Full-Length Research Paper

Consequences of Flooding on Residential Environment in Calabar Municipality, Nigeria

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ABSTRACT: This study is focus on the effects of flooding in the residential environment, with a focus on the Calabar municipality Local Government Area. To accomplish this goal, two hypotheses were developed for the study. In addition, the existing body of literature on the topic, as well as theoretical orientations, were reviewed. Structured questionnaires were randomly distributed to 400 respondents to investigate the causes and effects relationship of variables. For the study, the Pearson's Product Moment Correlation Statistical tool was used. According to the study's findings, the null hypothesis (Ho) was rejected, while the alternative hypotheses (H1) were accepted. As a result, there is a significant relationship between human activities and the ongoing occurrence of floods. As a result of the findings of this study, the researcher recommended that the government provide for a more extensive and proper drainage system, as well as improve the quality of roads and landscape. Strict laws should be enacted to prohibit the dumping of refuse/sewage into drainage channels. The institutions in question should raise awareness through an environmental education program to educate residents about the dangers of flooding.

Keywords: Consequences, flooding, residential and environment

INTRODUCTION

Flooding is a physical phenomenon caused by precipitation entering a drainage basin. The flood magnitude varies depending on the nature of the precipitation as well as the drainage basin (Ward, 1978). Floods cause significant property damage, mass homeless, and, in many cases, loss of life, and are frequently classified as natural disasters. Floods can be caused by excessive rainfall, which causes rivers and waterways to overflow their normal channels and spread across the surrounding countryside. It can also be caused by storm-force winds driving the ocean inland across low-lying areas (Robert, 2006). In estimating flood losses, they can be divided into direct and indirect losses, which can be further subdivided into tangible and

intangible losses (Smith and Ward, 1998). Floods cause direct tangible losses due to direct physical damage to property. Because of the relatively high levels of investment per unit area of flood-prone lands, these losses are typically greatest in absolute terms on urban flood plains in more developed areas. Direct tangible losses from floods are known as "mortality," as are increased rates of death as a result of disaster. Flood deaths are most commonly caused by drowning (Smith and Ward, 1998). Indirect tangible flood losses are primarily related to the disruption of economic and social activities, particularly in urban areas, immediately following a flood. To this extent, they can be referred to as consequential losses, and they are typically regarded

as impacts on traffic flows as well as losses in industrial production and trade. Intangible losses caused by floods are the most difficult to identify. It is particularly difficult to distinguish between primary and secondary effects. This is due in part to the fact that they are intertwined with the traditional adaptation strategies used by people who are regularly exposed to flood hazards.

Buildings along flow paths, impervious urban, inadequate storm drains, dumping of refuse in drainage paths, non-availability of drainage channels, incorrect termination of drainage channels, and land use issues are all perceived causes of flooding.

It is proving that human interaction with the environment worsens the condition of low-lying areas. It is becoming clear that floods harm more people than any other natural disaster, with the number of people affected steadily increasing. Floods are a frequent and recurring occurrence in Cross River State and Calabar Municipality. Low lying locations are particularly vulnerable to these risks in Calabar Municipal. Some of the locations affected by severe rainfall and storms that causes flooding include 8miles, Parliamentary, Ikot Ansa, Edem Otop, and others. Flooding of spaces, damage to urban infrastructure, and destruction of numerous lives and properties are all regular occurrences in such locations during a heavy downpour.

Statement of the research problem

Flooding is a global issue because of the harmful impact it has on people and the environment. Despite several efforts to control floods, particularly in tropical areas, it continues to have a wide variety of disastrous dimensions. Floods have been identified as a hazard to life and property in Calabar Municipality. This threat is a hindrance to many social and economic activities, as well as a detriment to many other utilities. Flooding in Calabar urban may also be natural, but man's influence on the environment through his misuse of technology has exacerbated the situation; houses, roads, and other structures have been built in flood-prone areas and even across natural drainage paths without the necessary precautionary measures. Those concerned have tended to ignore important aspects such as unplanned urban development and land use. The increasing rate of urbanization maybe a contributory factor of flooding in Calabar urban (Municipal). When it rains, the whole place is flooded due to indiscriminate dumping of wastes, along road sides houses, poor drainage channels.

