

EFFECTS OF FLOODING ON SOCIO-ECONOMIC LIVELIHOOD OF THE FARMERS IN LOWER KANO PLAINS, KISUMU COUNTY-KENYA

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Abstract: Periodic flooding is a menace to agricultural activities in such regions due to disruptions on farmlands, grazing grounds, sweeping of human beings and animals, and socio-economic livelihood and infrastructure of the residents. The purpose of this study was to determine the effects of flooding on socio-economic livelihood of the households living in Lower Kano plain, Kisumu County. The study was conducted at Lower Kano plain for a period of three months and targeted 950 households, out of which 273 were selected using Fischer's formulae. The households were selected through purposive sampling and snow balling. The study employed descriptive survey design. Questionnaires, observations, and documentary analysis were used to collect the data. Quantitative data was analyzed using descriptive statistics as well as inferential statistics such as Pearson's product moment correlation. This study revealed that majority of the respondents (77%) agreed that during flooding, their health infrastructure were destroyed as well as impeding the accessibility of health services. Pearson product moment correlation coefficient analysis revealed that $r = 0.9428$, implying that there was a strong positive correlation between the duration of floods and the level of damage to agriculture. In conclusion, floods continue to disrupt agricultural activities in Lower Kano Plains by drowning animals, washing away crops, killing humans and destroying basic infrastructure. The study recommended that government should design sustainable mitigation measures to minimize the impact of floods and the associated risks not only in Lower Kano Plain area but also in other flood plains.

Keywords: Destruction of property, Disaster, Displacement, Floods, Livelihood, Socio-economic.

I. INTRODUCTION

i. Background:

The occurrence of flood is traced to biblical times where the Bible, in Genesis (Ch 6) details an extensive and expansive flood covering the world which is popularly referred to as Noachian Flood whose magnitude was so huge that it covered the highest of known mountains. To escape this flood, the bible explains of the intervention through a large boat constructed to house and transport a pair of each of the animals on the earth. Similar story is found in the Quran detailing the same flood with the similar intervention (Sura 11, and Sura 71).

In the contemporary world and in ancient Babylonian empire, there are stories of extensive, expansive and devastating floods: Gilgamesh on River Euphrates (Academy of Ancient Text nd) and Atrahasis on River Tigris (Byers nd).

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Bangladesh in 1974 recorded the biggest and the worst flood ever occurred due to monsoons. The whole nation had to deal with constant flooding which brought famine and many diseases along with it. This flood killed nearly 30, 000 and countless were seriously ill.

In sub-Saharan Africa, floods are one of the extreme climatic events that adversely affect the agricultural sector, and by extension affecting the households economically and socially (UNDP *et al* 2002). This climatic event often has results into deplorable socio-economic conditions defined by food deficiency, lack of usable water and the general lack of essential commodities with the overall impact being food insecurity (International Plant Protection Convention, (IPPC, 2001). For instance, the effect of flood in Nigeria has been extremely witnessed on the people in the community as well as the institutions they interact with (IPPC, 2001). According to United Nations Environmental Program (UNEP, 2007), the notable cases of the effect of floods have been observed in areas such as Sokoto and Usman Danfodio University as well as other areas experiencing floods leading to displacement of populations with the built environment destroyed and development inhibited. It has not only left several people homeless, destroyed their agricultural businesses and built properties. Therefore these devastating and recurrent effects of floods form the basis of this research. Some of these effects being similar to the scenario in flood prone areas in Kenya yet people still occupy these high risk areas over the years then this research thus attempted to find the reason behind people sticking in this vulnerable regions like lower Kano plains.

Flood may also cause adverse effects on socio-economic livelihood of the affected communities. For instance, according to assessments undertaken by the Zambia Vulnerability Assessment Committee, the recent heavy rainfall have contributed to reoccurrence of rapid floods with the overall effect being water logging in valley and or low lying areas respectively. This causes varying impacts on a number of sectors but mostly in infrastructure, agriculture, education, health, water and sanitation and habitation (Zambia In-Depth Assessment of Floods Report, 2007). Floods therefore not only affect agriculture but also people are affected socially as education, health and sanitation are likely to be affected. When the floods turn into disaster, many affected residents have to be moved to emergency camps set by public and private organizations. These camps are characterized with overcrowding thus causing inadequate supply of services. This results in disruption of normal schooling, outbreak of diseases rendering people unhealthy thus unable to attend to their farms. Thus this study aimed at developing a wholesome approach towards handling effects of floods.

