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Channels Construction Strategies and Erosion Control in Ikom Local Government Area of Cross River State, Nigeria

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Abstract

The study examined channels construction strategies and erosion control in Ikom Local Government Area of Cross River State, Nigeria. To carry out this study, one research question was raised for the study. The study adopted the descriptive survey research design. The

population of the study comprised of 282 workers from five environmental protection agencies saddled with the responsibility of controlling erosion. A sample of 141 respondents was drawn for the study. The sampling was done through purposive and accidental sampling techniques. The instrument used for data collection was a structured questionnaire. The validity of the instrument was done through face and content. Cronbach Alpha method was used to determine the reliability coefficient. Descriptive statistics was used to analyse data in the research questions. The research findings revealed that channel construction strategies helps to control erosion in the study area. It was recommended among others that soil erosion control system should be implemented to reduced soil deterioration caused by a change in soil composition and leaching of nutrients from the soil.
Keywords: Channels, Construction, Strategy, Environment, Inhabitant and Erosion Control.

Introduction

Erosion generally is seen as the gradual washing away of land surface, which remains the world biggest environmental problem threatening both developed and developing countries. The erosion process involves forces associated with water, wind, ice and gravity which are constantly at work wearing down the earth's surface. Water erosion is deemed the widest spread agent of the erosion processes and is responsible for the bulk of rills and gullies erosion in the southern states of Nigeria. Gully formation and propagation reduces the land area available for human development activities- such as farming, construction of residential buildings, industrial facilities, recreation and further create hazards to livestock and people.

The Government of Cross River State through the State Projects Management Unit (SPMU) has appointed members into the Urban Development Authority to checkmate the activities of the Urban dweller toward the indiscriminate dumping of refuse on water channels and the affected areas are; Cameroon Street, Abakpa and Water Board Road,(Efio-Ita, 2024). Gwary, (2020) sees erosion as world's most significant environmental problem. This is because the effects of these environmental hazards on man and the society generally have been immersed. These include loss of lives and properties, threat to human security, distortions in economic activities among others.

Andrew and Obi, (2012) noted that, incidence of erosion with its accompanying landslides and slumping at the end of each event, leaves inhabitants crying and mourning for loss of agricultural lands, ancestral lands, homes and economic trees.

In another vein, the rural communities are characterized with clownish agricultural activities that leads to loss of the biological and economic productivity and complexity of rain-fed crop land. Irrigated cropland, range, forest and woodlands, resulting from land uses or from a combination of processes arising from human activities and habitation patterns. Such as soil erosion, caused by wind or water, deterioration of physical, chemical, biological and economic properties of the soil and long-term loss of natural vegetation (Omang, Aganyi, Nandi and Osang 2023).

According to Omang, Ojong, Olabisi and Osang (2023) generally speaking, people' attitudes are thought to be created through a process of personal subjective evaluation (including an analysis of costs and advantages), but they can also be influenced by affective, emotional, and belief-related responses. The cumulative effect is that, the affected inhabitants are left homeless and/or jobless when the hazard occurs as a result of improper drainage system.The threats posed by gaping and daunting large gullies to farmlands, settlements, roads and humans are enormous, the government attention should be drawn to intervene and put an end to this menace. It should be noted that erosion in its highest level in cities can contaminate water supplies and intensify the spread of epidemic diseases, diarrhoea, typhoid, scabies, cholera, malaria, dysentery and other water-borne diseases, as pointed out by Gwary, (2008) and Adeoti, (2010).

