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FLOOD RISK AND FLOOD MANAGEMENT IN NIGERIA: COPING STRATEGIES FOR RESIDENTS OF CROSS RIVER STATE

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Abstract

The paper examined flood risk and flood management in Nigeria with reference to the coping strategies of the residents of flooding in Cross River State. Data were obtained using questionnaire and interviews. A total of 400 copies of questionnaire were administered proportionally to residents of the study area. The multi-stage random sampling was used in selecting the sample area. Both descriptive and inferential statistics were used in carrying out the analysis. Therefore, frequencies, simple percentages, averages (mean) and Pearson product moment correlation (PPMC) were used in carrying out analysis. The study showed that there is a positive relationship between flood control measures and the level of effectiveness. It was also identified that the development of water drainage channels was the most common approach used for the control of flood risks in the study area. The residents also rely on flood prediction by government agencies while they also discourage indiscriminate waste dumping and encourage aforestation. Of all the measures used, the most effective was observed to be the development of drainage facilities. Apart from the prediction of flood possibilities by relevant agencies, other measures were mostly observed to be funded individually and collaboratively by the communities. Based on the effectiveness of the approaches, it was recommended among others that the government should strike partnerships with the residents in expanding the measures used for flood control in the area.

Keywords: Flooding, flood risk, flood management, coping strategies, sustainable development

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Introduction

The continuous increase in population which is as a result of urbanization, increase in birth rate, reduction in mortality rate through improvement in medicine and technology have effect on the environment generally. For instance, population increase results in the demand for land for housing which necessitates urban expansion and change in land uses/ land cover all of which tends to ignite the environment with natural disasters. Among the several natural disasters, flooding is the commonest. Flooding is basically triggered by both natural and artificial processes. Natural causatives include topography, overflowing of major rivers and excessive rainfall. Through artificial means, flooding is triggered by indiscriminate dumping of wastes, deforestation, poor and haphazard erection of developments and `land reclamation (Sule, Sani and Anozie, 2015; Yoade, Adeyemi and Adelabu, 2020).

Specifically, flooding refers to the covering or submerging of land that is normally dry. The amount of water that submerges such area is usually in very high quantity. The submerging of the land has several negative implications on the residents, the environment and livelihood of the affected victims. For instance, Rock, Nwankwor, Ahiarakwem and Alieze, (2016) posited that serious flood events result in hazardous externalities leading to damages, losses, deterioration of environment, retardation to development, loss of livelihood sources and sometimes human life. However, the nature of loses that are encountered are largely dependent on the extent/level of flood.

In Nigeria, flooding has become a regular feature. As a means of combating and managing floods, different measures and strategies are used. Okoye (2019) showed that flooding can be managed through the development of water distribution channels to facilitate surface run-offs and the redirection of water for productive purposes such as farmland irrigation, transportation, hydro-electric power generation, mineral mining, recreation and tourism. Emeribeole (2015) buttressed that adequate channelization and development of drainage channels can be useful in solving the challenges of flooding in Nigeria. The authoralso explained that the discouragement of developments and housing units on flood plains will be useful in managing flooding. Another approach for flood management is the development of stormwater distribution facilities and dams. The above studies explained the managementoptions of flooding without analyzing the level of effectiveness of the measures and strategies implying a gap in knowledge.

In Cross River State, several communities are prone to flooding. In these communities, efforts have been intensified to help cope with the negativities of the phenomenon.With the existing measures used by communities and paucity ofstudies toevaluate the effectiveness of the measures, there is need for a study of this nature to be carried out. Against this backdrop, this study was necessitated.

