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MITIGATION AND RESPONSE MEASURES TO FLOOD DISASTER IN KHANA LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA

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ABSTRACT

This study examines flood hazard effects in Khana Local Government Area of Rivers State, Nigeria. Both Primary and Secondary data were used. The study adopted the research survey method that used social area analysis to investigate flood hazard effects, people's perception, frequency, magnitude and socio-economic characteristics of dwellers of flood-proned areas. The sample size of the study was obtained from the application of Taro Yamene's formula on the population of the LGA projected to 2019 which gives 400. These 400 copies of the structured questionnaire were designed and distributed to the respondents. Out of this, 350 copies of the structured questionnaire were duly analyzed. From the analysis, different people lived in the flood-proned areas eg. farmers, traders, transporters, civil servants, business men, company staff and students. It also revealed that flood hazard mitigation and response measures adopted in the area include raised pavement, wooden foot bridge, raised elevations and sand filling of their premises found to be grossly inadequate; based on their socio-economic status, perception, flood frequency and cultural background. Globally, recent developments have also shown that flood disaster increases with rapid population, up springing residential buildings and other infrastructural facilities that depend on the natural environment. Hence, immediate attention and efforts are needed because it puts the human race and the environment into great risks and untold hardships as the problems persisted. Thus, the study recommends among others; the reclamation of floodable areas for agro-based industries in Khana L.G.A, re-design and implement Bori urban Master plan according to specification, enactment of environmental bye-laws with monitoring team, reactivate and strengthen the monthly environmental sanitation exercise in the area, provision of adequate basic amenities, dualization of all internal roads with good drainages in Bori Town, aggressive youth empowerment/poverty alleviation programmes

and capacity-building strategy for adequate security networks in Khana LGA and Nigeria at large.

KEYWORDS: *Flood-Hazards, Disaster, Mitigation Measures, Bori Town, Khana LGA.*

INTRODUCTION

The initial global trend from pure subsistence living condition to industrial and from rural to urban centers have its attendant environmental challenges including flood hazards in both developed and developing economies (Oku et al, 2011) **[1].** Again, it is also true that every niche of the landscape belongs to one ecosystem or the other. Thus, in an attempt to meeting the increasing demands for basic welfare facilities and services eg housing accommodation, infrastructural development, industrial and commercial activities associated with different land uses; the natural drainage configuration of the landscape is saddled with garbages that blocked water-flow in the drainage channels leading to flood (Aper et al, 2018) **[2].**

Hence, Smith and Tobin (1979) **[3]** defined flood as a discharge, which exceeds the channel capacity of a river and then proceeds to inundate the adjacent floodplain. In other words, flood is any relatively high stream flow, in any reach of the stream, i.e. the stage above bankfull. Flooding may also result when there is excessive rainfall or too much melt water from snow or when the natural or artificial channel is too small relative to the discharge or when the land is too level and less permeable to the water that gathers on top of the ground surface (Umeuduji, 2001) **[4].**

According to Udosen (2008) **[5],** drainage morphometry in terms of drainage density, intensity, frequency and bifurcation ratio among others have influence on how a catchment area yields to the process of gullying and flooding. The drainage basin is considered here as the entire area providing run-off to, and sustaining part or all of the stream flow of the main stream and its tributaries (Gregory and Walling, 1973) **[6].** For Oyegun (1997) **[7],** the entire area drained by the main river and its tributaries constitutes a drainage basin system. Furthermore, morphometry describes the measurement and quantitative analysis of the configuration of the earth's forms (Soufi, 2015) [**8].** This means that, there is relationship between drainage basin morphometric parameters, flooding and gully erosion potentials in a watershed. In reality, the drainage basin parameters influence the amount of discharge within a catchment area as well as the amount of run-off that can be channeled capable of initiating both gully erosion and flooding.

Again, it has also been noted that the higher the drainage density, the faster the run-off and the more significant the degree of channel abration is likely to be, for a given quantity of rainfall (Gregory and Walling, 1973) **[6].** It is thus reiterated here that surface run-off is one of the critical factors influencing the rate of gully initiation and flooding in humid tropical environments where rainfall intensities and frequencies are often high particularly during the wet season. Based on this, Kapoor (2012) **[9]** considered gully erosion, flooding and other hydrological processes whereby run-off water accumulates and re-occurs in narrow channels, and over short periods to causing erosion and flooding as major environmental degradation mechanisms particularly in the humid tropical environment.

Thus, the drainage systems are grossly affected as a result of poor drainage analysis and inefficient utilization of the area's natural resources. These have caused severe cases of urban

and rural flood hazards with its peak during the rainy season due to climate change and global warming effects (IPCC, 2007, Nnaji, 1999) **[10, 11].** Flood itself is a natural disaster which have telling effects including health risk and pollution of the human environment (Johnson et al, 2021) **[12].** In a nutshell, flood describes too much water flowing through the wrong path on the earth's surface (Konolufe et al, 2015) **[13].** It is therefore, a large quantity of water flowing and covering extensive expands of dry land due to excessive rainfall, ground water overland flow, blocked overland drainage systems or a combination of high river level and high tidal regimes. Besides, there are other causal factors of flood dynamics in Rivers State (Nigeria), where Khana Local Government Area is located. These include the degree of urbanization, lack of vegetation cover arising from indiscriminate deforestation, bunkering activities, poor land- use patterns, presence of impermeable soils and the existence of low- land surfaces or gentle slopes (Etuonovbe, 2011, Umeuduji, 2001) **[14,4].**