Many parts of Kenya experience unexpectedly heavy rainfall in mid-April which continues through to the end of May (the long rains) and from September to November (the short rains) (Ouma *et al* 2012). The notable areas known for frequent and heavy floods in Kenya include the greater Lake Victoria Basin, areas of Budalangi and along the Nzoia river basin whose flood waters are attributed to Cherangani Hills (Nyakundi *et al.*, 2010). Secondly, Kano Plains is a prominent flood flooding area with water loading from Tana River and the hills in the expansive Nandi hills whose waters floods along the downstream areas within the river basin where water flows downstream from Mt. Kenya and the Aberdares (Ouma *et al* 2012).

It is estimated that, over 5,000 people are affected every year by floods in the lower Kano plains and this generally happens in the rainy season labeled as long and short resulting from heavy downpours within the catchment of the rivers (Mungai *et al* 2004:43). Nyando flood plains traverse a large area emanating from the higher terrain in Nandi and Kericho regions which experience high amount of rainfall during the rainy season whose effect is the devastating nature of the floods in the basin (Eitel & Ochola, 2006:1). It is estimated that the yearly economic damage in monetary terms averages US\$ 850,000 with another significant US\$ 600,000 going to rehabilitation interventions within Kano Plains due to the regular floods (Eitel & Ochola, 2006:1). This indicates how costly the effects of floods are to the government hence there is a need to come up with sustainable solutions to reduce the impacts of floods in flood prone areas and assess the current techniques that have been employed and improve them.

ii. Statement of the problem:

Several flood disasters are still experienced worldwide indicating that appropriate and sustainable measures have not been employed to reduce the flood menace. People still stay in flood prone areas despite the associated risks; animals are still swept away in an event of flooding; crops are still destroyed in farms; and various infrastructures are still destroyed thus affecting agricultural activities hence this gaps forms the basis of this research. Inadequate and lack of conclusive research on how flood affect agricultural activities, therefore forms the gap that the present study, which investigates the effects of flood on agricultural activities of Lower Kano plain, Kisumu County.

iii. Objective of the study:

The main objective of this study was to determine the effects of flooding on socio-economic livelihood of the farmers in Lower Kano plain, Kisumu County.

II. LITERATURE REVIEW**i. Theoretical Framework:**

Applying the ecological resilience theory to the current study is based on the fact that floodplains are areas where climate, socioeconomic trends, built systems, and riverine processes are affected by flood hazards and disasters. Therefore, adaptation and coming with coping mechanisms for good agricultural activities among the people living in flood prone areas such as Lower Kano plain is one of the fundamental basis of the ecological reliance theory.

ii. Empirical review:

According to Nott (2006) flood event is not considered to be a natural hazard unless there is a threat to human life and /or property. This therefore implies that in an event of severe flooding in populated areas then this would strike a disaster that would cause loss of human life and properties. This would also cause significant interruption of the ongoing activities of a given region/community. Risk (2005) states that studies undertaken show that the economic impact of natural disaster shows a marked upward trend over the last several decades. Developing countries tend to be hit by hazards and this increases their vulnerability and hence setting back their social and economic growth. Floods lead to death of humans, destruction of infrastructure, and degradation of the ecosystem; socially, floods leads to changes in people's way of life in terms of their politics, culture, health, environment, property rights and aspirations, Nott, (2006:54).Floods lead to destruction crops in farms and sweeping away of animals thus causing financial loss to farmers. This implies that farmers income level is reduced hence reducing their purchasing power and thus low living standards.

