

# Assessment of Causative and Preventive Measures of Flood Menace in Urban Zaria L.G.A of Kaduna, State Nigeria

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**Abstract:**-Globally, flooding is one of the environmental problems that affect countries of the world, most especially developing countries. Flood has become more frequent and of increasing severity resulting to loss of life, injury, homelessness, damage to infrastructure and environment as well as impacting on other critical sectors such as education and agriculture in urban Zaria of Kaduna state, Nigeria. The study assessed the causative and preventive measures of flooding in Urban Zaria, Kaduna State, Nigeria. The study adopted quantitative approach, purposive sampling techniques was used to select five communities (Hanwa, Magume, Tudun-jukun, Muchia and Gyallesu). Descriptive statistics and Likert Rating System were used to analyse the data. The study revealed that flooding is a yearly occurrence (76.6%). More so, 70.5% of the respondents reported that flooding occurred mostly in the rainy season in urban Zaria within august to September. The respondents identified heavy rainfall and blocking of drainage systems with waste as the major causes of flooding in the study area. Also 33.3% of the respondents revealed that flooding caused extensive damage on infrastructures like roads, schools and houses in the communities impacting negatively on the delivery of services such as health and education in the study area. In line with the findings, the study recommends that flood zoning ordinances and land use control acts should be enacted by the state and local government. And flood forecasting should be well intensified with standard modern techniques for predicting the occurrence of flood to averting flooding in low lying areas of urban Zaria.

**Keywords:** Flood, Menace, Infrastructures, Causative Factors, Preventive Measures

## I. INTRODUCTION

Flooding has been observed globally as one of the natural damaging phenomena. It is one of the most serious environmental hazards. The high volume of storm water or rain water during rainy season can result in severe damage to properties and force several people to evacuate an area thereby rendering some people homeless. This may result in major disasters involving structural and erosion damages, disruption of socio-economic activities, transport and communication, loss of life and property, contamination of water and the environment in general (Okorie, 2010). Floods are common natural disaster occurring in most parts of the world. Nigeria is not an exceptional victim of flood,

resulting to damage and loss of human life and livelihood sources, deterioration of environment and retardation to development. Hewitt (1997) explained that floods are the most common occurring natural disasters that affect human and its surrounding environment.

According to Geo-science Australia (2013), flooding can simply be described as “water where it is not wanted.” It can also be conceptualized as a situation that results when a part of the earth surface that is usually dry is inundated and covered with water due to high amount of rainfall or the overflowing of a water body. Among all the natural hazards to which humans are exposed, floods are the most common and widespread natural hazards. Dille et al., (2005) estimated that more than one-third of the world's land area is flood prone affecting some 82 percent of the world's population. The reason being that most areas lies in the widespread geographical distribution of river flood plains and low-lying coasts, together with their long-standing attraction for human settlement.

Urban flooding can be coastal, fluvial, or pluvial or even a combination of these types of floods. Coastal flooding is caused by extreme tidal conditions that occur because of high tide levels, storm surge and wave action. Fluvial (River related) flood occurs when the discharge of a river exceeds the capacity of the river channel to contain it. While pluvial flood takes place when the rainfall rate exceeds the capacity of storm, water drains to evacuate the water and the capacity of the ground to absorb water (Ball et al., 2008).

Globally, floods have been reported to have damage properties worth billions of dollars in many regions of the world. Nigeria is not an exception as in 2012, it experienced an unprecedented flood disaster that affected half of the 36 states including Kaduna, with 21 million people displaced; 597,476 houses destroyed or damaged; over 363 people killed and an estimated loss of USD 19.6 billion (National Emergency Management Agency, 2013). Flood has therefore caused so many problems in Nigeria, resulting to death of people, collapse of buildings, destruction of properties and agricultural produce.

