Flood Warnings and Preparedness Uptake of Flood-Risk Households in Bayelsa State, Nigeria

Francis E. Atie[1] Elliot A Sibiri[2]

[1]Master of Science, PG School, Dept. of Sociology and Anthropology, Faculty of Social Sciences Niger Delta University, Wilberforce Island P.M.B 071, Amassoma Bayelsa State

[2]Professor & Lecturer Dept. of Sociology and Anthropology, Faculty of Social Sciences, Niger Delta University, Wilberforce Island P.M.B 071, Amassoma Bayelsa State

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ABSTRACT

Flood hazards are becoming persistent social and environmental concern in Nigeria especially in Bayelsa State with horrifying experiences of flood disasters causing monumental losses and untold hardship on vulnerable households. Flood-risk households are faced with the challenges of food insecurity, loss of livelihood, displacement even death with little or no option for improving their well-being due to deepening hunger and poverty. Theoretically flood warnings influences behavioral changes dependent on household's socio-economic status regarding income status, housing type, settlement patterns, house ownership and household alternate source of income influences household decisions and uptake of preparedness actions against flooding upsurge in Bayelsa state. A flood disaster recovery measure is recommended for all the eight LGAs of the state and this should consist of activities that continue beyond the contingency and emergency period to restore critical community functions and begin to manage stabilization efforts.

Keywords: Flooding, Flood Early Warning, Household, Household Preparedness, Flood-Risk

INTRODUCTION

Background to the Study

The impacts of floods on the Nigerian population over the years have been devastating and it is becoming more worrisome than any other environmental problem in the country. Many Nigerian residents especially those living in the riverine communities said to be more vulnerable to flooding due to its relatively flat and gently sloping terrain with occasional occurrences of torrential rainfall and failures of dams in the upstream (Odunola & Balogun, 2015).

Several factors have been attributed to have accounted for the incessant cases of flood disaster in Nigeria especially those states that have been declared as flashpoints for flood disaster (Nkwunonwo et al. 2016). Climate change has been highlighted to be responsible for global warming which has been singled out as the fundamental factor that accounts for the increasing cases of flood menace, which has been shown to contribute to more extreme storms and rainfall. Another factor that has contributed to flooding challenge in the country is that of the increasing rapid urban growth and poor drainage/culvert system planning (Nwigwe and Embergo, 2014), the severity of flooding problem in the nation has been on the increase, resulting to huge losses of lives, destruction of critical state infrastructures and the environment and its habitat (Ifiok, et al. 2022).

Agbonkhese et al. (2014) succinctly stated that Bayelsa State in the Niger Delta region is known to have being plagued by perennial flooding like other States in the Southern part of Nigeria and this is so because the state laid within a flat, low-lying swampy area of alluvial deposition within the tributaries of the Niger meander. In addition, the Rivers in the state being border by levees are overtopped by water when there is intense rainfall couple with sudden inundation resulting from the release of water from dams, the water often overflow the

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levees and extensively encroach the rural areas, villages and towns in the state resulting into displacement and loss of lives. Agbonkhese et al. (2014) noted this chaotic situation in the Niger Delta area when he stated that the 2012 flood disaster recorded in different states in Nigeria resulted into a great fiscal loss that affected the economy and general well-being of the people.

The National Emergency Management Agency (NEMA) 2013, in conjunction with the European Union in their post disaster survey report titled "Nigeria Post-Disaster Needs Assessment" (NPDNA) on the 2012 flood, analysed the impact of the flood on 12 most-affected states during and after the flood. The report buttressed that flooding is the most common and recurring disaster in Nigeria and it impacts on the country each year and asserted that the damage and losses from the 2012 flood was unprecedented and the Bayelsa state was adversely affected among others such as Rivers, Delta, Edo, Anambra etc. (NEMA and NBS, 2012). Further, NEMA in her data on the geographical distribution of the damages and losses sustained by these constituent states of country revealed that the residents of Bayelsa state were the most affected in the country, as they sustained a per capita damage and losses of N293, 400 (or its equivalent of US$1,835 per capita). More so, the post-disaster survey and analysis, revealed that Bayelsa state losses (N596 billion), Rivers (N507 billion), and Anambra (N484 billion) had the highest losses with Bayelsa state topping the list. The geographical location of Bayelsa other states such as Rivers and Anambra, which are located in areas with the highest flood peaks and water level rises, may as served as explanation to why Bayelsa is now known and classified as flood highly probable states. Also going by their natural vulnerability and the absence of effective flood-control features obviously makes the state susceptible to flooding problem. (NEMA and World Bank 2012).

Statement of the Problem

Flood as a natural phenomenon is now more than ever a common environmental issue with its damning consequences such as destruction of lives and properties, displacement, loss of livelihood and impoverishment that have continued to pose a serious threat to the inhabitants of towns and cities especially in Nigeria and Bayelsa State in particular. The problem of flood is not a novel one and as such over the years, there have been growing literatures on the subject in the Nigerian context with several researchers focusing on different aspects of environmental phenomenon including flooding, oil spillage and environmental degradation, global warming, urbanization and waste management issues etc.

However, in recent times, there are more studies focusing on Bayelsa State given the increasing concern among residents on flooding challenges and environmental degradation. Notably, Week and Wizor (2020) looked at the effects of flood on food security, livelihood, socio-economic and cultural characteristics in the flood-prone areas of the core Niger Delta region and its congruent states and asserted that flood affects food security, cause hunger, leads to acute food insecurity, displacement and abject poverty especially among vulnerable households in the region.

As Umar and Gray (2022) would put it, that in the wake of 2022 flood, Bayelsa was plagued with a humanitarian crisis with over one million persons in the state being displaced in over 300 communities across Sagbama, Ekeremor, Southern Ijaw, Ogbia, Yenagoa, Nembe and Kolokuma Opokuma local government areas and businesses totally shut down, properties lost and farm lands destroyed. More so, Ajumobi, Womboh and Ezem (2023) in their study, investigated the impacts of the 2022 flooding on the residents of Yenagoa, Bayelsa State and concluded that the impacts of the 2022 flooding on property, drinking water sources, buildings, farm produce and health were severe leaving many households with no choice than leaving their homes and properties decimated and destroyed. They buttressed that Bayelsa with most communities been submerged recorded over one million people being displaced across several riverine communities and businesses completely shut down, properties and farm lands destroyed and humans left with no home or shelter. Corroboratively, the Nigeria Flood Impact, Recovery and Mitigation Assessment report presented by NBS, NEMA and UNDP (2023) emphatically stating that the number of houses destroyed by the 2022 flood disaggregated by states revealed that Bayelsa state had the highest proportion of houses impacted by the flood.

Clearly, it is evident that many studies , Odubo (2014), Berezi et al. (2019), Umar and Gray (2022) and Ajumobi et al. (2023) regarding the issue of flooding and its impacts on Bayelsa have been researched focusing on different aspects on the phenomenon and various solutions postulated towards solving the

problem of flooding has remained unabated and daunted. The present environmental concern in Bayelsa state being one of the Niger Delta states lying below the sea level with majority of her communities located in the coastal regions and bounded by rivers and lakes makes her unavoidably susceptible to flooding challenges. Despite these growing literatures, the rhetorical question of whether Bayelsa state can overcome flood or be free from the devastating impacts in the event of another flood remains quite elusive and uncertain as the state continues in the euphoria of socio-economic woes and been highly vulnerable to flooding as indicated by the Nigerian Meteorological Agency.

Observably the researcher had identified that most of the studies are yet to examine preparedness strategy among flood-risk household in respect to mitigating and curtailing the impacts of flood. Thus, household flood preparedness strategy were scantly dealt with in most submissions and this has created a lacuna for further study for which this research work was birthed to bridge the gap by critically examining flood early warnings and preparedness uptake among the flood-risk household to mitigate the adverse effect of flooding in Bayelsa state, Nigeria.

Research Questions

I. What are the underlying causes of vulnerability among households in Bayelsa State?

II. How will flood warning lead to livelihood preparedness among flood-risk households to flooding in Bayelsa State?

III. How will flood warning help flood-risk households respond to flood displacement in Bayelsa State?

IV. To what extent will flood warning help flood-risk households to prepare for the vulnerability reduction uptakes before and during flooding in Bayelsa State?

Aim and Objectives

The main aim of this research work is to critically examine and explain the relationship of flood warnings and the socio-economic preparedness of flood-risk households in Bayelsa state.

The Specific Objectives include -

i. Identify the underlying causes of vulnerability of flood-risk households in Bayelsa State

ii. Examine how flood warning leads to livelihood preparedness of flood-risk households in Bayelsa State

iii. Explain how flood warning has helped flood-risk households to respond to flood displacement in Bayelsa State

iv. Expose how flood warning spurred flood-risk household preparedness uptakes as vulnerability reduction and mitigation strategy in Bayelsa State.

Hypotheses

Hypotheses I

Alternative Hypothesis H_A

There is a significant relationship between the underlying causes of flood vulnerability and the high impact of flooding among flood-risk households in Bayelsa State.

Null Hypothesis H_O

There is no significant relationship between the underlying causes of flood vulnerability and the high impact of

flooding among flood-risk households in Bayelsa State.

Hypotheses II

Alternative Hypothesis H_A

There is a significant relationship between flood warning and livelihood preparedness of flood-risk households in Bayelsa State.

Null Hypothesis H_O

There is no significant relationship between flood warning and the livelihood preparedness of flood-risk households in Bayelsa State.

Hypotheses III

Alternative Hypothesis H_A

There is a significant relationship between flood warning and housing preparedness of flood-risk households to flood displacement in Bayelsa State.

Null Hypothesis H_O

There is no significant relationship between flood warning and the housing preparedness of flood-risk households to flood displacement in Bayelsa State.

Significance of the study

The research work understudies how flood warnings helped and informed household preparedness uptake measures to mitigate, manage and navigate in the event of flooding in Bayelsa state. To this extent, this study is significantly relevant to;

Residential households: The study served as a bridge to knowledge gap for flood-risked households resident in the state dealing with the challenges of household's flood vulnerability and recommend to them an empirical based solution that would aid them in reducing their vulnerability to flood menace.

The study is also relevant to both the community and government as it serves as instruments to aid and guide in the designing of sustainable flood mitigation strategy that would improve household capacity and resilience against flood problems.

More so, the research work would significantly add value to the bulk of existing literatures bordering on the issue of environmental upheavals especially flooding challenges in Bayelsa State, Nigeria.

