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Evaluating the Flood Control Measures and Resilience Employed by Communities Along the New Calabar River Catchment

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ABSTRACT

Floods are one of the most frequent and dangerous natural disasters, affecting human lives and resulting in significant economic damage throughout the world. It is known that future flood threats won't go away, and the start of climate change will increase flood strength and frequency, endangering many parts of the world. It is the most commonly recorded catastrophe in the world continues to result in the susceptibility and adaptability of New Calabar Riverbank towns to floods, inundation, and erosion, which has had a persistent impact on the morphology of riverbanks and villages. These alterations, particularly in the New Calabar River, can be linked to the influence of the river's human and natural influences. This has also prompted communities along the new Calabar Rivers banks to experience unstable environmental circumstances. As a result, this study assessed how well these communities have adapted to floods, inundation, and erosion. The Time-Series/Longitudinal study design was chosen as the methodology for this investigation. The Taro Yamanne formula was employed for the studies in deriving the sample size which was 400. Findings revealed that community-driven solutions were the last options in the mitigation of floods especially in the use of early warning systems. Therefore, the study suggests that institutional frameworks be implemented to improve resilience and catastrophe risk reduction.

Keywords: Adaption, Inundation, Flood, Susceptibility, Environmental

INTRODUCTION

Di Baldassarre et al. (2010) observed that a number of factors have contributed to a rise in the frequency of severe floods over the past several decades. Despite this, very little efforts were put in place to mitigate such impact hence, most flood affected parties still possess low flood forecasting capacity.. Floods affect all aspects of society, but the poor and marginalised are typically the most at risk since they have few safeguards against natural catastrophes, especially in developing countries where agriculture is the primary source of income (Chan and Parker, 1996). People may encounter the same kinds of dangers, but due to differences in exposure, sensitivity, and adaptation capability, they may be more or less vulnerable. Disasters not only disturb the poor's way of life, but also cause them to suffer significant losses that may take some time to recover from. The majority of farmers in Sub-Saharan Africa Relies primarily on rain-fed agriculture and have no ability to reduce, adapt to, or deal with the consequences of extreme climatic events like floods, which severely hamper productivity. Smallholder farmers are particularly vulnerable to climatic extremes like floods, according to studies by Adhikari et al. (2014), Elum et al. (2016), and Hertel and Rosch (2010). This is because they are typically the least prepared for disaster, reside in the most vulnerable areas, and have few resources to help lower their level of risk.

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Many people reside in flood-prone locations in the major cities of low-altitude nations (Hardoy et al., 2001). For instance, according to McGranahan et al. (2007), 10% of the world's population and 13% of its urban population reside in low-elevation nations. Human settlements are susceptible to the impacts of climate change, according to IPCC (2001). Human settlements are impacted by climate change in a number of ways, including the economy, infrastructure, and public health. The most immediate dangers to human populations in coastal regions come from flooding brought on by sea level rise and storm surges. When they occur in metropolitan areas with poor drainage infrastructure and little adaptive ability, floods might be a major concern. Reducing climate change vulnerabilities is a pressing issue today, especially in low- and middle-income nations. In order to respond to actual and anticipated changes brought on by climate change, a system, people, and communities must adapt to the changing environment (McCharthy, 2001; Adger, et al., 2007). The first goal in many low- and middle-income nations in response to the effects of climate change is adaptation. Adger, et al. (2007) claim that adaptation entails altering social and environmental processes, how people perceive climate risk, as well as practises and functions, in order to lessen possible harm or take advantage of new possibilities.

Study Area

The research area is the New Calabar River, which flows through five local government areas in Rivers State, Nigeria: Obio Akpor, Emuoha, Asari-Toru, Degema, and Bonny. Along the way, it passes through the communities of Choba, Rumuparali, Emuoha, Ozuoba, and Rumulumini. The river runs between longitudes 6^0 50' 00'' E to 7^0 30' 00'' E at the beginning to latitudes 4^0 45' 00'' N to 5^0 00' 00'' N.

Relief and Drainage

All drainage channels in the studied region empty into the Atlantic Ocean, and the lowland areas are typically less than 30 metres above sea level in height (Oyegun et al., 1999). Alluvial sedimentary basin and foundation complex rocks make up its geology (Oyegun et al., 1999).

