FARMERS PERCEPTION AND ADAPTATION TO FLOOD EVENTS IN PART OF KADUNA BASIN, NIGERIA

*UMAR, A. AND EMIGILATI, M. A.
Department of Geography, Federal University of Technology, Minna, Nigeria
*Corresponding author: abdulfutminna@gmail.com

Abstract
Flood events have been perilous to people, communities and institutions. Recently, Baggi, Masalachi, Fokpo, Sosu and Wuya areas of Kaduna Basin have been affected by flooding chasing the inhabitants away and often destroy lives, farmland and properties. The aim of this study was to examine farmers' perception and adaptation to flood events in Kaduna Basin, Nigeria. The data collection instruments include questionnaire, field survey and oral interview and methods of data analysis were arithmetic mean and frequency percentage. The finding revealed that long duration of stormy windy rains ranked the highest with 108 respondents, changes in rainfall pattern ranked second with 90 respondents, information from NISEMA ranked third with 73 respondents and climate change ranked the least with 38 respondents. This revealed that the respondents have high degree of awareness and understanding of flood events. In adaptation strategies, the finding revealed that flood forecasting and warning schemes ranked the highest with 69 (38.5%) of the respondents, engineering scheme ranked second with 46 (25.7%) of the respondents, floodplain zoning ranked third with 27 (15.1%) of the respondents, public relief funds ranked fourth with 19 (10.6%) of the respondents, flood-protection scheme ranked fifth with 11 (6.1%) of the respondents, Flood Abatement Schemes ranked sixth with 7 (3.9%) of the respondents and Flood Insurance ranked the least with no response. Its therefore recommended that the relevant authorities should delineate both the non-flood areas and flood areas. The non-flood areas can serve as a temporary shelter for the settlements during floods. Government and key Stakeholders should engage the farmers and local authorities in making them aware of the flood risk in view of the climate variability.

Key Words: *Flood event, Farmers perception, Adaptation and Kaduna Basin*

Introduction

Flood is the overflow of water into an environment that is normally dry thereby causing inundation and harm to plants and animals, including man. Its harm can be extended to man's buildings and infrastructures (Udosen, 2013). Most flood definitions include damage they cause and depend on their sources or types and magnitude. In the case of flood resulting from rivers, Ating (2013) defines it as a relatively high flow which

overtakes the natural channels provided for run–off as well as a high stream which overtops its natural or artificial banks.

Wolf (2015) also describes flood as high rate of discharge in water sources and the inundation of normally dry lands. West (2013) further states that flood is a body of water which rises to overflow its banks or low-lying areas. All over the world, flood is known to cause great damage to people's lives, belongings and properties. Flood causes one third of deaths, one third of all injuries and one third of all damage from natural disasters (Etuonovbe, 2014). This damage is normally felt by various "receptors" being people, buildings, infrastructure, agriculture, and open recreational spaces.

According to Isah (2012), Flood is cause by two major factors such as Rainfall and poor drainage network; other causes are relief of the area and construction along drainages. The drainage network of the area, flow from high terrains towards lower terrain. Convergence over the flat surface was observed which is in line with topography of the area. This establishes the law which says water flow away from highlands. Second major cause is rainfall intensity, the sensitivity of the flow of river Kaduna to rainfall does not usually start until July, where traditionally the amount of rainfall increases drastically. Thus the month of August/early September mark the peak of white flood inflow into the river. The flood peak inflow occurs immediately following accumulated peak-rainfall period and may be attributed to the time-lag factors between rainfall and peak flow. River Kaduna therefore flows according to distinctive drainage between the wet and dry seasons in the region as indicated by rainfall regime. During the 2012 and 2015 flooding, water supplies in communities resulted in contamination of water (water pollution). Clean drinking water becomes scarce. Unhygienic conditions and spread of water-borne diseases resulted. People, buildings, infrastructure, agriculture, open recreational space and the natural world are affected negatively. In extreme cases the flooding led to loss of lives (Orji, 2015). Torrential rains pushed rivers over their banks, collapsed mud houses and washed away livestock. It damaged bridges and caused dams to overflow (like in the case under study, the 2012 flooding was linked to the overflow of the Lagdo dam, Shiroro dam and Kanji dam in Cameroon and Nigeria respectively), submerging buildings, displacement from homes, the loss of personal valuables and the ongoing fear and insecurity caused by the experience. Potable water supplies were lost or contaminated in the flood and with immediate health effects upon people and animals (Ken, 2013).