Scope and Limitations of the study

The research is limited in its scope of study in respect of geographical coverage. It focuses on Bayelsa State as a coastal and riverine state as well adjudged as flood-prone and probable states in Nigeria (NIHSA, 2023). This is so because the state is lying below the sea level and fall within those states in the coastal regions experiencing high prevalence of prolonged rainy seasons with mean annual rainfall ranges from 2,000 to 4,000mm and spreads over 8 to 10 months of the year between the months of March and November, which coincide with the wet season.

Further, the researcher limited the scope of study to household preparedness uptake among flood-risk household resilience strategy to prevent, cope, navigate and mitigate the adverse effect of the flood in Bayelsa state and its environment.

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Definition of Keywords

This refers to the specialized sense in which key concepts was used in the context of this study. The keywords as follows;

Flooding: The term refers to the comparatively high flow of water that overtops the natural or artificial banks in any reach of stream. Flooding in the context of this research is to mean an overflow or inundation that comes from a river or other body of water and threatens to damage or causes destruction to human lives, properties, and socio-economic existence of a human settlement.

Flood Vulnerability: Vulnerability in this work is conceptually described as the potential and susceptibility of household for loss due to a particular hazard. Flood vulnerability therefore is the extent to which a person, people or place are at risk of flooding and its adverse effects on them.

Households: A household comprised of an individual, a family of two or more, extended families, single parents with children, persons who are co-residing in a single residential unit, or even those who are transient.

Household Preparedness: The term household preparedness means all the measures put in place by an individual or household to enhance the safety of lives, properties and livelihoods of a people when flood occurs. It is the protective and preventive actions taken by individual households in a community to enhance the capability to undertake precautionary actions as a coping strategy and as emergency response to flood challenges either on a short-term or on a long-term basis.

Flood-risk: Risk literally refers to the "probability that a hazard would occur and trigger a disaster or series of events with an undesirable outcome". Flood-risk is simply the damage that may occur at a given location arising from flooding.

LITERATURE REVIEW

Conceptual Review

Flooding in Nigeria

Flood has remained a common environmental problem in Nigeria and it occurs when a body of water moves over and above an area of land, which is not normally submerged. It is also the inundation of an area not normally covered with water, through a temporary rise in level of stream, river, lake and sea. Magami, et al (2014) viewed flood as a natural consequence of stream flow in a continually changing environment.

Flood as a natural disaster is a consequence of the interactions of man and the environment he lives in and it is the most recurring, widespread, disastrous and frequent natural hazards of the world. It is worthy to note that not all floods are alike, while some floods develop slowly and last for a period of days. Flash floods can be form quickly, sometimes in just a few moments and without any visible signs of rain. Flooding is one of the most devastating hazards that are likely to increase in many regions of the world partly due to global climate change and poor governance in Nigeria. Flood usually occurs in Nigeria in three main ways, which are river flooding, urban flooding and fluvial and coastal flooding (Adeoti, 2010). River flooding is an unusual high rate of water flowing through the river channels often leading to inundation of land adjacent to streams and river band settlements because of intense or prolonged rainfall. The occurrence of such flood represents a major risk to riverside populations and floodplains, in addition to causing substantial impacts on the environment, including aquatic fauna and flora, and bank erosion.

Urban floodings are normally caused by heavy rainfall coupled with human activities in relation to the environment and lack of good drainage infrastructure in most Nigerian cities and this has left hundreds of people distressed and homeless. Accordingly, the UN-Water (2011), buttressed the impacts of urban flooding challenges that there have been a rapid growth in number of people killed or seriously impacted by flood disasters in many cities and urban settlements. No doubt, urban flooding has resulted in major loss of human lives; destruction of economic and household livelihoods, social infrastructure such as sources of portable

water, power installations, roads and railway lines and human settlements decimated in such a way that the recovery among the poor is unlikely to be achieved without external aid (Blaikie, 1994). This is to say that the urban poor are most vulnerable to the impact of flood because a good chunk of urban population lives in the floodplains and areas within water runways.

Agbonkhese, et al. (2013) highlighted that human activities such as rapid industrialization and urbanization, population growth, exploitation of natural resources and location of infrastructures exacerbate the occurrence of urban flooding. They emphasized further that indiscriminate dumping of refuse on drainage channels and poor drainage conditions aggravate flooding challenges in Nigeria. According to the United Nations Office for Disaster Risk Reduction (UNDRR) 2020, flood have been the most common type of natural disaster have accounted for 44% of the total disaster events in the world. In an assessment report by Human Cost of Disasters issued by the UNDRR 2000, that there are 3,254 recorded flood events worldwide from 2000 to 2019 and around 2 billion people are facing flood-related problems. It has affected 1.65 billion people globally, claimed about 100,000 deaths, caused economic losses of up to 651 billion U.S. dollars and nearly 600 million live in poverty (Simonovic, 2022).

Fluvial and coastal flooding both of which affects mainly coastal environments due to seasonal interruption of major rivers and water overtopping their natural and artificial defenses and overflowing areas not typically submerged. Fluvial floods account for the majority of the flood threats experienced in locations along the plains adjoining major rivers in the country, including rivers Niger, Benue and Hadeja (Adebayo & Oruonye, 2013).

The economic consequences of flooding reported in two decades before the millennium year amounted to tens of billions of US dollars and over 3,700 flood disasters globally was recorded in the EM-DAT database, between 1985 to 2014 (Tapsell, 2008). These events were responsible for hundreds of thousands of deaths mainly in Asia (most notably China, Thailand and Bangladesh) and adversely affected billions of people mostly through homelessness, spread of diseases, physical injuries, mortality mainly through drowning (Parker, et al. 2002). However, compared with the past 20 years, the frequency of global floods in 2020 increased by 23%, with 201 floods killing about 6,200 people, based on the Center for Research on the Epidemiology of Disasters (CRED) in Belgium. Western Europe, East Africa, South Asia, and China affected to a larger degree. The frequency and severity of floods increased due to climate change in the past few years, yet the risk of floods has been underestimated, resulting in huge casualties and property losses.

In the US, 32.9% of the total natural disasters in 2012 were hydrological with floods accounting for the most part, affecting more than 9 million people and causing about US$ 0.58 billion worth of damage (Tapsell, et al. 2005). The same source shows, for that year, more than US$4.7 billion worth of damage recorded for Europe, and about US$0.83 billion and US$19.3 billion damage for Africa and Asia respectively resulting from flooding. Four different floods that hit cities in UK in 2012 caused a total loss of $2.9 billion, with hundreds of people who were affected.

In many African countries for example Nigeria, flooding has impoverished hundreds of thousands of people through displacement from homes and loss of tangible properties. In Nigeria, flooding and means of addressing its challenges are critical issues Adeloye, & Rustum (2011). Evidently, the country has experienced devastating floods, which affected millions people and caused fiscal losses amounting to billions of US dollars (Cline, 2007)). These hazards are somewhat linked to poor urban planning and climate change especially in increased frequency and intensity of rainfall (Ogunbodede & Sunmola, 2014).

The impacts of floods in Nigeria include mortality, physical injuries, widespread infection and vector-borne diseases, social disorders, homelessness, food insecurity, economic losses (mainly through destruction of farmlands, social and urban infrastructure) and economic disruption (most notably in oil exploration in the Niger delta, traffic congestion in many cities in Nigeria, disruption in telecommunication and power supply) (Bashir, et al. 2012). In 2012, Nigeria adjudged to have experienced the worst flooding in more than 40 years because of heavy rainfall that lasted for many days but most devastating was the flooding in 2022. The incidence affected 32 states with 24 considered severely affected. The floods extended from July to October that year and affected 7.7 million people with more than 2 million others reckoned as internally displaced

persons (IDPs).

The Causes of Flooding in Nigeria

Several causes have been consensually and inductively identified to be responsible for flooding and that these causes are either human-induced (anthropogenic) or natural factors-caused due to changes in climate condition which can be referred to as climatological causes for flood. The usual remote cause of floods is heavy or excessive prolonged rainfall and it can manifest along marine coasts from wind-driven storm surges and rain-swollen streams associated with tropical typhoons and hurricanes. Besides, flooding can also occur on the shorelines of large inland lakes and not totally a natural phenomenon but an environmental hazard. Flood becomes a hazard when it impinges unfavorably on human activities as it frequently does because of the affinity which man tends to have for flood plains and coastal locations.

Ifiok et al, (2022) vividly opined that climate change is a major cause of flooding and that it makes weather less predictable, especially in developing countries like Nigeria where facilities to predict and manage weather conditions are inadequate. However, the United Nations Framework Convention on Climate Change (UNFCCC, 1992) defines climate change as a change of climate attributable directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable period. The activities of human such as industrialization, technology development, urbanization, deforestation, burning fossil and agricultural activities, etc and natural factors such as solar radiation quality and quantity, astronomical position of the earth are notable causes of climate change (Agbonkhese, et al. 2014).

Rufa'I, (2020) in his work on household preparedness on flood hazards observed and opined that climate change works in an indirect way to aggravate flooding by altering the pattern of flooding in the flood prone areas. It however goes beyond doubt that climate change and its impacts such as increase in sea level have direct impacts on urban and coastal floods, and it has continuously disrupted the social fabric of cities and exacerbates poverty particularly in most developing countries, including Nigeria. The unpredictability of rainfall being triggered by global warming in contemporary times informed the untold hardship in Nigeria's lowland and coastal cities which makes most people in such settlements increasingly becoming vulnerable during raining season as the urban population increases and the poor households being pushed into the fragile areas which are prone to flooding (Njoku et al. 2020).

Another major cause of flooding is human interaction with his environment in the form of increased industrial activities, consumption, population sprawl, urbanization, deforestation and development efforts and these human induced factors are no doubt assuming greater importance as cause of flooding. For instance, as urbanization intensifies, natural surfaces are replaced, which do not allow water to percolate readily into the ground. The effect is that a large proportion of the rainfall, which should normally infiltrate into the soil or intercepted by the vegetation will be delayed for some time before running off, is immediately available for surface run-off into streams and rivers, making them flood. Bad planning also brings about floods and as humans try to harness available water resources, which have resulted in the construction of dams and other water control structures, the failures of these structures have resulted in floods (Udoh, 2015).

The common and recurrent phenomenon of flooding in Nigeria occurs on a perennial basis in some parts of the nation. However according to NEST (1991), the following geographical areas suffer from the hazard more than other parts in Nigeria.

