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A Geographical Analysis of Erosion Problems in Ikere Ekiti, Nigeria

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Abstract

Natural disasters and environmental degradation have become important and alarming issues in contemporary Nigerian society. The aim of this study is to examine the effect of erosion in Ikere area of Ekiti State. The study evaluates the relationship between erosion types, drainage types and condition of the drainage channels. A total of 1,076 household heads were interviewed using a structured questionnaire. The respondents were chosen based on a systematic sampling techniques and a distance decay effect of 500 metres along direction of movement in all the eleven wards into which the town was stratified. The data was analysed using descriptive statistics and Likert rating scales. The study showed that poor drainage system with a Mean Weight Value of 4.74, above the Grand Mean Weight Value of 3.42 was accepted as a major factor that causes soil erosion in the area. The study therefore revealed that there is no adequate drainage system and the existing channels are in poor condition. The study concluded that managing and reducing the impact of erosion would require economic and technical measures such as construction of drainages, and proper channelization of rivers. This management measures though are essentially the responsibility of the government, the people also should be involved in the maintenance so that the drainage don't get blocked.

Keywords:
Natural disaster,
Environmental degradation,
Erosion,
Drainage system

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Background to the Study

Environmental issues are receiving increasing attention the world over. The environment is seen not as a static configuration of the earth's surface, but as a dynamic system over which man in his quest for livelihood plays a vital role. Gamble *et al* (1996) observed that United States had the highest awareness on environmental issues followed by European countries. The awareness in Asian and African countries is gradually coming up. The world over, whether in rural or urban centre, an environment free of a health hazard is desirable. Environmental and natural resource management spanning such topics as land, water, river basins, forestry, public health, sewage and refuse disposal, factories, food and drugs are of great concern to all and sundry. Jimoh (1995)argued that one of the most urgent problems confronting African cities today is how to plan and manage the environment. However soil erosion as a form of environmental degradation is a hydrological process with negative consequence the world over. The process may be a slow process that continues relatively unnoticed or happen at an alarming rate causing terrible damage and loss of soil especially top soil and vegetation. According to Julien (2010), Wiggs (2011), and Alexander (2014), erosion is a process of the detachment of soil materials as well as its transportation by water, wind or ice. Although more than 99 percent of the world's food comes from the soil, experts estimate that each year more than 10m hectares (25m acres) of crop land are degraded or lost as rain and wind sweep away topsoil. An area big enough to feed Europe – 300m hectares, about 10 times the size of the United Kingdom has been so severely degraded it cannot produce food, according to UN figures (Guardian, 2016).

The impact of simple soil erosion may not be too alarming if some other forms of soil degradation such as poor internal drainage, loss of soil structure, soil composition and sloppy terrain among others are not associated with it. Many factors therefore interplay to degrade the ecosystem. According to Adetutu and Adetutu (2008), Burbank *et al.* (2011) and Mainguet and Dumay (2011),a major resultant effect of land degradation in any society is poverty especially if the topsoil and fertile part is worn away by erosion process. For example, in an assessment by UNEP in 1984, it was found that in the arid, semi-arid, and sub humid regions of Africa, some 6,900 million hectares (including approximately 80% of the crop land regions) have lost between 25 and 100% of their productive capacity. In fact, Nigeria's mean annual loss through erosion is estimated to be about 25 million tonnes (Salau, 1995). The situation has not changed in the study area where properties and valuable land have been destroyed by erosion (Ogundare, 2008).

While erosion is a natural process, human activities have increased by 10 to 40 times the rate at which erosion is occurring globally. Excessive or accelerated erosion causes both "on-site" and "off-site" problems. On-site impacts include decreases in agricultural productivity and (on natural landscapes) ecological collapse, both because of loss of the nutrient-rich upper soil layers. In some cases, the eventual end result is desertification. Off-site effects include sedimentation of waterways and eutrophication of water bodies, as well as sediment-related damage to roads and houses. Water and wind erosion are the primary causes of land degradation; combined, they are responsible for about 84% of the global extent of degraded land, making excessive erosion one of the most significant

environmental problems world-wide (Blanco-Canqui and Rattan, 2008; Orlov *et al.,* 2011; Alexander, 2014).