Floods are among the most devastating natural disasters in the world, claiming more lives and causing more property damage than any other natural phenomena. In Nigeria, flood affects and displaces more people than any other disaster and also causes more damages to properties. At least 20 per cent of the population is at risk from one form of flooding or another (Kolawole, 2011). The study area is characterized by many unplanned and haphazard development and attitude that calls for great concern in order to halt the potential flood danger in the area. Flood disaster is on the increase in the study area due to reckless and unplanned constructions of building which are carried out without regards to

rules and regulations governing building along floodable areas in Niger State. The frequent and constant flooding experienced in the study area is a serious indication of more flooding to occur and these will lead to more damage and loss to infrastructure in the study area. Some of the houses in the study area are built on water ways or lands that are vulnerable to flooding. To be able to rectify these problems mentioned, motivated the writer to choose this topic for further investigation.

The aim of this study was to examine farmers' perception and adaptation to flood events in part of Kaduna Basin, Nigeria. The objectives of the study are to:

i.   Examine the socio-economic characteristics of farmer's in the study area.
ii. Analyse farmer's perception on flood disaster in the study area.
iii. Examine the challenges posed by flood to farmer's livelihood and the strategies adopted by farmers in the study area.

Study Area

Kaduna Basin is situated between latitude 6° 20′N and 7° 15′N of the equator and longitude 5° 40′E and 6° 33′E (Figure 1) of the Greenwich meridian on the world map and has area coverage of 1,698km². The area covered in this study geographically include Katcha, Lemu, Agaie, Bida, Lavun and Mokwa Local Government Areas of Niger State.
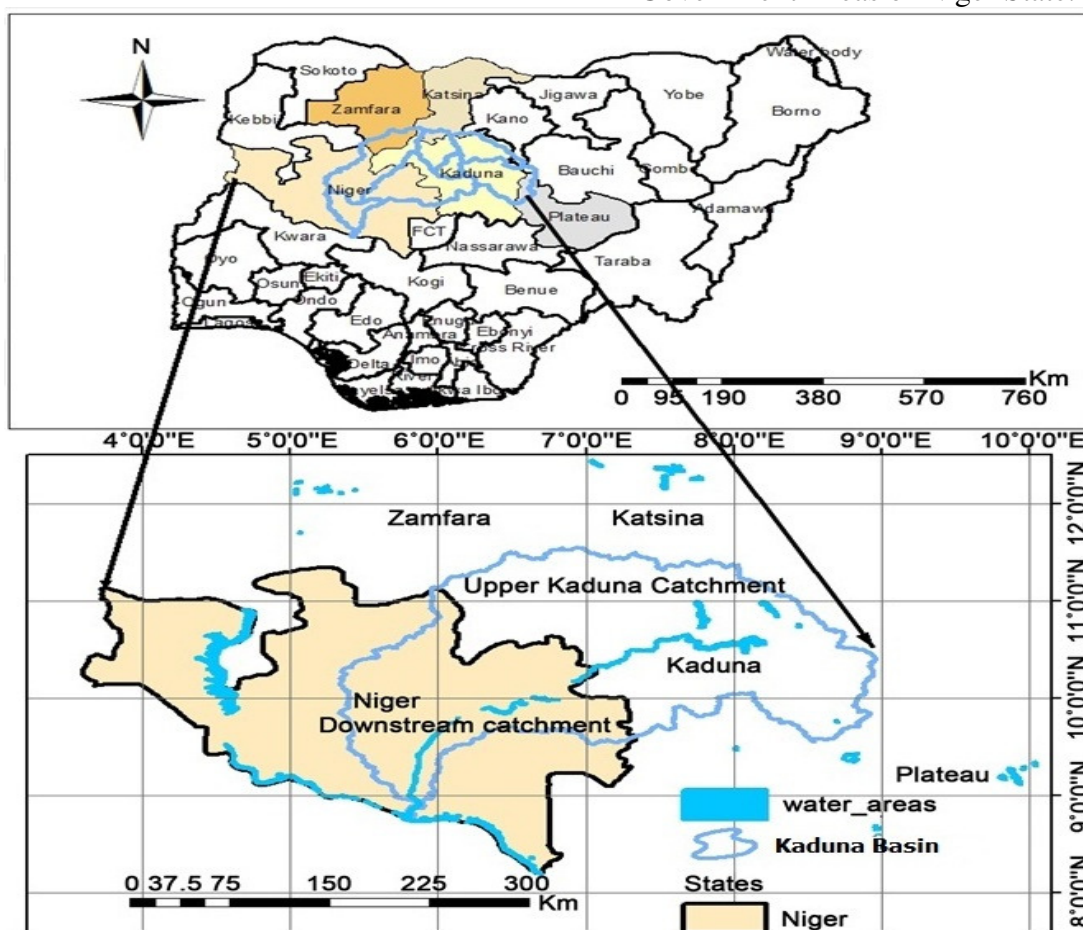

