

# Loss and Damage from Flooding In Lower Nyando Basin, Kisumu County, Kenya

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**Abstract:** Floods are becoming the most disparaging environmental catastrophe threatening lower Nyando basin, Kisumu County, Kenya. They have serious effects on the social, economic, environmental, physical and psychological wellbeing of people. Knowledge about the economic and social implications of these floods, therefore, formed the basis for this research. The study targeted 384 heads of households, Govt. officials, heads of NGOs, FBOs, as well as CBOs. The research the survey research designs. Simple random technique was used to select the household heads. Both primary and secondary data were sourced using questionnaires, interviews, FGDs; direct observation and document analysis. Descriptive statistics were used in data analysis. Findings reveal that (71.1%) of the respondents were affected by floods. Households were forced to relocate to alternative areas while some households sent their children to stay with relatives. Relationships within the family were also tested by living in temporary accommodation. This, in a way disrupted their pattern of life and social networks. Loss of their furniture and hardware was reported as well as traders suffering great loses due to loss of income generating activities. There was hiking of fare during the flooding season. Concerning meals, households reportedly ate fewer meals per day; some resorted to cheaper foods, while others reduced food portions. The study posits that tangible impacts of floods were more severe than intangible effects. The study concludes that, both government and households recognize the seriousness of the flooding problem and cognize the need to mitigate its impact. Flood warnings and insurance can help mitigate flood impacts.

**Keywords:** Floods, Households, Impacts, Nyando basin.

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## 1. INTRODUCTION

Floods have been observed to disrupt personal economic and social activities and set back a nations development and security. Globally, water-related disasters have posed major impediments to sustainable socio-economic development, as witnessed with disasters such as the Indian Ocean tsunami in 2004, Hurricane Katrina in the USA in 2005, Cyclone Sidr in 2007 and Cyclone Nargis in 2008 (UN, 2009).

In Africa, floods have largely affected countries in Western, Central and Eastern Africa regions. According to United Nations, at least 1.5 million people in 18 African countries have been affected by floods, with hundreds of thousands of people displaced and nearly 300 killed, (Smith, 2007). In September 2012, floods forced 15,000 people to leave their homes in northern Uganda where the deluge destroyed houses, crops, roads and bridges. These floods also affected the re-opening of schools (IRIN 2012).

Kenya's record of disasters indicates the worst floods were recorded in 1961-62 and 1997-98, the latter ones being the most intense, most widespread and the most severe. During this season the flooding was associated with the *El Nino* phenomenon. *El Nino* is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe (UNDP, 2004).

According to the Kenya Flood Mitigation Strategy (KFMS, 2009) floods are a recurrent problem in Nyando basin and an estimated 5000 people are affected by the flood in the area every year. The actual damage caused is estimated at 37 Million Sh. (Otiende, 2009). This phenomenon has serious impacts on the social, economic, environmental, physical and psychological wellbeing of people and even on the political and institutional levels of the country.

## 2. LITERATURE REVIEW

Loss and damage is an issue of growing importance for the international community as no country will escape the impacts of climate change (IPCC 2014). Loss and damage emanating from climate change could eventually result in loss of income or damage to property and assets and non-economic which include the cultural social and mental impacts of climate change as well as the loss of biodiversity and ecosystem services among others (Morrissey and Oliver-Smith 2013).

Theron (2007) indicated that at least 20 countries in Africa were affected by floods. These countries included Algeria, Benin, Burkina Faso, Cote d'Ivoire, Ethiopia, Gambia, Ghana, Guinea, Kenya, Liberia, Mali, Mauritania, Nigeria, Rwanda, Senegal, Sierra Leone, Sudan, Togo and Uganda. Reports estimated that approximately 300 people in 20 countries had died in floods during a period of two (2) months, noting that the inaccessibility of the affected areas had made it difficult to accurately access the death toll.

UN/ISDR (2005) observed that the economic impact of natural disasters shows a marked upward trend over the last several decades. The hazards were inclined to hit communities in developing countries especially the least developed countries, thus increasing their vulnerability and setting back their economic and social growth, sometimes by decades. Floods have led to loss of human life, destruction of social and economic infrastructure and degradation of already fragile ecosystems.

The physical impacts of disasters include casualties (deaths and injuries) and property damage and both vary substantially across hazard agents. The physical impacts of a disaster are usually the most obvious, easily measured and first reported by the news media. Social impacts, which include psychosocial, demographic, economic and political impacts, can develop over a long period of time and can be difficult to assess when they occur (RPA, 2005). The consequences of floods, both negative and positive, vary greatly depending on the location and extent of flooding, and the vulnerability and value of the natural and constructed environments they affect.

An additional dimension on the basis of which the consequences of flooding can be categorized is the division between primary and secondary effects. According to Parker (2000) primary effects are the 'first-round' or immediate effects. These immediate effects trigger further losses, which are termed secondary effects. The idea is that floods affect not just the property directly affected and the related indirect economic transactions, but that the impact spreads into the neighboring economic units by a general disruption to the regional economy (Penning-Roswell, et al., 2005). Besides, flooding can also be classified as internal or external.

UKELA (2010) stipulates internal flooding is used to designate flooding in a building, while external flooding points at the flooding in a garden or other open space such as roads or public grounds. Other definitions for internal and external flooding exist. Reyns, et al., (2008) define those effects that lay inside the flooded area as internal. The effects outside the flooded area are designated as external. Below is an overview of flood consequences.