A disaster is a serious destruction occurring over a short period of time which upstructs the functioning of a community or society; involving widespread human, material, economic and environmental loses and impacts exceeding the ability of the affected area to cope, using its own resources (WHO International, 2017) **[15].** In other words, flood is a calamitous event of the humid tropics especially one occurring suddenly and randomly, and causing great loss of life and property with prolonged hardships (Yekini, 2017) **[16].** Scholars like Okorie (2021) **[17]** and Adamu (2021) **[18]** defined a disaster as that incident which human beings can neither direct nor control and which causes total damages that ravage human existence. It thus, often results from the natural processes of the earth's surface eg floods, hurricanes, tornadoes, volcanic eruptions, earthquakes, tsunamis and other geological and hydrological processes (Kapoor, 2012) **[9].** Others are natural wildfire-outbreaks, landslides and sudden building collapse. However, the man-induced disaster on the other hand are the consequences of human errors or technological hazards e.g transport accidents, stampedes, fire outbreaks, nuclear explosion/radiation (Akpoghomeh, 2012, Adeyemo, 2008) **[19,20].**

Consequently, the observable devastating effects of flooding in Bori Town and rural settlements of Khana Local Government Area are not only limited to havocs on farmlands, houses, roads, household properties and human lives. This scenario is very obvious in communities such as Bori Urban, Kono-waterside, Bane, Kpean, Sii, Gwara, Kaa, Kono-Boue, Opuoko, Kanni-Sogho, Kaani-Babbe and other coastal areas in Khana LGA. This ugly situation has exposed many occupants of flood-proned areas to low farm yield, risk of collapse houses and road accidents.

Therefore, man's inability to direct and control disasters generally leaves him with the only option to manage them so as to reduce their impacts or consequences because they lack the required technological equipment and modern managerial skills in developing countries of the world. That is to say, such environmental management can only be sustainably accomplished with the aid of appropriate and adequate environmentallyfriendly technologies and services devoid of corruption and mismanagement of public funds or resources. Therefore, it is rarely easy to forecast and predict major storm periods, blizzards, cyclones, anti-cyclones and other weather vagaries arising from climate change, less their impacts on human environment and the required preventive/mitigation measures.

Dumping of domestic wastes along major roads/streets in Khana Local Government Area of Rivers State and Bori Town in particular, has become a way of life in the study area because no

bye-laws enacted to regulate people's conduct, behaviour and compliance to waste management and control policies. In fact, virtually all the roads/streets, in Bori town; the headquarters of Khana Local Government Area are saddled with garbages in flooded water at the instance of any slighted rainfall and hence worst hit during the wet season. According to Poronakie (2012) **[21],** the flood-proned areas in Bori Town are streets/roads like Gokana, Mayor, Kenule, Wisdom, Ndonake and Kaani respectively. Others include Igbara Water side zone, Timber, Bank,Market and Court Roads. Refuse dumped in the shallow drainage system during rainfall from catchment areas e.gKen-Poly, Nortem Village, T.T.C, Tigidam and Hospital Roads collect in this area without any government agency taking care of this deplorable situation over the years. Nevertheless, the 2012 flood disaster in Nigeria and others outside the country offered many lessons for the present and future development of Khana Local Government Area and Bori Town in particular.

As a result of the dehumanizing effects of flood-hazards in different parts of Nigeria and the world at large; some studies have been conducted to assess flood characteristics, frequencies, impacts and response strategies adopted in the affected areas. For instance, Aperand Hundu (2018) **[2],** Komolufe (2015) **[13],** Babatulo (1996) **[22**]. etc. However, there exists a deficiency in the literature as none was specifically conducted in Khana Local Government Area and Bori Town in particular which this study seeks to fill the gap. Therefore, it is against this backdrop and with regards to the extent people experience untold hardships during every rainy season in Khana LGA; most especially as it concerns the development of Bori Town as a secondary city in Rivers State that the study sought to evaluate the causal factors of flood hazards, frequencies, effects, characteristics of occupants of flood-proned areas, their perceptions and mitigation/response measures adopted to overcome the menace.

Conceptual Framework

The observed growing trends in global flood disaster in the literature have called for concern which captured the imagination and interests of many scholars including Amanagabara (2021) **[23],** Okechukwu et al (2018) **[24],** Matt (2017) **[25],** NEMA/UNICEF (2011) **[26],** Oku (2011) **[27],** Oyegun (1997) **[7]** etc. as earlier stated, these environmentalists severally examined the challenges of flood hazards, its perception, frequency, magnitude, impacts and responses adopted in each case at different locations and time. That is to say, the studies were conducted in response to the alarming incidents of flood hazards which have persisted till date with more intensity and severe impacts on urban centres. The affected cities include Texas, Louisiana, Florida, New York, Ibadan, Lagos, Port Harcourt, Yenegoa, Lokoja, Kaduna, Warri etc.

