NIGERIA ASSOCIATION OF HYDROLOGICAL SCIENCES (NAHS)

PROCEEDINGS

OF THE

13TH NATIONAL CONFERENCE LAGOS 2023

Theme:

WATER, ENVIRONMENT & SOCIETY

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THE NIGERIA ASSOCIATION OF HYDROLOGICAL SCIENCES (NAHS)

PROCEEDINGS OF THE 13TH NAHS NATIONAL CONFERENCE

(LAGOS 2023)

THEME:

WATER, ENVIRONMENT AND SOCIETY

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13TH NAHS NATIONAL CONFERENCE AND AGM
(LAGOS 2023)
CONFERENCE THEME: WATER, ENVIRONMENT AND SOCIETY

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Sub-theme 2: Water Resources and Sustainable Livelihood

Sub-theme 3: Water Resources in a Changing Climate

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Mapping Of Flood Vulnerable Areas In Lavun Local Government Area, Niger State, Nigeria.

By

[1] Yusuf Ahmed [2]Tasi'u Yalwa Rilwanu

[1]Department of Geography Federal University of Technology Minna
[2]Department of Geography Bayero University, Kano
yusuf.ahmed@futminna.edu.ng
tryalwa.geog@buk.edu.ng

ABSTRACT

Flood disaster is a common phenomenum in Lavun Local Government area, hence this examines and map flood vulnerable areas in order to attain an efficient and effective flood mitigation plan in Lavun Local Government Area of Niger State. Two FGD were conducted in each of the selected four (4) communities while total number of eleven male (20 to 40 age) and seven of 50 years above were interviewed. Rainfall data for the period of 30 years was downloaded from a website (Era – Interim). Quantitative data like Field measurement, GIS and RS were also used in obtaining the data and descriptive analysis was used to analyse the data. The Digital Elevation Model (DEM) result shows that, communities in lower elevation are located at the eastern and south eastern part which makes them more vulnerable to flood because they are in low elevation and more close to River Gbako. Furthermore, findings from the FGD reveals that the causes of the flooding are found to be, excessive rainfall, river back flow, discharge and over flow of Shiroro Dams. The wok concluded that communities in lower elevation are located at the eastern and south eastern part which makes them more vulnerable to flood and shows that activities like dam construction (spill-water from the major river) and back flow of the river, excessive rainfall, building and farming activities on flood plain in the study area.

It was recommended that, the communities that are discovered to be highly vulnerable to flood should be relocated.

***Keywords*:** Flooding, Land Degradation, Vulnerability, Flood Prone, DEM, Dams, FGD.

INTRODUCTION

Flood is one of the oldest and most devastating catastrophes that causes enormous damage and loss of life on a global scale. Upon all environmental hazard, flood is considered to be one of the most common and highly damaging. It is predicted that flood may likely become more prevalent, more frequent and more serious in the years to come, because of intensive rainfall (Muchtar and Bashar, 2010). Floods can be considered as one of the most recurring and devastating disasters affecting human lives and causing severe economic damage worldwide, because of the intensity of rainfall and location of some areas. It should be noted that floods occur naturally but pose a threat Flood is a natural hydrological extreme event affecting the flow regime of all rivers, particularly during the rainy season, while flow surpass the capacities of affected communities, destroying lives and properties (Eze, Vogel and Ibrahim, 2018). It is considered to be one of the most devastating and frequently occurring natural hazards globally, that poses a threat to sustainable livelihood and economic development of a society.