Fig. 1: Location of Kaduna Basin in Nigeria

Research Methodology

The primary data include questionnaire, personal interview and field survey. Structured questionnaire was designed to collect useful information from the respondents. The questionnaire was well designed to elicit information that bother on attainment of all the stated objectives of the research.

In order to have lucid and elaborate responses from the residents, personal interview was also conducted. The oral interview was interactive; it provided more detailed information and data to compliment that of the questionnaire. Questions that were not covered by the questionnaire were asked and responses were documented. The use of interview as an instrument for data collection was important.

A reconnaissance survey of the study area was done in order to ascertain the real problems peculiar to each of the hospitals. Vital and useful information or data were derived from the survey.

Documents produced by Government agencies such as Niger State Ministry of Agriculture and Niger State Emergency Management Agency were appraised to give more credence to the research work. Textbooks, journals, published and unpublished thesis, newspapers, and magazines formed part of the secondary data.

The sample size was determined using the technique employed by the National Population Commission for sampling households in Nigeria. A household in Niger State is considered to be made up of 5.9 persons, and the population of any locality can be divided by this figure in order to derive the number of households (General Household Survey Report, 2010). In the case of this study, the relevant computation is given below, bearing in mind that the population of the study area is 14,889 based on the 2006 National Population Census.

$$\text{Number of households in the study area} = \frac{\text{Population of the Study Area}}{\text{Average size of household}} = \frac{19,789}{5.9} = 3354.06$$

The study population was thus estimated to be 3354.06 households. A sample size of 10% of the population was decided. A total of 335 structured questionnaires were randomly administered to the respondents in the study area and 309 questionnaires were returned.

The use of questionnaire was employed, and both sample size and sample procedures were explained. Analyses of data was based on frequency-percentage technique. The frequency-percentage technique is easy to present, analyze, and interpret. The research encompasses many data, thus data analysis were represented in tables, text, pictures and graphical illustrations of the diversity and consequences of the circumstances.

Frequency percentage was used to achieve objective one, two and three. The frequency percentage equation is given below:

$$\text{Frequency-percentage} = \frac{\text{Number of observed}}{\text{Total Number}} \times \frac{100}{1}$$

Results and Discussion
Socio-Economic Characteristics of Farmers

The questionnaire administrated reveals various socio-economic characteristics of the farmers in the study area. This section addresses objectives one of the study. The socio-economic characteristics covered include gender, educational status and source of income.

