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SEDIMENT YIELD ON DIFFERENT AGRICULTURAL LANDUSE TYPES IN IKPOBA OKHA, NIGERIA

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ABSTRACT: *This work is an assessment of variations in the rate of sediment yield from different agricultural landuse types in Ikpoba Okha. The research design adopted in this study was based largely on direct field measurement. To generate the data required to accomplish the philosophy of this work, measurement of rainfall amount (mm), rainfall intensity (mm/hr) and sediment load (kg) were generated from the months of March to October 2019. The collected data were analyzed using percentages and degree. It was discovered that the rate of sediment yield was determined by the amount of rainfall and that the rate sediment yield on different landuse types vary widely due to the nature of man environment interactions. The sediment yield from bareland (26.9kg) was greater than fallow land (12.8kg) and that of vegetated land was (4.2kg). In order to protect the environment from erosion (sediment yield), the adoption of environmental education is recommended to track down the rate of sediment yield in the study area. An acceptable way for checking erosion over the affected land surfaces especially the bareland is to cover them with grasses mostly during the rainy season. Finally, this study suggests that man environment relationship should be minima so as not to jeopardize the ecosystem and this can only be achieved through formulation of bye-laws and policies that will guide the use and misuse of the land.*

KEYWORDS: sediment, landuse, erosion, Ikpoba, Okha

INTRODUCTION

Recently, the search for better means of livelihood has motivated man to focus attention on one of the source of erosion process (sediment yield) and to know the variability of it on different landuse types. Soil erosion as a prime factor responsible for sediment generation is a national and global issue that have generated much discussion and attention in recent time (Jimoh, 1997, 2000). This is because the problems of soil erosion ranges from land degradation, destruction of landuse, sceneries, destruction of human dwellings, road network systems, agricultural farm lands, among others. All these problems have made most governments in the world to give active support to programme of soil conservation.

The generation of sediment as a product of erosion is greater in the humid tropics than in the temperate region (Courtney and Trudgill, 1984). This is due to the erosive potential of rainfall (Climatic erosivity) and erodibility, which is higher in the humid tropics. Ofomata (1978) gave descriptive analysis of soil erosion in eastern Nigeria and

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according to him, human factors as well as physical factors such as climate, topography and geology of that particular area are responsible for soil erosion which further brings about sediment yield. However, various methods have been adopted by a number of scholars to study erosion in order to conserve the soil but result of such studies are often left unimplemented (Oyegun, 1980, 1983; Jimoh and Ajibade, 1995; Jimoh, 2000). According to Egboka (1999), most towns of Anambra Enugu, Ebonyi, Imo, Abia, Edo and Delta states is continuously devastated by water erosion.

In Ikpoba Okha, where this study is based, the predominant occupation of the people is farming and this farming operation have led to the subjection of parcels of land into a number of land use types but with disregard to the attendant environmental stress whose consequences are severe and hazardous on both man and the environment itself. However, healing the affected land areas are possible but the cost of such venture are enormous. One of the major features in soil conservation is measuring quantitatively the amount of soil loss due to erosion which in this work is referred to as sediment yield on runoff plots. Knowing the amount of sediment generated will help to solve the problem of soil erosion and land management.

The yield of sediment which is a product of erosion from a unit area of land is a complex process responding to all the variations that exists in precipitation, soils, vegetation, runoff, landuse and human activities. There is recurrent difficulty in the determination of the relative importance of each individual factor that are responsible for the generation of sediment through erosion. This is due to variation in the physical characteristics of soil and its ability to produce vegetation. However, many studies have revealed the overriding influence of rain fall characteristics in sediment generation through erosional process.

Due to the global consequences of erosion and removal of surface covers, this study will examine sediment yield on different landuse types in Ikpoba Okha and more so, to know the landuse type that can tolerate runoff in order to protect the natural features on it. There is a need for this considerations in order to conserve the land resources without which the hope of agricultural success and environmental management may be jeopardized. This is because, according to (Jimoh, 2003) any careless interaction with a land surface translates easily into high incidence of soil loss, the consequences of which are many and hazardous.

