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INVESTIGATING THE EFFECTS OF SOIL EROSION ON RESIDENTIAL HOUSING IN OGERE REMO, OGUN STATE, NIGERIA

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Abstract
The aim of the study is to examine the effect of soil erosion on housing in Ogere Remo area of Ogun State. The main objectives are to assess the physical impact of the erosion on existing housing and identify the existing management strategies place in the study area. One hundred and forty-two (142) questionnaires were distributed to Odugbesan, Ayegbami, and Akuro with the used photograph to identify most affected buildings shows that Survey method was adopted in data collection for this research. Data collected in the course of this study was analysed using both descriptive and inferential methods. The descriptive part will consist of frequency, percentages and measures of central tendencies while Kruskal Wallis non-parametric method of inference was used to infer on the physical impacts of soil erosion on existing housing in the study area. Therefore, there should be construction of drainages with specifications to drain and redirect rainfall water to the appropriate channels and planning regulations should be adhere strictly especially in the areas of development control and penalties on noncompliance need to enforce.
Keywords: Effects, Erosion, Housing, Residential, Soil

Introduction

Erosion is a natural process that involves soil separation, movement and deposition caused by water, wind, or ice. It always a slow process that comes unaware for a very long period or fast causing substantial top soil loss. Soil erosion can be regard as gradual removal of minerals from the soil from the by various agents of denudation, which occurs in several parts of Nigeria under different geological, climatic, and soil conditions, is merely a geomorphological process in which the utmost layer of weathering rock is loosened and carried away by wind or running water, exposing the lower part of the earth (Chude et al. 2020). The topography of the soil contributed to level of runoff in any area it happens (Adebayo, 2014). In recent time, it has been discovered that regular erosion in a particular area cause excessive ecosystem degradation, loss of land cover, sedimentation in water bodies and overcrowding contributed to soil erosion (Cohen *et.al*, 2007). The host community usually make efforts to reduce level of cases of erosion but poor quality of work usually leads to another face of unimaginable erosion challenges. For instance, not involving expert in construction of road, culvert, drainage and buildings.

Activities performed by humans in both urban and rural environments, such as construction and irrigation, have had a negative impact on the free flow of water in drainage channels, rivers, and streams (Aderogba, 2012 and Dalil, *et.al.*, (2016). The impact is felt most in urban areas where there are more activities regarding tampering the earth surface. The impacts include loss of life and animal, destruction of properties and land value (Abdulfatai, et.al.,2014 and Chude, et.al., (2020). Obi and Okekeogbu (2017) highlighted the major agents of soil erosion in the tropical area, include rainfall, type of soil and its attributes, topography, geological formation, socio-cultural practices relating to land matter and conservative practices applied to the land. Adeleye and Rustum (2011) revealed that, climate change or uncontrolled heavy rainfall causes flooding in urban area, rather the increased in urbanization and insufficient planning regulations in housing development in prone areas. Most of the areas lack adequate drainage system to support the run off during the raining seasons.

Aderogba, (2012) Assessed the challenges of flooding in south west Nigeria particularly in major towns and cities, it was discovered that the living habits of the inhabitants, lack of adequate planning within the

physical environment, non-compliance with the natural physiographic attribute of the landscape, and incompatible location of landuses. Chinweze, (2017) and Adebayo, (2014) pointed out the basic strategies to combat challenges of erosion which involves use sandbags, erect barriers, dig shallow containment wells to redirect the flow but all these efforts are not enough to check the occurrence. Anejionu, *et.al.,* (2013) studied mapping of erosional prone areas in south Nigeria using remote sensing and GIS techniques to determines long-time assessment of erosion activities. The research formulated a model call Revised Universal Soil Loss Equation. The model assists to discover the hotspots that need urgent attention. Chude, *et.al.*, (2020) concluded that there is need for regular studies on the factors responsible for soil erosion as a result of human activities within the environment and climatic approach such as soil texture, terrain, and geomorphological characteristics of the area.