Flood risks do not look likely to subside in the future, and with the recent incidence of climate change, flood intensity and frequency still pose as threats to many parts of the world (Ouma and Tateishi, 2014). The impacts of flood disaster on the society and its effect on sustainable development are overwhelming in recent years (Komolafe, Adegboyega, & Akinluyi, 2015). Within the last decade, many countries have experienced an upsurge of flooding events, which is attributed to the current climate change (Umar, Abdullahi and Usman, 2019). In Nigeria, coastal, fluvial or pluvial flooding event remains a recurrent phenomenon (Ogato, Bantider, Abebe and Geneletti, 2020). Coastal and fluvial flooding are due to seasonal water upsurge from large rivers like the Niger, Benue, Cross River, Kaduna, affects coastal and riverine environments . Recent flood occurrences in Nigeria have been particularly, among other factors, geared by the release of water from Dams in some parts of the country and the high intensity of rainfall in some regions and the haphazard development of land on flood prone areas (Atufu & Holt, 2018). Thus, the current trend of flood occurrences and impacts in Nigeria calls for more studies and accurate spatial information on the potential flood hazards.

The need for an effective and a reliable analytical approach to understand the nature of the flood vulnerability for appropriate decision-making therefore aimed at mitigating the associated impacts (Tarekegn *et al.,* 2010; Njoku *et al.,* 2020). This is necessary since floods are among the most dramatic forms interaction between man and its environment, occurring both in the developed and developing worlds and are always associated with heavy loses of life and property, misery hardship disease and at times famine. The type of flooding predominant in the Niger state is perennial flooding caused by heavy rainfall and overflow of river banks (Eni *et al.,* 2011).

Niger state, no doubt was created to bring the government nearer to the people and to meet the yearnings of the people for common entity. However, since 1976 when the state was created, flood disaster has been an annual environmental hazard confronting the state (Jubril and Yunusa, 2012) The vulnerability of the state to flood disaster could be attributed to two major factors, the first being the location of large parts of the state in a lower terrain (Niger valleys and Plains) along the largest river in Nigeria (River Niger), making the land and communities located in this low terrain area be prone to annual flooding. The second factor is the presence of the three Hydro Electric Power (HEP) stations in the state; the Kainji dam and Jebba dam on River Niger at Kainji and Jebba towns respectively and the Shiroro dam on River Kaduna.

MATERIALS AND METHODS

Study Area

Lavun is a Local Government Area in Niger State, Nigeria. Its headquarters is in the town of Kutigi, the study area is located between latitude 9°1′50″ N to 9°46′45″ N and longitude 5°18′ 55″E to 5°51′ 35″E. The Kaduna River forms the eastern border of the LGA. It has an area of 2,835 km² and a population of 209,917 at the 2006 census (FGN, 2007). The local government area is situated in the southern part of Niger state and bordered by Kaduna River and Gbako local government in the east, Wushishi and Mashegu local government areas in the north, Edati local government area in the south and Mokwa local government area in the west (figure 1). The majority of the population are Nupe. The working population of Lavun Local Government are Farmers, livestock/poultry farmers, marketers and also some administrative workers in the local government with rich cultural values.

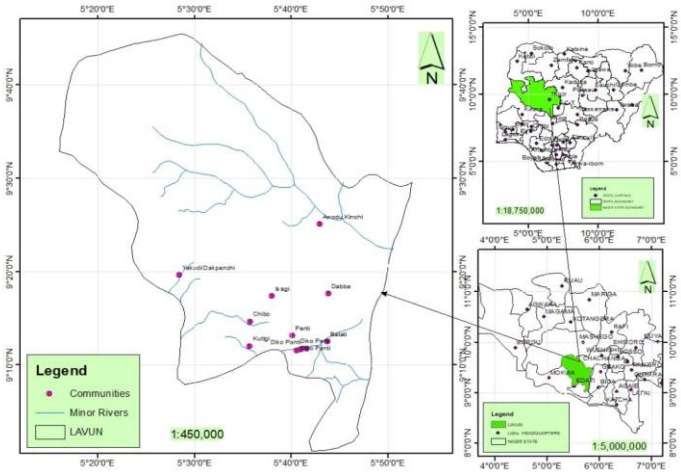

Figure 1: Lavun Local Government Area in Niger State
***Source*: Geography Department, Federal University of Technology Minna**

