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Flood Impact Assessment on the Environment: A Case Study of Birnin- Kudu, Jigawa State, Nigeria

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Abstract

Flood in Birnin-Kudu areas is a terrible catastrophe. The location of large parts of the study area is associated with river ways, one is situated along Masaya Bridge and the other along Kwanar-Huguma and many communities are at risk of flood hazard. This study is aimed at assessing the flood impact on the environment, identifying the factors responsible for flooding occurrence, determining the factors toward prevention, management and control of flooding and understanding the community's responses on ways to arrest flooding event ; A case study of Birnin Kudu, Jigawa State. A sample size of 600 respondents were drawn for self-administered questionnaire, 425 were fully completed. Data collected were analyzed descriptively using Microsoft Excel (Version 2019). Findings revealed that, some of the factors responsible for flood occurrence were poor drainage systems (70.6%), absence of drainages systems (60.5%), lack of unimproved water system in the neighboring community (51.1%), lack of sufficient water reservoirs (50.4%) and poor farming practices (28.9%). Some of the impacts were those that affect the economy of a given geographical area (95.1%), those that affect farm outputs (93.4%) and those that cause the destruction of human settlement (92.5%), deterioration of fertile land (86.4%) and declining of biodiversity (78.4%). Majority of the respondents showed awareness and interest on factors responsible for prevention, management and control of flooding across the affected areas. However, on ways to arrest flooding across the areas, 49.6% revealed that on maintaining the available drainages there is a need for community leaders and community members involvement. It is recommended that, there is a need for provision of standard infrastructural facilities by the government, repair and construction of these drainages where necessary should be embarked on to further ease the flow of storm water, environmental sanitation program must be made compulsory and appropriate agency should be vested with the power to deal with residents who fail to adhere to the rule of sanitation and public enlightenment programmes should be organized to educate the public on the dangers of flood disaster and its causes as a result of the habit of throwing and dumping refuse in gutters, drainage paths and river channels.

Keywords: Flood • Impact • Environment • Catastrophe

Introduction

Flooding is one of the environmental phenomenon which influenced the well-being of people in a given community. Flood is one of the oldest and most devastating catastrophes that causes enormous damage and loss of life worldwide [1]. It could also be seen as the inundation of an area not normally covered with water, through a temporary rise in level of stream, river, lake or sea [2]. In Nigeria, flooding destroyed more people than any other natural catastrophe with an estimated 20% of the population at risk [3,4]. This necessitated the need for studies to assess the negative impacts associated with flooding for proper management and mitigations.

This recurrent problem consistently results in death and displacement of communities. The number of flood-related fatalities has varied significantly from flood-to-flood with the percentage of displaced versus killed persons not conclusive in the literature. The causes and effect of this situation has been described severally in previous studies. The nature of flood catastrophe and their negative effects depend on the natural and man-made conditions on floodplains, economic development and the installation of flood protection measures which has political, economic and social dimension as well as engineering aspects [1]. A similar research has been conducted in a locality somewhere around the state in which this study has conducted. The purpose of conducting such study across different place is to find out the causes and thereby develop strategies to control the occurrence in order to save lives and properties. The environment is Nature's life support system, consisting of air, land and water systems [1]. Thus, this study investigates how the community responds to flood event and what are the factors responsible for the occurrence of flood Birnin Kudu, Jigawa State.

Flooding in various parts of Nigeria have caused four notable problems; forced millions to relocate, destroyed businesses, polluted water resources and increased risk of disease [5,6]. However, it also caused the destruction of the entire environment. Flood causes destruction of homes, grains stores, social and economic infrastructural facilities, it may result into destruction of farmlands together with crops and animals, it may also amounted to accumulation of massive quantities of silt on important environmental structure like water supply systems, sewage treatments and ecosystem services in an area. One of the major effect of flood is the destruction of the environment, leading to a decrease in environmental quality [1,7,8].