Gender of the Respondents

The gender of respondents revealed that 224 (72.5%) of the respondents are males while 85 (27.5%) of the respondents are females which indicate that most of respondents are male and they are active in both farming activities, fishing, trading and other activities such as wage labour and charcoal burning.
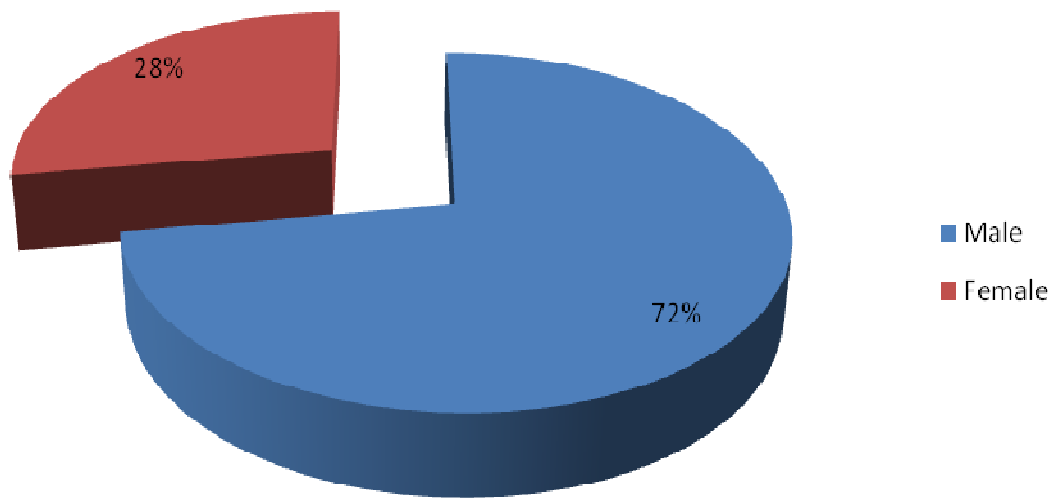

Fig. 2: Gender of the Respondents

Educational Status

The educational status covered in this study entail those who can read and write as well as those who understand what flood events (causes and effects) are all about. They include primary, secondary, higher institution and none education as indicated in Table 1.

Table 1: Educational Status

Options	Educational Status							
Locations	Primary School		Secondary School		Higher Institution		No Formal Education	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Badeggi	50	16.2	5	1.6	6	1.9	2	0.6
Baggi	48	15.5	3	0.9	4	1.2	5	1.6
Masalachi	32	10.5	2	0.6	10	3.2	4	1.2
Fokpo	30	9.7	2	0.6	2	0.6	4	1.2
Sosu	25	8.1	4	1.2	4	1.2	3	0.9
Wuya	30	9.7	11	3.6	15	4.8	8	2.4
Total	215	69.7	27	8.7	41	12.3	26	7.8

The results presented in Table 1 reveals that Badeggi ranked the highest in primary certificate with 50 (16.2%) of the respondents and Sosu ranked the least with 25 (8.1%) of the respondents; Wuya ranked the highest in secondary certificate with 11 (3.6%) of the respondents and Masalachi ranked the least with 2 (0.6%) of the respondents; Wuya ranked the highest in higher institution certificate with 15 (4.8%) of the respondents and Fokpo ranked the least with 2 (0.6%) of the respondents; Wuya ranked the highest in no formal education with 8 (2.4%) of the respondents and Badeggi ranked the least with 2 (0.6%) of the respondents.

All the sampled points indicated availability of education facilities in their communities. Furthermore, 17% of the sampled households indicated that school infrastructure was damaged due to floods in one way or another. The study showed that 38% of the sampled households indicated that school going children experienced disruption due to flood events. The disruption was attributed to various reasons such as road being impassable (32%) and school being submerged (9%).