On April 29, 2014, 350 houses were submerged, 1,000 displaced by flood in Calabar. An unprecedented flood had wreaked havoc in Calabar metropolis, Cross River State, which occurred following a six-hour down pour in the morning, adversely affected mobility in most part of the city. Areas worst hit by the flood include target-Goldie

and Mayne Avenue, Marian road, Diamond Hill axis, Etta-Agbor street, Mcc, Wappi Junction, Marian and Ediba within Calabar South and Municipal Council. The flood destroyed valuable household items and goods worth millions of naira and socked the residence from their homes, items including electric appliances, mattresses, kitchen utensils, clothes and foodstuffs were seen floating just as somewhere washed away.

Again flood destroyed 20 houses in Calabar Municipal on July 16, 2014 and displaced about 60 persons along road 7 within Federal Housing Estate, Calabar, Cross River State. The flood which occurred following a two-day downpour between Monday and Tuesday, submerged other house-hold items worth thousands of naira belonging to the residents. This was the fifth time this year when heavy rains would wreak havoc within Calabar Metropolis. Residents said the flood has been causing havoc to houses and impaired movement to work. There is the need to carry out this research to ascertain if their claims are true.

Aim and objectives

The aim of this study is to assess the consequences of flooding on residential environment in Calabar municipality, Nigeria. In line with this, the followings are the objectives of the study.

- i. To examine the causes of flooding in Calabar municipality.
- ii. To determine the consequences of flooding on the environment and people.
- iii. To assess the relationship between flood hazard and residential environment in the study area.
- iv. To make recommendation, strategies and preventive measure in combating flood hazards in the study area.

Research hypothesis

In this research, the flooding hypothesis will be tested:

H₀: There is no significant relationship between human activities and continuous incidence of flooding in residential areas in Calabar Municipality.

H₁: There is a significant relationship between human activities and continuous incidence of flooding in residential areas in Calabar Municipality.

Study area

Calabar Municipality lies between latitude 0°4 15' and 5°N and longitude 8°25'E. In the North, the Municipality is

Figure 1: Map of Calabar municipality showing the study area.

bounded by Odukpani Local Government Area, in the North-East by the Great Kwa River, its southern shores are bounded by the Calabar River and Calabar South Local Government Area (Figure 1). It has an area of 331.551 square kilometers. Calabar Municipality developed from a historic nucleus and this is still evident in the down town district (Floyd, 1969). The town developed from an ancient slave port, and its location on the Calabar River, a tributary of the Cross River, which is linked up to the main river by many navigable creeks, gave it greatest advantage as a trading port soon after the British Treaty with the chiefs of old.

The geology of the study area revealed it was endowed with huge deposits of barite and limestone. The study area is marked by a highly undulating rugged topography comprising dissected, irregular terrain of weathered steep ridges and deep troughs. The altitudes vary from about 10-65 meters above mean sea level, with sharp graduation down slope. Geologically, Calabar is composed of two main formations - the coastal main lands and the alluvial deposit plain land. The alluvial deposits are usually found in the low-lying area and river flood plain land. The alluvial deposits are usually found in low-lying areas and river flood plain. It therefore consists

of various mixture of sand and clay materials, together with feldspar frequents and assorted mineral grains. Calabar lies on the geologic formation known as "precarnbrain basement complex of the Oban massif". The oban massif lies in the south eastern part of Nigeria and it is considered the most important groundwater reservoir in Cross River State (Nigeria), providing water to the various cottage industries and communities in the area (Ekwere and Ekwueme, 2012). The rock types are mainly gneisses, teisses, granodiorites and schist (Edet et al., 1998). The crystalline basement complex lies at an average height of about 150m, rising gradually from the south northwards and falls away towards the Cross River to the north (Ayi, 1987).

The oban massif is described as being underlain by highly deformed precambrian crystalline basement rocks, mainly migmatites, granites, gneisses and schists (Ekwere and Ekwueme, 2012).

This rocks exhibit varying degree of weathering across varying degrees of weathering across the massif. They are intruded by pegmitites, granodionites, diorites, tonalities, monzonites, chronokites and dolorites (Ekwueme, 1990).