Faulty channel designs and unsavoury habits such as dumping of refuse into the gutters were amongst the identified factors responsible for the flooding in Lagos and it is unfortunately not limited to Lagos alone, public drains have become urban waste collection centres, most urban roads do not have drains as pointed out by Dutal, (2023). Where there exist, there are poorly designed or are filled with refuse. In addition, some socio-economic and anthropogenetic activities have been found to induce or intensify flood condition in our environment as noted by Omang, Ojong, Nandi and Osang (2023).
Theoretical framework

Maslow's hierarchy of needs theory (1963)
The hierarchy of needs theory was propounded by Abraham Maslow in the year 1954. The theory states that human activities are induced by attempts to satisfy needs. The needs are classified into basic needs, safety and security, love and belonging, self-esteem and self-actualization (Kozier, Erb, Berman and Snyder, 2022). With regards to environmental exploitation, people tend to strive to satisfy basic needs and safety needs more than any other. The need for survival has led to the depletion of environmental resources and the generation of wastes, which are dumped in runoff channels that threatens the health of human beings. Therefore, channel construction strategy should be used as one of those human endeavours to

influenced different level of human needs and at different times in one's life. Hence, the theory of Maslow's hierarchy of needs is in line with the study.

Erosion control in Ikom Local Government Area of Cross River State has raised a lot of concerns over the past few years. This is so because of its devastating impact on land. Farmers have lost their crops and crop lands, many lives have been claimed on our farm roads, highways and homes due to this menace. Properties worth millions of naira have also been lost to erosion due to mans' activities on the land. For example, Cameroon street, Abakpa and Water Board Road in Ikom Local Government Area are in the stage of chaos. As a result, this led to environmental pollution.

A variety of programs and policy tools are accessible to policymakers to manage channels resulting from careless waste disposal. Despite the options available, the problem continues as both urban and rural regions become filled with unpleasant smells. It seems that attitudes may have contributed to the poor sanitation in the area under study. The effort of government and well-intentioned companies to devise strategies for constructing channels and broadly promoting methods to minimize waste materials and make use of valuable discarded items all to no avail.

Omang, Ojong, Olabisi and Osang (2023) opine that, Channel construction strategies and erosion control are essential aspects of water management, especially in areas where water flow is regulated, or where natural watercourses are modified for purposes such as flood control, irrigation, or transportation. The strategies for both include: When constructing channels, whether natural or man-made, it is essential to design them in a way that ensures long-term stability, proper flow rates, and environmental balance. Key strategies include: Designing channel geometry, hydraulic design, material selection, sediment control andfloodplain design. Also, erosion control is critical in preventing the degradation of the channel itself, its banks, and adjacent lands. Several strategies can be employed to manage or mitigate erosion such as: vegetative cover, riprap and geotextiles, vegetated matting or erosion control blankets, check dams and weirs, bioengineering solutions, soil stabilization agents, flow management, riparian buffer zones andsediment traps or basins.

In many cases, effective channel construction should not just focus on the physical layout, but also integrate natural systems and erosion control techniques.Regular monitoring and assessment of channel conditions help to identify erosion-prone areas and allow for modifications and improvements over time.The construction of artificial structures like weirs,

and floodwalls should ideally be combined with plantings, bioengineering, and sediment control to balance the engineering approach with natural resilience. By carefully considering both construction strategies and erosion control techniques, you can build a stable channel that minimizes environmental impact while managing water flow efficiently.
However, the circumstances have not changed; the residents' psychology concerning their negative attitudes and sense of environmental identity significantly hinders the development of channels in the study area.

Erosions can destroy literally everything. The list of things flood can destroy is limitless. Floods do destroy urban infrastructure such as water supply, for example, the Mississippi river flood in the summer of 1993, which covered 9 states including Iowa destroyed Dea Maines, Iowa water supply when its water treatment plant eroded. human cannot survive without exploring their environment to use the numerous resources that are bound in their surroundings Ojong, Omang, Obibessong and Kujo (2022). Puwer supply was cut to one million people when Hurricane Katrina struck New Orleans. Economic cost of the erosion is put at $100billion in damages. The 1970 erosion disaster in Bangladesh claimed 300,000 lives; the 1974 erosion killed 1,200 people, 27,500 died from disease and starvation occasioned by the erosion. Hwang Ho in China, in only three erosions since 1887 killed over 6,000,000 people as reported by Clark, in Dennis (2002).

