WASTE MANAGEMENT PRACTICES AND PREPONDERANCE OF FLOODS IN KADUNA METROPOLIS, NIGERIA

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Abstract

Floods in Nigeria had done more harm without any notice of benefits. In the last three decades, Nigerian cities have experienced great physical development in terms of building, manufacturing industries and others without any appreciable infrastructures such as drainages, roads and canals to support them. These have made floods to be a serious challenge that plague many Nigerian cities. Thus, this study investigates the causes and impacts of flood in Kaduna City, Nigeria. The study sample consists of 166 respondents who were administered questionnaires in the Banawa area of Kaduna South Local Government Area of Kaduna metropolis. The study's results showed that there are poor waste management practices among the residents of Kaduna metropolis as they do engaged in indiscriminate waste disposal which have blocked inadequate drainages within the metropolis. Also, there is high rate of building construction along water channels which usually results to floods in Kaduna metropolis. The study concludes that factors such as: location of the buildings on flood prone areas, indiscriminate waste disposal, lack of flood warning system facilitate flooding in Kaduna metropolis. Thus, the study recommends that governmental and non-governmental organizations should set up various information programmes to enlighten the public in Kaduna on dangers of flood disaster. Likewise, the dumping of wastes indiscriminately should be a great offence with high fines; and government should make provisions for proper waste management schemes for the public.

Keywords: Floods, rainfall, waste management, drainages, Kaduna

Introduction

The vision of Nigeria to be among the first top twenty nations with leading economy by the year 2030 may be a mirage, if lives and properties are not safe from the frequent occurrence of flood in the country. Flood is one of the major factors that prevent Africa's population from escaping poverty level (Action Aid, 2006). A flood results when a stream runs out of its confines and submerges surrounding areas (Stephen, 2011). Similarly,

Kates (2008) defines flood as an overflow of an expanse of water that submerges land. European Union (2007) sees flood as a temporal covering of land by water, not covered by water before the incidence. Though, flood may be temporal as believed by the European Union, but the effects may not be temporal when such occurrence claims several lives and properties. Flood not only affects the victims, but also has a great gross effect on the national economy of the country where poverty level rises due to the incidence. Halley (2001) identifies the major cause of flood in Africa to be inadequacy of drainage. On the contrary, the major cause of flood in Nigeria has been identified to be excessive rainfall (Wetch, 2007; Taiwo, 2008; Akanin & Bilesanmi, 2011; Aderogba, 2012a and 2012b). Meanwhile, flood usually occurs when there is a continuous downpour of rain for a long period,

while resulted excess water has capacity beyond what available drainage can easily convey, due to its inadequacy or blockage of the drainage.

There are three schools of thought about the preponderance of floods all over the globe especially in the tropics (Dow, & Dowing, (2006). The first is of the opinion that there is global warming and climate change that is directly and or indirectly increasing the amount of rain and ice melting that is increasing the amount of runoff. In this case, the only source of water that results in great floods, in West Africa, and indeed, south western Nigeria, will be rain water. The second school of thought is of the view that there have been a lot of abuses heaped on the physical environment of man; and that the environment is only responding to the abuses heaped on it. The abuses include but not limited to poor planning of the physical environment, poor management of wastes, inadequate drains for the built-up areas and others. The third school has it that it is the combination of global warming, climate change, and the abuses of man on the environment that are the causes of prolonged and torrential showers of rains and the resultant runoff that led to devastating floods in America, Europe and Africa –including Nigeria; and south western Nigeria. The facts behind the three schools are yet to be thoroughly researched and confirmed, (Dow &Dowing, 2006 and Kersh & Simon 2005).

