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Advancing Environmental Health And Sustainability Through Public Awareness, Effective Waste Management, And Environmental Monitoring Strategies In Calabar Education Zone, Cross River State, Nigeria

By

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Abstract

The research is on advancing environmental health and sustainability through public awareness, effective waste management, and environmental monitoring strategies in Calabar Education Zone.Cross River State, Nigeria. To direst this study, two research hypotheses were formulated in line with the specific objectives of the study. The correlation research design was adopted. The population of this study includes all the 312,149 household heads in the Calabar educational zone (southern senatorial District) of Cross River State. The multi stage sampling technique is applied where the population is made of heterogeneous groups and provides a sample of ,872 household heads. Data were collected using a researcher-developed instrument titled "Environmental Health and Sustainability Via Public Awareness, Effective Waste Management, and Environmental Monitoring Questionnaire (EHSVPAEWMEMQ)," which yielded a reliability coefficient mean of .88-.92 using the Cronbach Alpha approach. Simple linear regression was employed for data analysis. the results revealed that public awareness, effective waste management, and environmental monitoring strategies significantly predict environmental hazards control in Calabar Education Zone of Cross River State. The researcher therefore concluded that effective public awareness, waste management as well as environmental monitoring strategies could go along way in advancing environmental health in the research area**.** Based on these findings, it was recommended, among others, that there should be consistent environmental monitoring strategies to eradicate environmental hazard in the area, there should be legislature for defaulters against environmental policies and victims should be penalised through a proficient law court

Keywords: Environmental Health, Sustainability, Public Awareness, Effective Waste Management, Environmental Monitoring.

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Introduction

In Nigeria, environmental hazards such as flooding, erosion, poor sanitation, and improper waste disposal have become recurrent, particularly in urban centers such as the Calabar Education Zone. These hazards not only threaten environmental sustainability but also compromise public health, economic activities, and infrastructural integrity (Okon & Bassey, 2023). Effective environmental hazard control requires the integration of various components such as institutional capacity, policy enforcement, public awareness, waste management practices, and environmental monitoring strategies. These variables interact to determine how effectively hazards are managed and mitigated within a geographical area (UNEP, 2022).

Public Awareness plays a crucial role in environmental hazard control. Awareness encompasses knowledge, attitudes, and behaviors related to environmental stewardship. When the public is informed about the causes and consequences of environmental hazards, they are more likely to engage in responsible behaviors such as proper waste disposal, tree planting, and reporting of environmental violations. Akor and Nkereuwem (2023) found that environmental education and sensitization campaigns significantly improve community participation in hazard mitigation. In Calabar, low levels of environmental awareness have been linked to continued practices such as open defecation, illegal refuse disposal, and misuse of public drainage systems.

Waste Management Practices refer to the collection, transportation, treatment, and disposal of waste materials in ways that minimize their impact on the environment and public health. Ineffective waste management has been cited as a key driver of environmental hazards, particularly urban flooding and land degradation. In many areas of Calabar, waste is often dumped in gutters, streets, and vacant plots due to irregular waste collection services and lack of disposal facilities (Okon & Bassey, 2023). According to Ekanem (2021), waste mismanagement contributes to 65% of urban flooding incidents in Cross River State. The adoption of effective practices such as recycling, composting, and proper landfill management can significantly reduce environmental risks.

Environmental Monitoring Strategies involve the systematic observation, measurement, and analysis of environmental parameters to detect changes and predict potential hazards. These strategies include the use of Geographic Information Systems (GIS), satellite imagery, sensors, and routine field inspections to track pollution levels, weather patterns, and other environmental indicators. Effective monitoring allows for timely intervention and informed decision-making (Essien & Ita, 2022). Essien and Ita (2022 futhers maintained that in Calabar, the absence of robust monitoring systems limits the ability of authorities to anticipate

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and respond to environmental threats. For example, flood forecasting systems and early warning mechanisms are either non-existent or poorly maintained.

The Calabar Education Zone, encompassing parts of Cross River State, is particularly vulnerable due to its geographic location, increasing population density, and weak infrastructure (Essien & Ekong, 2021). Waste disposal is often indiscriminate, drainage systems are poorly maintained, and government monitoring agencies are under-resourced. Flooding during the rainy season and refuse blockages along roads and drainages are common occurrences, suggesting systemic institutional and policy weaknesses (UNEP, 2023).