In another study on erosion menace in Nigeria: impacts, remedial and management strategies by Agbonkhese, Aka, Joe-Abaya, Ocholi and Adekunle, (2014) erosion menace in Nigeria have become a normal and re-occurring phenomenon which sometimes has devastating impacts on human livelihoods and infrastructural development. Causes of this problem such as rapid population growth, poor governance, poor channel facilities and decaying infrastructures, lack of proper environmental planning and management strategies, poor practice of dumping waste/refuse and climate change coupled withinadequate preparedness among others have been traced to be the root causes of erosion menace.

Human activities in terms of development had been adjudged to be very important factors in accelerating the rate of this disaster which often leaves in its wake spread of diseases, loss of thousands of lives from various parts of the country and properties worth billions of naira being destroyed.

The impacts of floods are more pronounced in low-lying areas. Although the Nigerian Meteorological Agency (NIMET) had alerted Nigeria that there would be an above normal rainfall in strategic parts of the country which might lead to erosion incidents in 12states of the federation, yet nobody gave consent to that warning. This paper provides an overview of how

Nigerian cities have been affected by erosion menace incidences as it takes a look at the devastating impacts, remedial and management strategies at curbing erosion in Nigeria. To improve the quality of life therefore implies caring for the earth in such a way that its degradation and destruction can be guarded against, for the benefit of mankind (Anthony, Ulayi and Omang 2024). A review of literature on erosion menace was done. The articles were accessed from public libraries, as well as online through internet search engines and relevant information extracted Sokari, (2004). Onsite assessment of some areas affected by erosion was done and pictures taken with the aid of a camera. Erosion in Nigeria is a serious issue requiring the attention of all stake holders aimed at preventing and remedying its adverse effects which threatens human existence.

Mike, Wilkinson, Roger, and Matthies, (2005) carried out research on erosion in Mozambiqueusing personal opinion and questionnaire from a sample population of sixty (60) persons in the eroded case study area. They found out that erosions are the most common natural disaster in both developed and developing countries, and they are occasionally of devastating impact. Their impacts on health vary between populations for reasons relating to population vulnerability and type of erosion event Kovats, (2003). Under future climate change, altered patterns of precipitation and sea level rise are expected to as reported increase the frequency and intensity of erosion in many regions of the world by Intergovernmental Panel on Climate Change, (2001). Carried out a review on the epidemiologic evidence of erosion related health impacts. The result showed that surprisingly limited evidence base about the health effects of floods, particularly in relation to morbidity were scarce. This may in part be due to the difficulty of carrying out rigorous controlled epidemiologic studies of erosion, especially in low-income countries.

Evidence on public health interventions (e.g., the need for measures to reduce the spread of infectious disease, dealing with mental health impacts, targeting of vulnerable groups) appears particularly limited.

It was also found that there is no study on the effectiveness of public health measures, including early warning systems. Nonetheless, the wide range of risks to health and well-being, both physical and mental, is understood, though there remains scientific uncertainty about the strength of association and public health burden for specific health effects.

Maneechit, Farhed and George (2012) carried out a study on erosion control and dammanagement, data were collected through findings, describing and interpreting from a

sample population of four hundred (400) persons in the eroded case study area. It was discovered that reservoir sedimentation reduces economic value and longevity of erosion control dams. Periodic sediment removal allows extension of reservoir life. An optimal control model is developed to evaluate alternative sediment management strategies for erosion control dam.

In another study on Gully Erosion in Anambra State: The Way Forward by Nwabinel and Ezeh (2013). The authors observed that the state is inundated with erosion and blockage of major and minor erosion channels as a result of improper planning and design over the years. These have been identified as the major causes of the environmental woes of the study area. Gully erosion menace has reached crisis level in the state.

From the perspective of domestic, social and economic life, the state accommodates over 6 million people daily as it houses one of the largest conglomerations of markets in Africa with intense commercial activities in all nooks and crannies, so reveals by the study. These activities contribute to drainage channels being blocked with solid wastes which lead to the flooding of street and highways during the rains, this result in uncontrolled flood water movement which has often resulted to gully erosion. This research work assesses the control factors and proffers mitigation/abatement solution to the gully erosion menace in the state.