In Philippines a study by Bankoff (2007) on floods suggests that socio-economic factors such as land use practices, living standards and policy responses are increasingly influencing the frequency of natural hazards such as floods and the corresponding occurrence of disaster. Flooding has been responsible for displacement of people worldwide and the number of those displaced by natural disasters is rising, as the adverse effect of climate change continues to mount (Holmes, 2008). Statistics puts it that as many as 50 million persons around the world are estimated to be displaced each year by floods, tsunami, hurricane, earthquake and landslides (Holmes, 2008).This is the scenario in flood plain regions in Kenya like Budalangi and lower Kano plains where thousands of people are forced to relocate when floods occur (Gichere, *et al* 2013).This displacements implies that farmers are not able to manage their farmlands as they are forced to relocate for safety. Therefore farming cycle is interrupted as the required agricultural activities have to be postponed.

Barrows and Bruin (2006:1) found that flooding has been responsible for various deaths worldwide and of all the floods worldwide, 70% is experienced in Asia. Barrows and Bruin (2006:1) explains that among natural catastrophes, flooding has claimed more lives than any other single natural hazard. It is estimated that between 1986 and 1995, flooding accounted for 31% of the global economic loss from natural catastrophes and 55% of the casualties Barrows and Bruin (2006:1).Flooding has continued to claim lives of farmers both in lower Kano plain and Budalangi in Kenya. This necessitated this study as both human and animals have been swept away by flood water. In this case the agricultural activities are affected as the farmers are affected physically, socially and economically.

Spatial Hazard Events and Losses Database for the United States (SHELDUS) records that floods claimed the lives of 2,353 people from 1970 to 2000. On the other hand, the Federal Emergency Management Agency (FEMA) estimates that flood events are responsible for the death of more than 10000 people in US since 1900. It is evident therefore that due to climate change, effects of flooding are likely to become more common, prevalent and more disastrous in the future. Therefore flood mitigation policies and measures have implemented in order to enable vulnerable societies to increase their resilience to flood hazards. As much as this study emphasizes on floods causing deaths, it should be noted that there are people who have been living in this flood prone areas for several years but have never been killed by this floods Barrows and Bruin (2006:1). Therefore it is evident that they have adopted various skills that have helped them to survive in such conditions. The present study has tried to find out the coping strategies of the people living in flood prone areas (Lower Kano plain) through questionnaires as this assisted in improving the current mitigation measures and create resilience.

Socio-economically flooding also lead to destruction of the environment as a study conducted in Ghana by Armah, (2010), shows that in northern Ghana there was a decline in the environmental quality after the floods. This study points out that after floods, swamps emerged and this became breeding grounds for water-borne diseases due to water stagnation. Secondly, floods led to destruction of settlements, by physically breaking down houses, grain stores and socio-economic infrastructure Armah, (2010). This study also points out that floods led to the destruction of crops and farm animals. They also noted that as a result of flooding, there was accumulation of massive quantities of silt on structures such as water supply, sewage treatment and this paralyzed life-support and ecosystem services. This study basically concentrates on the negative effects of floods. However it should be noted that floods also come with positive effects. For instance, apart from silt blocking various structures they play a huge role in soil fertility. It is this soil fertility that promotes agriculture. With this soil fertility and uninterrupted agricultural activities are put together then abundant and quality yields will be achieved. When abundant and quality yields are realized then the living standards of farmers is likely to be attained. The present study would therefore, also look into economic benefits of flooding among the people living in flood prone areas.

According to Theron (2007), flooding of areas used for socio-economic activities produces a variety of negative impacts and the magnitude of adverse impacts depends on the vulnerability of the activities of the population, the frequency, intensity and extent of flooding. Theron (2007) in England found that social impacts of floods include changes in people's way of life, their culture, community, political systems, environment, health and wellbeing, their personal and property rights and their fears and aspirations. However, these literatures shows the impacts of floods on the general social development of the victims, but has failed to give any data on the effects of floods on agricultural activities of these victims and how the disaster can be managed. The present study attempted to focus on these areas in order to fill the gap by also putting emphasis on various infrastructures in lower Kano plains affected by floods and their impact on agricultural activities.

