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Assessment of Flood Menace in Cities - A Perspective from Lokoja Communities of Kogi State, Nigeria

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Article History:

Received: 3 August 2024; Accepted: 12 October 2024;
Published: 24 October 2024

Abstract

Purpose: Flood menace affected 4.4 million Nigerians in 33 of the 36 states in 2022, including the Federal Capital Territory (FCT) Abuja, and displaced over 1.4 million people, and killed 612 people. This study assessed the impacts of flood menace on Lokoja communities in the absence of a clear strategy framework despite abundant research evidence.

Methods: Structured questionnaire surveys, focus group discussion (FGD) and key informant interviews (KII) methods were deployed to obtain data on the causes and dilemma of flood menace. A sampling technique was used to obtain five (5) communities in Lokoja, out of eleven (11), and 257 household heads were drawn from the study population. Data collected were analyzed using SPSS version 21.

Findings: The findings revealed that, flood menace caused damages to household properties, building collapse, vehicle breakdown, diminished water quality, and destroyed farmlands. Some of the other factors were poor drainage facilities, drainage pattern, and buildings across narrow floodplain. The need for sensitization of the general public on issues of climate change and Disaster Risk Reduction indices was recommended.

Research Limitation/Implication: The study focused on the causes and dilemma of the impact of flood menace in Lokoja communities, Nigeria.

Practical Implication: The knowledge derived in the paper will help the government to collaborate with other stakeholders on flooding and flood-proofing measures especially in marshlands and waterways.

Social Implications: This study will assist decision makers, planning authority, civil society, NGOs, Community Development Associations (CDAs), and developers in addressing diverse environmental and social effect of flood menace for the present and future generation.

Originality/Value: The novelty of this study is on informing about the social and environmental challenges of flooding, development initiatives on the protection of the environment in order to effectively foster awareness of key stakeholders toward the initiative of building resilient cities/towns.

Keywords

Confluence, Disaster, Flood impacts, Risk Reduction, Menace, Participatory

Volume 12, 2024

Publisher: The Brooklyn Research and Publishing Institute, 442 Lorimer St, Brooklyn, NY 11206, United States.

DOI: 10.15640/jges.v12a4

Reviewers: Opted for Confidentiality

Citation: Okosun, S. E., Patrick, R. A., & Banki, T.C (2024). Assessment of Flood Menace in Cities - A Perspective from Lokoja Communities of Kogi State, Nigeria. *Journal of Geography and Earth Sciences*, 12, 43-55. <https://doi.org/10.15640/jges.v12a4>

1. Introduction

Since the Paris Agreement (PA) in 2015, concerted efforts have been made towards solving the environmental problems created by flood menace, and these events have caused social and environmental impacts with the most significant impact being felt at the community level. The degree of impact varies in terms of seasonality, population exposure, geographical location and infrastructure (IPCC, 2007; Komolafe et al., 2015, United Nations Framework Convention on Climate Change, 2018). Observational evidence over the years has shown that flood menace is a frequent phenomenon globally, and cities have witnessed its consequences, thus held responsible for large scale fatalities, economic losses, and social and environmental damage to nations. Every year, about one hundred (100) million people globally are affected by the dilemma of flooding (Sayama et al., 2010).

In 2018, about 41% of the world's population lived within rivers banks and confluences (Downing, Prairie, Cole, Duarte, Tranvik, Striagi, McDowell, Kortelainen, Caraco, and Melack, 2016). This is because they offer significant economic benefits (recreation, tourism, fisheries water navigation, and agriculture. Man's unending quest for survival triggers a series of chain effects on the environment upon which human lives and livelihood depend, which is dramatically deteriorating both in quantity and quality. Human quest to harness water resulted in the creation of dams and other water related control structures. However, the recent failures of these structures resulted in floods (Akinbode, 2021; Okosun, et al., 2021). Hu et al. (2019) analyzed the effects of flooding on Chinese economy from the manufacturing sector perspective, and reported that, flood events reduce firm outputs/labour productivity by 28.3 percent yearly. Recent research evident revealed that, some of the unpleasant events; of flood menace will be in developing countries (DCs) like Pakistan and Nigeria, where the human populations are most vulnerable, and least expected to adapt global acceptable measures (Grafton et al., 2004; Baba, et al., 2021). The 2022 flood in Pakistan affected about 72 million people and caused about 14.9 billion US dollars in damages.