Soil

The soils in the area have several types of surface layers that are layered on top of substantial tertiary sandy and clayey soil deposits that, in some areas, are over 100 metres thick (Oyegun et al., 1999). The region temperature is unusually high from 64^0F to 90^0F and rains promote significant chemical weathering of rocks, which produces clay minerals that are common in the area (Oyegun et al., 1999).

Climate

According to Oyegun et al. (1999), the climate of this area is influenced by its location within the humid tropics with average monthly rainfall and humidity of 191.1mm and 69.08% respectively due to its proximity to the Atlantic Ocean, and the predominant tropical maritime air mass that blows over the area for the majority of the year. The climate of Rivers State is humid, with extended rainy seasons, significant rainfall, and a brief dry season. The wettest months in this region are July and September, whereas December and January, which is the harmattan season, are the driest. Similarly, the region's weather indicates that temperatures are largely stable throughout the year, with a mean annual temperature of 280°C and an annual range of 3.80°C, and a humidity level of 85% (Oyegun et al., 1999).

Vegetation

The vegetation in the study region mostly consists of raffia palms and varies from a light rain forest to a deep mangrove forest. About 20–30 miles of saline water, as well as a network of rivers and streams, connect Rivers State to the ocean. There are woodlands throughout the city in addition to the mangrove

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forest that is typical around rivers and streams (Oyegun et al., 1999).

Population

According to the 1991 census, there were 756, 741 thousand people living in the studied LGAs (NPC, census data 1991). 1,347,644 people were counted in the population as of 2006 (NPC, census data from 1991).

Economic Activities

One of the principal hubs of the Nigerian economy and a significant city in the Niger Delta is Obio/Akpor. The city is home to several international corporations, many of which use petrochemicals in the creation and processing of their goods, which contributes to a portion of the state's economy. However, there are more sources in the state, including those related to agro-based enterprises, education, medicine, engineering, and law.

Businesses that provide oil services, breweries, textile factories, hotels, and other commercial enterprises like merchants and hawkers are among the region's economic activities. Farming, which includes the production of local products such plantains, cassava, and bananas, is the main economic activity of Emohua. Due to the abundance of seafood in the region's rivers and tributaries, fishing is another well-liked pastime. The residents of Emohua also make boats and weave fishing nets as other businesses. A small number of community people work in the public sector, while others trade at the area's several marketplaces, including the Emohua International Market (Oyegun et al., 1999).

The majority of Okrika people are fisherman, while the others make palm oil, make local salt, farm, and fish. The majority of the women also participate in small-scale commerce to supplement their income. Therefore, trading activities are more prevalent in the studied regions, notably in Port Harrcourt's urban centres where there are many marketplaces to be seen, whereas small trading is more prevalent in the rural areas (Oyegun et al., 1999). Federal Government of Nigeria (FGN) (2007) states that refined petroleum products are Okrika's sole notable exports. Produce handling and transportation across the New Calabar River has an impact on the river's banks because of these economic activities.

Livelihood, Employment and Occupation

The residents in the research region work as crop farmers, fisherman, and other wage-earning jobs. All age groups and sexes in the research region predominantly engage in these jobs.

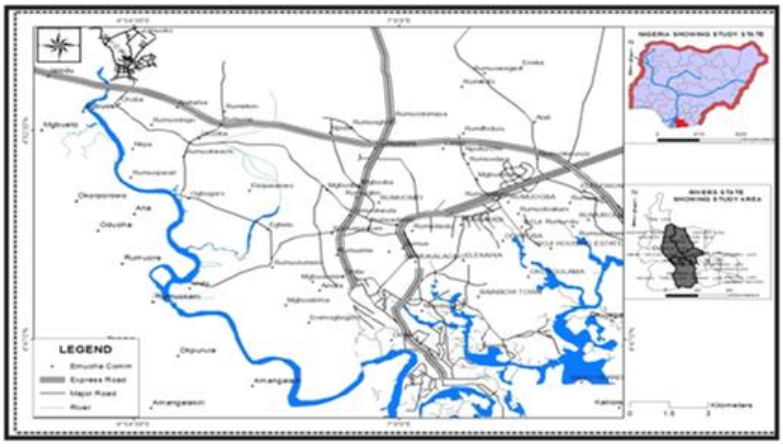

Figure 1 Map of Study Area Showing Communities

Source: Digitized from Google map, 2015.