A study conducted in Australia by Flood Management in Australia (1998), the emotional behavior of many flood victims was shocking and the emotional costs was long lived. According to the study, follow up studies found that about one-quarter still had not recovered from the emotional trauma of flooding event. The severity of flooding, the degree of resulting financial hardship, age and socio-economic status are said to have contributed to the non-recovery of the victims. Their results indicate that elderly people on low incomes whose houses were deeply flooded were the most ill-fated. There is a likelihood of experiencing the same in lower Kano as the youths have left to towns leaving the elderly to take part in agriculture. This thus affects agricultural activities as the elderly who take long to recover after floods are the once left in this regions. Lindsell and Praterb (2003), puts it that social impacts can cause significant problems for the long term functioning of specific types of households and businesses in affected areas as poor people lack choices thus they are vulnerable to floods. They lack power, exposure to risk and minimal capacity to cope with shocks. Farmers especially in developing countries therefore are more vulnerable to this flood effects. This vulnerability makes farmers to have no choice but to experience the losses in an event of floods hence lowering their living standards. This study sought to assess the mitigation measures that can lead to empowering the farmers and increase their resilience.

Flooding as a disaster may also lead to family break-ups an ideal example was in Nepal, Chitwan district where the extended family system collapsed and this left the women and the elderly without support (Ariyabandu and Wickramasighe 2005). When families break up, the labour and capital required to carry out agricultural activities will miss thus affecting agricultural production. Lind *et al.*, (2008:143), argues that the loss in case of flooding has many dimensions. Apart from floods causing economic loss, they may also contribute to loss of life and injuries. In some flooding events losses are experienced on land which has cultural and historical values. This results into loss of nature and ecological valuables. This in turn reduces the potential of farmers to maximize their production hence causing low living standards by farmers.

In Kenya floods impacts are felt across various sectors of the economy including: agriculture, livestock, transport, housing, public health, industrial processing, and tourism (Otiende, 2009). Being that a farmer in lower Kano greatly at 80% depends on agriculture, and then they are likely to experience devastating losses after floods. This would reduce their purchasing power hence affecting their livelihood. The impacts have severe socio-economic and political implications.

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Otiende (2009) found that thousands of people in the country’s flood-prone areas were displaced and rendered homeless following destruction of their homes leading to internally displaced persons. Buildings and business premises were also affected during floods (Otiende, 2009). The destruction of irrigation infrastructure had an impact on the livelihoods of those dependent on irrigated agriculture. Herds of livestock died from drowning in the floodwaters during the El Niño flood of 1997/98. Pastoralists suffered from reduced incomes of which 68% is derived from livestock. This resulted in the complete collapse of the main source of income amongst the pastoralists and agro-pastoralists. In addition to direct loss of animals, the decrease in livestock marketability also affected income generation. Food consumption was also affected due to the decreased production of milk and meat from livestock. The loss of income also translated into loss purchasing power. The combination of low purchasing power and high food commodity prices worsened the situation as farmers are unable to purchase due to no income from agriculture.

III. METHODOLOGY

i. Research design:

This study adopted descriptive (ex post facto) research design. Descriptive research includes surveys and fact-finding enquiries of different kinds.

ii. Target Population and sampling technique:

This study was conducted at Lower Kano Plain in Western Kenya, and the households living downstream in Lower Kano Plains was the target population unit of analysis. According to Kenya National Bureau of Statistics, KNBS (2009) records, there are approximately 950 household in this region, with a total population of 4891. It is from this population that the study sample was obtained. From the total population of 950 households in the study area, a sample of 273 households was computed using Slovin’s equation and the participating households selected through purposive sampling. According to Strydom, Fouche and Delpont (2005), purposive sampling is entirely based on the judgment of the researcher, in that a sample is composed of elements that contain the most characteristics, representative or typical attributes of the population. Therefore the researcher identified households with close proximity to the River Nyando channel which had high probability of being affected when the river bursts its bank.

iii. Data collection, analysis and presentation:

Questionnaires were used to collect quantitative data whereby structured questions were drawn and presented to the respondents. Lower Kano Plain has a large population and the uses of a questionnaire were effective for capturing many respondents. Data analysis employed descriptive statistics, where, quantitative data was analyzed through Statistical package for Social Sciences (SPSS) software to generate, frequency distribution tables as well as inferential statistics particularly Pearson moment correlation. After the analysis, bar graphs, tables and pie charts was used to present this data.

