African Journal of Social Sciences and Humanities Research
ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)
www.abjournals.org

SOCIO-ECONOMIC EFFECT OF FLOODING IN KARIM-LAMIDO LOCAL GOVERNMENT AREA OF TARABA STATE USING GIS TECHNIQUE

Mohammed B. Yusuf [1], Adelalu T. Gabriel[1], Ezekiel B. Bwadi[1],

Oliver A. Maima[1&2], Micah M. Ralp[1] and Ayesukwe R. Ishaku[1&2]

[1]Department of Geography, Faculty of Social Sciences, Taraba State University, PMB 1167,Jalingo, Taraba State, Nigeria

[2]Department of Geography, College of Education, Zing, Taraba State, Nigeria.

Email: bwadiben@gmail.com; Tel: +2349035604668

Cite this article:

Mohammed B.Y., Adelalu T.G., Ezekiel B.B., Oliver A.M., Micah M.R., Ayesukwe R.I. (2023), Socio-Economic Effect of Flooding in Karim-Lamido Local Government Area of Taraba State Using GIS Technique. African Journal of Social Sciences and Humanities Research 6(1), 49-78. DOI: 10.52589/AJSSHR-IKZKQ6YT

Manuscript History

Received: 5 Dec 2022

Accepted: 7 Jan 2022

Published: 23 Jan 2023

ABSTRACT: *Over the years, flooding has affected numerous aspects of the lives of the people in Karim-Lamido Local Government Area. The study aimed at assessing the effects of flood on socio-economic activities in Karim-Lamido Local Government Area of Taraba State using GIS techniques. The study employed questionnaires, oral interviews, personal observations and descriptive statistics to analyse data using pie charts and graphs to present data. ArcGIS 10.1 was used to analyse the flood vulnerability using LandSat images. The flood vulnerability analysis of Karim-Lamido indicates that about 80% of the area is flood vulnerable and the major stream order in Karim-Lamido is between 3-5. Results also revealed that rainfall received annually in the area and the proneness of the area to flood. In addition, loss of agricultural products, properties and lives were revealed as some of the negative effects of flooding in the study area. The result also revealed that the major effects of flood are the washing away of the community's farms lands and their businesses equipment. Furthermore, the researchers recommend that the resettlement scheme programs should be embarked on by the government to resettle most of the communities in the study area. Additionally, for good area planning, individuals, corporate entities, and the government should provide adequate funding for disaster management organisations. Furthermore, a local flood warning system needs to be created. This will go a long way towards educating and preparing the people of Karim-Lamido for major flooding.*

KEYWORDS: Effect, GIS, Flood, Vulnerability, Socio-Economic, Technique.

INTRODUCTION

Flooding occurs when a dry area overflows with water and is not able to absorb it into the ground (Bronstert, 2003). The hazard of flooding is an annual phenomenon that has displaced millions every year worldwide and claimed lives and properties (Bronstert, 2003). According to Bariweni, Tawari and Abowei (2012) and Etuonovbe (2011), Nigeria experiences floods every year especially flash floods and dam related floods during the rainy season. However, each disaster seems to get worse leaving a larger impact than the previous. Over 2.1 million Nigerians were made homeless by the 2012 flood (Bariweni et al., 2012). According to the National Emergency Management Agency (NEMA) (2012), numerous assets, including thousands of hectares of farmland, were destroyed, and many lives were lost. Floods are most prevalent in the northern parts of the nation, particularly in the States where the major rivers (the Benue and Niger rivers) flow through towns where the downstream areas were entirely drowned.

Flood often happens without warning but with a surprise package that always delivers disaster to unprepared communities like the ones in most sub-Saharan African countries. The huge human, financial and economic risk associated with most floodplains have made many experts recommend avoiding such an ecologically viable environment to a less vulnerable area especially as it relates to land use (Bello, Onuthoja & Asikhia, 2013). A settlement is defined as an assemblage of buildings with people residing in them. Thus, considering their general makeup, settlements are of major concern when discussing flood hazard. Going by number and economic losses, flood disasters account for about a third of all natural disasters (Nwilo, Olayinka & Adzanzeh, 2012). Thus, Nigeria is no exception to countries that experienced flooding in recent times. Many communities have suffered losses due to flood problems and the same can be said about floods in Karim-Lamido of Taraba State.

Taraba State has witnessed so many devastating flood incidents since the beginning of the 21st century. Several parts of the state have experienced different degrees of flooding in the past which devastated people's houses and properties, leading to displacement of people annually. Floods are natural occurring processes that are difficult to prevent but can be managed in order to reduce its social and economic impacts. Floods interfere with the local economy and destroy infrastructure, resulting in disruption of livelihoods, normal social services and health care. Flood incidence is likely to increase in the future due to urbanisation and land use changes, high concentration of poor and marginalised populations, lack of regulations and preparedness effort (Oruonye & Adebayo, 2015).

The most sustainable approach to mitigate the effects of flooding in an area is to ensure that all areas that are vulnerable are identified for precautionary measures (Oruonye & Adebayo, 2015). In 2012, there was heavy rainfall in the upper part of the catchment of River Benue in the Republic of Cameroon which led to flooding of the entire basins (SEMA, 2012). The flood was a severe one that the Lagdo Dam which was constructed on the River Benue in the Republic of Cameroon could not control it. Consequently, the dam had to be opened to release some water from the excess impoundments that is capable of collapsing the dam. The release of water from the Lagdo Dam upstream of the River Benue led to the flooding of the entire length and breadth of the downstream catchment of the basin (SEMA, 2012). All the settlements (both rural communities and townships) along the River Benue were flooded.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

The length of River Benue in Taraba State has been estimated to be about 390 km (SEMA, 2012). This made the State to be one of the most vulnerable states by the flood in 2012. All the 6 LGAs in the state located along the River Benue valley (which include Karim-Lamido, Lau, Gassol, Ibi, Ardo-Kola) were greatly affected. Also the flood came very suddenly as there was no sufficient communication from the Cameroonian government before the release of the water. This made the impact of the flood very devastating to the affected communities as they were taken unaware and could not rescue their properties and livestock (Oruonye & Adebayo, 2015).

The reoccurrence of flooding especially in Karim Lamido area is becoming more tragic as it is characterised by loss of lives, properties, agricultural lands and produce. The change in rainfall patterns attributable to climate change has made it worse. Since land degradation is causing many areas to reach a point where it is considered unsuitable for survival, climate change should be addressed urgently. Conflicts over the drastic depletion of natural resources, population growth, and poverty have resulted, endangering the stability of the political, economic, and social systems (Schwartz & Randall, 2003).

The advance in remote sensing and the GIS techniques has made it possible to simulate the functionality of watershed systems by using hydrological models on spatial and physical characteristics bases. These techniques provide powerful integrated tools for land use/land cover (LU/LC) monitoring and observing at regional as well as global scales and also tools for change detection in watersheds are very efficient and effective (Huang et al., 2012). The substantive and sustainable approach to mitigate the effects of river flooding is to ensure that all areas that are vulnerable are identified for precautionary measures (Ishaya et al., 2009). In addition, systematic (spatial) information is also needed for post impact assessment and quick estimation of the extent of damage. To deal with this, it is pertinent to adopt a powerful framework with geo-visualisation capability to analyse, model and visualise output for effective decision making. Geospatial technology involving the integration of geographical information systems (GIS) and remote sensing techniques is designed in such a way that multi-dimensional data can be entered, manipulated, checked, analysed and displayed as data referenced to the earth. The utilisation of remotely sensed data in the GIS environment has proved to be the most resourceful approach for river flooding assessment and risk analysis (Jayasselan, 2006; Ishaya et al., 2009; Irimescu et al., 2010). It is against this background that this research focuses on the socio-economic effect of flooding in Karim Lamido area of Taraba using GIS Application.

METHODS AND MATERIALS

The Study Area

The study is carried out in Karim Lamido Local Government Area of Taraba State which is located in North-eastern Nigeria between latitudes 8°33′-10°21′N and longitudes 10°21′-11°24′E (Fig. 1 and 2). It covers a land mass of 6,450.72 km² with a population of 193,924 according to the 2006 population census and sub-Sudan vegetation. It is bounded to the south by the River Benue and traversed by several tributaries of the same river. It has two distinct seasons, namely; rainy which extends from May to October and dry which extends from November to April. Karim Lamido has various ethnic groups, including Bandawa Jenjo,

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Wurkum, Karinjo Bambuka, Munga, Dadiya and Hausa Fulani. It contains about 11 political wards, some of which are Jen Ardido, Jen Kaigama, Muri A, Muri B, karim A, karim B.