Findings from these studies revealed that concentrated response as well as mitigation measures were given to individual perception of the problems and the adopted adjustment strategies are simplya function of the prevailing land-use patterns together with its frequency and extent of damages. Again, the trans-cultural orientation and trends in population dynamics and explosion particularly in developing countries have also made these researches not only common place but imperative service to humanity on the part of the academia which for obvious reasons is not entirely new. Hence, the concerns of many environmental experts were attracted in explicating flood hazards, its trend and attributes to ecological devastation and economic underdevelopment in the affected areas. According to Oyegun in Poronakie (2014) **[28],** the modern geospatial philosophy which aims to reduce human sufferings on earth and postponed death could be seen

as the underlying concern that gives rise to the growing literature on man-environment relationship today.

Nevertheless, studies of this nature originated from the United States of America in the 1930s through systematic researches and evaluation of urbanizing river catchment characteristics which have posed significant threats to flood management techniques. Consequently, this has led to the enactment of Flood Control Act in 1936 which was basically structured to reduce frequent flood hazards in the region (USEPA, 2011).

For instance, Matt (2017) **[25]** conducted an analytical study on 2017 hurricane flood disaster in USA. With accurate and reliable information (data) from forecasts including first hand news on radio and TV broadcasts watched on cell phones, Ipads as well as social media, responses were fast and quick from different directions and sources as articulated in what follows:

1. The state Governor of Texas mobilized over 12,000 guard men within a short time for rescue mission. Utility Companies ordered thousands of workers into the region to commence immediate power restoration and about 21,000 Civil Servants were dispatched to Texas and Louisiana to help with search, rescue and recovery efforts, Relief materials e.g food, water and medical services were provided to victims on the spot and also at rehabilitation centers.
2. In the case of the Federal Aid Package, President Trump Signed a Bill approving $15.25b for storm aid, increasing debt ceiling and an extension of government spending and disbursement by Federal Environmental Management Agency (FEMA). (David and Tom, 2017) **[29].**
3. Federal forces rescued 10,000 people trapped in their homes and flooded highways. About 507,000 volunteers collaborated with FEMA and released 80 tractor trailer loads of emergency relief materials which include coats, blankets and assorted meals. Fuel/gashorders/dealers were not only sanctioned and fined but also forced to release 500,000 barrels to strategic petroleum reserve gas/fuel stations. Again, individuals and private organizations also played vital roles in the various rescue operations.

Similarly, Oku et al (2011) **[1]** opined that the emerging studies from the above development have been channeled to both urban and rural land capes where various environmental processes are fast transforming its influence on man and his environment with limited alternatives to mitigate the effects. However, despite these constraints, most flood victims tend to be adamant of the periodically incurred human and material loses because they still live, work and do business in flood-proned areas. The fact is that they lacked alternative resources or means to survive outside these harsh environments. Hence, Leigh and Kwaism (1983) [**30]** conducted an analytical study on the associated attitudinal trend in flood hazards to victims in Malaysia, Erickson (1971) **[31]** did the same thing in New-Zealand and Oya (1970) **[32]** admirably researched on flood hazard dynamics and its problems in Japan.

Firstly, it was evident that the applied flood mitigation and response measures in the area vary spatially under different socio-economic status of the people living in flood-proned areas. Secondly, flood hazards and its pollution effects were common place causing untold hardships and costs to the people because of inadequate awareness; poor social and economic status and lack of adequate preparedness. Besides, these costs fall disproportionately on the poor who are unable to protect themselves from the impacts as they strongly depend on the environment for

health, vulnerability and for livelihood sustainability. Thirdly, the cultural orientation of the people was another serious factor that impedes modern policies and strategies to overcoming flood hazards headlong in the area. However, the establishment of National Emergency Management Agency (NEMA) as an institution incharge of environmental disasters including flood hazards has encouraged people to appreciate the causal factors of flooding eg lack of functional drainage/channels, poor drainage/channel maintenance and adjustment to urbanization processes, indiscriminate dumping of refuse into the drainage systems, absence of bye-laws to enforce compliance and adequate sanctions to defaulters (Poronakie and Igbara, 2018) **[33].** This finding agrees with Poronakie (2012) who advocated the need to develop Bori Town as a Secondary city in Rivers State. This suggestion becomes necessary because Bori Town is the administrative headquarters of Khana Local Government Area and also the Traditional headquarters of all the six kingdoms that constitute Ogoniland at large (UNEP'S Report, 2011) **[34].**

Thus, writing on sustainable flood mitigation and response measures in the coastal settlements of the Niger Delta Region (Nigeria), Oyegun (2007) **[35]** said;

> *The endemic problem of flooding in the coastal zone can only be permanently solved if the region is transformed along the pattern of the development of Rhine Delta in the Netherlands. It may be necessary to construct polders along the margins of the tidal flats with a view to draining and reclaiming them for paddy rice and plantain cultivation on massive scale. This will put investment capital in the hands of the people and make the development of the region sustainable. A comprehensive flood protection scheme similar to the type in the United Kingdom will have to be put in place to protect the settlements from flooding. This will however, lead to large scale resettlement of the affected local population in modern towns equipped with adequate infrastructure to make livability better than it is at present. There is also a dire need for the government of Nigeria to set up without further delays, 10 coastal tide gauges with global positioning systems (GPS) along the coastline of the country from Lagos to Calabar to monitor sea-level changes and other lithoral data necessary for a proper understanding of the dynamics involved and thus be able to predict flood and erosion hazards. This will enable the population along the coast to be warned in advance of impending flood disasters and arrange for evacuation to safer grounds (Oyegun, 2007:p54)*

Again, the huge losses which man has been sustaining due to flooding hazards have generated some responses or reactions on the part of man which Umeuduji (2001:146) articulated below.