(a). Low-lying areas in the southern parts of the nation where annual rainfall is very heavy.

(b). The Niger Delta zone

(c). The floodplains of the larger rivers of the Niger, Benue, Taraba, Sokoto, Hadeja, Cross River, Imo, Anambra, Ogun, Kaduna etc.

(d). Areas that are identified as flat low-lying around and to the south of Lake Chad may be flooded during and after a few weeks of the rain.

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Furthermore, Agbonkhese, et al (2014), highlighted that in Nigeria, other causes of flood, which are climatological factors, are only parts or indirectly responsible to flooding include:

(a). Flooding of low lying coasts by excessively high tides associated with storm-surge effect;

(b). Rivers and tributaries carrying water floors very much in excess of their transporting capacities due to concentration of run off;

c). Heavy rainfall synchronizing with spills of rivers;

(d). Main rivers backing up the water in their tributaries;

(e). Inadequate and inefficient drainage of low lying and flat areas to the overflow;

(f). Ponding back of stream flow by rising tides, particularly during spring tide conditions;

(g). Peak floods occurring at the same time in a main river and its tributaries

The Impacts of Flooding in Nigeria

Flood menace have ravaged several towns, cities and infrastructures in Nigeria for several decades causing losses of thousands of lives and tens of billions of naira worth of properties damaged. Flooding is not only becoming more frequent in Nigeria especially in the cities, it is also becoming more severe and devastating over the decades. However, the increase frequency and severity cannot totally be attributed to increased rainfall. In contrast, rainfall have been on the decrease. Rather they are in response to an increasing rate of urbanization in the absence of well-articulated and comprehensive physical planning and control, which invariably have left many of our coastal cities in flood dilemma. Over the years, some of the cities greatly ravaged by flood menace in Nigeria has been Ibadan in Oyo state and Lagos as a metropolitan city.

Historically, flooding in Nigeria dates back to the early 1950 and these floods are fluvial, coastal and pluvial in nature and have been a major cause of concern for rural areas and cities in the country (Agbola, 2011). Lagos recorded its first major flood in the early 1970s and until date, floods have become perennial event in the state. Ojikpong et al. (2016) noted that flooding leads to the destruction of lives, properties and socio-economic activities. However, the level of loss and destruction caused by flood depends on factors such as season and timing of floods, location, damages on the embankment and walking roads, location of river encroachment, status and condition of the drainage system, and prior experience of flood and flood management strategies. Therefore, flooding affect the livelihood of residents in both rural and urban areas in so many ways. For instance, flooding can cause collapse of buildings and bridges submerge farmlands and market places, while crops were destroyed causing food insecurity.

In the works of Agbonkhese, et al, (2014) posited that documented flood disasters reports in Nigeria have given us good insight into the extent of flood challenges and flood related problems in Nigeria.

Hence, table 1 below traced the inception of momentous floods in twelve (12) states in Nigeria and the states in no particular order were Kano, Lagos, Imo, Akwa-Ibom, Delta, Bayelsa, Oyo, Taraba, Jigawa, Sokoto, Yobe and Zamfara. Observably, Bayelsa and Delta first experienced hazardous floods in 1999 and ever since the first major floods in these states, the problem of floods has continued to pose serious threat to human existence in not only the states but also other states within the coastal region in the country.

Table 1: Flood Disasters and Associated Hazards Nigeria

S/No	State	Disaster	Associated Hazard	No of People Affected	Date & Year
1	Akwa - Ibom	Flood & Rainstorm	367 houses washed away	4000	March 2001

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2	Bayelsa	Flood	Houses, Schools, Markets & Farmlands submerged	2/3 of the population	1999 & March 2001
3	Delta	Flood & Rainstorm	Houses, Schools, Markets & Farmlands submerged	Half of the population	1999, March/April 2001
4	Imo	Rain & Windstorm	1000 houses, 150 electric poles & 40000, oil palm destroyed	Over 10,000 displaced	April 2001
5	Jigawa	Flood & Windstorm	Houses, farmlands & animals destroyed	35,500 displaced in 1988; 450,150 displaced in 2001	1988, March, April & August 2001
6	Kano	Flood & Windstorm	Schools, Houses, Farmlands & animals destroyed	300,000 displaced in 1988, 20,445 in 2001	1988, 2001
7	Lagos	Flood	Buildings collapsed, markets submerged, properties destroyed.	Over 300,000 Affected	Early 1970's Till Date
8	Oyo	Ogunpa Flood	500 Houses demolished, properties destroyed &	50,000 Affected	1948,1963 ,1978,198 0,1985,19 87 & 1990
9	Taraba	Flood	80 Houses totally swept off. 410 houses extensively destroyed	More than 50,000 Displaced	August 2005
10	Sokoto	Flood, Fire, Windstorm	Houses & Farmlands destroyed	16,000 Affected	July 2001
11	Yobe	Flood, Fire & Drought	Houses & Farmlands submerged, Houses razed, animals affected	100,000 Affected	April & September, 2001
12	Zamfar a	Flood	Building submerged, Farmlands destroyed, properties damaged	12,398 Affected	July 2001

Source: Adapted from the works of Agbonkhese, et al (2014)

Flood Early Warning

Early warning systems are an important component of disaster-risk management strategies. In contrast to flood forecasting systems, which assess flood risk, the main purpose of early warning systems is to issue warnings when a flood is imminent or already occurring. Early warning systems for floods comprise four inter-related elements:

1) Assessments and knowledge of flood risks in the area,

2) Local hazard monitoring (forecasts) and warning service,

3) Flood risk dissemination and communication service, and

4) Community response capabilities.

This multifunctional system improves community preparedness for extreme weather events such as floods, in

terms of both warning and increasing understanding of risks and appropriate flood responses. This minimizes safety and infrastructure threats. As part of the warning, the system provides a prediction of the scale, timing, location and likely damages of the impending flood. The system uses data from sensors to measure water levels at strategic points in local water basins (rivers, lakes) or flood defences (dikes, dams, embankments) to forecast a potential flood event (UNISDR 2006).

The National Oceanic and Atmospheric Administration (NOAA) USA in a presentation of flash flood early warning system presented to us a clear guideline and a reference that the current increase in the number and degree of extreme weather events such as floods make flood warning technology very crucial for climate change adaptation. The guidelines also hinted on the important role of implementation of effective governance in the arrangements to be spurred and supported by political commitments that should be established to maintain the early warning systems' four elements. It buttressed further that all stakeholders, including local communities, local and national government, international bodies, NGOs, the private sector and the scientific/technical community should be involved in the planning phase.

In highlighting the roles and responsibilities for system management and maintenance, it opined that the roles and functional responsibilities of various institutions and partners as well as stakeholders should be agreed upon, and necessary staff training should be completed prior to implementation.

The Implementation of the Four Flood Early Warning Element:

1. Risk knowledge: Establish a system/agreement to collect and share data, figures, maps, etc. on flood risks and vulnerability in the area.

2. Monitoring and warning service: Establish sensors measuring water levels at relevant sites in local waterways and link them to the local database. The best available data and models should be chosen for forecasting systems.

3. Dissemination and communication: Dissemination roles and responsibilities should be clear (e.g. media, governance institutions, NGOs). A means to improve the area telecommunication network may be necessary.

4. Response capability: Education, through information centres or training programmes, to improve community disaster preparedness is important. (UNISDR, 2006).

Socio-economic & Environmental Benefits of Flood Early warning

- Gives timely notice for gated dam water release, reducing damage to surrounding communities and ecosystems.

- It strengthens overall flood management, including preparedness, response and recovery.

- Minimizes human fatalities, injuries and health risks, as well as infrastructure damage, resulting from floods.

- Reduces costs related to post-flood rehabilitation and rebuilding.

- Improves network connectivity within and between local communities.

Opportunities and Barriers

Opportunities:

- Provides climate change adaptation and resilience benefits

- Technological advances have allowed citizens to receive data directly from the warning systems to

their smartphones, improving dissemination speed and reach

- It is implemented at local and regional scales and can reach all societal groups, including those that are especially vulnerable
- Improving disaster preparedness through the system can significantly reduce expensive relief efforts.

Barriers:

- Limited telecommunication networks could reduce flood warning efficiency and distribution, particularly in remote regions of developing countries
- The warning carries a degree of uncertainty, which could lead to false alarms
- Availability of good quality real time data may be limited.

Implementation Considerations:

This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:

i. Technological maturity: Fully mature and widely used initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology for early warning

ii. Initial investment: The fund investment to be made in early stages of research and development, but more specific costs and timelines are to be identified as relevant for the specific technology and geography.

iii. Operational costs: 1 – very low/no cost, to 5 – very high costs of Operation and maintenance

iv. Implementation timeframe: Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity.

Household Flood Preparedness

There have been many flood vulnerability assessment studies among researchers stemming from various discipline because of the country's consistent exposure to flooding challenges in both rural and urban areas. This challenge has caused a growing concern among vulnerable groups and flood-risk households on the need for an effective measures and efforts at reducing their vulnerability and flood impact generally. Flood preparedness is an active, ongoing process and an integral part of disaster management that involves the response to or anticipation of a hazardous event through a set of policy and administrative decisions and operational activities that pertain to the various stages of a disaster at all levels as reported by UNESCO (2010).

Flood preparedness entails all the measures aimed at enhancing life safety when flood occurs, such as preventive plans as well as protective actions (Siegel, 2003). One of the basis for preparedness activities is the knowledge households have about the flood hazards, different types of flood events, and the likely impacts on the natural and built environment, households, organizations, community institutions and communities. The measures may include actions designed to enhance the ability to undertake emergency actions in order to protect property and contain adverse damage and disruption, as well as the ability to engage in post flood restoration and early recovery activities

The measures taken by the households to strengthen this preparedness cycle may include planning, organizing, training, equipping, exercising, evaluation and improvement activities to ensure effective coordination, and enhancing capabilities to prevent, protect against, respond to, recover from, and mitigate the effects of flood disasters. Preparedness includes designing warning systems, planning for evacuation and reallocation, storing

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food and water, building temporary shelters, devising management strategies, and holding disaster drills.

Household Preparedness

The household is the smallest component of any society, which may be comprised of a nuclear or extended families, and it is unit analysis for preparedness. Just as "every disaster is local," preparedness begins in the home with some simple steps that can be taken to improve life safety, property protection, and survival from hazardous events. Households vary in many ways that are important for understanding both disaster vulnerability and disaster preparedness. Preparing to improvise may seem like a contradiction, but in fact, the two concepts are complementary (Ashenefe et al, 2017).