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RESULTS AND DISCUSSION

Bio data of respondents

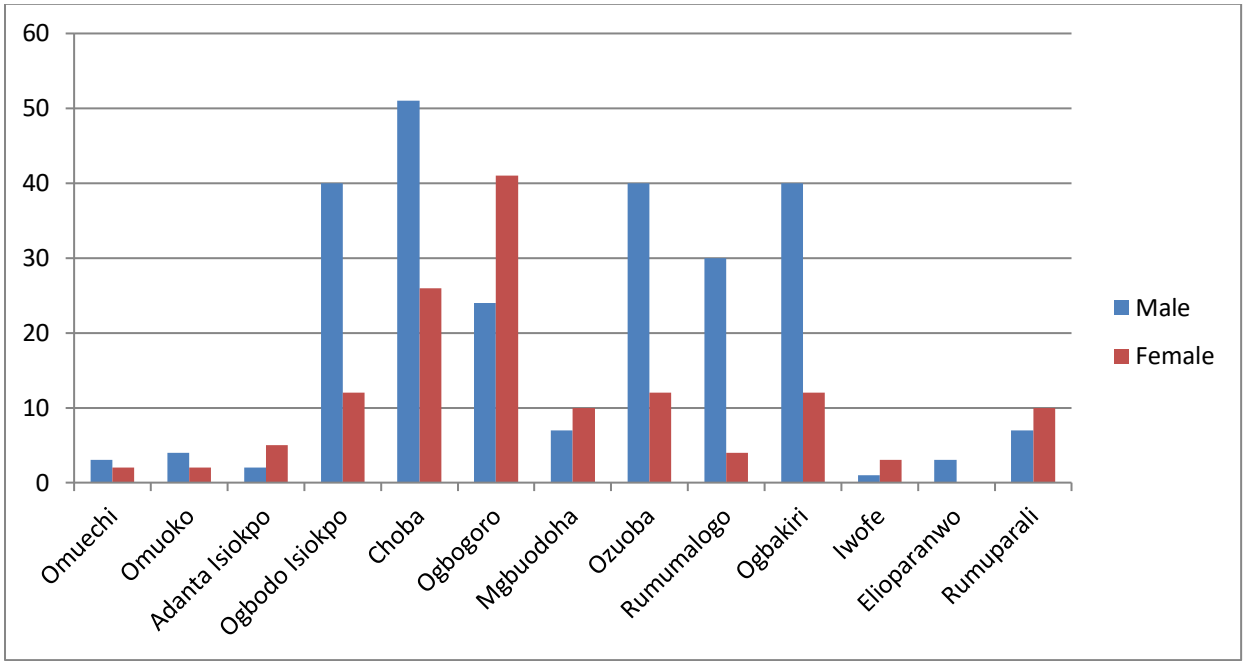

Figure 2: Sex of respondents

The figure 2 shows more male population of respondents in Choba , Isiokpo, Ogbodo Isiokpo, Ozuoba and Rumualogu and fewer female population in these mentioned places whereas, there is more female population in Ogbogoro, Rumuoparali and Adanta and fewer male population.

