meet a wide range of food and agriculture-related requirements and agricultural emergencies. It has been working on a number of projects related to Disaster Risk Management in various fields (such as early warning systems, vulnerability analyses, agricultural relief operations, drought management plans. More so, pastoral risk management, soil and water conservation techniques, and improving small-scale fishermen's safety at sea, as well as managing wild land forest fires were part of the project. More recently, FAO has launched initiatives to help member countries make the transition from emergency relief operations to better planned, long-term Disaster Risk prevention and preparedness strategies (Sarmiento *et al.,* 2015). These initiatives focus on integrating aspects of proactive Disaster Risk Management into ongoing agricultural sector development work. Disaster preparedness efforts greatly benefited from public input. This was especially true in rural areas, where stakeholders from all affected sectors and communities had to be involved in practically every move (Li *et al*., 2020). The need of studying people's risk perception levels in order to adopt effective flood risk management and disaster reduction programs cannot be overstated. Finally, an assessment of the role of Sustainable Land Management Technology in lowering flood risks considered the availability of funds to enable concrete results based on DRR measures proposed in national plans and the necessity of local-level implementation, which necessitated services and actions that aided local farming communities and promoted resilient livelihoods (Heidkamp *et al.,*2021).

In Kenya the flood prevalence by people in Western region therefore highlights the aspects to be improved in the DRR and inspired the National government consequently, (Tiepolo & Braccio, 2020). It was along these lines that governments needed to be more proactive in decreasing flood threat instead of being more reactive by offering post-catastrophe response and recovery, (Otieno, 2016). The study fulfills the gap identified that when the people's perception changes and accept to practice technologies that reduces impacts of flooding then livelihood will be resilient, Further empirical research is needed on flood prevalence and impacts realized by the community. Such information is imperative for policy-makers who are involved in the design of flood risk management policies, insurance companies who are interested in reducing flood vulnerability of their policy holders, and households and businesses who want to reduce the flood risk to their property (Kull *et al.,* 2013). This study, therefore, aims to provide data on the flood prevalence's on farmers in the study area. Flood damage savings are estimated using inferential statistics, data gathered by means of a survey of households who have experienced floods.

II. RESEARCH METHODOLOGY

2.1 Description of the survey and methodology

This study was carried out in two sub-county of Budalangi and Nyando. Busia County that host Budalangi extends from latitude 0º to 0º 45" North and longitude 33º55' to 34º25' East (869.3 km^2) and has 137 km^2 of its land under wetland conditions. Nyando Sub-County lies between latitude 0° 20' -0° 50' South and longitude 33° 20' - 35° 20' east. The area has a total of approximately 163km ^{2} and a population of about 73,227 persons. The flow regime of the Nyando is varied and has occasionally been as low as 2 m3/s and with extreme floods above 850 m^3/ s which indicates heavy siltation
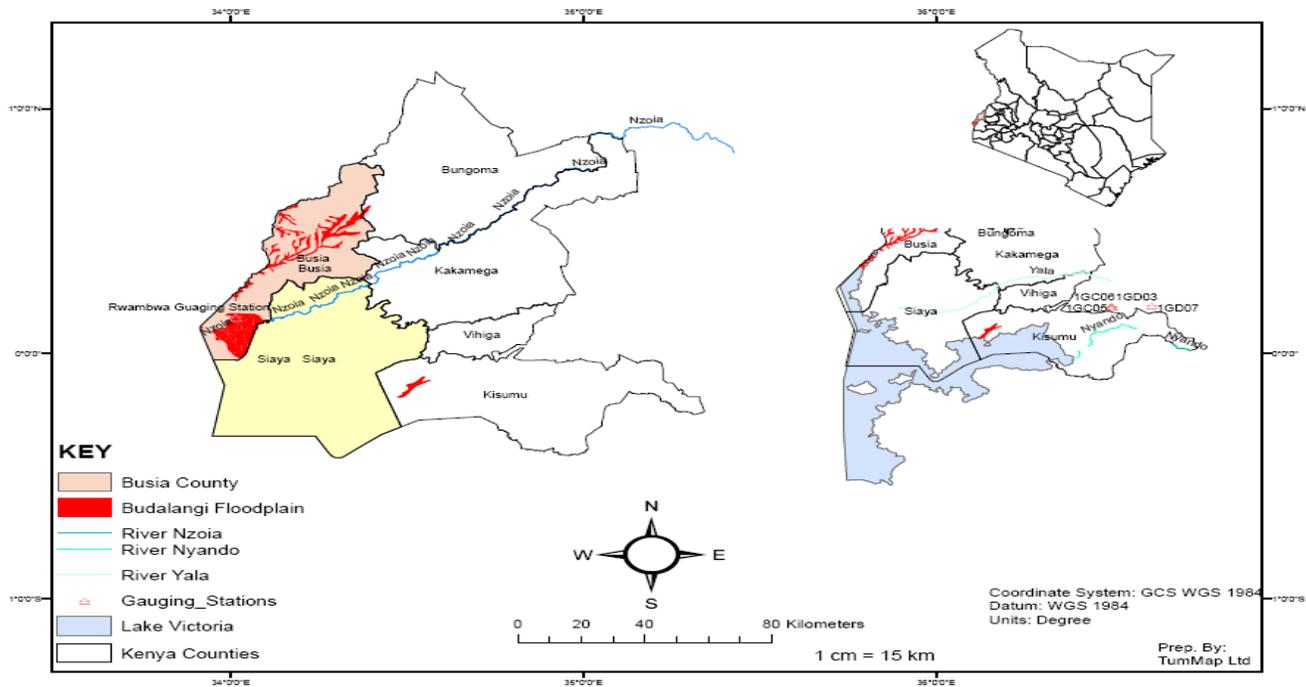
Figure 1: Study Map of Lower Nzoia River Basin and Nyando River basin showing administrative areas, rivers and elevation and Gaging derived from Digital Elevation Model (30m DEM) using ArcGIS 10.5

