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Public perception of communities towards flood vulnerability and resilience in Bayelsa state, Nigeria

Berezi OK[1], Obafemi AA[2], Nwankwoala HO[3]
[1, 2, 3, 4] Institute of Natural Resources, Environment and Sustainable Development, University of Port Harcourt, Port Harcourt, Nigeria.
[2] Department of Geography and Environmental Management, University of Port Harcourt, Port Harcourt Nigeria.
[2] Centre for Disaster Risk and Developmental Studies, University of Port Harcourt, Port Harcourt, Nigeria.
[4] Department of Geology, University of Port Harcourt, Port Harcourt, Nigeria

Abstract
The study examined the public perception of flood vulnerability and resilience among communities in Bayelsa State, Nigeria. Consequently, 1500 copies of questionnaire were administered to elicit information on the perception of flood vulnerability and resilience in the selected communities using a random sampling technique. However, 1265 copies were retrieved for further analysis. Findings revealed that flood occurrence in Bayelsa State is becoming a recurring issue which happens every year and lives and properties are lost numerously. The dominating coping strategies include construction of sandbag dykes, channel and drainage construction, opening/maintenance of blocked drains and channels, land reclamation, raise the floor of buildings above water level, resettlement and remove possessions from ground floor. The study concluded that public opinions were germane to understand the level of impact of flood in Bayelsa State and it was suggested that regular flood assessment should be encouraged in Bayelsa State. Also the communities with high and moderate vulnerability to flood should be provided with adequate preparedness in case of any flood disaster in the future. Government should really come to the aid of the flood victims in Bayelsa State

Keywords: public perception, flood, vulnerability, resilience and Bayelsa state

Introduction

The public perception of flood risk is now seen as one of the main components in flood risk management (Onwumele, 2018). Public perception of flood risk and flood risk information is often overlooked when developing flood risk management plans (Bradford *et al*; 2012) [11]. Flood is an inevitable natural phenomenon occurring from time to time in all rivers and natural drainage systems, which not only damages the lives, natural resources and environment, but also causes loss of economy and health year after year (Thilagavathi, *et al*, 2011) [30]. It has displaced people, claimed lives and destroyed properties. According to the UNISDR (2016) [31], floods have accounted for 47% of all weather-related disasters since 1995, affecting 2.3 billion people (Bradford *et al*., 2012; Onwumele, 2018) [11]. It was also recorded that within this period, about 3,062 flood disasters incidences occurred. Evidence from past studies confirmed the existence of an average of 171 incidences of flood disasters between 2005 and 2014 from the initial 127 in the previous decades (UNISDR, 2016) [31]. it is also known that each year, floods kill an average of 20,000 lives while at the same time affecting at least 20 million people worldwide (Smith and Petley 2009; Kellen *et al*., 2013 cited in Onwumele, 2018).

The analysis of socio-economic components of flooding adopts long-term risk management strategies grounded in an understanding of exposure to the flood, hazard characteristics and pattern of vulnerability and the relationship between different stakeholders in the perception of food risk (Brown *et al*., 2002) [12]. Since flood is often naturally occurring, they cannot be prevented and have the potential to lead to fatal causes such as displacement of people and damage to the environment (Adeoye *et al*., 2009) [1]. Floods, although a natural disaster, could also be caused by anthropogenic activities and human interventions in natural processes, such as increase in settlement areas, population growth located in areas prone to flooding (Balabanova and Vasiler (2010) [9]. The effects of natural hazards, like floods, can be felt at local levels, affecting communities and neighborhoods, or at regional or national levels, affecting an entire drainage basin and large spheres of land between states (Kwak and Kondoh, 2008) [22]. African nations have also been badly affected by floods (Akintoye *et al*., 2016) [2]. Media and aid organizations have reported a lot of flooding incidences in sub-Saharan Africa, which resulted from several days of rainfall (Paeth *et al*., 2010) [28]. The cost of losses resulting from floods in African countries like Mozambique has been in the order of millions of United States Dollars (USD) and the country has been affected by flooding almost yearly since it gained its independence from Portugal in 1975 (Wisner, 1979). Anwar (2008) [7] and Akintoye *et al* (2016) [2] has indicated that natural disasters disorder the existing everyday normative practices. He pointed out that the magnitude of any disaster created risk and vulnerability in different ways that applied to different groups.

However, flooding occurs throughout Nigeria in the form of coastal, river, flash and urban flood. Bayelsa State is seen as one of the most susceptible states in Nigeria to flooding due to its location in the heart of the Niger Delta. The Niger Delta is the main coastal flood plain through which the Niger-Benue river system discharges into the Atlantic Ocean. Flood resulting from annual river inundation has been plaguing most communities in the state and the Niger Delta even before the era of climate

change awareness. Nigeria and particularly Bayelsa State recently has experienced flood disasters that has claimed many lives and properties, and threatened the ecological biodiversity. Bayelsa State annually experiences flood occasioned by climate change that triggers devastating losses in human lives, economic assets, school attendance with multiplier consequences for the education system (Allen, 2015) [6]. It is on record that the 2012 floods and the recent 2018 floods experienced in the Niger Delta states occasioned by the climate change pandemic had serious consequences on Bayelsa state especially the educational sector where schools were closed down for a period of four weeks. The 2012 floods adjudged as the most severe and devastating flood disaster in the history of modern Nigeria affected over 7 million people (directly/indirectly), displaced 2.3 million people, killed over 363 persons and destroyed about 597,476 houses (Wills, 2014) [39]. Akpokodje (2012) [4] posited that the historic 2012 flood was caused by several factors ranging from Unusual rainfall associated with extreme climatic conditions caused by climate change and global warming, improper land use and development of natural water ways, blockage of drains and street inlets and the release of water from the Lagdo Dam in Cameroun and Kainji, Jebba and Shiroro on River Niger.