**TABLE.1: Overview of flood consequences**

Direct effects		Indirect effects	
Tangible	Intangible	Tangible	Intangible
Damage to buildings	Loss of lives	Production and income losses	Increased vulnerability of people
Damage to infrastructures	Physical and mental health effects	Clean up costs	Inconvenience caused by disruption of utility services
Damage to crops	Loss of memorabilia and irreplaceable items	Costs of evacuation	
Damage to inventories and consumer goods	Loss of ecosystem	Increased travel costs	

(Source: Researcher, 2014)

Coninx, et al., (2009) define social impacts as impacts that can be experienced physically or mentally by humans at different levels which include individual, family or community. These are induced by changes in the physical, economic, cultural, ecological or social system and which alter the way people live, work, relate to one another or organize to meet their needs and generally cope as members of society. Most social flood risk assessment methods or indicators take the number of people exposed as the starting point. Often the number of people exposed is approximated using data on the number of people living in the flood risk area.

Loss of livelihoods, reduction in purchasing power and loss of land value in the flood plains can leave communities economically vulnerable. Floods can also traumatise victims and their families for long periods of time. The loss of loved ones has deep impacts, especially on children. Displacement from one's home, loss of property and disruption to business and social affairs can cause continuing stress. For some people the psychological impacts can be long lasting (Apan, et al., 2010).

The flow-on effects of reduced agricultural production can often impact well outside the production area as food prices increase due to shortages in supply. On the other hand, flood events can result in long-term benefits to agricultural production by recharging water resource storages, especially in drier, inland areas, and by rejuvenating soil fertility by silt deposition. Damage to public infrastructure affects a far greater proportion of the population than those whose homes or businesses are directly inundated by the flood. In particular, flood damage to roads, rail networks and key transport hubs, such as shipping ports, can have significant impacts on regional and national economies (WMO, 2011).

Ninno, et al., (2003) revealed that the 1998 floods in Bangladesh caused severe damage to the rice crop and threatened the food security of tens of millions of households. Government food transfers to the affected people helped limit the impact of the flood on household access to food. The flood led to major crop losses, losses of other assets and lower employment opportunities and thus affected household income as well as market prices.

In Asia, following the 2004 tsunami, and in the USA following Hurricane Katrina, developers moved in and took over land, thus increasing people's existing social vulnerability (Klein, 2007). Increased insurance premiums following a flood may make the insurance prohibitively expensive, or it may only be affordable at the expense of some other resource, thus compromising the quality of life of individuals or households. Enders (2001) also argues that loss of resources can lead to high costs of goods and services, inflation and loss of economic growth of the region or the country at large, delaying its development programs.

There are also indirect consequences of the following upon the life conditions of the poorest strata of society. Alexander (1993) avers that widespread destruction of crops, food stocks and food distribution systems lead to food shortages and malnutrition, especially among infants and poorest, in the most isolated sectors of the community. Alexander (1993) concludes that, the impact on settlement and the economy comprises damage to housing, buildings and infrastructure, loss of household effects, depreciation of property, reduced output, loss of business income and rising prices which creates in the Third World distinctive and particularly serious outcomes.

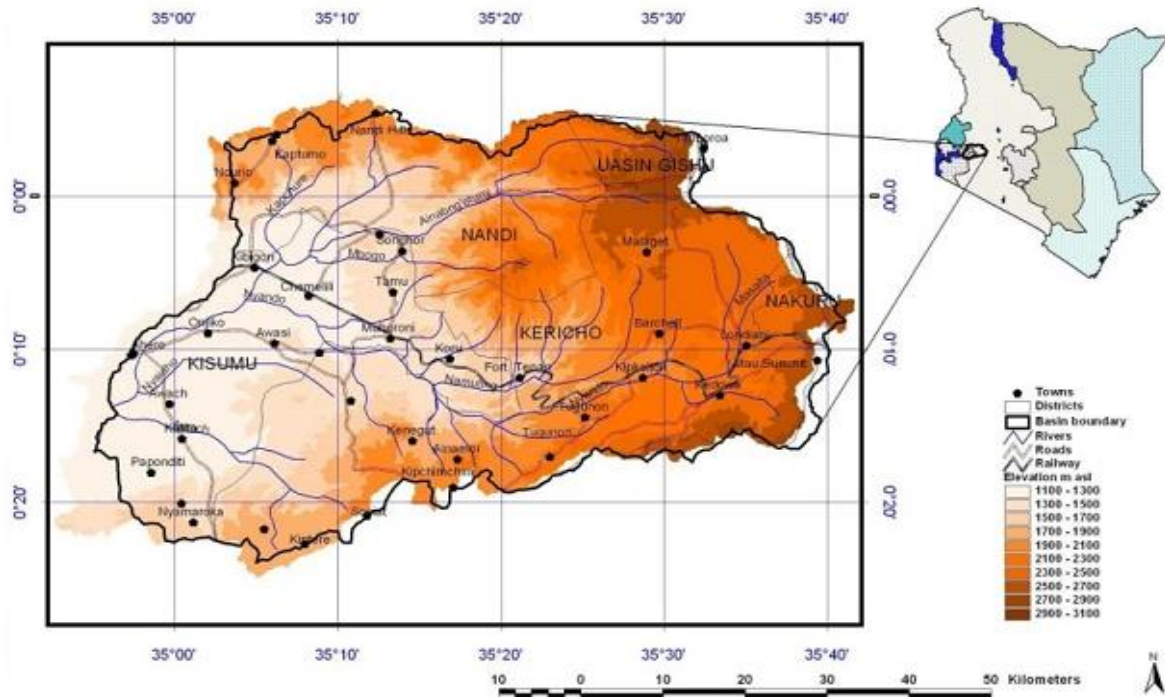
Nelson (2012) noted that floods also have a positive impact to the communities that live in flood prone areas. Firstly, floods provide jobs to the community who take advantage and transport people from place to the other at a cost; secondly, they revive ground water as seen in countries like Bangladesh which depend on ground water and underground aquifers for fresh water; thirdly, floods also balance the health of ecology of the wetlands which in turn promote healthy water supplied and improve the surrounding air quality. Fourthly, he further states that flood contributes fresh water and waste to the wetlands that carry and deposit nutrient-rich sediments that support both plant and animal life of the wetlands; and finally, floods return nutrients to the soil by distributing and depositing river sediments which replenish nutrients in top soils making agricultural lands more fertile.