The climate of Calabar has been observed to fall with

Table 1: Climatic data for Calabar.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
Average	28	29	29	28	28	27	26	25	26	26	27	28	27.3
High -°C (°F)	(83)	(85)	(85)	(83)	(82)	(80)	(78)	(77)	(78)	(79)	(81)	(83)	(81.2)
Average low °C	27	28	28	27	27	26	25	24	25	26	26	26	26.3
(°F)	(80)	(83)	(83)	(80)	(81)	(78)	(77)	(76)	(77)	(78)	(79)	(79)	(79.3)
Precipitation	41	69	157	216	292	394	445	394	409	310	175	50	2,952
mm (inches)	(1.6)	(2.7)	(6.2)	(8.5)	(11.5)	(15.5)	(17.5)	(15.5)	(16.1)	(12.2)	(6.9)	(2)	(116.2)

Source: Weather Base: Historic Weather for Calabar, Nioeria (2011)

equatorial south (Fanitan and Ojo, 1980). This climate characterized by eight months of rainfall. However, some years' experience total rainfall almost all year round period with the harmattan wind blowing over the area. The rainy season fall between the months of June, July, September and October with a sleek break in August under koppen's climate classification, Calabar features a tropical monsoon climate with a lengthy wet season spanning ten months and a short dry season covering the remaining two months. The harmattan which generally significantly influences weather in West Africa, is noticeably less pronounced in the city. Temperatures are relatively constant throughout the course of the year, with average high temperatures usually ranging from 25 to 28°C. There is also little variance between daytime and nighttime temperature as temperature at night are generally only a few degrees lower than the high temperatures which is typically attained during the daytime. Calabar averages under 3,000mm of precipitation. Table 1 shows the climate in Calabar according to the Wikipedia weather base.

This indicates that the double maxima rainfall occurs here, with monthly rainfall not typically falling below 25 centimeters (cm) in almost all rainy months. The average annual temperature is around 60° Celsius. The relative humidity in Calabar is high, ranging between 80% and 100% (Eze and Efiong, 2010). The average temperature in August ranges from 24°C (75°F) to 30°C (86°F) in February. Calabar's vegetation is dominated by mangrove swamps and fresh water swamps. However, because of over-exploitation of the environment for various land use purposes, this vegetation is almost entirely destabilized. Semi-wild palms and coconut palms are two of the most common plants in this area, and there are also cultivated vegetable gardens. Tropical rainforest once covered the Calabar river watershed. Agriculture, road construction, forestry, industry, and housing for the growing population have all taken their place (Efiong, 2011). As vegetation declines due to deforestation, flooding and erosion intervene to wash away top soil (manure) that will support agricultural production. Calabar has an extremely young population structure and a high age dependence ratio, in stark contrast to the rest of the country. Rapid urbanization also indicates that the physical environment has less of an impact on population

distribution patterns. Calabar, according to the national population commission (NPC), has a population of 371,022 people, with Calabar Municipality and Calabar South having a combined population of 371,000 in 2006 (Ottong et al., 2010). Calabar Municipal has 188,791 residents. Since 1991, the population of Cross River State has grown at a rate of about 3% per year. Calabar's growth rates are significantly higher. The state government faces a significant challenge in accommodating this growth while maintaining income levels and avoiding environmental disasters (Ottong et al., 2010).

METHODOLOGY

The type of data used in this study is data obtained through the administration of questionnaires. The questionnaire was created to assess the effects of flooding in Calabar Municipality's residential areas. However, data were also gathered by measuring flood sites in the area. This study's data came from both primary and secondary sources. The primary data for this study were collected through a questionnaire, while the secondary data sources for this study included rainfall and temperature from Calabar's historic weather (2011) and the National Population Commission (2006).

Sampling design

In this work, survey designs were used. The survey research describes the information derived from respondents' responses to questionnaire items. The research is intended to provide, at the very least, within the margins of error, the consequences of flooding in Calabar Municipality's residential environment. It is therefore critical to plan for people's perceptions of flooding, its effects on public, health, property, and environmental quality. Because Calabar Municipality is divided into ten wards, questionnaires were distributed in both offices and residential areas.