The vulnerability of a place on earth surface to flood is a function of the region's exposure to the hazard, (natural event) and the anthropogenic activities carried out within the catchment area which impedes the free flow of water (UNESCO, 2012). However, in practice, defining Vulnerability in the context of natural hazards such as floods is the extent to which a system is susceptible to flood due to exposure, a perturbation, in conjunction with its ability (or inability) to cope, recover, or basically adapt. (UNESCO-IHE, 2017). Generally, the purpose of vulnerability studies is to recognize correct actions that can be taken to reduce vulnerability before the possible harm is realized by building community resilience through adaptation and mitigation measures. Therefore, identifying areas with high flood vulnerability may guide decision making process towards a better way of dealing with flood societies. In the context of sustainability, Vulnerability refers to the degree to which and the reasons why a community may be susceptible to disruption that may compromise its long-term survival. In this way, vulnerability is related to resiliency-the degree to which a community may resist and/or recover from a disturbance (such as flood).

USAID (2012) defines resilience as "the ability of people, households, communities, countries, and systems to integrate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth." This can be achieved by implementing adaptation and mitigate measures designed to enable the victims attain Sustainability to hazards (such as floods). Zbigniew (1999) posited that Sustainability in the context of floods require that the civilization, wealth and environment (built and natural) should be relayed to future generations in a non-depleted shape. Another aspect of the definition states that, while flood protection is necessary to the present generation to attain a fair degree of freedom from disastrous events, it must be done in such a way that future generations are not adversely affected, assuring that the development meets the needs of the present without compromising the ability of future generations to assure their own needs (best known definition, after WCED, 1987). Hence, Sustainability should have a built-in maintenance of resilience against surprises and shocks, such as a violent abundance of destructive water.

The social aspects of floods have been reported for some time (Marincioni, 2001; Bradford, 2012) [11], their understanding in the context of flood risk management has become increasingly important (Brown and Damery, 2002) [12]. Perception of risk at both an individual and public level represents a key societal component in flood risk management that is integral to determining the response to flood warnings and efforts to increase community preparedness. Previous flood risk management policies have been known to fail or be adversely affected when policy makers overlook the subjective and highly contextualised nature of public perception (Granger-Morgan, 1997; Brown and Damery, 2002) [12]. On the other hand, flood studies in Bayelsa State have been done in patches in some local government areas which are Sagbama LGA (Mmom and Akpi, 2014); Yenagoa LGA (Wizor and Week, 2014) and Kolokuma/Opokuma LGA (Berezi *et al*, 2015); no detailed study of flood on the entire Bayelsa State with a view to investigating the perception of individuals towards the vulnerability, resilience and sustainability of flood in Bayelsa State. Thus, the present study focuses on the public perception towards flood vulnerability and resilience in Bayelsa State, Nigeria.

Methodology

The study area is the entire Bayelsa State comprising of eight LGAs of Ekeremor, Sagbama, Kolokuma/Opokuma, Yenagoa, Southern Ijaw, Ogbia, Nembe and Brass. Bayelsa State with its capital at Yenagoa falls within the geographical location of latitude 4º 20'N and 5º 20'N and longitudes 5º 20'E and 6º 40'E. The state shares boundary with Delta in the North, Rivers in the East and is bounded in the West and South by the Atlantic Ocean. It has a population of about 1.7 million people based on the Nigerian 2006 census (National Population Commission Nigeria (2006). The state is situated within a multi-splendored tropical rainforest with an approximate area of 21,110 square kilometers including the off-shore area.

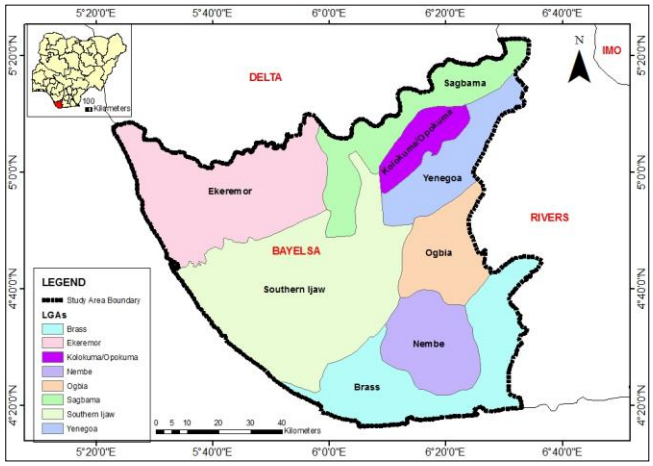

Fig 1: Bayelsa State showing the LGAs; Source: Bayelsa State Ministry of Land and Survey, 2018.

The study area has a tropical climate with two distinct seasons, wet (March-November) and dry (December-February). Bayelsa State is located within the lower delta plain believed to have been formed during the Holocene of the Quaternary period by the

accumulation of sedimentary deposits. The major geological characteristic of the state is sedimentary alluvium (Eteotor and Akpokodje, 1990) [15]. Major network of rivers such as Ramos, San Bartholomew, Brass and Nun serve as channels for the famous Rivers Niger and Benue for emptying into the Atlantic Ocean. A prominent feature of the rivers and creeks is the occurrence of natural levees on both banks, behind which occur vast areas of back-swamps and lakes/depressions where surface flow is negligible (Akpokodje, 1987) [3]. According to Alagoa (2013) [5], the back-swamps are soils flooded more than three months in a year. The major soil types in the state are young, shallow, poorly drained and acid sulphate soils. The vegetation in Bayelsa State is composed of mangrove forests, freshwater swamp and lowland rain forests. These different vegetations are associated with the various soil units of the area. Generally, along the ridges above the tide line, there exists a vegetation of palms with scattered trees while mangroves dominate the water courses. The study area has a riverine setting and thus fishing is a major occupation in Bayelsa State. Agriculture or farming is another mainstay of the economy of the study area. In a similar development, raphia palm tapping and local gin distillery, lumbering, carving, hunting, weaving and gathering of oil palm nuts and snails hunting are occupations in the area. The secondary occupations include trading, dressmaking, carpentry, gold smithing, food vending, bicycle and auto repairs. Therefore, the greatest potential for future industries in the study area lies in the fields of agriculture, fish processing and petro-chemicals.