Recent researchers have figured out some of the effects of flooding as well as the possible ways of reducing them in communities, geopolitical regions and various states within the country. Nevertheless, the point of focus of these studies is that a more all-inclusive perspective on the prevalent flooding in Nigeria necessitates wide-ranging deliberations [9-14]. The already existing techniques used in generating information in the affected areas have been decribed in previous studies as a satisfactory tool for revealing the needed information on flood disaster. Hence, the suggested that the use of modern day techniques would also assist in identifying steps that will help government and relief agencies identify flood prone areas and help with future flood prevention. Birnin-Kudu had experienced floods for more than five 5 years. Many a times in Birnin Kudu flood submerged houses, schools, clinics and roads among others causing serious to the entire environment [1].

Some of the recent flood catastrophe in Birnin Kudu LGA that was highly devastating in nature includes the floods of 2022. Despite the expected increase in frequency and magnitude of flood in the Nigeria and invariably Birnin Kudu, few impact studies on the environmental quality have been undertaken so far

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[1]. In addition to that there is no reliable and comprehensive data on impacts of flooding on environmental quality in the area for effective measures to be taken. Therefore, this study is aimed at assessing the impacts of flood, factors responsible for its occurrence, management, control and responses to flood in Birnin Kudu, Jigawa State, Nigeria.

Objectives of the study

- Assessing the flood impact on the environment of Birnin Kudu, Jigawa State, Nigeria.
- Identifying the Factors responsible for flooding occurrence in Birnin Kudu, Jigawa State.
- Determining the factors toward prevention, management and control of flooding in Birnin Kudu, Jigawa State, Nigeria.
- Understanding the Community's responses on ways to arrest flooding event in Birnin Kudu, Jigawa State, Nigeria.

Materials and Methods

Study area

The study area is Birnin Kudu Local Government, Jigawa State, Nigeria; which is located between Latitudes 11° 20'N to 11°39' north of the equator and Longitudes 09° 10'E to 09° 40' east of the Greenwich meridian. It covers area of about 2,073 square Kilometers. The main elevation of the plain surface of the area is between 400-420 m above mean sea level. The total annual rainfall received ranges between 500-600 mm in the region. The area is characterized by a long dry season which lasts on average of 8 months from October to April or May. The mean monthly temperature in the area ranges between 30 ºC and 35 ºC The wet season mean annual temperature is about 25 ºC and diurnal range of about 10 ºC to 13 ºC Relative humidity ranges from 80% in August to 23% between the month of January and March. The major rivers of the area are River Birnin Kudu, River Masaya and Kiyako (Figure 1).

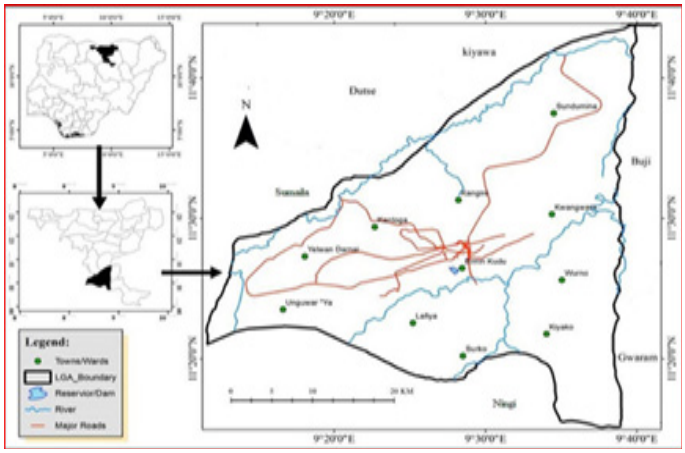

Figure 1. The study area (Birnin Kudu LGA).