Housing is crucial to each country's economic development, accounting for 10% to 20% of total economic activity and being the greatest fixed asset owned by individuals (European Commission, 2006). Housing is not only a basic human requirement, but it also serves as a mean of economic returns to improve living standard. Erosion in residential areas is fast becoming issues in urban center. Housing are being affected by frequent erosion in such areas. Erosion has been noticed as the one of the agents that destroy earth surface and constitute global environmental problem that pose negative effect on the inhabitant. Urban environment is made up various activities like cultivation and construction but man does not consider the negative effect on both biotic and abiotic element (Adeleye and Olayiwola, 2006). Erosion damages soil nutrient and destroy landed properties that result loss of life. The outcome of soil erosion in the particular area cannot get complete solution but its activities can be checked because several factors combine to cause soil erosion (Ajibade, 2008) and Bariweni, *et.al.*, (2012). The area experiencing environment degradation subjected to socio-economic exclusion and also have effect on the health status of the inhabitant and physical configuration of the environment (Omole, 2010).

Ananda and Herath (2003) investigate soil erosion challenges in developing nations and the study reveals that there are ineffective impacts of technical change, inadequate policies by the government and lack of institutions framework responsible in managing soil erosion in developing countries. Erosion destroys buildings, roads, fences, and other structures such as bridges, cars, buildings, sewage systems, streets, and canals. Erosion occurs in every part of the country; the level of occurrence vary from state or region to region depends on geomorphology formation. Soil erosion in Ogere Remo Ogun State, Nigeria is not new, it needs urgent attention. Therefore, the study investigates effects of erosion on selected quarters in Ogere Remo area of Ogun State. Soil erosion is one of environmental challenges in developing countries including Nigeria therefore there is need to observes the problems associated with the activities and factors influencing the occurrences, the extent of development, levels of havoc to the existing residential areas within the community and identification of the existing management strategies in the study area.

Study Area and research methods

Ogere is located in ogun state south-western part of the country in Ikenne Local Government. Ogere Remo can also be found in 6°47'N 3°34'E/ 6.783°N 3.567°E. It borders Ajura (an Egba town) in the north, Iperu Remo in the south, Ode Remo in the east, and Sagamu in the west. Ogere Remo is located on the Lagos-Ibadan Expressway and the Ijebu-Ode/Abeokuta route. The research's target population is housing units afflicted by soil erosion in the selected locations of Ogere Remo, Ikenne Local Government Area, Ogun State. Odugbesan, Ayegbami, and Akuro were not the only places affected but areas with major effect was selected. Purposive sampling technique was adopted in the identification of areas for the study, resulting to the number of respondents in the course of data collection. However, the researcher went to the study area to check houses affected with erosion and a map was developed by the researcher to identify the affected housing units. All the affected units were also used as the sample size for this study. Table 1 depicts the distribution of the research instrument to the household heads.

Table 1: Questionnaire administration and statistical analysis.

Areas	Housing units affected with soil erosion	Questionnaire returned
Odugbesan	63	57
Ayegbami	41	34
Akuro	69	51
Total	**173**	**142**

Source: Field Survey, 2023.

Survey method was adopted in data collection for this research study. Data collected in the course of this study was analysed using both descriptive and inferential methods. The descriptive part will consist of frequency, percentages and measures of central tendencies while Kruskal Wallis non-parametric method of inference was used to infer on the physical impacts of soil erosion on existing housing in the study area**.**

Results and Findings

Table 2: Analysis of the Socio-Economic Characteristics of the Respondents

s/n	Items		Frequency	Percent
		Male	109	76.8
1	Sex	Female	33	23.2
		Total	**142**	**100.0**
		18 - 25 years	18	12.7
		26 - 33 years	50	35.2
2	Age range	34 - 41 years	62	43.7
		42 - 49 years	12	8.5
		Total	**142**	**100.0**
3	Ethnicity	Yoruba	118	83.1
		Hausa	11	7.7
		Ibo	13	9.2
		Total	**142**	**100.0**
4	Years lived in the Area	< 1 year	29	20.4
		1 - 5 years	59	41.5
		5 - 10 years	44	31.0
		> 10 years	10	7.0
		Total	**142**	**100.0**
		No formal education	18	12.7
		Primary education	37	26.1
7	Highest level of education	Secondary education	31	21.8
		Tertiary education	56	39.4
		Total	**142**	**100.0**
9	Monthly Income	< N20,000	16	11.3
		N20,000 - N40,000	41	28.9