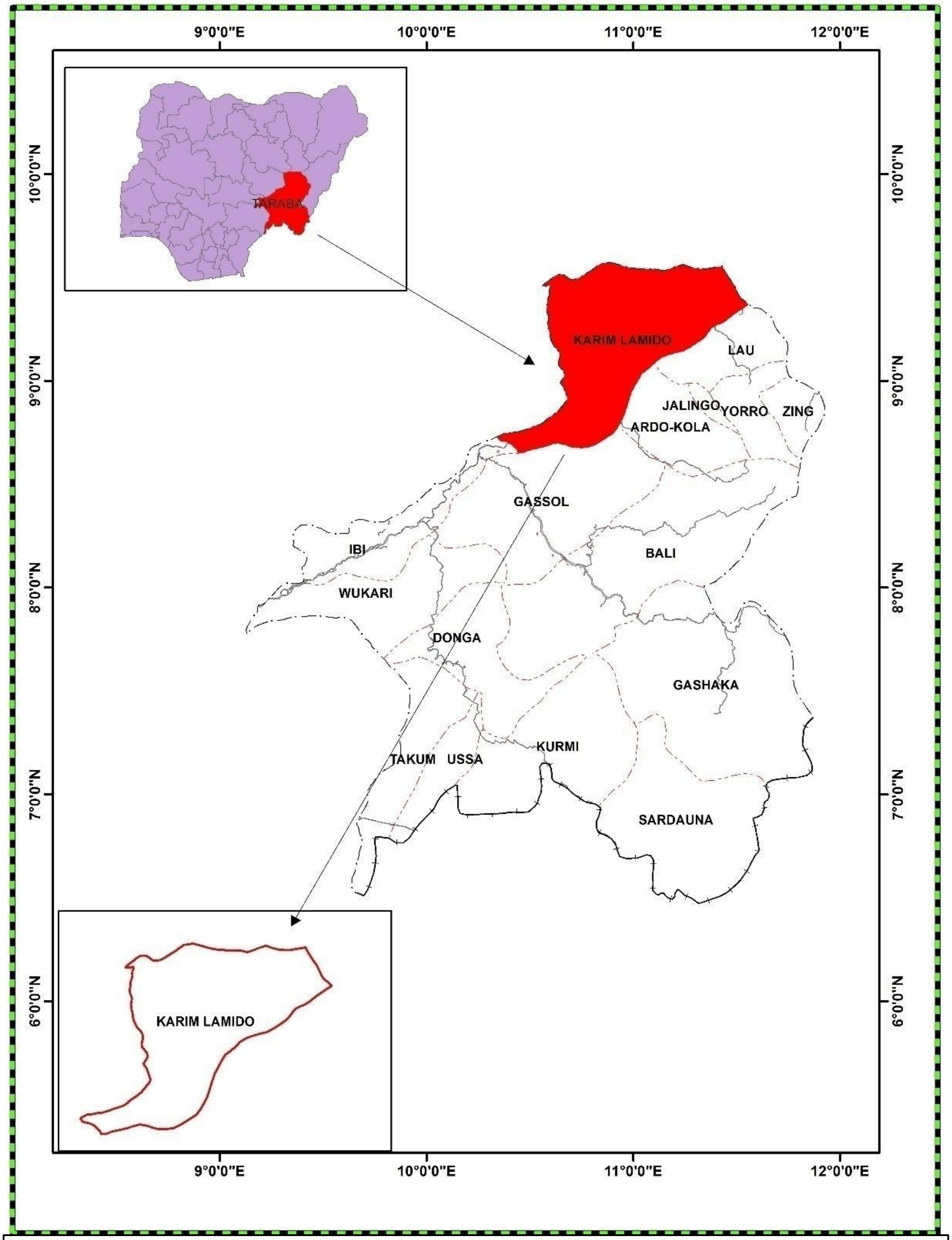

Figure 1: Map of Taraba State showing KarimLamido Local Government Area

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

African Journal of Social Sciences and Humanities Research
ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)

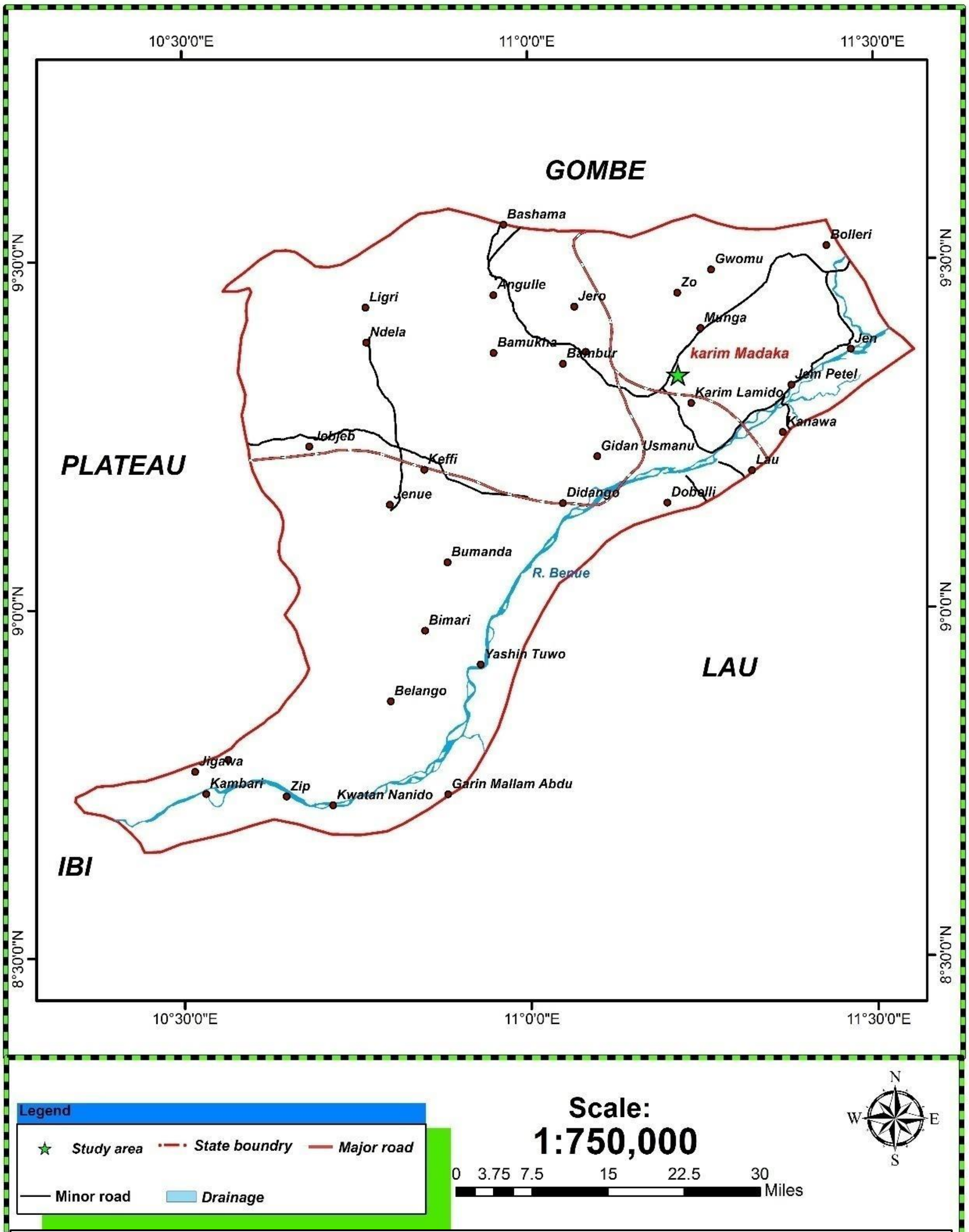

Figure 2: Map showing KarimLamido Local Government Area of Taraba

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Most part of Karim Lamido LGA occupies extensive Fadama swamps of Muri plains which are sparsely settled and virtually uncultivated. River Benue flood plain is an expanse of land occupied by villages in the now defunct Muri Division which is also referred to as Muri plains. The land area is largely made up of soil that is a mixture of clay and loam; this enables it to retain moisture much longer than other types of soils on the Benue floodplain but cracks in the dry season. The significance of the Benue basin and their marshland is that they provide arable land for agriculture. Most of Karim Lamido district areas could be described as extremely fertile land. Like most parts of the northern part of Nigeria, the Karim Lamido LGA has a wet and dry climate; the wet season lasts, on the average, from April to October with mean annual rainfall of 1058mm. The wettest months are August and September. The dry season lasts from November to March; the driest months are December and January with relative humidity dropping to about 15%. Mean annual temperature of about 28°C with maximum temperatures varying between 30°C and 39.4°C, and minimum temperatures range between 15°C to 23°C

The vegetation of Karim Lamido LGA is typically a Sudan Savanna vegetation pattern found in Nigeria as the land has insignificant tree cover, with grasses and flowers located between trees. The land area is characterised by a combination of pyrophytic species of trees and grassland in the border areas of Bandawa district with Munga Jen, Karim while a sparsely distributed short trees towards river Benue (Abdullazeez, 2016). The soil in the area is predominantly lixisols; soil with clay – enriched lower horizon, low CEC and saturation of bases. It has a lower water table in the dry season and an available water supply during the rainy season. Though the soil is good for agricultural activities, it does not support structural development as the movement of the soil or contraction of lixisols in the dry season leads to cracks on the building.

Research Method

The research design used for this study is the descriptive and analytical statistical design, which involves the use of graphs, pie charts and simply percentage and tables to present data. ArcGIS was used to analyse the flood vulnerability of Karim Lamido Local Government Area. The tools used include the questionnaire, personal field observation and focus group discussion among the residents in the study area. SRTM data were also used to generate the flood vulnerability analysis. A preliminary survey of the study area was carried out with special reference to areas which are mostly affected by the flood which include Madaka, Gwenzu, Dansha, Bandawa, Kwantalanga and Jen Petel. Spot assessments were made with respect to the economic activities of the people along the floodplain. The reconnaissance survey assists in determining the type of questionnaire to be administered; in this case, the questions of effects of flooding which helped in the determination of the coping mechanism are adapted over the years.

Data Collection

The research instrument chosen for this study includes the usage of questionnaires and interviews. Shuttle Radar Topography Mission (SRTM) data of Karim Lamido LGA were used to analyse the flood vulnerability of the area. Data were therefore collected through the administration of three hundred and seventy nine (379) well-structured questionnaires with twenty (20) closed ended and open ended questions.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

The questionnaire was structured into four sub-sections which includes;

i. The demography of the respondents
ii. The factors responsible for flooding
iii. The effect of flood on socio-economic activities
iv. The Coping Strategies

At the district and community levels, key informants were interviewed using a checklist. All significant players who are involved in flood management make up the composition of key informants. The interviews were representatives of the community on a local level. The representatives were expected to present typical viewpoints and perceptions on the subject. The interviews took place in a setting set up by the neighbourhood.

The key informant and focus group discussions at district and community levels cover the following topics:

1. Main Livelihood patterns
2. Main Sources of income
3. Main sources of food
4. Rainfall performance and its effects
5. Effects of floods on:
   i. Agriculture
   ii. Health
   iii. Infrastructure
   iv. Education
   v. Water and Sanitation
   vi. Housing and Property
6. Underlying causes of vulnerability to floods
7. Coping Strategies
8. Development options to deal with the problem of floods.

Population of the Study

The study area has a population of 193,924 as of 2016 based on the 3% annual growth rate of the 2006 Census (NPC, 2006). The target population for this study includes households, institutions, community leaders and practitioners; they were purposely selected at household and community levels respectively. This is because this group of people are well equipped with the knowledge of flooding in the study area. Purposive sampling, according to Strydom,

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Fouche and Delport (2005), is solely dependent on the researcher's judgement in that a sample is made up of components that have the majority of the traits, representative, or typical attributes of the population.

