Effect of Flooding on Livelihood of Communities in Muwo District, Mokwa Local Government Area, Niger State, Nigeria

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ABSTRACT

Flooding in Nigeria has been reported to affect and render people homeless than any other natural disaster. Muwo district is one of the adversely affected districts in Nigeria owing to its geographical location and many other factors. Unfortunately, there is dearth of literature on the effects of flood in the district, therefore this paper was aimed at assessing the effects of flooding on livelihood in the district. 425 questionnaires were administered and analyzed. Standardized Precipitation Index (SPI) was used to assess the trend of the occurrence of flooding in the past 30 years. Geographic Information systems (GIS) was used to analyze the terrain. The results revealed that among the underlying courses of flooding, 77% of respondents agreed that release of water from Kainji dam was the main cause of flooding in the area, while 23% attributed the flooding to excessive rainfall. As evident from the standard precipitation index, excessive rainfall is not the cause of flooding in the district but the release of water from Kainji dam. The results showed that there was a great loss of agricultural products worth millions of Naira. There was a significant increase of loss with an increase in farm size (R^2 = 0.98). The SPI results indicated that years the 1995 and 2007 r ecorded the highest amount of rainfall which made them very wet years. The year 2008 was moderately wet year. The years 2015 and 1988 were found to be m oderately dry and extremely dry respectively. The findings indicated that there were 22 near normal years. Migration was found to be the major coping strategies adopted by the communities. The terrain analysis indicated that 639.92 sq. mi, 880.83sq. mi and 155.37 sq. mi were found to be highly vulnerable, moderately vulnerable and less vulnerable to flooding.

Index Terms: Flooding, Livelihood, Vulnerability, Coping strategy, Standardized Precipitation Index, Agriculture

1. INTRODUCTION

Flooding is a dynamic and natural process which has adverse effects on livelihood of rural communities as houses are being submerged and most often destroyed. flooding occurs when river or stream discharge could not be accommodated within the boundaries of common water ways, water then moves further to neighboring grounds washing away crops and other important properties [1]. According to [2], flooding is the rise in water body that overflows land which is normally not covered by water. [3] listed types of flooding based on place of occurrence such as, upstream and downstream floods: Upstream flood occurs in the upper area of drainage basin. They are normally caused by heavy rainfall in a short time over a small area, but if the flood is sudden and of relatively large volume could be called flash flooding. Downstream flooding results when the ground is saturated, as a result of persistent storms over the same drainage basin. Flooding in Nigeria has been reported to affect and render people homeless than any other natural disaster. Among different natural disasters flooding causes severe damages to properties. [4] opined 20 per cent of the world populace faces the risk of flooding. He also stated that Flooding has been dangerous to communities. [5] stated that agricultural sector being the main source of livelihood in agrarian communities is the worst affected by flooding in most flood ravaged communities in the world. Flooding tends to submerge the farmlands and makes them waterlogged. This affects the wellbeing of the crops like maize, sorghums, potatoes and other root crops. Frequent floods promote increase in the price of farm produces and aggravate the short supply of food crops. Flooding also amplifies the transport problems due to flooded roads and dented infrastructure [6]. Particularly the 2012 flooding in Nigeria, the Niger Deltans were displaced, forcing many inhabitants out of their homes and halting economic progress.

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Many lives and properties worth millions of naira got lost as a result of flooding occurrence. Flooding not only displace people, destroy properties and collapse business activities of communities but also endanger victims to diseases [4].

Natural disasters such as flooding adversely affect human existence with an alarming rate in the 21st century. This predicament calls for urgent attention. In the past few years, studies emphasizing the effects of disasters on communities have increased sporadically, but vast of the literature are written by Astronomers and Natural scientists instead of social scientists [7].

On this note, literature on the effects of flooding on livelihood is few and limited number of studies have been carried out on this damaging phenomenon in the Muwo distict. Consequently, the aim of this research paper was to examine the effects of flooding on livelihood of communities in Muwo district and identify the coping strategies adopted by the inhabitants so as to minimize the effects.

2. MATERIAL AND METHODS

2.1. Study Area

The study area is located between longitude 4^0 52′ E to 4^0 47′ E and latitude $9^0$16′ N to 9^0 18′ N in northern Nigeria. It is situated between Kainji and Jebba Dams. Muwo district is village in Mokwa Local Government Area of Niger State (Figure 1). The climate of the study area can be described as hot equatorial climate with high temperatures with an average daily maximum of 33.5^0C in the warmest month. The difference in the river water level is controlled by the inflow of water from the Kainji hydro power plant. Rainfall in the area is about 1071mm. The river of the area is dammed at Jebba Hydro power plant [8].

