Evaluation of the Factors Responsible for Flood in Anambra West Local Government Area in Anambra State, Nigeria

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Abstract:  
This study was carried out to find out the factors responsible for flood that occurs in Anambra West Local Government Area of Anambara State. 100 questionnaires were distributed while 89 were returned. Data collected were analyzed using descriptive statistics and Likert scale. The causes of flood in Anambra West was deduced to be building on natural flood channel, release of water from dams, soil moisture saturation, yearly water surge, coastal area, and low laying area. Some recommendations include: public enlightenment, opening of blocked drainages, amongst others.

Keywords: Flood, Factors, Evaluation, Anambra West LGA

1. Background to the Study

Flooding, which is the occurrence of a flood event is one of the most occurring natural disasters in the world today and could be said to have top the list of natural disasters that is becoming more of a threat than a constant or declining one (Schramm & Dries, 1986). Flooding and flood related incidents accounts to about 50% of world’s natural disasters and also accounts to about 65% of all casualties involved. Murray, Krish, Doocy, Daniels (2013) state that it is responsible for 6.8 million deaths in 20th century. Also, in Pakistan summer 2010 flooding killing 1,600 and left over 4 million homeless, surpassing the calamity of 2004 Indian Ocean Tsunami, Pakistan's 2005 earthquake and the 2010 Haiti quake (“World News”, 2015).

The African continent is not left out in the devastation of flood. The 2007 African flood was reported by United Nations (UN) to be one of the worst flooding in recorded history. The flooding started in mid-September 2007. About 14 countries was affected, 250 people were reported killed and 1.5 million were affected. Countries affected included Senegal, Liberia, and Ghana where some villages were washed away and wiped out of map of Ghana, Togo, Burkina Faso, Mali, Niger, Nigeria, Chad, Sudan, Ethiopia, Uganda, Kenya and Rwanda (Baldassarre, Montanaria, Lins, Koutsoyiannis, Brandimarte & Bloschi, 2010).

In 2012 West African floods, the flooding left 111,000 people homeless in Niger. The flood spread along River Niger into Nigeria, Ghana Burkina Faso, Togo, Benerica, CAR, Morocco, and northern Algeria. The flood rendered 33,305 people homeless in Ghana. On the whole in West Africa over 1.5 million affected persons and over 300 deaths with socio-economic infrastructure with houses, roads, bridges, hospitals and schools destroyed (Diege, 2013; Independent Evaluation Group World Bank [IEGWB], 2013).

In 2012, Nigeria experienced its worst floods in decades. The 2012 Nigerian flood began early July 2012, killing 365 people and displaced over 2.5 million people as of November, 2012. According to the National Emergency Management Agency [NEMA] (2012), 30 of Nigeria’s 36 states were affected by the flood. The flood was termed the worst in 40 years. It affected an estimated total of seven million people. The estimated damages and losses caused by the flood were worth 2.6 Trillion Naira. Over 20,000 buildings affected (NEMA, 2015).

In 2012, Anambra state was also hit by the devastating flood. It affected 57 communities in 8 local government areas, damaging 117,148 Farms and agro-based industries, 79 water and sanitary facilities, 325 schools, 122 health facilities and about 20,000 houses and damages totally about 30 billion naira (Emmanuel, Ojinnaka, Baywood, & Gift, 2012).

In view of the effect of flood in Anambra state in 2012 in which over 20,000 building, homes, schools, industries etc., were affected and what is happens every year, it become necessary to identify and evaluate the factors responsible for flood events that occur in Anambra West LGA of the State and finding ways to cope with it.

