

Flood Hazard and Prevention Strategies Towards Sustainable Economic Development and Proper Community Planning in Yenagoa, Bayelsa State, Nigeria.

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ABSTRACT

The study examined the strong relationship between residents' locations, economic status, and flood prevention strategies. The study adopted survey research design imploring the use of primary and secondary sources of data. The primary data were generated through the use of 330 copies of questionnaires administered to 330 randomly selected respondents in the study area. Data were analysed using descriptive statistics such as simple percentage while a Pearson Product moment Correlation (PPMC) statistical technique was used to test hypothesis. The data analysis revealed that occupation significantly influences how residents respond to flood hazards. The P-value of 0.000 was lower than the Alpha level of 0.05. The result showed that where people live, their economic situation, and how they try to prevent flood damage are all connected. Some of the ways people protect their homes include building raised pavements, raising the level of their floors, using small bridges to cross water, and filling their yards with sand. The study also suggests that people's behaviors and choices about flood protection might change depending on how much money they have because some solutions cost more than others. However, the study further warns that business owners, property developers, farmers, fishermen, and traders remain highly vulnerable to severe floods, particularly when planning is inadequate or financial resources are limited.

Keyword: Flood, prevention strategies, sustainable economic development, Flood hazards, proper Community planning, Yenagoa.

INTRODUCTION

Over the past twenty years, the rapid growth of populations coupled with significant economic transformations has driven cities and urban centers to become the primary habitats for humans worldwide. This urbanization has brought with it a range of environmental challenges, notably urban flood hazards, which affect both developing and developed economies. It is important to recognize that cities and towns already bear the brunt of natural disasters such as flooding, with every corner of the landscape falling within a drainage basin or another (Oku, 2011). Many of the world's largest urban areas are situated along coastlines, rivers, and floodplains—regions that are inherently more vulnerable when natural disasters occur. As urban areas expand to meet the increasing demand for housing, infrastructure, industrial growth, tourism, and commercial activities, natural drainage patterns are often ignored or inadequately analyzed and utilized within flood-prone zones. This neglect has resulted in frequent and devastating urban flood hazards, which are more alarming today than ever before. Numerous researchers—such as Akintonla (1978, 1994), Ayoade & Akintola (1978), Enerd (1981), Olaniran (1983), Oriola (1994), Babatola (1996), Ologunorisa (1999), and Oku et al. (2011)—have critically examined flood problems, perceptions, response strategies, frequency, and adjustment mechanisms in various Nigerian towns. Their findings consistently show that particular attention has been given to how individuals perceive and adapt to flood hazards, with these responses often influenced by land use patterns on floodplains and the severity and frequency of flooding events. Key factors contributing to flooding in Yenagoa include channel modifications driven by urbanization and the indiscriminate disposal of refuse into drainage channels, which obstruct water flow and exacerbate flooding problems (Odermcho, 1985; Oku, 1997; Oyegun, 1997). This study aims to

contribute further to the body of knowledge on flood management by specifically assessing the adjustment strategies employed by residents of Yenagoa's flood-prone areas. By doing so, it seeks to inform policymakers and urban planners about effective measures and community-based solutions for mitigating flood hazards. Ultimately, understanding these adjustment mechanisms is essential for developing sustainable flood control strategies that are culturally appropriate and physically feasible, ensuring the safety and resilience of communities in Yenagoa amidst increasing environmental challenges. In the context of Yenagoa, a city characterized by diverse cultural practices and varying physical landscapes, residents continue to live and work in flood-prone areas such as Igbogene, Swali, Ebogoro, and Azikoro. These neighborhoods encompass mixed land uses—including commercial, industrial, and residential zones—making the understanding of local adjustment strategies particularly vital. While previous studies have explored community attitudes toward floods and adaptation mechanisms, they often involved complex and extensive methodologies. Consequently, there remains a need for targeted research to inform flood mitigation efforts in Yenagoa by understanding how residents perceive, respond to, and cope with flood risks. Studies conducted in other regions further emphasize that perception and adjustment strategies are not uniform across different spaces. For example, Leight and Kwaisim (1983) analyzed the attitudinal responses of flood victims in Malaysia, while Erickson (1970) carried out similar research in New Zealand, and Oya (1970) focused on Japan. These studies demonstrate that both perception and coping mechanisms vary significantly depending on local contexts, culture, and physical terrain. Therefore, it is crucial to understand that flood hazards and responses are not universally identical; instead, they are shaped by specific cultural, technological, and geographical factors. It is also noteworthy that cultural orientations within different regions influence how communities perceive and respond to flood hazards. Variations are evident across space, as people live and work in areas prone to flooding. White (1973) focused on urban floodplain dwellers, while Burton et al. (1964) examined rural communities in parts of the United States, emphasizing attitudes, perceptions, and adjustment behaviors related to flood risks. These studies highlight the importance of understanding human responses to flood hazards, which vary based on cultural, social, and physical factors. Historically, the study of natural hazards, including floods, is not new. Pioneering research by scholars such as Burton and Kates (1964), Burton, Kate, and White (1968), Mitchell (1981), and others (cited by Ekuase&Mogekwu, 2021), has helped elucidate the trends and characteristics of natural hazards. The origins of such research trace back to the United States in the 1930s, where careful observation of urbanizing river catchment areas revealed significant challenges in flood management and control. These insights led to the enactment of legislation such as the Flood Control Act of 1936, which was designed to reduce flood hazards through structural and non-structural measures.