Sampling procedures

The study adopted the methodology of Muhammad I [1] and Armah FA, et al. [8] in selecting sample sites. Thus, 12 villages including Birnin Kudu metropolis were purposively chosen out of the across the Birnin Kudu Local Government to form the sample, based on their location in flood prone and flood events [1]. The selected areas are Bigidam, Kantoga, Kafin-Gana, Yalwan-damai, Unguwar 'ya, Masaya, Ciyako, Bamaina, Babaldu, Kangire, Sundimina and Birnin-Kudu. These areas are considered the most floods prone in the study area. A total of 600 respondents were determined as a sample based on Taro Yamane's formula given as:

$n=N/1+N(e)^2$ ..... (i)

Where: n= sample size required, N= number of households (15,000) e= allowable error (%)

Substitute numbers in formula:n=5,000÷1+15,000 (0.04)^2 =600.

Data collection

A total of 600 questionnaires were administered, field observation and interview questionnaire were utilized in collecting data. All the information obtained from the field observation and interview from the research respondents were recorded in a designed data sheet and later the raw data were entered in to an excel sheet for further analysis.

Data analysis

The study used statistical techniques in analysing the data obtained from the research respondents. The statistical techniques involved the use of descriptive statistics. The data collected from the research respondents were represented statistically, using frequency distribution, tables, percentage and figures. The statistical analyses were carried out using the Microsoft Excel soft wares (version 2019).

Results

Socio-demographic profile of the respondents at different locations across Birnin-Kudu, Jigawa state

A total of twelve (12) areas across Birnin-Kudu L.G.A., were surveyed. The areas surveyed were; Bigidan, Kantoga, Kafin-Gana, Yalwan-Damai, Anuguwar 'Ya, Sundimina, Kangire, Masaya, Ciyako, Bamaina, Babaldu and Barnin-Kudu town. A total of six hundred (600) questionnaires were administered across the twelve (12) areas surveyed. Out of which a total of four hundred and twenty-five (425) were recovered and used for analysis. In this study, only males that were participated from all the areas surveyed. Among the age range used in the study, 25-30 years had the highest percentage of respondents across all the areas visited. Married individuals had the highest percentage of respondents than the percentage of single individuals participated in the study. Farmers/Business men had the highest percentage of respondents than other occupation across the areas visited. Respondents that don't have any certificate had the highest percentage, followed by those who had only secondary school certificate. Respondents with no position in the community had the highest percentage than those who have positions across the areas surveyed (Tables 1 and 2).

Table 1. Socio-demographic profile of the respondents at different locations across Birnin-Kudu, Jigawa State.

	Items	BGD	KTG	KGN	YDM	ANY	SMN
Sex	Males	30(100%)	30(100%)	40(100%)	30(100%)	25(100%)	50(100%)
	Females	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	Total	30(100%)	30(100%)	40(100%)	30(100%)	25(100%)	50(100%)
Age	15-20years	0(0%)	0(0%)	0(0%)	2(6.7%)	0(0%)	0(0%)
	20-25years	0(0%)	0(0%)	3(7.5%)	8(26.7%)	0(0%)	2(4%)
	25-30years	30(100%)	10(33.3%)	17(42.5%)	15(50%)	15(60%)	28(56%)
	35-40years	0(0%)	15(50%)	15(37.5%)	5(16.6%)	10(40%)	15(30%)
	40years above	0(0%)	5(16.7%)	5(12.5%)	0(0%)	0(0%)	5(10%)
	Total	30(100%)	30(100%)	40(100%)	30(0%)	25(100%)	50(100%)