The research tools used in this study included structured household questionnaires, interview guides stakeholder KIs questionnaire and Focus group discussion. The descriptive survey was conducted in villages that were carefully selected on the basis of having experienced flood risks and the length of stay in the area in terms of years. A comparison between the demographic statistics and the socio-economic characteristics of the respondents who experienced flood risks was sought and results obtained. Correlational design was used and data analysis was achieved through use of descriptive statistics, Chi square test and spearman rank order correlation for various variables and results presented in tables figures and frequencies The sample is approximately representative with respect to certain characteristics, such as residence, gender, education, marital status and age in relation to flood risk protection, behavior, experience

and trust in existing nature based approaches to provide nature based solution to the locals.

III. RESULTS

3.1 The prevalence of flood risk by farmers in Western region Kenya

The researcher set out to examine the prevalence of flood risk on farmers. The first aspect was to look at the period the residence had lived in the area and the knowledge they had in relation to flood risk. Summary of the findings are indicated in table 1

Table 1: Household respondents on duration of stay in Western Region, Kenya

Duration of stay	Frequency		Percentage
	Nyando	Busia	
11-25 years	31	150	47.1%
above 26 years	35	168	52.9%
Total	**66**	**318**	**100%**

Chi-square test conducted on duration of stay in the area gave ((X^3 $_{0.674}$= 0.176) which showed that there was highly significant (P < 0.01) variation on duration of stay in the area by households. The Key informants and FGDs participants indicated that most of the residence in the area had stayed for long enough to be able to understand the flood risk and the impact expected from the flood risk. The issue of sustainable land management technology should not be something new to them since they have

enough experience. Duration of stay in the area provided room for the households within to be able to understand the flood risks they have experienced and be able to predict and find out measures put in place to help them develop resilience. Those who had no experience in terms of years of stay were not able to understand the flood risks as opposed to those who stayed long enough in the area

3.2 Knowledge on the concept of Flood Risk

The Key informants, interviewees and FGDs participants indicated they had knowledge on Flood risk occurrence and the impact accompanied by floods. Results summarized in table 2. Majorly the results indicated (96%) (Nyando 63) and Busia (306) respondents acknowledged that they understood what the flood risk meant and (4%) Nyando (3) and Busia (12) had no little knowledge on flood risk. Chi-square test conducted on knowledge on flood risk gave (($X^1_{0.001}$= (43.31) which showed that there was significant (P < 0.01) variation about knowledge on concept of flood risk by households.

