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Urban Flooding and Vulnerability of Nigerian Cities: A Case Study of Awka and Onitsha in Anambra State, Nigeria

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ABSTRACT
The climate change phenomenon with its associated increase in global temperature, precipitation and rise in sea levels has also ushered in an increased frequency of flooding in recent times. In the year 2012, many Nigerian cities suffered from the ravaging effects of flooding. This led to lose of lives, internal displacements, destruction of properties, disruption of socio-economic, cultural and religious activities; and splintering of family ties. The cities of Awka and Onitsha in Anambra state, Nigeria featured among the vulnerable cities which are susceptible to flooding. This study set out to find out the causes of flooding in these cities with a view to recommending measures that will help ameliorate the situation. Direct observations and structured interview methods were used to acquire the needed primary data from residents of identified flood prone areas and in addition to secondary data obtained from official records of the State Ministry of Environment. The result revealed that although flooding gives the residents of Awka and Onitsha nightmares, especially during the rainy seasons; it had received only 15% of government intervention activities on environmental problems. There is gross inadequacy in the provision of drainage channels, coupled with poor designs, poor construction and blocked drainage channels. In addition, houses are built indiscriminately, while solid waste disposal are not properly managed. In view of the above discoveries, some of the recommendations which were postulated include the need to develop and implement proactive and holistic urban flooding control and management measures which are rooted in Public participation.
Key words: Urban flooding, Vulnerability of cities, Anambra state

1.0 INTRODUCTION

Globally, flooding has displaced more people than any other hazard or disaster. About 20% of the Nigerian population is at the risk of flooding as concluded by Etuonovbe, 2011 who also acknowledged flooding as a perennial problem in Nigeria which consistently causes death and displacement of communities. In 2010, lives were lost as about 1,555 people were killed and 258,000 more displaced while properties worth billions of naira were destroyed. Flooding is a recurring phenomenon in most cities of Nigeria. On the 26th of August 2011, the flooding disaster which occurred in Ibadan metropolis caused monumental destructions in the city. The continuous construction of structures on flood plains, indiscriminate dumping of refuse, excessive rainfall and deforestation were identified as the causative factors which helped render the town vulnerable (Khandihela and May 2006: 276). The National Emergency Management Agency (2012) reported that the 2012 flood in Nigeria was declared a national disaster as it affected over 2.3 million people and killed over 363 people. Some Nigerian cities were swept off by the flood and affected 34 out of 36 states of the federation including Anambra state which was ranked as the worst hit. According NEMA (2012), at least 68 people were killed in Plateau State in central Nigeria and also 25 bodies found in Benue River after the flood while properties were also lost. These occurrences show that flooding is ailing to the affected the national populace and economy; yet mitigation measures are still poor as affirmed by Anambra State Ministry of Environment (2012), ANSEMA (2012). Anambra state was decleared in 2012 as the most affected state in the flooding of 2012. This paper set out to find out what makes Awka and Onitsha cities of Anambra state vulnerable to flooding. Efforts will also be made to find out how this phenomenon can be curbed.

2.0 LITERATURE REVIEW

The impact of flooding on any given city is dependent on the vulnerability of the area. According to Tierney et al (2001), vulnerability to hazards and disasters is a bye product of natural events on the natural and built environment. The word vulnerability has been defined as the degree to which a system, settlement, people or assets is susceptible to coping with the adverse effect of natural disasters. It is function of character, magnitude and rate of hazard to which a system is exposed, its sensitivity (the degree to which a system is affected, adversely or beneficially) and its adaptive capacity (the ability of a system to adjust to changes, moderate potential damages, take advantages of opportunities or cope with the consequences).

2.1 VULNERABILITY EXPOSURE FACTORS: Types of vulnerability exposure factors include the following.

- Individual house hold level of education, age, gender, race, income, past disaster experience; social vulnerability: poverty, race, isolation, lack of social security service.
- Institutional vulnerability: ineffective policies organized and non committed public and private institutions economic vulnerability; financial insecurity, GDP, source of national income and fund for disaster prevention and mitigation.
- Physical vulnerability: This includes the location of settlements, building materials, maintenance, forecasting and warning systems.
- Environmental vulnerability: poor environmental condition, unprecedented population growth and migration system vulnerability which affects utility and services in the community such as health services that make for a resilient system.

