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SOIL AND SOIL EROSION MENACE IN OZORO ENVIRONMENT IN ISOKO NORTH LOCAL GOVERNMENT AREA IN DELTA STATE, NIGERIA

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Abstract

This study dwelt on soil erosion in Ozoro. Soil erosion is a global; menace that occurs in both forest land and range land. However it is more severe in soils that are exposed to agriculture. Soil erosion in Ozoro is a major concern because of major distinguishable soil erosion times namely sheet, rill and gully have continually washed away the top soils. This excessive erosion of the top soil reduces the fertility of the soil, and water holding capacity of the soil. The resulting sediment yield from the soil erosion is a source of major water pollution and silting of Lake Owen in the community. Both natural and human accelerated soil erosion have severe environmental impacts such as soil depletion, and degradation of agricultural lands which in turn reduces proceeds from farm produce. Relying on data obtained from field study, the paper advances that, both natural and human induced practices contributes to catastrophic destructive erosive processes. The paper further advances solutions to curbing the menace.

Keywords: Soil, Soil Erosion, Menace, Ozoro, and Environment

Introduction

The soil resources of the environment, in Ozoro and across the globe, constitutes a very valuable aspect of the earth's natural and Environmental resources; this loose weathered materials from the underlying rocks, known as soil, is the major source of life support system that provides anchorage for the vast variety of plant food for all terrestrial plants, soil microbes, and other products that are responsible for the maintenance of the biologically active world. It is approximately a seven inches layer of a combination of weathered rock materials of diverse origin.

Edewor & Atubi (2021) opined that the overwhelming factor in the consideration of soil as a valuable environmental resource, is dependent on its physio-chemical parameters composition in the right quality and quantity. The import of this reasoning, is based on the fact that man as the most potent agent of environmental change, is constantly and consistently interfering with the soils of the environment, for various socio-economic and cultural endeavors with a view to meeting his daily needs for livelihood; these activities either through farming or different infrastructural development, results in the modification of the soil structure, texture, and general physio-chemical parameters. This according to Edewor (2025), are capable of modifying soil suitability and capabilities.

Edewor (2022), pointed out that in order to maintain the health of the "soil", it must be exploited in a sustainable manner, and this is as a result of a combination of diverse physical and chemical factors and their peculiarity in soil formation in diverse environments. Factors such as parent material from which the soils have been weathered, rainfall, temperature, organic matter which have been added overtime from leaf fall, climate, slope and others. The broad classification of soils is based on their spatial distribution. In other words, soils are classified based on the climate and ecological zone from which they evolved.

Lal (1998), reasoned that most soils of the world today are not formed under natural conditions but as a result of hundreds and thousands of years of human impacts, through cultivation, ploughing and other anthropogenic impacts, that manifests in environmental hazards, such as soil erosion, leaching and general soil impoverishment. Soil as a natural resource is a globally occurring lithospheric resource that is available across continents, countries, states, cities and communities, and it serves useful purposes across time. Igwe etal (2017), posited that though soil is an indispensable and valuable environmental resource, that is vital for sustenance of human race, it remains

a highly abused natural resource due to the fact that human impacts of over exploitation is subtle in nature, that is, its exhaustion may not be glaringly visible

Soil erosion is a major environmental hazard that affects the effective utilization of soils of the environment. Onu & Mohamed (2014), remarked that there are three notable environmental problems associated with soil decline, they include; soil erosion, soil deterioration and soil desiccation, all these aggravate soil impoverishment, thereby reducing its productive potentials. Considering the amount of rainfall and flooding that occurs in Ozoro and environs, the soils are constantly exposed to or in most cases prone to soil erosion, while the gentle and flat rolling topography of the area may not have visible effects of damage to tangible infrastructure properties such as roads and houses, even outright washing away of farm lands in high points such as Agbor in Delta State. What occurs in Ozoro is gradual and subtle with critical negative effects in the nearest future as soil nutrients are constantly washed to lower horizons of soil profiles beyond the reach of plants. Gbigbi (2020), commented that soil erosion reduces the productive capacity of soils, he also posited that 80% of agricultural lands experience soil erosion in Delta state, and factors that aggravate soil erosion include but not limited to rainfall, flooding, deforestation, destructive extractive practices such as land excavation , reckless agricultural practices all contribute significantly to the menace of soil erosion. Soil erosion in its simplest definition, is the washing away of top soil, thereby transporting soil nutrients beyond the "A" horizon of the soil profile.