There is evidence that flood risk is increasing and continuing vigilance is needed to ensure that existing systems are maintained and improvements introduced. It is imperative that human society adopts a risk management approach if there is to be harmonious coexistence with floods. In practical terms, the chance of flooding can never be eliminated entirely. Further, it's clear that most flood studies acknowledge that floods have had negative impact on people. However, the studies have tended to address the subject matter depending on the objective of the study. This paper presents findings on socio-economic loss and damage from floods which include financial loss, loss of productive assets, loss of household items, transport difficulties and loss of livestock on rural households in Nyando basin.

### 3. METHODOLOGY

#### Study site:

The study was done in Nyando basin. The Nyando River Basin covers an area of 3500 square kilometers in Kisumu County. The Nyando River catchment straddles the equator bound by longitudes 34°45' 0"E and 35° 21"E (Figure1). Over 5,000 people are affected every year by floods in the area during (April-June) long and (October-November) short rainy season's (Otiende, 2009). The average annual damage is about US\$ 850,000 with annual relief and rehabilitation measures costing US\$ 600,000 in the Kano Plains (Eitel and Ochola, 2006). The area therefore provided a fertile environment for this study.



(Source: WKIEMP, 2006)

**Fig.1: Map of Study Area –Lower Nyando Basin, Kenya**

#### Study population and sampling:

The study targeted household heads that formed the basis of the study which was to investigate the adaptation mechanisms of households to flood risk in lower Nyando Basin, Kenya. Targeted stakeholders were the Kisumu County Commissioner, Deputy County Commissioners, Chiefs, Sub-chiefs, and Village elders, Faith Based Organizations (FBOs), NGOs like CARE, Red Cross, Action Aid, Ogra Foundation, Victoria Institute of Research and Development (VIRED), Japan International Co-operation Agency (JICA), Omega Foundation and insurance company managers who were all interviewed to establish their role in mitigating the effects of floods.

Purposive sampling technique was used to select the three locations under study. Two out of the seven locations in Nyando sub-county and one location in Muhuroni sub- County were selected because of the high risk of flooding associated with these locations. Considerations were applied on the basis of meteorological information by the Kenya Metrological Department (2012/2013) on the extent and frequency of flooding, discussions with the village elders on the area's history of flooding, close proximity to the river and subsequent visits to the area. The final selected areas of study were high-prone flood locations identified as Wawidhi and Kakola in Nyando Sub--County and Ombeyi in Muhoroni Sub-County respectively (GoK, 2009). The locations that had not experienced flooding were left out because they would not yield the required data for this study.

In order to take a random sample, a sample frame in the form of a list of all the household heads in each of the villages / clans was drawn with the help of local leaders who acted as gate-keepers to this study. The names and/or identification numbers of all household heads were written on pieces of papers; whereupon the desired sample was selected by picking the required number of papers. This was done by using the lottery method whereby numbers/names representing each element in the target population was placed in a container and thoroughly mixed. The researcher then blindly selected chips from the containers until the desired sample size was obtained. Gate-keepers who were conversant with the villages aided in identifying the selected homesteads.

#### Data collection:

The study collected both primary and secondary data. Different research instruments were used for complementary purposes. This ensured a triangulation approach to data collection. The study used a questionnaire, key informant interviews schedules, FGDs, and Observation check lists as tools of data collection. Questionnaires were administered to the sampled household heads. Focus Group Discussions were carried out among groups of 8-12 persons particularly heads of households and stakeholders. This work was supplemented with site visits to those areas that had been affected by flooding.

#### Data analysis:

Qualitative data was obtained from the open ended sections of the questionnaire and interviews and analyzed using the thematic approach. Analysis was done by use of descriptive statistics (percentages, and frequencies). This was used in describing and documenting the state of affairs as they were.

#### Research objective:

The main objective of this study was to examine the socio-economic effects of floods on households in lower Nyando basin.

## 4. RESULTS AND DISCUSSION

#### Loss of Productive Assets:

Floods have far reaching implications on the livelihoods of households which is suddenly lost but which is felt for many years to come. In this study, respondents were asked to indicate their experiences on productive assets during floods. The responses were summarized in Figure 2.