In Nigeria, the 2022 flood events were reported to have affected 33 of the 36 states of the federation, including FCT, Abuja, displaced over 1.4 million people, and killed 612 people (NIWA, 2022). Over 200,000 homes and 110,000 hectares of farmland were completely or partially destroyed (Okosun and Folorunsho, 2023). This indicates that, flood event is among the most destructive natural induced disasters in the 21st Century of human habitat. It has direct impacts on drought, water quality, land use, and ecological change (UNFCC, 2007). The global human population requires a standard of living that is economically and environmentally acceptable, as flooding now have a negative impact on our planet and human activities. Thus, climate change is held responsible for flood-related disasters (Nigerian Meteorological Agency, 2015; John-Nwagwu, et al., 2021), and climate change is the biggest global human debate, responsible for approximately 12.6 million deaths globally (UNFCC, 2018). The IPCC (2007) noted that flood menace hinders future development, and a serious challenge/concern in Nigeria; cases of flood events have had a negative effect on the lives and properties of the populous.

According to the Federal Government of Nigeria reports in 2022, there are facts that flood incidences have a significant impact on the country, and the effects will soon be severe in all parts of the states. In Nigeria more flood events are expected in 2024, and the next century if appropriate actions and management are not put in place. There is fact, that droughts cripple cities, towns, and communities in specific regions often leading to deaths, displacements of people, and destruction of properties in states like; Benue, Kaduna, Abuja, Sokoto, Yobe, Adamawa, Delta, Bayelsa, and Kogi. Indeed, there is research evidence that, the impact of flood menace in Nigeria's is increasing (John-Nwagwu, et al., 2021; Akinbode, 2021; NIMET, 2023; Okosun and Folorunsho, 2023). According to NIMET (2023), new destructive records of extreme flood events are sooner than expected, be experienced throughout the country.

Recent studies conducted in different cities reveal that, major economic damages and environmental challenges are associated with flood menace (Adriana et al., 2015; WHO, 2018) with an increase in diseases in the 20th century (World Health Organization, 2016). For over 35 years, flood events globally, killed over 500,000 persons, and historically displaced approximately 650,000,000 persons (Adriana et al., 2015).

In Nigeria, a study was conducted by Tawari-Fufeyin, et al. (2015), to evaluate the effects of flood waters in selected towns in Niger-Delta region, the study concluded that, potable water sources and infrastructure in Bayelsa and Delta States were adversely affected by the flood events. It did not assess and revealed the effect on lives and properties. In 2022, 700,000 persons in Bayelsa state were adversely affected by flood, which displaced over 300 inhabitants in the communities and villages, in five out of the eight Local Government Areas (LGAs) in the state (NIMA; 2022). It was revealed that, buildings constructed on water channels and non-compliance with building laws contributed to the cause of the disastrous floods that ravaged the country (NIMA 2022; in Punch.com 2022). As reported by Adedamola (2019), economic losses due to flood events in residential neighbourhoods have increased in folds. The incidence of flood events and magnitude was such that, 87 emergency camps were created to accommodate displaced victims across Kogi state.

In Lokoja, one of the major environmental challenges is flood events, which is directly responsible for land degradation over the years. These have become issues of serious concern to individuals and the government at all levels, as life is being lost and properties are being damaged yearly. This study aims at assessing the impact of flood menace on Lokoja communities, with a view to suggesting bottom-up approach for robust management strategies.

The following are the set objectives of this study: i) to establish if residents were exposed to flooding contaminants, ii) to find out the major causes of flood in the communities, iii) to ascertain the impacts of flood menace on the economic and basic amenities, iv) to examine environmental health related issues of the inhabitants, and v) to establish the duration of staying away from home due to the dilemma of flood menace.

2. Literature Reviews

Research evidence examined shows that, flood is a major factor influencing environmental and social problems, including severe hunger and poverty, and conflicts (Karki 2011; Oluwaseun *et al.*, 2013; Okosun *et al.*, 2021), building/structure collapse (Tawari-Fufeyin *et al.* 2015); destruction of properties (Adriana *et al.* 2015), displacement of people (John-Nwagwu *et al.* .2021), death (Umaru and Hafiz 2019) and the outbreak of diseases (Baba *et al.* 2021; Akinbode, 2022). Rabalao (2010) investigated an aspect of psychological impact of flood events of Moretele district of South Africa, using a participatory research approach through questionnaire administration; the study concluded that, increasing population, the changing of environment due to urbanization and sprawl, aggravated the flooding dilemma of Ga-Motia communities.