The sample size for this study was 400, drawn from the ten (10) wards in the study area using the Taro Variance Formula. To select respondents for each ward, a simple

random technique was used. The population sample consists of 183,791 traders, students, public servants, and civil servants. The sample size is 400, as determined by the formula.

$$n = \frac{N}{1 + N(e)^2}$$

Where

n = Sample

N = Finite population

e = Level of significance (limit of tolerable error)

i = Infinity

The data for this study came from two main sources: primary and secondary sources. Personal field observation entails conducting a reconnaissance survey of some of the major streets and flood-prone areas in the Calabar Municipality Local Government Area. The map of the study area was required in order to determine the area inundated by flood. Picture plates were used to support certain assertions made in this research project, as well as photographic images of flood hazards, numerical data of flood depth, and GPS locations to demonstrate the threat of flood in the study area. Oral interviews with residents of the study area that include face-to-face discussions. Questionnaires were distributed in reclaimed urban areas and flood areas in the Calabar Municipality Local Government Area (Table 2). The questionnaire developed by the researcher was intended to investigate the effects of flooding in the residential environment. A total of 400 questionnaires were administered to the ten (10) already existing wards in relation to their population. The data abstracted from questionnaires were then analyzed through basic statistical techniques.

Methods of data analysis

The collected data were presented both descriptively and analytically. To present the data descriptively, crossed-tabulated tables were used, and to test the hypothesis analytically, Pearson Correlation Statistical Technique were used. In terms of analysis, basic statistical techniques such as totals, means, and standard deviation computation were used for preliminary data treatment. The Pearson Product Moment Correlation Statistics were used to determine the relationship between human activities and the continuous incidence of flooding in residential areas (PPMC). The data collected from respondents Yes or No and ticking of options A-E was used to test the validity of each question posted. The total number of respondents and variables were recovered,

and the percentage of the total was calculated. The summation was then subjected to a statistical test using the above-mentioned Pearson's Correlation Statistical Technique formula, and the outcome of the test was influence and final conclusion based on the decision rule. The data collected for the study's purpose was thoroughly analyzed using tables, frequency, percentage, pictures, and SPSS package statistics.

RESULTS AND DISCUSSION

The data collected in the field were statistically analyzed in order to convert the raw data collected in the field into meaningful information about the study area. This is based on the assumptions that it is the best ideal way of investigating the consequences of flooding in the residential environment in Calabar municipality Local Government area of Cross River State, as well as people's opinions and attitudes toward the study. To analyze and present the data, tables, histograms, pie charts, percentages, bar charts, frequency, and pictures were used. Table 3 depicts the gender distribution of respondents in the Calabar Municipal Local Government. According to the above table, 164 (41%) of the respondents were male, while 236 (59%) were female.

Table 4 and Figure 2 show the respondent's main occupation in Calabar municipal. According to the (Table 4), 86 (25% of the respondents) were students, 72 (18% of the respondents) were civil servants, 124 (31% of the respondents) were public servants, but 107 (26.75%) of the respondents were entrepreneurs/traders, and 11 (2.27%) were involved in other occupations not mentioned.

Table 5 and Figure 3 indicate the areas prone to flooding in Calabar Municipality LGA. It was found out that 8 (3.5%) of the respondents identified Etitn Efla Effiom close in Ikot Efla Street, 10 (2.5%) of the respondents identified Big Qua road behind the Navy Barracks, 29 (7.25%) of the respondents identified Ikot Eflanga before The Apostolic Church, 51 (12.75%) of the respondent identified Ikot Eyo Street by express supermarket, 10(26.5%) of the respondents identified Effio-Ette Junction, 17 (4.25%) of the respondents identified Parliamentary Extension by Ib'an Amanso Layout while 123 (30.75%) of the respondents identified 8 miles road before the First Bank, the remaining 27 (6.75%) respondents identified parliamentary road (Plate 1).

The major causes of flooding in the study area are shown in (Table 6 and Figure 4). Rainfall is the leading cause of flooding, according to 158 (38%) of the respondents; 33 (8.25%) of the respondents believe flooding is caused by poorly maintained drainage channels; however, 64 (16%) of the respondents believe flooding is caused by the terrain or topography of the

Table 2: Population of Calabar municipality.

WARD	Population	Sampled population
1	19,620	43
2	22,830	50
3	22,328	48
4	17,581	38
5	19,712	43
6	16,501	36
7	17,126	37
8	14,669	32
9	17,897	39
10	15,527	34
Total	183,791	400

Source: National Population Commission (2006).

Table 3: Sex distribution of respondents.