Methods of Data Collection

Data for identification and mapping flood vulnerable areas was collected through extensive field survey and ground truthing of the study area. Hand held global Positioning system (GPS) was used to pick the geographic coordinate of the vulnerable areas. Up to date satellite images of the study area was downloaded from the United States geological survey (USGS) website to map out the flood vulnerability areas using ArcGIS software to produce DEM of the study area. The DEM support spatial distribution map using ArcGIS to identify the various susceptible communities. In addition, participatory mapping which involve the identification of the vulnerable areas, physical measurement using tape to take the height and length of areas affected by the flood was carried out. Rainfall data was downloaded from a website (Era – Interim) for the period of thirty (30) years(1990 to 2020) to run a descriptive statistics to find out the trend and to see how rainfall have contributed to flood in the study area. This was complemented by focus group discussion (FGD) with inhabitant to give more insight on the causes of flooding.

Table 1: Remote Sensing data used in the study

1990	TM	190	053/054	1to5 and 7	6	10.45-12.45	30	
2010	ETM+	189	053/054	1to5 and 7	6	10.45-12.45	30	USGS
2020	OLI & TIRS	189	053/054	1to7 and 9	10 & 11	10.60-12.51	30	

Source: Authors Analysis 2021

Methods of data Analysis

For the identification and mapping out of flood vulnerable areas, GPS coordinates of the study area were imported into ArcGIS environment to produce a spatial distribution map which helped in identifying the various vulnerable communities. This was supported by DEM to show the level of flood vulnerability of the area. In addition, participatory mapping which involve identification of the vulnerable areas was carried out, and physical measurement using tape to take the length of areas vulnerable to flood.

For Examining the causes of flooding in the study area, Rainfall data were collected and analyzed using descriptive Statistical method and where presented on charts for the purpose of this study to see the trend and if rainfall is the main causes of flood in the study area.

The mean form of descriptive statistics was used to show the rainfall intensity in the thirty years period. The qualitative data (FGD) was analyzed after transcribing the FGD and translating them to English language because all the FGD were conducted in Nupe Language. Narrative analysis was used to classify the qualitative data gotten from FGD.

RESULTS AND DISCUSSION

Figure 2 indicate the study area exhibits a range of communities with varying degrees of vulnerability, determined by their respective elevations above mean sea level. Among these communities, including Tsogi, Nagyafu, Batati, Dabba, Awodu Kinchi, Isagi, and Dikko Panti, those situated at lower elevations are at a heightened risk and are therefore represented in red. Conversely, communities such as Yakudi Dakpanchi, Chibo, Kutigi, and Panti, situated at higher elevations, are less vulnerable and are represented in green, yellow,

and the findings agreed with the work of Ejenma *et al*. (2014) Over the Kaduna River, researchers employed a digital elevation model (DEM) to establish the flow accumulation of the waterways and subsequently inferred the floodplain, thereby demarcating the areas of vulnerability within the region.