The effects of flood are not wholly negative as painted by many researchers, but also have its positive impact. Although flooding, generally, is a bane of most people, floods can be quite beneficial. Actually, nature benefits more from natural floods than from not having them at all (Abowei and Sikoki, 2005). The thing that makes natural floods a disaster is when flood waters occur in areas populated by humans and in areas of significant human development. Otherwise, when left in its natural state, the benefits of floods outweigh the adverse effects (Bradshaw *et al*., 2007). The higher the flood waters from the river, the better the harvest for that year (Bariweni, P., Tawari, C., & Abowei, J. (2012). In the last 20 years, Nigerian cities have

experienced great physical development, in terms of building, construction and reconstruction of roads, offices, markets and stores, manufacturing industries and others without any appreciable infrastructures such as drainages, roads and canals to support them (Aderogba, 2012c); and these have made floods to be a call for concern in the country. Floods experienced in Nigeria had done more harm in Nigeria without any notice of benefit. From the report of National Emergency Management agency (NEMA) in 2012, between June and September 2012, over 63 lives were lost and about 600 Nigerians were displaced. The report also declared that over one million Nigerians may die due to the effects of floods before 2015, if no precautionary measures are not taken. Havoc caused by the flood incidence of Kaduna River in Kaduna, Nigeria in 2018 are still cause of sorrow for many victims, where several lives were lost and properties worth millions of Naira went into air, people who were bourgeois became proletariat in a twinkling of an eye.

There is an urgent need to evaluate the causes of flood, and also diagnose ways to avert its future occurrence in Nigeria. There are many questions that people are concerned about in Nigeria. Is government really enforcing laws guiding people from indiscriminate dumping of wastes; is it inadequate drainage facilities that are responsible for flood; are the public not well enlightened on the effects of flood while they carry out various activities that result to flood, like building along the water channels, indiscriminate dumping inter alia. This research is to answer the research question: "What are the causes and impacts of flood in Banawa Area of Kaduna, Kaduna State, Nigeria, and proffer recommendations to avert the future occurrence of flood in the area." In attempting to answer the research questions, four objectives set for the study are to: examine the socio-economic characteristics of the inhabitants, identify the possible causes of flood, determine the overall effects of flood and to proffer solutions on how to mitigate future occurrence of flood in the study area.

Flooding in Developing Societies

The poor in the society have been identified to be the most of the victims of flood, by having no choice, but to end up living in flood prone areas (Lutz *et al*., 2008). In the view of Stephen (2011), the loos of life due to flood is lower in the developed countries compared to the developing countries. The assertions of Stephen (2011) and Lutz *et al* (2008) appeared to be right because in developing countries, there are absence of effective zoning regulations, flood controls, emergency response to infrastructure and early warning systems. Bangladesh is a developing country and one of the most susceptible countries to flood disasters in the world. Up to 30% of the country has been covered with flood waters. In 1991, more than 2000 lives

were lost due to flood in Bangladesh (Stephen, 2011). The poor in either developed or developing countries usually reside where the value of land is cheap, like river banks which are flood prone areas, thereby endangering their lives due to flood. Floods all over the world in the recent time have been related to the occurrence and reoccurrence of prolonged heavy rain (Welch *et al*., 2007; Christopherson, 2007; Action Aid, 2006; Adeaga, 2008; Aderogba, 2011; Wright, 2011; Pilgrim and Cordery, 2003). Climate change has been the resultant effect of prolonged heavy rain across the globe that usually results to floods. Climate Change is an attributed cause of flooding because when the climate is warmer it results to; heavy rains, relative sea level will continue to rise around most shoreline, extreme sea levels will be experienced more frequently (Bariweni *et al*, 2012). Most of the recent deadly floods have happened where the population has increased more. Due to the population increase, there is also an increase in human settlements in floodplains (Hardoy *et al*., 2001; Douglas *et al*., 2008).

Human activities such as dam construction, irrigation, bridges and others have negatively impacted on free flow of water in the drainage channels, rivers and streams. Particularly at the urban centers, construction of roads, buildings, factories, manufacturing plants, bridges and culverts, farmlands and others have reduced drainage channels and erosion passages and or diverted the natural courses of the flow of water (Aderogba, 2012). For instance, in Lusaka, the capital of Zambia, flood risk has strongly increased because of the fast growth of the city in flood prone areas (Nchito, 2007). This is also the case of Alexandria in Egypt (Klein *et al*., 2003), Ibadan in Nigeria also experienced great damage in 2012 flood, the Senegalese capital, Dakar, and the Burkina Faso's capital, Ouagadougou, strongly affected by the 2009 flooding. Poorest people, in particular, often have a limited choice and ended up living in high flood risk zones, such as riverbanks and coastlines, unaware of the risk and unprepared to react to floods (Lutz *et al*., 2008).