Egede (2013), noted that erosion is a major threat to food security and agriculture, because where soil nutrients are eroded and leached to deeper parts of the soil profile, the soil would be rendered unproductive as the zone of nutrient storage is between 0-15m. The implication of soil erosion is that it reduces soil fertility especially in Ozoro and environs where the main stay of the inhabitants is predominantly farming (Izeke 1989). Ojo and Adebayo (2012), posited that soil erosion is an issue that demands urgent attention since it remains a major environmental hazard that diminishes the productive capacity of arable farmlands, with adverse negative effects on the health of the soil.

The main thrust of this article is soils and soil erosion in Ozoro environment", field surveys and archival sources would be relied upon to elicit relevant knowledge of the subject of enquiry. The outcome of this research piece, no doubt, will give will give impetus to understanding the nature of soils and soil types prevalent in Ozoro environment, issues bordering on soil erosion in the environment as well as advancement of mitigative and adaptation measures of soil conservation, preservation, management and restoration for sustainable development; and its goals in view. This view is aptly corroborated in Edewor & Atubi (2021) on the need for soil management for production of staple food crops, such as cassava and other food crops cultivated in the area.

Method

The Study Area: the area delineated for this study is Ozoro town in IsokoNorth Local Government Area of, Delta State Nigeria.

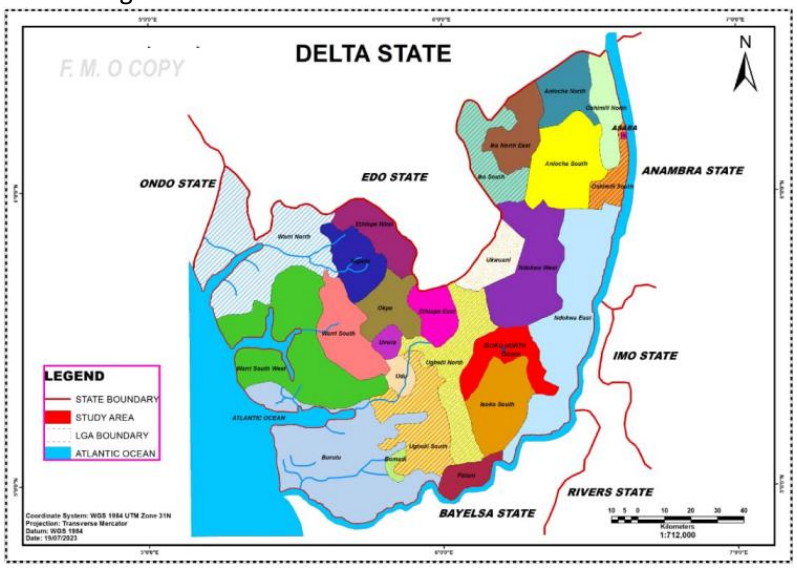

Figure 1: Map of Delta State showing Isoko North.

Location: Ozoro is located in Isoko North. It is the headquarters of Isoko North Local Government Area, Delta State, southern Nigeria. Geographically, it lies in the South-South geopolitical zone of Southern Nigeria, in the Niger Delta. Ozoro lies between latitude 5^0 26^{11} 20^{22} N, and 5^0 33^1 10^0 N and Longitude 6^0 19^1 20^{11} E and 6^0 12^1 30^{11} E. it is bounded by Akiewe (Owhe) to the West, Idtheze – Southwest, Oleh to the South, Ellu to the North

East, and Owhelogbo to the Northwest. It has a built up area of 21 square kilometers (see figs 1& 2).The methodology adopted for the study is the direct field study method where various plots of lands in the area were studied for the effect of soil erosion, using the map of Ozoro.