Objective of the Study

The aim of this study is to identify and examine the prevalent type of erosion in the study area, and discuss its implication for sustainable development.

Conceptual Framework and Relevant Literature

Erosion and environmental degradation are posing serious threat to property and land in both the urban and rural areas of Nigeria. This environmental menace is one of the intractable problems in the world today. This is true as this environmental menace impinges on the quality of the environment and human health (Smart, 2002). Erosion is an important natural process. According to Cunning and Saigo (1999),it results in the redistribution of the products of geologic weathering and is part of both soil formation and soil loss that has sculptured the world's landscape. However, it becomes a problem when it occurs in a wrong place and at the wrong time.

In earth science, erosion is the action of surface processes such as water flow or wind that remove soil, rock, or dissolved materials from one location on the Earth's crust, and then transport it away to another location (Alexander, 2014). The particulate breakdown of rock or soil into clastic sediment is referred to as physical or mechanical erosion, this contrasts with chemical erosion, where soil or rock material is removed from an area by its dissolving into a solvent (typically water), followed by the flow away of that solution. Eroded sediment or solutes may be transported just a few millimetres, or for thousands of kilometres. If the rate of erosion is higher than the rate of soil formation the soils are being destroyed by erosion. Where soil is not destroyed by erosion, erosion can in some cases prevent the formation of soil features that form slowly. Inceptions are common soils that form in areas as fast erosion

The process of soil erosion begins with the splatter of the first raindrop that is; there must be a detachment of soil materials and then transportation by water, wind or ice depending on the ecological zone. There are many factors responsible for erosion in our environment. According to Onuigbo (2004), urban development aggravates some erosion problems as when housing projects are carried out on unsuitable soils that are subject to landslides. Ogundare (2008) observed that one major human activity that can result in soil erosion is poor agricultural practices such as over cropping and overgrazing of domestic animals. He also observed that deforestation; roads, anthropogenic climate change and urban sprawl are amongst the most significant human activities in regard to their effect on stimulating erosion. According to Ojo (1993), the activities of man have tended to promote erosion such as indigenous farming methods which encourages deforestation by bush clearing and burning while the rising demand for food for the teaming population does not allow the land enough time for full recovery and vegetal cover. He pointed out that unplanned location of buildings and road networks as well as their constructions give little consideration to drainage or blockage of the existing ones. The need to direct storm water is very important, hence, Wahab (1983) found out that

inhabitant drained off rain water falling inside their courtyard through a hole dug in the middle through which water is tunnelled out of the enclosure. Otherwise, the resultant event could be disastrous.

Apart from the obvious impact of the conversion of natural habitats to agricultural use, Ariyo (1983) opined that urban development constitute menace to the incidence of soil erosion. Adebiyi (1996) observed that the recent urban expansion coupled with uncontrolled pattern of physical development within the urban sector has generated erosion and that most urban road and private properties have been damaged by surface erosion. The reason for this is that in most developing countries like Nigeria, erosion problems are caused and aggravated by expanding population and inadequate or lack of drainage channels to direct storm water flow especially torrential rainfall during the rainy season. Chudley (2002) stated that the stability of a road relies on two factors which are the strength and stability of the upper surface of the road and strength and durability of the subsoil. He further stated that these two structures are affected by water and that proper drainage channel is required to prevent erosion. Obiegbu (1999) asserted that a functional drainage system is essential to control water in our estate and highways.