However, the response of government and relief agencies to floods in Kaduna and other parts of the country has only been in the area of rescue and supply of relief materials to victims of flood. So far, nothing has been done to ensure that the hazard is prevented and its associated risk is reduced to the barest minimum (Jeb and Aggarwal, 2008).

Due to the serious damage posed by flooding, there is an urgent need towards establishing the causative factors and effective measures to combat future occurrence of flood in this area. Hence, it is against this background that this study intends to critically assess the issue of flood thereby establishing preventive and curative measures that will help curb the menace of flooding in the study.

## II. THE STUDY AREA

Urban Zaria comprises two area councils (Zaria and Sabon-gari L.G.A). The area is located approximately within longitude 7°38' 00" E to 7°46' 00" E of the Greenwich meridian and on latitude 11°40' 00" N and 11°10'00" N of the equator. It falls within the northern Kaduna sub-region (Mortimore, 1970). It is the second largest town in Kaduna state with a total land mass of 61 kilometres square making it a nodal point in terms of road and rail transport (Yusuf, 2013). Zaria is situated at an average height of about 600metres above sea level. It is bounded by Kudan Local Government Area (L.G.A) to the north, Soba L.G.A to the east, Igabi L.G.A to the south, and Giwa L.G.A to the west. Urban Zaria has a total population of 408, 198 people in 2006 (NPC, 2006). Zaria's climate is a characteristic tropical continental type marked by distinct wet and dry season. The soils of Zaria are classified as leached tropical ferruginous soils layer mostly formed from crystalline basement complex rocks. The drainage system of the area comprise River Galma with its tributaries as River Shika, Saye, Yashi and Kubanni which are intermittent or seasonal in character and dendritic in nature (Mortimore, 1970).

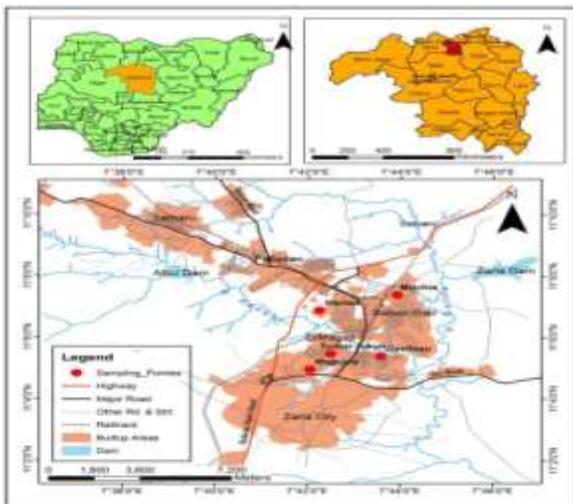


Figure 1: Map of Zaria Sowing Sample Communities.

Source: Modified from Administrative Map of Kaduna State, 2015.

This paper assessed the causative and preventive measures of flood menace in urban Zaria L.G.A of Kaduna State, Nigeria. Specifically, the objectives of the paper are to:

- i. examine the perception of people on flooding in the study area.
- ii. examine the causes of flooding in the study area.
- iii. identify measures to reduce the impact of flood in the study area.

## III. METHODOLOGY AND RESEARCH DESIGN

The study adopted quantitative approach and purposive sampling technique was used to select the sampled communities, namely Gyallesu, Muchia, Magume, Tudun-jukunand Hanwa. The reasons for selecting these communities are due to their vulnerability to flood and location along the floodplains; they experience higher frequency of flooding. The study sampled a total of 400 respondents out of the 107,208 population size. The sample size was determined using a formula developed by Yamane (1967) for determining the sample size where a population is known. And systematic sampling technique was used to choose respondents based on households to ensure spatial coverage. Accordingly, every third house was selected and household head was the target respondent. In each community, 20 questionnaires were equally administered to give a total of 100 questionnaires. The analyses was done using simple descriptive statistics, charts and Likert Rating Scale of Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D) and Strongly Disagree (SD).