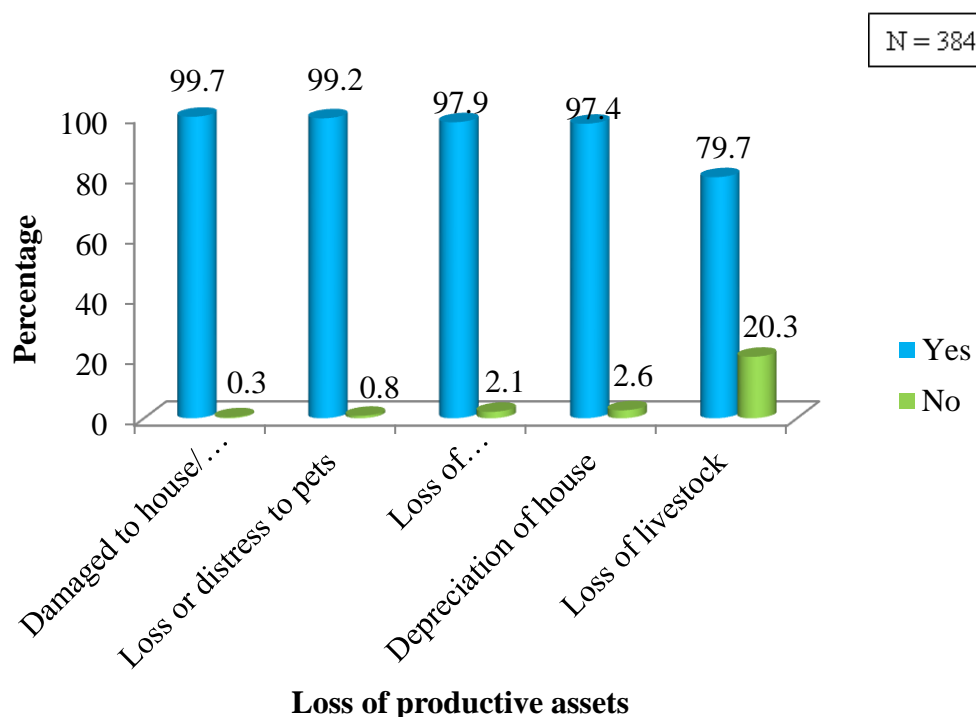


Fig.2: Loss of productive assets



Out of the 384 sampled households, 383 (99.7%) indicated that their house belongings were damaged while 1 (0.3%) did not. Furthermore, 374 (97.4%) reported depreciation of house value with a paltry 10 (2.6%) not reporting this effect. About 381 (99.2%) of the households whose houses were impacted by floods also reported loss and distress to pets while 3 (0.8%) did not.

The results of this study are in agreement with Tobin and Montz (1997) who demonstrated that the value of houses decreases immediately after flooding, but recovers 2-3 years later and (Yeo, 2003) who noted that investment in a flooded area would have a knock-effect on housing if substantial migration occurs. Findings of a study by RPA (2005) in England and Wales show that damage to and loss of memorabilia and irreplaceable items was ranked as a major impact by respondents. Although ranked below the effort of getting a house back to normal, having to leave home, and anxiety about future flooding, the loss and damage of memorabilia was ranked above health impacts. From FGD findings, it emerged that some households were forced to relocate to alternative areas while some households sent their children to stay with relatives. Relationships within the family were also tested by living in temporary accommodation. This, in a way disrupted their pattern of life and social networks. Some moved temporarily to higher grounds and returned to their usual residence later.

One participant noted that:

It is very difficult to maintain family cohesion when children are sent to live with relatives and friends. Floods will break family units in Nyando: basin. (Source: Field data, 2014).

Some of the respondents explained that they had rented their houses and therefore had no authority to make structural changes to homes without the consent of their landlords. This confirms the assertion that those who rent are more socially vulnerable. A number of respondents 374 (97.4%) reported that flooding affected their houses in two ways: in monetary terms and in terms of security value. They concluded that prices go down because of damage, but also because of undesirable living circumstances. However prices may rise as well, because of the sprucing up and the reparations of properties. Secondly, the security value of property, which is an intangible aspect, can be lost by flooding. It means that people lose the sense of place, feel insecure, loose trust and do not consider their homes as safe places after being flooded. One speaks of a loss of sense of security. Some heads of households explained that they recognized the importance of mitigating the impact of flood risk but they simply did not have the money for structural changes and were ready to take risks. Interestingly, participants expressed a positive will to move permanently to safer land should alternative fertile land be secured by relevant authorities, thereby going against popular belief that many residents were not willing to move out of this area because it was their ancestral land.

Livestock keeping is an inseparable part of agriculture in the Nyando basin. Large numbers of people own livestock mainly because of availability of grass and water. Major types of livestock in the area are cattle, goats, sheep and chicken. Pets include cats and dogs. Local people rear cows for dairying. Oxen were reared for ploughing. The study sought to find out the effects of floods on livestock.

From the survey 306 (79.7%) of the respondents reported loss of their livestock during floods while 78 (20.3%) did not. 381 (99.2%) reported distress to their pets while 3 (0.8%) did not. This was confirmed in the FGD where participants testified that they lost goats, sheep and chicken. For those who owned cattle, luckily, their animals survived as they would wade in water and therefore did not drown. These livestock were found majorly to be of local breed and were sometimes sold at the local markets for subsistence, pay school fees and sort out medical problems but did not fetch a lot of money.

It also emerged from the FGD that during flooding, the major problems faced in livestock rearing were loss of pasture and outbreak of livestock diseases caused by flood waters as well as death of livestock caused by diseases especially if they were not treated early. The study found out that the floods of 2012 killed around 220 heads of livestock including cows, oxen and goats. Moreover more than 1500 chicken, goats and sheep were swept by the floods in April 2013 (Field survey, 2014).