In another study on erosion disaster: an empirical survey of causative factors and preventive measures in Kaduna, Nigeria by Augustine and Akinlolu (2015) erosion is a water induced disaster that leads to temporary overflow of dry land and causes serious damage on lives, property, and infrastructures. Erosion has created a lot of damaging effect in Nigeria, resulting to the death of people, collapse of buildings, destruction of properties, damage of agricultural produce, loss of land and increased government expenditure. Despite persistent occurrence of this disaster, there is limited research geared at studying the factors that cause erosion and measures to effectively control it. To fill this gap, a random survey was conducted on 40 households, community leaders and agencies responsible for the management of erosion in Kaduna State, Nigeria. Relative Important Index (RII) was employed for ranking the factors and the preventive measures. From the result, the common factors that cause erosion were poorly constructed drainage, heavy rainfall and improper construction of channels.

Preventive measures for erosion were proper raising of trees, desilt, awareness of the public on the need to adhere to environmental rules, empowerment of government agencies to monitor residential buildings construction, implementation of government policies on erosion and sensitization of town or city will be taken care off. Increased awareness at all levels (community, local, state and federal) of the risk of erosion, appropriate response

techniquessuch as regular monitoring and assessment of channel conditions help to identify erosion-prone areas and allow for modifications and improvements over time. The construction of artificial structures like weirs, and floodwalls should ideally be combined with plantings, bioengineering, and sediment control to balance the engineering approach with natural resilience. By carefully considering both construction strategies and erosion control techniques, you can build a stable channel that minimizes environmental impact while managing water flow efficiently. If the above-mentioned measures are been taken care of channel construction and erosion control in Nigeria won't be a problem any longer.

Research Design and Methodology

The research design adopted in this study is the descriptive survey research design. It is a design where the researcher collects information and opinions from the respondents through questionnaires or other methods. The design is found appropriate since the study aimed at examining the variables in the study which cannot be manipulated and the sample will be used for generalization across the population. The population of the study consists of two hundred and eighty-two (282) workers which consist of the five (5) environmental protection agencies saddled with the responsibilities of maintaining the environment. Niger Delta Development Company (NDDC), Nigeria Erosion and Watershed Management Project (NEWMAP), Ikom Urban Development (IUDA), Cross River Ministry of Works and Cross River Ministry of Environment. The non-probability sampling techniques of purposive and accidental sampling technique were adopted for this study. From the population of two hundred and eighty-two thousand (282), a total of one hundred and forty-one (141) respondents (50%) of the total population was drawn from each stratum. Information was gathered through the use of a questionnaire. This instrument is a structured questionnaire titled Channels Construction Strategies and Erosion ControlQuestionnaire (CCSECQ). The 5-items questionnaire consist of two sections – A and B. Section 'A' would elicit information from the subjects' responses on demographic data such as age, and rank, while Section 'B' would consist of 5 items that will measure the Channels Construction Strategies and Erosion Control. Which was "Yes" and "No" respondent options of the questionnaire. The face and content validity of the instrument was carried out by giving the questionnaire to two (2) experts, one in Ministry of environment and one research Lecturer in Educational Foundation, University of Calabar. After further modification and improvement by the two (2) experts and supervisor of this researcher, the questionnaire was finally accepted as relevant. The statistical tool used for this study is simple percentage.

Result and discussion

Table 1 presents the result of data analysis with respect to how channel construction by environmental protection agencies control erosion in Ikom Local Government Area of Cross River State. The overall total response show that 62.09 percent of the respondents are involved in channel construction to control erosion in Ikom Local Government Area of Cross River while 37.91 non-involvement in channel construction for erosion control in Ikom Local Government Area of Cross River State. Generally, respondents that were involved in channels construction as a means of erosion control in the study area were higher in items 1(70.21%), 3(58.16%), 4(93.62%) and 5(63.83%) only item 2 show negative. This implies that there is control of erosion occurrence through channel construction in Ikom Local Government Area of Cross River State. However, 74.47 percent responded negatively and 25.53 percent responded positively to item 2 on any on-going project of channel construction for erosion control.