Sample Techniques and Sample Size

The study used stratified sampling and simple random sampling techniques to select the participants for the sample; these techniques help to minimise cost whilst maximising generalisation. Using stratified sampling, the parent population or the sampling frame is made up of subsets of known size. These subsets make up different proportions of the total, and therefore sampling should be stratified to ensure that results are proportional and representative of the whole. In administering the questionnaires and the interviews after stratifying the respondents into group and sub-group, simple random sampling techniques were adopted in administering the questionnaires and personal interviews.

The sample size for the study was calculated and determined based on the Taro (1964) formula for determination of sample size. According to Taro Yamani, to determine a sample from a population:

$$n = \frac{N}{1+N(e)2}$$

Where n = sample

N = population size

e = error limit

1 = constant

N = 193,924

e = (0.05) or (0.0025)

$$n = \frac{193,924}{1 + (193934 \times 0.0025)}$$

Using the technique, the sample size of this study will be 400.

GIS Application

In implementing the assessment of flood vulnerability within the study area using ArcGIS, the necessary framework and methods in data acquisition, data creation, data processing and manipulation involved in the production of a flood vulnerability map of the study area are discussed.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Data Requirement

The following datasets was used for this study:

i. Administrative map of Karim-Lamido LGA

ii. Shuttle Radar Topographic Motor (SRTM Data)

System Selection

The system used includes hardware and software components. The hardware components include the physical equipment that will be used to execute this research and they include:

i. HP Pavilion dv6 Notebook PC with processor of Intel(R) core(TM) i5-2410M CPU @2.30GHz, 6.00GB RAM and 500GB hard drive.

ii. Printer

The software components include:

i. ArcGIS 10.2

ii. Microsoft word

Data Sources and Collection

The data used in running the various steps for the flood vulnerability model were obtained from different sources.

i. The Shuttle Radar Topographic Motor (SRTM Data). The SRTM imagery covering the study area was clipped out from the full imagery of the entire region.

ii. The administrative map of the study area which defines the boundary of the region of concern was obtained.

Data Processing Procedure

Data processing procedure involves the various steps which were involved for the production of the flood vulnerability. During the course of the thesis, the following analyses were carried out. These processes which involve the use of spatial analytical tool for it analysis are:

1. Fill Sink: Fill sinks in a surface raster to remove small imperfections in the data. A sink is a cell with an undefined drainage direction; no cells surrounding it are lower. The pour point is the boundary cell with the lowest elevation for the contributing area of a sink. If the sink were filled with water, this is the point where water would pour out.

2 Flow Direction: It creates a raster of flow direction from each cell to its steepest downslope neighbour. The output of the Flow Direction tool is an integer raster whose values range from 1 to 255. The values for each direction from the centre are for example, if the direction of steepest drop was to the left of the current processing cell, its flow direction would be coded as 16.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

3 Flow Accumulation: Creates a raster of accumulated flow into each cell. A weight factor can optionally be applied. The result of Flow Accumulation is a raster of accumulated flow to each cell, as determined by accumulating the weight for all cells that flow into each downslope cell.

4 Maths Algebra: Builds and executes a single Map Algebra expression using Python syntax in a calculator-like interface. The Raster Calculator tool allows you to create and execute a Map Algebra expression that will output a raster.

5 Stream Link: Assigns unique values to sections of a raster linear network between intersections. Links are the sections of a stream channel connecting two successive junctions, a junction and the outlet, or a junction and the drainage divide.

6 Stream Order: Assigns a numeric order to segments of a raster representing branches of a linear network. The output of Stream Order will be of higher quality if the input stream raster and input flow direction raster are derived from the same surface. If the stream raster is derived from a rasterized streams dataset, the output may not be usable because, on a cell-by-cell basis, the direction will not correspond with the location of stream cells

7 Slope: Identifies the slope (gradient, or rate of maximum change in z-value) from each cell of a raster surface. Slope is the rate of maximum change in z-value from each cell. The use of a z-factor is essential for correct slope calculations when the surface z units are expressed in units different from the ground x,y units.

8 Contour: Creates a line feature class of contours (iso-lines) from a raster surface. Contours do not extend beyond the spatial extent of the raster, and they are not generated in areas of No-Data; therefore, adjacent contour inputs should first be edge-matched into a continuous feature dataset.

9 Aspect: Derives aspect from a raster surface. The aspect identifies the downslope direction of the maximum rate of change in value from each cell to its neighbours. Aspect can be thought of as the slope direction. The values of the output raster will be the compass direction of the aspect.

10 Base Height: There are two ways to set base heights for features in 3D without requiring 3D geometry:

i. Using an attribute or constant value

ii. Draping features on a surface

When using the first option, attribute values containing height information are assigned to the layer or used to create an expression that can provide base height values. The constant value to be applied can be any whole number, which would become the future's height in metres above the surface.

The second option, draping, is essentially setting the base heights from a surface. Surface elevation data includes single-band digital elevation model (DEM) rasters, triangulated irregular networks (TINs), and terrain datasets, but in ArcScene, terrain datasets cannot be directly consumed. The area of interest must first be converted to a raster or TIN. There are

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

some conceptual differences when it comes to setting the role of the layer between ArcScene and ArcGlobe, including steps to define data as a draped layer.

The elevation surface providing z-values to the data does not have to be in the Arc-Scene document. When working with raster layers, setting the base heights can be done with a surface or constant value.

Data Analysis

For this study, the use of table and statistical mode of data presentation found the basis for analysis; results were presented in graphs and tables and flood vulnerability tests were conducted using GIS techniques, using Shuttle Radar Topographic Motor (SRTM Data).

RESULTS AND DISCUSSION

This section basically deals with data presentation analysis, their interpretation, finding and the discussion of results.

Demographic Analysis of Respondents

This section deals with the report on the demographic characteristics of the respondents and their influence on floods in Karim Lamido area. These include gender, age, marital status, educational background and occupation status of the respondents as seen on Table 1.

Table 1: Demographic characteristic of respondents

Gender	**Respondents**	**Percentage (%)**
Male	325	86
Female	54	14
Total	**379**	**100**
Age		
29 & below	18	5.8
30-39	109	28.7
40-49	159	41.9
50 & above	89	23.4
Total	**379**	**100**
Marital status		
Single	128	34
Married	215	57
Divorced	27	7
Widow/Widower	9	2
Total	**379**	**100**
Educational status		
Primary	86	23
Secondary	198	52
Tertiary	64	17
None	31	8
Total	**379**	**100**

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Occupation		
Student	61	16
Civil Servant	19	5
Public Servant	22	6
Farmer	277	73
Total	**379**	**100**

Source: Field Survey, 2021.

Table 1 shows that 325 of the respondents representing 86% which are majorly into farming activities are male while there are 54 female counterparts representing 14%. This agrees to the fact that the majority of farmers in developing countries are male due to the fact that farming activities are labour intensive as noted by Umar (2002). This also implies that the majority of the respondents are capable of controlling the flood.

The age distribution of the respondents shows that 18 of the respondents representing 5.8% are 29 years and below, 109 of the respondents representing 28.7% are within the age bracket of 30-39, 159 of the respondents representing 41.9% are within the age range of 40-49 and respondents which are 50 and above of age are 89 representing 23.4%. It can therefore be concluded that majority of the respondents are within their productive age bracket of 40-49 years and as such they have the needed strength to be active in farming activity, which include fishing and other agricultural activities

The marital status of the respondents as seen on Table 1 shows that 128 of the respondents representing 34% are single, 215 representing 57% are married, and 9 of the respondents representing 2% are divorced. By implication, it is clear that the majority of the respondents have family and this is very good in developing countries as families are the major source of labour in agricultural activity.

From the educational background of the respondent, it is clear that the majority of the respondents in the study area have formal education. It is shown that 52% of the respondents have secondary education, 23% have only a primary school certificate, and 17% further their education after obtaining a secondary certificate to a higher institution of learning. On the other hand, 8% of the respondents attest to the fact that they do not have any form of formal education from any formal school; this therefore means that they only have informal education. By implication, it is clear that the majority of the respondents have formal education and as such they clearly understand the effects of flooding in their local communities; as education plays a vital role in coping mechanisms of any form of natural disaster.

On the occupational status of the respondents, Table 1 shows that 16% of the respondents are students, 5% are civil servants, mostly working with State or Local Government Authority, 6% of the respondents are public servants and 73% are farmers. Based on the result, one can therefore conclude that Karim Lamido is predominantly occupied by farmers, as majority of the respondents are farmers. This is in line with the general assertion that the major occupation of people in Taraba State is farming (Oruonye, 2012).

Findings indicate that the majority of the respondents are male, the age bracket of the majority of the respondents lines between the ages of 40-49 years most of which are married with children and they have at least a secondary certificate and they are farmers. By implication, it

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

is clear that respondents are well equipped with adequate knowledge that the researcher needs regarding the effect of flooding in Karim Lamido LGA.

Factors Responsible for Flooding

This section deals with the major factors responsible for flooding as agreed by the respondents in Table 2. The section also tried to ascertain if the respondents have experienced flooding, its last occurrence and how often it occurs in their communities.

Table 2: Factors Responsible for Flooding

Number of Respondents that have experienced flood in their community	Respondents	Percentage (%)
Yes	371	98
No	8	2
Total	**379**	**100**
Occurrence of flood		
Annually	103	27
Biannually	79	21
Often, more than three times a year	197	52
Never	-	-
Total	**379**	**100**
Causes of flood in the Area		
Building on/close to water course	36	9
Bad refuse Disposal	11	3
Unplanned Settlement	15	4
Lack of/Inadequate Drains	10	3
Flood prone Areas	39	10
Heavy downpour	136	36
Total	**132**	**35**
	379	**100**

Source: Field Survey, 2021.

Table 2 shows the number of respondents who had witnessed flooding in their communities. It is clear from the result that the majority of the respondents which constitute 98% attest to the fact that they have experienced flooding. By implication, it is clear that most of the respondents who are rural dwellers of Karim Lamido had experienced flooding in their various communities. On the other hand, 2% of the respondents had never experienced flood. Studies indicate that every year all the communities in the study area usually experience floods which affect their activities in the areas. The most recent devastated flood recorded in the community was in 2005, 2011 and 2012.