Flood Risk Management and the Concept of Sustainability

Generally, the aim of managing flood risk is to ensure a reduction in the losses (both social and economic) that are encountered during the events of flooding. Flood risk management is an offshoot of the broad field of risk management. The tenets of flood risk management are hinged on the relationships between physical systems and socio-economic environments as it concerns flood risk assessments. Flood risk management further seeks to build understanding and actions/strategies that are brought on the environment by the submerging of places with large water bodies. Solín and Skubinčan, (2013) explored the concept of flood risk management in explaining how the environment can be managed sustainably such that the negative impacts of flooding can be mitigated. They explained that for flood risk to be managed effectively, there is need to ensureflood risk assessment. Basically, flood risk assessmententails a combination of flood hazard, probability and potential negative consequences of floods for human health, economic activities, the environment and cultural heritage. Assessmentsof flood risks concentrates on theestimation ofyearly maximum discharges for different nonexceedance probabilities and establishment of the corresponding flooding area and specific parameters of flood (water level, flow velocity, etc.) (Solin and Skubincan, 2013). Furthermore, flood risk management take excerpts from detailedanalysis ofpredictednegative consequences of floods which are measured by social, economic and environmental systems vulnerability.

In contemporary times flood risk have become deepened especially in countries of developing world due to poor institutional representation and organizational approaches to handling flood menace (Mfon, Oguike, Eteng and Etim, 2022). In available studies, there is insufficient knowledge regarding the relationship that exist between flood risk management and the concept of sustainable development. Binns (2022) states that attempts were made to explain the nexus that exist between the concepts. The study showed that sustainable water management can be useful in combating the menace of flood in the environment. The author further suggested that

for there to be sustainable water management, communities have to be engaged through the process of participatory planning which will involve community engagement in flood risk planning. There is also need for proper awareness and community resilience to be encouraged in the process. Sustainable management of the risk will suggest that social, economic, ecological, and hydrological aspects of flood risk management be generated into lasting solutions from the menace of flooding while preparing communities for resilience.

Carther, White and Richards (2009) opined that sustainability appraisals should be carried out regularly particularly as it related to flood. This is because, it strengthens spatial plans that are related to flooding issues.Sustainable flood management thus, reliesonthe adequacy of knowledgeof flood hazard and the likelihood of flood events. The knowledge will help in the design of approaches and strategies that will be helpful in flood management. Flood management at this level therefore, demands the use of high quality flood prediction/detection techniques and technologies in the prediction of flood. Flood mapping, element of risk identification and detection of the likelihood that flooding will occur in places ill be visibly helpful in flood management.

Specifically, the tenets of sustainable development are broadly hinged on the exploitation and use of natural resources in such a way that the aspirations of future generations will not be compromised. Sustainable development seeks to create the proper use of resources. The assumption is that, it is impossible to avoid harnessing resources or subjecting the environment to use, yet while the environment is subjected to use, the gains and aspirations of future generations should not be compromised (Ajom, Etim and Eteng, 2022). In the present study, it is clear that flooding being a natural phenomenon is difficult to avoid in its entirety, thus, the environment has to be used such that the risk of flooding will not cost the future generations their aspirations. With sustainability as a goal and flood risk management as a concept, it may be relatively easy to conserve the environment against the hazards of flood. Most importantly, human factors that trigger inundation of flood should be discouraged. This can be done through the discouragement of deforestation, environmental depletion and environmental damage.

Flood Management Strategies

Due to the negative effects of flood, approaches are designed that will be helpful in the management of flood risk. Such approaches differ with respect to locations, probability of flood occurrences and climatic factors. Holistically, flood risk management requires preparedness, prevention and the mitigation of flood (Ani, Ezeagu, Nwaiwu and Ekenta, 2020). Each of the phases require certain approaches to be put in place in order to ensure effective management of flood risk. In the preparedness phase, possibilities of flooding should be predicted and zones at risk should be identified. The prediction and identification of flood zones require the use of technologies and advanced prediction tools for zone identification. In occasions when such areas are identified and mapped long before the flood proper, elements of risks can be spared as some maybe relocated. The prevention phase involves forecasting, early warning, observation and monitoring as well as developing plans for flood management in case of occurrence. The prevention phase therefore seeks to establish a common ground for advanced approaches towards reducing the negative impact of flooding while the mitigation phase describe activities that take place after flood occurrence (Ani et al., 2020). In most cases, mitigation is in the form of damage assessment, distribution of relief materials, relocation and resettlement of victims among others.