2.2 Measuring Vulnerability:

To measure vulnerability at different scales, hazard researchers have used numerous strongly correlated variables, such as the physical, social, economic, and political condition of the area of occurrence. Some of the major factors which tend to increase the vulnerability of cities to urban flooding, especially in developing countries, are poverty, poor housing and living conditions, lack of preparedness and management of flood defenses, increasing population growth, development of squatter settlements in hazard prone regions, poor maintenance of drainage structures, lack of awareness among the general population, and limitations in early warning system.

A study conducted on privacy, vulnerability and the impact of flooding in the Limpopo province in South Africa argues that while disasters may affect everyone and play an important role in increasing vulnerability, poor people are made more vulnerable from a web of circumstances that make them prone to the effects of disasters (Khandihela and May 2006: 276). They established that the varying impact of floods on households and the community at large showed that vulnerability to the effects of a flood disaster is indeed an outcome of the interaction between socio- economic and political process.

Adamson (1983:24) also observed that extreme events such as floods over southern Africa have resulted in loss of life, massive damage to property, crops, livestock and disrupted communications. The Laingsburg flood disaster of January, 1981 was also described as South Africa's greatest natural catastrophe. The flood washed away a considerable part of the town with a loss of 100 lives. In addition, extensive damages were largely on bridges and irrigation schemes. The heavy rains of January 1974 had a disastrous effect on the agricultural economy of the central regions of South Africa.

Global trends suggest that flood risk is expected to increase substantially in subsequent years as a result of both climate change and continued socio-economic development. However, the consequences of flooding can be mitigated by appropriate behaviors and actions. Successful flood risk management is dependent upon the active support of all on whom the effects of flooding may impact, those directly at risk, the civil authorities and the wider community and its leaders.

2.3 SOME FLOOD LOCATIONS IN NIGERIA AND THE DAMAGES

Flood has been identified as the most commonly occurring natural environmental hazard. It normally takes place at areas where there are water bodies such as rivers and oceans which when their banks can no longer contain water, resulting in an overflow hence the occurrence of flood conditions. According to Ahaman (1997), flood is a body of water, which rises to overflow and submerge surrounding lands. Floods bring about loss of lives and properties, agricultural crops, animals and vegetation. Settlements mostly around wetlands and flood plains regularly fall victim of flooding. Apte N.Y (2009) saw urban flooding as distinct from other types of floods. He opined that unlike river basin floods where areas close to river banks get affected to maximum extent; urban floods can badly affect any part of a city more significantly, especially the low lying areas. Some previous cases in Nigeria are listed below:

TABLE 1: SOME FLOOD LOCATIONS IN NIGERIA AND THE DAMAGES

S/No	Location of flooding	Fatalities	Cost of damages	Remarks
1	Ojirami Dam Akoko Edo (Former Bendel State of Nigeria)	Submergence of 100 houses more than 500 people were rendered homeless	Millions of Naira worth of properties lost.	Collapse of the Ojirami dam.
2	Ogunpa stream, Ibadan, Oyo State of Nigeria.	A total of about 50 lives were lost in 1956, 100 people rendered homeless in 1960 occurrence, 500 homes were damaged in 1968 occurrence, 32 live officially lost in 1971 occurrence, 100 house were destroyed.	Million of Naira worth of goods and properties were lost.	The overflowing of the Ogunpa stream which flow through Ibadan, Nigeria.
3	Ilorin Metropolis Nigeria	Submergence of 24, evacuations of 56 people, damaged farmlands and roads.	Millions of naira.	
4	Kano metropolis Nigeria	Loss of 146 lives; damaging of 18,000 houses, washing away of 14,000 farms and displacement of 200,000 people	About N650 Millions of residential and infrastructures and facilities were lost.	A persistent rainstorm caused the storage capacity of Bayunda dam of 22 million cubic litters to be increased to 142 million cubic litters (Chibuike, 1997) hence the collapse of the dam.
5	Misan council area of Bauchi State in Nigeria	4 persons died, 750 homes destroyed	Crops and houses worth hundreds of thousand of naira, wasted.	Resulted from a heavy downpour
6	Parts of Borno state Nigeria.	Loss of 52 lives, damage of over 170 houses.	Thousands of Naira lost	Resulted from a heavy downpour
7	Parts of Niger state especially in Gawn district of Suleja L.G.A Nigeria.	Loss of farm crops and farm lands.	Thousands of naira worth of crops lost put at ₦1,000,000	Heavy downpour
8	Baudu, Bunza and Agumgu L.G.A of Sokoto State Nigeria	300 villages and settlement submerged	N10, 000,000 (Ten Million Naira) worth of properties lost	Flooding of River Niger.
9	Parts of Cross River and Akwa-Ibom state, Nigeria.	130 hecters of Agricultural land destroyed, 150,000 farming families homeless, 500 families displaced in Uyo.	Millions of Naira worth of properties destroyed	Continuous and heavy downpour.