Sex Distribution	Frequencies	Percentage
Male	164	41
Female	236	59
Total	400	100

Source: Researcher's Fieldwork, 2020.

Table 4: Occupation of the respondents

Occupation	Frequency	Percentage
Students	86	21.5
Civil Servants	72	18
Public servant	124	31
Entrepreneur/traders	107	26.75
Others	11	2.75
Total	400	100

Source: Researcher's Fieldwork, 2020.

Figure 2: Pie chart showing occupation of respondents in Calabar Municipality Local Government Area.

Source: Researcher's Fieldwork, 2020.

Table 5: Areas liable to flooding in the study area.

Some flood prone areas	Frequency	Percentage
Etim Effiom close, Ikot Effa Street	8	3.25
Big Qua (behind Navy Barracks)	10	2.5
Ikot Effanga (before Apostolic Church)	29	7.25
Ikot Eyo (beside Express Supermarket)	51	12.75
Effio- Ette Junction	106	26.5
Parliamentary Extension by Iban Amanso	17	4.25
8miles (before First Bank)	123	30.75
Parliamentary road	27	6.75
Total	400	100

Source: Researcher's Fieldwork, 2020.

Figure 3: Bar chart showing some flood prone areas in Calabar municipality.

Plate 1: Flood prone areas in Calabar municipality
1st gate parliamentary
DEPT: 9.65M
Length covered: 502m
location: Longitudes 8.34579e, latitude 4.99816n
date of occurrence: 18th October, 2020.

Table 6: Causes of urban flooding in Calabar municipality

Causes of urban flooding	Frequency	Percentage
Heavy rainfall	152	38
Poorly maintained drainage channels	33	8.25
Terrain of the area	64	16
Building unapproved structures along drainage channels	30	7.5
Non-existence of drainage channels	121	30.25
Total	400	100

Sources: Researcher's Fieldwork 2020.

Figure 4: Bar graph showing causes of flood in Calabar municipality.

area; 30 (7.5%) of the respondents believe flooding is caused by the construction of unapproved structures along drainage channels; and 1 respondent believes flooding is caused by the construction of unapproved structures along drainage channels (Figure 4).

Table 7 depicts the extent to which flood water has impacted the study area's road transportation system and movement. 165 (41.25 %) of respondents stated that they had been affected, 152 (38 %) of respondents stated that they had been thereby affected, 77 (16.75 %) of residents stated that they had been partially affected, 5 (1.25 %) of respondents stated that they had not been affected, and 1 (0.25 %) of respondents were undecided (Plate 2).

Table 8 shows the extent to which flood water has impacted residents in the study area's residential environment. 23 (5.73%) of respondents stated that flood water caused building structures to collapse, 45 (11.25%) of respondents stated that flood water destroyed early building foundations, 1 (0.25%) of respondents stated that flood water caused loss of life, 197 (49.25%) of respondents stated that flood resulted in loss of properties and valuables, and the remaining 144 (36%) of respondents stated that flood resulted in loss of property and valuables (Plate 3).

Table 9 depicts the various techniques that can be used to address the occurrence of flooding in the study

Table 7: Effect of flooding on road transport system

Effect of flood on road transport	Frequency	Percentage
Seriously affected	165	41.25
Affected	152	38
Partially affected	77	16.75
Not affected	5	1.25
Undecided	1	0.25
Total	400	100

Source: Researcher's Fieldwork, 2020.

Plate 2: Flood prone areas in Calabar municipality
parliamentary road
dept: 1ft (30m)
length covered: 1036m
location: longitude 8.34579e, latitude 4.99816n
date of occurrence: 18th October, 2020

Table 8: To what extent has flood water affected the inhabitants?

Extent of flood water effects	Frequency	Percentage
Collapse of building structure	23	5.75
Destruction of early building foundation	45	11.25
Loss of life	1	0.25
Loss of properties and valuable	197	49.25
Restriction of movement till flood water is reduced	144	36
Total	400	100

Source: Researcher's fieldwork, 2020.

area's residential environment. 13 (3.25%) of respondents believe that creating drainage channels can help to combat flooding, while 191 (47.75%) believe that regular maintenance and cleaning of drainage channels can help to combat flooding. 25 (6.25%) of respondents

believe that planned urbanization and buildings will help to combat floods, 170 (42.5%) believe that improving the quality of roads and landscape will help to combat floods, and only 1 (0.25%) are undecided about the best ways to combat floods.