They then sold the remaining livestock to sustain their family income. From the households surveyed it was found that 5 households did not have any livestock at all, whereas 19 households had more than 4 livestock and rest of the surveyed household had 1-3 livestock; mostly cows. It was also mentioned that pastures were always submerged in water hence the livestock lacked where to graze during the floods. Similarly, respondents reported a high frequency of some infectious and epidemic livestock diseases that affected the surviving livestock after floods which they attributed to having been

brought about by the flood waters hence some people resorted to selling them at throw away prices while others suffered losses due to the death of the livestock. This finding concurs with Mogaka, et al., (2006) who reported that herds of livestock died from drowning in the floodwaters during the El Niño flood of 1997/98 in Tana River. According to a livelihood zoning exercise undertaken by World Bank in 30 districts in the country following the 1997/98 El Niño, most sources of livelihoods in Tana River and Garissa districts like fishing, subsistence cropping, urban and pastoralism, dry riverine, and agro-pastoralism were negatively affected (GoK, 2007).

The study also established from the FGD in Wawidhi that some of the households also enjoyed positive effects of floods. It was revealed that during flooding, residents in the study area welcomed floods as they provided rich alluvial fertile soil for planting, plenty of fish, water for domestic use and irrigation and relief from NGOs, government and other stakeholders. It also emerged that these were some of the reasons that made them not to move out of this area burdened with floods. This finding concurs with APFM (2013) that floods have beneficial impacts like recharging water sources, agriculture, fishing and rejuvenation of the river ecosystem. This implies that victims of floods may not readily accept to be relocated to safer sites because of the benefits they enjoy.

Floods can cause a lot of material damage to houses, household goods, gardens and vehicles. Water entering living spaces is devastating and this would be a pointer to the loss of their house value during floods as seen in plate 1.



**Plate.1: House Destroyed by Floods**

Photographs, videos, letters, pets and gifts are items of personal value, and they denote milestones in a person's life. These items are bonds with the past and losing them is partly losing the owner's identity. The study found out that the loss of personal items is experienced as being severe, 376 (97.9%) of the respondents reported to have lost sentimental items during floods while 8 (2.1%) did not report this incident. From the FGD discussions, it emerged that the loss of these items affected their mental health. The loss of family photos was particularly acute for the elderly for whom these items were amongst the most cherished.

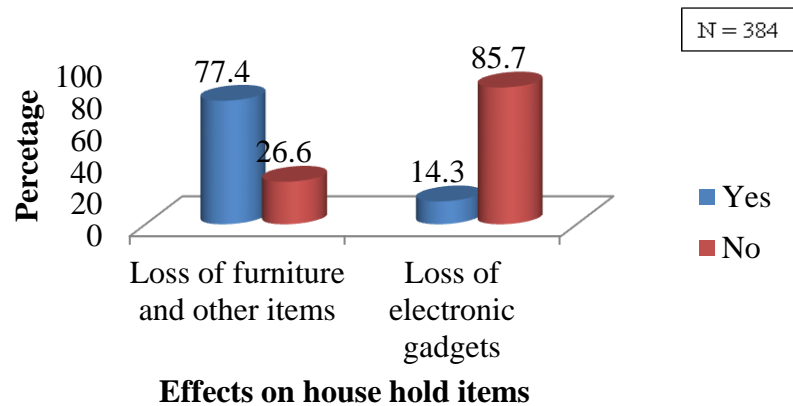
One respondent said this;

I lost photos that I had taken with my husband before he died. Photos serve as a means of remembering someone. Now I am left with nothing (Field data, 2014).

The main problem is that the value of irreplaceable items is hard to express in monetary terms, since they differ for each one of us. And in addition, the items are rarely covered by insurances. Personal belongings that have been collected over years would be impossible to replace. Although insurance would give money to replace such memorabilia if something happened to them, it would not have the same sentimental value as the old one and it wouldn't be the same. A study by RPA (2005) England and Wales showed that damage to and loss of memorabilia and irreplaceable items was ranked as a major impact by respondents. Flood insurance can help mitigate the effects of floods. The loss of material possessions' apparently can create a sense of emotional loss, particularly for retired people who often see their home and contents representing their lifetimes work. The loss of sentimental items, especially photos appears to be particularly upsetting.

**Loss of Household Items:**

Mango, et al., (2007) argue that floods in Kenya destroy household assets. The study sought to investigate what the households experienced with their household items during floods. The results are discussed in Figure 3.