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Previous studies had paid so much attention on the fact that, rainfall characteristics is the most overriding factor that brings about sediment generation on land surfaces. In another dimension, several studies conducted on different landuses such as bareland surfaces, grassland, fallow land and tree land, states the impact of rainfall components on the different landuse types at different rates (Jimoh, 2003). There is dearth of information on causes, effects and preventive measures of soil erosion in Ikpoba Okha Urban and its rural areas. It is on this basis that this work seeks to examine sediment yield due to erosion on different land use types, factors responsible for its generation, effects of its occurrence and ameliorating measures associated with sediment yield and to suggest solutions on how to reduce sediment yield on different land use types.

MATERIALS AND METHODS

Study area

Ikpoba Okha area of Edo State in Nigeria, is located approximately between latitude 6°10' and 6°17' North of the equator and longitude 6°09' and 6°11' East. It is drained by the popular Ikpoba river which acts as a reservoir and receives almost all run-off within the catchment area. The area falls within the equatorial climate (Af Koppen's climatic classification). The wettest mouth being July and September with a short break in the mouth of August. The minimum temperature reaches about 28^0C and maximum of 38^0C with relative humidity of over 90%. With rapid urbanization and most of the land surfaces left bare of vegetal cover as well as fumes from automobiles and industries have created a microclimate within the area. The study area is located within the rainforest belt of Nigeria which is characterized with tall trees, thick undergrowth and dense vegetation canopy. But in recent times, as a result of population pressure, urbanization and anthropocentric activities have greatly diminished the vegetation from the rainforest type to a derived savannah with stunned trees and grassland. The soil type is made up of ferrasols, precisely the red and brown soil with abundant free iron oxides. The weathering profile consist mostly of red and yellow earths and loose, poorly sorted sands, intermixed in some places with clay barns. Their nature makes it easy to cultivate and also suffer from excessive internal drainage and intense leaching, giving the soils very strong acid reaction (Akinbode, 2006).

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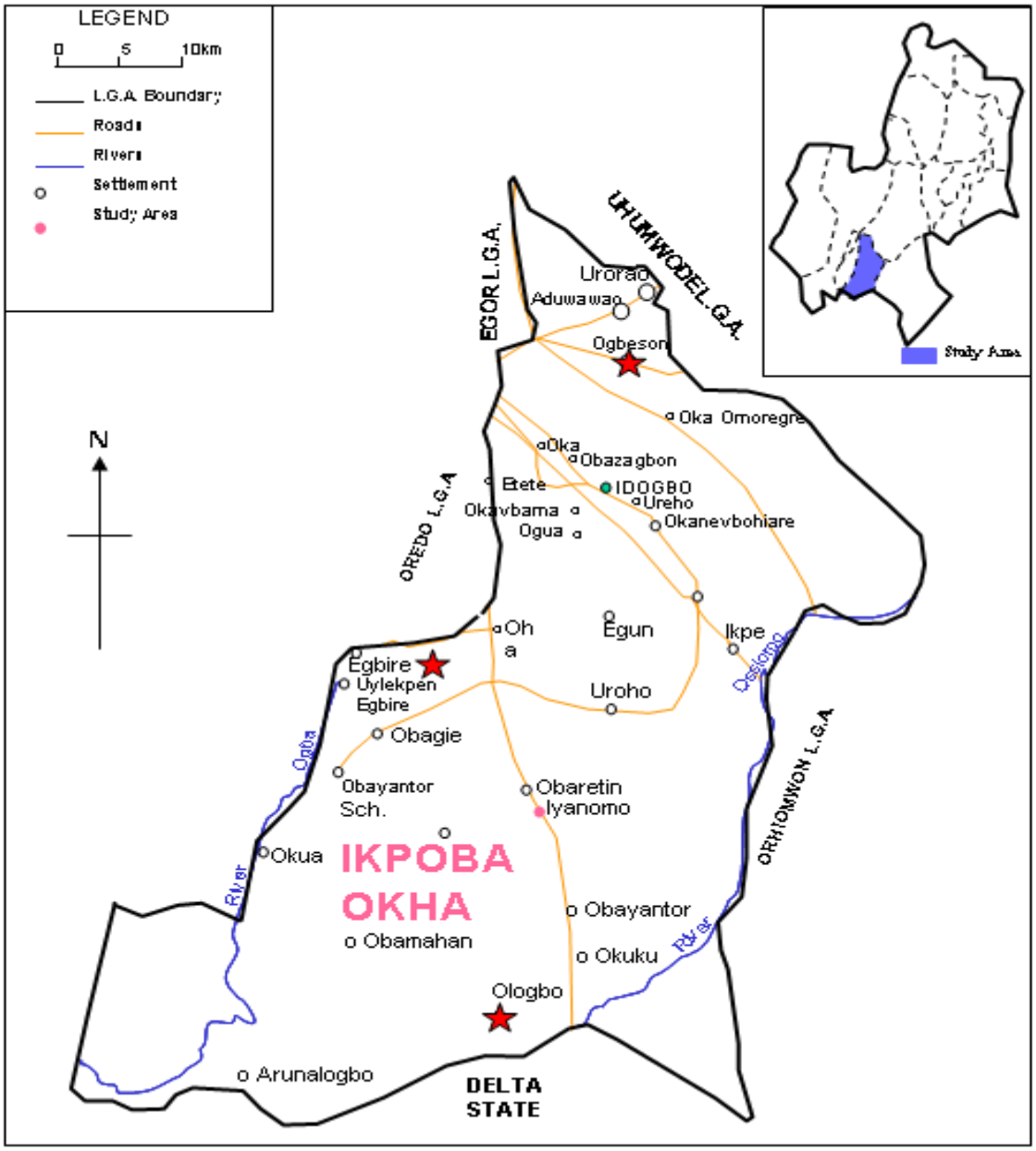