Marital Status	Single	0(0%)	0(0%)	0(0%)	21(70%)	0(0%)	3(6%)
	Married	30(100%)	30(100%)	40(100%)	9(30%)	25(100%)	47(94%)
	Total	30(100%)	30(100%)	40(100%)	30(100%)	25(100%)	50(100%)
Occupation	Farmer	12(40%)	9(30%)	10(25%)	5(16.7%)	0(0%)	8(16%)
	Civil servant	0(0%)	3(10%)	0(0%)	3(10%)	0(0%)	7(14%)
	Business	0(0%)	7(23.3%)	5(12.5%)	7(23.3%)	5(20%)	15(30%)
	Farmer/Business	18(60%)	11(36.7%)	21(52.5%)	12(40%)	18(72%)	18(36%)
	Others	0(0%)	0(0%)	4(10%)	3(10%)	2(8%)	2(4%)
	Total	30(100%)	30(100%)	40(100%)	30(100%)	25(100%)	50(100%)
Qualification	Primary cert	5(16.7%)	3(10%)	0(0%)	5(16.7%)	0(0%)	11(22%)
	Secondary cert	10(33.3%)	7(23.3%)	0(0%)	10(33.3%)	0(0%)	9(18%)
	Tertiary	5(16.7%)	3(10%)	0(0%)	3(10%)	0(0%)	5(10%)
	None	10(33.3%)	17(17.7%)	40(100%)	12(40%)	25(100%)	25(50%)
	Total	30(100%)	30(100%)	40(100%)	30(100%)	25(100%)	50(100%)
Position in the Community	Member	27(90%)	28(93.3%)	40(100%)	30(100%)	25(100%)	50(100%)
	Traditional ruler	0(0%)	1(3.3%)	0(0%)	0(0%)	0(0%)	0(0%)
	Political leader	3(10%)	1(3.3%)	0(0%)	0(0%)	0(0%)	0(0%)
	Philanthropist	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	Total	30(100%)	30(100%)	40(100%)	30(100%)	25(100%)	50(100%)

Keys: The numbers outside the parenthesis are the frequencies of the respondents, numbers inside the parenthesis are the percentage of the respondents, BGD= Bigidan, KTG= Kantoga, KGN= Kafin gana, YDM= Yalwan damai, ANY= Anguwar'ya, SMN= Sundimina.

Table 2. Socio-demographic profile of the respondents at different locations across Birnin-Kudu, Jigawa State.

	Items	**KGR**	**MSY**	**CYK**	**BMN**	**BBD**	**BKD**
Sex	Males	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)
	Females	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	Total	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)
Age	15-20years	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	20-25years	15(30%)	0(0%)	15(33.3%)	0(0%)	0(0%)	5(10%)
	25-30years	25(50%)	20(80%)	20(44.4%)	22(88%)	0(0%)	12(24%)
	35-40years	10(20%)	5(20%)	10(22.2%)	3(12%)	20(80%)	20(40%)
	40years above	0(0%)	0(0%)	0(0%)	0(0%)	5(20%)	13(26%)
	Total	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)
Marital Status	Single	15(30%)	0(0%)	13(28.9%)	0(0%)	0(0%)	5(10%)
	Married	35(70%)	25(100%)	32(71.1%)	25(100%)	25(100%)	45(90%)
	Total	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)
Occupation	Farmer	14(28%)	15(60%)	10(22.2%)	2(8%)	0(0%)	3(6%)
	Civil servant	1(2%)	0(0%)	8(17.8%)	3(12%)	5(20%)	7(14%)
	Business	5(10%)	5(20%)	5(11.1%)	5(20%)	8(32%)	13(26%)
	Farmer/Business	30(60%)	5(20%)	16(35.6%)	11(44%)	10(40%)	25(50%)
	Others	0(0%)	0(0%)	7(15.6%)	4(16%)	2(8%)	2(4%)
	Total	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)
Qualification	Primary cert	5(10%)	0(0%)	12(26.7%)	4(16%)	5(20%)	15(30%)
	Secondary cert	19(38%)	5(20%)	18(40%)	6(24%)	10(40%)	13(26%)
	Tertiary	15(30%)	0(0%)	7(15.6%)	10(40%)	10(40%)	20(40%)
	None	11(22%)	20(80%)	10(22.2%)	5(20%)	0(0%)	2(4%)
	Total	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)
Position in the Community	Member	49(98%)	25(100%)	42(93.3%)	25(100%)	25(100%)	50(100%)
	Traditional ruler	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	Political leader	1(2%)	0(0%)	3(6.7%)	0(0%)	0(0%)	0(0%)
	Philanthropist	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	Total	50(100%)	25(100%)	45(100%)	25(100%)	25(100%)	50(100%)

Keys: The numbers outside the parenthesis are the frequencies of the respondents, numbers inside the parenthesis are the percentage of the respondents, KGR= Kangire, MSY= Masaya, CYK= Ciyako, BMN= Bamaina, BBD= Babaldu, BKD= Birnin Kudu respectively.