In other areas, flood risks are managed using different techniques. Ologunorisa, (2009) assessed the strategies adopted in the management of flood risks in the Niger Delta.He made a case for both structural and non-structural methods in managing flood. The author argued that structural methods of flood control represent false sense of security to flood plain residents thus encouraging investments in flood prone area while non-structural methods makesbehavioural adjustments to flood control. He observed that for flood management to be effective in the Niger Delta, there is need for establishment of coastal management zone authority, land-use zoning, legislation, building codes, flood forecasting and warning systems, flood insurance and engineering control of the major river system.

Oluchi, Chinwe, James and Dickson (2017) examined the effectiveness of flood management strategies in Nigeria in Anambra State. The authors are of the view thatthe development of dams across the river channels,construction of wing dykes and afforestation can be an effective approach for flood management. Their study noted that there was no proper management of

flood in the studied communities. They specifically identified that proactive measure measures of flood managementwere not made, thus, residents in flood prone areas are usually caught upby flood and then end up being evacuated to camps at the upland or at other parts of the state where flooding was not endemic. It was suggested that rather than waiting for flood to start before handling the aftermath, flood preparedness should be taken seriously. This will help in the detection of flood and mapping of locations that are prone to flood thus, reducing the negative impacts.

In Awka, Anambra State, Onwuka, IkekpeazuandMuo (2015) assessed the effectiveness of the measures that are operational inAgulu, Amaenyi, Ezi-Awka, Amikwo, Ifite and Nkwelle communities all in Anambra State. They noted a significant difference in the various efforts made to check flooding in as well as measures that are used in flood management. They specifically noted that flood management among residents of the communities is individually tackled hence, it is difficult for success to be achieved. They suggested that for the desired results to be achieved, there is need foran integrated approach to be adopted in tackling flooding. they suggested that the approach will involve massive campaign against improper dumping of refuse in the drainage system, construction of sound drainage system, creation of environmental awareness to keep the drainage system from waste dumps, encouragement of people to open their drainage system constantly in order to help check and control flooding as well as avoiding dumping of refuse in drainage system as the enforcement of all these strategies will be helpful in minimizing flood incidences.

Adefisoye, (2017) was of the view that citizen's participation in flood management is a useful approach that will help in management of the menace of flooding.the author highlighted that communities should have concrete and functional mitigation plans aside the conventional monthly environmental sanitation exercises prior to the 2011-2012 flood disaster in Nigeria. He also noted that the level of interaction between government agencies and citizens concerning flood management is low thus, there is need for citizen participation in the flood management system.

Materials and Methods

Study Area

Cross River State is one of the Thirty-Six (36) States that make up Nigeria. The state is bordered in the North by Benue State, in the North -West by Ebonyi State,in the South, by Akwa Ibom State and the Atlantic Ocean while in the East, it is bothered by the Republic of Cameroon and Abia State (Figure 1). The State is located between Latitudes $4^{0}28'$ and 6^{0} 55' North of the Equator and Longitudes $7^{0}50'$ and $9^{0}28'$ east of the Greenwich Meridian. Rainfall in the area is perennial. It reaches its peak in June and July with anaverages of 3058mm. The torrential nature of rainfall largely triggers flooding in the area (Inah, 2022). The socioeconomic drivers of the area include farming, civil service, artisans, trading and so on. The fact that primary activities occur in the area suggest that erosion affect the activities of the residents. For instance, flooding affect farm lands which in turn affect the livelihoods of the residents of the study area. Flooding also affect housing units, trade and commerce among others.