Table 2 elicits information from the respondents on the occurrence of flood in their locality; the results shows how often the floods occur in the study area with 52% of the respondents opening that flooding occurs often more than three times yearly, 27% suggest that flooding in Karim Lamido occur annually, while 21% are with the view that it occurs biannually. By

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

implication and based on these findings, one can conclude that flooding in the study area occurs at least three times on a yearly basis since the majority of the respondents agree with this fact.

Based on the result in Table 2, it is clear that floods occur annually in Karim Lamido, though there are years that the disaster of flood in the area is devastating. The devastation is usually triggered by the release of water from Lagdo Dam in Cameroon as a result of high rainfall as reported by Oruonye and Adebayo (2013). Although different parts of Taraba state are exposed to flood almost every year, the 2005, 2011 and 2012 floods broke all records of the past, washing away farms and destroying houses.

The results show that the major cause of flood in Karim Lamido Local Government Area according to the respondents includes heavy rainfall and also the fact that majority of the communities are located in flood prone areas; with 36% and 35% of the respondents attesting to this fact. The next causes of flood according to the survey are poor design of drain, building close to water bodies, unplanned settlement and lack/inadequate drains (Table 2).

Conclusively, it is very clear that the majority of land area of Karim Lamido Local Government Area lies on flood prone areas; this makes the areas vulnerable to flood vulnerability. This conjured with the findings in the unpublished report of Taraba State Environment Protection Agency (2010) on flood disaster assessment in Karim Lamido LGA; the report clearly shows that Karim-Lamido LGA lies majorly on flood prone areas along River Benue. Findings in this section agree with the findings in Oruonye (2015) which assert that the 2012 flood in Taraba state alone destroyed over 2,068 farms, 363 houses and partially affected 1,562 houses. Over 6,213 persons were internally displaced and 1,420 families were affected by the flood in 5 LGAs, namely; Jalingo, Lau, Karim Lamido, Ardo Kola and Yorro. This also concords to the assertion in Oruonye and Adebayo (2013) that the 2012 flood in Karim Lamido was majorly as a result of the release of the Lagdo Dam in the Republic of Cameroon on the 24th August, 2012. Their findings show that all the areas adjacent to the River Benue are low lying and part of the extensively flooded Great Muri plain are greatly affected with the flood. By implication, one can therefore confidently say based on these findings that,the major causes of flood in Karim-Lamido are usually increase in annual rainfall which will trigger the release of Lagdo Dam in Republic of Cameroon and also the fact that majority of the part of Karim Lamido is flood vulnerability area.

Effects of Flooding on Socio-Economic Activities

This section elicits information from respondents on the effects of flooding on their socio-economic activates; which includes their business and the extent of the effect in monetary terms as presented in Table 3.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)

Table 3: Effects of Flooding on Socio-Economic Activities

Do you have business in this Area	Respondents	Percentage (%)
Yes	368	97
No	11	3
Total	**379**	**100**
Effects		
Loss/Damage to money, stock, equipment, fittings etc.	145	38
Reduction in the amount of time business/trade conducted	50	13
Low patronage from customer	15	4
Temporarily closed down of business	78	21
Course difficulty in transportation	91	24
Total	**379**	**100**
Estimate of annual Income lost due to flood (Amount in Naira)		
Below 50,000	8	2
50,000 – 100,000	37	10
100,000 – 500,000	88	23
Above 500,000	131	35
Cannot Estimate	115	30
Total	**379**	**100**

Source: Field Survey, 2021.

Table 3 shows the response of the respondents to their respective business activities in the Karim Lamido LGA community. Based on their responses, it is clear that the majority of respondents, constituting 97%, own an enterprise that earns them money in the communities. Findings obtained through interviews show that most of the businesses are agricultural incline businesses, such as farming, canoe makers, canoe riders and sales of agrochemicals.

Table 3 also seeks to examine the effects of flood in Karim Lamido Local Government Area of Taraba State on the businesses of the local people. The result shows that, the major effect of flood in the study area are loss/damage of money, stock, equipment, fittings etc (38%) and course difficulty in transportation (24%); this is basically due to the fact that flood usually come suddenly and residents are fully aware or ready for it. Other impacts of the flood include temporal closure of business (21%), reduction of business time (13%) and low patronage from customers (4%).

This study agrees with findings in Oruonye (2013) that the 2012 flood disaster came suddenly and did not allow the people any chance to pick their things or save their properties. For some communities, the flood arrived in their area at night while they were sleeping. Before they could understand what was happening, water had already filled their houses and as such they could only flee for safety. So many communities could not get help on time because their communities were completely inaccessible to government officials. The flood was so ravaging that many people lost their lives in the process of trying to rescue their properties and assist their neighbours. Bariweni et al. (2012) also revealed that the floods of 2012 had a major impact

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

on socio-economic life for days, weeks and even months in some areas. Roads and buildings were submerged and victims were trapped due to blockage of road. Children could not go to school, workers to work and traders to the markets. These automatically took its toll on the economy as businesses were affected.

Furthermore, Table 3 indicates the estimated annual income lost from business due to the flood in the study area. The result of the survey shows that 35% of the respondents opined that they lost over Five Hundred Thousand Naira (500,000) and 30% are of the view that their loss cannot be estimated. On the one hand, 23% of the respondents agreed on losing about 100,000-500,000, 10% lost about 50,000-100,000 and 2% lost below 50,000.

This is in line with the findings in Oruonye and Adebayo (2013) that properties worth millions of naira were carted away by the flood in the 2012 flood. In 2012, the unpublished report of Taraba State Flood Disaster Assessment on 2012 Flood in Karim Lamido shows that residents in Karim Lamido lost properties, farmland and other valuables worth millions. The report shows that averagely most residents affected by the flood loss are estimated to be around 400,000 -700,000 with the exception of a few who lost more than a million due to the size of their farmland and store rooms.

This section has vividly revealed that most of the respondents are business owners in Karim Lamido LGA and are residents in the environment. The study shows that most of these businesses are agro-inclined businesses, such as fish selling, canoe making, sales of agro-product, among others. The result also revealed that the major effects of flood according to the respondents include the loss of money, equipment, fittings, among other valuables.

Coping Mechanism and Adaptive Measures Employed

This section examines the coping mechanism and adaptive measure employed by the people of Karim Lamido Local Government Area in checkmating floods in their communities. The section will try to highlight the method employed if any and identify its traditional or scientific method.

Table 4: Coping Mechanism and Adaptive Measures Employed

Can flooding be prevented?	Respondents	Percentage (%)
Yes	198	52
No	88	23
I don't know	93	25
Total	**379**	**100**
Are there Public Awareness and Campaign on flood?		
Yes	379	100
No	0	0
Total	**379**	**100**
Do People relocate from floodplain during raining season?		
Yes, people often relocate	129	34
Yes, but not often	124	32
People don't relocate	126	34
Total	**379**	**100**

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Aid received during the flood		
National Disaster Management	196	52
State Government	119	31
Traditional Council	25	7
Friends/Relatives	39	10
Total	**379**	**100**

Source: Field Survey, 2021.

Table 4 seeks to determine if flooding in the study can be prevented. The result shows that 52% of the respondents believe that floods can be controlled or prevented; 23% reject the fact that floods cannot be prevented or controlled and 25% are not sure if floods in their communities can be controlled or prevented. Those who opine that flood can be controlled or prevented are further probed by suggesting various ways or means to prevent it.

The study seeks to elicit information on the coping mechanisms employed by respondents to check out or reduce the effects of floods in their locality. The result shows that 18% of the respondents agree that there are coping strategies employed to check the activities of the flood by the locals in Karim Lamido communities while 30% are with a contrary view that there are no coping mechanisms in place to check the activities of flood in the area (Table 4). On the other hand, the majority of the respondents, which represent 52%, are of the view that they do not know if there is any coping mechanism in place to check activities in their locality.

Further interview to ascertain the coping strategy, if any, employed by the resident shows that there is no scientific strategy or coping mechanism in place in Karim Lamido communities to check off the destructive activities of flood. The residents who claim there are coping mechanisms agree that the coping mechanisms include vacating their communities at a slide notice of the flood, building of their tent on a projected woody platform during the raining seasons and the use of canoe as the major means of transportation within their areas during flooding. These methods or coping mechanisms are traditional coping mechanisms, as such, they are not effective due to the nature of the flood. Interview clearly indicated that the government has done nothing aside from a public awareness campaign to cushion the effect of the flood in the area. Though several Government reports had recommended a resettlement scheme for the most affected area in the communities, none of such reports has been implemented. An example of such a report is the TEPA Report (2010).

The study also examines if people usually relocate their settlement along waterways (flood plain) during the rainy season. The results show a slide difference in the respondents' as 34% agree that they do relocate often during the rainy season, 32% opine that they do relocate but not often and 34% say they do not relocate during the rainy season as seen on Table 4. This clearly shows why the impact of floods in these communities is usually devastating. Residents do not tend to move out of the water plain during the rainy season until floods catch up with them. This is always the situation of these communities year in and out.

Result of this section shows that there is no clear coping mechanism employed by the locals to check floods in Karim Lamido. Most of the respondent's interviews indicated few traditional methods of coping with the flood in their area. Most of this method is an archaic method which is not effective when the river is fully charged from excess rainfall. Interviews and field surveys

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)

show that other coping strategies employed by households were using sandbags, shifting to higher grounds, and raising the floor of the house and making furrows and canals during floods. It is clear from the findings that these coping strategies are not very effective. The coping strategies depend on a number of factors, some of which include the types of livelihood strategy and marital status as postulated by Mirza et al. (2003). The flood disaster has a different impact on individuals, households and communities, thereby making people cope in different ways. The way and manner people cope with the flood determines the level of impact of the flood.

Extent of Water Coverage and Vulnerability

This section seeks to examine the spatial extent of water coverage and vulnerability of River Benue and its tributaries in Karim-Lamido Local Government Area of Taraba State.