Plate 3: Flood prone areas in Calabar municipality
 Etim Effiom close, Ikot Effa street
 dept: 10.75m
 length covered: 524m
 location: longitude 8.34116e, latitude 5.00379n
 date of occurrence: 18th October 2020.

Table 9: What in your own opinion would be the best way to tackle flood in residential areas

Best ways to tackle flood	Frequency	Percentage
Regular maintenance and clearing of drainage channels	13	3.25
Creation of drainage channels	191	47.75
Planned urbanization and buildings	25	6.25
Improving on the quality of roads and Landscape	170	42.5
Undecided	1	0.25
Total	400	100

Sources: Researcher's fieldwork, 2020.

Table 10: How would you describe the occurrence of flooding in your area of residence.

Describing occurrence of flooding	Frequencies	Percentage
Unbearable	153	38.25
Bearable	89	22.25
Partially bearable	147	36.75
Not affected at all	0	0
Devastating	11	2.75
Total	400	700

Source: Researcher's Fieldwork, 2020

Table 10 shows how residents in the study area would describe the incidence of flooding. 153 (38.25%) of the respondents saw the experience as being unbearable and needs serious attention, 89 (22.25%) of the respondents attested that the experience is bearable, 147(36.75%) of the respondents are of the opinion that it is partially bearable, zero (0%) or none of the respondent stated not to be affected at all by flood incidence while the remaining 11 (2.75%) of the respondents asserted

that flood experience was devastating when it occurs. Table 11 shows the specific human activities suspected of being the cause of flooding in the study area's residential areas. Building structures along drainage paths, according to 149 (37.25%) of respondents, is one of the human activities that causes flooding. 72 (18%) of respondents believe that dumping refuse/sewage into drainage paths causes flooding. 3 (0.75%) of those polled believe that planting trees along drainage paths/gutters,

Table 11: What specific human activities are suspected to be the cause of flood.

Human activities that cause flood	Frequency	Percentage
Building on drainage paths	149	37.25
Dumping refuse/sewage in drainage paths	72	18
Planting trees along drainage paths/gutters gutters that cause future collapse	3	0.75
Failure to plan houses correctly using an architectural re to ensure good landscaping and drainage path provision	14	3.5
	162	40.5
Total	400	100

Source: Researcher's Fieldwork, 2020.

Table 12: Human activities and residential areas prone to flood.

Human activity	Residential areas prone to flood
Building on drainage paths	Etim Effiom close by Ikot Effa Street
Dumping refuse in drainage paths	Big qua by Navy Barracks
Planting trees along drainage paths/gutters that cause collapse	Ikot Effanga before Apostolic church
Failure to plan houses correctly using an architectural plan	Ikot Eyo by Express super market
Failure to ensure good landscaping and drainage path provision	Parliamentary extension by Iban Amanso layout 8 miles before First bank
	Parliamentary road.

Source: Researcher's Fieldwork, 2020.

which cause them to collapse later, could cause flooding. 14 (3.5%) of respondents claimed that failing to plan houses correctly using an architectural plan can cause flooding, while the remaining 162 (40.5%) claimed that failing to ensure good landscaping and drainage path provision has caused flooding in their residential area.

The relationship between human activities and continuous incidence of flooding in residential areas of Calabar municipality.

It was noticed that in Calabar Municipality, many residential areas were affected by impacts of flood. In many streets and roads, close and layout, human activities were blamed to be major causes of flood. From the foregoing, the major streets/roads affected by flood include parliamentary road, parliamentary extension by Iban Amanso layout, Etim Effiom close by Ikot Effa, Big Qua behind Navy barracks, Ikot Effanga street before the Apostolic church, Effio Ette Junction and 8 Miles road before the first bank. Some of the causes of this flood was traceable to human activities in those area. Table 12 shows the various human activities that trigger flood occurrence and the residential areas which is prone to these floods.