2. Statement of the Problem

Nigeria cannot easily forget her experiences in the famous 2012 flooding. Persistent torrential rainfall and the compelling release of water from Lagdo Dam from Cameroun, Kainji and Jebba dams in Nigeria led to massive flooding in Nigeria (Ebonugwo, Njoku, Nnabugwu, Duru & Olasupo, 2015). These 2012 Nigerian floods killed 365 people and...
displaced over 2.1 million people as at 5th November 2012. According to the National Emergency Management Agency (NEMA) in Nigeria, 30 of Nigerian 36 states were affected by the floods. The floods were termed as worst in 40 years (Integrated Regional Information Network [IRIN] Africa, 2015). It affected an estimated total of seven million people (The Guardian, 2015). 45,253 buildings in Adamawa State were affected seven local government areas were lost in Benue State as reported by Ebonugwo, Njoku, Nnabugwu, Duru & Olasupo. (2015, p.58).

Also, in Anambra State, the 2012 Flood affected 8 out of 21 local government areas of the state. Over 20,000 buildings, schools, industries and structures were affected (Emmanuel, Ojinnaka, Baywood, & Gift, 2012). Since then flood have been having devastating effect in the local governments areas, and the affected local governments includes Awka South LGA, Onitsha south, Onitsha North, Ogbarnu, Oyi, Anambra East, Anambra West, and Aghamelum local governments areas.

In view of the effect of flood in Anambra state in 2012 and what happens every year, it become necessary to identify and evaluate the factors responsible for flood events that occur in Anambra West LGA as flood is a yearly occurrence there and finding ways to cope with it.

3. Literature Review

3.1. Causes of Flooding

Although flooding can result from a single event (CIRIA, 2007), it more commonly occurs through a combination of events:

- Rainfall fills rivers, streams and ditches beyond their capacity. Floodwater overflows river banks and flood defences.
- Coastal storms can lead to overtopping and breaching of coastal flood defences. Properties built behind these defences are therefore still at risk from flooding, although the 'residual' risk is lower. However, the consequences of this type of flood could be high.
- Blocked or overloaded drainage ditches, drains and sewers may overflow across roads, gardens and into property.
- Overloaded sewers can sometimes back up into properties when they become blocked or too full.
- Rainfall can be so intense that it is unable to soak into the ground or enter drainage systems. Instead the water flows overland, down hills and slopes.
- Property at the bottom of hills or in low spots may be vulnerable. In urban areas, floodwater may become contaminated with domestic sewage.
- Prolonged, heavy rainfall soaks into the ground and can cause the ground to saturate. This results in rising groundwater levels which leads to flooding above the ground. Floodwater may enter properties through basements or at ground floor level. Groundwater flooding may take weeks or months to dissipate.
- A reservoir or canal may cause flooding either from overtopping or bank failure. This type of flooding (infrastructure failure) can result in rapidly flowing, deep water that can cause significant damage or loss of life.

The occurrence and reoccurrence of prolonged heavy rain showers and the resultant floods all over the world in the recent time are becoming concerns to researchers and governments. Particularly during rainy seasons, flooding usually is a common story heard around the globe and Nigeria as well. Based on this, Nwari (2013) recommended that before any sustainable prevention and control measure can be suggested for the recent flooding in Nigeria, knowledge of its cause(s) and the kind of flood is necessary. In addition, Aderogba (2012) reported that there are three schools of thought about the preponderance of floods all over the globe especially in the tropics:

- 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 runoff, (floods), 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. These 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 to do with the combination of both global warming and climate change, and the abuses of man on the environment which is causing prolonged and torrential showers of rains and the resultant runoff that lead to devastating floods in America, Europe and Africa –including Nigeria.

Generally, causes of flooding are grouped into following:

3.2. Climate Change

Alterations in meteorological patterns associated with warmer climate in the recent time are potentially the drivers to the increase of impact of meteorological disasters such as flooding. Observed and projected patterns of climate change can have a compounding or amplifying effect on existing flood risk, for example by:

- Augmenting the rate of sea level rise which is one of the factors in causing increased flood damage in the coastal areas.
- Changing local rainfall patterns that could lead to more frequent and higher level riverine floods and more intense flash flooding.
- Changing frequency and durations of drought events that lead to groundwater extraction and land subsidence which compounds the impact of sea level rise.
• Increasing storminess leading to more frequent sea surges.