Factors responsible for flooding occurrence in Birnin Kudu, Jigawa state

Based on the information collected from twelve (12) areas on the factors responsible for flooding occurrence in Birnin-Kudu, Jigawa State, 70.6% of the total respondents revealed that they have strongly agreed poor drainage system as a factors responsible for flooding occurrence, 60.5% strongly believed that absence of drainages system across the surveyed areas serve as a factors responsible for flooding occurrence 56.2% revealed mismanagement of water reservoirs, 50.4% strongly agreed with lack of sufficient water reservoirs,

45.2% revealed climatic changes, 51.1 supported that lack of unimproved water system in the neighboring community, were 28.9% of the respondents believed that the poor farming practices remain as the factors responsible for flooding occurrence across the surveyed areas (Table 3).

Table 3. Factors responsible for flooding occurrence in Birnin Kudu, Jigawa State.

	Responses				
Variables	**Agree**	**Strongly Agree**	**Disagree**	**Strongly Disagree**	**Neutral**
Poor drainage system	125(29.4%)	300(70.6%)	0(0%)	0(0%)	0(0%)
Lack of sufficient water reservoir	126(29.6%)	214(50.4%)	50(11.8%)	35(8.2%)	0(0%)
Mismanagement of water reservoirs	156(36.7%)	239(56.2%)	30(7.1%)	0(0%)	0(0%)
Climatic changes lead to flooding	192(45.2%)	183(43.0%)	50(11.8%)	0(0%)	0(0%)
Lack of unimproved water system in the neighboring community	208(48.9%)	217(51.1%)	0(0%)	0(0%)	0(0%)
Poor farming practices	122(28.7%)	123(28.9%)	90(21.2%)	90(21.2%)	0(0%)
Absence of drainages system	143(33.6%)	257(60.5%)	25(5.9%)	0(0%)	0(0%)

Keys: The numbers outside the parenthesis are the frequencies of the respondents, numbers inside the parenthesis are the percentage of the respondents.

Impact of flooding event in Birnin-Kudu, Jigawa state

Out of the total four hundred and twenty-five (425) questionnaires recovered which was used for analysis, 92.5% believed that flooding causes destruction of human settlement with only 7.5% that don't believed. 91.3% of the respondents believed that flooding leads to the destruction of animal's habitat, 93.4% agreed that flooding affect farming activities across the areas surveyed, 90.1% believed that it affect life schedule of different forms of terrestrial biodiversity, 93.4% revealed that it affect farm output were 88% revealed that flooding event leads to loss of lives, 86.4% agreed that it leads to the deterioration of fertile land, 78.4% revealed that it leads to the declining of biodiversity with the highest percentage of 95.1% of respondents whose revealed that flooding event affect the economy of a given geographical area (Table 4).

Table 4. Impact of flooding event in Birnin Kudu, Jigawa State.

	Responses			
Variables	**Yes**	**%**	**No**	**%**
Flooding event lead to destruction of human settlement	393	92.5	32	7.5
Flooding event lead to destruction of animal's habitat	388	91.3	37	8.7
Flooding affect the farming activities	397	93.4	28	6.6
Flooding affect life schedule of different forms of terrestrial biodiversity	383	90.1	42	9.9
Flooding affect farm output	397	93.4	28	6.6
Flooding leads to loss of lives	374	88	51	12
Flooding lead to deterioration of fertile land	367	86.4	58	13.6
Flooding leads to the general decline of biodiversity	333	78.4	92	21.6
Flooding affect the economy of a given geographical area	404	95.1	21	4.9