## IV. RESULTS AND DISCUSSION

### Perception of Flooding Occurrences in the Study Area

On the nature of floods in the study area, five parameters including the knowledge of respondents on floods, causes of floods, month of occurrence, duration of the flood was examine

Table 1: Perception of Flooding Occurrences in the Study Area

Flood Experiences		
Responses	Frequency	Percentage
Yes	338	86.6
No	52	13.3
<b>Total</b>	<b>390</b>	<b>100</b>
Forms of Flooding in the Area		
Spillage of excess water upstreams (R. Galma and Kubanni).	289	74.1
Heavy Rainfall	101	25.8
<b>Total</b>	<b>390</b>	<b>100</b>
Month of Flooding Occurrences		
Month	Frequency	Percentage
July/August	50	12.8

August/September	275	70.5
September/October	65	16.6
<b>Total</b>	<b>390</b>	<b>100</b>

Source: Field Survey, 2017

The study revealed that about 86.6% of the respondents affirmed that they had terrible experiences of flooding in their communities over the last 10 years. Also, out of the 86.6% respondents who affirmed that they experienced flooding occurrences in their areas, 62% of them concurred that the flooding was on a yearly basis. Further investigation showed that floods occur normally from August to September with other minor occurrences in the early part of July and late part of October. The August and September period is the main rainfall period in Urban Zaria as espoused by the respondents. About 70.5% of the respondents believed that the onset, duration and cessation of the rainy season was grossly responsible for the intensity of flooding occurrences within the months of August and September which was the peak of rainy season in Zaria. Because of the low-lying nature of the area, flooding experienced in Urban Zaria is categorized into river and flash flood. During heavy rainstorm, most of the communities are affected with flash floods and landslides whilst that of the river flood caused serious gully erosion, crop and property damage.



a. b.

Plate 1: Showing flooded area in Magume(a) and Muchia (b) Communities(August, 2017).

Source: Field work Photograph of the Site (August, 2017).

Table 2: Perception on the Impact of flooding in the Area

Impacts of flooding	Frequency	Percentage
Loss of lives and properties	56	14.4
Disruption of means of livelihood	56	14.4
Damages to infrastructures	130	33.3
Outbreak of diseases	39	10
Destruction of houses	109	27.9
<b>Total</b>	<b>390</b>	<b>100</b>

Sources: Field Survey, 2017

Table 2 shows the extent to which floods have affected the populace in the communities. (Musah and Akai, 2014), stated that among all the natural hazards to which humans are exposed, flooding is the most widespread and account for most damages and loss of life. Infrastructure sectors in Urban Zaria community include electric power, roads, bridges, hospitals, and schools. 33.3% of the respondents identify the effects of floods on infrastructure were severe in the study area as the surroundings were completely marooned and long stretches of roads were damaged completely delinking the other parts for some period. The damaged infrastructure affected negatively on the delivery of services such as health, agriculture, and education in the study area. Equal (14.4%) of the respondents argued that lives and properties have been lost coupled with the fact that the means of livelihood for most people in the area has been disrupted because of flooding occurrences. Crop farming which is one of the major livelihood option for the households was seriously impacted. The destruction of food crops on farms as well as seeds stores; eventually culminate into a decline in food production and loss of income to the farmers, which contributes to increasing the problem of food shortages and starvation within households. While a lesser proportion stressed that flooding has exposed the populace to diseases and epidemic.

The finding agrees with Abdulhamid and Ibrahim, (2010) that heavy rainfall especially during the months of August and early September, led to severe flooding, loss of lives, displacement of vulnerable persons and the destruction of key infrastructure, food stocks and livestock in Greater Zaria area.

The finding also agreed with (BMI, 2005) about 60% of the respondents affirmed that infrastructures and housing were the worst affected in the disaster. Infrastructures are systems with great importance for society that, if disrupted, impact various supply chains that leads to further dramatic consequences (BMI, 2005).