1. **Accepting the loss**: The least in the hierarchy to the scourge of flooding is to accept whatever loss incurred. This complacent resignation to the supremacy and intractability of flooding problem may largely stem from poverty and ignorance of alternative courses of action. It is a reflection of mental and technological incapacitation to handle flooding hazards.
2. **Public Relief**: A major response which severe flooding has often evoked is the provision of relief materials by voluntary organizations (such as the Red Cross), Volunteers and Governments. In some places e.g. U.S.A, a relief fund as provided by the constitution is usually kept aside and whenever severe flooding occurs, a quick action is taken to ease

immediate distress especially by the provision of the necessary relief materials to victims of flood hazards.

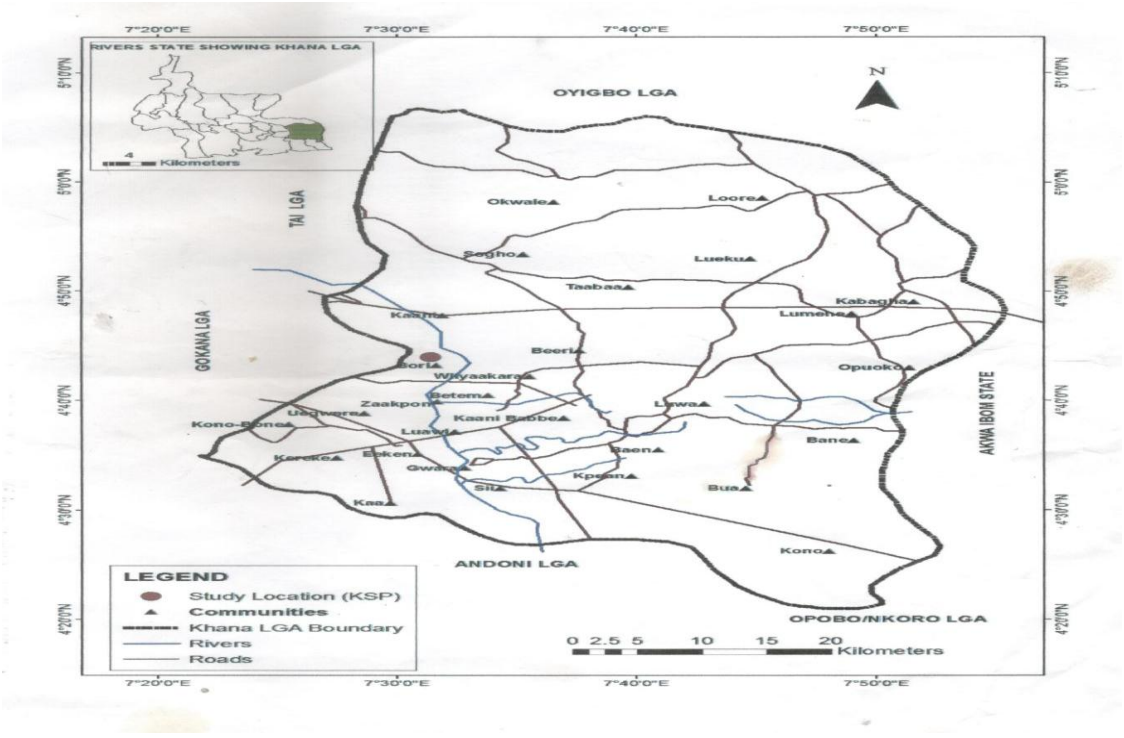
3. **Emergency Action and Rescheduling:** Whenever people are on the alert and flooding occurs, a quick emergency action can be carried out which may involve massive evacuation or rescue programmes or directly fighting the flood by building temporary dykes or artificial levees and by elevating goods and equipment above the flood water been experienced. A quick decision can be taken to reschedule transportation or manufacturing arrangements.
4. **Flood Proofing:**After a thorough monitoring of the history of flooding in an area, it is possible to predict or forecast the level and severity of flooding. Thus, armed with a fair knowledge of the dynamics of flood phenomenon, appropriate mitigation measures are articulated which have to be put in place immediately flood warning is received. This may involve installation of removable covers such as steel and aluminum over doors and windows or other entrances to the houses or estates, and elevated outlet pipes with functional pumping systems ready for use in draining flood waters. Counters in stores can be placed on wheels to allow for easy removal, especially shortly before flooding occurs.
5. **Erecting Flood Resistant Structures**: This measure is similar to flood proofing since it is based on adequate understanding of flooding magnitude and frequency or regularity but the difference is that it involves permanent and immovable structures that can withstand the onslaught of flooding. Materials that repel water are carefully chosen and utilized for construction. For instance, walls can be made of impermeable material such as burnt bricks. Buildings can also be solidly set up on stilts.
6. **Land-use Regulations**: Based on land-use analysis, it has been recognized that flood losses are closely related to the type of investment on land or simply land-use. When the land is used for urban or industrial purposes, the losses are highest, but if used for agriculture or recreation, the losses are lowest. When the land is not used at all, there is no tangible economic loss. The tool of development control can thus be used to regulate the land-uses and in this case, only the land-use that can conveniently afford to pay the natural tax of flood losses is allowed to locate on floodplain.
7. **Flood Control:** This action can be in two phases, namely the land an channel phases. The land phase involves a careful regulation of land-use patterns. Emphasis is placed on specific actions such as afforestation, terrace farming, contour ploughing or construction of drainage or channel water systems or pits to trap excess water and increase infiltration. This is because human activities such as agriculture and urbanization can significantly reduce infiltration, increase overland flow and ultimately swell up the river causing overbank flooding. The land phase aspect of flood control therefore aims at regulating such causative human activities thereby minimizing the quantity of water that eventually gets to the river as overland flow. Conversely, the channel phase addresses the channel itself. Specific structural measures with increasing capacity to draining the water in the channel are often put in place. For example, excessive deposition of sediments can reduce channel capacity, hence leading to overbank flooding. Thus, once these offending depositional sediments are removed through dredging activities, the channel capacity increases and the river flows more freely without overtopping its bank. Again, the channels can also be widened and sometimes new ones constructed to enhance free flow thereby reducing flooding. In addition to the above measures, artificial