The socio-economic implications of these environmental challenges are significant. Communities in the Calabar Education Zone frequently experience the loss of property due to flooding, contamination of water sources, and outbreaks of diseases such as cholera and malaria. Poor infrastructure in schools, including poor drainage and waste management practices, exacerbates the problem. Many of these issues can be traced to poor environmental planning and weak institutional oversight, raising urgent concerns about sustainable urban management and the enforcement of relevant environmental regulations.

Public' awareness refers to the level of knowledge, attitudes, and behaviors exhibited by the maxes regarding environmental issues and hazards. As the younger generation, pupils play a crucial role in sustaining environmental values and practices that mitigate environmental hazards in the long term. Increasing environmental awareness among pupils helps to build resilient communities and promote sustainable environmental behaviors. Nwachukwu and Umeh (2021) observed that early environmental education significantly impacts public awareness of hazards such as flooding, pollution, and. Ibrahim and Okeke (2023) found that pupils in schools where environmental clubs were active displayed higher knowledge about recycling, climate change, and health-related environmental issues. Their research suggested that hands-on activities and school-based campaigns strengthen hazard awareness. Chukwu and Adamu (2021) studied environmental literacy in public and private schools in Enugu State and reported that pupils with higher awareness scores were more likely to engage in safe waste disposal, tree planting, and water conservation practices.

Kumar (2017) stated that enumerated the negative impacts of unplanned farming on the environment as conversion of forests. grasslands and other habitats for agricultural use, degradation of soil quality (20 per cent of African soils are seriously degraded). According to the authors, pollution of soil and surface water, aquifers and coastal wetlands through excessive or inappropriate use of pesticides and fertilizers, significant loss of crop and

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livestock genetic diversity through the spread of industrial monocultures, reducing resilience in the face of climate and other changes. Olowu (2020) added that main reasons of environment pollution are irregular and rapid industry, urbanization, organic and inorganic wastes that left in environment, unintended usage of agricultural lands and wrong agricultural applications. According to them, erroneous using of pesticides and chemical fertilizers. irrigation, tillage, plant hormone applications are some of the wrong applications. All these expressions are clear indications that farming systems have environmental consequences on the society especially when they are not well planned and managed.

According to Akor and Nkereuwem (2023) timber harvesting is a threat to tropical forests, and is an international issue that has been attracting the attention of the international community because it is believed to cause environmental damage and promote corruption. The authors stressed further that logging, particularly uncontrolled logging, can have variable but usually deleterious impacts on biodiversity and other globally important environmental services therefore the need to develop a monitoring programme to ensure that consumers does not exceed the threshold that will hamper sustainability. Moiseyev et al (2010) observed that illegal logging causes serious environmental problems such as global deforestation leading to reductions in carbon stocks, degradation of biodiversity, lowering water quality, discouraging sustainable logging practices and forest management, and also destroys the protective function of the forests--natural disasters, such as the massive landslides and flooding after heavy monsoon rain. Uche and Ibrahim (2020). added that if illegal logging practices occur at a large destructive scale, it can lead to the conversion of forests to grassland and to the depletion of plant and animal species, and that if illegal logging occurs in protected areas, rare plants and animals may become threatened).

Objectives of the study

The purpose of this study is to examine how environmental health and sustainability is impacted on by public awareness, effective waste management, and environmental monitoring strategies in Calabar Education Zone.Cross River State, Nigeria. Specifically, the study aims to:

1. Evaluate the role of public awareness in promoting control of environmental hazards in the Calabar Education Zone.
2. Analyze the impact of waste management practices on the control of environmental hazards in the Calabar Education Zone.
3. Examine the effectiveness of environmental monitoring strategies control of environmental hazards in the Calabar Education Zone.

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Research hypotheses

1. The following null hypotheses will guide the study:
2. Public awareness does not significantly predict the control of environmental hazards in the Calabar Education Zone.
3. Waste management practices does not significantly predict the control of environmental hazards in the Calabar Education Zone.
4. Environmental monitoring strategies does not significantly predict the control of environmental hazards in the Calabar Education Zone.