Table 2: Household respondents on knowledge concept of flood risk in Western Region, Kenya

Knowledge on flood risk	Frequency		Percentage
	Nyando	Busia	
Yes	63	306	96%
No	3	12	4%
Total	**66**	**318**	**100%**

Source: Field data (2022)

According to New Jersey Department of Environmental Protection; the probability of floods occurring is multiplied by the value of the assets in danger. The probability of flood threats and the value of the assets at risk together constitute flood risk. This justifies that if people have the knowledge on the risks prevailing then practice of the SLMT that are to help in control of the problem should be embraced with ease (SLM baseline, 2011). This suggests that only after a specific amount of flood knowledge education would the public's perception of the risk of flooding improve. As a result, the government should mandate increased flood education in order to promote sustainability via technological means (Water, 2018). A correlation was carried out to understand how period of stay and experience on flood risk correlate and spearman moment correlation established and results indicated in table 3

Table 3: Correlations between duration of stay and experience on flood risk Western Region Kenya

Spearman's rho			Duration stay	Experience on flood risk
	Duration of stay	Correlation Coefficient	1.000	
		Sig. (2-tailed)		
		N	384	
	Experience on flood risk	Correlation Coefficient	.934**	1.000
		Sig. (2-tailed)	.001	
		N	384	384

** Correlation significant at the 0.01 level (2 tailed).

The results in table 3 shows that duration of stay had a strong positive significant correlation with experience on Flood risk in Western region Kenya (r_{s}= 0.934, p= 0.001. The results suggested that duration of stay played significant role on experience towards flood risk in Western region. The more years' people have stayed in the flood risk area the more experienced they have become in the issues of disaster risk reduction. The findings present a major shift in the study area where by households who had stayed more than eleven years and above showed to have more experience on issues preparedness and predictions on impact of flood risks compared to those with less period of stay. This study concur with that of SLMT baseline, who found out that people who have stayed in the area long enough they are well able to understand the risks and management. It disagrees with Rogers's innovation diffusion theory where he states that period of stay matters not but the acceptance and adoption of the technology is what matters.

3.3 Type of Houses lived by Households

The Respondents were asked to indicate the type of houses they occupied and the results shown in Table 4. (98%) Nyando (65) and Busia (311) respondents indicated they lived in single family houses and (2%) Nyando,(1) and Busia, (7) only managed to live in Block flat,. Chi-square test conducted on type of residence lived in gave (($X^1_{0.001}$= (43.01) which showed that there was minimal significant (P < 0.01) variation on type of houses lived in the area by households.

Table 4: Household respondents on type of houses lived in Western Region, Kenya

Type of Houses	Frequency		Percentage
	Nyando	Busia	
Block Flat	1	7	2%
Single family house	65	311	98%
Total	**66**	**318**	**100%**

Source: Field data (2022)

The results were backed up by interviewees and Key informants who concluded that the residence simply lived in single family houses because most of them had been affected by impact of flood risks often and any time floods occurred they had to migrate to higher and safer grounds. They simply dwelt on building simple houses that were cheaper and offered safety before flooding season. After the floods subsided, the displaced families returned to their houses. Those whose homes were wiped out in the floods rented new accommodations in the city areas. Due to lack of resources, this population was unable to return to their original residences. Some families relocated to live with non-displaced-related relatives. (Omungu, 2014)