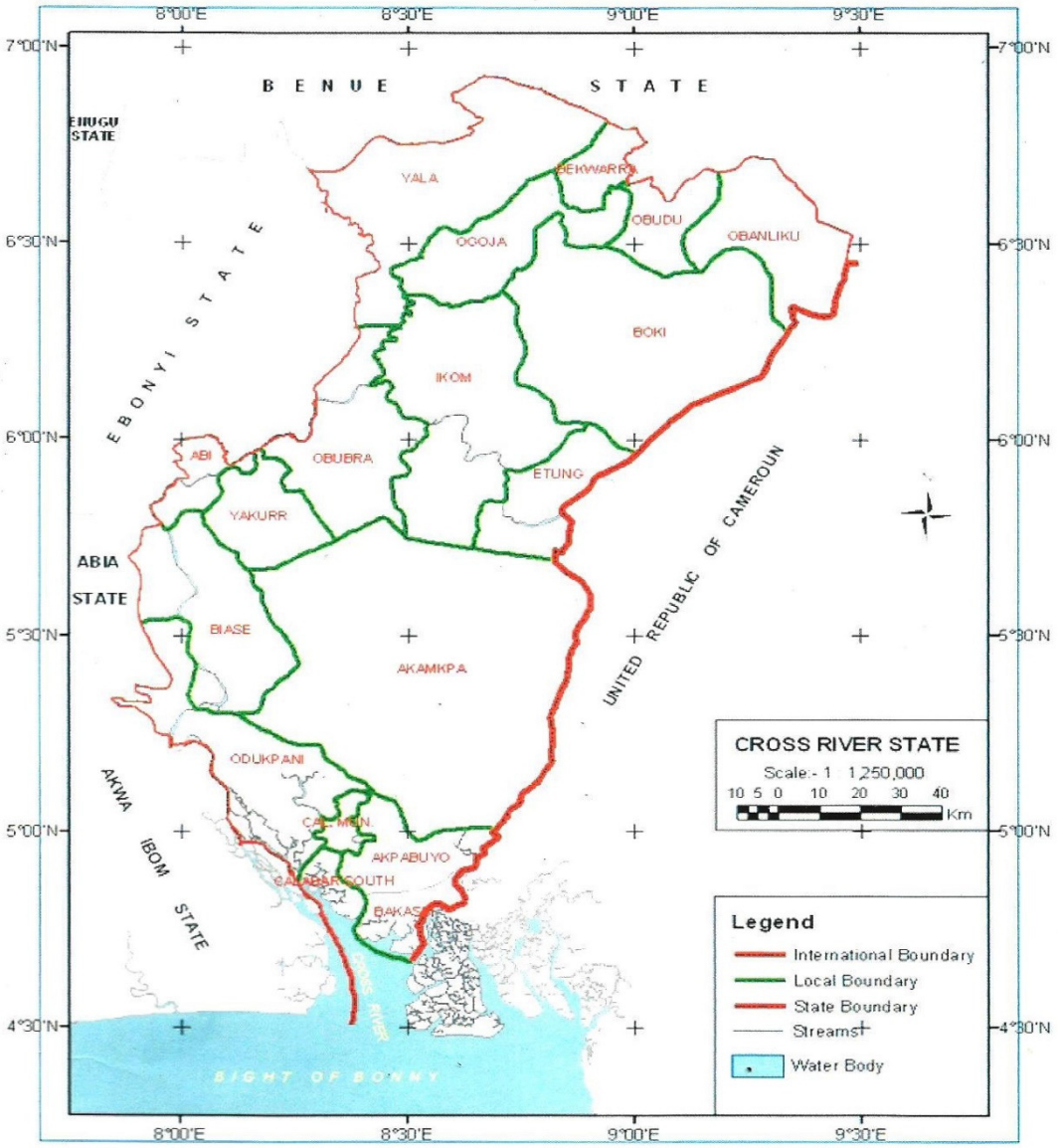

Figure 1: Map Showing the Regional location of Cross River State in Nigeria

Source: Cross River State Geographic Information Agency, 2022