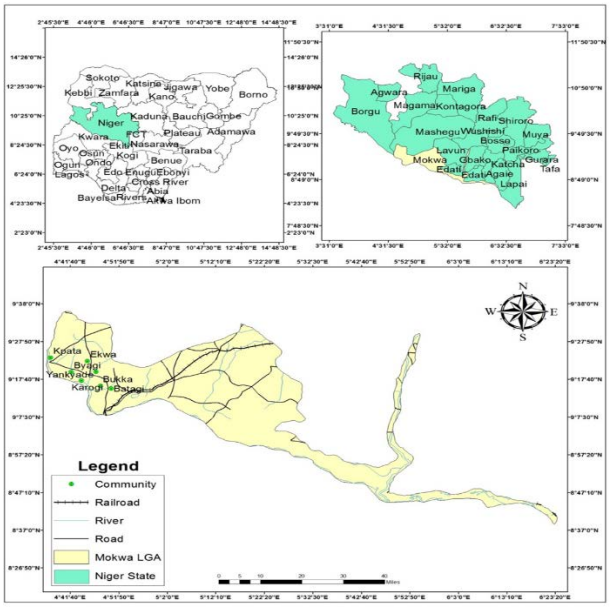

Figure 1: The Study Area

2.2. Method of Data Analysis

The data used in this research work was obtained from both primary and secondary sources. The primary data was acquired through administering of questionnaires. Moreover, rainfall data was acquired from Nigerian Meteorological Agency (NIMET). SPSS (Statistical Package for Social Sciences Application Software) was used to analyze the administered questionnaires. SPSS was also used for computing mean and standard deviation of the rainfall data which are necessary inputs for obtaining Standardized Precipitation Index (SPI) equation (1). Microsoft excel spreadsheet was used to calculate SPI values.

$$SPI = \frac{X - \overline{X}}{SD} \qquad (1)$$

Where, SPI is standardized precipitation index; X is rainfall variable; $\overline{X}$ is mean of the rainfall data and SD is standard deviation which is given as equation 2.

$$SD = \frac{\sqrt{(X_i - \overline{X})2}}{n} \qquad (2)$$

Where; SD is standard deviation; X_i is value of the ith item X, (rainfall variable); $\overline{X}$ is mean of the rainfall data.

Simple linear regression analysis was also used to assess the relationship between inundated farms sizes and estimated loss in the study area. Simple linear regression analysis was also used to assess the relationship between inundated farms sizes and estimated loss in the study area. Flood vulnerability map was produced in ArcGIS 10.2.2 environment.

3. RESULTS AND DISCUSSION

3.1. Causes of Flooding in Selected Communities

The findings showed that the principal causes of flooding in the study area were excessive rainfall and release of water from Kainji dam . From the study it was observed that among the underlying courses of flooding, 77% of respondents agreed that excessive rainfall was the main cause of flooding in the area, while 23% attributed the flood to residing on flood plain.

3.2. Standardized Precipitation Index (SPI)

The Standardized Precipitation Index (SPI) is an index used to assess the occurrence of extreme weather events (flood and drought). [9] suggested seven classes for SPI. According to this classification, the results revealed that there was no extremely wet year throughout the thirty years under study (Table 1). The years 1995 and 2007 (light blue bars) recorded the highest amount of rainfall which made them very wet years (Figure 2). The year 2008 (orange bar) was moderately wet year. This shows that the release of water from

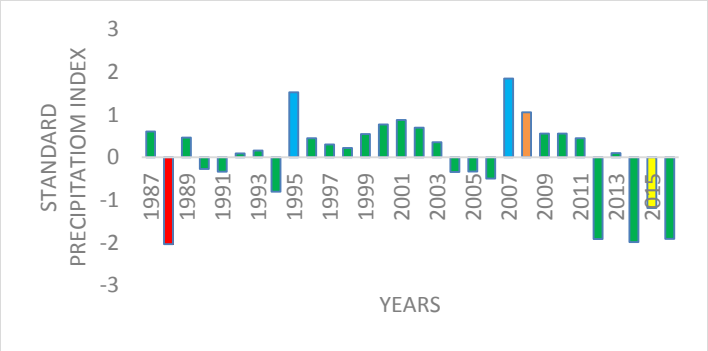

Figure 2: Standardized Precipitation Index (SPI) for the Study Area (1986 to 2015)

Kainji dam is major cause of flooding in district.

Similarly, the years 2015 (yellow bar) and 1988 (red bar) were found to be moderately dry and extremely dry respectively. The findings indicated that there were 22 near normal years (green bars), (Figure 2).