Survey research design was adopted for this study because the design gives room to observe and measure a phenomenon along with other factors that would be of necessity to the research. This study employed structured questionnaire to elicit information about the communities' resilience rate and perception towards flood occurrence in the respective localities. The study employed stratified and random sampling techniques to select the communities and the sample size from the entire population of Bayelsa State. For the selection of the communities, all the communities were grouped into two groups which were those that frequently witness flooding and those that rarely experience flooding. From those that always witness flooding, at least 5 communities were randomly chosen from each local government area for the study and in total, 41 communities were selected (Table 1).

Table 1: Study Population and Sample Size

LGA and Selected Communities	No of Sampled Households
Brass LGA	
Twon Brass	34
Okpoama	26
Odioma	30
Sangana	21
Ewoama	26
Total	137
Ogbia LGA	
Ogbia Town	26
Otuokpoti	31
Kolo Town	26
Opume	31
Imiringi	31
Total	145
Southern Ijaw LGA	
Ammasoma	44
Oporoma	44
Ekowe	26
Ukubie	31
Azuzuama	44
Total	189
Ekeremor LGA	
Aleibiri	44
Ekeremor	44
Agoro	26
Peretorugbene	44
Isampou	34
Total	192
Kolokuma/Opokuma LGA	
Odi	44
Kaiama	87
Opokuma	31
Sabagreia	31
Igbedi	26
Total	219
Sagbama LGA	
Trofani	26
Sagbama	44

Toru Ebeni	34
Ebedebiri	31
Adagbabiri	26
Total	161
Yenagoa LGA	
Yenagoa Town	65
Obunagha	26
Tombia Ekpetia	34
Biseni	60
Edepie	56
Total	241
Nembe LGA	
Ogbolomabiri	60
Bassambiri	44
Fantuo	26
Olodiama	31
Okoroama	34
Akukumama	26
Total	221

***Source*:** National Population Commission, 1991

For the sample size selection, the household population was used. The houses in the selected communities were numbered in both even and odd numbers. The houses with odd numbers and the household heads of each household in the chosen houses were selected for the questionnaire administration. In case the household head is not found, the next person in the hierarchy was given the opportunity to complete the questionnaire. In total, 1505 respondents were selected for the questionnaire administration for the entire state using random sampling technique but only 1265 (84.1%) copies of completed questionnaires were retrieved and used for further analysis (Table 2).

Table 2: Questionnaire Administered and Retrieved Analysis

Communities	Questionnaire Administered	Questionnaire Retrieved
Twon Brass	34	29
Okpoama	26	26
Odioma	30	27
Sangana	21	19
Ewoama	26	22
Ogbia Town	26	21
Otuokpoti	31	27
Kolo Town	26	23
Opume	31	25
Imiringi	31	28
Ammasoma	44	38
Oporoma	44	31
Ekowe	26	23
Ukubie	31	21
Azuzuama	44	37
Aleibiri	44	34
Ekeremor	44	33
Agoro	26	23
Peretorugbene	44	38
Isampou	34	30
Odi	44	42
Kaiama	87	62
Opokuma	31	24
Sabagreia	31	28
Igbedi	26	25
Trofani	26	21
Sagbama	44	30
Toru Ebeni	34	32
Ebedebiri	31	27
Adagbabiri	26	24
Yenagoa Town	65	60
Obunagha	26	26
Tombia Ekpetia	34	32

Biseni	60	54
Edepie	56	48
Ogbolomabiri	60	52
Bassambiri	44	31
Fantuo	26	20
Olodiama	31	27
Okoroama	34	25
Akukumama	26	20
Total	1505	1265 (84.1%)

***Source*:** National Population Commission, 1991.

Results and Discussions

Socio-Economic Characteristics and Livelihood of Residents in Bayelsa State

The analysis on the socio-economic characteristics of residents is discussed in this section and this covers the gender, educational status, occupational status, marital status, age, and household size of the respondents. The socio-economic characteristics of respondents in the study locations are displayed in Table 3. The results revealed that questionnaires were administered to 68.7% male and 31.3% female respondents. Furthermore, in terms of the age of respondents, 27.8% were between 20 and 30 years, 23.5 % were between 31 and 40 years, 26.1% were between 41 and 50 years while 17.4% were between 51 and 60 years. The marital status analysis of respondents showed that 22.6% were singles, 64.3% were married, 0.9% were divorced, 3.5% were separated while 5.2% were widowed and 3.5% were having common relationship. The results also showed that 0.9% had primary education, 13.9% had secondary education, 33% had lower tertiary education and 50.4% had university education while 1.7% did not have formal education. The analysis therefore shows that majority of the respondents were married. It is revealed that 32.2% of respondents were traders or business men, 33.1% were civil or public servant and 10.4% were artisan. Furthermore 6.1% were farmers, 8.6% were fishermen and 7.8% were applicants or those looking for jobs. The household size analysis of respondents in Bayelsa State revealed that 59.1% had household size between 0 and 5 persons, while 34.8%, 4.3%, 3.5%, and 0.9% had household size between 6 and 10, between 11 and 15, between 16 and 20 and above 20 respectively. This shows that more than 80.0% of the respondents had household size between 1 and 10. The religion settings of the respondents in the study area showed that 95.7% were Christians while 4.4% practiced Islamic religion.