levees or dykes or walls can be erected along the river banks to increase channel capacity and to restrict water to the channel. Once this is achieved, overbank flooding will stop. Besides, the construction of dams and reservoirs can also reduce the incidence of flooding down streams.

The Study Area

Geographically, Khana Local Government Area is located between latitudes $4^{0}5^{1}$ and $4^{0}10^{1}$, North of the Equator and longitudes $7^{0}10^{1}$ and $7^{0}30$ East of the Greenwich Meridian (Rivers State Ministry of Lands and Survey, 2019). This latitudinal locations shows that the area lies within the tropical rain forest zone of Nigeria with all its climatic and topographic characteristics. Khana Local Government Area has a total landmass of approximately 620km^2 and a projected population figure of 336,278 (NPC, 2021). In other words, the area has a population density of 542 persons per km^2. The area is bounded in the north by Oyigbo Local Government Area; in the South by Andoni and Opobo/Nkoro Local Government Area, in the east by AkwaIbom State and in the west by Gokana Local Government Area respectively. As earlier stated, Bori Town is the administrative headquarters of Khana Local Government Area as well as the traditional headquarters of Ogoniland. This area (Ogoniland) is made up of four LGAs namely, Khana, Gokana, Tai and Eleme.(See figure 1 below).

Fig. 1: Khana Local Government Area showing Communities



Source: Rivers State Ministry of Lands and Survey, 2019

The weather condition of Khana L.G.A. is affected by the fluctuation of the Inter-Tropical Discontinuity (I.T.D.). Hence, areas which lie between the ITD and Equator are often wet while those beyond ITD are dry (Tamuno, 2008) **[36].** It is the fluctuation of the ITD that gives rise to rainfall variability, intensity and duration over the study area. On the whole, the prevailing wind

in the area is characterized by South-west monsoon which makes it moisture laden. The mean annual rainfall is about 3000mm while its average temperature is approximately 27^0C. The type of rainfall that falls here is convectional and it is characterized by heavy rainfall throughout the year, energetic in downpour with heavy thunder storms at the beginning and cessationof the wet season, and spans over 10 months. The hamattern wind that was hardly felt in the coastal zone is now a notable feature of the humid tropic due to climate change, ozone depletion and global warming (Oyegun, 2007) **[35].** The soils found here belong to the ferraliticgroup which are old, highly leached and weathered red soils of the humid tropics. The main occupations of the people are farming, fishing, hunting and palm wine tapping activities that hardly advanced their living conditions and socio-economic wellbeing..

Methodology

The study adopted a research survey design method which uses social area analysis to investigate all the issues related to flood hazard in the 84 autonomous communities that constitute Khana Local Government Area. These 84 autonomous communities are further grouped into four districts namely Nyo-Khana, Ken-Khana, Babbe and Bori Urban respectively. The sample size of the study was obtained by the application of the Taro Yamene's formula on the population figure of Khana Local Government Area. The Taro Yamene's formula is given thus;

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

Where n = Sample Size Sought

1= Constant

N = Total Population Size

e^2 = Level of Significance $(0.05)^2$

Thus, substituting the population of Khana LGA in equation 1 above, the result is given as;

$$n = \frac{336{,}278}{1 + 336{,}278\ (0.05)^2} = \frac{336{,}278}{1 + 840.695} = \frac{336{,}278}{841.695} \therefore \boldsymbol{n = 399.5} \ \therefore \boldsymbol{n \cong 400}$$

Therefore, 400 copies of the structured questionnaire were distributed to identified household heads of residents of Nyo-Khana, Ken-Khana, Babbe and Bori Urban districts with the aid of a table of random numbers. Out of the 400 copies of the questionnaire distributed in the study area, 350 copies were duely completed, retrieved and analyzed which represented a response rate of 88%. The data obtained were analyzed using descriptive statistical techniques eg frequency distribution tables, simple percentages etc.