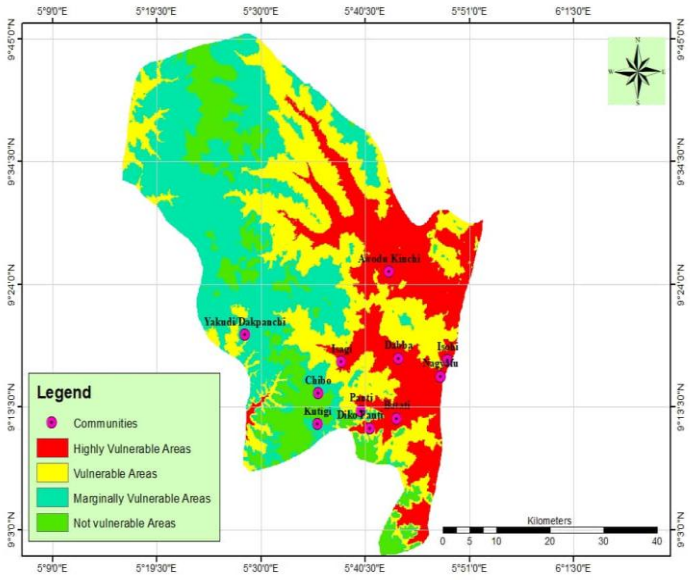

Figure 2: Flood Vulnerability Mapping of the study Area
Source: Author 2020

The outcomes of the study indicate that the eastern and southeastern part of the examined area exhibit the highest susceptibility to flooding, primarily due to their low altitude or elevation. Furthermore, a significant proportion of the community is situated along the River Lavun and Gbako, thereby exposing them to considerable risk when the river overflows and inundates these areas. This, in turn, results in the loss of lives, properties, farmland, and commercial businesses. The investigation has revealed that the structures situated in Tsogi and Nagyafu are situated within a distance of less than 20 meters from the river banks, rendering them extremely susceptible to flood events, as depicted in Figure 3. These structures are in close proximity to the primary River Gbako.

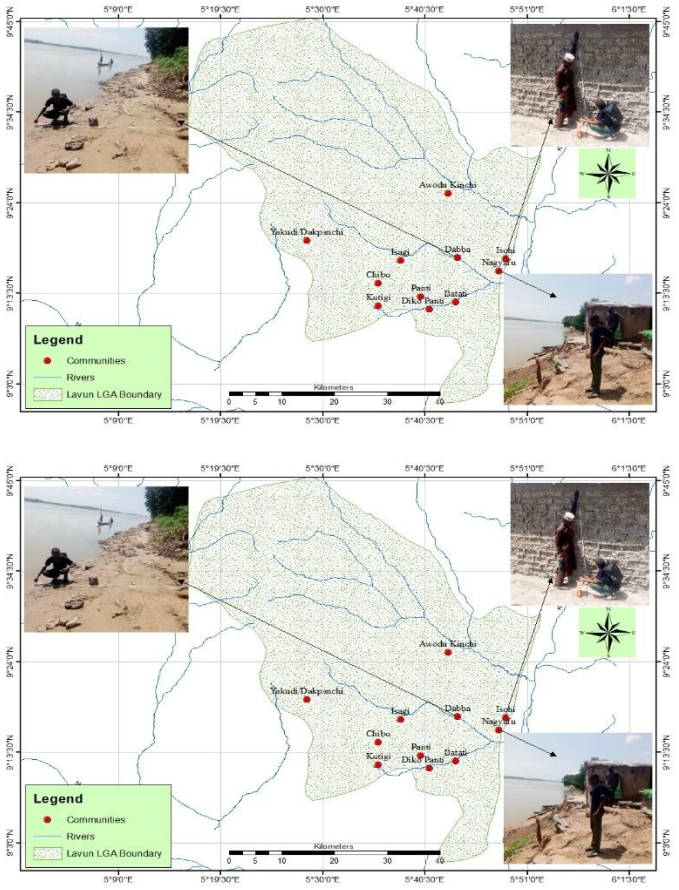

Figure 3: Highly vulnerable buildings on the River banks in the study area

Source: Author's Analysis, 2020.

CAUSES OF FLOODING IN THE STUDY AREA

The trend of precipitation is deliberated in this study, specifically in relation to the activities and events of rainfall over the period of 30 years (1990

to 2020) within the examined Area. The subsequent subheading provide a comprehensive discussion;

Trend in climatic parameter (Rainfall) in the study area.

For a number of years, the distribution of rainfall in the study area has exhibited non-uniformity. The m anifestation of this phenomenon is clearly illustrate d in Figure 4, which depicts the variation that has il lustrated annual rainfall distribution over a 30 years temporal span ranging from 1990to 2020.