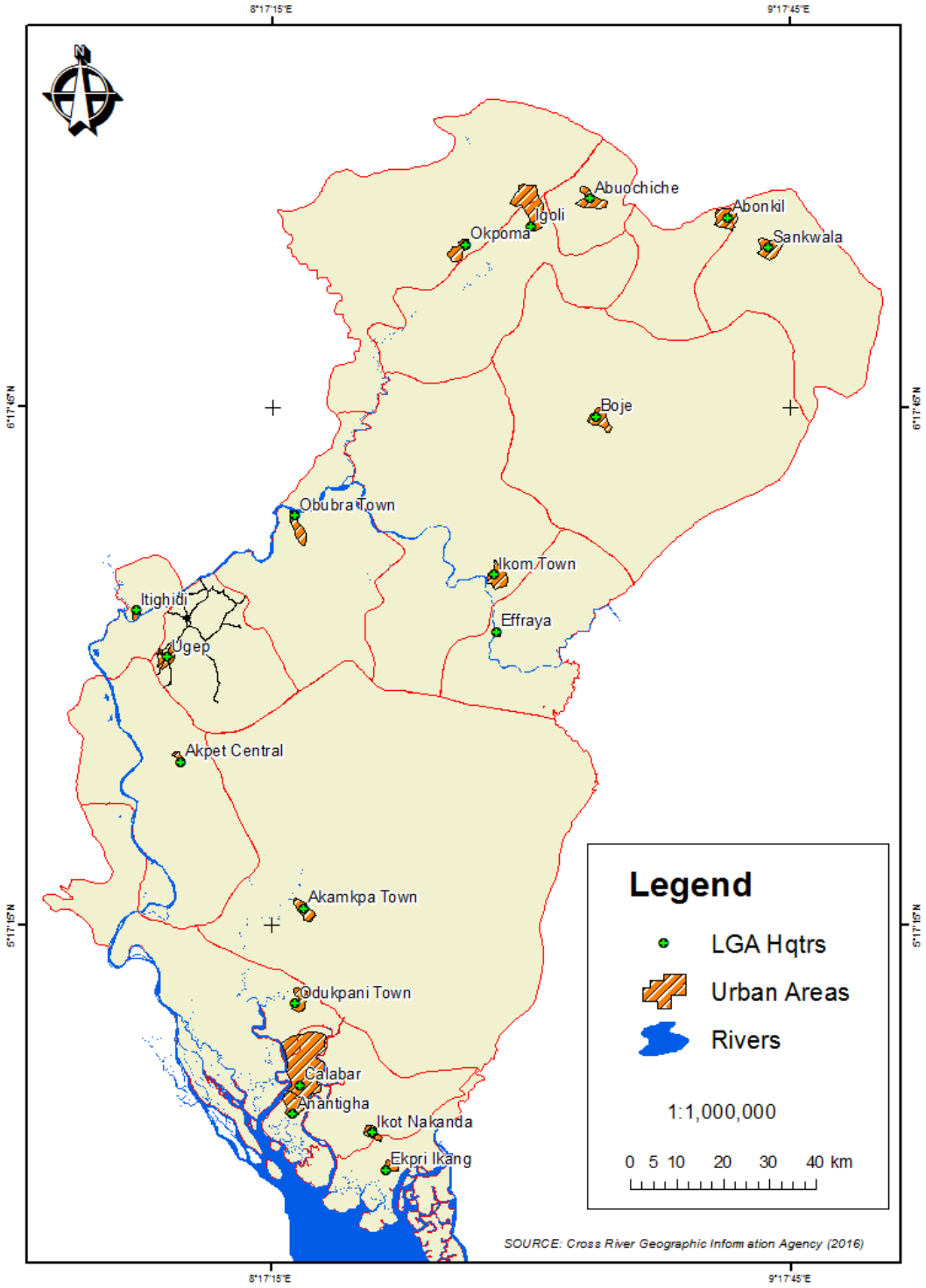

Figure 2: Map Cross River State Showing Local Government Headquarters
Source: Cross River State Geographic Information Agency, 2022