RESULTS AND DISCUSSION

TABLE 1: SUMMARY OF SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

S/N	Category	Component	Frequency	Percentage (%)
1	Sex	Male	200	57.1
		Female	150	42.9
		Total	350	100.0
2	Age (yrs)	18-29 years	120	34.3
		30-50 years	100	28.6
		51-70 years	85	24.3
		71 & above years	175	12.8
		Total	350	100.0
3	Marital Status	Single	125	35.7
		Married	200	57
		Separated/Divorced	25	8.2
		Total	350	100.0
4	Family size	1-2	45	12.8
		3-4	100	28.6
		5-6	120	34.3
		7 & above	85	24.3
		Total	350	100.0
5	Respondents occupation	Farming/fishing	50	14.3
		Petty Trading/Transportation	100	28.6
		Civil/Public Service	110	31.4
		Business	40	11.4
		Company Employee	30	8.6
		Students	20	5.7
		Total	350	100.0
6	Mean Monthly Income	Below ₦30,000.00	160	45.7
		₦30,000- ₦50,000	100	28.6
		₦51,000.00- ₦70,000.00	70	20.0
		₦71,000.00 & above	20	5.7
		Total	350	100.0
7	Residential houses	Rooming house (Wagon)	150	42.9
		Rooming house (courtyard)	95	27.1
		Single family (Detached)	70	20.0
		Semi-Detached	25	7.1
		Storey Building	10	2.9
		Total	350	100.0
8	Tenancy status	Tenants	75	21.4
		Landlords/landladies	275	78.6
		Total	350	100.0

Source: Researchers' Fieldwork & Analysis (2022)

Table 1 above shows that majority of the respondents (57.1%) are male while 42.9% are female. It is also observed from Table 1 that most of the respondents (63.2%) fall within 18-50 years age bracket. In other words, the people are active population who need modern facilities and services for sustainable development in the study area. It is also deduced from Table 1 above that majority of the respondents (57.1%) are married couples, 35.7% are single while 8.2% are either separated or divorced. The table also revealed that majority of the respondents (92.0%) are living in poor housing accommodation with large family sizes. No doubt, these buildings are susceptible to the effects of flood hazards. Besides, the inhabitants are low-income earners (74.3%) basedon their occupations in the informal economic sector such as petty trading, transportation, farming, fishing, etc.By extension, the people strongly depends on their immediate environment for livelihood sustainability, health and vulnerability with few alternatives to mitigate the effects of flood hazards

TABLE 2: INDIVIDUAL PERCEPTION OF ANNUAL FLOOD FREQUENCY AVERAGES IN THE STUDY AREA

Averages	Annual Perception Rate	Percentage (%)
1-5	115	32.9
6-10	210	60.0
11-15	25	7.1
16 & above	-	-
Total	350	100.0

Source: Researchers' Fieldwork & Analysis (2022).

Table 2 above indicates that 60% of the occupants of flood-proned areas perceived between 6-10 severe cases of flood hazards annually. This further implies that flood menace is very high in the study area particularly among the coastal settlements of Kono-watersides, Kaa, Bane, and along Sii,Gwara, Opuoko, Kpean, Kwuri-Boue and Bori Urban District. In Bori Town, flood hazards have not been only significant but frequent owning to constant refuse dumps within major streets/roads and the shallow andfew drainages.

TABLE 3: MITIGATION/ADJUSTMENT STRATEGIES TO FLOOD HAZARDS IN KHANA LGA OF RIVERS STATE

Adaptation/Adjustment Strategy	Frequency	Percentage
Raised Elevations	25	11.4
Sand filling of Premises	40	8.2
Use of Wooden Foot Bridge	85	24.3
Raised Pavement	200	57.1
Total	350	100.0

Source: Researchers' Fieldwork & Analysis (2022)

Table 3 above reveals that some adaptation/adjustment strategies were adopted to fight problems posed by frequent flood hazards in the study area. It is also deduced from Table 3 that majority of the respondents (57.1%) used raised pavement as adaptation or adjustment strategy. This is followed by 24.3% of the respondents who used wooden foot bridge to overcome flood hazard activities in the area. However, some of the respondents make do with raised elevations (11.4%) and sand filling of their premises (8.2)% respectively.One fact to note from the different strategies adopted in the study area is that they are reflections of the socio-economic status of the

people living in flood-proned environment of Khana Local Government Area. This further implies that the socio-economic background of people living in flood-proned areas determines the different strategies adopted to surmount flood-hazard effects in the area. This agrees with Oku et al (2011) who argued that the people's perception, socio-economic characteristics and cultural background were determinant factors of flood-hazard mitigation and response measures or adjustment strategies adopted in Khana LGA. Nevertheless, these strategies are not only outdated but also inadequate to human, material and economic loses incurred from frequent flood hazard effects in the study area.

TABLE 4: EFFECTS OF FREQUENT FLOOD HAZARDS IN BORI TOWN AND ITS ENVIRONS

S/N	Effects	Frequency	Percentage (%)
1	Premature crop harvests leading to food scarcity, hunger and poverty.	105	30.0
2	Buildings in affected settlements are flooded with polluted water and other garbages causing severe health risks, socio-economic lost and displacement of victims of flood hazard.	100	28.6
3	High cost of relief materials, resettlement, land-reclamation and rehabilitation schemes for displaced persons, families and communities.	50	14.3
4	Encourages criminalities in the affected areas through looting of people's properties	30	8.6
5	Poor economic values in flood proned areas leading to their abandonment eg land, houses etc.	40	11.4
6	It sometimes reduces development options for future generations due to constant instability and lost of valuable items.	25	7.1
	Total	350	100.0

Source: Researcher's Fieldwork & Analysis (2022).