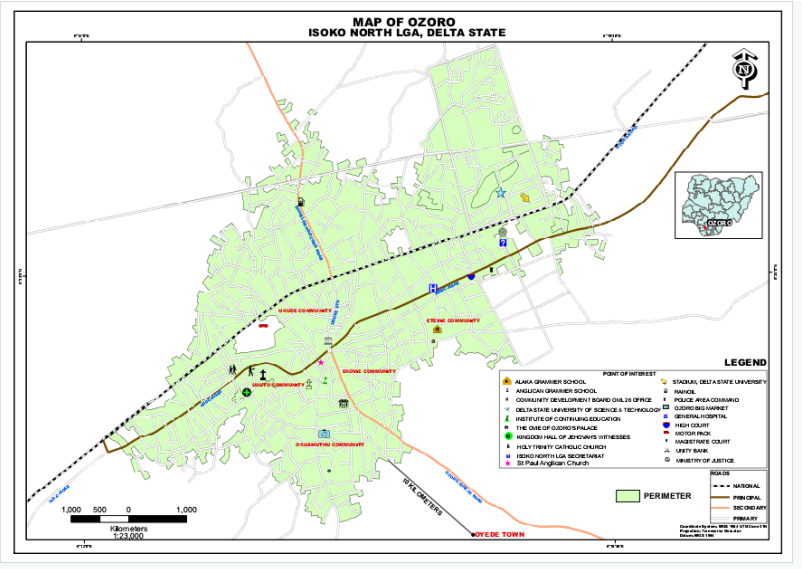

Figure 2: Map of Ozoro Town

Findings and Discussions

The nature of soils found in any environment across space is a function of the nature of the underlying rocks (Parent Material) from which the soils have been weathered. Ozoro lies within the genetic classification scheme of soils found within Delta State region of Nigeria being a prominent part of the Niger Delta Region. Which according to Ayeni (2015) falls within the Benin-Agbada formation whose rocks are of sedimentary origin. Fagbemi (1985), remarked that the genetic classification schemes of soils found in Delta State generally can be classified into three groups namely:

1. Hydromorphic and alluvial soil
2. Ferrasols
3. Ferruginous tropical soils

A causal link exists between soils and vegetation therefore soils cannot be discussed without the mention of vegetation because the vegetation plays a crucial role on the nature of soils of any given environment and the suitability and fertility of soils to a large extent is dependent on vegetation cover.

Olomo & Ejemeyovwi (2008), stated that the soils of Ozoro environment are mainly hydromorphic acidic and generally sandy. This view was corroborated by Edewor and Atubi (2022), which also affirms a high degree of sandiness in the soils of the area, however, a variety of other soil types found in the area especially in the cultivable farmlands are sandy loam, and clay loam soils; especially around the swamps and water logged landscapes. The import of the soils characteristics is that the soils of Ozoro have a high erodibility potentials which makes the soils highly susceptible to soil erosion and leaching with negative effects on agricultural practices and available arable farmlands. The major environmental factors that aggravate soil erosion in the area are high intensity rainfall and floods. The washing away of top soils which is the zone of nutrient activities from the 'A' horizon of the soil profiles renders the soils impoverished and the impact of soil erosion in the soil is usually reflected in low crop yield, which is inimical to food security in an emerging, of agrarian to secondary production economy with teeming population, that will rely on agricultural produce from farmlands for daily supply of staple food supply (see table 1).

Table1: Soil Parameter Values of Ozoro Environment.