But the overall involvement of the agencies in their responses to channel construction is 62.29 percent. Hence this result implies that their involvement in channel construction for the control of erosion occurrence in Ikom Local Government Area of Cross River State is effective. There is also a one-way ANOVA comparison of the mean score difference across the five environmental protection agencies (Ministry of environment, Nigeria erosion and watershed management project, Niger Delta Development Commission, Ikom urban development authority and Ministry of works). The result shows a significant difference in the mean score based on agencies difference perception about how channel construction control erosion occurrence in Ikom Local Government Area of Cross River at df = 4 and 136 and F-ratio = 22.189 and $p<0.05$.

The result on table 2 shows a significant influence of the responses of the agencies on their involvement in channel construction for erosion control in Ikom Local Government Area of Cross River at df = 4 and 136 and F-ratio = 22.189. The Nigeria Erosion and Watershed Management Project (9.71) has the highest mean followed by the Ministry of Works (8.83) of channel construction for erosion control. This implies that Nigeria watershed Management Project are more involved in channel construction than every other agency.

Table 1: Channels construction strategy by environmental protection agencies for the control of erosion in Ikom Local Government Area of Cross River

	Response	Total N percentage
1. Has your agency involved in channel construction in	No	42(29.79)
	Yes	99(70.21)
	Total	141(100.0)
2. Does your agency has any ongoing project on channel construction in	No	105(74.47)
	Yes	36(25.53)
	Total	141(100.0)
3. Is there any public-partnership with your agency on channelization in the community	No	59(41.84)
	Yes	82(58.16)
	Total	141(100.0)
4. How effective would you consider the channelization for erosion control in the community	No	9(6.38)
	Yes	132(93.62)
	Total	141(100.0)
5. Is there any public awareness programme on channel maintenance	No	51(36.17)
	Yes	90(63.83)
	Total	141(100.0)
Overall Respondent for channels construction	No	268(37.91)
	Yes	439(62.09)
	Total	707(100.0)

Table 2: One-way ANOVA of the influence environmental protection agencies on channel construction strategy for erosion control in Ikom Local Government Area of Cross River State

	Group	N	Mean	Std. Deviation	Std. Error
Environmental	Ministry of environment	22	9.00	1.51	.322
	Nigeria erosion and watershed management project	30	9.17	.53	.097

Niger Delta Development Commission	32	8.53	1.57	.277	
Ikom urban development authority	28	6.54	.96	.182	
Ministry of works	29	8.83	1.19	.222	
Total	141	8.40	1.53	.129	
	Sum of Squares	Df	Mean Square	F-ratio	p-level
Between Groups	128.720	4	32.180	22.189	.000
Within Groups	197.238	136	1.450		
Total	325.957	140			

The result of research revealed that environmental protection agencies are involved in channels construction to control erosion in Ikom Local Gogernment Area of Cross River. This implies that there is a significant influence of the responses of the agencies on their involvement in channels construction for erosion control in Ikom Local Government Area of Cross River State. The finding of the research question is in line with the view of Werner and Lockington, (2003) who noted that channels filled with agricultural and fruit farms situated in hilly regions on erodible soils with frequent extreme rainfall events are highly endangered by water erosion. It is obvious that soil conservation and erosion control are therefore necessary.

Discussion of findings

Channels construction by environmental protection agencies in erosion control.