However, Watson *et al* (2003) observed that change in the system is inevitable but limits of acceptable environmental change often called the carrying capacity should be established before development begins. According to them, acceptable change should not approach the upper limit of capacity before unpredictable events may go beyond that limit and cause the entire system to collapse. In ecology, Steiner (2000) defined the carrying capacity as the number of individuals that the resources of a habitat can support without deterioration. Therefore, carrying capacity concept which is the number of individual or activity an area can support or accommodate at a given point in time, suggest a limitation for the growth population and activity in any ecosystem. This means that every site has a carrying capacity for development and any form of human activity. Therefore, site analysis should determine this capacity based on the sensitivity of site resources. Otherwise, the ecosystem would be stressed beyond its capacity. Mabogunje (1988) identified three main forms of environmental stress in the ecosystem. First is Exploitative stress, arising directly from the rate at which we have wiped out most of the wild animals and plant population in the ecosystem to the point where the survival of the prey species is threatened. The second is Disruptive, and involve the modification of the structure of the ecosystem to the point where it is highly susceptible to invasion and replacement by another ecosystem by agencies such as overgrazing, over-cropping and bush burning. The third type is Eutrophic, resulting from the deposition of human body wastes and food residues in small areas where concentration of nutrients can rise sufficiently to affect plant growth and the balance of the ecosystem. Based on above, Sada (1988) revealed that there are lower and upper levels of tolerances within which man can operate in the ecosystem and that the goal of the environmentalist should be to ensure that the limits of tolerance are not exceeded. Man therefore, should ensure that before any developmental activity takes place, the carrying capacity of the land must be determined to identify its tolerance level; otherwise stress to the ecosystem is sure to happen. This is to say that if man wants to continually enjoy the product of the ecosystem then, he must arrive at a balance

between development and ecological perfection. Mabogunje (1988) therefore suggested that the major aim of environmental management should be to avoid stressing our valued ecosystem beyond the limits of its resilience and stability.

The foregoing empirical evidence and concept reviewed indicate that various factors interplay to deteriorate the quality of environment regularly, thereby increasing environmental degradation. Davis *et al* (2004), Hughes (2004), Ode (2005) and Oniyekaeya (2005) identified causes of soil erosion to be attributed to land use types, urbanization, agricultural practices, deforestation, and lack of drainage system and poor provision of infrastructural facilities. If probably safety and sustainable disaster risk management must be achieved to avert environmental problems, then conscious and continuing effort must be put in place to protect the environment.

The Study Area

Ikere - Ekiti, the setting for the study is a traditional Nigeria town and like other traditional Yoruba towns in the country, it existed long before the advent of British Colonial rule in Nigeria. The town is located within Ekiti State in the South-western part of Nigeria (Fig. 1). It lies approximately on latitude $7^0$30'North of the Equator and longitude $5^0$14' East of Greenwich Meridian. Ikere is bounded in the north by Ado-Ekiti, in the south by Akure North local government, and in the east and west by Ise/Orun and Ekiti South-west local governments respectively. The last National Population Census puts the total population of Ikere local government at 147,355 (NPC, 2007).

Ikere Ekiti experiences a tropical climate with distinct wet and dry seasons which can be better described as Koppen's 'A' Climate (Adebayo, 1993). The wet and dry seasons are associated with the prevalence of the most maritime South westerly monsoon winds from the Atlantic Ocean and the dry continental north easterly harmattan winds from the Sahara deserts respectively. The rainy season span from April – October while the dry season (November – March). Temperature is almost uniform throughout the year with very little deviation from the mean annual of 27^0C. February and March are the hottest months with mean temperature of 28^0C and 27^0C respectively while June with temperature of 25^0C is the coolest (Adebayo,1993). The mean annual total rainfall is 1367mm with a low coefficient of variation of about 10%. Rainfall is highly seasonal with well-marked wet and dry seasons and double maxima as a result of the 'little dry season' experienced in August (Ogundare, 2008).

An important feature of the town is the large number of hills it possesses, notably the Olosunta and Ugele hills, and Orole inselberg. The hills are steep-sided and make much of the area susceptible to the risk of soil erosion. Predominantly the people are farmers cultivating both cash and food crops. The cash crops are mainly for export while the food crops are cultivated on subsistence level. Some of the rocks that are granitic in nature are also used for construction activities. No wonder two prominent quarry sites are located in the town.