Sources of Income of Respondents

The sources of income identified in this study include crop production, trading, fishing, charcoal burning and civil service as revealed in Figure 3.
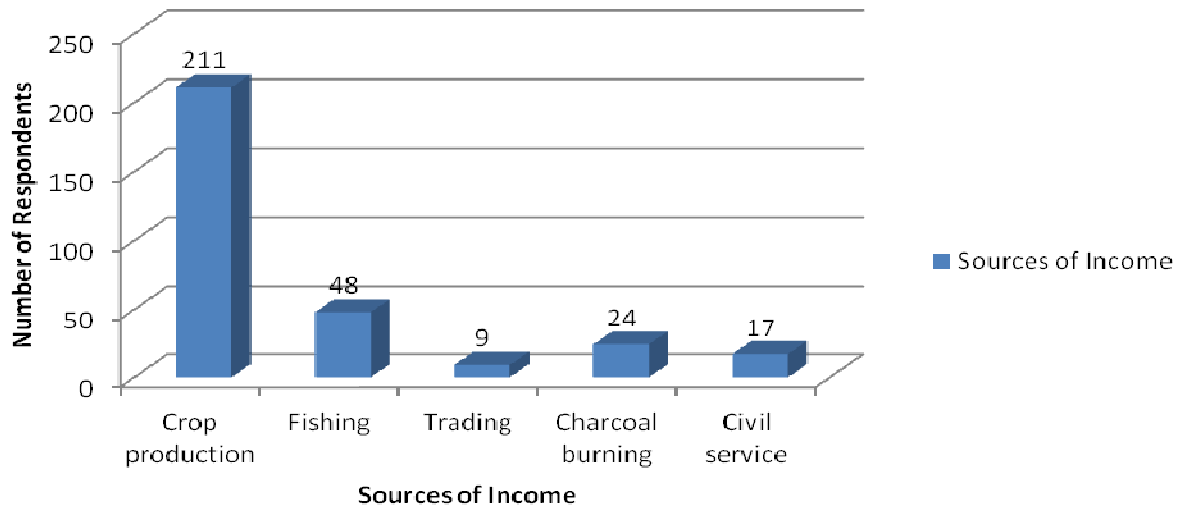

Fig. 3: Sources of Income of the Respondents

The result presented in Figure 3 revealed that crop production is the major means of livelihood, it recorded about 211 respondents, followed by fishing with 48 respondents, 24 respondents are into charcoal burning, 17 respondents are into civil service and 9 respondents are into trading. Discussions with respondents in the study area established that the main source of income for most households was crop production followed by fishing. These main sources of livelihood were found to be subsistence farming. Also, the flood had a devastating effect on food stocks where many households lost their food. Consequently, this has affected the households' food security level and in turn leads low standard of living.

Farmers Awareness and Understanding of Flood Events

The farmers' awareness and understanding of flood events in this study include long duration of stormy windy rains, changes in rainfall pattern and climate change as indicated in Figure 4.
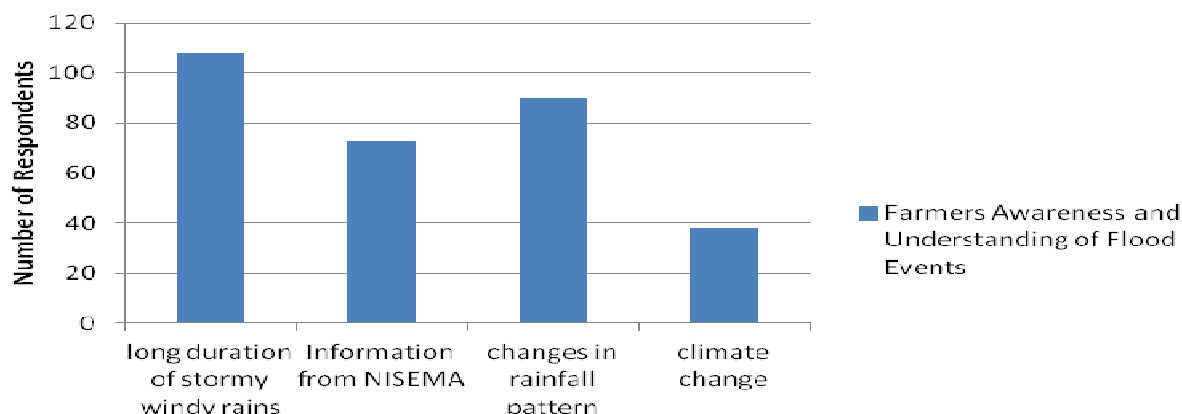

Fig. 4: Farmers Awareness and Understanding of Flood Events

As indicated in Figure 4, long duration of stormy windy rains ranked the highest with 108 respondents, changes in rainfall pattern ranked second with 90 respondents, information from NISEMA ranked third with 73 respondents and climate change ranked the least with 38 respondents. This revealed that the respondents have high degree of awareness and understanding of flood events.