Plate 2: Showing damage to houses, road and farmland

Source: Field work Photograph of the Site (August, 2017)

**Major Causes of Flooding in Urban Zaria**

The major causes of flooding in Nigeria urban areas include long hours of rainfall, type of land use pattern, dumping of refuse into water channels, lack of and poor drainage networks, topography, nature of urban land surface and building types, and stream basin parameters (Ayoade, 1988; and Babatolu, 1997).

Table 3: Major Causes of Flooding in Urban Zaria

Major causes of flooding	Likert Rating Scale				
	SA	A	N	D	SD
Heavy rainfall	285(73.0.)	64(16.4)	30(7.6)	11(2.8)	11(2.8)
Absence/poor drainage Channels	225(57.6)	91(23.3)	56(14.3)	12(3.1)	6(1.5)
Dumping of wastes on Channels	204(52.3)	127(32.5)	33(8.4)	17(4.3)	9(2.3)
Overflowing of rivers	157(40.2)	100(25.6)	22(5.6)	39(10.0)	72(18.4)
Building on water channels	140(35.8)	100(25.6)	25(6.4)	82(21.0)	43(11.0)
Climate change	56(14.3)	143(36.6)	39(10.0)	87(22.3)	65(16.6)

Key: SA=Strongly Agreed, A=Agreed, N=Neutral, D=Disagree, SD=Strongly Disagree

Source: Field Survey, 2017

Table 3 revealed that 73.0% of the respondents strongly agreed that heavy torrential rainfall is one of the major causes of flooding in the study area. Rainfall intensity and amount are generally considered as the principal factors in most flood events in the tropics, which are partly or wholly climatologically in nature (Ayoade, 1988). Other factors only aided the incidence of flooding in urban areas of Nigeria.

Absence or poor drainage network in the disposal of floodwater is believed to be another major factor substantially aiding flooding in the study area. About 57.6% of the sampled population strongly agreed that lack or poor drainage network is a chief factor that facilitated events of flooding in Urban Zaria. In addition, respondents affirmed dumping of waste on

drainages obstructs the free flow of water resulting into various degrees of flash floods in the area.



Plate 3: Waste Dumping on Drainages

Source: Field work Photograph of the site (July, 2017)

As shown in Plate 3, good drainage systems is constructed to ensure that wastewater and sewage are transported neatly to disposal points there by keeping the environment well drained and free of waste. Unfortunately, most of the residents in the target communities regularly dump their waste in gutters, and this clogs the gutters and prevent the flow of water, causing the gutters to overflow with any slight increase in volume of the wastewater. During rainy seasons as these drainages are filled up with waste, after even a short period of rainfall the blocked drainages systems will overflow resulting into flood in the communities.

However, 40.2% of the sampled respondents strongly affirmed that overflowing of rivers and building on flood plains and riverbanks has made people vulnerable to flood events as the major rivers (Galma and Kubanni Rivers) overflow their banks especially at the peak of the rainy season.

The finding agreed with the research carried out by Nnachi, Solomon, Alemaka et al, (2016) who assessed flood vulnerability in Kubanni River channel, Zaria, Kaduna State. The study revealed that blocking of the drainage systems caused by the dumping of wastes, sewages and sediments on the river bed is the major causal factor of flood along the river channel Zaria.

**Measures of Reducing Flooding**

Man responds to flood hazards through adjustment, flood abatement and flood protection measures. Adjustment covers any action to minimize or ameliorate flood hazards; flood abatement relates to land use modification within a river basin to reduce the risk of flooding, and flood protection has to do with physical construction such as embankment, dykes, levees, river channelization, flood diversion channels, and storage of floodwaters (Ward, 1978). In this study, respondent were asked to suggest the appropriate measures to reduce the

risks of flooding in Urban Zaria. The bar chart in Figure 2 below shows several methods that are employed to address the problem of flooding on the study area.