The result of research question revealed that environmental protection agencies are involved in channels construction to control erosion in Ikom Local Government Area of Cross River State. This implies that there is a significant influence of the responses of the agencies on their involvement in channels construction for erosion control in Ikom Local Government Area of Cross River State. The findings of the research question is in line with the view of Peter (2011) who observed that erosions have increasingly become an environmental and housing problem. To note are cracked walls, scaling on walls, collapsed walls, rising damp, moulded walls and swampy environment. The foul air quality a stagnant pool emits, the sordid sight it presents, the extra cost of cleaning and maintenance are some of the negative effects of erosion on housing utility and the risk of sudden loss of personal effects. The aim of this study was to examine the type of relationship which exists between flood and health implications of the occupiers. Data were collected by direct observation, questionnaires and personal interviews from a sample population of seventy (70) houses in the flooded case study area. The result showed that clearing of drainages is significant in controlling flood and trees planting helps in limiting the destruction of the earth surface.

Agbonkhese, Aka, Joe-Abaya, Ocholi and Adekunle, (2014) also revealed that erosion menace in Nigeria have become a normal and re-occurring phenomenon which sometimes has devastating impacts on human livelihoods and infrastructural development. Causes of this problem such as rapid population growth, poor governance, poor drainage facilities and decaying infrastructures, lack of proper environmental planning and management strategies, poor practice of dumping waste/refuse and climate change coupled within adequate preparedness have been traced and among others, human activities in terms of developmental involvements adjudged to be very important factors in accelerating the rate of this disaster which often leaves in its wake spread of diseases, loss of thousands of lives from various parts of the country and properties worth billions of naira being destroyed. The impacts of floods are more pronounced in low-lying areas.

Mike, Wilkinson, Roger, and Matthies, (2005) also found out that floods are the most common natural disaster in both developed and developing countries, and they are occasionally of devastating impact, as the floods in China in 1959 and Bangladesh in 1974 and the tsunami in Southeast Asia in December 2004. Their impacts on health vary between populations for reasons relating to population vulnerability and type of erosion event. Under future climate change, altered patterns of precipitation and sea level rise are expected to as reported increase the frequency and intensity of erosion in many regions of the world by Intergovernmental Panel on Climate Change, (2001). The result showed that surprisingly limited evidence base about the health effects of floods, particularly in relation to morbidity were scarce. This may in part be due to the difficulty of carrying out rigorous controlled epidemiologic studies of erosion, especially in low-income countries. Evidence on public health interventions (e.g., the need for measures to reduce the spread of infectious disease, dealing with mental health impacts, targeting of vulnerable groups) appears particularly limited. It was also found that there is no study on the effectiveness of public health measures, including early warning systems. Nonetheless, the wide range of risks to health and well-being, both physical and mental, is understood, though there remains scientific uncertainty about the strength of association and public health burden for specific health effects. The immediate risks of trauma and death are generally clear, but it seems that longer-term impacts, specifically on mental well-being, are often underestimated and probably receive too little attention from public health authorities.

Reservoir sedimentation reduces economic value and longevity of erosion control dams. Periodic sediment removal allows extension of reservoir life. An optimal control model is developed to evaluate alternative sediment management strategies for erosion control dams. An illustrative empirical analysis shows that sustainable management is economically

desirable for a wide range of parameter values. Erosion is a water induced disaster that leads to temporary overflow of dry land and causes serious damage on lives, property, and infrastructures. Erosion has created a lot of damaging effect in Nigeria, resulting to the death of people, collapse of buildings, destruction of properties, damage of agricultural produce, loss of land and increased government expenditure. Despite persistent occurrence of this disaster, there is limited research geared at studying the factors that cause erosion and measures to effectively control it.

Conclusion

In Nigeria, erosion disaster has been perilous to people, communities and institutions. It shattered both the built-environment and the undeveloped areas. One prominent feature about erosion is that it does not discriminate, but marginalizes whosoever refuses to prepare for its occurrence. This study attempt to underscore the use of channel construction in assessing the involvement of the environmental protection agencies in erosion control in Southern Senatorial District of Cross River State, Nigeria. Efforts were also made in identifying the causes and challenges of erosion in the affected communities as well as the method available in checking erosion.

Recommendation

Based on the findings of the study and their implications for the future of educational process and the country as a whole, it is recommended that environmental protection agencies should be involved in channels construction activities to control erosion in Southern Senatorial District of Cross River.

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