Table 3: Socio-economic Characteristics of Respondents

Gender	**Frequency**	**Percentage (%)**
Male	869	68.7
Female	396	31.3
Total	1265	100.0
Age (Years)	Frequency	Percentage (%)
20-30	352	27.8
31-40	297	23.5
41-50	330	26.1
51-60	220	17.4
60 and above	66	5.2
Total	1265	100.0
Marital Status	Frequency	Percentage (%)
Single	286	22.6
Married	814	64.3
Divorced	11	.9
Separated	44	3.5
Widowed	66	5.2
Common relationship	44	3.5
Total	1265	100.0
Educational Level	Frequency	Percentage (%)
Primary	11	.9
Secondary	176	13.9
Other Tertiary	418	33.0
University	638	50.4
None of the above	22	1.7
Total	1265	100.0
Occupational Level	Frequency	Percentage (%)
Trade/Business	407	32.2
Civil/Public servant	418	33.1
Artisan/Craftsman	132	10.4
Farmer	77	6.1
Fisherman	110	8.6

Applicant	99	7.8
Others	22	1.7
Total	1265	100.0
Household Number	Frequency	Percentage (%)
0-5	715	56.5
6-10	440	34.8
11-15	55	4.3
16-20	44	3.5
More than 20	11	0.9
Total	1265	100.0
Religion	Frequency	Percentage (%)
Christian	1210	95.7
Muslim	55	4.4
Total	1265	100.0

Geographical Characteristics of Selected Settlements and Type of Flood

Table 4 presents the geographical characteristics of the selected settlements. It can be deduced from the analysis that 59.1% of respondents agreed that the study communities were located in the flood prone areas or areas close to a river. However, 33% of respondents agreed that they are all found in the coastal area while 7.8% attested that they are located in urban areas with large artificial impermeable surfaces. Still from the same Table 4.8, it is shown that 66.1% of respondents are of the view that the type of flood experienced in the study locations was flash flood while 13.9% agreed on pluvial flood and 1.7% believed that they have no experience of flood in the area.

Table 4: Geographical Characteristics of Selected Settlements.

Location	Frequency	Percentage (%)
Flood prone area or close to a river	748	59.1
Coastal Area	418	33.0
Urban Area with large artificial impermeable surfaces	99	7.8
Total	1265	100.0
Type of Flood Experienced	Frequency	Percentage (%)
River Flood	44	3.5
Flash Flood	836	66.1
Urban Flood	33	2.6
Coastal Flood	66	5.2
Pluvial Flood	176	13.9
Dam or Dike Overflow	88	7.0
No Experience of Flood	22	1.7
Total	1265	100.0

Exposure of Residents to Flood in Bayelsa State and Causes of Flood Vulnerability

The exposure characteristics of residents to flood, causes of flood in the locality and the underlying causes of vulnerability to flood are revealed in Table 5. The analysis showed that in the last five years 92.2% of the respondents had bitter experience about environmental hazards in which flood might be one of the key hazards. The understanding of respondents on causes of flood revealed that more than 60% of the respondents agreed to heavy rainfall, overflow from dams, and rising sea level as the causes of flood. For the underlying causes of communities' vulnerability to flood, findings indicated that more than 80% agreed on each of residing in a flood prone, poverty, and lack of alternative livelihoods as the dominating causes of the vulnerability to flood by individuals and communities at large.

Table 5: Exposure of Residents to Floods in Bayelsa State.

Environmental Hazards	SA	A	N	D	SD
In the last 5 years, I have been affected by environmental hazards	970 (76.7)	196 (15.5)	7 (0.6)	54 (4.3)	38 (3.0)
Causes of Flood in the Locality	SA	A	N	D	SD
Heavy rainfall	737 (58.3)	407 (32.2)	88 (7.0)	11 (0.9)	22 (1.7)
Overflow from Dams to the rivers	451 (35.7)	682 (53.9)	66 (5.2)	44 (3.5)	22 (1.7)
Rising sea level	220 (17.4)	594 (47.0)	187 (14.8)	165 (13.0)	99 (7.8)
Storm surge	33 (2.6)	44 (3.5)	176 (13.9)	770 (60.9)	242 (19.1)
The will of God	99 (7.8)	66 (5.2)	165 (13.0)	704 (55.7)	231 (18.3)
Underlying Causes of Vulnerability to Floods	SA	A	N	D	SD
Residing in a flood prone area	979 (77.4)	187 (14.8)	11 (0.9)	66 (5.2)	22 (1.7)
Poverty	737 (58.2)	220 (17.4)	154 (12.2)	110 (8.7)	44 (3.5)
Lack of alternative livelihoods	715 (56.5)	396 (31.3)	77 (6.1)	44 (3.5)	33 (2.6)
Health challenges	98 (7.5)	45 (3.7)	319 (25.2)	748 (59.2)	55 (4.3)

Percentage in brackets

Frequency and magnitude of flood occurrence and duration for flood subsidence

It is revealed in Table 6 that 91.3% of respondents agreed that flood incidence happens every year in Bayelsa State. However, the magnitude of the flood in 2018 was seen to be high in height as more than 80% of respondents differently agreed that the flood height was above the feet, up to ankle, knee and above the knee. This suggested that the height was clearly observed in the study communities and it was confirmed to be high. Comparing the magnitude of flood in 2012 to that of 2018, 54.7% of respondents agreed that the 2018 flood was higher than that of 2012 while 30.4% agreed that it was less than that of 2018. The analysis on the duration of flood every year revealed that more than 70% of the respondents attested that flood lasted maximum of 3 months.