FIG 1: IKPOBA OKHA L.G.A. SHOWING STUDY AREA
Source: *Ministry of Lands and Survey, Benin City, 2017*

Research Methods

In other to achieve the desired objective of the study, two principle methods were employed in data collection (primary and secondary sources).In other to determine the degree of sediment yield in the study area, the area was stratified into three landuse types based on plant cover. These are: the bare surfaces situated in Ogbeson in the northern part of the area, the fallow grassland at Egbire western part of settlement and vegetated/forest land at the reserved area of Ologbo south-south (See fig. 2).

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The researcher used a measuring tape to measure an experiment plot size (sample site) of 2.0m by 2.0m in each zone (landuse type). The experiment plot size (sample site) was to allow for effective collection of sediments. Each plot was clearly demarcated with asbestos inserted 10cm below the ground surface. A small channel bordering the lower side of each test plot, collected runoff water and sediment load through a connecting plastic pipe into a 13 litre collection sediment tank installed in pit in each sample site (runoff plot). The runoff water in the plastic collection sediment tank was separated from the sediment after every rainfall event. The sediment collected is air dried and weighed. Rainfall amount in (mm) is recorded along side with the duration that is the rainfall intensity (mm/hour) for 8 months that is March to October, 2015. The data were collected and recorded appropriately.

RESULT AND DISCUSSION

Data analysis and discussion of results were deduced from empirical test, that is, measurement and were presented, interpreted and analyzed with tables, simple percentages, line graphs.
The results of the findings were based on the following:

i) Amount of rainfall;
ii) Sediment yield in the area;
iii) Rainfall intensity.

Table 1: Rainfall Amount

Months	**Rainfall total amount (mm)**	**Percentage (%)**
March	180	6.51
April	195	7.06
May	210	7.60
June	310	11.2
July	476	17.2
August	362	13.1
September	480	17.4
October	550	19.9
Total	**2763**	**100**

Source: Author's Work, 2019.

From the table above, it can be said that the month with the highest amount of rainfall is October with (550mm) with a percentage of (19.9) and the month with the lowest amount is March (180mm).