Research Hypothesis

H_o: There is no significant relationship between drainage system and soil erosion in Ikerearea of Ekiti State.

Research Methodology

The data for this study were based on both primary and secondary data sources. Structured questionnaires were designed to gather information from residents in the study area. Information gathered include socio-economic characteristics and other variables such as erosion types, drainage types, condition of drainage channels; refuse disposal methods and problems caused by erosion in the study area. Since erosion is prone to every area in the town, systematic sampling techniques was used to select buildings at intervals of every tenth building in the eleven wards into which the town is stratified. In all, a total of 1,076 questionnaires were administered on households' head using a distance decay effect of not more than 500 metres in the direction of movement in each ward. In addition, other relevant materials and data were sourced from published sources such as the report of the survey on erosion problems in Ekiti State by Ekiti State Ministry of Environment, journal articles, State diaries, newspapers, textbooks, and internet sources among others. Appropriate statistical techniques including frequency tables and percentages were used to explain the result of the study.

Results and Discussion

The findings of the study are as discussed under the various sub-headings below:

Occupational Status of Respondents

The survey of respondents' occupational status for this study shows that about 44% are farmers while 33% are civil or public servants. Almost 18% of the respondents who are privately employed are artisans and about 6% claimed to have retired from active labour services.

Table 1: Occupational Status of the Respondents

Occupation	Frequency	% of Total
Farming	468	43.5
Civil/public servants	356	33.1
Privately employed	188	17.5
Retiree	64	5.9
Total	**1076**	**100.0**

Source: Fieldwork, 2015

The result shows that majority of the respondents are farmers. This corresponds to the fact that Ekitiland is rural and her people are predominantly farmers according to Ogundare, (2008).

Educational Qualifications of Respondents
The educational qualifications of the respondents were sought after and the information got is as shown in Table 2.

Table 2: Educational Qualification

Qualification	Frequency	% of Total
No formal education	41	3.8
Primary school certificate	106	9.9
Secondary school certificate	438	40.7
Degree holders	491	45.6
Total	**1076**	**100.0**

Source: Fieldwork, 2015

About 3.8% of the respondents had no formal education while almost 10% had primary school certificate. However, more than 85% of the respondents are literates. It is much easier for them to fill the questionnaires and give appropriate responses to the problems of erosion in the study area.

Erosion Types in the Study Area
There are three main types of erosion ravaging the study area as shown in Table 3. Majority of the respondents claimed sheet erosion (55.6%) is the most prevalent, while gully and rill erosion are 19% and 25% respectively.

Table 3: Erosion type in the Study Area

Erosion Types	Frequency	% of Total
Gully	206	19.1
Sheet	598	55.6
Rill	272	25.3
Total	**1076**	**100.0**

Source: Fieldwork, 2015

Drainage Types in the Study Area
The summary of the data collected on drainage types is as shown in Table 4. Open concrete drainage system (19.9%), close concrete drainage system (4.9%), and earth drainage system (32.3%). The table however reveals that most of the study area has no drainage system as shown by No drainage system (42.9%).

Table 4: Drainage Types in the Study Area

Drainage types	Frequency	% of Total
Open concrete drainage system	214	19.9
Close concrete drainage system	53	4.9
Earth drainage system	347	32.3
No drainage system	462	42.9
Total	**1076**	**100.0**

Source: Fieldwork, 2015

Nature of Drainage in the Study Area

The nature of drainage in the study area is poor as revealed by Table 5. About 61% of the respondents agreed that drainage condition is poor, while 34% claimed it was fair. However, about 5% of the respondents said the drainage conditions were good. There is therefore, an urgent need and attention to salvage the dilapidated drainage condition in the study area.