The Study Area

The southeast trade wind, which originates over the moist South Atlantic Ocean, carries significant moisture and influences Nigeria's weather, particularly during the rainy season, which spans from February to November. During this period, the moist south-west wind system predominantly brings rainfall to the region, contributing to its lush vegetation and humid climate. Conversely, the northeast trade winds, originating from the hot and arid Sahara Desert, bring dry conditions as they pass over the desert before reaching Nigeria. These dry winds tend to influence the northern parts of Nigeria, including Bayelsa's coastal communities, bringing hot and dry weather during certain periods. The climate system in Nigeria, especially the rainfall pattern, is largely influenced by the interaction of two dominant pressure and wind systems. These are generated by two dynamically sustained sub-tropical high-pressure cells; one situated over the Azores Archipelago off the coast of North Africa and the other over the St. Helena Islands near the coast of Namibia. These high-pressure centers, or anticyclones, persistently form and influence the regional atmospheric circulation, driving the northeast trade winds and southeast trade winds over the South Atlantic Ocean. These wind patterns, originating from their respective pressure systems, traverse the region of Bayelsa, shaping the climatic and weather conditions experienced there. The soil composition within the study area consists of various superficial deposits that overlay thick layers of tertiary sandy and clayey formations, some of which extend to depths exceeding 100 meters in certain locations. These geological features influence the region's land use, agriculture, and drainage patterns, further shaping the environmental and socio-economic landscape of Yenagoa LGA. The geographical location of Bayelsa State near the equator ensures it is endowed with abundant sunshine throughout the year. The sun's position remains nearly overhead for much of the year, resulting in longer daylight hours. However, the overall solar radiation reaching the surface is somewhat moderated by cloud cover, a consequence of the region's coastal environment. This

cloudiness, along with other climatic influences such as the Harmattan winds and the effects of local vegetation, contributes to slight variations in temperature on daily, monthly, and annual scales. The designated study area is Yenagoa Local Government Area (LGA) situated within Bayelsa State, as illustrated in Figure 1. Geographically, this region is positioned along latitudinal lines ranging from approximately 4°48'00" North to 5°24'10" North, and longitudinally between 6°12'00" East and 6°39'30" East. It shares borders with Rivers State to the north and east, Kolokuma/Opokuma LGA to the northwest and west, Ogbia LGA to the southeast, and Southern Ijaw to the southwest. As per the 1996 population estimate, Yenagoa LGA had an approximate population of 352,285 residents.