Table 6: Knowledge of the Frequency and Magnitude of Flood Occurrence and Duration for Flood Subsidence.

Frequency of floods occurrence in your community	SA	A	N	D	SD
Every year	583 (46.1)	572 (45.2)	66 (5.2)	21 (1.7)	23 (1.8)
Every 2 years	55 (4.3)	77 (6.1)	110 (8.7)	957 (75.7)	66 (5.2)
Every 5 years	77 (6.1)	77 (6.1)	55 (4.3)	154 (12.2)	902 (71.3)
Every 10 years	33 (2.6)	44 (3.5)	66 (5.2)	77 (6.1)	1045 (82.7)
No knowledge	165 (13.0)	891 (70.4)	22 (1.7)	77 (6.1)	110 (8.7)
Magnitude of the 2018 floods in your community in terms of depth of flood waters (flood height)	SA	A	N	D	SD
Above my feet	165 (13.0)	935 (73.9)	88 (7.0)	55 (4.4)	22 (1.7)
Up to my ankle	198 (15.7)	924 (73.0)	88 (7.0)	44 (3.4)	11 (0.9)
Up to my knee	957 (75.7)	99 (7.8)	99 (7.8)	77 (6.1)	33 (2.6)
Above my knee	847 (66.9)	110 (8.7)	121 9.6)	110 (8.7)	77 (6.1)
No knowledge	154 (12.2)	77 (6.1)	77 (6.1)	54 (4.3)	902 (71.3)
How do you compare the magnitude (height or dept of flood) of the 2012 floods to 2018?	Frequency	Percentage			
Higher	693	54.8			
Less than	385	30.4			
Same height	22	1.7			
No idea	165	13.0			
Total	1265	100.0			
Duration of flood every year before subsiding	SA	A	N	D	SD
Less than 1 Month	231 (18.3)	704 (55.6)	176 (13.9)	80 (6.3)	74 (5.9)
1-3 Months	924 (73.1)	209 (16.5)	22 (1.7)	44 (3.5)	66 (5.2)
4-6 Months	143 (11.3)	11 (0.9)	65 (5.1)	111 (8.8)	935 (73.9)
More than 6 Months	121 (9.6)	66 (5.2)	43 (3.3)	45 (3.7)	990 (78.2)
Household farmlands often affected by floods	836 (66.1)	231 (18.3)	77 (6.1)	110 (8.7	11 (0.9)

Percentage in brackets

Susceptibility to Flood

The susceptibility level of residents to flood is revealed in Table 7 which shows that the type of house common in the study location is the one built with block walls and iron/tile sheet roof being attested to by 70.4% while the least was observed to be mud walls with thatched roof as having 3.1%. Meanwhile the means of livelihood analysis showed that agriculture dominated as agreed by 38.7% and followed by fishing which was attested to by 22.7% of the respondents while trading was just 11.8%.

Table 7: Susceptibility Analysis

Type of dwelling for the household	Frequency	Percentage (%)
Block walls with iron/tiles sheet roof	891	70.4
Mud walls with Iron/tiles sheet roof	231	18.3
Mud walls with that thatched roof	39	3.1
Wooden walls with thatched roof	56	4.4
Wooden walls/sheet roof	48	3.8
Total	1265	100.0
Main Sources of Livelihood		
None	4	0.3
Agriculture	490	38.7
Braiding	124	9.8
Fishing	287	22.7
Handcraft	43	3.4
Trading/business	149	11.8
Tapping/distiller	63	5.0
Palm oil production	105	8.3
Total	1265	100.0

Awareness of Floods

The results in Table 8 reveal various ways in which the residents' awareness on flood were observed. It shows that 73.9% of respondents were aware of the risk of flood in their locality. There are many reasons attributed to the continuous living in such communities and as a result, 40.9% of respondents agreed that they are still staying there because of job proximity while 16.5% and 13.9% of respondents agreed on close to relatives and maintenance and defence for the home grounds respectively. Surprisingly, 59.1% of respondents agreed that there is always the announcement about the threat of floods. The information about flood was being communicated through different media. And the analysis showed that radio was mostly agreed to (58.3%) while volunteers NGO was observed to be the least. It is also revealed in Table 8 that 52.2% of respondents agreed not to be prepared despite being communicated through various media while only 47.8% attested to be preparing. Analysing different ways of their preparedness, 64.4% agreed to be making use of alternative house to live while 15.8% agreed on raising the compound with sand to prevent flood attack.

Table 8: Awareness of Flood Occurrence

Are you aware of the risk of floods in your locality?	Frequency	Percentage (%)
Yes	935	73.9
No	330	26.1
Total	1265	100.0
Why do you still live in such an area?		
Job proximity	517	40.9
Access to Amenities	143	11.3
Close to relatives	209	16.5
To maintain and defend home grounds	176	13.9
Same Community	154	12.2
Cultural affiliation to land	66	5.2
Total	1265	100.0
Was there any information or announcement or warning about the threat of floods?		
Yes	748	59.1
No	517	40.9
Total	1265	100
If yes, how is the information communicated to you?		
Television	374	29.6
Radio	737	58.3
Traditional ways	66	5.2
Volunteers/NGOs	11	.9
Mobile/ Internet	77	6.1
Total	1265	100.0
Were you affected by floods in your locality recently?		
Yes	979	77.4
No	286	22.6
Total	1265	100.0
Did you prepare for the floods?		
Yes	605	47.8
No	660	52.2
Total	1265	100.0
If yes, in what way?		
Making alternative house to live	814	64.4
Leaving that area totally	154	12.2
Raising my compound with sand	199	15.8
Others	98	7.7
Total	1265	100.0

Relief Assistance

The relief assistance given to victims of flood hazard is presented in Table 9. The analysis revealed that 72.2% agreed that there has been no assistance from the government or other institutions during and after floods while only 27.8% agreed that there was assistance. Considering the items that are always given to the flood hazard victims, majority (47.5%) agreed that food items is always provided, while 13.4% agreed on financial grant and 13% agreed on children school materials. Concerning the response rate and time by government during and after flood showed that 46% agreed that it is always belated while 25.2% agreed that it is always inadequate. However, In case of flood, 57.4% of respondents agreed that they are able to evacuate their household; and 37.4% were of the opinion that they were evacuated to public school building while 20% agreed on IDP Camp and 3.5% agreed that they migrate to other areas less vulnerable.