Digital Elevation Model of KarimLamido LGA

Figure 3 shows the Digital Elevation Model (DEM) of Karim-Lamido LGA which are determined from the ASTER DEM using surface analysis tools under the spatial analyst toolbar in ArcGIS. Contours of the study area are extracted from the DEM and this is used to generate the slope and elevation maps. The steepness of the slope affects the flow and inundation of a particular area. Low-lying areas with gentle slope angles have the tendency to be inundated first as compared to areas with steep slope angles during flooding. Flat terrain decreases water runoff and this causes high infiltration where there is open soil, or stagnation where there is impermeable surface leading to water logging conditions.

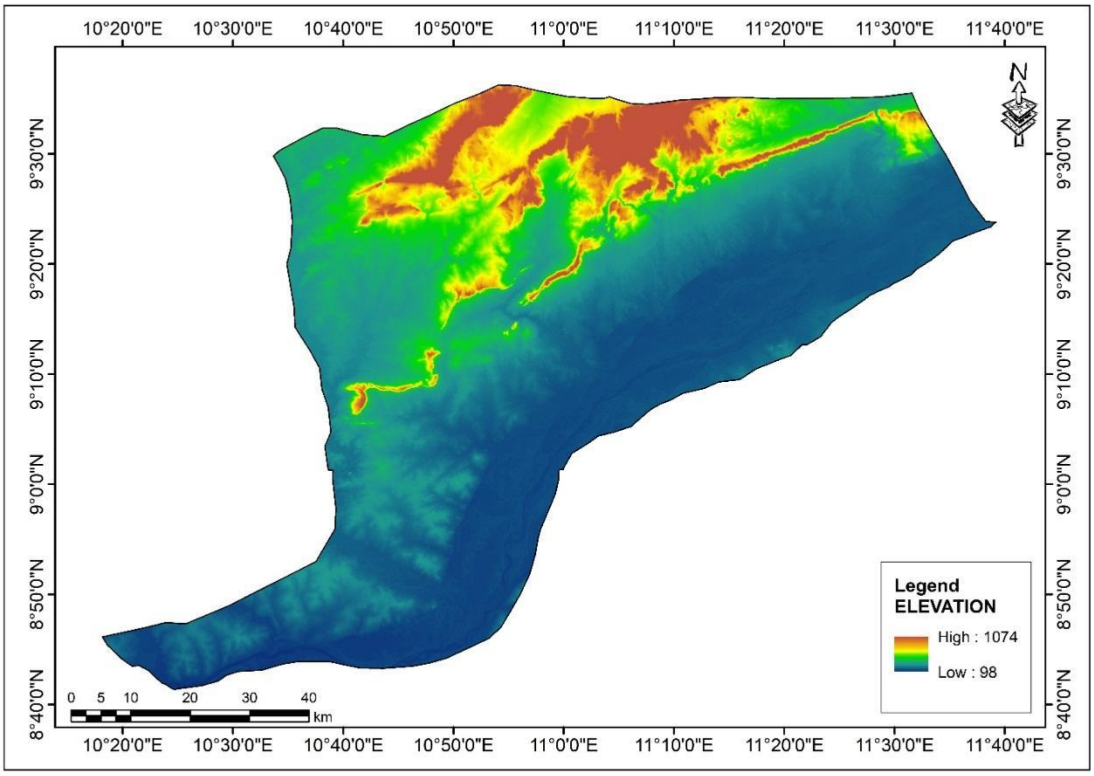

Figure 3: Digital Elevation Model of KarimLamido LGA

Source: USGS Earth Explorer

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)

Figure 3 shows the digital elevation model of KarimLamido LGA. The analysis reveals that the elevation of KarimLamido LGA falls between 98 to 1074 metres above sea level.

Slope and Aspect of Karim-Lamido LGA

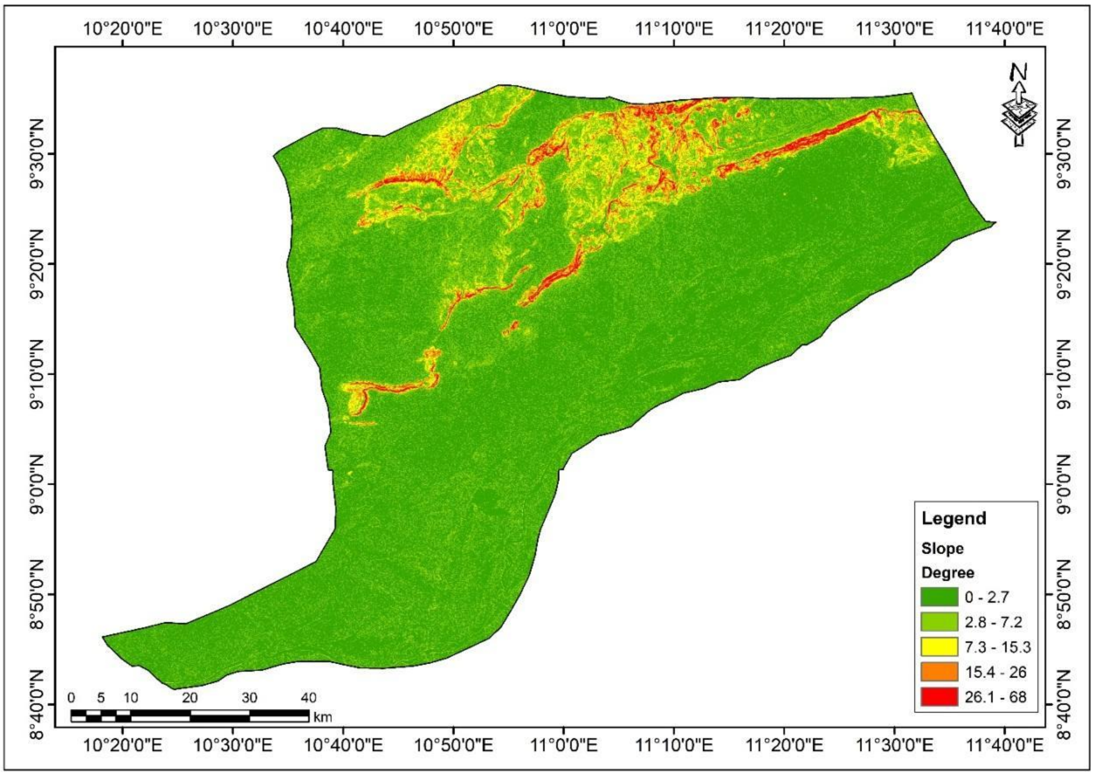

Figure 4: Slope of Karim Lamido LGA

Source: Researcher's Analysis.

Figure 4 shows the Slope of Karim Lamido LGA classified into 5 classes using the Natural Breaks method. The analysis revealed a random slope in the study area with values between 0 – 2.7 degrees as the lowest slope of the study area followed by 2.8 – 7.2 degrees, 7.3 – 15.3 degree, 15.4 – 25 degrees and 26.1 – 68 degrees as the steepest slope in the study area.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

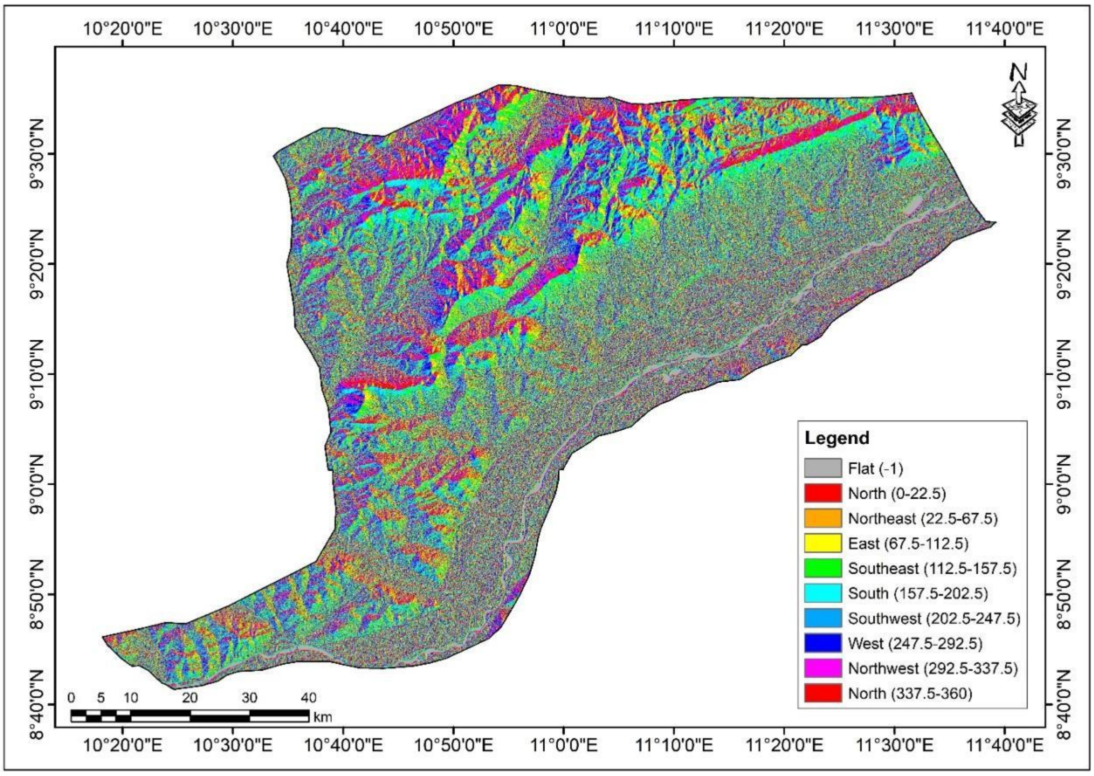

Figure 5: Aspect of Karim Lamido LGA

Source: Researcher's Analysis

Figure 5 above shows the aspect of the study area. The analysis identifies the downslope direction of the maximum rate of change in value from each cell to its neighbours. The values of the output analysis show the compass direction of the aspect.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

African Journal of Social Sciences and Humanities Research
ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)
www.abjournals.org