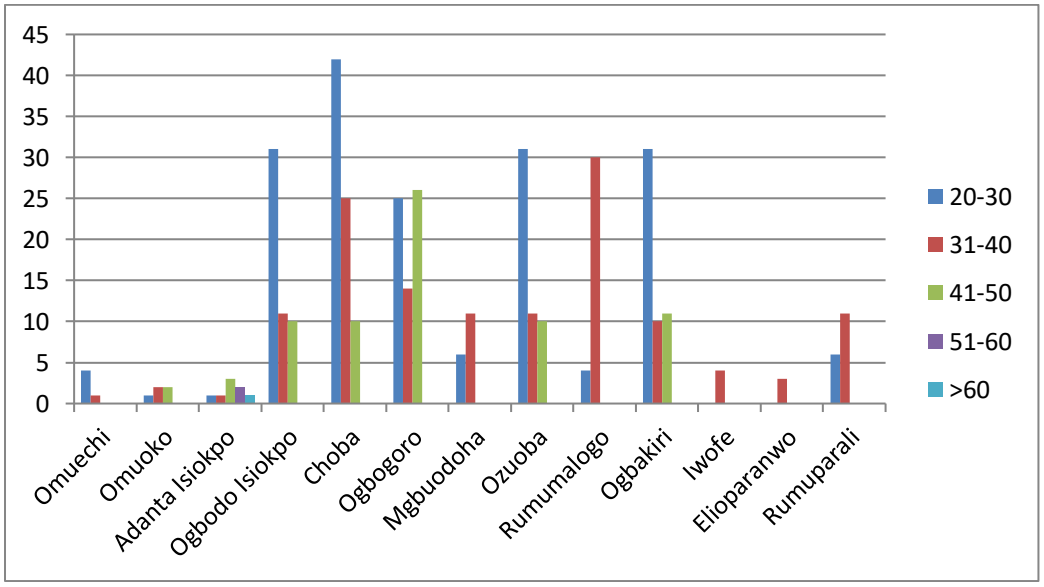

Figure 3 Age Category of respondents

The graph in figure 3 highlights the highest numbers of respondents are between the ages of 20-30 as seen in Choba, Ogbodo Isiokpo, Ozuoba and Isiokpo, with ages 31-40 following as seen in Rumualogu, Rumuoparali, Iwofe and Elioparanwo. The next ages following are from 41-50 with ages 51-60 following behind, the age with the minimum numbers of respondents is the age 60.

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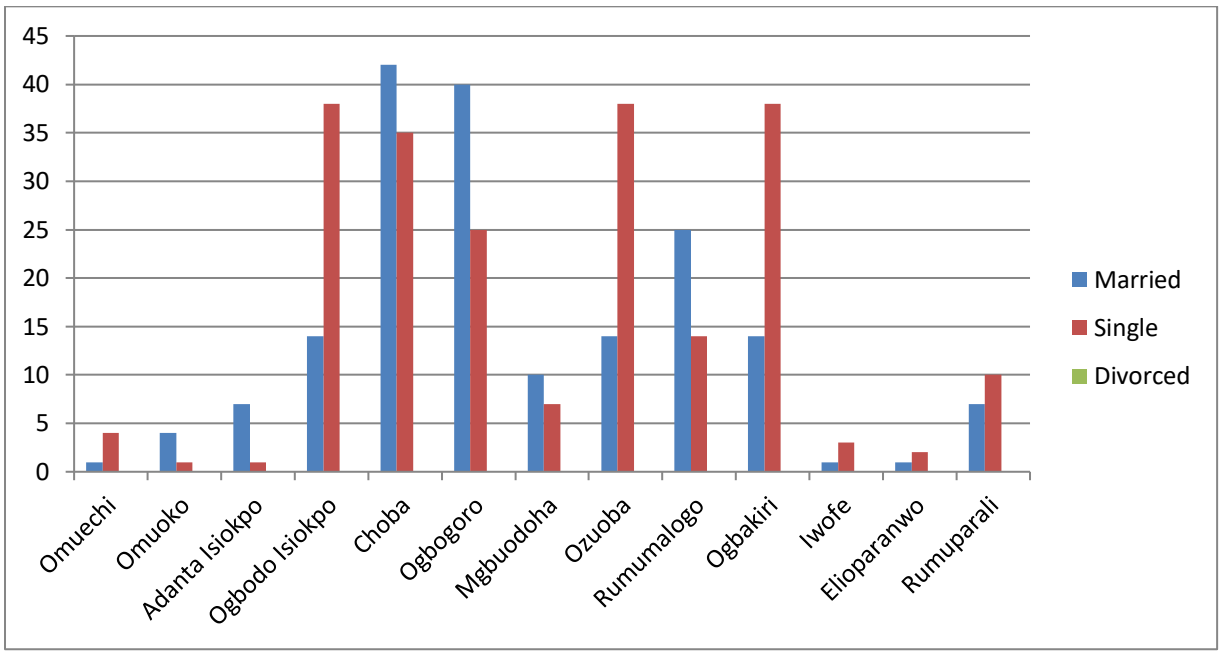

Figure 4 Marital Status of respondents

The figure 4 displays the marital status of respondents and reveals that there are more married people in Choba, Ogbogoro, Rumualogu, Rumuorlumeni, Adanta, and Omuoko while there are more single respondents in Ogbodo Isiokpo, Ozuoba, Isiokpo, omuiwhechi, Iwofe and Elioparanwo.