3.4 Distance to the nearest river lived by the Households

The Respondents were asked to indicate the distance they lived near to the river and results are shown in the figure 1. (31.4%) Nyando (21), Busia (100) respondents indicated they lived about one kilometer near to the river, above 1km and about 500m at (27.5%) Nyando (18), Busia (88) each respectively and (13.7%) Nyando (9), Busia (44) lived less than 100M. Chi-square test conducted on distanced lived gave (($X^3_{0.300}$= (3.67) which showed that there was no significant (P > 0.01) variation on the distance lived by residence near to the river.
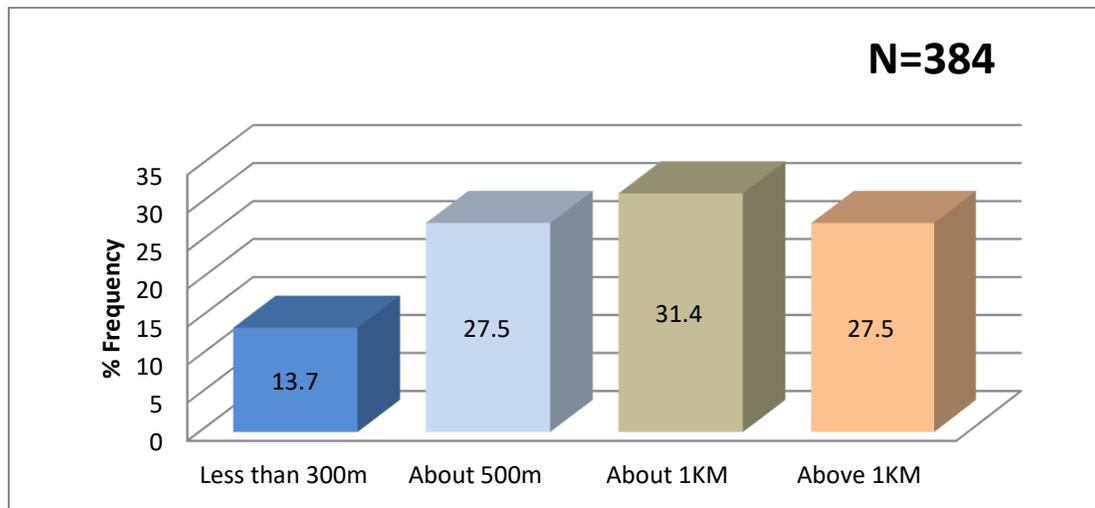

Figure 1 Household response on Distance to the River in Western Region, Kenya
Source: Field data (2022)

According to Omungu (2014), the majority of individuals who were forced to leave their houses were residents of the area's lower regions near the river, while the region's non-displaced residents were concentrated in its higher regions. This research confirms the findings of (Omungu, 2014) that the concentration of casualties was highest in areas close to rivers. The research contradicts (Water, 2018), who found that the impact of floods and people's perception of risk were the same regardless of how close or far away the affected area was. People had to find new places to live because their homes either flooded or were too chilly to live in. The distance a home or other valuable was located from the river bank likely determined how long flood waters lingered there. Evidence from the data showed, for instance, that homes located near the river channel were subjected to floodwaters for a longer

duration than those located in elevated locations. The length of time it takes for floodwaters to recede may also be affected by factors such as the soil type, the availability of flood drainage systems, and the presence of human settlements in valleys (Omungu, 2014)

3.5 The perception experienced on flood events

The respondents were called upon to state the feeling experienced in relation to damages due to flooding. Summary of the findings indicated in Figure 2. Majority of respondents (66.7%) Nyando (44) and Busia (212), indicated were mostly scared for loss of family lives, (13.7%) Nyando (9) and Busia (44) were scared of their own lives and afraid for property damage respectively, (5.9%) Nyando (4) and Busia (19) weren't scared at

all. The Chi-square test conducted on of feeling experienced on recalling flood events by households gave (X^3 0.0001= 48.05) which showed that there was highly significant (P < 0.01) variation on feeling experienced on recalling flooding events in the area by households. Since many people in the study region had to evacuate their homes, most people there were worried about the safety of their loved ones. People had to leave their homes because they were destroyed or because the water made it too chilly to live there. After the floods subsided, the displaced families returned to their houses. Those whose homes were wiped out in the floods rented new accommodations in the city areas. Due to a lack of resources, this population was unable to return to their original residences. Some families relocated to live with relatives who had not been uprooted.