Most people and human settlements around the world concentrate on confluence and its environment rather than elsewhere (Aljazeera 2011). In recent times, flooding has become the world most reverberation theme, due to its impact to man, plants and animals, and has damage mental health, lives, and property (John-Nwagwu, *et al.* 2021, Akinbode, 2021). Those studies failed empirically, to establish if residents were exposed to flooding contaminants in the confluence of the two major rivers in Nigeria.

In Nigeria, many state capitals are vulnerable and faced with the dilemma of extreme flooding (NIMET 2015, 2023), in coastal areas/regions, built-up environment (land-use), water (rainfall patterns/quality of water), farmlands (Baba, *et al.* 2021; Channels TV 2022; NIMET, 2023). Those environmental challenges and impacts on man are of great concern to mankind (Nwilo & Nihinlola, 2012). In Bauchi, 29 people were confirmed dead in the 2022 flood (Punch newspaper, 2022). The incidences of flood events and magnitude were such that, 87 emergency camps were created to accommodate 623, 690 displaced victims across Kogi state (Adekola & Ogundipe, 2017). This implies that, flood menace each year, is a normal occurrence in Nigeria. This information raises questions of; *“who/what will be affected by the flood, and what the extent of it effects?”*

Lokoja the capital of Kogi state, in recent times, has experienced increased in flood occurrences, during periods of extreme climate variability, and this is quite worrisome since 2012. Lokoja is referred to as a confluence city with two foremost rivers in Nigeria, Over the years, it and has been at the receiving end each time the country experienced massive flooding, and there have been reported cases of floods all over the city. Major roads linking communities within the town and its surroundings, Local Government Areas including the FCT Abuja were more often taken over by flood. In recent times, there has been cases of human induce casualties, who are either declared missing or reported to have be drowned. Researchers, should as; Alabi (2009), and Akinbode (2021) opined that, there is an increasing environmental hazard, and disaster in flood-plains areas in Lokoja. This may be the reason why residents in the area are more vulnerable to environmental hazards such as exposure to flooding contaminants, and disease outbreak among others which were reported in recent past. This study concentrated on the causes and dilemma of the impact of flood menace, and areas most vulnerable to flooding, and suggests workable strategies for managing flooding problems in Lokoja communities, Nigeria.

3. Materials And Methods

3.1. The Study Area

Lokoja has two major drainage systems: the Rivers Niger and Benue that divide the country (Nigeria), and Lokoja is one of the areas frequently affected by floods (Nigerian Meteorological Agency, 2012; Oluwaseun *et al.*, 2013). Efforts must be harnessed to address those events occurring more frequently. However, five (Adankolo, Ganaja, Gadumo, Sarkin-Noma, and Kabawa) out of the eleven communities in Lokoja is located around the confluence/channels of these rivers, and thus, the most affected. The creation of Kogi state on 27th August 1991 with Lokoja as the capital accelerated the urbanization process as well as the expansion of the town, therefore resulted in the increase in human population and rapid development which modified land use patterns in the area. Today, Lokoja is a trade center with several commercial and human activities. There are about 77,516 persons in Lokoja as at 1991, in 2006 it increased to 197,645 persons (National Bureau of Statistics, 2017) and now estimated at 839,046, a 6.07% increase from 2022. Lokoja has a strategic road that links 5 geo-political zones, out of the 6 zones in Nigeria, and it is characterized by wet and dry seasons with annual rainfall of above 1767.1mm. Lokoja land use is predominantly residential. The main economic activities of people are agriculture (farming, fishing, and pottery), trading and spinning, etc.

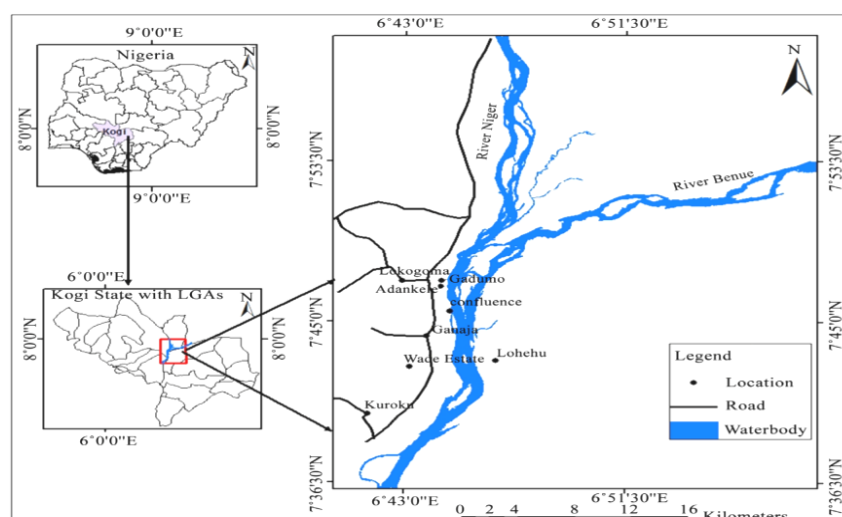


Figure 1: Map of Lokoja communities in its state and national setting (Study area)