Table 5: Nature of Drainage in the Study Area

Nature of Drainage	Frequency	% of Total
Very good	13	1.2
Good	38	3.5
Fair	367	34.1
Poor	658	61.2
Total	**1076**	**100.0**

Source: Fieldwork, 2015

Test of Hypothesis

The hypothesis states that there is no significant relationship between drainage system and erosion in the study area. There are some factors which contribute to soil erosion in the study area and varied subjective notions of respondents on them are shown in Table 6.

Table 6: Factors of Soil Erosion

Factors	SA	A	SD	D	U
Poor drainage system	902	102	43	26	03
Heavy rainfall	82	60	442	385	107
Topography	341	104	356	114	161
Inadequate layout	84	128	552	288	24

Source: Fieldwork, 2015

In order to ascertain the notion of the respondents about the most prevalent factor, their indicated subjective notions were transformed to objective notion using 5-point rating scale of Likerts. The summary of this analysis is shown in Table 7.

Table 7: Respondents' Notion on Factors Causing Soil Erosion

Factors	SA	A	SD	D	U
Poor drainage system	4510	408	129	52	03
Heavy rainfall	410	240	1326	770	107
Topography	1705	416	1068	228	161
Inadequate layout	420	512	1656	576	24

Source: Fieldwork, 2015

Thereafter, the Mean Weight Value (MWV) and the General Mean Weight Value (GMWV), that is, the cut-off point of rejecting or accepting any of the responses above were done as calculated by Ogundare (2013). The summary of this analysis is as shown in Table 8.

Table 8:Summary of Accepted Factors Causing Soil Erosion in Ikere-Ekiti

Factors	MWV	Decision
Poor drainage system	4.74	Accepted
Heavy rainfall	2.66	Rejected
Topography	3.32	Rejected
Inadequate layout	2.96	Rejected

Source: Fieldwork, 2015

From Table 8, factors such as heavy rainfall, topography and inadequate layout were rejected because their respective MWV of 2.66; 3.32; and 2.96 are lesser than the GMWV of 3.42. Moreover, the notion that poor drainage system causes soil erosion in the study area was accepted because its MWV of 4.74 was greater than the GMWV of 3.42. Therefore, H_o is rejected and alternative H_1 accepted.

Planning Implication of the Study and Conclusions

The environment is where we live, and development is what we do in an attempt to improve on our lot within the abode. The environment must not be seen as an inert object whereby various human and developmental activities can take place without consequences. However, erosion is one of these major consequences of uncontrolled human activities and improper developmental planning. Specifically, soil as established in the study is a resource and it must be conserved and managed properly by all means to avoid disaster. The paper argued that sheet erosion is degrading the study area and this is aggravated by inadequate and poor condition of drainage system. The planning implication of this is that this menace that washes away topsoil occurs virtually in residential areas of the study. This is as a result of so much developments going on without proper cognizance of the carrying capacity of the land. This has further led to rugged terrain, exposure and weakening of building foundations, washing away road floors and exposure of the base of electric poles. The topsoil is also washed away into some existing drainage channels thereby blocking the channels and in turn resulting to

flooding during rainy season. Hence, the need for constant and comprehensive surveillance and management of the drainage condition in the study area.

The need to manage and reduce impact of erosion in any area requires both technical and economic measures. This should however, be the responsibility of the government. Government as part of her social responsibility should construct drainages in the study area especially along roads and foot of the hills to reduce this menace. On the part of individuals, attention must be taking to bush burning and when this is required, they are advised to channel water off the burned area and release to nearest drainage channel. This should be done because bare ground and hydrophobic soils left after a fire, increases water runoff. Sheet flow of ground water should be directed to down slope land which should be linked to drainage channels. The practice of removing soil from one area to another should also be discouraged.

Finally, the effort of government in improving quality of the environment should include public environmental information system which is aimed at conveying factual data on environmental risks and opportunities to the public. The government should provide budgets for environmental research, sustainable rehabilitation and various approaches to the control of developmental activities in the study area. If these measures are put in place and implemented effectively, it will go a long way in enhancing sustainable environment and reduce disaster or environmental risk anywhere in Nigeria.

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