Soil Parameters	Rain Forest	Farmlands
P^H	4.94	4.99
Organic Carbon (%)	2.40	2.93
Total Nitrogen (%)	0.37	0.32
Available Phosphorus (ppm)	13.44	13.39
Calcium (cmol/kg)	0.91	1.20

Sodium (cmol/kg)	1.79	1.64
Magnesium (cmol/kg)	0.58	0.88
potassium (cmol/kg)	0.16	0.13
ECEC	3.37	3.92
SFI (Soil fertility Index)	10.75	10.78

Source: Edewor and Atubi, 2021.

Table 1, shows the soil parameters values of various physio-chemical parameter values of soils in the area. PH values obtained shows that soils are tending towards acidic which reduces soil fertility and other soil parameter values reflected gives a general over view of the soil conditions in the area. This is also an indication that the soils are highly leached.

Table 2: Soil Textural Characteristics of Soils Ozoro Environment.

Soil type	Sand (%)	Silt (%)	Clay (%)	landscape
	74.40	15.40	10.20	Rainforest
	77.32	14.00	8.68	farmland

Sources: Edewor, (2025)

Table 3: Soil Texture Description (Ozoro Environment)

Rainforest Sand 78.9	Silt 11.7	Clay 9.3	Soil type Sandy Loam
Cultivated Farm land Sand 78.9	Silt 11.4	Clay 9.6	Soil type Sandy Loam
Grass lands (Udude) Sand 80.1	Silt 10.33	Clay 9.6	Soil type Loamy Fine Sand

Source: Edewor, 2025

The import of the above soil textures descriptive is an indication of that the soils of the area are vulnerable and highly susceptible to soil erosion. Excessive erosion of top soil reduces both soil fertility and water retention capacity of the soil. (Edewor, 2025). With this occurrence, the resultant sediments constitute the largest source of water pollution. If the average rate of top soil erosion exceeds the rate of top soil, formation, on a piece of land, the soil becomes depleted. In tropical and temperate regions, the renewability of one inch of soil takes an average of 500 years, if renewal aids are not explored. Worldwide annual erosion rates for agricultural lands are 18-100 times the natural renewal rates.

Implication of Soil Textural Characteristics

From table 3, the soil textural characteristics indicates a high content of sand to soil and clay. The implication is that the soils in the area have high potential of erodibility. This will also affect the water retention capacity of the soils, also sediment yield will increase, thereby silting up water bodies, example is the high yield of sediments that has almost ruined the largest fishing lake in Ozoro which is “Owen lake”, located in “Uzowen farmlands”, like the shrinking lake Chad on the national scale, this community “OwenLake” is shrinking as well as disappearing due to anthropogenic forces, resulting from soil erosion and sedimentation.

Soil Erosion occurs in two major forms:

i. Normal geological soil erosion
ii. Accelerated Soil erosion.

The nature of soil erosion in Ozoro is an amalgam of both accelerated and geological erosion, because natural process of denudation such as rainfall being located in an area of high intensity rainfall. Accelerated soil erosion is more rapid, because it is mainly induced as a result of various activities on the earth surface. It is highly linked with agricultural development on the earth surface. It is very destructive in nature, thus it has consistently attracted the attention of scholars as it relates to checkmating its menace. Ozoro’s topography is generally flat, gentle, and even, as a result, glaring erosive outcomes on landscape may not be obviously visible as it is in higher terrains like Agbor, Delta State where gully erosion destroys both roads, houses and occasionally lives.

However, sheet erosion which occurs in Ozoro environment is a subtle menace that destroys arable farmlands and sedimentation of water bodies. The major propelling forces of this type of erosion is heavy rain fall experienced in the area, and flooding incidence especially as recorded between the months of September to December 2022 where river within the hinterlands were inundated beyond their water holding capacity.

According to Ikime (1972), Ozoro was regarded as a flood free zone in Isoko Area, however, anthropogenic activities and global circulation such as climate change and Ozone layer depletion, have modified the environmental landscape of Ozoro, and the area is now liable to, flooding and highly susceptible to erosive condition, and the nature of the soils makes the land highly erodible as a result of the high degree of sandiness, that facilitates soil wash, and low water retention capacity (see table 3).