The case of urban flooding in Kaduna, a non-coastal city in Nigeria is a typical example of man-made flood disaster. Kaduna has been afflicted by very devastating flood incidents since 1983, when Kaduna rivers drowned houses of those living on its banks. During flooding water is contaminated. Clean drinking water becomes scarce. Unhygienic conditions and spread of water-borne diseases result. People, buildings, infrastructure, agriculture, open recreational space and the natural world are at risk. In extreme cases flooding may cause a loss of life. Torrential rains pushed rivers over their banks, collapsed mud houses and washed away livestock (Adelye and Rustum, 2011). The economy can also be severely affected by flooding. Businesses may lose stock and patronage. Disruption to utilities and transport infrastructure can have knock-down effects on a wider area.

Tourism, farming and livestock can equally be affected. Vital infrastructure may also be damaged or disrupted.

Road links, railways, canals etc., may be blocked causing disruption to the wider transport network (Adelye and Rustum, 2011). The beneficial effect of flood is when the river overflows, and the flood waters flow into the banks, sand, silt and debris are deposited into the surrounding land. After the river water subsided and go back to its normal flow, the deposited materials will help to make the land richer or more fertile. The organic materials and minerals deposited by the river water keep the soil fertile and productive (Abowei and Sikoki, 2005). Flooding adds a lot of nutrients to lakes and rivers which leads to improved fisheries for a few years, also because of the suitability of a floodplain for spawning (little predation and a lot of nutrients). Fish like the weather fish make use of floods to reach new habitats. Together with fish also birds profit from the boost in production caused by flooding (Bariweni *et al* 2012).

Flood control according to Bariweni *et al* (2012) refers to all methods used to reduce or prevent the detrimental effects of flood waters. Some methods of flood control have been practiced since ancient times. These methods include: Planting vegetation to retain extra water, the introduction of flood forecasting systems, the building of population awareness and preparedness, urban planning and discouragement of human settlements in flood prone areas, along with the development of local institutional capacities, are effective and socially sustainable actions that should be pursued with priority in the African continent. These actions can appreciably increase the societal capacity to cope with floods, thereby decreasing their overall impact (Giuliano *et al*, 2010). In Europe, remembering the misery and destruction caused by the 1910 Great Flood of Paris, the French government built a series of reservoirs called Les Grands Lacs de Seine (or Great Lakes) which helps remove pressure from the Seine during floods. In India, Bangladesh and China, flood diversion areas are rural areas that are deliberately flooded in emergencies in order to protect cities (Bariweni *et al*, 2012). Other methods of controlling the effects of flood include: dam construction and river defense. Dams and their associated reservoirs are designed completely or partially to aid in flood protection and control. Defenses as levees, bunds, reservoirs and weirs are used to prevent rivers from overflowing their banks. When these defenses fail, emergency measures such as sandbags or portable inflatable tubes are used. A weir, also known as low head dam, is most often used to create millponds, but on the Humber River in Toronto, a weir was built near Raymore Drive to prevent a reoccurrence of flood damage caused by hurricane.

Theoretical Framework

Theories are essential bedrock of analysis in any research issues discourse. Hence, it is a systematic way of understanding events and situations. Nevertheless, for the purpose of this study, the Freire Praxis theory of reflection and action will be used to explain the effect of flood on environment. Freire (2005) speaks of "praxis: reflection and action upon the world to transform it" (p.15). its through this definition that I explore essential dispositions and behaviour in the practice of environmental sustainability serving high chronic environment setting. This is situation that demonstrates "the twin concepts of critique and possibility" (Shields, 2009. P.5). in other words, how environment confront challenging issues without destroy their sustainability while maintaining hope that actions will lead to social justice outcomes and development.

As Giroux (2003) reminds us, critical discourses are more than just thoughts and ideals, it is an active process of critique leading to social transformation of the environment. For starters, Sergioyanni (1992) speaks of characteristics of a virtuous unique environment. He states that virtuous unique environment, create aesthetic and conducive environment for leaving, society over time, begin to become more appreciative of their environment and aware of their own convictions. Such society have a commitment to the immediate environment and work toward in sustaining it.