Climate change is a major cause of flooding (Nwoli, 2013). Changing climate means we can no longer expect to keep water away from urban settlements and beyond (Jha et al., 2011). Also, changing flood patterns resulting from climate change, increased intensity of rainfall and rising sea levels are likely to ensure that such an approach will be less feasible in the future. Flash flooding and overtopping mean that the full complexity of flooding within an urban setting will need to be addressed (Jha et al., 2011). Ezeabasili and Okonkwo (2013) argue that climate change will increase the frequency and intensity of heavy rainfall events, thereby increasing the risk of urban flooding. Furthermore, Bariweni et al. (2012) stated that climate change causes flooding because when the climate is warmer it results to: heavy rains, sea level will continue to rise around most shorelines and extreme sea levels will be experienced more frequently including storm surges.

However, in Anambra state, Ezeabasili and Okonkwo (2013) observed that Storm-water management infrastructure has traditionally been designed with the assumption that weather and climate conditions are static, and historical climate conditions can be used to accurately predict the future climate. Therefore, increase in the frequencies of extreme rainfall events caused by climate change will mean that storm-water management infrastructure design standards will be less reflective of the frequency and intensity of events that we will experience in the future.

3.3. Extraordinary Heavy Rainfall

Generally speaking, floods are believed to be due to extraordinarily heavy rains. Heavy rain causes rivers and other water bodies to overflow their banks leading to flooding of the surroundings. In Anambra state, Ezenwaji and Otti (2013) observed that the northern part of the state is getting wetter at the rate of 6.86mm. With this increase, there is enough water in the ground and river flow will increase flooding. In addition, Ezenwaji and Otti (2013) found out that rainfall contributed 58.2% to flooding in the area. Also, Ezenwaji and Otti (2013); Nwoli (2012) observed that the heavy rainfall recorded in Nigeria between May and October 2012 gave rise to flooding of unbelievable magnitude all over the country.

3.4. Release of Water from Dams

The continuous release of excess water from dams is another reason for flooding. With river overflowing, some dam overflows and if nothing was done could amount to flooding. When water is discharged from the dam may lead to the inundation of the surrounding settlement. Ezenwaji and Otti (2013); Nwosu, Olajinka, & Nwilo (2013); NIHASA (2013); Nwoli (2012); Muhammad (2012) observed that one of the major causes of the 2012 flooding in Nigeria is due to release of water from Ladgo Dam in Cameroon. River Benue overflow its bank in faraway Cameroon and forced the Cameroon Government to open the dam, thereby sending the flood down to River Niger causing an upsurge in the flood menace. The threat of the ravaging flood on the three Nigerian Hydro power dam forced the government to release water from the dams again and the combination of both Rivers which flows down through the area to the Atlantic Ocean. This unplanned action by both the Nigerian and Cameroon Government caused both Anambra River and River Niger to forcefully find its way into the streets of Anam in Anambra west entering people’s houses and forcing them to become refugees and homeless in their own father land (Nnaemeka, 2012).

3.5. Soil Moisture Saturation

Soil moisture saturation could lead to serious flooding. When the wetlands which are floodplains are saturated, water is therefore forced to move landward leading to inundation.

3.6. Impervious Surfaces/Decrease in Permeability of Open Spaces

A major component of urbanization and a contributor to flood occurrence, is the increase in impervious surfaces. One of the most significant ways in which impervious surface cover can exacerbate flooding is through the alteration or elimination of naturally occurring wetlands (Brody et al, 2007). Impervious surfaces are mainly constructed surfaces - rooftops, sidewalks, roads, and parking lots - covered by impenetrable materials such as asphalt, concrete, and stone. These materials effectively seal soils surfaces, repel water and prevent precipitation and melt water from infiltrating soils. Surfaces covered by such materials are hydrologically active, meaning they generate surface runoff (Barnes, Morgan, & Roberge, 2002). Based on this, Jha et al., (2011) states that “impermeable urban areas add to the flood hazard problem”. 