Methodology

The survey research design was adopted in the study. In order to reach the target audience, the multistage random sampling technique was employed. The first stage involved the stratification

of the Eighteen Local Government Areas (LGA) based on the three (3) existing senatorial districts. The Senatorial Districts are; Cross River North, Cross River South and Cross River Central Senatorial Districts. Specifically, Cross River North contained Obudu, Obanliku, Bekwarra, Yala and Ogoja LGAs while in Cross River Central Senatorial District, it was made up of Yakurr, Abi, Boki, Etung, Obubra and Ikom LGAs and Cross River South Senatorial District contained Biase, Akampka, Odukpani, Calabar Municipality, Calabar South, Akpabuyo and Bakassi LGAs. In each senatorial district, a random choice of LGAs was made. In Cross River State North, Yala LGA was selected while in Cross River South, Obubra LGA was selected and in Cross River South, Biase LGA represented. Therefore, the sampled was made up of three LGA with even representation from the Senatorial Districts. Furthermore, there was a random selection of communities that are prone to flooding in each selected LGA. Therefore, 10 communites that are flood prone were selected in each of the three LGAs making a total of 30 communities. In in each of the sampled LGAs, a random selection of 10 communities was done. In all, order to determine the actual sample size, the 1991 population of humans was obtained from the National Population Commission (NPC), Calabar Area office. The population was projected to 2021 using a growth rate of 2.8 persons. The projected population was further converted to households using a household average of 6 persons. Furthermore, the Taro Yamane formular was applied in the establishment of the sample size. The fomular for determining the sample is as follows;

$n = \frac{N}{1+N(e)^2}$ Where, n is sample size, N is population of the study, e is tolerable error (5%)

In all, the exercise resulted in the selection of 400 households. Therefore, 400 copies of questionnaire were used in eliciting data. Data were obtained at the household level. The systematic random sampling technique was used in the distribution of copies of questionnaire. Data were presented using tables and analysis were done using frequencies and simple percentages.

Findings and Discussions

Table 1: Flood control Measures

S/N	Variables	5	4	3	2	1	Total	Mean
1	Development of Drainages	201	65	52	43	39	1698	4.2
2	Flood prediction	161	83	71	26	89	1562	3.9
3	Avoidance of development on flood prone areas	181	76	83	41	19	1642	4.1
4	Discouragement of indiscriminate waste disposal	96	65	86	92	61	1329	3.3
5	Afforestation	120	43	89	56	92	1332	3.3

Source: Field Survey, 2022

Table 1 showed the measures through which flooding is controlled in the study area. As noted in the Table, the development of drainages to facilitate surface run-offs represent the largest indicator to flood control in the study area. Flood prediction by meteorological agencies and organizations equally contributed to flood control as it influences preparedness of residents of the study area. Equally, the residents avoid flood prone areas to a large extent when it comes to development. However, while such places may be avoided for housing development, they may not be completely avoided for agricultural purposes thus, flooding may rather than affect humans directly, affect the crops that are cultivated or other activities that are carried out in such places. It was also observed that discouragement of dumping wastes indiscriminately as well as afforestation also contribute towards the regulation of flooding in the study area. Further interviews revealed that it is mostly the residents that ensure the implementation of the strategies apart from flood prediction. However, the prediction of possibilities of flooding was basically to be prior to torrential rainfall and possibility of inundation of water which maybe through other means.

Table 2 shows that the most effective measure through which flooding is regulated in the study area was through the development of drainage channels to facilitate surface run-offs. Therefore, residents of the study area revealed that the drainages were basically developed individually. Unless along major roads in few selected communities which represented less than 15 percent of the entire sampled areas, drainage development was a prerogative of individual efforts. Furthermore, the residents also rely on flood prediction from relevant agencies in making plans for possible flood occurrences and the effectiveness of the prediction culminated into a mean

values of 3.8 which is relatively fair being that the scaling was in a Likert scale of 1-5. Equally, the approach of avoiding to develop in flood prone areas showed fair contribution of effectiveness while afforestation and discouragement of indiscriminate waste disposal was not effective. The least contribution to the effectiveness in the strategies for managing waste was that of the discouragement of indiscriminate waste disposal.