The displaced population was concentrated in the lower half of the study region, whereas the non-displacement population was concentrated in the higher parts. This study agrees with that of (Omungu, 2014). The Key informants and Focus group discussion had similar sentiments that actually people were afraid of losing lives of their family members as opposed to other losses. However Loss of agricultural products was also a sentiment where Key informant extension workers indicted that after math of flooding food security has always been affected and most families have no food hence starvation is high. This therefore means that Sustainable Land Management technology when gets practiced ends up providing a solution to the Flood impacts. According to (WOCAT, 2008a), the environmental and sustainable development benefits of SLM are numerous. Adaptive management, incorporating land users and other stakeholders to use local knowledge, and paying attention to competing aims at the landscape or watershed scale all increase the benefits.
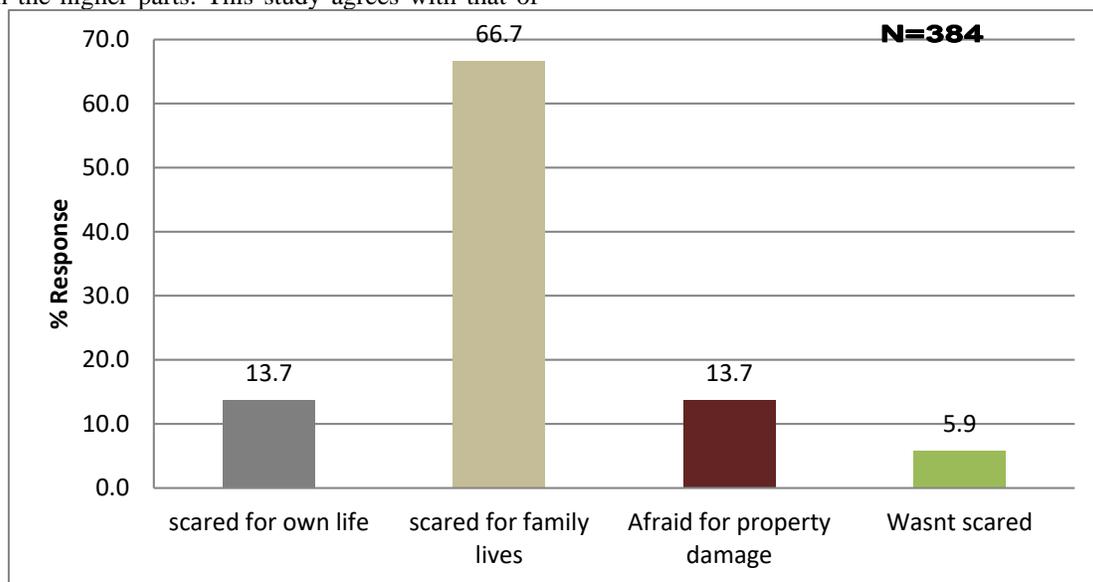

**Figure 2: Household response on Feeling experienced on flooding event in Western Region, Kenya
Source: Field data (2022)**

3.6 Flood disaster risks

The response on floods being dangerous to the households and community at large was summarized in figure 3. Majority (35.3%) Nyando (23); Busia (113) respondents indicated that it was due to lack of adequate protection from the concerned parties, (29.4%) Nyando (19); Busia (94)showed adoption of bad behavior from the community and households that exposed them to dangers of floods such as practicing of unsustainable land management technologies in the area such as mono cropping, overgrazing and deforestation that exposed the area into soil erosion hence flooding risks. (17.6%) Nyando (12); Busia (56) acknowledged danger of flooding was due to poor management by the local authorities and floods being unpredictable respectively. The Chi-square test conducted on the dangers of flooding by the household gave ((X^3 0.19= 4.77) which showed that there was highly significant (P < 0.01) variation on dangers of floods in the community households.
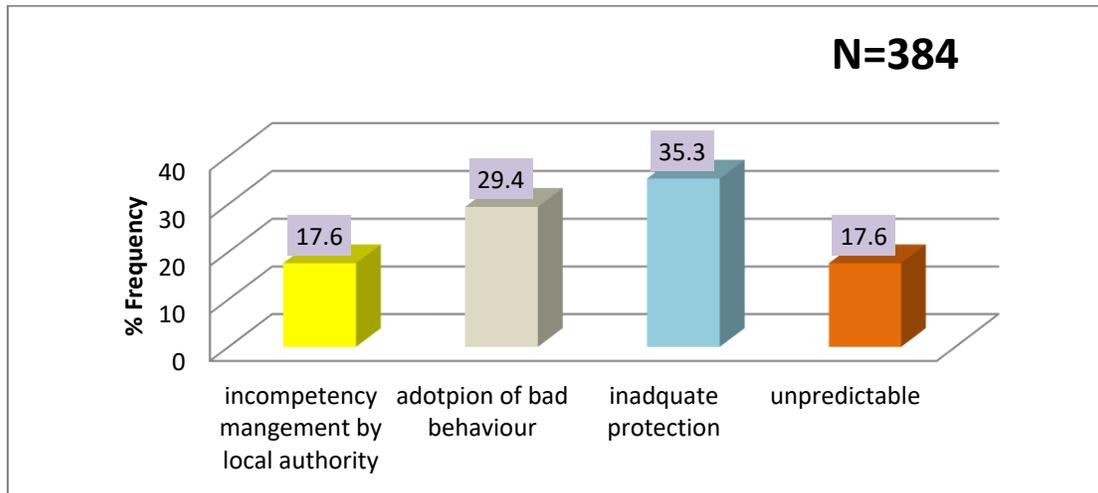
Figure 3: Household response on danger of floods in Western Region, Kenya
Source: Field data (2022)