3.2. Methodology

In this study, a mixed-method approach was adopted. The questionnaires developed were both closed and open-ended questions, which was administered to a target population within Lokoja consisting of residents in the local communities, Non-Governmental Organizations, and agencies such as the Kogi State Bureau of Lands, and the Kogi State Town Planning Board. The communities worst hit by flooding was selected. In this regard, five (5) communities out of eleven (11), were identified and studied in detail, which included; Adankolo, Ganaja, Gadumo, Sarkin-Noma, and Kabawa. The information captured included causes of floods, frequency of flood events, flood menace experienced in relation to economic, social and environmental. A total of 10,283 housing units exist in the selected residential areas. Adankolo has 5,840 housing units, Ganaja has 749 housing units, Gadumo has 1,120 housing units, Sarkin-Noma has 1,357 housing units, and Kabawa has 1,217 housing units as shown in Table 1. In all, 257 copies of the questionnaire were administered, based on the number of housing units from a frame of 10,283, using a convenient purposive sample. 2.5% of the total housing units, representing 210 copies (81.7%) of the administered questionnaire were retrieved in usable forms. Thus, the sample of 2.5% was used to obtain in-depth insight regarding the impact of flood menace on Lokoja communities. Data were further obtained via five key informant interviews (KII) and focused group Discussions (FGDs) in each of the five communities. Data for this study were analyzed using frequency count, percentage and Chi-Square inferential statistical test to determine the association between the areas impacted and flood events.

Table 1: Questionnaire Administered and Retrieved

Name of residential area	Location/corridor	No of housing units	Questionnaires Administered (2.5%)	Questionnaire Retrieve
Adankolo	Lokogoma Road	5840	146	112
Ganaja	Ajakuta road	749	18	16
Gadumo	Ganaja Road	1,120	28	25
Sarkin-Noma	Okene-Abuja Road	1,357	34	30
Kabawa	Old Market	1,217	31	27
Total		10,283	257	210

Source: Author compilation, 2023

4. Results and Discussion

The analysis in this study shows that 132 (62.9%) of the residents were exposed to flooding either directly or indirectly, 49 (23.3%) were indecisive, and 29 (13.8%) claimed they had not experienced any form of flood menace either directly or indirectly. More than half of the population was affected by flood menace either directly or indirectly. This implies that, whether your residence is in the flood zone or not, you are affected by the flood in one way or the other. This is because when a flood occurs, roads are covered by water that hinders the movement of

vehicles, pedestrians, goods, and services. Apart from heavy rainfall which is caused by nature, other causes (opening of dam, blocked narrow drains) can be linked to man (the residents).