Household vulnerability is associated with income, education, ethnicity, age and linguistic isolation. Factors such as income influence access to safe housing options and to insurance. Other axes of stratification play a role in making households either more or less vulnerable, better or less well prepared (Amata, 2023). Behavioural metrics and normative guidance for household preparedness generally focus on six dimensional issues on flood:

i. Hazard knowledge of household,

ii. Formal and informal response plans and agreements,

iii. Life safety protection,

iv. Property protection,

v. Emergency coping and restoration of key functions,

vi. Initiation of recovery.

The main emphases tend to fall in the area of hazard knowledge, life safety, and property protection, with specific attention placed on assembling a disaster supplies kit, mitigation activities, and developing a family communications plan.

Factors Associated with Household Flood Preparedness

Variables such as gender, age, educational status, religion, household income, occupation, marital status, family size, house ownership, warning system in household, knowledge, prior exposure, previous flood experience, awareness, any training for flood prevention and preparedness, and duration of flooding were found to be eligible for multivariable logistic regression. Flood preparedness is a critical and essential component of disaster management planning because it minimizes the adverse effects of a hazard. Ashenefe et al, (2017) in a multivariable analysis, posited that age, household monthly income, educational status, warning system in household, knowledge, prior exposure, and duration of flooding were significantly associated with household flood prevention and preparedness. Flood preparedness should be seen as an essential component of any disaster management planning because it minimizes the adverse effects of a hazard and six preparatory steps;

1. Protection of personal documents and special Items: This involves the activities at collecting and safeguarding critical financial, medical, educational, and legal documents and records from projected water level. This could also take the form of providing a backup for all documents in a waterproof bag and store electronic copies.

2. Buy and keep disaster evacuation Kit: Ensure to adequately plan for your entire household including children, elderly and those with special needs and animals to guarantee safety and hassle free evacuation process in the case of flash flood, Households must be equipped adequately to tend to any eventuality or unexpected medical conditions your family member may have. Tools and safety items: Small items like

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matches, flashlights, a multi-purpose tool, and a whistle can be handy and will make a difference for your family.

3. Food and supplies: it is important, as a preparatory uptake, the household should pack at least a three-day supply of non-perishable food and water for your family. Packing anything specific to your family's needs, such as infant formula is needful.

4. Flood-risk Flood proofing house: Shutting off the major circuit breaker to prevent appliances from short-circuiting and eliminate the threat of electrocution.

Keep gutters and drains around your house free of debris.

Install a water alarm and sump pumps with battery backup.

Places Check valves" in sewer lines to prevent floodwater from backing up into your drains.

Stock emergency protective materials such as plywood, plastic sheeting, and sandbags.

Elevate the heating system (furnace), water heater, and electric panel if susceptible to flooding.

Waterproof the basement or foundation.

In areas with repetitive flooding, consider elevating your house.

5. Develop a Family Evacuation Plan: It is important to prepare an evacuation plan regardless of being outside high risk area. Ensure an emergency exit and evacuation routes are well known to member of household. Prior to flooding, one should have or create an emergency shelter location such as IDP.

Communication is also key to your plans with friends or family outside of your home area.

6. Flood-risk Insurance cover: There are varieties of hidden risks that can put one's house in danger of flooding, like new housing developments or changes in weather patterns. Flood insurance is a sure-fire way to protect your home, even when it does not face the obvious risks for flooding. Most property owners and owners could take up insurance policies to cover fire upsurge but most policies do not cover flood damage, and flood insurance policies do not automatically renew.

Empirical Literature

In recent decades, flooding has led to the loss of thousands of lives and properties. According to available studies, flooding in Nigeria is caused by weak implementation of planning policies, streams and channel obstruction due to indiscriminate waste disposal habits and human activities in flood plains (Ekpoh, 2015; Udoh, 2015 and Evan et al., 2017). Their findings showed that the development of illegal structures on or across drainage channels, land reclamation or encroachment, poor physical planning, inadequate drainage channels, blockage of canals and drains, collapsed damns and nature of terrain were the primary causes of flooding in major cities and towns in Nigeria.

Olajuyigbe et al., (2012) assessed flood hazard in Lagos, Nigeria. Their study showed that flooding in Lagos results from high river levels, concentration of overland flow due to heavy rainfall, limited capacity of drainage systems as well as blockage of waterways and drainage channels that are developed to facilitate surface run-offs. They also noted that narrow river channels and construction of housing units and other developments along flood prone area contribute significantly to flood occurrence.

Further, they observed that flooding in Lagos has continued to become a menace with socio-economic and environmental consequences on Lagos residents. Their study recommended that provisions for sufficient setbacks to streams and rivers be made. They also suggested that there should be construction of roads with good drainage system, adequate channelization and building of more dams to avoid excess loading of the

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existing dam in Lagos State.

Magami et al., (2014) assessed the causes and consequences of flooding in Nigeria. They revealed that flooding in Nigeria is caused by dam failure, over flowing of major rivers, coastal storms, ignorance of warning from Nigeria meteorological agency, delay in evaluation of flood victims and settlement of people at flood prone areas such as riverine areas and seacoast. Other causes of flooding that they observed were climate change, extraordinary heavy rains and continued release of excess water from artificial reservoirs. They also pointed out that poor maintenance of drainage channels coupled with indiscriminate waste disposal result in flooding in Nigeria.

In a similar study, Ekpoh (2015) assessed climate change and recent severe flooding in Uyo, Akwa Ibom State. He designed a detailed rainfall analysis for Uyo using statistical distributions commonly deployed to describe climate states, such as the mean, the running mean, and the standard deviation, coefficient of variability, skewness, and kurtosis. Parametric statistics such as Kruskal-Wallis test and ANOVA were also used in operationalizing the analysis. His findings noted that rainfall amounts and patterns in Uyo were out of step with long-term mean conditions. He specifically mentioned that between 2005 and 2014 mean rainfall was 22% above the 30-year mean from 1985 to 2014. The rainfall Skewness and Kurtosis showed significant swings in the central tendency and confirmed the establishment of a new mean and a new standard deviation in the 2005-2014 decade. He confirmed the trends to be statistically significant by Post Hoc Test at 0.05 level. He explained that rainfall is adding more water to surface runoff, leading to incessant and severe flood conditions.

Nkwunonwo et al., (2016) assessed flooding and flood risk reduction in Nigeria with a view to determining the cardinal gaps. They noted that factors such as rapid population growth, urbanization, poor urban planning and climate change especially increased frequency and intensity of rainfall had resulted in flooding in major parts of Nigeria. Specifically, they showed that between 1985 and 2014, flooding in Nigeria has affected 11 million lives resulting in 1100 deaths and properties being damaged to exceed US$17 billion. According to them, Lagos State has recorded the largest percentage of flooding in Nigeria while Niger, Adamawa, Oyo, Kano and Jigawa states are also experiencing flooding. They argued that in spite of the growing scenarios of flooding and its potentials to affect lives and properties, there are no viable actions to stem the tide of flood occurrence in Nigeria. They suggested that more robust and scientific approaches to flood risk reduction such as flood modeling and vulnerability assessment be employed in flood management in Nigeria.

Adebayo et al. (2012) examined the effect of flood disaster on rural livelihood and coping mechanism in Lau Local Government Areas of Taraba State in Nigeria. Their findings revealed that flood have negative effects on the socio-economic status and livelihood of the people in the Local Government Area. They identified that flood incidents had seriously devastated the economy of the rural communities within Taraba. For instance, they noted that farmlands were submerged and agricultural products were destroyed which have affected the environment by causing serious gully erosion.

According to Bamidele and Badiora, (2019) several empirical literatures have soughed to explain how people's knowledge can be integrated in the planning and management of flooding. That it has been observed that the willingness of the public to participate in flood management plays an intricate role in the flood management process.

From the foregoing empirical literatures, it is evident that there have been several studies undertaken in the past, which have shown that the frequency and intensity of flood have tremendously increased over the last few years, rendering the already impoverished populations more vulnerable. Despite these researches, not much has been achieved in terms of addressing the flooding problems as there have been a continuous lapse in the social policy framework that could have improve and ameliorate the impact of flood on the socio-economic livelihoods of flood–risk populations. There is, therefore an urgent need to establish and coordinate a preparedness approach to flooding to achieve flood-risk mitigation and vulnerability reduction as opposed to reactive risk and vulnerability framework for disaster reduction.

Theoretical Review: Deep Ecology Theory

Coined by the Norwegian philosopher Arne Naess in 1973 Deep ecology is a questioning theory and persists in

asking deeper questions concerning "why" and "how" human life as one part of the ecosphere has impacted the entire ecosystem.. Deep ecology seeks a more holistic view of the world we live in and seeks to apply to life the understanding that separate parts of the ecosystem (including humans) function as a whole, which constitute an interconnected system (Devall, et al, 1985).

The Principles of Deep Ecology

The Deep Ecology perspectives consists of eight basic principles, which are guidelines for a reformed way of thinking about our environment posited;

1.) The well-being and flourishing of human and non-human life on Earth have value in themselves (this is commonly referred to as inherent worth, or intrinsic value).

2) Richness and diversity of life contribute to the realization of these values and are values in themselves.

3) Humans have no right to reduce this richness and diversity except to satisfy vital needs.

4) The flourishing of human life and cultures is compatible with a substantial decrease of the human population.

5) Present human interference with the non-human world is excessive, and the situation is rapidly worsening.

6) Policies are dynamic must therefore be changed. The changes in policies affect basic economic, technological structures to address current realities of environmental upheavals.

7) The ideological change is mainly that of appreciating life quality (dwelling in situations of inherent worth) rather than adhering to an increasingly higher standard of living.

8) Those who subscribe to the foregoing points have an obligation directly or indirectly to participate in the attempt to implement the necessary changes.

In the lens of Deep Ecology, everything is seen as having its own value through the explanation of interconnectedness. This reinforces the importance of biodiversity in the world--that everything is connected to everything else. There is no hierarchy that exists of living things, simply because without everything, nothing would exist. There is a reliance of everything upon everything, and therefore nothing can be less or more than anything else in the web of life.