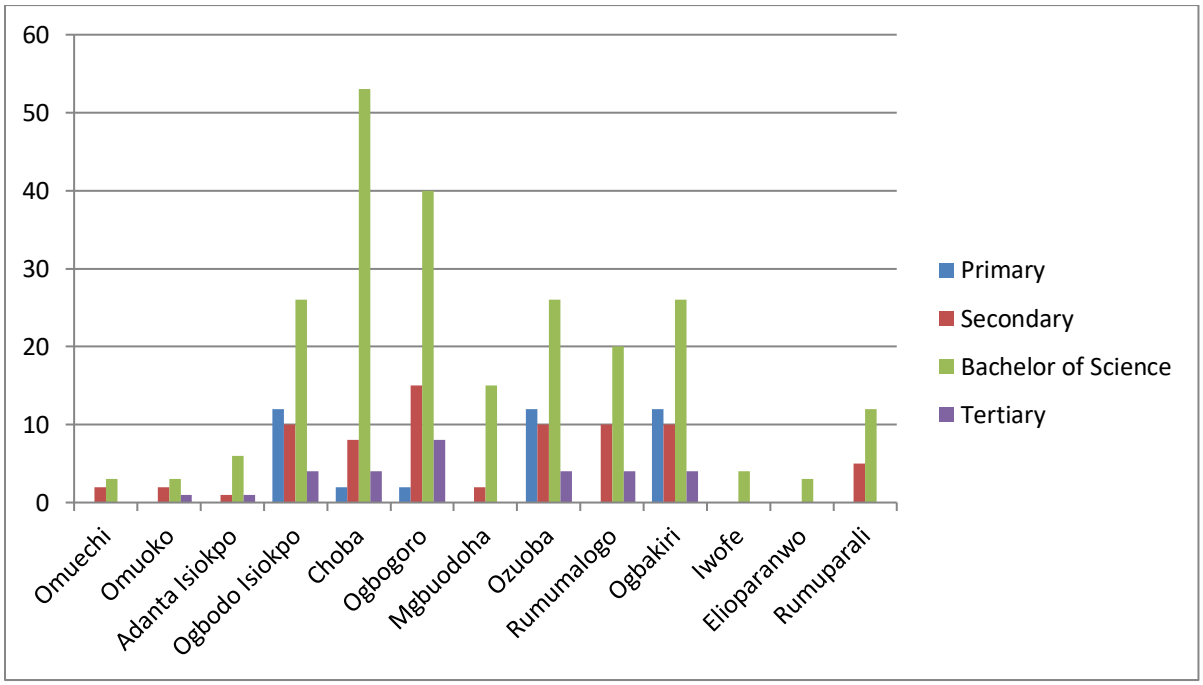

Figure 5 Educational qualifications of respondents

The chart in figure 5 is a representation of the educational qualifications of respondents which shows a majority people with Bachelor of Science qualifications across all the communities followed by Primary education qualifications in only Isiokpo and Ozuoba while the rest of the communities have more respondents who have Secondary educational qualifications leaving Post Graduate educational qualifications as the least amount of educational qualifications found in all the communities.

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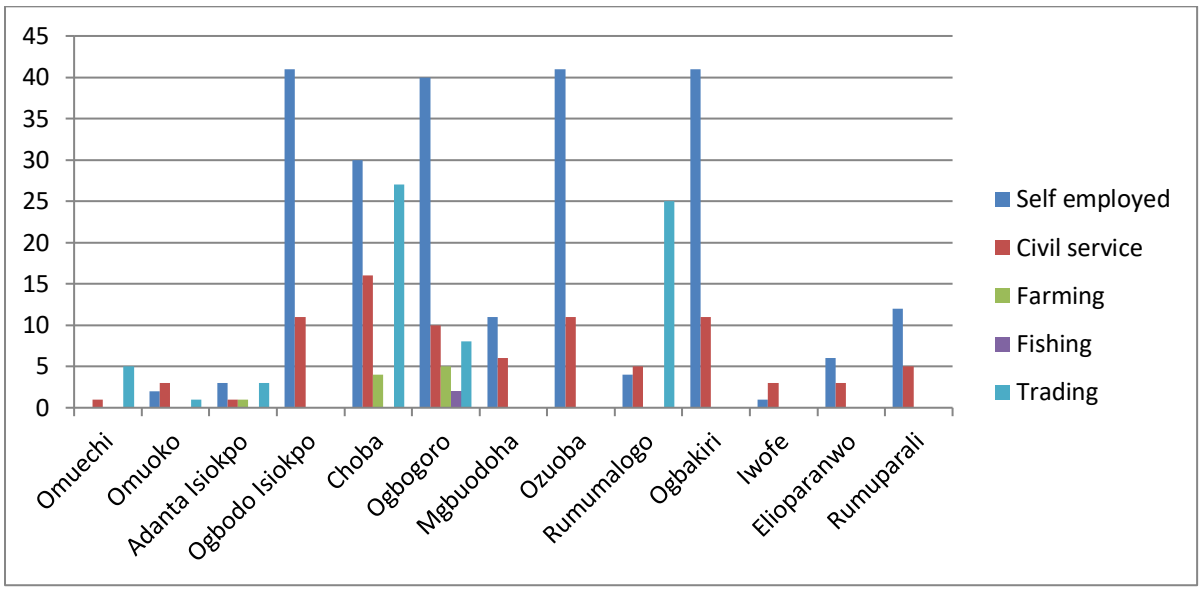