On the dangers of the household agriculture losses was important because agriculture is a major source of livelihood in the study area. Destruction of agricultural assets due to unsustainable Land management technologies therefore means loss of sources of livelihoods and food insecurity resulting into poverty. Due to lack of adequate protection from the required agents flood risks and impacts have become thorns in the flesh of most households.

3.7 Flood preparedness

The responses on how well the community was prepared for the flood, findings are summarized in figure 4. Majority of the respondents (84%) Nyando (56), Busia (267) indicated they were never prepared for the flood event, (14%) Nyando (9), Busia (45) showed positive response on preparedness to face the flood event while (2%) Nyando (1), Busia (6) had no idea on what was happening. The Chi-square test conducted on how well prepared by households to face the flood event gave ($X^2_{0.0001}= 60.71$) which showed that there was highly significant (P < 0.01) variation on preparedness of flood event by households in the area. A flood risk has always been a big threat to the community and society at large whenever it occurs.

The foregoing results point to the importance of a two-way information exchange in facilitating conversation. Institutions will need to learn what locals find confusing about risk communication, according to a key source from the Kenya Meteorological Department in Busia, while others have suggested that better education and more straightforward language could help. Lack of communication and understanding between people of floodplains and experts/policy makers appears to be a more substantial and crucial gap than any difference in risk assessment between the two groups. These results were backed up by the FGDs members who indicated that mostly technologist used the technical language when passing information about early warning systems and so majority of the locals could not comprehend what was being communicated. However other members disagreed and said that most household heads were just ignorant and had no interest in the whole process. Some Key informants had a different approach where they said that sensitization was the key thing on issues of preparedness. The findings agree with that of (Masibayi, 2011) where he reveals that for people to be able to prepare for the Floods then timely offer of early warning system must be communicated in advance to pave way for preparedness.
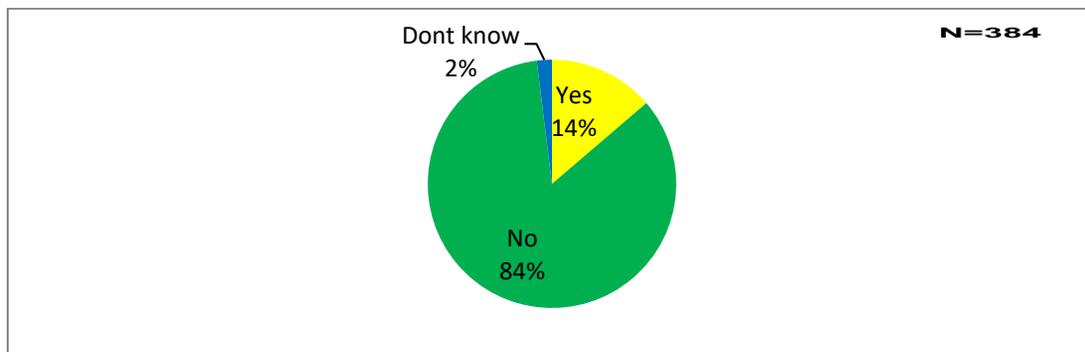