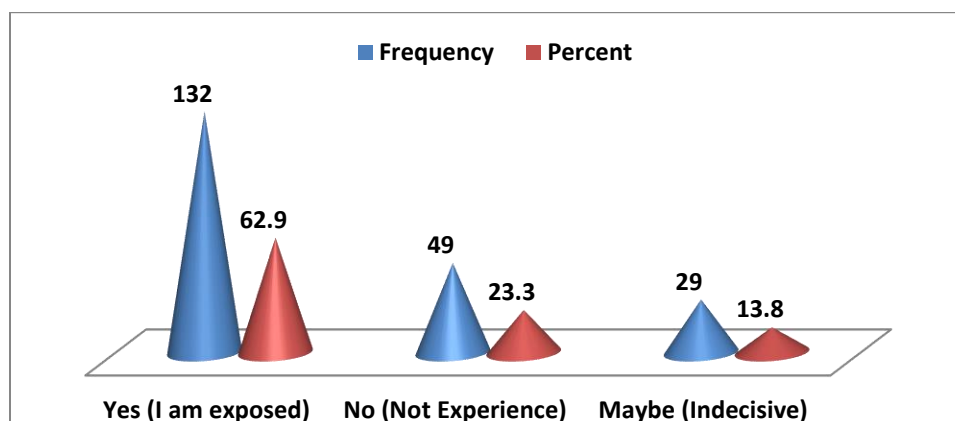


Figure 2: Exposure to flooding Contaminates

As shown in Table 2, the causes of flood menace in Lokoja communities were overflow of rivers, heavy rainfall (greater than 8mm per hour), the opening of dam, erosions, lack of drainage facilities, /system, and blocked narrow drain. The most important cause of flood menace is the overflow of rivers (48.0%) like River Niger, Benue, and Meme, experienced in Lokoja communities, especially in Adankolo, Kabawa, and Gadumo. Further findings indicated that the opening of the Ladgo dam (18.6%) was the main reason for flooding in Lokoja especially in Adankolo and Sarkin-Noma, to a lesser degree in Kabawa who attributed flood menace in the study area to the opening of dam. The next important cause of flood menace in the study area was attributed to the heavy rainfall (18.6%) experienced in communities such as Gadumo and Sarkin-noma. Erosion, lack of drainage facilities, and blocked narrow drains were other notable factors mentioned that aggravate flood menace. According to the respondents, the 2012 and 2022 flood menace in Lokoja is caused by the release of waters from Ladgo dam into River Benue. A similar trend was identified by Baba *et al*, (2021), who conducted a study, on participatory assessment of flooding in Kogi State, Nigeria, and Akinbode (2021) who researched the appraisal of flood challenge in Niger-Benue Confluence of Nigeria. The major cause of flooding is overflow caused by heavy rainfall and opening of the Lagdo Dam, and the area is 125 meter above. It can be concluded that, flood menace were a result of unhealthy environmental behaviors. Residents are vulnerable to flood menace due to the natural terrain of the area that make it susceptible to flooding, however, inadequate physical planning control and attitude of dumping refuse in the drains also contributed to their vulnerability.

Table 2: Major causes of flood menace according to the respondents

	Adankolo		Ganaja		Gadumo		Sarkin-Noma		Kabawa		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Heavy rainfall	20	9.5	2	0.9	6	2.9	5	2.4	6	2.9	39	18.6
Overflow of rivers	59	28.1	8	3.8	11	5.2	10	4.8	13	6.2	101	48.0
Opening of dam	29	13.8	2	0.9	2	0.9	5	2.4	1	0.4	39	18.6
Lack of drainage facilities/system	0	0	1	0.4	4	1.9	0	0	3	1.4	8	3.8
Erosion	1	0.4	2	0.9	2	0.9	10	4.8	3	1.4	18	8.6
Blocked narrow drains	3	1.4	1	0.4	0	0	0	0	1	0.4	5	2.4
Total	112	53.3	16	7.6	24	11.4	30	14.3	27	12.6	210	100.0

Furthermore, it was revealed that, the release of water from the dams, heavy rainfall and poor maintenance cultures of the dams (Figure 3) were identified as the three main causes of flooding in the study area, as revealed in the focus group discussions and key informant interviews. These findings were consistent with the analysis of information from the survey about the causes of flood menace in Lokoja communities.



Figure 3: Poor drainage system in Ganaja Community

From Table 3, the research findings show that, 29.5% of the respondents experienced destruction of farmlands, 11.0% witnessed the collapse of houses/shops, 25.7% experienced disruption of the transport system, 7.6% experienced loss of life, and 26.2% shared all the experience above at one time or the other. Findings showed that there was hardly any household that did not experience one form of impact or the other. The implication is that the impact of flooding increases the level of poverty of its victims (John-Nwagwu, et al., 2021; Akinbode, 2021; Okosun and Folorunsho, 2023). These impacts are in line with the results from the questionnaire survey analysis of the focus group discussion and key informant interviews, which reported that there is no doubt, flood-impacted the community socially, economically, and psychologically. Further findings reveal that the impact of flood menace on Lokoja communities has caused the destruction of houses, loss of life and properties, low business patronage, and destruction of farmlands. This further justifies the need for adequate policy framework to regulate and monitor buildings and building development in the flood-affected areas.