Figure 6 Occupations of Respondents

The chart in figure 6 represents the occupation of the respondents in the communities displaying that in all the communities there are more self-employed people in all the communities than other occupations, this means that respondents are majorly into businesses. This comes after trading which is likewise classified under self employed followed by people with Civil Service occupation before farming occupation and fishing as the least occupation being practiced in these communities.

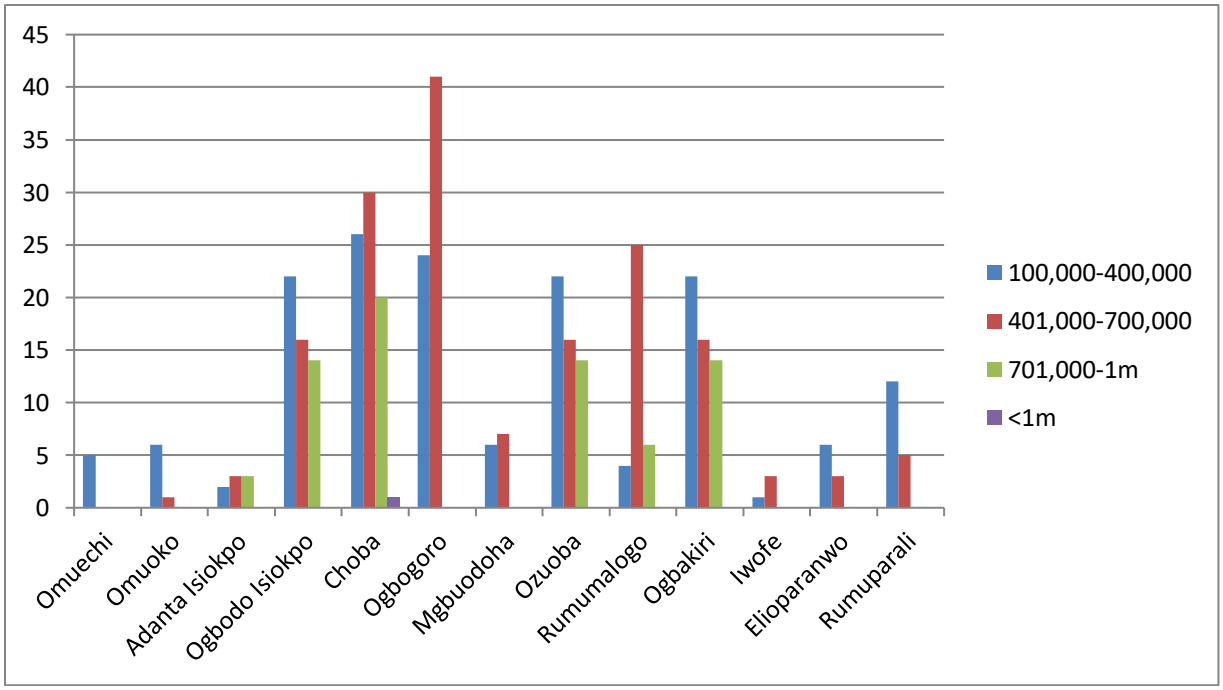

Figure 7 Income of respondents

From the chart in figure 7, it shows that the peak income is between 401-700 thousand in Ogbogoro, Choba, Iwofe and Rumualogu followed by 100-400 thousand in Omuiwhechi, Omuoko, Rumuoparali, Eliparanwo, Isiokpo, Ozuoba, and Ogbodo Isiokpo. The next income level which follows is from 701-1million while the least level of income is from 1million and above.

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Flood control measures and resilience of communities along the New Calabar river catchment.

Table 1: Adequacy of Drainage

	Frequency	Percent
Yes	204	51.0
No	196	49.0
Total	400	100.0

The table 1 shows the response of respondents on the availability of drainages in their areas. 51% had drainages around their homes and 49% had no drainages, therefore, majority of the respondents had drainages around their homes.