Figure 4: Household response on flood preparedness in Western Region, Kenya
Source: Field data (2022)

3.8 Training related to flood risk

Response on training attended results indicated in Figure 5. Majority (80%) Nyando (53), Busia (254) said they never attended the training and (20%) Nyando (13), Busia (64) had attended the training. The Chi-square test conducted on if the households attended any training of Flood risk gave ($X^3_{0.0001}$= 18.84) which showed that there was highly significant (P < 0.01) variation on training attended households on Flood risk.
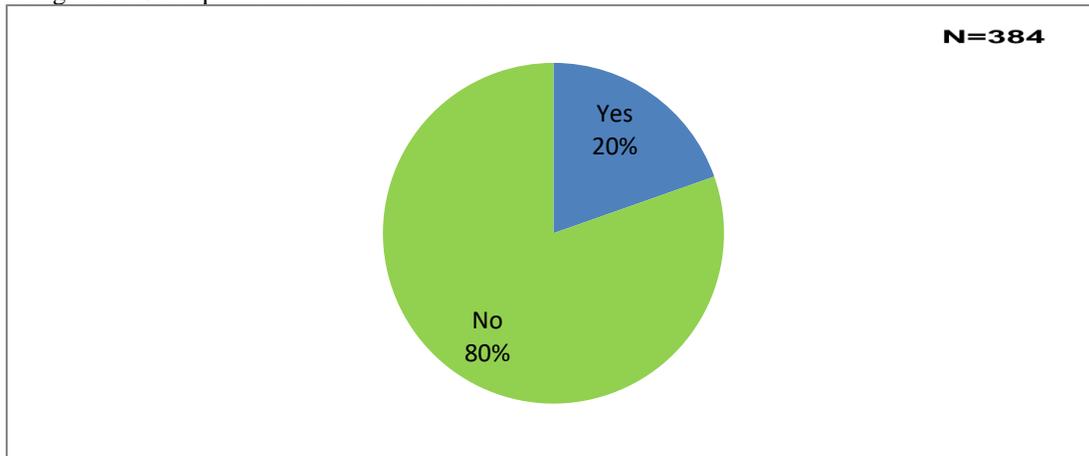

Figure 5: Household response on Flood risk training attended in Western Region, Kenya
Source: Field data (2022)

The public's perception of risk has been thought to be based on more subjective judgments of danger. Expert risk assessment and decision-making have relied on logical, objectively computed evaluations of likelihood. When pushed beyond the bounds of available evidence and relying on intuition, even experts' judgment appeared to be prone to many of the same biases as the public (Slovic *et al*., 2011). Consistent with the idea proposed by (Slovic *et al.,* 2011), this research shows that both specialists and the general public rely on subjective considerations when making disaster management decisions. There is a dis-connect between the technical community and the general population in other respects as well; notably, there is a failure to appreciate common problems and worries. According to the technical experts, locals' impression of flood risk is skewed, and they aren't aware of the true danger they face. The majority of technical responders agreed that some people living in floodplains do not fully grasp the concept of flood frequency. Experts in the field, however, could not agree on whether or not people in their communities get too much information that is too technical and difficult. Water claims that Education on floods has been found to have a significant impact on people's sense of safety. The perception of flood risk was lower among those who knew less about the factors that contribute to floods. Similar to other research, this one found that people with higher levels of flood knowledge education also had a higher level of flood risk perception. The perception of flood risk was lowest in the group that received the most information about flooding, while it was highest in the group that received the least. Trainings on flood risk problems are crucial for prevention and reduction of flood-related damage.