Stream Order of Karim Lamido LGA

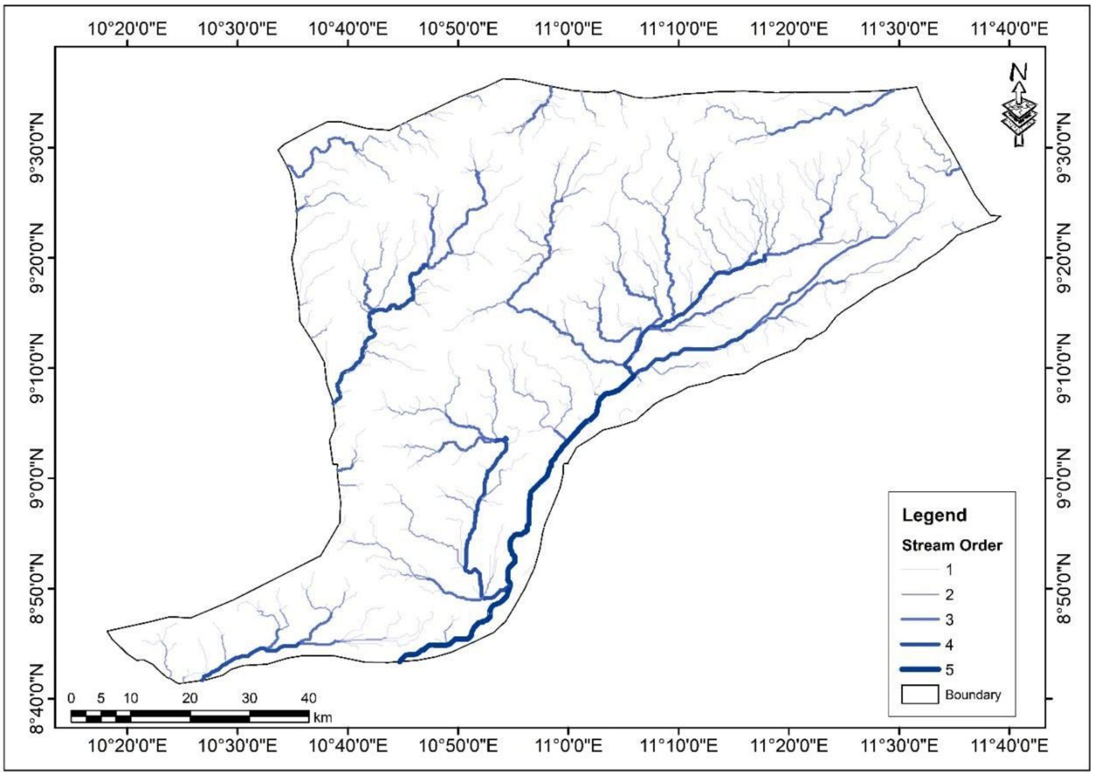

Figure 6: Stream Order of Karim Lamido LGA

Source: Researcher's Analysis

Figure 6 shows the stream order of the study area. The result reveals that the natural stream of the study area ranges from stream order 1 to 5. The analysis revealed that most part of the Karim Lamido is drained by 3-5 stream order, which makes the area prone to flooding.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

African Journal of Social Sciences and Humanities Research
ISSN: 2689-5129
Volume 6, Issue 1, 2023 (pp. 49-78)
www.abjournals.org

3.5.4 Stream Density of Karim Lamido LGA

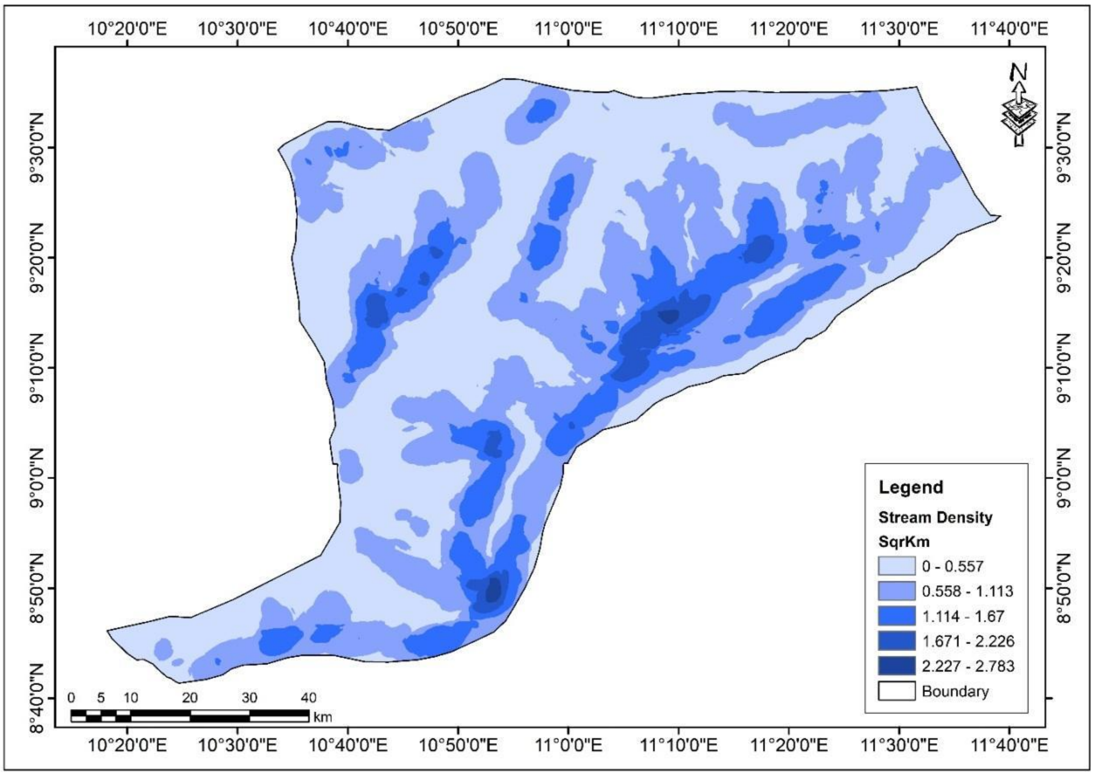

Figure 7: Stream Density of Karim Lamido LGA

Source: Researcher's Analysis

Figure 7 seeks to examine the stream density of Karim Lamido Local Government Area. This was achieved using the natural drainage patterns of the study area and line density analysis was performed. The result reveals that the study area has drainage density of 0 – 2.783 square kilometres.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Flood Risk Map of Karim Lamido

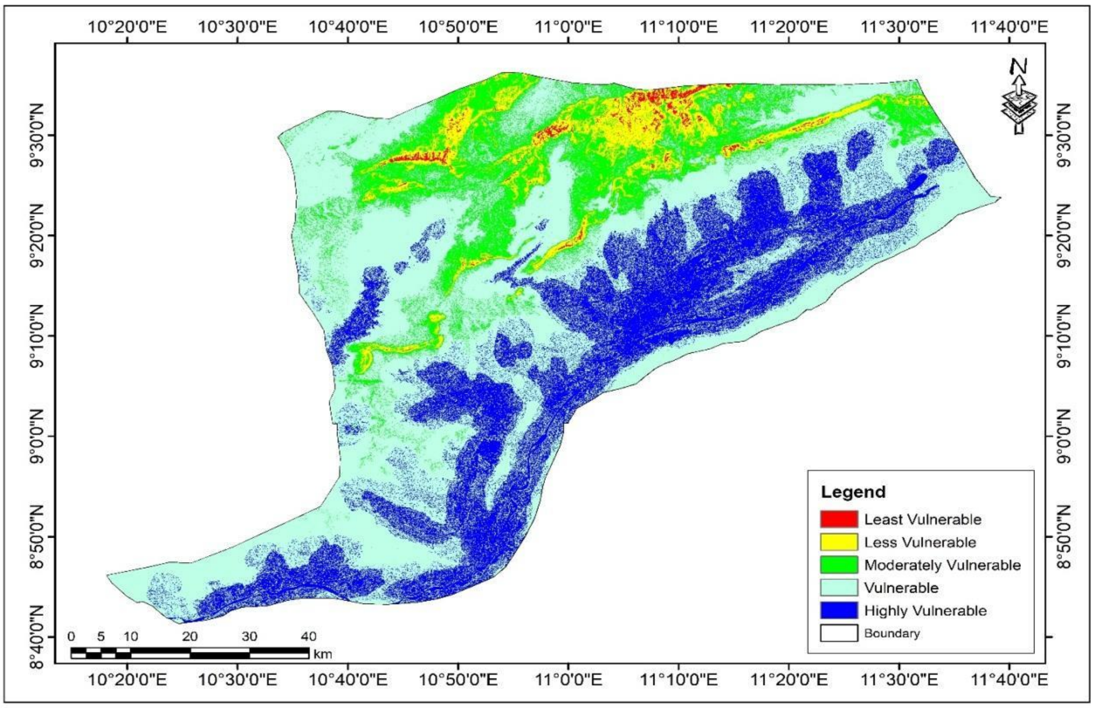

Figure 8: Flood Risk Map of Karim Lamido LGA

Source: Researcher's Analysis

Table 5: Show Flood Vulnerability Values

Levels	Area (Hectare)	Percentage (%)
Least Vulnerable	4984.8	0.726
Less Vulnerable	40554.1	5.906
Moderately Vulnerable	94664.9	13.787
Vulnerable	373743.9	54.431
Highly Vulnerable	172664.7	25.150

Figure 8 and Table 5 reveal the result of the flood vulnerability analysis of Karim Lamido LGA. The result shows that 25.2% of the study area is highly vulnerable to flooding, 54.4% of the study area are vulnerable, 13.8% of the study area are moderately vulnerable, 5.9 % of the study are less vulnerable while 0.71 % of the study area are least vulnerable. This result clearly revealed that about 80% of the total land area of Karim Lamido Local Government Area of Taraba State is vulnerable to flood, with at least 20% moderately vulnerable to flood. This supports the findings in this work that revealed that Karim Lamido is majorly drained by stream order from 3-5. This puts the Local Government Area as a high risk flood prone environment.

The result revealed that the major cause of flood in Karim Lamido is heavy rainfall which usually recharges the river which agrees with Gabriel, Abdullahi and Joseph (2018) that rainfall

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

variability resulted in the major flood along the Benue river tributaries in Taraba State. Investigation also shows that almost part of Karim Lamido communities lie adjacent to the River Benue and are low lying areas which are part of the extensively flooded Great Muri plain and are greatly affected by flood. Usually increase in annual rainfall triggers the release of Lagdo Dam in the Republic of Cameroon which leads to excessive recharge of Rivers Benue and its tributaries in Karim-Lamido LGA.