Table 9: Relief Assistance and Evacuation Styles during Flood

Do you get assistance from the government or other institutions during and after floods?	Frequency	Percentage (%)
Yes	352	27.8
No	913	72.2
Total	1265	100.0
Type of assistance did you get during floods		
Building materials	105	8.3
Food items	601	47.5
Clothes	115	9.1
Financial grant	170	13.4
Soft loans	10	0.9
Mattresses	24	1.9
Utensils	76	6.0
Children School materials	164	13.0
Total	1265	100.0
How do you value government response during and after the flooding in your area?		
Belated	583	46.0
Immediate	187	14.8
Inadequate	319	25.2
Adequate	132	10.4
Others	44	3.5
Total	1265	100.0
Is your household able to evacuate in case of a flood?		
Yes	726	57.4
No	539	42.6
Total	1265	100.0
Place evacuated to		
Neighbours or relatives in non-flooded area	352	27.8
Public School Building	473	37.4
IDP Camp	253	20.0
Church building	22	1.7
Rented accommodation	77	6.1
Migrate to other areas less vulnerable	44	3.5
Others	44	3.5
Total	1265	100

Identification of anthropogenic activities that could increase community vulnerability to flood in Bayelsa State

Table 10 reveals the anthropogenic activities that can increase community vulnerability to flood in Bayelsa State. It is revealed that 66.4% agreed on the increase in urbanization with an expansion of urban structures close to river channels., 80.3% agreed on poor drainage capacity of water channels resulting from blockage of facilities by waste/debris; 73.4 agreed on development along flood drains and drainage facilities while 81% agreed on cutting down of too many trees at faster pace than nature can replace(deforestation) increases flood vulnerability and 68.3% agreed on indiscriminate dumping of waste/debris along natural drainage channels.

Table 10: Anthropogenic activities

Statement	SA	A	N	D	SD
Increase in urbanization with an expansion of urban structures close to River channels.	402 (31.8)	438 (34.6)	83 (6.6)	125 (9.9)	217 (17.1)
Poor drainage capacity of water channels resulting from blockage of facilities by waste/debris.	502 (39.7)	513 (40.6)	56 (4.4)	114 (9.0)	123 (9.7)
Development along flood drains and drainage facilities.	364 (28.8)	564 (44.6)	102 (8.1)	157 (12.4)	78 (6.2)
Cutting down of too many trees at faster pace than nature can replace (deforestation) increases flood vulnerability.	562 (44.4)	463 (36.6)	26 (2.1)	108 (8.5)	106 (8.4)
Indiscriminate dumping of waste/debris along natural drainage channels.	250 (19.8)	617 (48.5)	124 (9.8)	127 (10.0)	147 (11.6)
Failure to heed to flood warnings.	149 (11.8)	649 (51.3)	149 (11.8)	197 (15.6)	121 (9.6)

Percentage in brackets

Factors influencing the extent of community resilience to flooding in Bayelsa State

The analysis in Table 11 reveals the factors affecting the extent of community resilience to flooding in Bayelsa State and it indicates that 78.2% of respondents believed that availability of social networks (electricity, water, telephone) is an important factor in building resilience of local communities, 82.7% accepted that support of neighbours, friends and relatives contribute to the resilience of communities while 76.6% of respondents agreed that geographical location of Housing units, business/industries, shelters and critical infrastructures is a factor that influence community resilience. More than 70% decided that access to physical infrastructure like roads, bridges, dams and levees as well as communication and transport facilities are essential factors for community resilience. However, factors like

knowledge/information developed from previous experiences with floods shared with neighbours, friends and relatives influence community resilience, livelihoods pattern (level of income, type of employment) contribute to the resilience of communities, level of education influences resilience and availability of Non-Governmental Organizations (NGOs) to a large extent influence community resilience to flooding in Bayelsa State.

Table 11: Factors influencing the extent of community resilience to flooding in Bayelsa State

Statement	SA	A	N	D	SD
Community resilience to flooding is influenced by the following factors:					
Availability of social networks (electricity, water, telephone) is an important factor in building resilience of local communities.	418 (33.0)	572 (45.2)	88 (7.0)	154 (12.2)	33 (2.6)
Support of neighbours, friends and relatives contribute to the resilience of communities.	440 (34.8)	605 (47.9)	110 (8.7)	0 (0.0)	110 (8.7)
Geographical location of Housing units, business/industries, shelters and critical infrastructures is a factor that influence community resilience.	374 (29.6)	594 (47.0)	88 (7.0)	176 (13.9)	33 (2.6)
Access to physical infrastructure like roads, bridges, dams and levees as well as communication and transport facilities are essential factors for community resilience.	374 (29.6)	605 (47.8)	143 (11.3)	121 (9.6)	22 (1.7)
Knowledge/information developed from previous experiences with floods shared with neighbours, friends and relatives influence community resilience.	682 (53.9)	418 (33.0)	77 (6.1)	88 (7.0)	0 (0.0)
Livelihoods pattern (level of income, type of employment) contribute to the resilience of communities.	429 (33.9)	528 (41.7)	121 (9.6)	110 (8.7)	77 (6.1)
Level of education influences resilience	528 (41.7)	528 (41.7)	77 (6.1)	121 (9.6)	11 (0.9)
Availability of Non-Governmental Organizations (NGOs) also influences resilience.	495 (39.1)	440 (34.8)	66 (5.2)	176 (13.9)	88 (7.0)