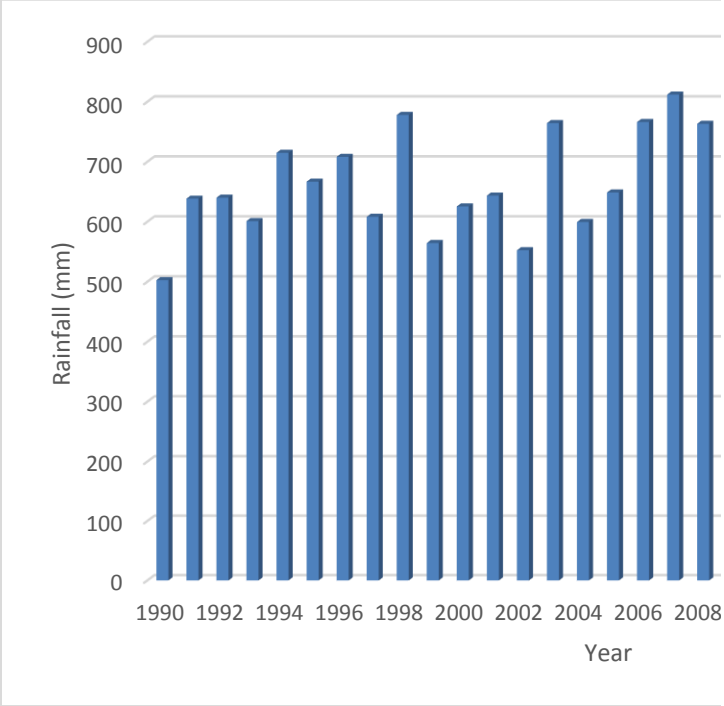

Figure 4: Annual rainfall distribution (1990-2020)

Source: Author's Analysis, 2020.

The year 2019 witness to the highest recorded precipitation with a total of 883.49 mm, whereas the lowest precipitation was observed in the year 2002, having a total of 552.38mm. Notably, extreme values were documented in the years 2009, 2013, and 2017, at 603.9mm, 598.43 mm, and 631.62mm, respectively. The years 2002, 1999, and 2014, conversely, saw a reduced amount of precipitation, amounting to 552.38mm, 564.41mm, and 543.43, respectively (refer to figure 4). This trend depicts an indication of heightened precipitation levels throughout the years. Consequently, years with the highest precipitation may have encountered flooding as a consequence of excessive rainfall.

High and extended rainfall will lead to frequent flooding of farmlands which is harmful to the crop. The study area however receives an average, evenly spread rainfall of between 552.38mm and 603.9mm annually (figure 4). But since the rainfall is not equally distributed monthly, it is possible to witness the flooding in some particular months such as August in the years where high rainfalls were recorded.

Causes and Effect of Flooding in the area

This particular aspect of the study focuses on examining the perception of floods, their underlying causes, and the resulting effects within the study area. They discussed in following subsequent subheadings;

Perception on flooding

The findings from the Focus Group Discussion (FGD) indicate that the members of the communities possess a heightened awareness of the phenomenon of flooding, including its causes and the consequential effects.

These aspects are elaborated below.

‘‘Flooding is the overflow of water into communities which causes destructions and it happens often, it happens here almost every year.’’

‘‘From my own understanding I think it’s the too much water that come as a result of rainfall and too much water from the River (River Lavun).’’

On the matter of perceiving flooding within communities, the individuals residing within said communities possess a thorough understanding of the origins and consequences of flooding. This comprehension stems from the occurrence of numerous flood events in the past, which have resulted in significant disorder and devastation. The communities, in their diverse capacities, regard floods as a natural calamity that inflicts destruction whenever it transpires. This destruction encompasses the displacement of individuals from their dwellings, agricultural lands, schools, healthcare establishments, as well as bridges, among other infrastructural features. This work is similar with the work of Umaru and Hafiz (2019) on the perceived effects of flood on lives and properties of the residents of Lokoja. They found out that past flood event has affected our farmlands and its produce, our shops were damaged, buildings and the little means of survivor we had. We have to start from the scratch after the water recedes.