Flood vulnerability analysis of Karim Lamido LGA indicates that most parts of the local government are vulnerable as it lies in flood prone areas of River Benue and its tributaries of the entire Karim Lamido LGA are prone to flood. The major effects of flood are the washing away of the communities' farms lands and their businesses equipment.

CONCLUSION

This study has examined the impact of flooding on socio-economic activities in KarimLamido LGA. The findings show that about 60% of Karim Lamido communities are flood prone areas. Floods in these areas for the past decades are disastrous both in magnitude of damages and spatial spread. So many people were internally displaced, while others lost their lives and properties worth millions of naira. The study shows that all the three tiers of government (Federal, State and Local), individuals and non-governmental organisations responded by providing cash and relief materials to the affected people. There is, therefore, a need to resettle the affected communities. Resettlement plans need to be in place since the most part of Karim Lamido communities are directly affected by flooding annually. Resettlement scheme is the major solution to this annual disaster in this area.

RECOMMENDATIONS

Flooding is an increasing problem in Karim Lamido and Taraba State at large. Governments at all levels, stakeholders and residents of affected communities should collectively play a role in the alleviation of floods. It can accordingly be deduced that application of these aforementioned techniques are essential in all the several stages of flood management which include flood prediction, prevention, mitigation and the identification of flood risk zones (Opolot et al., 2013). It is recommended that the listed management guidelines suggested below are established and undertaken to address the identified problems in the community.

i. Dredging of River Benue should also be a priority now if we need to control floods along River Benue.

ii. There should be proper documentation of information on the local history of flooding, mark areas affected and commemorate the dates of significant floods. Steps can be taken to increase protection of such areas by placing emergency response teams on high alert and preparing emergency shelters.

iii. There should be provision of adequate materials for the state emergency management team such as flying boats and helicopters in order to address the issues of difficult terrain and tidal waves.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

iv. Emergency managers will also require adequate insurance policy to cater for their welfare in event of serious injury or loss of life. This will go a long way in motivating them to give their best to the task of rescuing in event of any disaster.

v. There should be an intensive public awareness campaign through use of local languages, media houses and the involvement of traditional and religious leaders of the dangers of building along floodplains and the need to respond to disaster warning alerts.

vi. The Nigerian Government should flag off a resettlement scheme program for the people of Karim Lamido.

REFERENCES

Abowei, J.F.N. and Sikoki, F.D. (2005).*Water Pollution Management and Control*. Port Harcourt: Double Trust Publications Co.

Adeloye, A. J., and R. Rustum. 2011. "Lagos (Nigeria) Flooding and Influence of Urban Planning." *Proceedings of the Institution of Civil Engineers-Urban Design and Planning* 164 (3): 175–187. doi:10.1680/udap.1000014.

Aderogba, K. A. 2012. "Qualitative Studies of Recent Floods and Sustainable Growth and Development of Cities and Towns in Nigeria." *International Journal of Academic Research in Economics and Management Sciences* 1 (3): 1.

Action Aid (2006): Climate change, urban flooding and the rights of the urban poor in Africa. *A report by Action Aid International*

Adelekan, I. O (2009) Vulnerability of Poor Urban Coastal Communities To Climate Change In Lagos, Nigeria. *Fifth Urban Research Symposium* 2009.

Adeloye, A. and Rustum, R. (2011).Flooding and Influence of Urban Planning in Nigeria.*Journal of Urban Design and Planning*. 164 (3): 173-187.

Aderogba, K. A., (2012). Qualitative Studies of Recent Flood and Sustainable Growth and Development of Cities and Towns in Nigeria.*International Journal of Academic Research in Economics and Management Sciences*. 1 (3): 1-25.

Agbola, B.S., Ajayi, O., Taiwo, O.J. &Wahab, B.W., (2012).The August 2011 Flood in Ibadan, Nigeria: Anthropogenic Causes and Consequences.*International Journal of Disaster Risk Science*. 3 (4): 207-217.

Agwu, J., and Okhimamhe, A., (2009) *'Gender And Climate Change In Nigeria': A Study Of Four Communities In North-Central And South-Eastern Nigeria*. ISBN: 978 - 978 – 904 – 502 – 0. Copyright ©Heinrich BöllStiftung (HBS), 2009.

Askew, A. J., (1999).Water in the International Decade for Natural Disaster Reduction. In Leavesley et al. (eds) *Destructive Water: Water-caused Natural Disaster, their Abatement and Control*. IAHS Publication.

Babbie, E. and Mouton, J., (2001). *The Practice of Social Research*. In Research Methodology: Practical Research Planning ND Design, 7th Edition, Study Guide for DIM 601. Bloemfontien: University of the Free State.

Bariweni, P. A., Tawari, C. C. and Abowei, J. F. N., (2012).Some Environmental Effects of Flooding in the Niger Delta Region of Nigeria.*International Journal of Fisheries and Aquatic Sciences*. 1 (1): 35-46.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Bello, I. E., Adzandeh, A. &Rilwani, M. L. (2014), "GeoinformaticsCharacterisationof Drainage Systems Within MuyaWatershed in The Upper Niger Drainage Basin, Nigeria. International Journal of Research in Earth & Environmental Sciences. 2(3): 18-36.
Bello, I. E., Adzandeh, A. &Rilwani, M. L. (2014), "GeoinformaticsCharacterisationof Drainage Systems Within MuyaWatershed in The Upper Niger Drainage Basin, Nigeria. International Journal of Research in Earth & Environmental Sciences. 2(3): 18-36.
Bello, I. E., Adzandeh, A. &Rilwani, M. L. (2014), "GeoinformaticsCharacterisationof Drainage Systems Within MuyaWatershed in The Upper Niger Drainage Basin, Nigeria. International Journal of Research in Earth & Environmental Sciences. 2(3): 18-36.
Bello, I. E., Adzandeh, A. &Rilwani, M. L. (2014), "GeoinformaticsCharacterisationof Drainage Systems Within MuyaWatershed in The Upper Niger Drainage Basin, Nigeria. International Journal of Research in Earth & Environmental Sciences. 2(3): 18-36.
Bello, I. E., Adzandeh, A. &Rilwani, M. L. (2014), "Geoinformatics Characterisation of Drainage Systems WithinMuya Watershed in The Upper Niger Drainage Basin, Nigeria. International Journal of Research in Earth & Environmental Sciences. 2(3): 18-36.
Bello, I. E., Onothoja, U. T. &Asikhia, M.O. (2013), "Application of GIS Technology in Floodplain Delineation and Risk Mapping in Some Communities in Upper Benue Catchment, Taraba State, Nigeria". West African Social and Management Sciences Review (WASMSR). 4(1): 79-89
Bradshaw, C. J., Sodln, N. S., Peh, S. H. and Brook, B. W., (2007). Global Evidence that Deforestation Amplifies Flood Risk and Severity in the Developing. *Global Change Biology*. 13: 2379-2395.
Borgadi, M., Anagnostou, E.N.,Blöschl, G. and Creutin, J. D., (2011). Flash flood
forecasting, warning and risk management: The hydrate project. *Journal for Environmental Science Policy.*14, 834–844.
Bronstert, A.,(2003): Floods and Climate Change: Interactions and Impacts. *Risk Analysis,* Vol.23, (3).
Chorley, R. J. (1977). *Introduction to Geographical Hydrology: Spatial Aspects of the Interacting between Water Occurrence and Human Activity (6th ed.)*. Methuen: Associated Book Publishers Ltd.
Doocy, S., Daniels, A., Murray, S. and Kirsch, T. D., (2013). The Human Impact of Floods: a Historical Review of Events 1980-2009 and Systematic Literature Review. *Available at http://currents.plos.org/disasters/article/thehuman-impact-of-floods-a-historical-review-of-events-1980-2009-and -systematic-literature-review/*
Eneji, C.-V.O., J. E. O. Eneji, V. Ngoka, and M. Abang. 2016. "Attitude Towards
Waste Management and Disposal Methods and the Health Status of Cross River State, Nigeria." *SCIREA Journal of Agriculture* 1 (2): 231-247.
Etuonovbe, A. K. (2011). "The Devastating Effect of Flooding in Nigeria." Paper
presented at the FIG working week, Maputo.
Efe, S. I., (2007).Urban Flooding in Abraka, Delta State, Nigeria.*Journal of Environmental Conservation and Research* 1(1): 96-103.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Eludoyin, A.O.; Akinbode, M.O. and Okuko, E. (2007).Combating Flood Crisis with Geographical Information System: An Example from Akure Southwest, Nigeria.*Proceeding of International Symposium on New Direction in Urban Water Management. Paris: UNESCO*.

Etuonovbe, A.K. (2011). *The Devastating Effect of Flooding in Nigeria*.FIG Working Week.

Farrell, K. (2018). "An Inquiry into the Nature and Causes of Nigeria's Rapid Urban Transition." *Urban Forum 29*: 277-298.

Farauta, B. K., Idrisa, Y. L., Egbule, C. L. and Agu, V. C., (2011): Climate Change and Adaptation Measures in Northern Nigeria: Empirical Situation and Policy Implications. *African Technology Policy Studies Network.*Working Paper Series: (62).

Few, R.; Kovats, S.; Matthies, F. and Ahern, M. (2004). Floods, health and climate change: *A Strategic review from http://www.tynadall.ac.uk/content/floods-health-and-climate-change-strategic-review*.

Few, R.; Kovats, S.; Matthies, F. and Ahern, M. (2004). Floods, health and climate change: *A Strategic review from http://www.tynadall.ac.uk/content/floods-health-and-climate-change-strategic-review*.

Fubara, D.M.J. (1987). *The Menace of Flood and Erosion and Enviromental Disaster*. Combat Plan in Sagua,

Gabriel, T. A., Abdullahi, I., & Joseph, A. E. (2018). Rainfall variation, water resources potential and implication for flooding: A case study of catchment area of major tributaries to River Benue in Taraba State. *African Journal of Engineering Research, 6*(3), 55-63.

Garg, S.K. (2010). *Hydrology and Water Resources Engineering*. Delhi: Khanna Publishers.