Percentage in brackets

Integration of traditional (non-structural) and conventional (structural) methods

Table 12 shows the traditional and conventional methods adopted to control flood in the study locations. More than 70% of respondents agreed on the different traditional methods namely construction of sandbag dykes, channel and drainage construction, opening/maintenance of blocked drains and channels, land reclamation, raise the floor of buildings above water level, resettlement and remove possessions from ground floor. Similarly, more than 70% of respondents have agreed to community orientation and awareness raising programmes (including flood warning signals), and development of local preparedness plan as the conventional methods that are adopted. Table 13 has shown the degree of resilience achieved by the two methods as the analysis reveals that 22.7% agreed that it was high while, 64% agreed that it was low. Table 14 showed that influence of flood resilience measures on sustainability of future generations whereby more than 70% of the respondents have agreed on availability of flood management committees, availability of hazard or vulnerability assessment reports, availability of community orientation and awareness raising plan, and development of local preparedness plan.

Table 12: Integration of traditional (non-structural) and conventional (structural) methods

What are the traditional (structural) flood resilience measures adopted in your locality in case of floods?	SA	A	N	D	SD
Construction of sandbag dykes	330 (26.1)	737 (58.2)	85 (6.8)	91 (7.2)	22 (1.7)
Construction of earth dykes	605 (47.8)	418 (33.0)	121 (9.6)	110 (8.7)	11 (0.9)
Channel and drainage construction	144 (11.4)	530 (41.9)	320 (25.3)	262 (20.7)	11 (0.9)
Opening/maintenance of blocked drains and channels	407 (32.2)	663 (52.2)	132 (10.4)	66 (5.2)	0 (0.0)
Land reclamation	154 (12.2)	220 (17.4)	693 (54.7)	198 (15.7)	0 (0.0)
Structural stabilization	143 (11.3)	539 (42.6)	319 (25.2)	253 (20.0)	11 (0.9)
Resettlement	649 (51.3)	319 (25.2)	165 (13.0)	132 (10.4)	0 (0.0)
Reforestation	451 (35.6)	253 (20.0)	330 (26.1)	198 (15.7)	33 (2.6)
Raise the floor of buildings above water level.	506 (40.0)	539 (42.6)	55 (4.3)	66 (5.2)	100 (8.0)
Remove possessions from ground floor	572 (43.3)	451 (35.7)	77 (6.1)	121 (9.6)	44 (3.5)
Place flood guards at door steps	110 (8.7)	319 (25.2)	627 (49.6)	143 (11.3)	66 (5.2)
Make Furrows in the gardens to divert flood water	396 (31.3)	385 (30.4)	198 (15.7)	242 (19.1)	44 (3.5)
What are the Conventional (Non-structural) flood resilience measures adopted in your locality in case of floods?					
Community orientation and awareness raising programmes (including flood warning signals)	495 (39.1)	396 (31.3)	154 (12.2)	176 (13.9)	44 (3.5)
Development of local preparedness plan	407 (33.2)	506 (40.0)	132 (10.4)	176 (13.9)	44 (3.5)
Creation of Community flood Management committees to implement local strategies.	352 (27.8)	352 (27.8)	242 (19.1)	231 (18.3)	88 (7.0)
Food plain regulations (including land use strategies)	176 (13.9)	154 (12.2)	286 (22.6)	253 (20.0)	396 (31.3)
An efficient flood forecast-warning signals	176 (13.9)	242 (19.1)	264 (20.9)	506 (40.0)	77 (6.1)
A system of flood risk assessment	99 (7.8)	264 (20.9)	176 (13.9)	429 (33.9)	297 (23.5)
Economic instruments	484 (38.2)	231 (18.3)	132 (10.4)	330 (26.1)	88 (7.0)
Maintenance of existing community drainage systems and creation of new small scale ones.	275 (21.7)	605 (47.9)	143 (11.3)	220 (17.4)	22 (1.7)

Percentage in brackets

Table 13: Degree of resilience achieved by these traditional /conventional methods

Degree	Frequency	Percentage (%)
High	287	22.7
Low	810	64.0
Unknown	168	13.3
Total	1265	100.0

Table 14: Influence of flood resilience measures on sustainability of future generations

Statement	SA	A	N	D	SD
Community/individuals adopt sustainable flood resilience practices when there is flood	517 (40.9)	528 (41.7)	66 (5.2)	133 (10.5)	21 (1.7)
Sustainable flood resilience measures that were taken by your community can be rated by future generations as inappropriate flood defenses					
Availability of Flood Management committees.	352 (27.8)	748 (59.1)	66 (5.2)	75 (5.9)	24 (1.9)
Availability of Hazard or vulnerability Assessment reports.	330 (26.1)	615 (48.6)	121 (9.6)	154 (12.2)	44 (3.5)
Availability of Community orientation and Awareness raising plan.	594 (47.0)	473 (37.4)	77 (6.1)	100 (7.9)	21 (1.6)
Development of local preparedness plan.	473 (37.4)	484 (38.3)	143 (11.3)	110 (8.7)	55 (4.3)
Maintenance of existing community drainage systems to avoid blockage and creation of new small scale ones.	187 (14.8)	495 (39.1)	308 (24.3)	231 (18.3)	44 (3.5)
Availability of efficient flood forecast and warning signals.	440 (34.8)	297 (23.5)	275 (21.7)	165 (13.0)	88 (7.0)
Raise floor of building doors above water level	352 (27.8)	209 (16.5)	198 (15.7)	407 (32.2)	99 (7.8)
Construction of dykes (sandbank and earth dykes)	242 (19.1)	407 (32.2)	110 (8.7)	286 (22.6)	220 (17.4)
Resilience measures adopted can influence flood sustainability in Bayelsa State	220 (17.4)	561 (44.3)	121 (9.6)	209 (16.5)	154 (12.2)

Coping Strategies of Residents to Floods

It is revealed in Table 15 that there are some coping strategies with respect to flood in Bayelsa State and as a result more than 60% of the respondents agreed that construction of canals, evacuation to higher/safer grounds, Making furrows in gardens/farms to divert flood water and moving properties out of the house are dominating coping strategies for flood in Bayelsa State.