		N40,001 - N60,000	39	27.5
		> N60,000	46	32.4
		Total	**142**	**100.0**
10	Occupation	Farming	36	25.4
		Student/Apprentice	8	5.6
		Trader	61	43.0
		Civil Servant	37	26.1
		Total	**142**	**100.0**

Source: *Field Survey, 2023*

Table 2 depicts the frequency and percentage distribution of respondent's sex ratio. Result shows that majority are male, representing 76.8% of the entire respondents, while 23.3% of them are female. From the frequency and percentage distribution of respondents age grouping in table 2, 12.7% of the respondents were between ages 18 to 25 years, 35.2% are between 26-33 years, 43.7% were between ages of 34-41 years while 8.5% fall within the age range f the respondents in table3, about 83.1% of them are from the Yoruba ethnic group, 7.7% are Hausa while 9.2% are of Igbo ethnic group. From the respondent's length of the stay in the area, analysis indicated that 20.4% of them are new in the area as they have not used up to a year, 41.5% have stayed between 1-5 years, 31% of them have stayed between 5-10 years while 7% of them have stay in the area for more than 10 years. This implies that majority of the respondents have not stayed in the area for up to a decade. Table 2 depicts the frequency and percentage analysis distribution of the respondent's monthly income, majority of the respondent's average income is higher N60,000.00, 11.3% of the respondent's monthly income is less than N20,000.00 while 28.9% of them makes an average of between N20,000.00 to N40,000.00. However, 27.5% of them makes an average income of N40,001.00 – N60,000.00. This implies that majority of the respondents are low-income earners. It can also be evidenced in table 2 that majority of the respondents representing 43% are traders, 25.4% are into farming while 26.1% of them are civil servants, implying that due to the semi-urban nature of the area, the residents are majorly into trading.

Table 3: Frequency and Percentage Analysis of Respondents on Building Characteristics

s/n	Items		Frequency	Percent
		Brazilian	28	19.7
		Compound	70	49.3
1	Types of Building Design	Flat	32	22.5
		Duplex	12	8.5
		Total	**142**	**100.0**
		Bungalow	75	52.8
2	Height of Building	Storey Building	67	47.2
		Total	**142**	**100.0**
3	Number of Floors	One	24	16.9
		Two	19	13.4
		Three	12	8.5
		Above three	12	8.5
		Total	**67**	**47.2**
4	Use of building	Residential	86	60.6

		Commercial	34	23.9
		Recreation	12	8.5
		Public	10	7.0
		Total	**142**	**100.0**
5	Age of Building	0-10 years	25	17.6
		11-20 years	27	19.0
		21-30 years	32	22.5
		31-40 years	26	18.3
		Above 40 years	32	22.5
		Total	**142**	**100.0**
6	Building Ownership	Owner	10	7.0
		Rented	31	21.8
		Inherited	101	71.1
		Total	**142**	**100.0**
7	Construction Material	Mud	94	66.2
		Brick	4	2.8
		Block	44	31.0
		Total	**142**	**100.0**
8.	Wall Finishing	Not plastered	35	24.6
		Plastered only	59	41.5
		Painted	48	33.8
		Total	**142**	**100.0**
9	Condition of Wall	Minor crack	20	14.1
		Major crack	69	48.6
		Not cracked	53	37.3
		Total	**142**	**100.0**
10	Accessibility	Tarred road	68	47.9
		Untarred road	49	34.5
		Footpath	25	17.6
		Total	**142**	**100.0**
11	Presence of drainage	Yes	83	58.5
		No	59	41.5
		Total	**142**	**100.0**

Source: *Field Survey, 2023*

Taking the characteristics of the building affected with soil erosion into cognizance, table 3 indicated that 19.7% of the buildings were Brazilian in nature, 49.3% are compound buildings, 22.5% are flats while 8.5% are duplex. This implies that majority of the respondents are living in compound buildings.

Plate 1: A compound building redesign with an eroded road

It can also be seen from the building heights that 52.8% of the houses affected with erosion are bungalow, while 47.2% of them are storey buildings. On the use of the buildings as shown in table 3, it can be seen that majority of them are residential representing 60.6%, 23.9% are commercial while 8.5% are meant for recreation with 7% for public use.