Perceived Causes of Flood Events

Perceived causes of flood events identified in the study area include excessive rainfall, flood plain development, poor drainage system and blockage in the drainage as revealed in Table 2.

Table 2: Perceived Causes of Flood Events

Option	Frequency	Percentage (%)
Excessive rainfall	221	71.5
Poor drainage system	22	7.1
Flood plain development	49	15.9
Blockage of the drainage	16	5.2
Waste disposal	1	0.3
Total	309	100

Based on the analysis in Table 2, excessive rainfall accounts for the highest with 221 (71.5%) of the respondents, flood plain development ranked second with 49 (15.9%) of the respondents, poor drainage system ranked third with 22 (7.1%) of the respondents, blockage of the drainage ranked fourth with 16 (5.2%) of the respondents and waste disposal ranked the least with one respondents. This revealed that heavy rainfall and flood plain development are the major perceived causes of flood events in the study area.

The study shows that the rising of water level along the river channels

arising from heavy rainfall is the main cause of flood events in the study area. Specifically, 71.5% of the households attributed the reason for this menace to this factor as shown in Table 2. The drainage channels cannot therefore accommodate the flow of the fast running storm water as a result of heavy rainfall making it to spill into streets and houses.

Challenges Posed by Flood to Farmers Livelihood and Strategies by Farmers

Challenges posed by flood events to farmers' livelihood include buildings and farming damages which covered loss crops on farmland, loss of livestock and human lives and equally loss of building structure and the properties within as indicated in Figure 5.
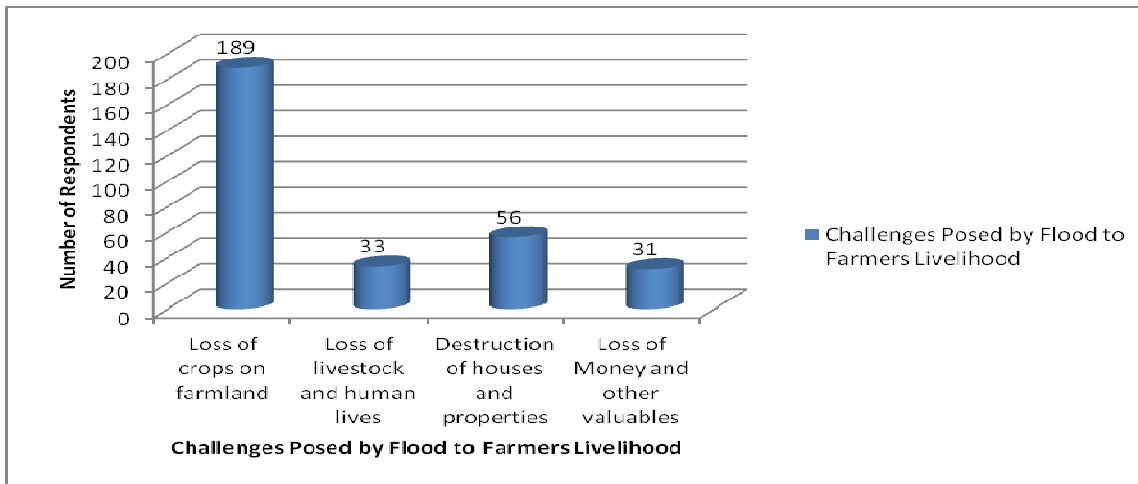

Fig. 5: Challenges Posed by Flood to Farmers Livelihood in the Study Area

As revealed in Figure 5, loss of crops on farmland ranked the highest with 189 respondents, destruction of houses and properties within ranked second with 56 respondents, loss of livestock and human lives ranked third with 33 respondents and loss of money and other valuables ranked the least with 31 respondents. Most of the losses to these assets were attributed to households' proximity to flood prone areas.