Extend of flooding in the study area

The findings of the FGD indicated the magnitude, scope, and impact of flooding in the study area, which encompasses nearly all areas. The subsequent findings are as follows:

‘‘The flood those not only wash away our houses but the most tallest structure and trees in the community and it washes away everything on its path, like buildings, farmlands, schools, clinics, properties, amongst others.’’

‘‘Flood covers almost everywhere in the community which lead to the destructions of farmlands, some houses; because it does not consume all the buildings, the flood water enters the buildings through the windows and doors. It cut off our roads, restrict our businesses activities and movement, our houses are destroyed, we can’t farm and it also enter our houses.”

In relation to the magnitude of the inundation, it encompasses numerous kilometers, stretching towards diverse localities. The floodwaters engulf residences, including the loftiest structures measuring approximately 28 meters in height, as well as lofty trees within the area. Consequently, the communities become inaccessible, compelling the inhabitants to temporarily abandon their houses. Moreover, this situation instigates psychological

suffering and strain among the communities as they endeavor to adapt and endure throughout the duration of the flooding events. This work is related to the work of Frederick *et al.,* (2010) Impact of Floods on Livelihoods and Vulnerability of Natural Resource Dependent Communities in Northern Ghana who said extensive rural–urban migration has occurred in the two communities in response to the economic and social inequalities inherent the two communities. Such migration followed the loss of land used by poor farmers and pastoralists, and discriminatory pricing of crops produced in small quantities by poor farmers. Migration has equally forced increased numbers of individuals to seek living space and subsistence on flood-prone land within and alongside the Volta River.

Plate 1: Extent of flood vulnerability

Plate 1: the respondent states that the degree of flood consequences on the communities can be determined by the extent to which flooding events used to impact structures, occasionally resulting in the complete destruction of buildings up to the roof of the house. Additionally, such flooding events also have an adverse effect on the worship areas, as indicated by the high level of vulnerability observed and as shown on the picture.

Causes of flood in the area

> The findings from the FGD indicated that the occurrence of flood is due to intense precipitation, the discharge of water from reservoirs, and the reversal of water flow in River Gbako within the research area, which will be further elaborated below.
>
> ‘‘The main causes of flood in this our community is the overflow of the River Gbako because of its closeness to the community, and also excessive rainfall which last several hours and days, and when the flood occurs it consumes the most tallest structures and trees which forced us sometimes to move to another locations, and later come back to our various homes.’’
>
> ‘‘The causes of flood in this community is as a result of excessive rainfall and discharge of water from Kainji Dam which causes back flow. We get to understand that it’s the back flow of the flow of River Gbako from River Niger that also led to the flooding in this our community and other communities along the River Gbako and also discharge of water from Shiroro Dam.’’

The origins of flooding in the study area have been ascribed to an abundance of precipitation, which greatly augments the incidence of floods. The primary causative factors of flooding in the communities were determined to be the discharge of water from dams upstream, the backward flow of water, the overflow of water, and the persistent habitation of river banks and floodplain areas. This work agreed with Ojigi *et al*. (2013), work on the geospatial mapping of the 2012 flood disaster in central parts of Nigeria. In the study, the researchers attributed the 2012 flooding to the release of waters from Ladgo dam in Cameroun into the River Benue floodplain. The people have also contributed to their problem as the communities are in low altitude which are at risk of flood events, and they have refuse to evacuate and settle in places that are in high altitude for them to be safe from the occurrence of flood.

CONCLUSION

This study demonstrates that the growth of human habitation and human-induced actions are progressively intensifying towards the eastern and south-eastern part of the study area, thereby exacerbating the occurrence of floods in the study area. The primary factors that have been identified are the release of water from upstream dams, the reverse flow of water, the inundation of water, and the continuous occupation of river banks and floodplain regions. Consequently, it is advocated that individuals residing in flood-prone regions should be relocated.

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