From table 4 above, it is observed that majority of the respondents (58.6%) opted for premature harvest of crops by the farmers leading to food scarcity, severe hunger and pervasive poverty in the area as well as buildings flooded with polluted water and toxic wastes which affected livability generally. Next to this is 14.3% who complained of inadequate provision of relief materials to flood victims and high overhead expenditure for resettlement, land-reclamation and rehabilitation schemes. This is followed by 11.4% of the respondent who reported the case of poor economic values of landed properties and houses leading to abandonment and hence, complete waste of resources. 8.6% of the respondents said that flood hazard effects encourage criminal activities as such areas are often deserted. Finally, the rest 7.1% of the respondents reported that flood hazards reduce options for future development of generations' unborn. However, modern technological developments in advanced countries have proved that nothing is a waste as flood waters can be impounded to generate hydro-electricity supply and floodable lands areas can be reclaimed for paddy rice and plantain cultivations (Oyegun, 2007). In other

words, technological improvement increases man's ingenuity to change the environment rapidly to suit his needs, wants and aspirations (Arokoyu and Umeuduji, 2004) **[37].**

CONCLUSION

There is spatial and socio-economic characteristics of dwellers of flood-proned areas in Khana Local Government Council. These include farmers, fishermen, traders, transporters, civil servants, students and businessmen who interact among themselves in one way or the other presumably for survival and life sustainability. With reference to the findings in Tables 1, 2, 3 & 4, the people's perception, socio-economic characteristics and cultural background have combined to determine their adjustment strategies as well as mitigation and response measures to flood-hazards effects in the study area. This agrees with Oku et al (2011) who argued that the people's perception, flood frequencies, magnitude, socio-economic characteristics and influence of flood-hazards have significant relationship with their various adaptability measures in the area. On the whole, these have modified the way people adjusted to live, work and do business in flood-proned areas in Bori Town and Khana Local Government Area at large.

Recommendations

1. The Government should re-design and implement the master plan of Bori Town for sustainable development.
2. Government should embark on massive reclamation scheme of floodable lands in the study area and establish on them, agro-based industries and other investments for the employment of the jobless youths in the area.
3. Enactment of Environmental bye-laws and monitoring teams to regulate people's attitudes and behaviour towards waste management disposal and control in Bori Town and Khana LGA at large.
4. Provision of adequate basic amenities as well as infrastructural facilities and services across the LGA eg electricity, potable water, effective healthcare delivery system etc.
5. Construction of modern ultra markets in each of the four districts of Khana LGA egBori, Taabaa, Baen and Kaa respectively.
6. Need to dualize all the internal roads/streets in Bori Town with functional drainage systems eg Gokana, Kenule, Mayor, Ndonake, Kaani, Timber, Bank Road, Court Road, IkinagbaraStreet, Back of Police Station etc.
7. Intensification of aggressive youth empowerment/poverty alleviation programmes and public enlightenment campaigns on community basis including organization of cooperatives, conferences, seminars and workshops with themes e.g environmental quality, livelihood sustainability and human security.
8. Re-activate and strengthen the monthly sanitation exercise with monitoring team to ensure compliance.
9. Re-structure Bori Urban Transportation system to include full time Keke and Taxi town service model.

10. Improved capacity-building strategy for adequate security networks in Khana LGA and Rivers State at large.

REFERENCES

1. Oku HB, Wichendu S, Poronakie NB. Adjustment Strategies to flood hazards in Port Harcourt, Nigeria. Nigerian Journal of Agriculture, Flood and Environment, 2011;7(4):1-4.

2. Aper JA, Hundu WT. The use of GIS and Remote Sensing to Determine Morphomtric Characteristics of the Katsina-Ala Watershed in North-Central Nigeria. Journal of Geography and Development, 2018;8(1):923-934.

3. Smith K, Tobin GA. Human Adjustment to the Flood hazard. Topics in Applied Geography. Longman. 1979.

4. Umeuduji JE. An Introduction to the Science of Land forms. Jodigs and Associates. 2001.

5. Udosen CE. Gully erosion in Ikpa River Basin: A Threshold Phenomenon. Lagos Time communications, 2008. pp. 10-212.

6. Gregory KJ, Walling DE. Drianage Basin Form and Processes: A Geomorphological Approach. Fletcher and sons Ltd. 1973. pp. 22-58.

7. Oyegun, C.U. (1997). The Human Environment. Its forms and Processes. Paragraphics.

8. Soufi M. The Impact of Land-Use and Soil Characteristics on Gully Formation in an Arid Ecosystem, Southwest of I.R. Iran. 2015. Retrieved from http://www.sciencedirect.com/science. On 30th November, 2017.

9. Kapoor GP. Disaster Management and Economic Development APH Publishing Corporation. 2012.

10. IPCC. Inter-governmental Panel on Climate Change 2 Synthesis Report, Summary Policy Makers. 2007. pp 1-22.

11. Nnaji A. Climate variation in Sub-Saharan Region of Nigeria. Study of Rainfall variability in Northern Nigeria. Unpublished PhD Dissertation, Department of Geography University of Florida, Gainesville. 1999.