The theory emphasized that we need to value the richness and diversity of life forms in and of themselves, because we as humans also rely on them. It explains that ecosystems are self-regulating and self-maintaining because of this biodiversity and interdependence. Vital needs are opposite of “other” needs, meaning that while it is the individuals job to determine the difference between the two, all of these should be categorized as such. It further buttressed that no human has the right to reduce any other living things right to live and flourish, except in the case of its own vital needs, and every living thing needs should be taken into consideration when talking about development. If an individual violates another being’s right when it is not a vital need, it should never be done with intention or awareness of doing so.

There will be a profound awareness of the difference between “big and great” The theory supports a simplified lifestyle which enhance quality of life and that it should take precedent over quantity of things, to reach a higher level of happiness instead of a higher standard of living. It calls for voluntary simplicity, meaning that not only is it that the human reduction of needs must happen, but that it must be wanted to happen, and through this, a greater happiness will emerge. More so, the theory buttressed that by addressing just the environment, there are many things that are being overlooked, and essentially, what this philosophy is trying to get across is a coming about of a better world as a whole, spawned by the better individual. It is something that can and should be adopted by all humans, and through living these principles,

Thus, this theory sees environmental problem stemming from human interference. That human beings should

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know and identify that the ecosystems are self-regulating, and there is no need for human involvement. Essentially, humans are a part of nature, and expected to interfere in their environment to a certain extent. It theorized that not just the environmental problems such as flood and climate change will disappear, but social, political, economic, and human relational problems will dissolve as well.

RESEARCH METHODOLOGY

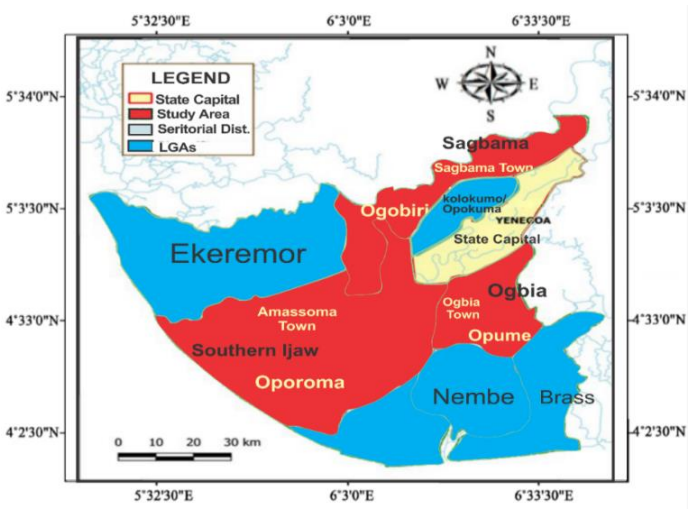
The methodology adopted for this work is primarily a quantitative research method, which involves eliciting numerically data from the sample drafted systematically from the population of the study and the data analyzed to provide logical answers to the research questions adopted in testing the hypothesis of the research

The Study Area

Bayelsa State was founded on October 1, 1996 and geographically located approximately within Latitude 4°15 North at the Southern part & 5°23 North at the Northern limit and Longitude 5°22 East at the Western part & 6°45 East at the actual Eastern limit. It is bordered by Delta State to the West, Rivers State to the East, the Atlantic Ocean to the South and both Rivers and Delta States to the North. Domiciled within the lower delta plain. The major geological characteristic of the state is sedimentary alluvium. The major soil types in the state are young and shallow, (inceptisol Aquepts) and acid sulphate soils Sulphaquepts (Oyegun, 1990)

The state is comprised of eight Local Government Areas; namely, Brass Ekeremor. Kolokuma/Opokuma, Nembe, Ogbia, Sagbama, Southern Ijaw and Yenagoa, which serves as the Capital city playing host to most of the Government and private institutions. There are four major languages spoken by the people and they are; Izon, Nembe, Ogbia and Epie-Atissa while English like the rest of Nigeria, is the official language.

Figure 1: Map of Bayelsa State Showing Study Area



Source: Researcher's Fieldwork

Predominantly fishers by occupation because of the abundant creeks, lagoons, rivers and swamps within which commercial fishing being practiced with over 200 species of fishes found in the waters within and around the state. Fish oil extraction is a common economic activity throughout all the LGAs of the state, and the coastal areas abound in seafoods such as fish, oysters, crabs, lobsters, periwinkle et cetera. There are also sea animals such as Hippopotamus, manatee, crocodile etc. in the seas, rivers and streams that crisscross the state. Food crops grown in the state include yam, cocoyam, banana, pineapple and plantain. Cash crops grown in the state include coconut, pears, oil palm and raffia palm. Bayelsa State has one of the largest crude oil and natural gas deposits in Nigeria. As the largest crude oil reserve state in the Niger Delta of Nigeria, the state produces over 40% of the country's on-shore crude oil and vast quantities of associated gas (Alagoa, 1999).

The state has a maximum temperature of $30^{o}C$ and it is usually constant throughout the year. The latitudinal location of the state in the equatorial belt ensures that high temperature values recorded all the year round.

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Seasonal and latitudinal variations affect the extremes of recorded temperature and diurnal and seasonal ranges. Rainfall in the State varies in quantity from one location to another. The state experiences equatorial climate in the southern the most part and tropical rain towards the northern parts. The mean annual rainfall ranges from 2,000 to 4,000mm and spreads over 8 to 10 months of the year between the months of March and November, which coincide with the wet season. There is usually a slight break between July and September. This short dry season is called August break. The duration of the dry season is comparatively short beginning from December and extending to February – a period of three months. It is not uncommon to experience occasional rainy days and storms even during this short season. The direct effect of the extensive wet season is that over 70% of the total area of the state inundated with floodwater during the wet season.

Population of Study

The Nigeria Impact of Flood, Recovery and Mitigation Assessment Report (2022-2023) in her official gazette reported that Bayelsa state ranked as most affected state with approximately 700,000 people displaced among her counterpart states such as Anambra, Cross River, Delta, and Rivers in southern Nigeria and the Federal Capital Territory in the northern central Nigeria, (NBS, NEMA & UNDP 2023). The researcher adopted for this study the 700,000 flood-risk households as its population of study and these number represented by households is said to be vulnerable to flood hazard and at risk of facing displacement, loss of lives, livelihoods and valuables and other adverse effects the flood in 2022 in the state. Inductively the flood-risk population of the state which is 700,000 which represent a significant proportion of 27 percent of the entire population of Bayelsa state projected to be 2,537,375 in 2022 at 2.5% Annual Population growth rate between 2006 to 2022 (NBS 2006).

Sample Size and Sampling Techniques

For the sample size, the task is to determine the sample size for the study using a sample calculation formula known Andrew Fisher's Formula.

Andrew Fisher's Formula;

Sample Size= $\frac{\text{(Z-score) ^2 x StdDev x (1-StdDev)}}{\text{(Confidence Interval) ^2}}$

p = the population proportions 700,000

Confidence level of 95%

Standard deviation of 0.5,

e = acceptable sampling error or i.e confidence interval (margin of error) of ± 5%,

z = z value at reliability level or significance level

Reliability level 95% or significance level 0.05

Using the sample size formula to get the sample size is as follows;

Thus, the researcher uses substituted the values in the formula:

((1.96)2 x .5(.5)) / (.05)2

(3.8416 x .25) / .0025

.9604 / .0025 = 384.16.

The researcher accordingly allows 0.05 sampling margin of error and uses 380 as the sample size for the study

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Sample size (n) =**380.**

Hence, a sample size of 380 was used for this study and the number was drafted systematically from the population of the study that comprised of all the flood-risk households in Bayelsa.

The sampling techniques used was a non-probabilistic sampling technique within a multi-stage sampling. This method adopted is to help break the study area to micro components of state, which enables the researcher to easily administer the questionnaire to selected flood-risk households representing the entire flood-risk households in the state into the sample frame.

The sampling techniques shown below;

Stage 1: Cluster Sampling- Bayelsa clustered into 3 Senatorial Districts (West, East and Central)

Stage 2: Purposive Sampling- One LGAs selected from each of the Senatorial District

Stage 3: Purposive Sampling- Two communities each LGAs (Sagbama, Ogoibiri, Ogbia, Opume Oporoma, Amassoma)

Stage 4: Systematic Sampling- Every 3rd compound (Households) selected from the six communities

Stage 5: Purposive Sampling- 380 Heads of Households selected from each compound (Households)

Method of Data Collection

This study made used of both primary and secondary data sources. The primary source is solely through the instrumentality of questionnaire while the secondary source was by the uses of documented official reports, literatures, published journals and newspaper. The questionnaire was structured and administered on the 380-sample size drawn from the population universe of flood-risk households in Bayelsa and the responses derived from the respondents were collated, tabulated, quantified and analyzed to provide answers to the research questions and further testing of the hypotheses.

Method of Data Analysis

Since the nature of the research called for a combination of methods, the researcher used both parametric and non-parametric tool for measurement in analyzing the data obtained from the respondents. The parametric tool such as simple percentage and bar charts were adopted to compute the socio-economic demographic of the respondents, while the non-parametric tool for measurement such as cross-tabulation and Chi-square were employed respectively to analyzed the quantitative data generated from the questionnaire.

The Simple Percentage

The simple percentage is the proportion of the whole multiplied by 100 of responses.

$$\frac{\text{No. of responses}}{\text{Total number of respondents}} \times \frac{100}{1}$$

The Chi-square

The Chi-square is to compare observed and expected frequencies, as well as in testing the hypotheses concerning the significance of difference between two variables to show whether or not there exist a relationship. The Chi-square method as non-parametric tool for measurement is represented as;

$$X^2 = \frac{\sum (F_o - F_e)^2}{F_e}$$

Where F_o = Observed frequencies

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F_e = Expected frequencies

DATA ANALYSIS AND RESULTS

Tabular Analysis of Household Socio-economic Data

The bio-data characteristics of the respondents was tabulated to describe the household's socioeconomic background and their major sources of livelihood and this indicated that 65% of the respondents were male and 35% were female representing the total sample size of the study. All Head of Households drew into the sample frame were adults of 18years and above. On marital status, 55% of the respondents were married; the single constituted 30% followed by those who are widowed making 10% and those separated were just 5% of the entire population. On their educational status, those with secondary education constituted 40% of the entire respondents which is the highest proportion followed by those who are without any formal education representing a proportion of 25% of the respondents and the proportion of those with elementary or basic primary school education constitutes 20% while 15% were those with tertiary education.