Table 3: Characteristics of Soil Erosion in Natural and Cultivated Terrestrial Ecosystems.

Factor	**Natural**	**Cultivated**
Abiotic water infiltration rate	**High**	**Low**
Water run-off rate	Low	High
Soil erosion rate	Low	High
Leaching losses	Low	High
Soil organic matter	High	Low
Soil temperature	Low	High
Silting of Water Bodies (Lake Owen)		
Biotic Factors	**Natural**	**Cultivated**
Structural diversity of plants	High	Low
Plant and animal species diversity	High	Low
Plant reproductive potential	High	Low

Source: Edewor, 2025.

Policy Recommendations

The outcome of this discourse is specifically relevant for all categories of land users in Ozoro and environs because it will open new vistas for soil management and conservation strategy examined in the article "Soil and Soil Erosion in Ozoro". Based on the following findings.

1. Excessive erosion of top soil in the area, reduces both soil fertility, soil sustainability, and water retention capacity, which is inimical to arable farming and other land use types. The resulting sediment yield from erosion and deposition activities is the largest single source of water pollution, and silting of streams and lakes e.g. the silting up of Owen Lake in Ozoro in Uzowen farm lands. There is therefore need to look into the restoration of this Lake for utmost cultural and economic value. It is needful to introduce soil management and conservation practices to forestall soil desiccation, soil depletion, and soil degradation, which are all aftermath of soil erosion. The natural regeneration process of bush falling and shifting cultivation is grossly insufficient due to reduction in fallow periods resulting from population pressure.
2. The top soil which is called 'A' Horizon is classified as a renewable resource because

It has the potentials to regenerate itself by natural processes or with very little conservation efforts, like shifting cultivation and bush fallow, which are common practices in the area, though with drastic reduction in the length of fallow (Edewor 2016, Izeke 1989). Nevertheless, if average rate of top soil erosion exceeds the rate of top soil formation, on a piece of land, the top soil becomes non-renewable and becomes totally depleted, consequently the land will become unproductive and unsuitable for cultivation of crops.

3. Ozoro people cultivate cassava, yams, maize, plantain oil palm, cocoyam, and other food crops, which are deep rooted crops with high requirement for both soil macro and micro nutrients. There is therefore need to boost the soil fertility and soil quality of the area to avert food insecurity. Edewor (2006), also noted that soil constraints arising from soil erosion are site specific and there is need to treat every site based on the observed constraints.

Therefore, there is need to combat sheet erosion resulting from run-off occasioned by heavy rainfall and flooding by introducing sustainable soil conservation and management techniques, and measures of remediation to checkmate this delicate environmental catastrophe known as "soil erosion" with its attendant negative effect on the environment..

Conclusions

This study examined a topical issue title "Soil and Soil Erosion in Ozoro Environment'' Findings revealed that the soils in Ozoro environment, are sandy in nature, therefore they are highly susceptible to soil erosion, which results to soil loss. It has a ripple effect on food scarcity and food security. Heavy rainfall in the area, also induces flooding which is also an agent of soil erosion, the flooding is further aggravated by influx of water from boundary communities that are linked to major water bodies as witnessed in the 2022 floods and leaching.

In line with Goal 15 of the Sustainable Development Goals which is anchored on protection, restoration, and sustainable use of terrestrial ecosystem (Edewor 2021). This is also intended to halt and restore soil degradation,

combat desertification and forestall loss of biodiversity, it is therefore expedient that the issue of soil erosion be addressed with utmost urgently to avert loss of cultivable arable lands to soil erosion, as its consequent environment hazards, with a view to conserve, preserve, and ensure appropriate soil management conservation measures in the area, in order to ensure that the integrity of the soil resources of the area is not jeopardized, for both the present generation and posterity.

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