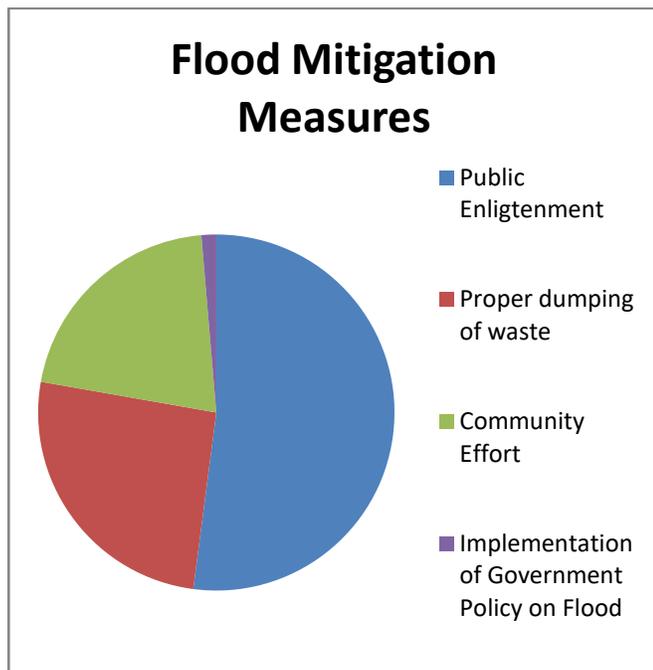


Figure 2: Measures Employed in Mitigating Flooding Occurrences

Source: Field survey (2017)

From the chart above, a total of about 46.6% of the respondents argued that Public enlightenment on the dangers of inhabiting areas that are liable to flood and stopping further building on it and channelization of drainage systems are important measures that should not be overlooked in trying to minimize flooding occurrences in the study area. Another 23.0% of the respondents argued that indiscriminate dumping of refuse on drainage lines was one of the major causes of flood in the areas. They believed that proper dumping of waste in their disposal point not on drainage lines would address the issue of flooding in the study area. 18.7% of the respondents believed that community effort comprising, the (regular dredging and clearing of drainage lines, making sandbags to create a defensive wall against flooding especially at the riverbanks and bigger drainage lines) is also another important measure to control flood in the area. However, only 11.5% of the respondents were on the opinion that implementation of government policies on flood can address the issue of flooding in the study area.

## V. CONCLUSION AND RECOMMENDATIONS

To a larger extent, the results of the analysis led to the conclusion that flood occur on yearly-basis during rainy seasons in the study area. The factor that is responsible for flooding in the study area is heavy rainfall which leads to overflow of rivers. Poor drainage and dumping of waste in the culvert contribute little to the rate of flooding occurrence in

the study area. The Floods wreaked havoc on infrastructures, housing and livelihood badly which impacted negatively on the delivery of services such as health, agriculture and education in the study area. However, the general agreement among respondents was that public enlightenment, community effort, proper dumping of refuse. Channelisation of drainage systems is one of the measures to reduce the rate of flood occurrence in the study area.

Based on the revelation from this study, the following controlling measures are advanced to minimize if not totally eliminate the problems caused by floods in Urban Zaria.

- Concerted efforts should be made by the local and state government, urban planning and environment control department towards flood hazards by construction of new drainage channels along inland streets in Urban Zaria areas where drainages are absent, and expand existing ones to increase their capacity for detaining and conveying heavy rains and high stream flow especially areas where the major rivers passes through.
- Flood zoning ordinances and land use control acts should be enacted by the state government. Based on the opinion of scholars and having observed that parts of the metropolis are situated in low-lying areas, which can be submerged during heavy rains; such areas should adequately be coped with rather than being controlled or mitigated.
- Flood forecasting should be well developed with standard modern technique of predicting the occurrence of flood. This will also be supplemented by the construction of flood frequency curves to determine the occurrence frequency of floods in certain areas.

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