Table 4.1.1 Operationalization of Socio-economic Characteristics of Households

Socio-economic Characteristics	**Operationalization**	**No of Respondents**	**Proportion/ Percentage (%)**
Household Size	0-4	117	30.8
	5-9	190	50
	10-14	63	16.6
	15 above	10	5
			100
Major source of income/ Occupation	Farming/Fishing	176	46.3
	Trading/Entrepreneur	76	20
	Civil /Public Servant	90	23.7
	Artisan Work	38	10
			100
Household income Threshold	10,000-19,999	63	16.6
	20,000-39,999	132	34.7
	40,000-59,999	89	23.4
	60,000-79,999	60	15.8
	80,000 above	36	9.5
			100

Table 4.1 Result Interpretation

The household size depicted above shows 50% of the respondents had 5-9 household sizes, while 30.8% were of 0-4 household size. Hence, 80.8% were of household sizes between 0 to 9 and while above 10 household sizes. Regarding the occupation of the respondents, most of the respondents engage in agriculture (farming/fishing) though constituting 46.3% of the respondents drawn into sample of this study. Traders constitutes 23.7%, closely followed by civil servants representing 20%, and 10% engaged in artisan and informal jobs, followed this. On income, 25.3% of the respondents earn above 60,000 to 79,999 and a chunk of

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74.7% earns less than 59,999 and formed the bulk of flood victims.

Table 4.1.2: Households Flood Awareness and severity in Bayelsa State

Questions on the Questionnaire	**Operationalization of Responses**	**Frequency of Responses**	**Percentage/ Proportion of Responses**
13.Have you experienced flood disaster before?	Yes	364	95.8
	No	16	4.2
		380	**100**
14. What Year?	2022	293	77.1
	2018	23	6.1
	2012	46	12.1
	2010 below	18	4.7
		380	**100**
15 Do you consider your house vulnerable to flooding each year?	Yes	311	81.8
	No	69	18.2
		380	**100**
16. Are you aware that houses/ residents built on and along flood-prone areas are highly vulnerable to flood yearly?	Yes	327	86.1
	No	53	13.9
		380	**100**
17. Do you agree that flood bring about severe financial and socio-economic losses to households?	Yes	284	74.73
	No	96	25.27
		380	**100**
18. Going by your experience, in relative terms would you say 2022 flood was the most devastating of all flood events in the state?	Yes	324	85.3
	No	56	14.7
			100
19. How would you describe the degree of the severity of the 2022 Flood in your community?	Very Much Severe	242	63.7
	Very Severe	113	29.9
	Fairly Severe	13	3.5
	Not Severe	12	3.1
		380	**100**

Source: Research Fieldwork, 2024

Table 4.2 Result Interpretation

The above table depicted that 95.8% had experience one form of flood event or the other in time past with well over 77% indicated were directly affected by the 2022 while about 53% have experienced more than two flood events in recent times from 2010.

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Further on the data presented in the table on question 18, the respondents with a proportion of about 75% consented that the flood brings to bear financial and non-financial losses on the households resulting to great economic losses both the micro households and macro-economic of the state.

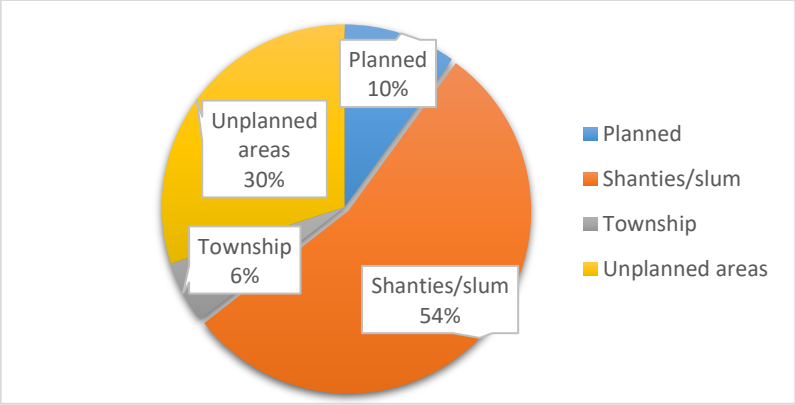
On the severity of the effect of flooding in 2022 responses on the degree of severity indicated severe, much severe and very much severe aggregating 94% (355 respondents) inductively meaning the impacts of floods were devastating relative to its widespread effect on humans and non-humans.

Graphical Analysis of Household's Flood Vulnerability

In this analysis, bar chart, pie chart and simple percentage used to compute the proportion of flood-risk household's data to describe the remote causes of flood vulnerability of flood-risk households in Bayelsa state.

Graph 4.2.1: Pie Chart Showing Flood-risk Households Settlements

Using question 21 in the Questionnaire (How would you describe the area you live in?)



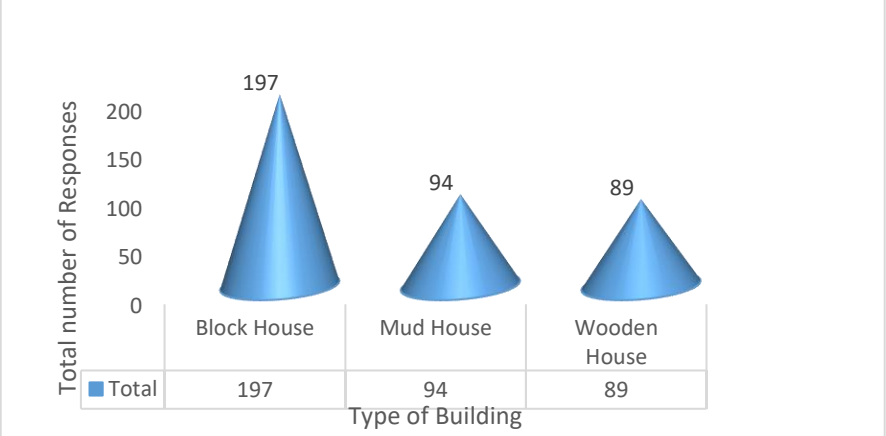
Source: Fieldwork, 2024.

Result Interpretation:

Indicated 207 respondents representing (54%) lived in an area categorized as slums while 114 respondents corresponding to (30%) resided in an unplanned settlement and 59 respondents proportionate to (16%) lives planned or township settlements. Informing a chunk of 84% of the households are living within settlements that are unplanned and below acceptable settlement standards.

Graph 4.2.2 Bar Chart showing Flood-risk Households Housing Types

Using question 22 in the Questionnaire (What type of building/housing do you live in?)



Source: Fieldwork, 2024

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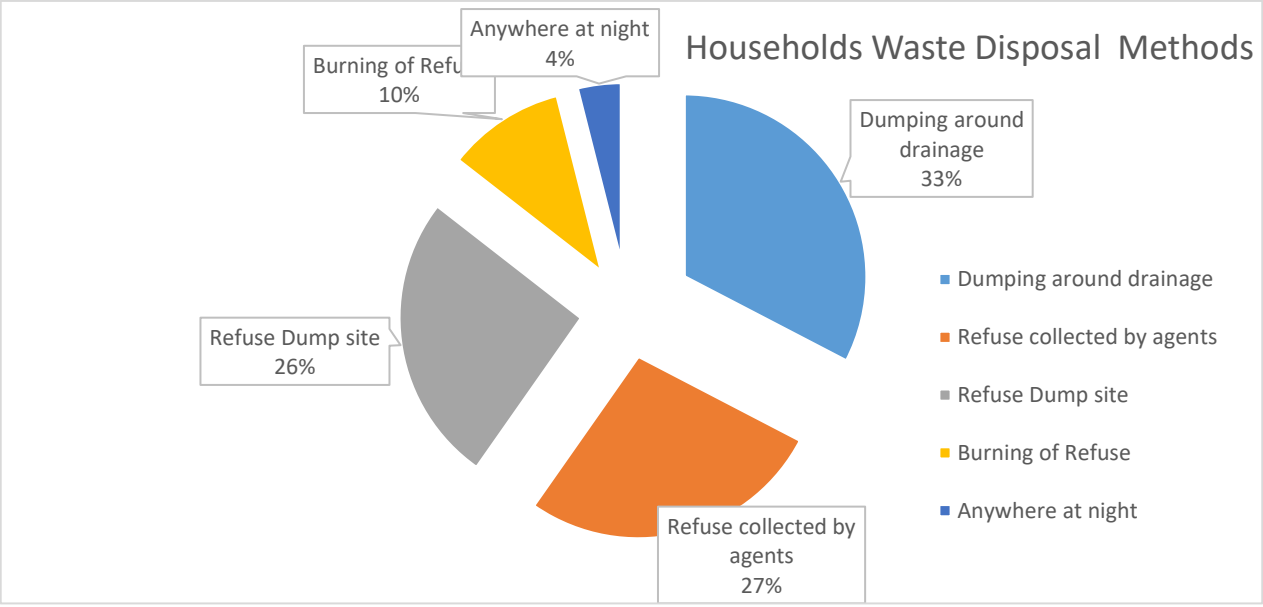
Result Interpretation:

On the housing type, the data shown in the bar chart graphically revealed that Flood-risk Households living in wooden houses popularly known as batcher were 89 representing 23.4% and those in Mud or Clay houses were 94 representing 24.7% while 197 (51.8%) Households were living in blockhouses.

Graph 4.2,3: Pie Chart showing Flood risk Households Method of Waste Disposal

Using question 24 in the Questionnaire (How does your household dispose waste and refuse?)