A relationship built upon mutual trust and mutual benefits. Collins. J. (2001) found that environmental sustainability exhibiting characteristics of ethics of critique are aligned with core tenets of transformative environment. Flood actions of interest include those that ensure it power trending are brought to the barest surface. Injustices related to race, class, and other biases in addressing flood are made visible. There is intentionality in raising the consciousness of flood among the inhabitant on contradictions of effect and outcome. Stakeholders are authentically engaged in decision-making. Barriers are removed to ensure decisions are informed, collaborative and focused on unity over division. Mclaren (2003) draws on Henry Giroux's distinction between micro and macro-objectives as evidence of critical discourse in the action of environmental sustainability.

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Research Methodology

This research was carried out in Barnawa Area of Kaduna south local government area, Kaduna State Nigeria. Kaduna South Local Government which was created from the former Kaduna Local Government in May, 1989. The total population of Kaduna South local government according to the 2006 population census was 164,261 whereby male was counted to be 72,852 and female was 91,403. On account of extensive fertile soil which is suitable for agriculture, the basic occupation of the people is trading and farming. There are pockets of grass land which are suitable for animal rearing, vast forest reserves and rivers. The people grew variety of crops such as yam, Mango, and vegetables such as Tomatoes, Okra, *Ewedu* and others. Kaduna south local government area is called the fruit and vegetable bowl of the township. Apart from trading and farming, the local government area has also gained tremendously from the services of medium and small-

scale industries for processing agricultural products like cassava and tomatoes.

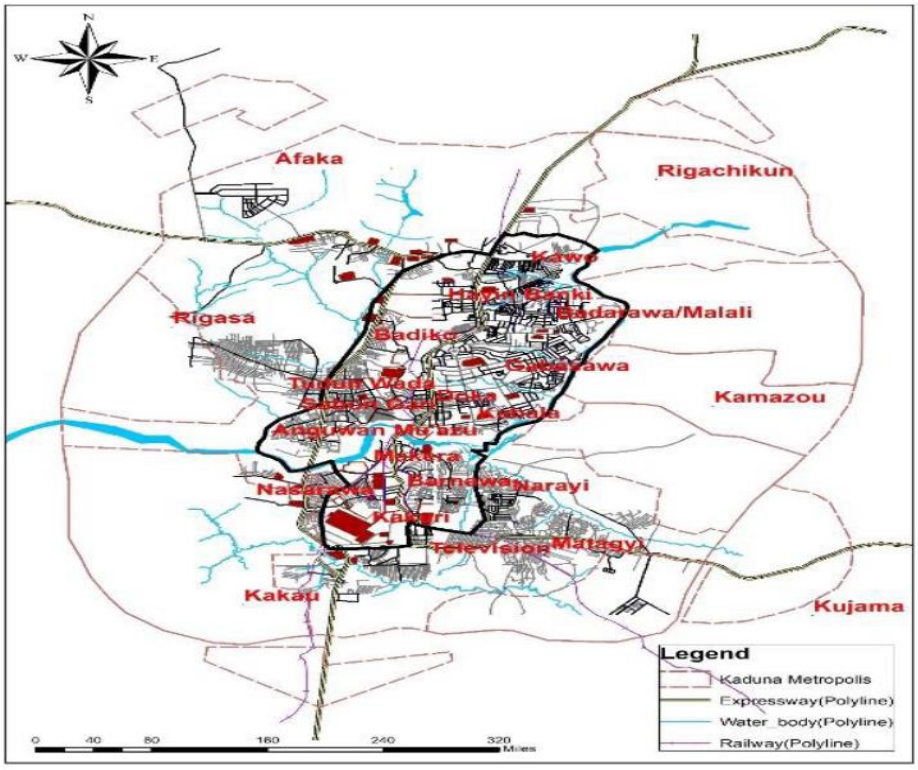

Figure 1 Kaduna Metropolis.
Source: Max Lock 2010 and modified. 2021

The data used for this research was obtained through both primary and secondary sources. The secondary data were gathered from the 2012 report of NEMA (National Emergency Management Agency) in Nigeria, and other available published and unpublished literature. Primary data were obtained through a set of questionnaires administered to the residents of the study area. The questionnaire was used to obtain the socio-economic data of the residents in Banawa Area of Kaduna. Interview and observation were used to collect information on the causes and impacts of flood in Barnawa. The total number of questionnaires used for this study was one hundred and sixty-six (166), (See Table 1) which was eleven percent of the overall number of houses in the seven selected areas in Barnawa. i.e. (11 ÷ 100) x 1511 = 166.21, approximately 166. The sampling method used for the questionnaire administration was systematic sampling, where the first