Findings of this study have revealed that the consequences of flooding in Calabar Municipality are

realized under human activities. The study has revealed that the major causes of flooding in the area include heavy rainfall, terrain or topography of the area, non-existence of drainage channels or gutters, etc. this is well presented in (Table 4). A total of 400 questionnaires were administered to residents in Calabar Municipality, information came from the ten (10) wards chosen for this research, and different opinions were given concerning the consequences of flooding in residential areas in Calabar Municipal. This was noticed in (Table 4). The extent to which flood has affected residents including collapse of building structures, Destruction of early building foundation, loss of properties and valuables, restriction of movement till flood water is reduced and loss of lives especially children.

The sex distribution of the respondents was shown in (Table 4), the occupation of the respondents shown in (Table 3) consist of students, civil servants, public servants, entrepreneur/traders and others. Table 4 indicated the areas prone to flood in the study areas which include 8 miles, Big qua road etc. Table 6 shows the extent to which flood water has affected the road transport system and movement in the study area as 165 respondents asserted that they have been seriously affected. Table 8 shows the possible techniques which can be applied to solve the incidence of flood in residential environment, meanwhile 191 respondents suggested that the creation of large drainage channels

would help tackle flood in their residential area. Table 8 shows how residents in the study area would describe the incidence of flood. 153 (38.25%) of the respondent saw the experience as being devastating. In (Table 10), respondents stated that human activities are among the major activities that trigger the consequences of flooding in the environment. 162 (40.51%) of the respondents believe that human activities such as failure to ensure good landscaping and drainage path provision while 149 (37.25%) of the respondent are of the opinion that building along drainage as a result of residents trying to use up all available land are the major human activities that trigger the negative consequences of flood in areas were flood were not formerly experienced. This in line with works of Eze, (2008) and Ezenwaji et al., (2013). The statistical technique used to test the formulated hypothesis was Pearson's Product Moment Correlation Statistics (PPMC). The formulated hypothesis was:

H_0 : There is no relationship between human activities and continuous incidence of flooding in residential environments.

H_1 : There is relationship between human activities and continuous incidence of flooding in residential environment

The occupation of the respondents further divided into x (male) and y (female) was used to determine the amount of linear relationship and further test the hypothesis. After testing the formulated hypothesis using the Pearson's correlation statistical technique, the calculated value gotten was $r_{xy}=0.7377$ while the tabulated value was 0.4937. Since the calculated value was greater than the tabulated value, H_0 was rejected and H_1 was accepted. Therefore, there is a relationship between human activities and continuous incidence of flooding in residential environment (Offiong and Eni, 2007) and Odufuwa et al., 2012). Human activities trigger the occurrence of flood, they include erecting building structures along drainage path which could be as a result of residents trying to fully utilize the available land and also failure to ensure good landscaping and drainage path provision after building, dumping refuse/sewage into drainage path/gutter is also another suspected cause of flood especially in areas where flood was formerly not experienced. It was therefore suggested that creating of wide drainage channels, improving on the quality of roads and landscape because tarred roads and well planned landscapes will reduce incidence of floods.

Conclusion

The conclusion drawn from this study shows that flood has resulted in loss of properties and valuables, collapse

of building structures, restriction in movement and thereby reducing environmental safety in residential areas. Human activities have triggered floods in residential environment of the study area such as planting large trees close to drainage paths, remove that cause their future collapse when the roots of these trees rove in search of nutrients, failure to plan houses correctly using an architectural plan and dumping of refuse or sewage into drainage pathways which would not allow water to move freely etc. However, for this reason and results obtained in this study, it is therefore concluded that the Government of this area should consider flood occurrence very important and they should ensure that the recommendation is made in this study is put into practice to reduce further loss of lives and properties.

Recommendations

Based on the findings of this study, the following recommendations were made

- Government should make provision for wider and proper drainage system in Calabar Municipal
- Plans should be made to improve on the quality of roads and landscape especially for roads that are untarred
- Dumping refuse /sewage into drainage paths/ gutters should be halted
- There should be environmental education programmes to educate residents on the menace of flood.
- No residential building should be allowed to be set along drainage pathways and flood prone areas and already existing residents along the flood prone areas should be relocated.
- Afforestation and Anti-deforestation laws should be enacted.
- Construction of open channels is a commonly used method of reducing the size of flood plains or floodways, to prevent run off due to flood, channels should be lined with grass and concrete.
- Tree planting should be done reasonably far from drainage paths so as to avoid their future collapse due to the roving nature of the roots of these large trees.

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