Plate 4: A residential building with an exposed foundation

From table 3, representing the building age, it can be depicted that ages varies from building to building as majority of the buildings were erected between in 21-30 years. These buildings were found to be at the core areas of the town as 22.5% of the inspected buildings were erected more than 40 years. From table 3, it can be evidenced that majority of the affected buildings representing 7% were personal buildings, 21.8% were rented while 71.1% were inherited. These buildings were built with different materials such as mud, brick and block as indicated in Table 3, the highest number of the buildings with mud construction are 66.2%, 2.8% were built with brick while 31% of them were built with blocks. However, these mud buildings were situated in the core area. Moreover, the houses with wall finishing as evidenced from the respondents in table 3 showed that 24.6% of it were not plastered, 41.5% were plastered while 33.8% were painted. It can also be seen from table 3 that majority of the buildings affected with erosion have major crack as opined by 48.6% of the respondents, 14.1% of them said that it has minor crack while 37.3% of the buildings do not crack. From table 3, it can be observed that majority of the respondents representing 58.5% said that there is drainage in their area, while 41.5% said they have no drainage.

Plate 8: Damaged existing drainage

Table:4 Analysis on the Physical Impacts of Soil Erosion on Buildings

Physical Impacts	Mean	Std. Deviation
Destruction of roads	4.22	0.215
Destruction of drainage	4.39	0.208
Erosion of foundation	3.56	0.391
Exposure of foundation	4.20	0.262
Destruction of social amenities/utilities	4.30	0.753
Cracking of walls	3.67	0.623
Loss of housing properties	3.54	0.422
Loss of lives	1.24	0.652

Source: Extracted from SPSS Output, Version 20

From the results emanating from respondents opinion on the physical impact of soil erosion on the buildings, table 4 showed that respondents highly agreed on the five point Likert scale that destruction of roads has impacted negatively on the buildings due to erosion (mean 4.22, standard deviation 0.215); destruction of drainage, erosion of foundation, exposure of foundation, destruction of social amenities, cracking of walls, loss of housing properties and loss of lives as evidenced from the mean response score of 4.39, 3.56, 4.20, 4.30, 3.67, 3.54 and 4.24 respectively. However, observation revealed that the effects of erosion are enormous. At the household level, onsite effects include building damage, drain and road damage, landscaping devastation, and flooding. Erosion exposes building foundations, requiring annual house repairs. In certain situations, erosion causes full collapse of buildings, which must be reconstructed, increasing the spending of poor households. When houses collapse due to erosion, they can leave families homeless. In certain situations, erosion causes full collapse of buildings, which must be reconstructed, increasing the spending of poor households. When houses collapse due to erosion, they can leave families homeless.

Table 5: Kruskal Wallis H test for Difference in respondents' opinion on the physical impact of erosion on buildings

	Location [b]	N	Mean Rank	Test Statistics [a]
Destruction of roads	Odugbesan	57	58.22	11.114 (2) [.004]
	Ayegbami	34	80.04	
	Akuro	51	80.65	
Destruction of drainage	Odugbesan	57	98.27	43.692 (2) [.000]
	Ayegbami	34	56.29	
	Akuro	51	51.72	
	Total	**142**		
Erosion of foundation	Odugbesan	56	80.38	5.282 (2) [.071]
	Ayegbami	34	66.34	
	Akuro	51	63.81	
	Total	**141**		
Exposure of foundation	Odugbesan	57	95.26	33.655 (2) [.000]
	Ayegbami	34	56.04	
	Akuro	51	55.25	
	Total	**142**		
Destruction of social amenities/utilities	Odugbesan	57	83.42	10.210 (2) [.006]
	Ayegbami	34	60.81	
	Akuro	51	65.30	
	Total	**142**		
Cracking of walls	Odugbesan	57	105.47	76.984 (2) [.000]
	Ayegbami	34	62.54	
	Akuro	51	39.50	
	Total	**142**		
Loss of housing properties	Odugbesan	57	100.55	79.437 (2) [.000]
	Ayegbami	34	80.34	
	Akuro	51	33.14	
	Total	**142**		
Loss of lives	Odugbesan	57	68.39	.968 (2) [.616]
	Ayegbami	34	75.87	
	Akuro	51	72.06	
	Total	**142**		