Awareness factors toward prevention, management and control of flooding in Birnin Kudu, Jigawa state

Most of the respondents across the areas visited explored their interest on awareness factors towards prevention, management and control of flooding across the areas visited. 97.4% supported the need for the enlightenment on the importance of drainage system, 89.2% supported an awareness on how to practice good farming system, 93.4% shared awareness interest on good management of water reservoirs, 96.7% supported an awareness on any form of activities that can affect the climatic stability, 82.8% revealed their awareness interest on knowledge of how to protect biodiversity and the effect of losing them, 92% explored awareness interest on the effect of land deterioration and how to prevent it's occurrence. 98.6% cares to have a standard awareness on the management of available drainages across the areas visited were 97.6% cares about awareness on the flooding control measures (Table 5).

Table 5. Awareness factors toward prevention, management and control of flooding in Birnin Kudu, Jigawa State.

	Responses			
Variables	**True**	**%**	**False**	**%**
Community members should be enlighten on the importance of drainage system	414	97.4	11	2.6
Community dwellers should be encourage to practice good farming system	379	89.2	46	10.8
Enlighten on the need for good management of water reservoirs should be given to the community members	397	93.4	28	6.6
Any form of activity that can affect the climatic stability should be avoided, such as deforestation	411	96.7	14	3.3
Knowledge on the importance of protecting biodiversity and effect of losing them should be acknowledged among community members	352	82.8	73	17.2
Effect of land deterioration should be highlighted to the community	391	92	34	8
Management of available drainages should be encourage among community members	419	98.6	6	1.4
Flooding control should be encouraged among community members	415	97.6	10	2.4

Community's responses on ways to arrest flooding event in Birnin Kudu, Jigawa state

On the provision of sufficient drainage systems across the areas, 41.9% of the total respondents supported that they need government, community leaders and community member's intervention, 39.3% need only government intervention with the least in 2.4% who's revealed that they need only volunteers' intervention. On maintaining of available drainages, 49.6% supported on the

need of community leaders and community member's intervention, 35.1% believed on the intervention of government and community leaders alone with the least in 15.3% whose supported the intervention of volunteers only. 66.1% of the respondents believed that enlighten on the importance of protecting biodiversity need the intervention of professional in biodiversity conservation, were 14.4% of the respondents believed on the intervention of government, community leaders and community members with the least in 6.6% who's believed the intervention of government and community leaders alone. 51.5% supported the intervention of agriculturalist with idea on the awareness of good farming practices, were 45.9% believed the intervention of ministry of agriculture alone, with the least in 2.6% whose supported the intervention of government, community leaders and community members. On the measures for flood control, 49.4% believed on the intervention of climatologist, were 48.7% believed the intervention of environmentalist with the least in 0.7% who's believed the intervention of conservers alone. Highlights on the climate change causes factors and its consequences, 89.4% believed the intervention of ecologist, were 10.6% believed the intervention of environmentalist (Table 6).

Table 6. Community's response on ways to arrest flooding event in Birnin Kudu, Jigawa State

Provision of sufficient drainage systems need the intervention of	Government	Community leaders	Volunteers	Government and Community leaders	Government, Community leaders and Community members	
	167(39.3%)	59(13.9 %)	10(2.4%)	11(2.5%)	178(41.9%)	
Maintaining the available drainages and reservoirs need the intervention of;	Volunteers	Workers	Political leaders	Government and Community leaders	Government, Community leaders and Community members	
	65(15.3%)	0(0%)	0(0%)	149(35.1%)	211(49.6%)	
Enlighten on the importance of protecting biodiversity are expected from;	Professional on biodiversity	Science organization	Community heads	Government and Community leaders	Government, Community leaders and Community members	
	281(66.1%)	0(0%)	55(12.9%)	28(6.6%)	61(14.4%)	
Awareness on good farming practices should be given by;	Ministry of agriculture		Agriculturalist with idea	Rulers	Government and Community leaders	Government, Community leaders and Community members
	195(45.9%)		219(51.5%)	0(0%)	0(0%)	11(2.6%)
Enlighten on the measures for flood control should be enlighten by;	Political leaders		Environmentalist	Climatologist	Ecologist	Conservers
	0(0%)		207(48.7%)	210(49.4%)	5(1.2%)	3(0.7%)
Highlights on the climate change causes factors and its consequences should be expected from;	Traditional rulers		Political leaders	Ecologist	Environmentalist	Farm surveyor
	0(0%)		0(0%)	380(89.4%)	45(10.6%)	0(0%)