12. Johnson OM, Olanrewaju RM, Ukange PA, Ali IP. Precipitation Characteristics and Response to Global Warming in High and Low lands of Nigeria. In: Chukwu-Okeah GO, Elenwo EI, Amangabara GT. (Eds). Man, Environment & Sustainable Development. Amagov & COY. Nig. 2021. pp.25-52.

13. Komolafe AA, Adegboyga SA, Akinluyi FO. A review of Flood Risk Analysis in Nigeria. American Journal of Environmental Sciences, 2015;1(3):157-169.

14. Etuonovbe AK. The devastating effects of floods in Nigeria. Hydrology and Environment Journal, 2012;10(3);24-36.

15. WHO International (2017). Disasters & Emergencies. Definitions (PDF), Humanitarian Action. Retrieved 2107-11-26 via WHO International.

16. Yekini J. Flood displaces 10,000 people in Kogi. This day Newspaper, September 13, 2017.

17. Okorie LC. Learning through Crisis: The Tools and techniques to manage yourself and your team in trouble times. Paper presented at the 3rd Annual Emergency Crisis & Disaster Risk Management Conference, Uyo, Akwa-Ibom State, 24th-26th November, 2021.

18. Adamu K. Strategic Crisis Management by Integrating Security and Emergency Responses. Paper presented at the 3rd Annual Emergency, Crisis & Disaster Risk Management Conference, Uyo, AkwaIbom State, 24th -26th November, 2021.

19. Akpoghomeh OS. The Terror of Transportation and the Transportation of Terror. An Inaugural lecture Series No. 94, University of Port Harcourt Press. 2012.

20. Adeyemo AM. Environmental Policy Failure in Nigeria and the Tragedy of Underdevelopment of Niger Delta Region. An Inaugural Lecture Series No. 63, University of Portharcourt Press. 2008.

21. Poronakie NB. Challenges and prospects of Developing Bori Town as a Secondary City in Rivers State. Journal of Social and Policy Research, 2012;7(3):107-117.

22. Babatulo JS. Rain patterns and their implications for flood frequency in Ondo. Journal of Arts and Social Sciences, 1996;1(1):125-126.

23. Amangabara GT. eomorphological Processes and Gully Formation in Southeast Nigeria. In: Chukwu-Okeah GO, Elenwo EI & Amangabara GT (Eds). Man, Environment and Sustainable Development. Amajov & COY, Nig. 2021. pp. 1-24.

24. Okechukwu CA, Okwu-Delunze VU, Ajaelu H. Disaster Management: Lessons for Nigeria from the 2017 hurricane floods in the USA. Paper presented at the Annual Conference of Environmental Management Association of Nigeria (EMAN), Jabi, Abuja (FCT), December, 5-7, 2018.

25. Matt W. Massive Storm, one of history's worst. Corpus caller-Times, Friday August 25, 2017.

26. NEMA/UNICEF. National Emergency Management Agency & United Nations International Children's Education Fund. Planning, research and fore casting; national Contingency plan of Nigeria. Government of Nigeria, Abuja. 2011.

27. Oku HB. Public Perception of Flood Hazards in Mgbuoba, Port Harcourt, Nigeria. International Journal of Educational Development, 2011;6(2).

28. Poronakie NB. The Role of Quantification and Statistical Methods in Geography & Environmental Studies Education, International Journal of Educational Development, 2014.4(2):181-190.

29. David S, Tom HJ. President Signs Emergency Disaster Bill, keeps government open through December. The Washington Times September 8, 2017. 2017.

30. Leigh HC, Kwaism O. Attitude and Adjustment to the flood hazard in mixed ethnic community in Malaka Town Penisular (Malasia). Singapore Journal of Tropical Geography. 1983;4(1).

31. Erickson NJ. Human Adjustments to Floods in New-Zealand. New-Zealand Geographer. 1971;23:105-129.

32. Oya M. Land-use Control and Settlement Plans in the flood area of the city of Nagoya and its vicinity. Geoforum 1970;4:7-62.

33. Poronakie NB, Igbara SA. Environmental Laws and Enforcement in Nigeria. Paper presented at the Annual Conference of Environmental Management Association of Nigeria, Jabi-Abuja (;[FCT), December 5-7, 2018.

34. UNEP'S Report (2011). Environmental Assessment of Ogoniland (Retrieved 2012/10/02, accessed on http:/www.unep.org.wes/ondex.html.

35. Oyegun CU. Climate Change and Nigeria's Coastal Resources; An Inaugural Lecture Series No. 56, University of Port Harcourt Press Ltd. 2007.

36. Tamuno TT. The Geogrpahical Niger Delta. Paper presented at the International Conference on the Nigerian State, Oil Industry, and the Niger Delta, Yenagoa, Bayelsa State, 11th-14th March, 2008.

37. Arokoyu SB, Umeuduji JE. The Concepts of environment. In: Belt-Gam WI. Arokoyu SB and Umeuduji JE. (Eds). Perspectives on the Human Environment, Amethyst & Colleagues Publishers. 2004. pp. 1-8