Table 3: Impact of flood menace on Lokoja communities

	Adankolo		Ganaja		Gadumo		Sarkin-Noma		Kabawa		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Transport system	15	13.4	8	50.0	10	40.0	11	36.7	10	37.0	54	25.7
The collapse of houses and shops	15	13.4	2	12.5	1	4.0	3	10.0	2	7.4	23	11.0
Farmlands	52	46.4	1	6.2	2	8.0	2	6.7	5	18.5	62	29.5
Loss of life	10	8.9	2	12.5	1	4.0	0	0	3	11.1	16	7.6
All of the above	20	17.9	3	18.8	11	44.0	14	46.7	7	27.0	55	26.2
Total	112	53.3	16	7.6	25	11.9	30	14.3	27	12.9	210	100

In terms of basic amenities affected by flooding as shown in Table 4, 31.9% of the residents claimed that flooding has affected their houses, for those families whose houses have been flooded, they experienced unplanned relocation, they had to seek refuge from friends, family members and religious societies (churches) and forsake their properties and other valuables. This situation at times hinders and impoverishes the residents, and has caused exploitation by unscrupulous landlords. In some cases, households took refuge in hotel accommodations/guest houses for weeks. Only 16.7% of the residents were faced with the challenges of water supply as a result of the broken public water pipes, in some cases, the water is contaminated, and 6.2% of the respondents experienced disruption in electricity supply. However, 5.7% witnessed inaccessibility/disruption of health facilities, 4.8% experienced disruption of market activities, and 4.3% experienced disruption of drainage systems. All of these basic amenities were affected as a result of floor menace resulting in the degrading of the environment and paralysis of activities in Lokoja communities.

A cross-section of participants (FGDs and KII) expressed that, when the flood sets in, it destroys so many houses and lead to relocation of people away from Adankolo community, adding that in some cases, flooding keeps students from classes. In Ganaja community, the flood collapsed some of the buildings, as most of the foundations were not strong. In Gadumo community, some households have moved out from the affected residence, while some moved out temporally, and return after renovation of their house, after the flood has gone, they return after renovating the house. In Sarkin-Noma and Kabawa communities, it has resulted in reduction in renter services (accommodations).

Table 4: Basic amenities affected by flood menace in the study area

	Adankolo		Ganaja		Gadumo		Sarkin-Noma		Kabawa		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Houses	35	31.3	5	31.2	9	36.0	10	33.3	8	29.6	67	31.9
Health Facilities	3	2.7	3	18.8	1	4.0	2	6.7	3	11.1	12	5.7
Electricity	4	3.6	1	6.2	4	16.0	2	6.7	2	7.41	13	6.2
Roads	30	26.8	2	12.5	5	20.0	7	23.3	6	22.2	50	23.8
Schools	11	9.8	1	6.2	0	0	1	3.3	1	3.7	14	6.7
Water supply	21	18.7	3	18.8	3	12.0	5	16.7	3	11.1	35	16.7
Market	2	1.8	1	6.2	1	4.0	3	10.0	3	11.1	10	4.8
Drainage system	6	5.3	0	0	2	8.0	0	0	1	3.7	9	4.3
Total	112	53.3	16	7.61	25	11.9	30	14.3	27	12.9	210	100.0

Table 5 reveals that the outbreak of diseases due to flood menace/incidence in Lokoja communities has resulted in; malaria, typhoid fever, cholera, hepatitis, and other diseases. From the analysis, the majority of the residents were affected by malaria (33.9%) and cholera (25.9%). With the findings above, it could be deduced that, malaria is one of the leading causes of environmental health issues during flooding. Other diseases (12.2%) as indicated by the survey respondents due to flooding include, skin problems, leg cuts, snake bite, scorpion bite, guinea worm, and cold. Findings also revealed an empirical association between health challenges such as malaria, cholera, and typhoid fever. These findings are also consistent with a study carried out by Umaru and Hafiz (2019) and Baba *et al.*, (2021). This means that, the residents in the study area were exposed to diseases during floods. In Kabawa, the water flowing is poisonous; while in Sarkin-Noma it was reported that, there is bacterial infection, residents will have to fumigate their surroundings. In Adankolo, the flood causes hepatitis and malaria.