Keys: Number out the parentheses are the frequencies of the respondents while numbers inside the parentheses represent the percentage of responses by the respondents.

Discussion

In this study, only males participated from all the areas surveyed. Studies have found out that, male respondents tend to perceive risk more acutely than their female counterparts and thus, may represent a specific target audience for risk reduction strategies. This was in contrary with the previous findings who's revealed that female respondents tend to perceive risk more acutely than their male counterparts [15-17]. Among the age range participated in the study, 25-30years had the highest percentage of respondents across all the areas visited. This was in accordance with the previous findings as revealed that the gender and age are known to influence human vulnerability to natural hazards; more especially floods [17-19]. Therefore, being in their middle and active age ranges, majority of the respondents might have exhibit overall tendency towards certain physical, psychological, social and economic conditions which may in turn maximize their ability to overcome floods hazards [17]. Because, the people in this age category are adult with a full maturity and understanding ability towards different situation. Therefore, there is a chance of giving meaningful information on how flood disaster occurred in the areas and also give according to their understanding a way forward to the problem. Married individuals had the highest percentage of respondents than the percentage of single individuals participated in the study. This is because most the people in the areas who can be able to explain he scenario clearly are those who are married as they are mostly in possession of either farm or other buildings around residential areas. Farmers/Business men had the highest percentage of respondents than other occupation across the areas visited.

Respondents that don't have any certificate had the highest percentage, followed by those who had only secondary school certificate. Despite the higher population of respondents who have no certificate but they still possessed the ability to give an account on the occurrence of flood disaster. However, they can also give as much as they can control measures towards prevention, management and control of flood disaster across Birnin-Kudu areas of Jigawa State. Despite the fact that the United Nations Development Programme-UNDP, postulates that the efficiency of any initiatives targeted at reducing flood impacts, especially the efficacy of flood warning systems, strictly depends on the level of knowledge of the inhabitants and the users of inundation areas regarding local flood hazards and the awareness of defined appropriate behavioral patterns prior to and during floods. Still our findings corroborates their postulation as majority of the respondents lacks any formal certificate but with the capacity of bringing ways toward flood control. Respondents with no position in the community had the highest percentage than those who have positions across the areas surveyed. Poor drainage system is a major human-induced digger of the flooding experienced in many states of Nigeria including some part of Jigawa State. However, poor drainage system have revealed to cause flood disaster in many state across Nigeria [10,20]. Most residential areas in Birnin-Kudu have no drainage system, or they have a poorly managed drainage system and rely on natural drainage channels and it is common for buildings and other infrastructure to be constructed in a manner that actually obstructs these drainage channels which results in flooding during the rainy season [10]. Nigeria's increasing urbanization has seen a growing proportion of ground surfaces concreted, which means there is no percolation of water and adequate drains are not in place to take care of the surface runoff.

The lack of sufficient drainages in addition to the lack of proper maintenance of existing ones is some of the main causes of flooding in Birnin-Kudu. There is a pressing need on the management of available drainages across the surveyed areas and to construct drainage systems to tackle the flooding problem [4,10]. Most of the respondents believed that flooding causes destruction of human settlement with only little percentage that doesn't believed. Also a greater percentage of the respondents believed that flooding leads to the destruction of animal's habitat, as large amounts of water may have a detrimental impact on natural, ranching [21]. Such extreme flowing water results in the death of thousands of farm animals, affect farming activities across the areas surveyed, life schedule of different forms of terrestrial biodiversity, it also affect farm output, it leads to loss of lives, leads to the deterioration of fertile land, this was in line with the findings of the previous work which revealed that due to flooding, the fertile agricultural land becomes less fertile or infertile due to soil erosion and sedimentation [21], leads to the declining of biodiversity, If a flood is intense and extreme enough, it can result in the loss of habitats and biodiversity in the flooded regions [21]. This will render catastrophic effects on the Ecosystem's biodiversity, habitat potential