Table 15: Coping Strategies with Floods in Bayelsa State

Main coping measures (or strategies) adopted during the floods	SA	A	N	D	SD
Construction of canals	836 (66.1)	33 (2.6)	396 (31.3)	0 (0.0)	0 (0.0)
Evacuate to higher/safer grounds	759 (60.0)	11 (0.9)	495 (39.1)	0 (0.0)	0 (0.0)
Build sandbag dykes around building and elsewhere	671 (53.0)	0 (0.0)	594 (47.0)	0 (0.0)	0 (0.0)
Raise the floor of the house	660 (52.2)	0 (0.0)	605 (47.8)	0 (0.0)	0 (0.0)
Place flood guards at doorsteps	660 (52.2)	0 (0.0)	605 (47.8)	0 (0.0)	0 (0.0)
Make furrows in gardens/farms to divert flood water	770 (60.9)	0 (0.0)	495 (39.1)	0 (0.0)	0 (0.0)
Move to IDP camps	649 (51.3)	0 (0.0)	616 (48.7)	0 (0.0)	0 (0.0)
Move to neighbour/relatives house	616 (48.7)	0 (0.0)	649 (51.3)	0 (0.0)	0 (0.0)
Build earth dyke on property or elsewhere	704 (55.7)	0 (0.0)	561 (44.3)	0 (0.0)	0 (0.0)
Pump water away from or out of the house	638 (50.4)	0 (0.0)	627 (49.6)	0 (0.0)	0 (0.0)
Move properties out of the house	869 (68.7)	0 (0.0)	396 (31.3)	0 (0.0)	0 (0.0)
Move animals and pets to safer grounds	1056 (83.5)	0 (0.0)	209 (16.5)	0 (0.0)	0 (0.0)
Others(Specify	11 (0.9)	440 (34.8)	451 (35.7)	286 (22.6)	77 (6.1)

Percentage in brackets

Discussion of Findings

Findings revealed that the magnitude of the 2018 flood was higher than that of 2012. This is in consonance with Cutter *et al*., (2003) [13], and Vos *et al*., (2010) [36] and Salami *et al* (2017) [29], whose studies reported that there is an increase in the magnitude and scale of natural and human-induced disasters, in particular the hydro-meteorological-related disasters such as floods and windstorms. More so, It is seen as the most devastating disaster that is most frequent and widespread globally in the recent times (Vojinović 2015) [35]. Baker (2012) [8] also corroborated that the ensuing risks of climate change and natural hazards like floods largely affect the urban poor living in cities particularly in developing countries because of their usual location in urban areas with unique spatial characteristics denoting informal settlements. It was proven that there is significant variation in the rate of vulnerability of communities to flood in the entire study area. This can be likened to different degrees of communities to different factors influencing flooding in Nigeria. The finding is in tandem to the study of Fraser *et al*. (2017) [17] where it was reported that sub-Saharan Africa faces mounting disaster risk rooted in deep inequality and environmental deterioration, and is being transformed by a late-onset and fast-paced urbanization process. Generally, the findings from the study showed that many people in Bayelsa State have been affected by environmental hazards in the last five years. The dominating factors causing floods in the study area are heavy rainfall, overflow from dams to the rivers and rising sea level, residing in a flood prone area, poverty and lack of alternative livelihoods. This shows that climate and increase in population are the underlying factors that can cause flooding. For instance, poverty and residing in a flood prone area and lack of alternative livelihoods are informed by the increase in the population which has invariably resulted from human interference with the natural climate system and landuse. No wonder IPCC warned that the frequency and gravity of extreme weather events such as drought and excessive rainfalls

resulting in flood and landslides are unstoppable because of the human interference with the climate system (Hardoy *et al*., 2013; IPCC, 2013; Mitlin & Satterthwaite 2013) [20, 21, 24]. In a related development, Dodman *et al*., (2017) [14] emphasized on African urbanism and urban change, as they have influenced exposure to hazards of various types, and contribute to the vulnerability of individuals, households and communities as more population have been shifting from rural to urban settlements. The most frequent type of flood in the entire study area was river flood. This is because it is triggered by excessive rainfall intensity which makes a river to overflow its banks. This findings is similar to that of Few (2003) and Vojinovic (2015) [16].

Conclusion and Recommendations

The study arrived at the conclusion that intensity and frequency of flood has increased over time in Bayelsa State as flood occurrence in Bayelsa State is becoming a recurring issue which happens every year and lives and properties are lost numerously. Also, knowledge/information developed from previous experiences with floods shared with neighbours, friends and relatives influence community resilience and level of education influences resilience are the major factors influencing flood resilience in Bayelsa State. The dominating coping strategies include construction of sandbag dykes, channel and drainage construction, opening/maintenance of blocked drains and channels, land reclamation, raise the floor of buildings above water level, resettlement and remove possessions from ground floor. The study therefore recommended that environmental education on flood risk mitigation and management should be carried out in the entire study locations; government should come out boldly to assist flood victims at all times. The residents of the flood affected communities should obey the flood early warnings given to them by the constituted authorities like NIMET.

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