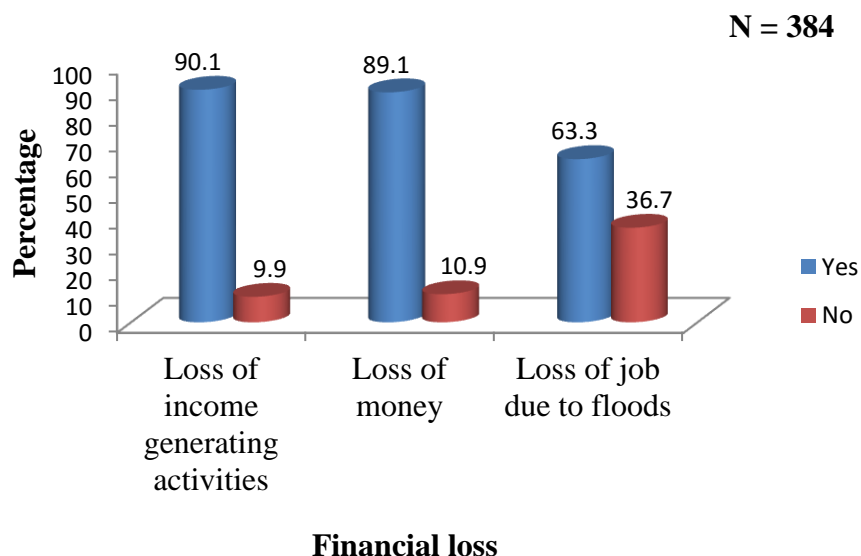


**Fig.3: Loss of household items**

From the results, 282 (73.4%) of the respondents reported loss of their furniture and hardware during floods but 102 (26.6%) did not. Other respondents 55 (14.3%) also reported having lost electronics during floods while 329 (85.7%) did not. This suggests that the flood was so severe that households did not get ample time to salvage their household items. Loss of items is a major setback to households considering the poverty index in the area. This result implies a continued cycle of poverty in the area as the residents struggle to re-build their broken lives.

**Financial Loss:**

The study sought to find out the effects of floods on their livelihoods. The results are summarized in Figure 4.



**Fig.4: Financial losses**

The results indicate that most of the traders 346 (90.1%) suffered great losses due to loss of income generating activities while 38 (9.9%) did not. People sell vegetables, groundnuts and other food stuffs as small scale traders in Nyando basin. Some have small shelters turned into shops/stalls to sell their merchandize, which also includes washing detergents, soaps and other domestic household items which they sell to earn a living. It emerged from FGDs that during the flood season the prices of foodstuff like maize, beans, tomatoes, vegetables fruits etc. go up because the traders outsource them from neighboring counties. A participant reported losing all his wares during the flood and not being able to report to work for three weeks:



As soon as it starts raining, we know that danger is eminent. It causes an awful feeling. I one time lost all my wares in the flood and was unable to report to work for three weeks. I had nothing to feed my family on. (Field data, 2014)

According to key informants during the time of floods most people's small shops became waterlogged or the roads became impassable, hence closure and stoppage of trading. The little income for basic needs was no longer there, making it very difficult to survive. This response would be a pointer to vulnerable households where modest incomes may inhibit post flood recovery.

Most of the sampled respondents were self-employed. Therefore, during flooding, the first people to be affected were those in self-employment. It is worth noting that those in this sector do not enjoy any paid leave, sick leave and besides loss of property and lives, their business activities are also adversely affected by flooding. This, according to respondents led to low business returns. When flooding occurred, most shops did not open and workers were unable to go to work, therefore, slowing down businesses. The study also found out that most of the respondents 342 (89.1%) usually got to work late or did not go to work at all when the area was flooded and therefore suffered financial loss. In addition, 243 (63.3%) reported having lost their jobs during the floods while 141 (36.7%) did not.

From the FGD, respondents lamented that they often pass through the flood at their own peril because they must still earn a living whether there were floods or not. Since majority of respondents interviewed were self-employed, they disclosed that it became increasingly difficult to get raw materials for their work in the event of any floods. Traders and shop owners in the studied locations, reported that, when flooding occurred, the water entered their shops and destroyed their wares including items like rice, sugar, pampers, clothes, and shoes that were for sale and for use. Key respondents also clarified that this was a perennial problem in the study area during floods.

These findings are supported by Enders (2001) who argues that loss of resources can lead to high costs of goods and services, inflation and loss of economic growth of the region or the country at large, delaying its development programs.

#### Transport Difficulties:

Nyando basin has two major trunk roads in addition to some primary networks. The primary networks are made from marram. The study sought to find out the effects of floods on the transport network. The results are summarized in Figure 5.

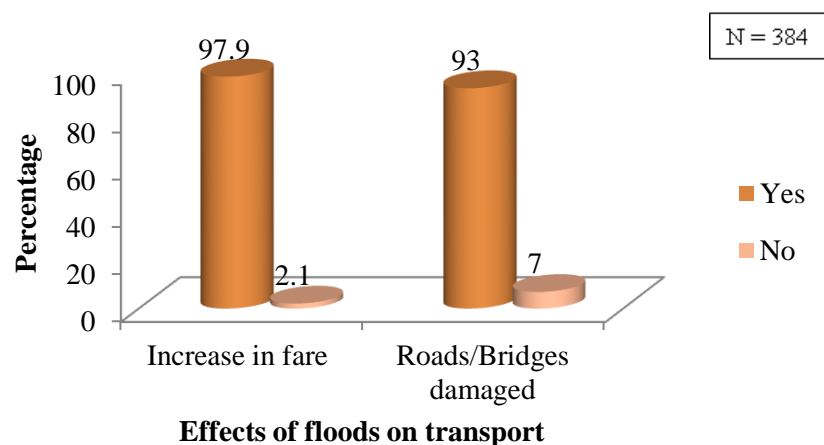


Fig.5: Transport Difficulties

Findings indicated that 375 (97.7%) of the respondents reported hiking of fare during the flooding season while 9 (2.3%) of the respondents did not. The study observed that the most common mode of transport in Kano is the motor bike and the bicycle commonly known as 'bodaboda' used on seasonal/murram roads and 'matatus' which are used for long distance travels. Nyando basin has seasonal roads also known as murram roads with very few all weather roads. Transport is usually affected during flooding period hampering service provision because roads become inaccessible while others get damaged. The floods also damaged irrigation infrastructure such as intake structures, canals and drains. Roads were completely cut off resulting in the isolation of communities for long periods and disruption of transport, communication and business activities. The effects experienced include shortages of food and other basic supplies in the study area. Relief

operations coordinated by the government and other relief and humanitarian agencies during the flood disaster were also affected due to destruction of transport infrastructure.