This finding has provided better understanding of the vulnerability of the respondents due to the over dependency on crop production as their main livelihood source. Amount lost in the area by sample respondents from the Figure 4.6 shows that 31 respondents in the study area loss 10-200 thousands of Naira during the past flood events,

especially those respondents that their building were damage and they keep the money in their houses as no proximity of bank in the study area except Badeggi respondents that have bank close to the sample point.

The research revealed that 18.1% of respondents said a substantial number of productive and non productive assets (properties) were damaged by floods. Properties worth millions of naira were lost, some of them were Jewelleries and utensils, fishing nets, hoes while the majority of non -productive assets were beds, chairs and radios. Some of the respondents who are household head indicated that they lost other property such as clothes and blankets. Most of the losses to these assets were attributed to

households' proximity to flood prone areas.

Equally, 10.7% of the respondents reported loss of livestock, these were lost either by drowning, over exposure to water or by falling of building structure, though 3 loss of human lives were recorded and many injured in Masalachi and Fokpo. Animals such as goats and poultry are easily drowned, infected or even killed by over exposure to water and even the stronger ones cannot survive the crush of falling building structures.

Present of Adaptation Strategies

As indicated in Figure 6, 130 (42.1%) of the respondents strongly agreed that they have flood adaptation strategies in the study area and they include public relief fund, flood forecasting and local warning devices while 179 (57.9%) said they don't have any effective adaptation strategies and they are at the mercy of God when their communities are flooded.
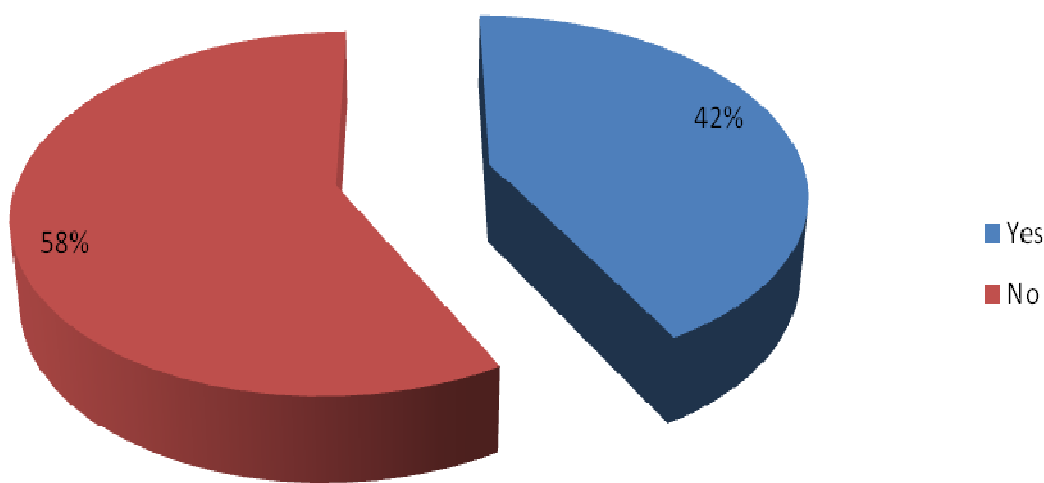

Fig. 6: Affirmation of Flood Adaptation Strategies in the Study Area

Effective and Efficient Flood Adaptation Strategies

Effective and efficient flood hazard adaptation strategies were highlighted and coded for this study and they include Engineering Scheme, Flood Abatement Schemes, Flood-Protection Scheme, Public Relief Funds, Flood Insurance, Flood Forecasting and Warning Schemes and Floodplain Zoning.