IV. FINDINGS AND DISCUSSIONS

i. Socio-demographic characteristics:

In investigating the socio-demographic information of the respondents, respondents were asked to indicate their level of education, occupation and number of dependent they had. The number of dependents would reflect the burden experienced during flooding. The level of education was necessary to assess the knowledge of the farmers as regards to flooding and preparedness. The information on occupation was important in assessing the extent at which the population would be affected by floods. Details on socio demographic characteristics are presented in Table I.

Table I: Socio Demographic characteristics

Characteristics	Percentages
Level of education	
None	(12.5%)
Primary school	(50.5%)
Post primary school	(37.0%)
Occupation	

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Farming	(57.0%)
Business	(22.6%)
Civil servant	(6.1%)
None	(14.3%)
Number of Dependents	
0-5	(33.1%)
6-10	(50.8%)
Above 10	(16.1%)
Duration of floods	
0 – 5 months	(60%)
6 – 10 months	(28%)
11 – 15 months	(08%)
More than 21 months	(04%)

The findings show that slightly more than half of the respondents at 50.5% had only primary education and this could influence their socio-economic status in this area. This low level of education this is likely to affect agricultural activities because of lack of knowledge in modern ways of practicing agriculture, (Onyango et al., 2005). This would include aspects such as use of terraces, building of gabions, use of early maturing seeds and also ploughing across a slope to minimize soil erosion. Farmers who had not obtained basic education only practiced traditional methods of farming. The study found out that only 37% of the respondents had obtained post primary education. This explains the reason as to why the impacts of floods are severe. Over 60% lack the modern knowledge on practice of farming and modern knowledge on floods. This increases their vulnerability to floods as they are only equipped with the traditional knowledge of coping with floods.

Based on occupation of the respondents, the study found that 57.0% of the respondents were farmers. This shows that in comparison to other occupation farming is slightly higher though large number of farmers in this area would not practice large scale farming due to destructive nature of flood. The findings indicate that more than half of the respondents participated in agriculture. 22.6% were taking part in business while 6.1% were civil servants. The study also found out that 14.3% of the respondents did not have any clear occupation. According to this finding, majority are farmers thus an indication a great number of people would be affected if floods occur as their crops and animals would be at risk of being washed away.

In relation to the number of dependents, the study found that 33.1% of the respondents were having dependents of between 0-5, while the majority at 50.8% were having dependents between 6-10. Those above ten dependents stood at 16.1%. According to this findings majority of the respondents were having heavy burdens of taking care of up to almost ten people in some cases. This indicates financial constraints and explains why this people could not manage to come up with permanent or strong structures like houses that could withstand floods. Most of their incomes are directed towards feeding the dependents.

As regards to the duration of floods, majority of the respondents at 60% indicated that the floods would last between 1-5 months. This is supported by the previous work by Njogu and Otiende, (Njogu, 2002; Otiende, 2009). This duration of floods is instrumental as it helps to come up with the coping measure that would be applicable for the entire period. Five months of floods reflects a severe implication on agricultural activities. This implies that there is no agricultural activities that would take place until the waters resides.

ii. Effects of flooding on socio-economic livelihood:
a. Destructive Nature of the Floods:

The sampled population was asked to indicate based on their opinions on how floods could affect agricultural activities. The study therefore asked them to do this by indicating whether the following statement relating to floods and agricultural activities were true or false. Table II reveals that majority of the respondents who took part in this study agree that floods destroy their infrastructural facilities.

Table II: Destructive Nature of the Floods (n=273)

Destructive Nature of the Floods	True	False
	Percentage	Percentage
After the floods, lots of infrastructural projects were destroyed	89%	11%
Houses collapsed due to floods hence owners are forced to relocated	91%	09%
Households experienced crop damage due to floods	80%	20%
Food stock are lost as a result of floods	78%	22%
Animal stock are lost due to floods	75%	25%

Culverts were blocked by sediments resulting from flooding. Destruction of roads meant that even the little agricultural produce could not easily access the markets. About 91% agreed that houses collapsed due to floods hence people were forced to flee. This is supported by a study in Zambia which indicated that the floods caused displacement of people from their usual dwelling places resulting into varying impacts on infrastructure, crops, health, education, environment as well as damage to property (Zambia In-Depth Assessment of Floods Report, 2008). An average of 78 % indicated that households experienced crop damage due to floods; food stock was lost; and animals stock was also lost as a result of floods.

b. Effects of Floods in Education:

The respondent’s opinion was sought on how floods affected education facilities. Table III shows the responses.