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Table 2: Sediment Yield from Different Landuse Types

Months	Bareland (kg)	Vegetated land (kg)	Fallow land (kg)
March	0.3	0.1	0.2
April	0.5	0.2	0.2
May	0.8	0.3	0.5
June	2.7	0.5	1.4
July	5.6	0.2	1.6
August	2.5	0.2	1.3
September	5.8	1.2	2.0
October	6.2	1.5	3.0
Total	**26.9**	**4.2**	**12.8**

Source: Author's Work, 2019.

From table 2 and Fig. 3, it is observed that sediment yield from bareland has the highest total amount of 26.9kg with the month of October recording 6.2kg, this is followed by fallow land with a total of 12.8kg and vegetated land with 4.2kg.
Furthermore, it is observed that the range of values of sediment yield from bareland is in agreement with earlier studies carried out by Egharevba (2004), Jimoh, (2003) which stated that sediment yield increases with increase in rainfall.

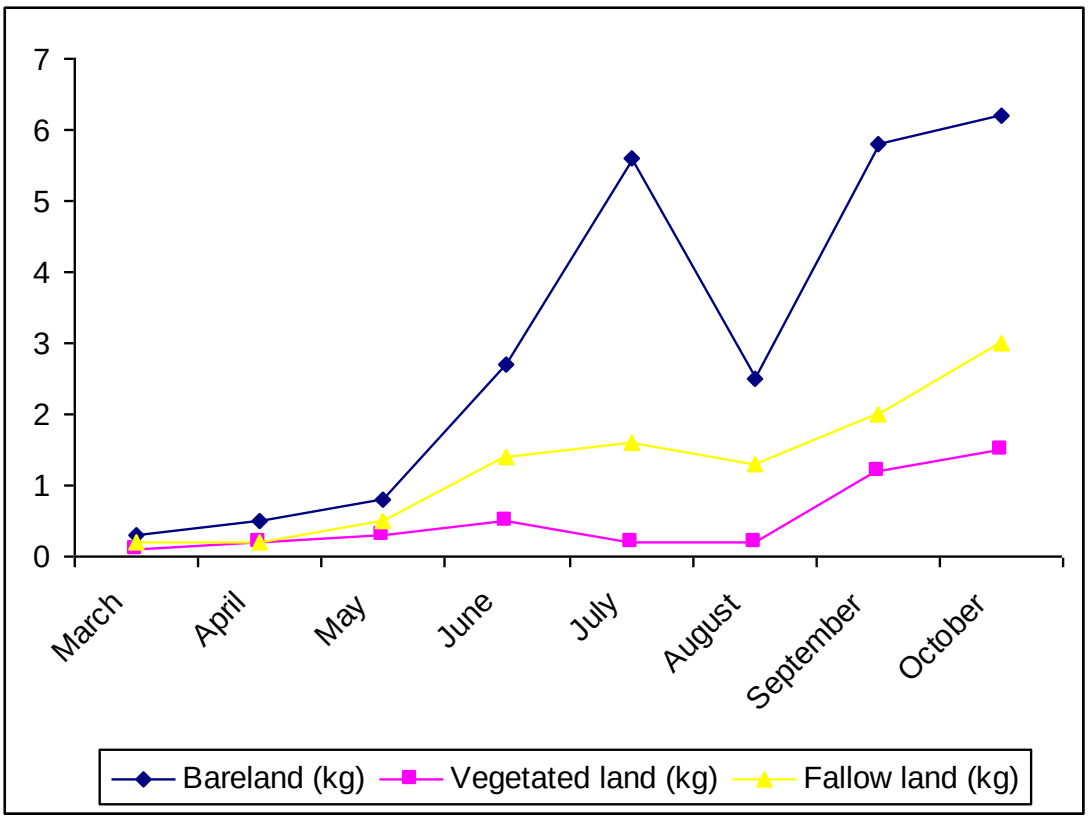

Fig 2: Line Graph Showing Monthly Sediment yields

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Table 3: Total sediment yield

Landuse types/Location	**Total sediment yield (kg)**	**Percentage (%)**
Bareland (Ogbeson)	26.9	61.3
Vegetated land/forest (Ologbo)	4.2	9.57
Fallow land (Egbire)	12.8	29.2
Total	**43.9**	**100**

Source: Author's field work, (2019)

From the table, it can be said that the percentage of sediment yield from bare surfaces had the highest value of 6l.3%, this is followed by fallow land with 29.2% and vegetated land with 9.57%.