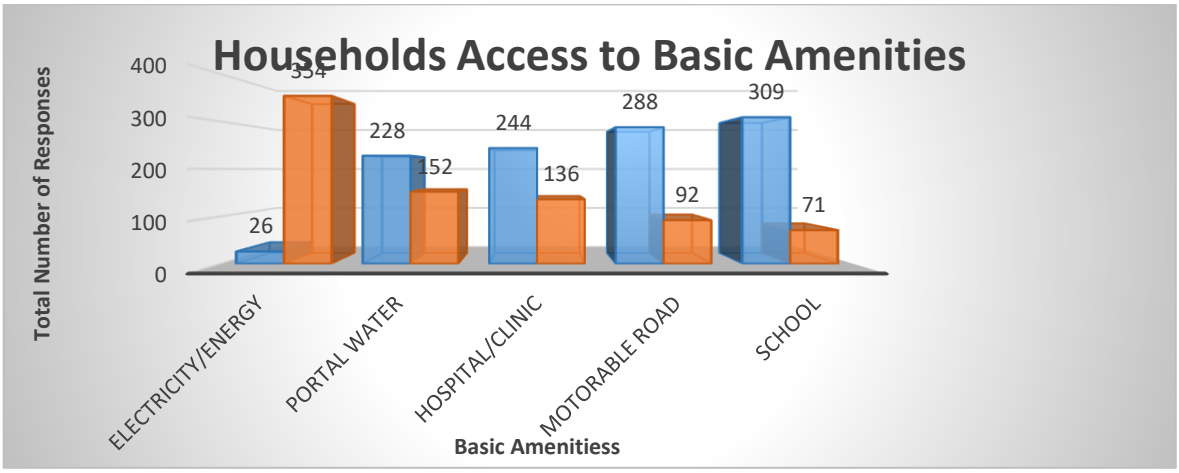
Source: Research Field Work 2024

Result Interpretation

On the method of waste disposal available to flood-risk households, 4% of the household's drop-off their waste at night anywhere around and 10% simply burn their refuses while 26% representing (98) respondents were dumping their wastes at a dumpsite. However, 33% representing (124) respondents indicated that they usually dumped their wastes around drainages while 27% representing (103) have refuse agents collating their waste and properly disposed to designated waste sites.

Graph 4.2.4: Bar Chart Showing Household's Access to Social Amenities

Using question 25 in the Questionnaire (Does your household have access to basic amenities?)



Source: Research Field work 2024

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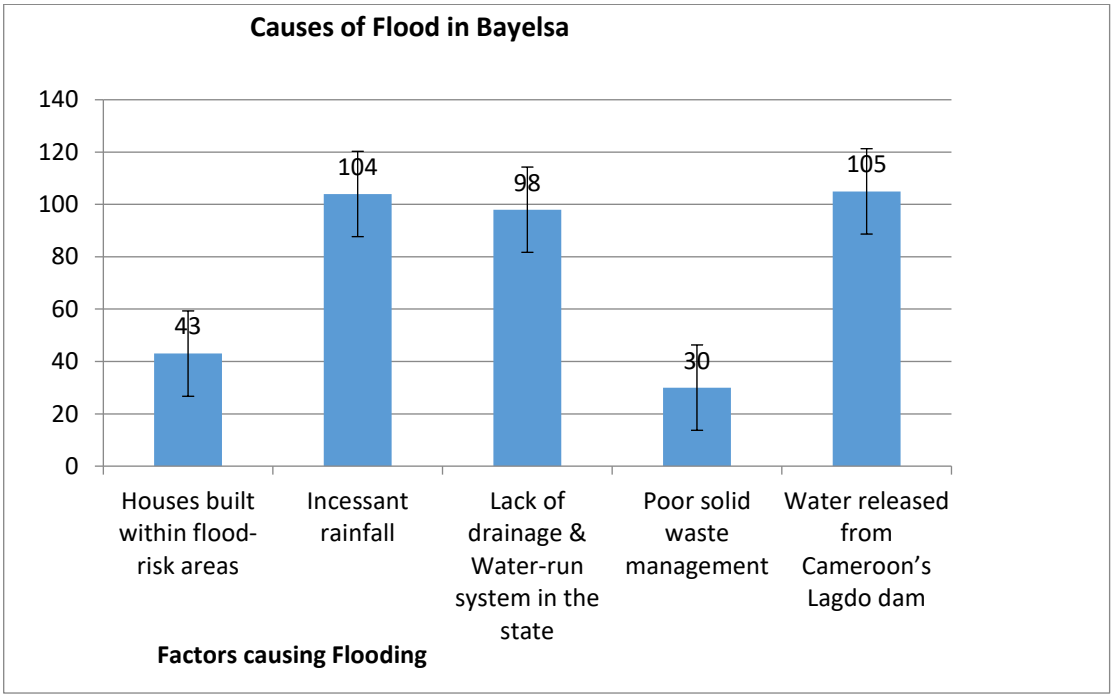
Result Interpretation

The bar chart 4.2.5 aptly states the basic and social amenities available to households in the state. Succinctly, the data explains that most of the flood-risk households indicated that basic amenities such as portable water, clinical and medical services, road and education facilities are easily accessible within and around the neighbouring communities while electricity and other energy sources is almost not available and inaccessible to flood-risk households and the entire state.

Graph 4.2.5: Bar Chart Showing the Remote Causes of Flooding in Bayelsa State.

Using question 26 in the Questionnaire (What are the major causes of flood in your community and Bayelsa in general?)



Source: Research Fieldwork, 2024

Result Interpretation

The chart indicated that the incessant heavy rainfall with (105), the released of water from Cameron Lagdo Dam (104) and the lack of quality drainages system and good water run-way (98) among the 380 sample proportionally represented 27.6%, 27.3% and 25.9% respectively. Inductively, the causes of flood are both natural and man-made comprises of the consistent heavy down pour resulting from the effects of climate change and global warming in the region been experienced in recent times, poor drainages channelization, the non-existence of good water-run way and sudden released of water from Dam in and around neighboring countries. Other causes may include poor solid waste management system, houses built within flood flash point and on water-run ways obstructing flow of water resulting into devastating flood.

Testing of Research Hypotheses

Testing of Hypothesis I

Null Hypothesis (Ho)

"There is no significant relationship between the underlying causes of flood vulnerability and the high impact of flooding among flood-risk households in Bayelsa".

Question 29 was used to test the validity of the Hypothesis stated above

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Contingency Table 4.2.1: Testing of Hypothesis I

Underlying Causes Of Flood	**Frequency of Response Options**		**Total**
	YES	**NO**	
Neighboring countries taking insufficient measures before releasing water	**23**	**65**	**88**
Global climate change causing intensified rainfall	**70**	**20**	**90**
Poor town planning and building in high-risk areas	**42**	**8**	**50**
Lack of mitigation measures (Clearance of drainages, Dumping of wastes on water run-ways)	**35**	**50**	**85**
Poor warning systems and government intervention	**40**	**27**	**67**
Total Frequency of Responses	**210**	**170**	**380**

Computation of X^2

Fo	Fe	Fo-Fe	$(Fo-Fe)^2$	$\frac{(Fo-Fe)^2}{Fe}$
23	**48.63**	**-25.63**	**656.90**	**13.51**
65	**39.32**	**25.63**	**656.90**	**16.69**
70	**49.75**	**20.15**	**406.02**	**8.16**
20	**40.26**	**-20.26**	**410.47**	**10.20**
42	**27.63**	**14.37**	**206.50**	**7.47**
8	**22.37**	**-14.37**	**206.50**	**9.23**
35	**46.97**	**-11.97**	**143.28**	**3.05**
50	**38.03**	**11.97**	**143.28**	**3.77**
40	**37.03**	**2.97**	**8.82**	**0.24**
27	**29.97**	**-2.97**	**8.62**	**0.24**
$X^2 = \sum\frac{(Fo-Fe)^2}{Fe}$				**72.61**

Research Result:

Calculated $X^2 = 72.61$

Critical value = 9.48

Level of significance = 0.05

Research Decision:

The calculated X^2 **72.61** is greater than critical value X^2 9.48 at a significance level ά 0.05

Data are statistically significant at 5% sampling error. Hence, the research decision, that there is a significant relationship between the variables and we would reject the (Null Hypothesis **H_o**) and accept the (Alternative Hypothesis **H_A**)

Statistical Inference

"There is significant relationship between the underlying causes of flood vulnerability and the high impact of flooding among flood-risk households in Bayelsa"

Testing of Hypothesis II

Null Hypothesis (Ho)

"There is no significant relationship between flood warning and the livelihood preparedness of flood-risk households in Bayelsa.

Question 33 was used to test the validity of the Hypothesis stated above

Contingency Table 4.2.2 Testing of Hypothesis II

Household Livelihood Preparedness to Flood Warnings	**Frequency of Response Options**		**Total**
	YES	**NO**	
Household relocation and forfeiture of livelihood	**42**	**86**	**128**
Seek alternative source of livelihood (petty trading and artisans work)	**20**	**56**	**76**
Trades to solve flood problems and earn money (Canoe carving, selling flood related items, ferrying and conveying of commuters etc)	**94**	**12**	**106**
Dependent on palliatives, government interventions, Private Donors and Public Goodwill for livelihood	**41**	**29**	**70**
Total Frequency of Responses	**197**	**183**	**380**

Presentation of the Expected Frequency (F_e) of the Responses for Hypothesis II

Computation Of X^2

Fo	Fe	Fo-Fe	$(Fo-Fe)^2$	$\frac{(Fo-Fe)^2}{Fe}$
42	**66.36**	**-24.36**	**593.41**	**8.94**
86	**61.64**	**24.36**	**593.41**	**9.63**
20	**39.40**	**-19.40**	**376.36**	**9.55**
56	**36.60**	**19.40**	**376.36**	**10.28**
94	**54.95**	**39.05**	**1524.90**	**27.75**
12	**51.05**	**-39.05**	**1524.90**	**29.87**
41	**36.29**	**4.71**	**22.18**	**0.61**

29	**33.71**	**-4.71**	**22.18**	**0.61**
$X^2 = \sum\frac{(Fo-Fe)^2}{Fe}$				**97.27**

Research Result:

Calculated $X^2 = 97.27$

Critical value =7.81

Level of significance = 0.05

Research Decision:

The calculated X^2 **97.27** is greater than critical value X^2 7.81 at a significance level ά 0.05

Data are statistically significant at 5% sampling error. Hence, the research decision, that there is a significant relationship between the variables and we would reject the (Null Hypothesis $\mathbf{H_o}$) and accept the (Alternative Hypothesis $\mathbf{H_A}$)

Research Inference

"There is a significant relationship between flood warning and the livelihood preparedness of flood-risk households in Bayelsa"

Testing of Hypothesis III

Hypothesis III

Null Hypothesis (Ho)

"There is no significant relationship between flood warning and the housing preparedness of flood-risk households to flood displacement in Bayelsa".