Source: Anierobi (2010); Tabulated by Walter (2000) and adapted from Uchegbu (2002).

3.0 Urban Flooding and Vulnerability of Cities in Anambra State: A case study of Awka and Onitsha

The word, Anambra is derived from the great Omambala river, which is also easily called Anambra River. The river is situated at the northern part of Anambra State and stretches to the famous River Niger. The population of Anambra state is 4,182,032 people with a land area of 4,844km^2 and population density of 863km^2 (Anambra state-Wikipedia, 2001).The state has three major cities, namely; Onitsha, Nnewi which are commercial centers

and Awka, which is the capital territory. For the purposes of this study; Awka and Onitsha were selected as Nnewi shares the same qualities with Onitsha. The population study for the area under consideration revealed that Awka has a total population of three hundred and one thousand, six hundred and fifty seven (301,657) inhabitants and comprises of two local government areas (i.e. Awka north and, Awka south local government areas) while Onitsha has a total of two hundred and sixty one thousand, six hundred and four (261,604) inhabitants and comprises also of two local government areas; (i.e. Onitsha north and Onitsha south L.G.A) hence, giving the two cities, a grand total population of five hundred and sixty three thousand, two hundred and sixty one (563,261), (National Population Commission, 2006). Direct observations and structured interview methods were used to acquire the needed primary data from 40 residents of identified flood prone areas and from the officials of the State Ministry of Environment. Secondary data were collected from the official records of the ministry. The result revealed that the major causes of flooding in Awka and Onitsha cities include (i) Nature of soil (ii) Predominant heavy rainfall (iii) Unplanned and poorly distributed drainage channels (iv) Poorly designed narrow and shallow drainages where available (v) High population density and haphazard development (vi) Building encroachment on drainage channels (vii) Poor clearance and maintenance of drainage channels (viii) Non existence of drainage channels in some areas (ix) Blockage of existing drainage channels with wastes, silt and buildings (x) Bad refuse disposal habit and Habitual dumping of refuse into drainage channels during rainfall (xi) Institutional weakness and poor enforcement of environmental sanitation regulations in the state. These among other natural and man made causative factors have resulted to the perennial problem of urban flooding in these two cities in Anambra state. The attitude of residents and government in condoning these factors can be said to be a catalyst in this event which hampers sustainable development of the cities. The resultant deplorable environmental condition is depicted in plates 1to7.

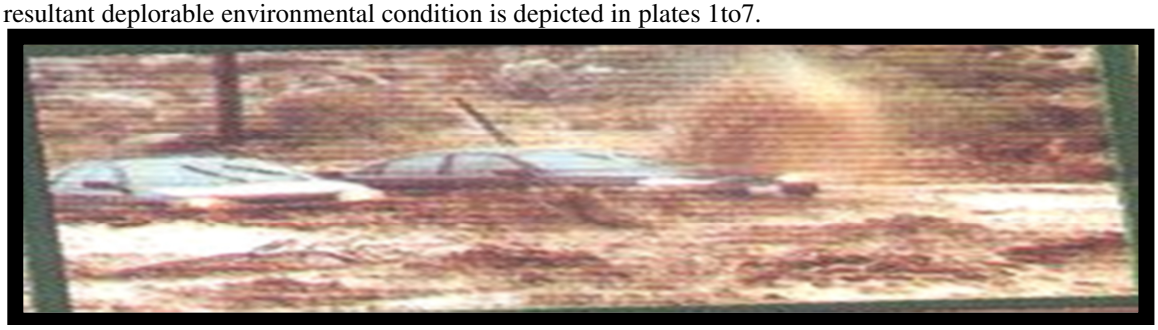

Plate 1: The effect of flood on traffic at Eke-Awka.
Source: Anierobi (2010).