building was selected randomly, followed by a systematic selection of the next building at an interval of every 8th houses. The data collected from the primary source was analyzed using Scientific Package for Social Scientist (SPSS). Descriptive statistic like tabulations, frequency counts, percentages, charts and graphs were used to present the research data.

Table 1: Number of houses in the selected areas and sample size

S/N	Selected Area	No of households	Sample size at 11%	No of questionnaires
1	Faith area	231	25.41	25
2	Morubo	185	20.45	21
3	Narayi	228	25.08	25
4	Mango area	220	24.2	24
5	Papa area	192	21.12	21
6	Fruit market	235	25.85	26
7	Low cost	220	24.2	24
	Total	1,511	166.21	166

Source: Author's fieldwork, 2024.

Results and Discussion:

Table 2: Socio-economic characteristics of the respondents

Sex	**Frequency**	**Percentage (%)**
Male	80	48.2
Female	86	51.8
Total	166	100
Marital status	**Frequency**	**Percentage (%)**
Single	66	39.8
Married	88	53.0
Widow	12	7.2
Total	166	100
Educational Qualification	**Frequency**	**Percentage (%)**
Primary school	34	20.5
Secondary school	63	38.0
Tertiary education	42	25.3
No formal education	27	16.2
Total	**166**	**100**

Source: Authors fieldwork 2024

The study area, Banawa in Kaduna, Kaduna state Nigeria has more females than males. There is a general belief that women generate waste more than men. Indiscriminate dumping of the generated wastes might have resulted to the blockage of drainage in the study area, as shown in (plate 1). Banawa has drainage, but the drainage has been blocked with indiscriminate waste dumps. Over 70% of the respondents are not with tertiary education, which indicates that majority of the inhabitants of the study area may not be aware of the consequences of building structures along water channels, importance of tree planting and indiscriminate waste dumps inter alia.

Plate I: Improper disposal of waste into the drainage channel causing flood in Banawa Area.
Source: Authors fieldwork, 2022.

Plate 2: Improper disposal of waste into the drainage channel causing flood in Banawa Area.
Source: Authors fieldwork, 2022.

The major causes of flood in the study area as indicated by the respondents were eight. Many of the respondents selected more than one options for the causes of flood. The study area has drainage (See Table 3), 92.9% of the respondents were of the opinion that blocked drainage with waste has been responsible for flood in the area, while all the respondents attributed the causes of flood to poor waste management (See Table 3). 89.7% of the respondents also said, building along water channels is also a cause of flood. Other causes of flood in the study area include; collapsed bridge (84.6%), climate change (38.4%), inadequate drainage channel (96.1%), poor physical planning (92.3%), and other various causes (57.7%) like inadequate trees, ignorance, and poor government intervention inter alia (See Table 3).

Table 3: Possible Causes of Flood in Banawa Area of Kaduna, Kaduna State, Nigeria.

Causes of Flood	**No of respondents**	**percentages**
No Drainage	**32**	**20.5**
Blocked drainage with waste	**145**	**92.9**
Building along water channels	**120**	**89.7**
Poor waste management	**156**	**100.0**
Collapsed of bridge	**132**	**84.6**
Climate change	**60**	**38.4**

Inadequate drainage channel	**150**	**96.1**
poor physical planning	**144**	**92.3**
Others (specified)	**90**	**57.7**

Source: Authors fieldwork 2024.