Figure 1: Buildings under Flood in Anambra State
Source: Anyanechi (2019) in Uche (2013)
High levels of urbanization in river flood plains and different parts of its catchment might also change the frequency of occurrence of flooding in a particular area (Jha et al., 2011).

In the US, rapid growth and sprawling development patterns have contributed to a marked increase in urbanization and built-up land (Brody et al., 2007). Also in the mid-1970s when urbanization was just starting to accelerate, Jha et al. (2011) observed that small floods might increase up to 10 times with rapid urbanization and big floods with return periods 100 years or over might double in size if 30% of roads were paved.

### 3.7. Land Use Change

Changes in the use of land can contribute to an increase of hazard from flooding by reducing the flexibility of the system to absorb excess water. Consequently, it contributes to increases in urban flooding. New infrastructure development such as transportation networks may introduce elevated structures obstructing previous natural flow paths; thus, destroys the delicate water and land balance leading to reduced storage and increased overland flow.

In developing countries, such as Nigeria, removal of primary natural canopy forest reduces the ability to naturally dissipate rainfall energy and promote the retention of water. Deforestation in particular area can contribute to a reduction in land cover, and with increasing precipitation there can be an increase in sediments in rivers. The removal of ground vegetation for farming further increases the risk of accelerating the rate of rainfall runoff and causing erosion. The sudden influx of people into upper catchments, often associated with extraction of minerals, can cause serious land degradation and increase the speed of rainfall runoff.

### 3.8. Impact of Increased Urbanization and Urban Expansion

One important land use change which contributes to excessive discharge of water leading to flood conditions is urban expansion, particularly development in flood prone areas. Urbanization aggravates flooding by restricting where floods waters can go, by covering large parts of the ground with roofs, roads and pavements, by obstructing sections of natural channels, and by building drains that ensure that water moves to rivers more rapidly than it did under natural conditions (AuctionAID, 2006). The changes in land use associated with urbanization affect soil conditions and the nature of run-off in an area. Changing land use increases the percentage of impermeable surfaces leading to enhanced overland flow and reducing infiltration. It also affects the natural storage of water and modification of run-off streams (Wheater & Evans, 2009). Natural watercourses are often altered during urbanization, with their capacity restricted or more narrowly channeled, or perhaps piped. Periodic narrowing and obstruction such as bridges and culverts are erected. Smoothing of channels leads to faster conveyance causing alteration in downstream flow and possible flood hazard. The overwhelming run-off water is transported to the drainage system creating high discharge in a short time, leading to breakdown of the system.

### 4. Research Methodology

This research work employed exploratory research method by reviewing extensively related literature to ascertain the types of flood that occurs. Questionnaires were designed to obtain relevant information from local residents of the study area. Population, Sample and Sampling Technique. The National Population Commission (2013) gave Anambra West L.G.A population as 192,440.

This research adopted using published table of the strategy for determining sample size (i.e. published table). From the published table (see table 1), the sample size for a population of more than 100,000 at 5% precision level is 400 (Glenn, 2013). This number was reduced to 100 during the field study by concentrating in some sections of the local governments and not the entire local governments.

Questioner was designed and administered to the inhabitants of the area. Descriptive statistics and Likert scale were used in the analysis of the data.
### Size of Population

| Size of Population | Sample Size (n) for precision (+_5%) | Sample Size (n) for precision (+_10%) |
|-------------------|--------------------------------------|---------------------------------------|
| 500               | 222                                  | 83                                    |
| 1,000             | 286                                  | 91                                    |
| 2,000             | 333                                  | 95                                    |
| 3,000             | 353                                  | 97                                    |
| 4,000             | 364                                  | 98                                    |
| 5,000             | 370                                  | 98                                    |
| 7,000             | 378                                  | 99                                    |
| 9,000             | 383                                  | 99                                    |
| 10,000            | 385                                  | 99                                    |
| 15,000            | 390                                  | 99                                    |
| 20,000            | 392                                  | 100                                   |
| 25,000            | 394                                  | 100                                   |
| 50,000            | 397                                  | 100                                   |
| 100,000           | 398                                  | 100                                   |
| 100,000           | 400                                  | 100                                   |

**Table 1: Sample Size for +_5% and +_10% Precision Levels**

Where Confidence Level is 95% and P = 0.