3.9 Rating prevalence of flood risk by farmers

The impact of floods has worsened and induced forced migration of the already vulnerable community in Western region. Result are indicated in Figure 6. Out of the 384 households (49.0%) Nyando (50), Busia (238) indicated that the prevalence was moderate on flood risk control, (35.3%) Nyando (23), Busia (113) was slightly prevalent, (9.8%) Nyando (7) Busia (31) felt highly prevalence and (5.9%) Nyando (4), Busia (19) said not prevalent in any way.
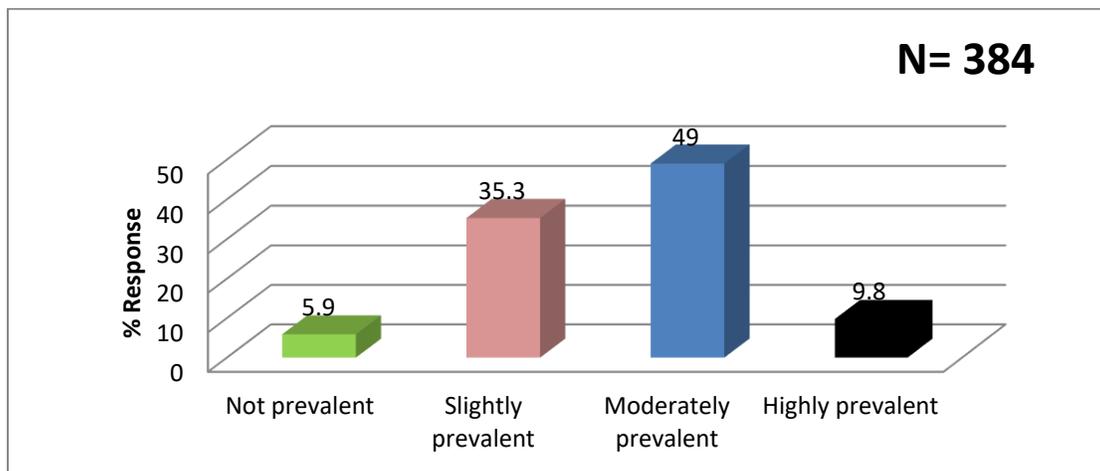
Figure 6: Households response rating of flood risk prevalence in Western Region Kenya
Source: Field data (2022)

The Chi-square test conducted the various household gave ($X^3_{0.000}= 26.10$) which showed that there was highly significant (P < 0.01) variation on Flood risk prevalence. The key informants and some members of FGDs from Busia pointed out that SLMT had a positive influence on flood risk impacts only that the government had not shown much interest in idea of helping the community to embrace the technology and the importance of adopting the technology as a way of reducing poverty and controlling the impact of flood risks using the Sustainable Land Management Technology. However, those from Nyando indicated that concerned authorities took it to be business as usual, cycle and the 'paper plan syndrome' rather than looking at it as a crisis that is an impediment to sustainable developments that requires broad-based and holistic approach. Land degradation is a central challenge to sustainable development. Sustainable land management had been defined as a system of technologies and/or planning that aimed to integrate ecological with socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and intergenerational equity (Hurni, 1997). SLM thus composed of the three development components; technology, policy and land use planning. A stakeholder impact and responsibility analysis has to be integrated in establishing sustainable land use practices in order to understand the interplay of factors, levels of interaction and the responses for addressing issues within the watershed. The main drivers within the integration of sustainable land use practices include local community, national and international organizations among others. The legislative and policy framework that yield to the adoption of the integrated management at watershed level, encourage the settlers within the river basin to adopt agricultural practices that increase agricultural output of which the enforcement is lacking. Communities have preferred to develop their own domestic legislation to enhance them practice the technology. Moreover, they embrace conservation practices such as cropping management and water conservation measures to gap flood risks.

IV.   CONCLUSION AND RECOMMENDATIONS

Conclusion
From the study it was clear that residents of Western region experienced lots of impacts from the floods that were persistent and that prevalence rate was moderate and highly significant. The region requires nature based approaches to provide nature based solution with little interference on the environment.

Recommendations
Based on the findings, for specific objective on examining prevalence of flood risk by famers it has been highly significant. However, it is possible to achieve sustainability if deliberate and pragmatic efforts from project implementers, farmers and trainers take in to consideration available time, not just for new activities, but also emphasize on the need to embrace nature based approach to reduce the flood risks.

Acknowledgements

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