Table 2: Frequency of Drainage Maintenance

	Frequency	Percent
very often	106	26.5
rarely	155	38.8
never	139	34.8
Total	400	100.0

The table 2 shows the response of respondents on how often they clean their drainages. 26% said they cleaned it very often, 38% cleaned their drainages rarely, 34% never cleaned their drainages, and therefore, the drainages were rarely cleaned.

Table 3 Availability of Flood control Measures

	Frequency	Percent
Yes	115	28.8
No	285	71.3
Total	400	100.0

The table 3 above shows the response of respondents on the availability of government's flood control measures in their areas. 28 agreed that there were government flood control measures in their area while 71% said there were no government flood control measures in their areas. Therefore, in majority of the areas there was no government flood control measure.

Table 4 Flood control measures adopted

	Frequency	Percent
chanelling of streams	25	6.3
creation of drainage network	63	15.8
desilting of drainage network	14	3.5
None	6	1.5
Total	108	27.0

The table 4 above shows the government flood control measures in the studied areas. The result shows that

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the major flood control measures put in place is the creation of drainage network.

Table 5 Most relevant flood control measures

	Frequency	Percent
creation of drainage system	170	42.5
raised foundations	14	3.5
sand bags to keep flood away	21	5.3
proper land use planning	75	18.8
Others	114	28.5
Total	394	98.5
Total	400	100.0

The table 5 above shows the response of respondents on the most important measure to reduce flooding. The result shows that the most important measure to reduce flood hazards in the studied areas is the creation of drainage system.

Table 6 relevance of early warning system in flood detection

	Frequency	Percent
Very relevant	160	40.0
Not relevant	240	60.0
Total	400	100.0

The table 6 shows the responses of respondents on whether they used early warning signals to deduce flood hazards, the result shows that 40% used early warning signals while 60% do not use early warning signals to deduce flood hazards. Therefore, majority of the respondents did not use early warning signals to deduce impending floods.

Table 7 Flood early warning sources

	Frequency	Percent
Rstv	39	9.8
Social media	40	10.0
Cool fm	14	3.5
Wazobia	73	18.3
NTA	7	1.8
Channels	18	4.5
Total	191	47.8

The table 7 shows the media outlet through which respondents got the early warning signals for floods. 20% got their signal from Rstv, another 20% from social media, 7% from Cool Fm, 38% from Wazobia Fm, 3% from NTA and 9% from Channels TV. Therefore majority of the respondents got flood early warnings from Wazobia FM.

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Table 8 Availability of flood relief programme in communities

	Frequency	Percent
Yes	180	45.0
No	220	55.0
Total	400	100.0

The table 8 shows the response of respondents to the availability of flood relief programs for victims of floods so as to enable them cope with the effects of flooding. 45% responded that there were no relief programs while 55% responded that there were relief programs. Therefore, most communities do not have relief programs for victims of floods.

Table 9 Building development are directed away from flood prone areas

	Frequency	Percent
Strongly agree	97	24.3
Agree	66	16.5
Disagree	191	47.8
strongly disagree	25	6.3
undecided	21	5.3
Total	400	100.0

The table 9 above shows the response of respondents on whether buildings are planned so as they are directed from flood prone areas as a strategy for adaptation to flooding. The result showed that 24% strongly agreed that buildings are planned such that they are directed away from flood prone areas, 16% agreed, 47% disagreed, 6.3% strongly disagreed and 5.3% were undecided. Therefore buildings are not planned so as they are directed from flood prone areas.

Table 10 Drainages have capacity to evacuate water adequately

	Frequency	Percent
strongly agree	51	12.8
agree	147	36.8
disagree	171	42.8
strongly disagree	31	7.8
Total	400	100.0

The table 10 shows the response of respondents to whether drainages are built in environmentally friendly ways to mitigate the impact of floods. 12% strongly agreed that buildings are built in environmentally friendly ways, 36% agreed, 42% disagreed, and 7.8% strongly disagreed, therefore, majority of the drainages were not built in environmentally friendly ways to mitigate the impact of flooding.

Table 11 Flood buffer are built in neighbourhood

	Frequency	Percent
agree	81	20.3
disagree	113	28.3
strongly disagree	192	48.0
undecided	14	3.5
Total	400	100.0

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The table 11 shows the response of respondents to whether flood buffers are used in their area. The result shows that 20% agreed that flood buffers are used, 28% disagreed, 48% strongly disagreed and 3% were undecided. Therefore for majority of the areas, flood buffers are not used.