( ) parenthesis represents degree of freedom; [ ] parenthesis represents p-value
a. Kruskal Wallis Test; b Grouping Variable
Source: Extracted from SPSS Output, Version 20

Empirical analysis of the Kruskal Wallis H test for difference in respondents' opinion on the physical impact of soil erosion on buildings in table 5 indicated a statistically significant difference on the opinion of respondents with respect to how erosion led to the destruction of roads, $\chi^2_{(2)} = 11.114$, $p < 0.05$ based on locations. Kruskal Wallis H test also showed a statistically significant difference on the response of respondent due to drainage destruction, $\chi^2_{(2)} = 43{,}692$, $p < 0.05$ with a mean rank of based on the selected locations. Inference made on erosion of foundation, destruction of social amenities/utilities, cracking of walls, and loss of housing properties were also found to be statistically significant, implying mean difference in the responses emanating from the respondents' point of view taking the locations affected with flooding into consideration as shown in the Chi-square p-value < 0.05 level of significance. However, respondent's opinion was not different from location to location on the physical impact of soil erosion on buildings taking loss of lives into consideration.

Table 6: Respondents opinion on types of strategy in place to curb erosion

Strategies in Place	Frequency	Percent	Valid Percent	Cumulative Percent
Filling of eroded roads	31	21.8	29.8	29.8
Construction of drainage	32	22.5	30.8	56.7
Planting of trees	33	23.2	31.7	88.5
Others	8	5.6	7.7	100.00
Total	104	73.2	100.0	
Missing System	38	26.8		
Total	**142**	**100.0**		

Source: Field Survey, 2023

Taking the types of strategy in place to curb erosion, into consideration, it can be evidenced that 29.8% of the respondents said they adopt filling of eroded roads, 30.8% of them said that they adopt construction of drainage, 31.7% said that they adopt planting of trees while 7.7% of them said that they adopt other means to curb the erosion. Housing units within these core areas were found to be affected mostly with soil erosion as seen from the physical counting of the affected buildings. Empirical analysis of research findings also showed that the physical impact of the erosion on existing housing in the study area were not limited to erosion of foundation, destruction of roads, exposure of foundation and cracking of walls. These have also impacted negatively on the residence through loss in housing properties. Empirical analysis of the research findings also indicated that the water facilities do not have direct effect on the inhabitant as they were found to be in bad shape. The implication of this is that the provided public facilities water lacks maintenance culture due to the fact that it is not owned by individuals. It cannot be overemphasized that efforts put in place to curb the soil erosion in the identified areas were road grading, drainage construction and road construction respectively. Evidence has shown that soil erosion has impacted negatively on the existing housing in the area.

Conclusion and Recommendations

This study examined the effects of soil erosion on housing in Ogere Remo, Ikenne Local Government Area of Ogun State. However, it was discovered that soil erosion has causes havoc on the existing housing in the study area in so many ways which include damaged road, erosion of foundation, exposure of foundation, damaged drainages etc. The findings also revealed that the government has made no attempt to control or solve the problem of soil erosion in the study region. Furthermore, our environment is an important aspect of our economic and social survival, and whatever occurs in the environment in which we live might have a negative impact on our survival. Finally, the local government and the Community Development Association (CDA) should work together to safeguard Ogere Remo from the problem of soil erosion that the community is experiencing.

The Residents in the study areas attempted to control the soil erosion with various means by covering roads with materials such as stones and soil-filled bags, constructing drainages, and so on. But not having positive impact on the environment. However, the following steps should be taking in assisting the community;

- The policy makers at all levels including the stakeholders in environmental management such as State Ministry of Environment and Federal Ministry of Environment should create awareness to educate the people on the causes and impacts of soil erosion in the area.
- The construction of drainages with specifications should be encouraged in order to drain and redirect rainfall water to the right channels.
- Efforts should be made to reclaim the roads where soil erosion has affected severely.
- Planning regulations and standard should be adhered strictly especially in the areas of development control and penalties on non-compliance.

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