Table 4: Rainfall Intensity

Months	**Rainfall total amount (mm)**	**Duration (Mins)**	**Rainfall intensity (mm/hr)**	**Sediment yield(kg)**
March	180	75	2.40	0.6
April	195	78	2.50	0.9
May	210	80	2.63	1.6
June	310	110	2.82	4.6
July	476	160	2.98	7.4
August	362	145	2.50	4.0
September	480	165	2.91	9.0
October	550	176	3.13	10.7
Total	**2763**	**989**	**21.87**	**38.8**

Source: Author's field work, (2019)

In the study area, it was observed that the intensity increases with increase in rainfall patterns. Also, that average intensity over longer duration accelerate erosion. It was observed that at smaller intensity value, the rainfall intensity is higher.

Table 5: Rainfall features over the different land use types

	Rainfall characteristics		**Sediment yield from different landuse types (kg)**		
Months	**Rainfall total amount (mm)**	**Rainfall intensity (mm/hr)**	**Bareland**	**Vegetated (tree) land**	**Fallow (grass) land**
March	180	2.40	0.3	0.1	0.2
April	195	2.50	0.5	0.2	0.2
May	210	2.63	0.8	0.3	0.5
June	310	2.82	2.7	0.5	1.4
July	476	2.98	5.6	0.2	1.6
August	362	2.50	2.5	0.2	1.3
September	480	2.91	5.8	1.2	2
October	550	3.13	6.2	1.5	3
Total	**2763**	**21.87**	**26.9**	**4.2**	**12.8**

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Source: Author's field work, (2019)
From table 5, it can be deduced that rainfall amount stimulate the amount of sediment yield of 26.9kg from bareland, 4.2kg for vegetated land and 12.8kg for fallow land. Apparently, the bareland is the most affected because of the direct impact of rainfall.

RECOMMENDATION AND CONCLUSION

From the study, it is evident that the rates of soil loss from different land surfaces vary in proportion throughout Ikpoba Okha. This is brought about by the rainfall patterns. However, the enormous rates of sediment generation from the different agricultural land use surfaces are beginning to assume a dangerous dimension and if left unchecked will become catastrophic over a long period of time. There is therefore, the need to adopt some policy measures as a way of minimizing this problem and such measures include;

The rates of soil loss from different landuse arise from human interaction with the environment. Thus, it is more rewarding that a good knowledge of the soil condition must be gained before putting any land into any particular use. In order to ensure an effective control over sedimentation, the planning exercise must incorporate both the landscape and rainfall factors before reaching a decision about the use of any parcel of land.

The various levels of government should embark on public enlightenment campaigns through their environment agents so that the people can be educated on consequences and adverse effect of sediment yield through erosion.An acceptable way of controlling soil loss is to cover the surface by planting grass, cover crops and flowers. This is because, the rate of soil loss decreases with the increase in the coverage of land surfaces by grasses.

Finally, government should formulate bye-laws and policies that will act as a guide to the use and |misuse of land.This work was carried out with the sole aim of investigating the various factors and control measure of sediment yield on different agricultural landuse types in Ikpoba Okha. Sediment yield results from erosion. Erosion is a global issue whose effect are enormous and also have negative consequences.

In the course of the investigation, it was observed that the impact of rainfall amount had also affected the different landuse types in different proportion. This is due principally to the variations in the nature of landuse types and the level of man environment interaction. It was also observed that the rate of sediment yields from the landuse types varied due to the fact that some land surfaces were not protected by plant cover.

Furthermore, as the rainy season progresses, the rate of sediment generation increased consistently on bareland and decreased to the nearest minimum on other landuse types with plant cover. In order to minimize the rate of sediment generation, grasses and trees should be planted. Also, the inhabitants of the study area should be taught how to be

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mindful of the ways they interfere with the natural plant cover so that erosion will not destroy the area.

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