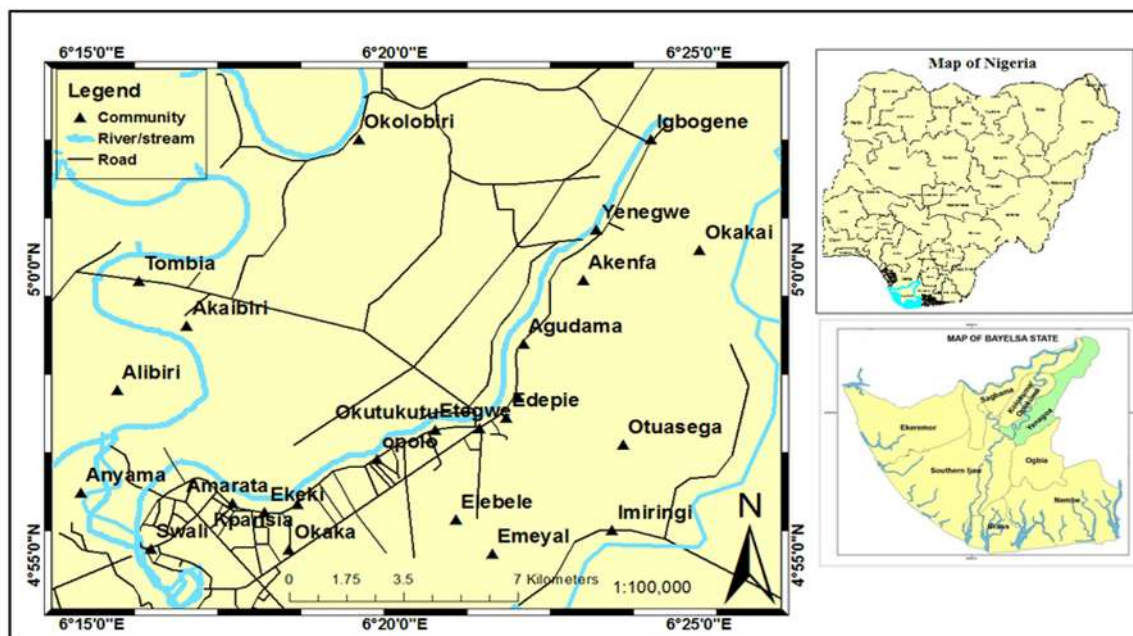


Figure 1: Map showing the study area in Yenagoa, Bayelsa State

METHODOLOGY

We gave out 350 questionnaires, which are like questionnaires or forms, to people living in areas that sometimes get flooded in places called Tombia, Igbogene, Swali, Akaibiri, Okolobiri, Yenegwe, and Amarata. We picked who to give the questionnaires to using a fair way called simple random sampling, where we used a special table of numbers to choose randomly. We gave these forms to people living in those areas. Out of the 350 we gave out, 330 people filled them out and returned them back to us. That means most of the people we asked, about 94 out of 100, answered our questions.

Data Analysis

Data for the study were analysed using table and simple percentages. Hypotheses were tested using Pearson Product Moment correlation (PPMC). Occupation (socioeconomic factor) and Flood strategy data were coded in SPSS in order to compute a *true* correlation coefficient *r* and *p*-value statistically

RESULTS

Table 1: Sex structured of respondents

Sex	Number	Percentages
Male	190	57.6
Female	140	42.4
Total	330	100

Based on the table, we can see that about 58% of the people who answered the questions were boys, and about 42% were girls. These groups gave us important information about the problem we studied.

Table 2: Tenancy states of respondents

Tenancy status	Number	Percentages
Tenants	280	84.8
Landlords / Landlady	50	15.2
Total	330	100

Table 2 tells us that about 85 out of 100 people are tenants, meaning for every 1 landlord, there are about 5 tenants in Yenagoa.

Table 3: Occupation characteristics of flood-prone occupants

Occupation	Number	Percentages
Students	20	6.0%
Business	100	30.3%
Civil Servants	180	54.6%
Farmers	30	9.1%
Total	330	100

Table 3 shows that about half of the people we talked to are civil servants (people who work for the government). About one-third are business people, and the remaining few are mostly students and farmers.

Table 4: Do people know about floods before they move to the new place.

Questions	Number	Percentages
Born in this area	50	15.2
Knew about flood risk before moving to this area	125	37.9
Didn't know about flood risk before moving to this area Total	155	46.9
Total	330	100

Table 4 tells us that nearly half of the people, about 47 out of 100, didn't know about the risk of floods before they moved into their homes. About 38 out of 100 people knew about floods but decided to live there anyway. Only small groups, 15 out of 100, were born in that area and already knew about it.

Table 5: Individual Perception of Annual Flood Frequency Averages

Average	Annual Perception rate	Percentages
1 – 5	102	30.9
6 – 10	210	63.6
11 – 15	16	4.9

15 and above	2	0.6
Total	330	100

Table 5 shows that about 210 dwellers (63.6%) perceive between 6 and 10 flood hazards annually. This indicates that the flood menace is high in Yenagoa, given the high perception rate.

Table 6: Adjustment strategies to flood hazards

Adjustment strategy	Number	Percentages
Wooden footbridge	104	31.5
DPC level of (6–9) blocks	80	24.2
Raised pavement	111	33.6
Sand filling of premises	35	10.9
Total	330	100

Table 6 shows how people in Yenagoa deal with the problems caused by floods. About 31.5% of the people use wooden foot bridges to help them cross flooded areas. Some residents, making up 10.7%, fill their yards with sand to stop the floodwaters from bothering them. Additionally, 33.6% of the people build raised walkways or pavements so they can walk more easily even when it's flooded.

Testing of Hypotheses

H₀ (Null Hypothesis): There is no significant relationship between occupation (Socio-Economic factor) and flood response strategy.

H₁ (Alternative Hypothesis): There is a significant relationship between occupation and flood response strategy.