From the FGDs it also emerged that during flooding seasons the fares normally sky rocket therefore hindering movement of people from one place to another. The damage to infrastructure not only exacerbates impact of flood disasters, but also creates problems in the evacuations of the affected population. Because of the interrelationship between the infrastructures and other sectors of the economy, disruption of infrastructure also disrupts socio-economic activities leading to loss of livelihood as well as scarce resources to coping with reconstruction. When the disruption of infrastructure and roads takes too long it may result in the material impoverishment of the neighborhood, social impoverishment and migration of people. This adversely impacted investment and development activities in the area and in certain cases crippled the frail economy of the region. Consequently, it can be concluded that the resistance, resilience and susceptibility of the infrastructure determine the degree of household's vulnerability as well as that of the community in which they are situated.

The study also established that most of the roads had been either partly or completely damaged, making them at many times impassable as captured in Plate 2.



**Plate.2: A road adversely affected by Floods in Kakola Location**

*(Source: Researcher, 2014)*

Heavy floods sometimes destroyed economic infrastructure such as roads and bridges 357 (93.0%) of the respondents attested to the fact that roads were destroyed during the flooding seasons while 27 (7.0%) did not. This small group formed part of the sample that lived near the tarmac roads.

Findings from FGD supported the above results where it was observed that most of the roads had been either partly or completely damaged, making them at many times impassable. From plate 3 it is evident that women used walking sticks to determine the depth of the floods.



*(Source: Researcher, 2014)*

**Plate.3: Women crossing a flooded footpath in Wawidhi location**

According to key informants, the problem of extreme weather changes affected the built environment and infrastructure negatively. They were in agreement that much attention needed to be given to infrastructural development when addressing future flood impacts. The findings are in agreement with Apan, et al., (2010) who state that damage to infrastructure causes long-term impacts, such as disruptions to supplies of clean water, wastewater treatment, electricity, transport, communication, education and health care. As communication links and infrastructure such as power plants, roads and bridges are damaged and disrupted, some economic activities may come to a standstill, people will be forced to leave their homes and normal life will be disrupted. In the study area, only two telephone networks were found to be reliable. *Safaricom* and *Airtel* were the dominant telephone networks in the area. When flooding occurred, communication network is usually affected thus affecting effective response thereby increasing vulnerability. The study observed that at least most households interviewed had a radio in Nyando from where they got information on possible flooding. Those interviewed reported that they learnt about possible flooding from one another through radio and television. Assessment and knowledge about the possible vulnerabilities of critical infrastructure is essential for forestalling major dangers that can influence local well-being.

### Modifying Food Consumption Patterns:

Food is a basic necessity of life. Destruction of agriculture in this area whose predominant source of livelihood is farming can lead to food scarcity. Consequently, households that engage in farming may experience food shortage. Such households may be forced to modify food consumption patterns. Respondents were asked to indicate the effects of floods on food supply to households. The results are recorded in Figure 6.