Hill, A.R. (1976). The Environmental Impacts of Agricultural Land Drainage.*Journal of Environmental Management*. 4 (4): 251-274.

Ishaya, Ifatimehin and Abaje, "Mapping Flood Vulnerable Areas in a Developing Urban Centre of Nigeria," Journal of Sustainable Development in Africa, Vol. 11, No. 4, 2009, pp. 180-194. [Citation Time(s):3]

Ishaya, S., Ifatimehin, O. O. and Abaje, I. B., (2009), Mapping Flood Vulnerable Areas in a Developing Urban Centre of Nigeria.*Journal of Sustainable Development in Africa*, 11(4), pp 180-194.

Ibrahim, M. K., David, A. M. and Okpanachi, G.U., (2010): 'Climate Change, Agriculture and Food Management In Nigeria' *Journal of Environmental Issues and Agriculture in Developing Countries*, 2 (2 & 3).

Ijeoma, S., (2012): Nigeria & Climate Change Adaptation. *International Society of Sustainability Professionals.*ISSP Insights, May 2011. Accessed online on the 20th of January 2015 via: http://www.sustainabilityprofessionals.org/nigeria-climate-change-adaptation

Imogie, A.E.; Udosen, C.V.; Airede, C.I. and Enonuya, D.O.M. (2012).Utilization of Niger Delta Basin Coastal Fresh Water Swamps for Meaning Agricultural Production.*Greener Journal of Agricultural Sciences*. 2 (5): 180-187.

Integrated Regional Information Networks (IRIN) (2012). NIGERIA: *Worst Flooding in decades.*fromhttp://www.irinnews.org/report/96504/NIGERIA-Worst-flooding-in-decades.

IPPC, (2007): *Climate Change 2007: Synthesis Report.* Accessed online on the 1http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf stof October 26, 2020

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Iroaganchi, N. &Ufere, K. (2013).Flooding in Nigeria and Sustainable Land Development: Case of Delta State.*Journal of Environment and Earth Science*. 3 (5): 38-42.

James, P. H. (2019). *Farmers' Perception of Causes of Soil Degradation in Northern Taraba, Taraba State of Nigeria*. Retrieved from AgEcon Search.:

Johnson, T. (2001). Northern Nigeria hit by Floods. *Published by theInternational Committee of the Fourth International (ICFI).*

Keller, E.A. (2005). *Introduction to Environmental Geology. New Jersey:* Pearson Prentice-Hall.

Lawal, A.F. and Nagya, M.T. (1999).Socio-Economic Effects of Flood Disaster on Farmers in Mokwa Local Government Area, Niger State, Nigeria.*A Paper Presented at the 33rd Annual Conference of Agricultural Society of Nigeria held at National Cereal Research Institute, Badeggi, Niger State.*

Lobell, D. and Burke, M., (2010). Climate Effects on Food Security: An Overview. *Advances in Global Change Research* 37, DOI 10.1007/978-90-481-2953-9_2, © Springer Science+Business Media, B.V. 20 0 Accessed online on the 30 http://www.ocf.berkeley.edu/~marshall/papers/Chap2_overview.pdf [th]of November 2020.

National Aeronautics and Space Agency (NASA), (2011): 'Flooding in Nigeria'. *Accessed online on the 2http://visibleearth.nasa.gov/view.php?id=51907 on October 13, 2020.*

Nwilo P.C, Olayinka N.D, and Adzandeh A.E (2012): Flood Modelling and Vulnerability Assessment of Settlements in the Adamawa Flood Plains Using GIS and Cellular Framework Approach. *Journal of Human Social Science, 12 (3).*

Nkeki, F. N., P. J. Henah, and V. N. Ojeh. 2013. "Geospatial Techniques for the Assessment and Analysis of Flood Risk along the Niger-Benue Basin in Nigeria." *Journal of Geographic Information System* 5 (2): 123. doi:10.4236/jgis.2013.52013.

Nkeki, Henah, Ojeh (2012): Geospatial Techniques for the Assessment and Analysis of Flood Risk along the Niger-Benue Basin in Nigeria

Nabegu, A. B. 2014. "Analysis of Vulnerability to Food Disaster in Kano State, Nigeria." *Greener Journal of Physical Sciences* 4 (2): 22–29.

Nnaemeka-Okeke, R. 2016. "Urban Sprawl and Sustainable City Development in Nigeria." *Journal of Ecological Engineering* 17 (2): 1-11

Ogundele, J., and A. O. Jegede. 2011. "Environmental Influences of Flooding onUrban Growth and Development of Ado-Ekiti, Nigeria." *Studies in Sociology of Science* 2 (2): 89.

Oruonye, E. D. (2013). An Assessment of Flood Risk Perception and Response inJalingo Metropolis,.Taraba State, Nigeria. International Journal of Forest, Soil ...11 pages

Ojo, O. O., and J. A. Adejugbagbe. 2017. "Solid Waste Disposal Attitude in Sango Ota, Ogun State: Implication for Sustainable City Development in Nigeria." *Journal of Environment and Waste Management* 4 (3): 253–260.

Oladokun, V., and D. Proverbs. 2016. "Flood Risk Management in Nigeria: A Review of the Challenges and Opportunities." *Flood Risk Management and Response* 6(3): 485-497.

Oluwaseyi, O. B. (2019). "Assessment of Physical Planning Administration in Nigeria."

Omoboye, I. F., and I. A. Festus (2014). "Environmental Challenges in Nigeria:Typology, Spatial Distribution, Repercussions and Way Forward."

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Onwuemele, A. 2012. "Chapter 11 Cities in the Flood: Vulnerability and Disaster Risk Management: Evidence from Ibadan, Nigeria." In *Urban Areas and Global Climate Change*, edited by W. G. Holt, 277–299. Emerald Group Publishing Limited.

Olukanni, D. O., R. A. Adebayo, and I. T. Tenebe. 2014. "Assessment of Urban Drainage and Sanitation Challenges in Nigeria." *International Journal of Emerging Technology and Advanced Engineering* 4 (12): 100–105.

Odjugo, P.A.O. (2012). Valuing the Cost of Environmental Degradation in the face of Changing Climate: Emphasis on Flood and Erosion in Benin City, Nigeria.*African Journal of Environmental Science and Technology*. 6 (1): 17-27.

Odufuwa, B.O.; Adedeji, O.H.; Oladesu, J.O. and Bongwa, A. (2012)."Floods of Fury in Nigerian Cities".*Canadian Center of Science and Education*. 5 (7): 2.

Olajuyigbe, A.E.; Rotowa, O.O. and Durojaye, E. (2012).An Assessment of Flood Hazard in Nigeria. The Case of Mile 12, Lagos.*Mediterranean Journal of Social Sciences*. 3(2): 367-377.

Olanrewaju D.O and Fadairo G (2003): Flooding as an Induced Environmental Problem. *Journal of the Nigerian Institute of Town Planners XVI (1)85-95.*

Oruonye, E.D. and Adebayo, A.A. (2013).Flooding in Taraba State: An Assessment of the Effects of the 2012 Floods.*Proceedings of the 5thannual conference of the Nigerian Association of Hydrological Sciences (NAHS), held at University of Nigeria Nsukka, October 21-24, 2013. Pp. 13 – 20.*

Oruonye, E. (2015). Assessment of the Impact of Land use Changes Along the Floodplains of River Lamurde, Jalingo LGA, Nigeria. *Journal of Forests, 2*(1), 1-9.

Opolot, E. (2013). Application of remote sensing and geographical information systems in flood management : a review. *RESEARCH JOURNAL OF APPLIED SCIENCES ENGINEERING AND TECHNOLOGY*, *6*(10), 1884–1894.

Pere, A. (2013).Accounting Experience of Flood Disaster in Niger Delta Region, Nigeria.*Retrieved November 8th, 2020 from* *http://ayaperescholar.blogspot.in/2013/03/accounting-experience-of-flood-diasater.html?m=1*.

Reacher, M., Mckenzie, K. and Lane, C. (2004). Health Impacts of Flooding in Lewes: a Comparison of Reported Gastrointestinal and other Illness and Mental Health in Flooded and non-flooded households. *Journal of Communicable Diseases Public Health* 7(1): 56-63.

Sridhar, M., and O. Ojediran. 1983. "The Problems and Prospects of Refuse
Disposal in Ibadan City, Nigeria." *Journal of Environmental Health* 46(1): 28–31.

Schwartz P and Randall D (2003): *An Abrupt Climate Change Scenario and its Implication for United States National Security.*

State Emergency Management Agency (SEMA), (2012). *Report on Flood Disaster in Taraba State, October 2012.*

Strydom, H., Fouche C. B. and Delport C.S.L., (2005).*Research at Grassroots for Social Sciences and Human Service Professions.*

Sule, B.F., Salami, A. W. and Okeola, O. G. (2009).Operational Impact of Hydropower Generation and Highlights on Preventive Measures in Lowland Areas of River Niger, Nigeria.*Journal of Engineering Mathematics*. 7 (2): 109-126.

Torti, J. (2012). Floods in Southeast Asia: A Health Priority. *Journal of global health*. 2 (2): 020304.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT
DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT

Ujah, O.C. (2007). Internal Displacement in Nigeria. Enugu: *The African Institute for Applied Economics (AIAE).*

UN Office for the Coordination of Humanitarian Affairs (2012) Nigeria: Floods as of November 15. Relief Web Accessed December 2012.

Uyigue, E. (2007). Climate Change in the Niger Delta.*A Publication of the Community Research and Development Centre (CREDC), Nigeria.*

Webster, T., McGuigan, K., Collins, K. and MacDonald, C., (2014).Integrated River and Coastal Hydrodynamic Flood Risk mapping of the Lattive River Estuary and Town of Bridgewater, Nova Scotia, Canada.*Applied Geomatics Research Group, Nova Scotia Community College, Middleton, Nova Scotia Canada*.Reteived from: www.mdpi.com/journal/water.

WHO. 2014. WMO Disaster Risk Reduction Work Plan (2012-2015) Updated as of : 21 March 2014. World Meteorological Organization, Geneva.

Article DOI: 10.52589/AJSSHR-IKZKQ6YT

DOI URL: https://doi.org/10.52589/AJSSHR-IKZKQ6YT