Table 5: Outbreak of diseases due to flood menace in the study area

	Adankolo		Ganaja		Gadumo		Sarkin-Noma		Kabawa		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Malaria	74	51.4	15	26.3	24	36.4	27	31.4	23	30.7	136	33.9
Typhoid fever	33	22.9	13	22.8	18	27.3	21	24.4	11	14.7	96	23.9
Cholera	19	13.2	11	19.3	20	30.3	29	33.7	25	33.3	104	25.9
Hepatitis	3	2.1	3	5.3	1	1.5	2	2.3	7	9.3	16	3.9
Other diseases	15	10.4	15	26.3	3	4.5	7	8.1	9	12.0	49	12.2
Total	144	35.9	57	14.2	66	16.5	86	21.4	75	18.7	401	100

From the analysis in Table 6, 5.7% of the affected respondents in the study area stayed away from their residence for less than a week, once they experienced flood menace, 13.3% abandoned their homes between one to two weeks, 13.8% of the households had the cause to vacate their residences for three to four weeks, 9.0% had kept off their homes for one to two months, while 58.1% of the households have nowhere to go than to live with the menace. Cumulatively, 41.9% of the respondents had no cause to vacate their residences annually due to the flood incidence experienced.

In terms of the duration of staying away from home, due to the dilemma of flood menace. A cross-section of participants (FGDs and KII) expressed the following; *"In Gadumo, when this flood comes, some individuals take it as an opportunity to make money from us; if you want to rent a room for just 1 or 2 months before you return to your house, somebody will tell you to pay N40, 000 for one-bedroom flat with agency fee of 10%."* In Adankolo, this situation imposes hardship on the community. The finding is in agreements with earlier reports of Baba *et al.*, (2021) and Akinbode (2022) who observed that some households stayed away from their actual homes during flood disasters. This implies that, flood menace is a multifaceted environmental issues/challenge (Figure 4) that requires perceptions

and knowledge claims of multiple stakeholders. However, in understanding and investigating the complexities of flood menace/mitigation, a bottom-up approach to flood adaption/knowledge from the perception of the affected communities will assist policymakers, and decision-makers.

Table 6: Duration of staying away from home due to the flood menace

	Adankolo		Ganaja		Gadumo		Sarkin-Noma		Kabawa		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Less than 1 week	7	6.3	0	0	1	4.0	3	10.0	1	3.7	12	5.7
1-2 weeks	14	12.5	2	12.5	3	12.0	5	16.7	4	14.8	28	13.3
3-4 weeks	15	13.4	6	37.5	2	8.0	4	13.3	2	7.4	29	13.8
1-2 Months	9	8.0	4	25.0	4	16.0	2	6.7	0	0	19	9.0
Not Applicable	67	59.8	4	25.0	15	60.0	16	53.3	20	74.1	122	58.1
Total	112	53.3	16	7.6	25	11.9	30	14.3	27	12.6	210	100



Figure 4: Houses destroyed by flood

To establish an empirical relationship between some key impacts of flood menace effects/outcome on Lokoja communities, the Chi-Square Test analysis was employed. Those include transportation systems, houses, water supply, farmland, health facilities, and environmental health such as malaria.

Hypothesis 1:

Table 7: Chi-square results on the effect of transportation

Alternatives	Observed	Expected	Residual
Yes Responses	89	105.4	-11.1
No Responses	61	44.6	11.1
Level of degree of freedom		df = 1	
Chi-Square		$X^2 = 9.873^a$	
p-Value		p = 0.002	

Determination of critical value

The result of the analysis as shown in Table 7 shows that, transportation system in the study area is affected by floods. Therefore, the hypothesis of no association was rejected, given that the degree of freedom (df) = 1 at 5% level of significance ($X^2 = 9.873^a$ p = 0.002) is less than the 0.05.

Hypothesis 2:**Table 8: Chi-square results on the effect on houses**

Alternatives	Observed	Expected	Residual
Yes Responses	179	167.3	15.2
No Responses	2	14.7	-15.2
Level of degree of freedom		df = 1	
Chi-Square		$X^2 = 8.646^a$	
p-Value		p = 0.003	

Determination of critical value

Table 8 shows that, houses in Lokoja communities are affected by flood events/occurrence. Therefore, the hypothesis of no association was rejected, given that the degree of freedom (df) = 1 at 5% level of significance ($X^2 = 9.246^a$ p = 0.003) is less than the 0.05.

Hypothesis 3:**Table 9: Chi-square results on the effect on farmland**

Alternatives	Observed	Expected	Residual
Yes Responses	203	196.7	24.3
No Responses	7	21.3	-24.3
Level of degree of freedom		df = 1	
Chi-Square		$X^2 = 7.786^a$	
p-value		p = 0.020	

Determination of Critical Value

As shown in Table 9, farmlands in Lokoja communities are affected by flood events. Therefore, the hypothesis of no association was rejected, given that the degree of freedom (df) = 1 at 5% level of significance ($X^2 = 7.786^a$ p = 0.020) is less than 0.05.