Six major effects of flood were indicated by the respondents. 91.0% of the respondents said property loss was a major effect of flood in the area as many buildings were drowned already. 25.6% of the respondents were of the opinion that flood also claimed lives in the area. 91.7% of the respondents indicated that there was economy loss caused by flood in the area. Other effects of flood in the study area include; diseases outbreak (26.9%), building collapse (50.0%) and injury sustained to be (27.6%).

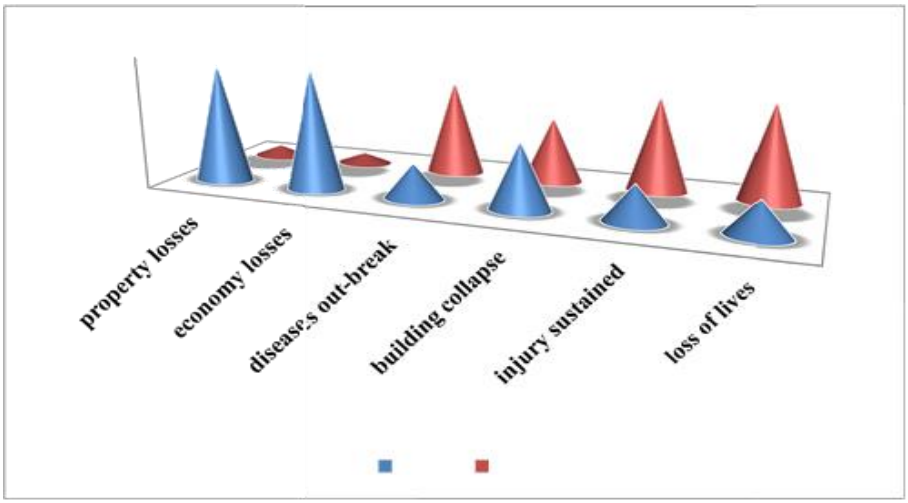

Figure 2: Possible Impacts of flood in Banawa Area of Kaduna, Kaduna State, Nigeria.
Source: Author fieldwork 2024

It can be deduced from the study that man induced factors such as: location of the buildings on flood prone areas, indiscriminate waste disposal, lack of flood warning system and natural factors which include: rainfall, saturated soil, and dam failure facilitate flooding. The socio-economic characteristics of the inhabitants such as sex, marital status, and educational status have effects on the occurrence of flood in the study area. Despite the fact that majority of the respondents have drainages at the front of their buildings yet flood disaster is a prevalent environmental problem in the area. This is because of the blockage of drainage channel with solid wastes as indicated

by over 90% of the respondents. Flood in the study area also causes damage to properties, outbreak of diseases, collapse to structures, damage to vehicles as well as loss of lives. Lack of proper waste management may also contaminate the water sources to transmit environmental diseases such as typhoid, dysentery, while the stagnant water also breeds mosquitoes which cause malaria fever through the anopheles' mosquitoes. During the interview, reconstruction and rehabilitation of buildings, granting of loans to affected resident, production of quality building materials as well as adequate flood warning system has been suggested by the residents as ways in which flood disaster can be mitigated.

Conclusion and Recommendations

Though flood disaster has diverse impacts associated with it both in developed and developing world. These effects such as economic devastation, property loss, environmental disease and untimely death can be reduced and properly managed by adopting both remedial and preventive action to combat the problem of flooding as both approaches are needed to run concurrently to achieve success in dealing with flood. Also, the above stated measures could be adopted so as to have disaster free environment and to achieve a safe, conducive, pleasant and aesthetic environment for living and working.

To manage the impacts of any future occurrence of flood in the study area and beyond, following measures are suggested. There is need for repair and construction of new drainages. Construction of flood diversion channels which involves the construction of artificial channels along main river channels to divert part of the discharge during flood flows. Governmental and non-governmental organizations should set up various information programmes to enlighten the public on dangers of flood disaster. Adequate medical facilities should be provided for the treatment of various environmental diseases emanated from occurrence of flood. Government should provide adequate funding for disaster management bodies and agencies. Regular monitoring of disaster zones should be done by development control of all planning authorities within the area and reduction in building plan approval charges. Government should plant trees and encourage citizens to plant trees as well. Dumping of wastes indiscriminately should be a great offence with high fines, and government should make a provision for proper waste management schemes for the public.

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