Plate 2: Effect of flood on the residents of Iyiagu, Awka
Source: Anierobi (2010).

Plate 3: The effect of flood on traffic at Iweka, Onitsha.
Source: Anierobi (2010).

Plate 4: Blockage of drainage channel at Omagba, Onitsha
Source: Anierobi (2010).

Plate 5: A section representing the Ariel view of the densely populated urban environment of Anambra state
Source: Anierobi (2010).

PLATE 6: Shallow and narrow Drainage Channel in the city Channel in the city Source: Anierobi (2010).

PLATE 7: Building Encroachment on Drainage Source: Anierobi (2010).

Urban flooding was estimated to constitute only 15% intervention activities of government with no technique for determination of frequency and nature of occurrence. Although flooding gives urban residents a nightmare especially during the rainy seasons; there is gross inadequacy in the provision of drainage channels coupled with poor design and construction as well as the blockage of available drainage channels with buildings and indiscriminately disposed solid waste among others which are the greatest contributory factors in the state. 85% of respondents claimed that some of the consequences of such flood on them include; internal displacement and great socio-economic loses, such as personal buildings and means of livelihood while only 5% reported deaths and bereavement. Disruption of socioeconomic activities and obstruction of traffic flow coupled with the pollution of the urban environmental quality particularly natural sources of water was also reported; hence a threat to health and general well being of the residents. Vulnerable parts of Awka city were also reported to include Iyiagu, Eke Awka, Ziks avenue, Arthur Eze Avenue, Okpuno, UNIZIK junction and temporary site, Nodu, Ifite and Amikwo. While at Onitsha, the vulnerable sections are Iweka, Fegge, Ose, Marina, Bida, Awada, Omagba and Ochanja areas.

4.0 CONCLUSION AND RECOMMENDATIONS

The results of the study revealed that proactive and holistic urban flood control and management approaches, rooted in Public participation among others, are essential in addressing the major causes of urban flooding in the cities of Anambra state. The monthly environmental sanitation exercise in the state should be resuscitated, enforced and utilized as an avenue for the general clearance of available drainage channels and proper waste disposal. Other mitigation measures include:

1. Effective and public oriented urban renewal exercises that can guarantee safety, functionality, efficiency, health and comfort in the built environment of the state while the drastic construction of canals and drainage channels should be undertaken.
2. Proper land use planning and mapping of drainage channels in the state should be undertaken, towards sustainable flood management that ensures collection, treatment and recycling of drained waters.
3. Hydrological and ecological inventory in the state should be conducted towards adequate provision and management of drainages and run offs which are soil type compliant.
4. Proper enforcement of waste disposal management strategies, development and building regulations in the state must be crafted to ensure liter free environments, proper setbacks, access roads as well as utility and facility spaces.
5. Review and proper implementation of policies relating to flood management and delineation of flood zones and maps, must be drafted, while adopting effective public participation techniques which will involve the residents.
6. Sensitization and awareness creation through the utilization of local peculiarity and administrative structures in achieving effective flood prevention and management strategies such as early warnings,

relocation, master plans, land use plans, creation and clearance of water ways and drainage channels among others.

7. Policy on compulsory construction of houses with durable building materials away from flood prone areas delineated for residential uses.
8. Efforts should be made to organize the people into groups of cooperative societies for mutual support and benefits, through capacity building, pulling resources together, education and information sharing and effective public participation in government programs. This will better equip them, empower and build resilience into them, while curbing the tendency of rural-urban migration.
9. Infrastructure should be put in place for the harvesting of excess or flood water for human development, through the construction of water reservoirs and treatment plants, dams for irrigation, power generation and potable water supply for sustainable developments.

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