Source: Sigh & Masuku (2014) adopted from Glenn (1992)

### Ranking of Factors Responsible for Flooding in Anambra West LGA

| S/N | Factors                                                   | SA | A | U | D | SD | Mean Score | Ranking | Remark |
|-----|-----------------------------------------------------------|----|---|---|---|----|------------|---------|--------|
| 1   | Building on natural flood channel                        | 39 | 37| 7 | 4 | 2  | 4.20       | 5       | Agree  |
| 2   | Extraordinary Heavy Rainfall                             | 3  | 4 | 4 | 12| 66 | 1.49       | 13      | Disagree|
| 3   | Release of Water from Dams                               | 47 | 30| 9 | 1 | 2  | 4.34       | 4       | Agree  |
| 4   | Soil Moisture Saturation                                 | 49 | 33| 7 | 0 | 0  | 4.47       | 2       | Agree  |
| 5   | Impervious surfaces/Decrease in permeability of open spaces | 3  | 4 | 4 | 12| 66 | 1.49       | 13      | Disagree|
| 6   | Land use change                                          | 3  | 5 | 1 | 35| 45 | 1.72       | 9       | Disagree|
| 7   | Rapid urbanization and urban expansion                   | 3  | 5 | 1 | 35| 45 | 1.72       | 9       | Disagree|
| 8   | Impact of urban microclimate                             | 3  | 5 | 1 | 35| 45 | 1.72       | 9       | Disagree|
| 9   | Lack or overload of drainage systems                     | 3  | 5 | 1 | 35| 45 | 1.72       | 9       | Disagree|
| 10  | Discharges from adjoining streets                         | 3  | 5 | 1 | 35| 45 | 1.72       | 9       | Disagree|
| 11  | Blockage of drainage system                              | 3  | 5 | 1 | 35| 45 | 1.72       | 9       | Disagree|
| 12  | Yearly water surge                                       | 41 | 30| 4 | 9 | 5  | 4.04       | 6       | Agree  |
| 13  | Coastal area                                             | 55 | 20| 7 | 4 | 3  | 4.35       | 3       | Agree  |
| 14  | Low laying area                                          | 62 | 20| 7 | 0 | 0  | 4.62       | 1       | Agree  |

**Table 2: Ranking of the Factors Responsible for Flooding In Anambra West LGA**

Source: Anyanwah (2019)

5. Result
With a Likert benchmark of 3.0, the result shows that the factors responsible for the flooding in Anambra West LGA were building on natural flood channel, release of water from dams, soil moisture saturation, yearly water surge, coastal area, and low laying area (with strata mean values ≥ 3.0).

6. Conclusion
It is concluded that the factors responsible for the flooding in Anambra West LGA are building on natural flood channel, release of water from dams, soil moisture saturation, yearly water surge, coastal area, and low laying area...
7. Recommendation

- Since flood is a yearly major occurrence in the study area it is recommended that flooding and its effect on the environmental should be thought in primary and secondary schools and discussed in Town Hall Meetings in the study area for the concerned people to be better equipped to handle the effect of floods in their various localities.
- Government of the State and the Local Government Authority should discourage People from building on flood channels.
- Blocked drainage should be opened for easy flow of flood waters during heavy down pour. Also, where drainages are found to be inadequate better and bigger drainage should be provided to contain flood water.
- Rapid urbanization and urban expansion should be controlled as people build indiscriminately without control and planning.

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