Table 2: Effectiveness of Flood control Measures

S/N	Variables	5	4	3	2	1	Total	Mean
1	Development of Drainages	235	65	32	53	15	1684	4.2
2	Flood prediction	204	42	36	48	70	1498	3.8
3	Avoidance of development on flood prone areas	164	62	39	41	94	1400	3.5
4	Discouragement of indiscriminate waste disposal	96	38	56	54	156	1120	2.8
5	Afforestation	132	91	36	56	85	1365	3.4

Source: Field Survey, 2022

Table 3: Correlation Between Flood Control Measures and Level of Effectives

		strategies	Effectiveness
Flood control Measures	Pearson Correlation	1	.889*
	Sig. (2-tailed)		.044
	N	5	5
Effectiveness	Pearson Correlation	.889*	1
	Sig. (2-tailed)	.044	
	N	5	5

*. Correlation is significant at the 0.05 level (2-tailed).

The Pearson Product Moment Correlation was used in examining the relationship between flood control measures and the level of effectiveness. Before embarking on the test proper, preliminary analysis were conducted. This was to ensure that there was no violation of the assumptions of normality, linearity, continuity and none presence of significant outliers.ThePearson Correlation Coefficient (r) shows the strength of the relationship between the variables. From the result as seen in Table 3, the Pearson correlation coefficient was positive (0.044). This is because that

computed value was less than 0.05. Furthermore, the magnitude of the Pearson correlation coefficient determines the strength of the correlation such that a Pearson correlation coefficient (r = 0.889) suggests a strong relationship. The level of statistical significance (i.e., the -p-value) is shown in the second row of the matrix. Its value can range from -1 for a perfect negative linear relationship to +1 for a perfect positive linear relationship while a value of 0 (zero) indicates no relationship between two variables. Based on the results above, it was reported thus:

i. Pearson product moment correlation was used in assessing the relationship between the variables
ii. The result showed a positive correlation between the variables with flood control measures explaining 79 percent of the effectiveness level.
iii. The direction of the relationship is positive (i.e., measures for flood control and effectiveness are correlated). This imply that both variables tend to increase together.

On the basis of the result, the null hypothesis which states that there is no significant relationship between flood control measures and the effectiveness level was rejected and the alternative hypothesis which states that there is a significant relationship between the variables was accepted.

Conclusion

The study analysed the measures that are used for the control of flood in selected communities in Cross River State, Nigeria. The study revealed that the residents employ various strategies in other for them to cope with the menace of flooding. Particularly, it was revealed that the residents develop drainages to facilitate surface run-offs while the approaches of avoiding housing development on flood prone area, discouragement of indiscriminate waste dumping and afforestation were other measures that were applied in the process of controlling flooding. Prediction on the possibilities of flooding was also another approach but was observed to be purely an activity of the government using relevant environmental agencies. The study further established the effectiveness level of the measures that are applied in comparison to the effectiveness. It was specifically observed that the most effective strategy was the development of water drainage channels to facilitate surface run-offs while the prediction of flooding possibilities by relevant agencies among other contribute to an extent in the effectiveness of flood management in the study area.

The strength of the relationship that exist between flood measures and level of effectiveness was explored using inferential statistics and the results of the tests showed significant relationship between the variables. This imply that the approaches used by the residents in the control/management of flood in the study area were effective. As such more efforts should be intensified towards ensuring that drainage channels, afforestation among other control measures for flooding in the study area are taken seriously.

Recommendations

Based on the findings of the study, the following recommendations were made;

i. The government should develop strategies that will allow for partnerships with the local communities and individuals that will bring about promotion of flood management strategies for the sustainability of the study area.
ii. Emphasis on afforestation should be made with the setting up of units and formations to ensure enforcement of legislations against deforestation
iii. The planning and development control departments should intensify efforts towards discouraging development of housing units on flood prone areas

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