Table 12 Flooding result in the relocation of some residents

	Frequency	Percent
strongly agree	264	66.0
agree	81	20.3
disagree	28	7.0
strongly disagree	6	1.5
undecided	21	5.3
Total	400	100.0

The table 12 shows the response of respondents to whether those who can't adapt to flooding vacate their homes. The result showed that 66% strongly agreed, 20% agreed, 7% disagreed, 1% strongly disagreed and 5% were undecided. Therefore the residents who could not adapt to flooding vacated their homes temporarily.

Table 13 Community members are sensitized on flood management

	Frequency	Percent
strongly agree	105	26.3
agree	94	23.5
disagree	65	16.3
strongly disagree	78	19.5
undecided	58	14.5
Total	400	100.0

The table 13 shows the response of respondents on whether there is sensitization of community members on flood preparedness, response and recovery measures. The result showed that 26% strongly agreed that there were sensitization, 23% agreed, 16% disagreed, 19% strongly disagreed and 14 were undecided. Therefore there was sensitization of community members on flood preparedness, response and recovery.

Table 14 The sensitization resulted flood adaptation among residents

	Frequency	Percent
strongly agree	91	22.8
agree	108	27.0
disagree	66	16.5
strongly disagree	71	17.8
undecided	64	16.0
Total	400	100.0

The table 14 shows the response of respondents on whether the sensitization led to high adaptation to flood among the residents. The result showed that 22% agreed that the sensitization led to better flood adaptation among the residents, 27% agreed, 16% disagreed, 17% strongly disagreed, 16% were undecided. Therefore, the sensitization has led to better flood adaptation among the residents.

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CONCLUSION

From the analysis, there are more male population of respondents in Choba , Isiokpo, Ogbodo Isiokpo, Ozuoba and Rumualogu and fewer female population in these mentioned places also, there is more female population in Ogbogoro, Rumuoparali and Adanta and fewer male population. The graph analysis of age brackets highlights that the highest numbers of respondents are between the ages of 20-30 as seen in Choba, Ogbodo Isiokpo, Ozuoba and Isiokpo, with ages 31-40 following as seen in Rumualogu, Rumuoparali, Iwofe and Elioparanwo. The next ages bracket are 41-50 with ages 51-60 following behind, the age with the minimum numbers ofrespondents is the age 60. The marital status of respondents and reveals that there are more married people in Choba, Ogbogoro, Rumualogu, Rumuorlumeni, Adanta, and Omuoko while there are more single respondents in Ogbodo Isiokpo, Ozuoba, Isiokpo, omuiwhechi, Iwofe and Elioparanwo. From the analysis of the sample representation, it's obvious that the majority of the respondents educational qualificationswere Bachelor of Science qualifications across all the communities followed by Primary certificate majorlyin Isiokpo and Ozuoba while the rest of the communities have more respondents who have Secondary educational qualifications leaving Post Graduate educational qualifications as the least level of educational attainment found in all the communities. Therefore the occupation of the respondents as displayed that showed more self employed people in all the communities than other occupations, this means that respondents are majorly into businesses**.** This trend created a peak income of 401-700 thousand in Ogbogoro, Choba, Iwofe and Rumualogu followed by 100-400 thousand in Omuiwhechi, Omuoko,Rumuoparali, Eliparanwo, Isiokpo, Ozuoba, and Ogbodo Isiokpo. The next income level which follows isfrom 701-1million while the least level of income is from 1million and above. Responses on the availabilityof government's flood control measures in their areas revealed that there were no government flood controlmeasures in place in their areas. Respondents therefore employed other measure to reduce flood hazards in the studied areas which includes the creation of drainage system, early warning signals to deduce floodhazards, flood relief programs for victims of floods so as to enable them cope with the effects of flooding planned building in places that are not flood prone. Though, the majority of the drainages were not built in environmentally friendly ways to mitigate the impact of flooding which has resulted in increased floodoccurrence. From the result of the findings of this work, it is therefore recommended that The Governmentshould build bank protection facilities within the areas of human habitation along the new Calabar Rivers. There should be development control implemented by the government through the Local Government Administration within the areas inhabited along the river bank. Drainages should be constructed to direct water run-off to avoid flooding. Sand-mining or dredging should be discouraged by the river bank dwellers.

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