Research Design

This study employed a correlational design. This design aims to identify the relationship between institutional capacity, policy enforcement and hazard control in Calabar Education Zone. The population of this study includes all the household heads in the Calabar educational zone (southern senatorial District) of Cross River State. Nigeria details of the information are from the National Bureau of statistics, 2025. Reveal that there are three hundred and twelve thousand one hundred and forty-nine (312,149) regular household in Calabar Educational zone of Cross River State. This makes the total population of the study to be three hundred and twelve thousand one hundred and forty-nine (312,149) subjects. The multi stage sampling technique is applied where the population is made of heterogeneous groups and provided a means whereby the entire population of the study in grouped into homogeneous sub-groups from which proportionate random sampling can be used to select. Stratified random sampling will be used to divide the entire Calabar Educational zone of Cross River State into 7 strata based on the seven (7) local Government Areas that make up the zone: Akamkpa, Akpabuyo, Bakassi, Calabar municipality,Calabar-South and Dupain. All the seven (7) local Government Area in Calabar Education zone of Cross River State will be used for the study. The researcher will use proportionate sampling to select twenty percent (20%) of the wards and thirty percent (30%) of the households as sub-sample for this study. The multi stage sampling technique is applied where the population is made of heterogeneous groups and provides a sample of ,872 household heads. Data were collected using a researcher-developed instrument titled “Environmental Health and Sustainability Via Public Awareness, Effective Waste Management, and Environmental Monitoring Questionnaire (EHSVPAEWMEMQ),” which yielded a reliability coefficient mean of .87 to .91 using the Cronbach Alpha approach. Simple linear regression was employed for data analysis. All hypotheses were analysed at .05 level of significance.

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Results

Two hypotheses were stated and tested to address the problem of this study. Each hypothesis was tested at 0.05 level of significance.

HO_1

Public awareness does not significantly predict environmental hazards control within Calabar Education Zone of Cross River State. The independent variable is policy enforcement while the dependent variable is environmental hazards in control. In analyzing the hypothesis simple regression statistical analysis were employed and finding outlined within Table 1

Table 1: Simple regression analysis of public awareness and environmental hazard control within Calabar Education Zone of Cross River State (N=1,872)

Source of variation	SS	Df	MS	F-ratio	Sig.
Regression	91.125	1	91.257	7.815	.020[b]
Residual	14130.691	1870	8.418		
Total	14221.816	1871			

significant at p <.05, R=.181, R^2=.033, Adj R^2=.031

The analysis in Table 8 showed that the Adj R2is 0.021 This implies that 2.1 % of the variance within dependent variable (environmental hazard control) could be accounted for by housing system. However, though the percentage contribution is small, a cursory look at the table showed that F=8.335 (p<.05) is significant. Also since p(.012) is less than p(.05), it implies that policy enforcement significantly predicts environmental hazard control within Calabar Education Zone of Cross River State. Therefore, the stated null hypothesis is rejected. Meaning that a better policy enforcement can affect environmental hazard control within Calabar Education Zone of Cross River State.

HO_2

Waste management does not significantly predict environmental hazards control within Calabar Education Zone of Cross River State. The independent variable is public awareness while the dependent variable is environmental hazards control. In analyzing the hypothesis simple regression statistical analysis were employed and finding outlined within Table 2.

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Table 2: Simple regression analysis of waste management system and control of environmental hazard in Calabar Education Zone of Cross River State (N=1,872)

Source of variation	SS	Df	MS	F-ratio	Sig.
Regression	194.352	1	194.352	31.312	.000[b]
Residual	14027.464	1870	10.021		
Total	14221.816	1871			

significant at p <.05, R=.343, R^2=.178, Adj R^2=.176

The analysis in Table 2 showed that the Adj R2is 0.031 This implies that 3.1% of the variance within dependent variable (environmental hazard control) could be accounted for by public awareness. However, though the percentage contribution is small, a closer look at the table showed that F=7.815 (p<.05) is significant. Also, since p(.020) is less than p(.05), it implies that public awareness significantly predicts environmental hazard control within Calabar Education Zone of Cross River State. Therefore, the stated null hypothesis is rejected. Meaning that a better public awareness can help in environmental hazard controlling within Calabar Education Zone of Cross River State.

HO_3

Environmental monitoring strategies does not significantly predict environmental hazards control within Calabar Education Zone of Cross River State. The independent variable is environmental monitoring strategies while the dependent variable is environmental hazards control. In analyzing the hypothesis simple regression statistical analysis were employed and finding outlined within Table 3.