Question 37was used to test the validity of the Hypothesis stated above

Contingency Table 4.3.3 Testing of Hypothesis 1II

Household Displacement Preparedness to Flood warning	**Frequency of Response Options**		**Total**
	YES	**NO**	
Moving into uncompleted houses and IDP Camps	**46**	**10**	**56**
Reconstruction of house/Residence before the flood as a resistance against	**80**	**29**	**109**
To relocate families within & out of town	**47**	**21**	**68**
Raising up valuables, properties and live with others	**29**	**16**	**45**
To be housed by relatives & goodwill neighbours	**18**	**84**	**102**
Total Frequency of Responses	**220**	**160**	**380**

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Computation Of X^2

Fo	Fe	Fo-Fe	$(Fo-Fe)^2$	$\frac{(Fo-Fe)^2}{Fe}$
46	**32.42**	**13.58**	**184.41**	**5.69**
10	**23.58**	**-13.58**	**184.41**	**7.82**
80	**63.11**	**16.89**	**285.27**	**4.52**
29	**46.89**	**-17.89**	**320.05**	**6.83**
47	**39.37**	**7.63**	**58.22**	**1.4**
21	**28.63**	**-7.63**	**58.22**	**2,03**
29	**26.05**	**2.95**	**8.70**	**0.33**
16	**18.95**	**-2.95**	**8.70**	**0.33**
18	**59.05**	**-41.05**	**1685.10**	**28.05**
84	**42.95**	**41.05**	**1685.10**	**39.23**
$X^2=\sum\frac{(Fo-Fe)^2}{Fe}$				**97.38**

Research Result:

Calculated $X^2 = 97.38$

Critical value = 9.48

Level of significance = 0.05

Research Decision:

The calculated X^2 **97.38** is greater than critical value X^2 9.48 at a significance level ά 0.05

Data are statistically significant at 5% sampling error. There exist relationship between the variables, this means that we should reject the (Null Hypothesis $\mathbf{H_0}$) and accept the (Alternative Hypothesis $\mathbf{H_A}$) "There is a significant relationship between flood warning and the housing preparedness of flood-risk households to flood displacement in Bayelsa"

Statistical Inference

The research result indicated that early Flood warning has significant relationship with the housing preparedness of the flood-risk households in Bayelsa.

Interpretation of Findings

Based on the empirical analysis of this study, the following findings was made;

- The study revealed that flooding is majorly caused by extraordinary heavy rains and climate change in Bayelsa state aggravated by factors such as poor physical planning resulting in the increased of unplanned settlement patterns in the state. Other drivers identified as responsive to intensify the daunting challenges

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of flooding were;

a. The poor design and lack of maintenance of drainage system,

b. Rapid population growth stimulating high consumption with an unstainable waste management practices in the state.

c. Flooding in the state is further triggered by a continuous release of excess water from artificial reservoirs in neighboring countries without adequate preparedness uptake and remedial response plan by stakeholders

- There exists a causal-and-effect relationship of flood warnings and preparedness uptake actions among flood-risk households to mitigate the effects of incessant flood occurrence and as well reduce their vulnerability to flooding challenges in Bayelsa state.

- Flood warnings significantly influences a degree of awareness among the flood-risk households and in turn enhance their capability to create simple flood contingency plans toward ensuring flood disaster adaptation, vulnerability reduction and short-term mitigation.

- Inductively, poverty amongst flood-risk households aggravate their vulnerability to flooding, hence the households can only adopt less costly measures in preparing for flood that are less defensive and not viable enough to reduce, mitigate, prevent and control flood.

- Flood-Affected Persons (FAPs) often raised up their valuables and household properties beyond speculated water level and further moving family members to either designated IDP camps, goodwill neighbours housing or family members and uncompleted housing for a temporary stay as uptake to secure their households,

- Flood warnings causes panic and fear among flood-risk households and this trauma is further aggravated by lack of livelihood options with the consequential effect of the lack of emergency housing support for majority of Flood-Affected Persons (FAPs) during flooding in the state. This leaves the FAPs and majority of vulnerable households with little or no chances to enhance their resilience strategies against predicted flood hazards.

- The study therefore theorized that the income status and livelihood choices of flood-risk households significantly contribute to the preparedness uptake for flood disaster adaption and mitigation strategies.

- This study empirically postulates that flood-risk households are more likely to suffer in the event of another flooding owing to their poor socio-economic status, which incapacitate them in engaging in household holistic preparedness measures, which would have helped them build an effective flood resilience against flood upsurge.

CONCLUSION

Flood disaster has been perilous to the people, their communities and institutions especially the Niger Delta region of Nigeria. The recurring flood decimal along the coastal communities in Nigeria particularly Bayelsa state and a few other states lying within the coastal region should be considered a national phenomenon. Etunonovbe (2011) clearly stated that at least 20 per cent of the Nigerian population is at risk from one form of flooding to another. The hazards associated with flood are generally link to poor urban planning, ineffective or lack of drainage system and climate change especially in increased frequency and intensity of rainfall (Ogunbodede, 2014). This research work is a call-up to all stakeholders including the corporate bodies and the government at all level to address the challenges of flood to collaborate and engage with the local communities to harness resources and enhance local capacities for preparedness strategies. This approach guarantees an effective preventive and protective response to prevent, mitigate and control flood, which ultimately would affect socio-economic aspects of the dilemma given considerable attention.

Summary

Unarguably, flood has affected and displaced more people than any other disaster and has caused more suffering with a ripple effect on the livelihood and activities of communities especially those settled along the riverine and coasted region of Nigeria. In many African countries like Nigeria, flooding has impoverished hundreds of thousands of people through displacement from their homes and caused loss of tangible properties. According to UN-Water (2011), worldwide, there has been rapid growth in number of people killed or seriously impacted by flood disasters. The impact of flood is said to be felt more by the urban poor in a way that recovery is unlikely to be achieved without external aid (Blaikie, 1994).

It is pertinent to note that several studies on the menace of flooding in Nigeria have opined that the country overtly lacks the commitment and political goodwill to guarantee her citizens well-being in the event of environmental disaster and emergency like flooding challenge as a result bad governance. There is a consistent attitude of negligence of government with a carrot and the stick approach to issues of social problems and flood is one of such social menace that have been given lip attention and this has been one of contributing factors to why flood remains unabated and uncontrollable despite early warnings.

The relevance of this study lies within the premise of the findings that modern methods of managing flood has shifted from disaster response mechanisms to preparedness and mitigation approach that is sustainable to reducing the otherwise grave consequences of incessant flooding which impacts on the livelihood of the people particularly flood-risk households being susceptible to untold hardship, hunger and poverty. The need for preparedness at all levels of governance for the effective management of flood in Bayelsa state is of paramount importance. This means preparedness action if not taken seriously spells grievous consequences on the households, livelihood of entire population that includes agricultural activities, commercial and financial sectors as well as the infrastructure and the environment as a whole.

Summarily, these research findings imminently served as a clarion call to all households, communities and government at all tiers of governance to collaboratively plan, manage and coordinate all efforts and enshrine prevention mechanism, mitigation and emergency response plan and directly invest in all the complexity it brings to bear on the people.

RECOMMENDATIONS

This study recommend as follows;

1. Flood walls and levee should be built in communities bordered by coastal rivers and sea as this will help confine water flow and uprising within predetermined channels and level thereby reducing flood incidences,

2. An effective and efficient waste and sewage disposal management system is urgently required in the state to cushion the effects of high population density and high consumption been witnessed which no doubts result into large wastages with no recycling mechanism, hence indiscriminate disposal of wastages is indispensable leading to unending flooding problem,

3. At the community level, a collaborative effort be made by all stakeholders within the communities with high rate of flow of storm water encroachment to construct an embankment to breakdown storm water so as to reduce the water inundation resulting into flood,

4. An immediate construction of the downstream culverts in Bayelsa state especially in communities known as flash-point and highly probable. The culverts must be designated and designed to linked and properly aligned with the drainage systems to ensure effective runoff of water discharge and self-cleaning of the drainage systems in towns and communities so linked to the culverts,

5. Effective drainage systems within and around the eight Local Government capitals of Bayelsa State be constructed to aid the channelization of water from the flood prone areas to outlets as a check to reduce

peak flow stages of flood and divert excessive flow.

6. Households Flood Proofing: Where the inundation of flood water is relatively low (nominally less than 700mm), Households can install solid fences, raising windows, sealing doors with 'stop boards' and limiting sewage contamination through reflux or backflow valves which are possible ways to keeping flood waters out of homes,

7. Town planning laws should be properly enforced and strictly adhered to as this will go a long way to curbing the menace of floods. The Bayelsa State Government should always plan ahead of the population to avert the occurrences of unplanned houses littering flood plain areas. They should strongly prohibit certain types of buildings and all forms of human activities in flood risk zones.

Further Recommendation for Bayelsa State Government

The following three recommendations if implemented by the State Government will no doubt articulate a positive change in addressing the flooding menace in Bayelsa state.

Flood Awareness and Understanding

The Bayelsa state GIS should take responsibility in monitoring tide and rainfall forecasts and alert residents when the conditions that may result in flooding are evident. BGIS must synergize with other agencies to engage residents in an awareness campaign against indiscriminate building and settlements in flood prone zones and this will ensure some level of mitigation and resilience. Communities in collaboration with the newly established Flood and Erosion Control Directorate must synergize to create awareness among residents of certain territories and areas marked-out as highly probable to flooding within the state. This is to enhance the resident's knowledge of flood history and developing an understanding of how floods behave in such areas and as well provide them with the ability to respond on time of an impending flood to reduce their vulnerability.

Flood Contingency and Response Plan –

The Government at the state level should support the local government at the grassroots in providing an emergency preparedness plan with emergency response kits that would get flood victims through the first 72 hours of a flood event. They should keep emergency supplies gathered and stored in a portable and flood/rodent-proof container or warehouse with food, water, safety and hygiene supplies for flood-affected households. The response plan should be transparent, all-inclusive and to be managed by professionals with proven integrity to strategically distribute the kits without discrimination, resentment and political undertone.

The response actions should include the activation of an emergency operations center, evacuating threatened populations, opening shelters and providing mass care, emergency rescue and medical care, firefighting, and urban search and rescue and in all of these response actions community leaders and their representatives must be involving in the coordination and management of resources utilizing the Incident Command System.

Flood Disaster Recovery Plan-

The recovery phase begins immediately after the threat to human lives and the goal of the recovery phase is to bring the affected area back to some degree of normalcy, including the restoration of basic services and the repair of physical, social and economic damages. A flood disaster recovery measures be advocated and implemented across the eight LGAs of the state and this should consist of activities that continue beyond the contingency and emergency period. Typical recovery actions include debris cleanup, financial assistance through cash transfer to individuals and their households, rebuilding of roads and bridges and key facilities, and sustained mass care for displaced human and animal population.

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