Table 1: Rainfall Characteristics over the Study Area (Based on Standardized Precipitation Index)

SPI Range	Range Meaning	Occurrence
2 and above	Extremely wet	0
1.5 to 1.99	Very wet	2
1 to 1.49	Moderately wet	1
-.99 to .99	Near normal	22
-1 to -1.49	Moderately dry	1
-1.5 to -1.99	Severely dry	3
-2 and less	Extremely dry	1

Source: Author's Analysis, 2017

3.3. Flood Vulnerability Map

The flood vulnerability map was produced to delineate the areas that are highly, moderately and low vulnerable (Figure 3). The vulnerability map shows that Kpata community resides within 16m to 100m above sea level. It is also situated very close to the bank of Niger river thereby making it highly vulnerable to flooding. While communities of Byagi, Yankyade, Ekwa, Karogi, Bukka and Batagi located between 100m-200m are moderately vulnerable to flooding and communities above 200m above the sea level are less vulnerable to flooding (Figure 3). Moderately vulnerable area occupies 52.55% of land area of study site. Highly

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vulnerable area and Less vulnerable area occupy 38.18% and 9.27% respectively [Table 2].

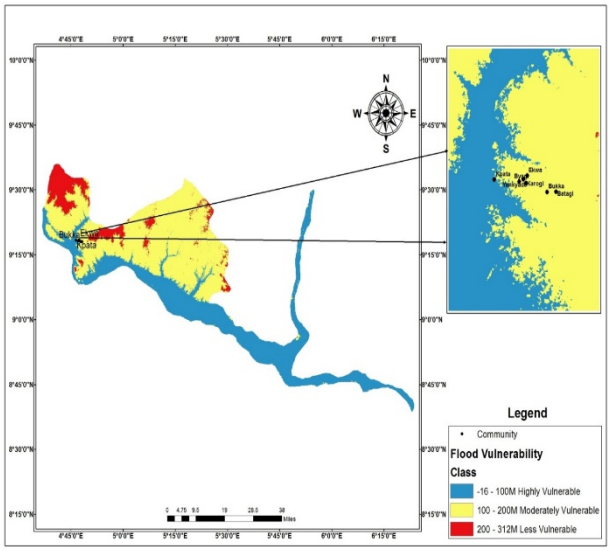

Figure 3: Flood Vulnerability Map

Table 2: Area Coverage of the Vulnerability Classes

S/N	Vulnerability Class	Area (sq. mi)	Area (%)
1	Highly vulnerable	639.92	38.18
2	Moderately vulnerable	880.83	52.55
3	Less vulnerable	155.37	9.27
	Total	1676.11	100.00

Source: Author's Analysis, 2017

3.4. Effects of Flooding on Agriculture

The common cultivated crops in the study area include beans, yam, cassava, ground nut, maize, sorghum and millet. The findings revealed that 93.9% of the respondents affirmed that flood event affected not only agricultural land but also agricultural produce. Only 6.1% of the respondents affirmed that flooding has never affected their farm produce. In the seven communities sampled after 2012 flooding disaster, it was revealed that 144 hectares of land were flooded for over four days and resulted in a great loss of agricultural products worth millions of Naira. It is vividly seen in figure 4 that Gbajibo and Batagi were severely ravaged by flood in the study area with estimated loss of N45 and 32 million naira respectively. This huge loss could adversely affect the living of the communities. On the other hand, Ekwa and Karogi were least affected in the study area. Simple linear regression between farm size (independent variable) and estimated loss (dependent variable) produced $R^2 = 0.98$. This indicated that there was a significant increase of loss with an increase in farm size (Figure 4).

Figure 4: Relationship between farm size and estimated loss in the study Area

3.5. Coping Strategies

The investigation revealed that the communities engage in series of coping strategies for the period of flooding. The most common central coping strategy/ line of attack to flood menace was migrating to nearby communities to stay with relatives especially women and children this account for 35% while 25% make use of sand bag to build Dikes in front of houses as a coping strategy before the flood, 16% of sampled population evacuated vital items to safer place and 6.3% made furrows to reduce the inflow of water.

Table 3: Coping Strategy

Coping Strategies	No. of Respondents	Percentage (%)
Migration	149	35
Use of sand bags	106	25
Cultivating on high land	72	17
Evacuation of	68	16

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vital items		
Making of furrows	30	7
Total	425	100

4. CONCLUSION

Devastating events such as flooding are natural phenomenon that cannot be stopped from occurring but its effects can be minimized if effectively tackled and appropriate measures are taken to slow down its effects and frequency. In conclusion, it is evident from the findings that flooding has negative effects on the livelihoods of communities in Muwo district. The contemporary coping approach employed by most household is moving to safer places during flooding or constructing embankments which are temporary solution to flooding. Moderately vulnerable area occupied the greater percentage of the areal extent of the district. It was concluded that there was a significant increase of loss of agricultural produce with an increase in farm size during flood event. So any loss in land, crops and houses affect the livelihood of people of Muwo District.

5. RECOMMENDATIONS

The paper offers the following recommendations:

i. Reliable weather forecasting and early forewarning systems should be developed and encouraged in these communities.

ii. Government should collaborate with Stakeholders to move those communities located in riverside to elevated ground.

iii. Flood alertness campaigns should be introduced in these rural communities to enlighten people on the tragedy associated with flooding.

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