Table 3: Simple regression analysis of environmental monitoring strategies and environmental hazard control within Calabar Education Zone of Cross River State (N=1,872)

Source of variation	SS	Df	MS	F-ratio	Sig.
Regression	116.881	1	116.881	-11.291	.001[b]
Residual	14104.935	1870	12.441		
Total	14221.816	1871			

significant at p <.05, R=.192, R^2=.037, Adj R^2=.035

The analysis in Table 3 showed that the Adj R2is 0.035 This implies that 3.5% of the variance within dependent variable (environmental hazard control) could be accounted for by environmental monitoring strategies. However, though the percentage contribution is small, a cursory look at the table showed that F=-11.291 (p<.05) is significant. Also since p (.001)

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is less than p(.05), it implies that environmental monitoring strategies significantly and negatively predicts environmental hazard control within Calabar Education Zone of Cross River State. Therefore, the stated null hypothesis is rejected. Meaning that the environmental monitoring strategies practiced in the research area if continued unchecked can hamper the environmental hazard control within Calabar Education Zone of Cross River State

Discussion of findings

Public awareness of environmental hazard control

The findings from analysis of the third hypothesis showed that the null hypothesis was rejected and the alternative upheld implying that public awareness significantly predict environmental hazard control within Calabar Education Zone of Cross River State. This finding is in accordance with the study of Nwachukwu and Adebayo (2022) that observed that early environmental education significantly impacts public awareness of hazards such as flooding, pollution, Ibrahim and Okon (2021) found that pupils in schools where environmental clubs were active displayed higher knowledge about recycling, climate change, and health-related environmental issues. Their research suggested that hands-on activities and school-based campaigns strengthen hazard awareness. Chukwu and Eze (2023) studied environmental literacy in public and private schools in Enugu State and reported that pupils with higher awareness scores were more likely to engage in safe waste disposal, tree planting, and water conservation practices.

Waste management practice on environmental hazard control

The findings from analysis of the second hypothesis revealed that the null hypothesis was rejected implying that waste management practice significantly predict environmental hazards control within Calabar Education Zone of Cross River State. The present finding is in line with the study of Ekanem (2021), that stated that waste mismanagement contributes to 65% of urban flooding incidents in Cross River State. The adoption of effective waste practices such as recycling, composting, and proper landfill management can significantly reduce environmental risks. Waste Management Practices refer to the collection, transportation, treatment, and disposal of waste materials in ways that minimize their impact on the environment and public health. Ineffective waste management has been cited as a key driver of environmental hazards, particularly urban flooding and land degradation. In many areas of Calabar, waste is often dumped in gutters, streets, and vacant plots due to irregular waste collection services and lack of disposal facilities (Okon & Bassey, 2023).

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Environmental monitoring strategies and environmental hazard control.

The findings from analysis hypothesis five indicated null hypothesis were dropped and the alternate hypothesis upheld. It hence implied that indeed environmental monitoring strategies does not significantly predict environmental hazards control within Calabar Education Zone of Cross River State. This is in concurrence with the study of Essien and Ita (2022) that maintained that in Calabar, the absence of robust monitoring systems limits the ability of authorities to anticipate and respond to environmental threats. For example, flood forecasting systems and early warning mechanisms are either non-existent or poorly maintained. Yonariza and Webb (2007) equally asserted that timber harvesting is a threat to tropical forests, and is an international issue that has been attracting the attention of the international community because it is believed to cause environmental damage and promote corruption. The authors stressed further that logging, particularly uncontrolled logging, can have variable but usually deleterious impacts on biodiversity and other globally important environmental services hence the need for efficient mornitoring.

Conclusion

Based on the outcome of the data analyses, he researcher concluded that effective public awareness, waste management as well as environmental monitoring strategies could go along way in advancing environmental health in the research area**.**

Recommendations

The following recommendations were made by the researcher sequel to the study results that emerged from the data analysis that:

1. Comprehensive public awareness should be sited in a place where it will play a critical role in preventing environmental hazards by promoting sustainable practices, reducing energy consumption, minimizing waste generation and enhancing the overall resilience of communities to environmental threats.
2. Erroneous usage of waste management facilities, such as trash can, waste bin, dump sites, refuse dump and inadequate recycling method be implemented in environmental hazard control. All these expressions are clear indications that farming systems have environmental consequences on the society especially when they are not well planned and managed
3. There should be consistent environmental monitoring strategies to eradicate environmental hazard in the area, there should be legislature for defaulters against environmental policies, victims should be convicted.

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