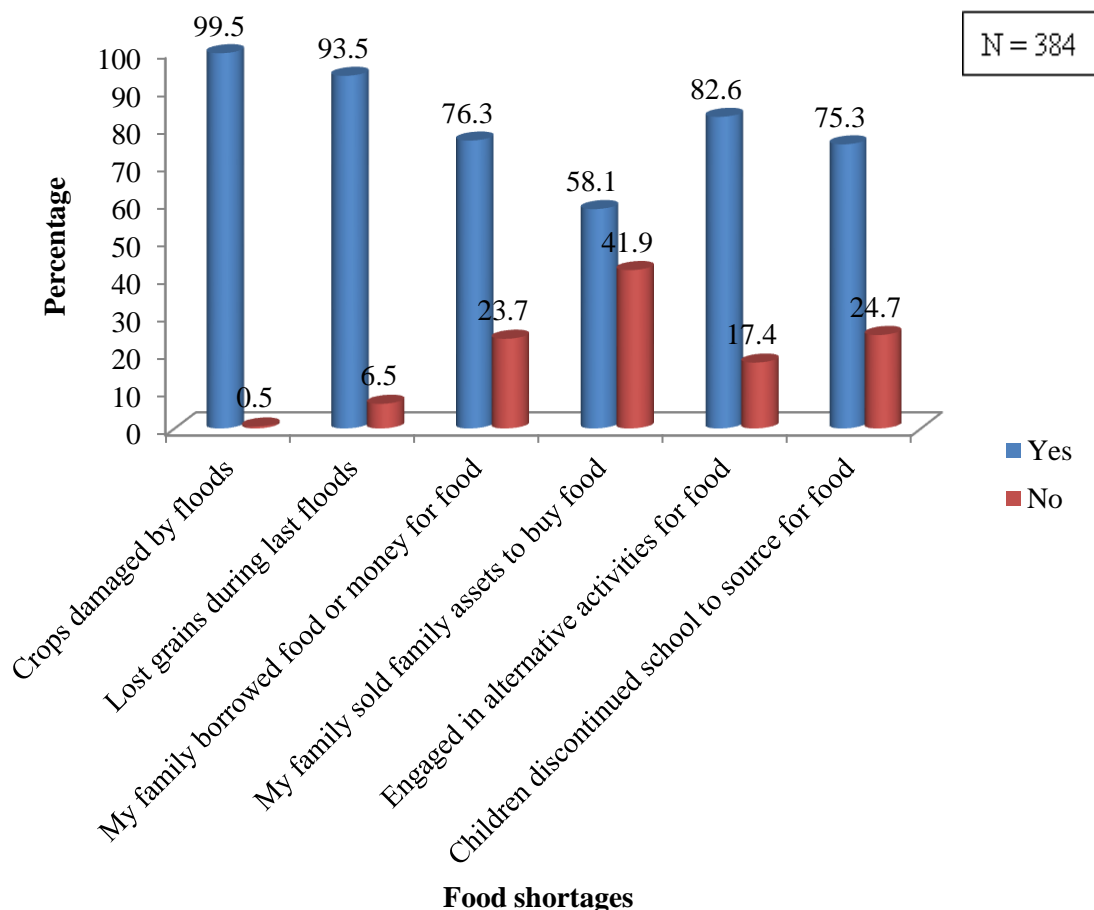


Fig.6: Food Shortages

The results point out that 382 (99.5%) of the respondents reported that floods damaged crops while 2 (0.55) did not. Whooping 359 (93.5%) reported loss off grains while 25 (6.5%) did not lose any. Consequently 293 (76.3%) borrowed money for food while 91 (23.7%) did not. From the responses, 223 (58.1%) indicated that their families sold assets to

have enough food while 161 (41.9%) did not indulge in this. Some respondents 317 (82.6%) reported to be engaging in alternative income generating activities for food during floods while 67 (17.4%) did not. Finally, 289 (75.3%) of the respondents had their children discontinue going to school to source for food while 95 (24.7%) did not. From the FGD (Plate 4), it was pointed out that some of the coping mechanisms adapted were eating fewer meals per day, some resorted to cheaper foods, while others reduced food portions. Other measures of last resort used by respondents included adults eating less and fewer individuals eating at home. Reducing food portions and number of meals per day highlights the desperation of households amid food scarcity. Thus, it is doubtful whether modification of eating patterns is a coping strategy or an indication of the failure of coping strategies.



(Source: Researcher, 2014)

**Plate.4: Researcher (in yellow) in a FGD with Nyanam women group in Ombeyi location.**

Most families sent out family members to go to neighboring towns in search of paid labor to supplement their income or engaging in work schemes such as debris collection, construction and fishing. This could explain why many youths were not at home during the study. Key informants gave the explanation that providing livelihood support programs like setting up a community funding scheme, utilizing government grants, providing compensation based on loss of livelihoods or adapting farming techniques that are not at risk from seasonal flooding would help this population at risk. This finding is in agreement with Apan, et al., (2010) who in a study of Vulnerability, Resilience and Adaptive capacity in Queensland found out that flood led to disruptions of life and livelihoods, leaving communities economically vulnerable. This finding is supported by Bogardi (2004) who described the socio-economic structure of countries affected by floods and concluded that third world countries are mostly agricultural, and the fields are affected by the floods thus making it very difficult to recover after the event and to restore the economy.

#### **SUMMARY:**

It was established that that the floods, particularly from the 2007/08 rainfall season impacted on the livelihoods and critical social aspects namely Agriculture, Health, Education, Water and Sanitation, Housing and Property and Assets of people in lower Nyando basin. The main livelihood of the sampled households was crop production followed by trading and fishing. The survey established that over (99.5%) of households had their crops damaged; mainly maize which is the staple crop and this ultimately resulted into food insecurity at household level. Farmers and traders suffered most damage, both in absolute and relative terms. Households also lost livestock (99.27%). This in a way reduced people's income since income sources are embedded in livelihoods. Disruption of transport (97.9%) hampered access to the health services due to damaged and/or washed away roads, bridges and culverts. This ultimately contributed to increased disease burden (mainly diarrhea, malaria and coughing) at household level as people were not able to reach hospitals. The disease incidences were attributed to access to unsafe water sources and flooded sanitation facilities. Housing units, most of which were made of pole and mud (99.7%) were damaged in one way or the other forcing households to relocate to other alternative areas. The results from the study established that households (73.4%) lost a number of both productive and non-productive assets (both directly and indirectly) making them more vulnerable.



## 5. CONCLUSION

Lack of finance meant that the affected households would not make any meaningful developments to mitigate the flood impacts. The most severe impacts of floods on households of Nyando basin were mainly on the health of the households, loss of homes and household items, agriculture, education, transport, businesses and on household food supply.

On the impact of floods on households, this study found out that homes, roads, businesses, education and household's health were most impacted by floods. The study recommends that the County Government of Kisumu sets aside funds for emergency, build strong infrastructure like schools, hospitals and bridges by adhering to laid down flood proofing regulations, building well equipped rescue centers, hospitals and investing more on preparedness. Kisumu County Government initiatives to control house construction in the basin and across the natural drains should also be increased. 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 aspects of society. The County Government should do all it can to make available large numbers of housing plots located on safer sites for all income groups. Kisumu County Government should work closely with the populations they are supposed to serve for that is what devolution is all about.

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