Table 3: Effective and Efficient Flood Adaptation Strategies

S/No	Coping Strategies	Frequency	Percentage (%)
A	Engineering Scheme	46	25.7
B	Flood Abatement Schemes	7	3.9
C	Flood-Protection Scheme	11	6.1
D	Public Relief Funds	19	10.6
E	Flood Insurance	0	0
F	Flood Forecasting and Warning Schemes	69	38.5
G	Floodplain Zoning	27	15.1
	Total	179	100%

As indicated in Table 3, flood forecasting and warning schemes ranked the highest with 69 (38.5%) of the respondents, engineering scheme ranked second with 46 (25.7%) of the respondents, floodplain zoning ranked third with 27 (15.1%) of the respondents, public relief funds ranked fourth with 19 (10.6%) of the respondents, flood-protection scheme ranked fifth with 11 (6.1%) of the respondents, Flood Abatement Schemes ranked sixth with 7 (3.9%) of the respondents and Flood Insurance ranked the least with no response. The implication of this finding is that flood forecasting and warning schemes either from government or private donor is the major flood adaptation strategy in the study area. Engineering Scheme include river training, works designed to prevent local bank erosion, flood embankments, channels enlargement, flood-relief channels and flood storage reservoirs; Flood Abatement Schemes include afforestation and reducing the land-to-channel runoff; Flood-Protection Scheme: stocking of suitable shields to be placed in position at doors and windows prior to a flood, raising of building above the flood level and inclusion of pumping facilities in basement and Floodplain Zoning include Prohibitive Zone, Restrictive Zone (All buildings should be flood proofed and establishment of Game reserve) and Warning Zone.

Conclusion
This study examined farmers perception and adaptation strategies to flood events in lower Kaduna Basin and the findings revealed that the farmers has perceived flood events has disastrous phenomenon which has affected their food security negatively. Farmers in the study area are not only faced with changing socio-economic conditions, they are also been coping to the best of their ability and resources from flood events which is expected to continue as long as climate change continue to change. The farmers should be encouraged to build houses using durable materials and away from the flood prone area as a way of coping with the flood events. Clearly, there is need to develop better and appropriate measures (as discussed under the effective and efficient adaptation strategies in chapter four of this study) to prepare and mitigate the effects of the flood events there-of. Above all, the aim must be to involve all the players to enhance farmers' resilience to flood events. The study concluded that building flood resilience dwellings and farms is preferred by the farmers to relocation. This is because as they put it, their livelihood revolves around the water: farming, fishing, transport and ancestral history. It's therefore recommended that the relevant authorities should delineate both the non-flood areas and flood areas. The non-flood areas can serve as a temporary shelter for the settlements during floods. Government and key Stakeholders should engage the farmers and local authorities in making them aware of the flood risk in view of the climate variability.

References
Ating, E.E. (2013). "Environmental and Ecological Problems of Nigeria". *Journal of Environment and Ecology,* 1: 1-30.
Etuonovbe, A.K. (2014). "The Devastating Effect of Flooding in

Nigeria". FIG Working Week, 2014 paper.

General Household Survey Report in Nigeria, (2010). Social Statistics in Nigeria. Compiled by National Bureau for Statistics in 2012. Pp. 1-55.

Isah, U. (2012). A survey of the area vulnerable to flood and mitigation strategies, Adopted by Akare community, Niger State, Nigeria. Unpublished Project submitted to the department of Disaster Risk Management and Development Studies, Federal University of Technology Minna Niger State, Nigeria.

Ken, R. (2013). Environmental Effects of Floods. Retrieved February 9, 2013 from http://www.soest.hawaii.edu/GG/Ask/floods.html.

Kolawole, G. (2011). Managing Flood in Nigerian Cities: Risk Analysis and Adaptation Options – Ilorin City as a Case Study. *Archives of Applied Science Research*, 3(1):17-24 Available online at www.scholarsresearchlibrary.com.

Orji, C.I. (2015). Application of GIS to the Spatial Spread of Flood in Aba Metropolis. Unpublished B.Tech Project, Dept of Environmental Technology, Federal University of Technology, Owerri, Nigeria.

Udosen, C. (2013). "Flood Problems in Uyo Local Government Area" Eroflod Consulting services. Uyo, Nigeria.

West, E.M. (2013). *Engineering Hydrology,* Third Edition. "A Guide to the Use of Waterproofing, Damp Proofing, Protective and Decorative Barrier Systems for Concrete" ACI 5151R America Concrete Institute, Detroit, MI.