Hypothesis 4:**Table 10: Chi-square result on effect on water supply**

Alternatives	Observed	Expected	Residual
Yes Responses	103	125.9	-16.9
No Responses	87	64.1	16.9
Level of degree of freedom		df = 1	
Chi-Square		$X^2 = 8.349^a$	
p-Value		p = 0.001	

Determination of critical value

Table 10 shows that, water supply in Lokoja communities is affected by flood menace. Therefore, the hypothesis of no association was rejected, given that the degree of freedom (df) = 1 at 5% level of significance ($X^2 = 8.349^a$ p = 0.001) is less than 0.05.

Hypothesis 5:**Table 11: Chi-square result on effect on health facilities**

Alternatives	Observed	Expected	Residual
Yes Responses	39	39.5	-5.4
No Responses	168	161.5	5.4
Level of degree of freedom		df = 1	
Chi-Square		$X^2 = 1.467^a$	
p-value		p = 0.230	

Determination of critical value

As shown in Table 11, healthcare facilities in Lokoja communities are affected by flood events/occurrences. Therefore, the hypothesis of no association was rejected, given that the degree of freedom (df) = 1 at 5% level of significance ($X^2 = 1.467^a$ p = 0.230) is less than 0.05.

Hypothesis 6:**Table 12: Chi-square result on the effect of malaria as a disease**

Alternatives	Observed	Expected	Residual
Yes Responses	119	136.4	19.6
No Responses	64	52.6	-19.6
Level of degree of freedom		df = 1	
Chi-Square		$X^2 = 6.470^a$	
p-Value		p = 0.024	

Determination of critical value

The result of the analysis as shown in Table 12 shows that, there is no relationship between the flood events and prevalence of malaria in the study area. Therefore, the hypothesis of no association was rejected, given that the degree of freedom (df) = 1 at 5% level of significance ($X^2 = 6.470^a$ p = 0.024) is less than 0.05.

In summary, inferential statistical technique using the Chi-square test revealed that, there is an empirical relationship between the flood and the variables in the five communities. The finding from the further analyses shows empirical association of destruction of houses, transportation system, water supply infrastructure and farmlands with flood menace. The reason, the Chi-square statistical test showed no association between flood menace in present study is because infrastructures, such as health facilities is sited outside the floodplain. The information on the sternness of flood menace to lives and property insurance claims is evidenced in developed countries and unlike in most developing countries.

5. Conclusion and Recommendations

The research concludes that Climate change induced flash floods in Lokoja and that, flood menace in the study area is mostly caused by the overflow of the rivers due to the persistent downpours of rain, and water released from the Ladgo Dam in Northern Cameroun. Other notable factors such as, erosion, inadequate/absence of drainage systems, and blocked narrow drains exacerbate flood menace in the study area. The flood incidences are mostly being felt in houses, transportation systems, and farmland. Flood reduces Lokoja's agricultural production should; as rice production, (flooded-rice-farm affected). From the research, it can be empirically concluding that, flood menace has a relationship with loss of lives/properties in the research locale. However, flood menace in Lokoja is held responsible for the outbreak of some disease, destruction of properties/basic amenities in the identified communities. Therefore, flood menace is a complex theme that requires the participation/engagements of multiple stakeholders in flooding-related themes that involve the local knowledge/views of the people.

To remedy the impact of flood menace in Lokoja, the research recommended;

a) Enforcement of building codes/standards in Lokoja Communities in order to stop the arbitrary approval/erection of structures in marshlands and waterways, in this case, government should built an enforcement procedures into the process of approval, b) Government should introduce strict penalties to approving officers in the planning authority of the state, who certified and signed the letter to erect illegal structures, c) There is need for the

government to introduced inspector reports and verify design of flood-proofing measures in the surveyor certificates in order to ensure design elevations measures are implemented, d) Sensitization of the people on Climate change and Disaster Risk Reduction indices campaign is urgently needed, e) The government and civil society should encourage people/private's participation and involvement in flood-related themes, which in turn will save lives and properties, f) A bottom-up approach to flood mitigation is advocated for policymaker as well as decision-makers. This implies that, government should intensify programs of environmental awareness to complement the efforts of the environmental agencies charged with the protection of the environment. The implementations of the aforementioned recommendations will assist the governments and NGOs to effectively foster community engagement/awareness toward the initiative of building resilient cities/towns.

Conflict of Interest: None declared.

Ethical Approval: Not applicable.

Funding: None.

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