Data used for statistical computation are reproduced below:

Table 7: Occupation characteristics of flood-prone occupant's data for statistical computation

Occupation	Number	Percentages
Students	20	6.0%
Business	100	30.3%
Civil Servants	180	54.6%
Farmers	30	9.1%
Total	330	100

Table 8: Adjustment strategies to flood hazards data for statistical computation

Adjustment strategy	Number	Percentages
Wooden footbridge	104	31.5
DPC level of (6–9) blocks	80	24.2
Raised pavement	111	33.6
Sand filling of premises	35	10.9
Total	330	100

Table 7: Correlation Matrix between Occupation and Flood Adjustment Strategies

Variables	Mean (%)	N	r	p-value	Remark
Occupation vs. Flood Adjustment Strategy	-	330	-0.825	0.000	Significant

The result in Table 7 above shows a strong negative correlation ($r = -0.825$, $p < 0.05$) between occupation and flood adjustment strategies. This implies that occupation significantly influences how residents respond to flood hazards. Since calculated p-value of 0.000 is lower than 0,05 significant level, the null hypothesis which state that there is no significant relationship between occupation (a socioeconomic factor) and flood response strategy is rejected, and the alternate hypothesis H_1 which state that There is a significant relationship between occupation and flood response strategy is accepted. Hence, occupation significantly influences the type of flood response measures adopted by residents in flood-prone communities.

Specifically, civil servants and business owners, who represent higher-income and more stable socio-economic groups, tend to adopt cost-intensive and technically improved flood control measures such as raised pavements and DPC-level reinforcements. In contrast, students and farmers, with lower or unstable income levels, rely more on low-cost and improvised coping mechanisms, such as wooden footbridges or sand filling of premises.

DISCUSSION

Experts who studied floods before said that when people see floods as more or less likely to happen, it changes how they prepare for them. They also found that people who have more education and money usually understand floods better and know what to do to stay safe.

Implications for Community Planning and Economic Development

If communities don't think about floods and how to stay safe from them when planning how to build and develop, many people and things could get hurt or damaged. This includes houses, people who live and work there, traditional indigenous owners, insurance companies, builders, farmers, fishermen, tourists, environmental groups, and others who enjoy the area. Without good plans, these floods can cause a lot of trouble and make things worse. It's very important for governments to work together and have good rules to handle big storms and floods, especially in places near the coast that are very vulnerable. But because many different laws and responsibilities from local, state, and national governments can get confusing, it's hard to make sure everyone is doing what they should to protect these coastal communities.

Again, flood risk management policies must incorporate socio-economic variables—such as occupation, income, and education—into vulnerability assessments. Programs should prioritize livelihood empowerment and microfinance support to enhance adaptive capacity among low-income groups. In terms of Rural and urban planning, Planners should align flood mitigation efforts with urban land-use zoning and rural livelihood patterns, ensuring that informal settlements and farming communities are equipped with the infrastructure and technical knowledge to manage recurrent flooding.

Correlation Analysis of Socio-Economic Factors and Flood Response

The study critically looks at the relationship between occupation (a socioeconomic factor) and flood adjustment strategies among residents of flood-prone areas using the Pearson Product Moment Correlation (PPMC) technique. Data from Tables 3 and 6 were coded numerically to allow correlation analysis between the two categorical variables. The correlation analysis in Table 7 reveals a strong negative relationship ($r = -0.825$, $p < 0.05$) between occupation and flood adjustment strategies. This indicates that occupation significantly influences the type of flood response measures adopted by residents in flood-prone communities, but the relationship is inverse in direction.

Specifically, civil servants and business owners, representing relatively higher socioeconomic groups, are more

likely to adopt structured and cost-intensive adaptation strategies such as raising pavements and elevating DPC levels (6–9 blocks). Conversely, students and farmers, with lower income stability, tend to rely on less expensive or improvised coping mechanisms, such as wooden footbridges and sand filling of premises. This pattern mirrors evidence from other flood-prone contexts globally. For example, in Accra, Ghana, wealthier households sometimes employ private dredging of drainage channels or build more permanent structural modifications, whereas lower-income residents in marginal informal settlements build temporary structures out of lighter, cheaper materials or rely on community-led, ad hoc spillways (Owusu et al., 2021).

This finding corroborates Adelekan (2016) and Nkwunonwo et al. (2020), who observed that socioeconomic capacity and livelihood type are key determinants of adaptive behavior to flood hazards in developing nations. It further emphasizes that flood resilience is not merely a function of environmental exposure but is deeply intertwined with social equity and economic empowerment.

CONCLUSION

This study found that how often people think floods happen, their economic situation, and how they deal with floods are all connected for people living in areas that are at risk of flooding in Yenagoa. These things also affect how the city looks and how people manage to work and live in places that can flood.

The PPMC analysis statistically validates that socio-economic characteristics—particularly occupation—significantly affect flood response behavior. Therefore, effective flood risk management programs in developing nations should integrate income empowerment, livelihood diversification, and awareness education. Strengthening the economic capacity of vulnerable groups would enable equitable access to sustainable and effective flood mitigation strategies.

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