and food supply, with long-term consequences for surviving wildlife [22] and it also affect the economy of a given geographical area. This assertion supports the general appreciation of how flooding can lead to colossal damages on the economy of the affected areas [23-27] and how flooding is noted to hold back the growth of the economy in Nigeria [12]. Most of the respondents across the areas visited explored their interest on awareness factors towards prevention, management and control of flooding across the areas visited.

Higher percentage of respondents have also supported the need for the enlightenment on the importance of drainage system, awareness on how to practice good farming system, on good management of water reservoirs, on any form of activities that can affect the climatic stability, on knowledge of how to protect biodiversity and the effect of losing them, on the effect of land deterioration and how to prevent it's occurrence, on the management of available drainages across the areas visited and on the flooding control measures. On the provision of sufficient drainage systems across the areas, a greater percentage of the total respondents supported that they need government, community leaders and community member's intervention, followed by those who need only government intervention. On maintaining of available drainages, higher percentage of the respondents supported on the need of community leaders and community member's intervention, followed by those who believed on the intervention of government and community leaders alone. Most of the respondents believed that enlighten on the importance of protecting biodiversity need the intervention of professional in biodiversity conservation, were few of the respondents believed on the intervention of government, community leaders and community members. Higher percentage of the respondents supported the intervention of agriculturalist with idea on the awareness of good farming practices, followed by respondents who believed the intervention of ministry of agriculture alone. On the measures for flood control, a considerable percentage of the respondents believed on the intervention of climatologist, were others were with the believed on the intervention of environmentalist. Highlights on the climate change causes factors and its consequences, majority of the respondents believed the intervention of ecologist, were others believed the intervention of environmentalist.

Conclusion

Effort was made to assess flood impacts on the environment; a case study of Birnin-Kudu LGAs, Jigawa State of Nigeria. Flood in the study area was on the increase and the worst scenario was recorded in 2022 precisely, as the event leads to the destruction of settlements, loss of farms, loss of lives and the bridges collapse. While factors, such as: heavy rains, overflow of river/stream and long period of rainfall cannot be controlled, the issue of drainage mismanagement, lack of sufficient drainages, may continue to prevail and damages, attributed to their human understanding beliefs, is henceforth uncontrollable. This is rather true especially, when the respondents and the users of inundation areas were satisfactorily knowledgeable and lived in the area for a long period of time to gain experience regarding local flood disaster. The negative effect of flood could be worsening by day. There is need therefore for; provision of proper management of available drainages and water regulatory outlets, also create awareness on climate change and environmental effects associated with flood event.

Recommendations

Based on the findings of this study, the paper recommends possible solutions that would accommodate immediate remedial and preventive measures to minimizing flood problems observed in the study area. Therefore, the following measures are recommended:

i. There is a need for provision of standard infrastructural facilities by the government. These facilities include good surface drainage and other supporting facilities.

ii. Repair and construction of these drainages where necessary should be embarked on to further ease the flow of storm water.

iii. Environmental sanitation program must be made compulsory and appropriate agency should be vested with the power to punish residents who fail to adhere to the rule of sanitation. There should be fines and penalties for people who fail to comply with the sanitation program.

iv. Public enlightenment Programmes should be organized to educate the public on the dangers of flood disaster and its causes as a result of the habit of throwing and dumping refuse in gutters, drainage paths and river channels. There is also need for government to set up various information Programmes to educate the masses on how to respond to flood disaster.

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Conflict of Interest

There are no conflicts of interest by author.

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