Table III: Effects of Floods on Education (n=273)

Effects of Floods in Education	True	False
	Percentage	Percentage
During the floods school infrastructure such as classrooms were destroyed	88%	12%
Facilities such as desks and chairs were washed away by water	69%	31%
Children failed to go to school due to flooding in the area.	90%	10%
Roads leading to schools are impassable during flooding	94%	06%

(Source: Researcher, 2016)

From the findings, majority of the respondents (88% and 69%) agreed that during flooding, school infrastructural facilities such as classroom, desk and chairs were destroyed by the floods respectively. The study also found that during flooding, children failed to go to school as roads leading to schools were mostly destroyed. This was confirmed by 90% and 94% respectively. Destruction of school learning facilities by floods as depicted by the results were therefore some of the danger effects of floods on education. Destruction of education facilities hampered learning and in the long run affect the basic knowledge on good farming practices, people who are deprived of education are ignorant of the best agricultural activities. Effects of floods on education also encourages school drop-outs thus hindering this population from attaining the right information about flood preparedness and even how to embrace sustainable development in order to reduce the flood impacts.

c. Effects of Floods in Health:

The study asked respondents to indicate whether the following statement relating to floods and health were as to their opinion. The findings are shown in table IV.

Table IV: Effects of Floods on Health (N=273)

Effects of Floods on Education	True	False
	Percentage	Percentage
During the floods health infrastructure such as hospitals were destroyed	77%	23%
Accessibility of health services was difficult due to flooding in the area	91%	09%
Diseases such as cholera/malaria/fever / dysentery are rampant during flooding	84%	16%

(Source: Researcher, 2016)

The findings show that majority of the respondents at 77% agreed that during flooding, their health infrastructure were destroyed. The study also shows that flooding also impeded the accessibility of health services as was confirmed that majority of the respondents at 91%. Finally, the study found that as a result of flooding other diseases such as malaria, cholera, and typhoid were prevalent in the area, as indicated by majority of the respondents at 84%. The stagnating water provides ample breeding grounds for mosquitoes thus resulting to high rate of malaria. Secondly, the flooding water mixed with sewages and this got into the river channel. This water upon being consumed by the residents resulted into cholera and typhoid. This shows that on matters of health, flood causes a serious havoc ranging from inaccessibility of health services, destruction of health facilities, to pronouncement of certain diseases such as cholera, malaria, typhoid and dysentery. With respect to agricultural activities, areas with destroyed health facilities makes the communities in those areas are vulnerable for weak health, hence the farmers may not be actively involved in agricultural activities when they are not healthy or are of ill-health.

d. Duration of floods and corresponding damage:

In an attempt to find the relationship between the dependent and the independent variables, this study evaluate the relationship between the duration of floods and the damaged caused in monetary terms as an impact on socio-economic standing. Information about the previous floods in lower Kano plains and the correspondent loss on agriculture was obtained and a Pearson product moment correlation coefficient was run using SPSS. The study found strong positive correlation between duration of floods and the economic damage ($r = 0.9428$; $p = 0.003$) which was statistically significant. This shows that an increase in flood duration results into increased damage thus affecting the socio-economic status of the residents of Kano Plains in Nyando Sub County, Kisumu County-Kenya.

V. CONCLUSION

Socio-economically, flooding interferes with education activities as well as health service provision. For instance, destruction of classroom and other learning facilities and through interference with accessibility of schools, learning could be interrupted. The destruction of other social amenities such as electricity and roads could also interfere with trade in the area. On health, flooding could promote waterborne diseases such as cholera, dysentery, typhoid and bilharzia. On the other hand, the destruction of health facilities and accessibility to health facilities could also affect proper healthcare in the area. The study recommends that community initiated mitigation measures should be promoted so as to build community resilience and in the long term, community based floods early warning system should be developed. Multi-sectoral approach to flood mitigation as opposed to single sector should be promoted as there are inter-linkages in terms of flood impact on various aspect of society.

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