



SOIL EROSION AS AN EMERGING ENVIRONMENTAL CHALLENGE IN SOUTH - EAST GEOPOLITICAL ZONE OF NIGERIA: TOWARDS A SUSTAINABLE LAND CONSERVATION FOR NATIONAL DEVELOPMENT

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ABSTRACT: *Soil erosion is recognized as one of the world's most serious environmental problems, which has sculpted our landscape for centuries. It depletes the productive capacity of land as it removes nutrients, organic matter and clay from soil, which are most important for plant growth. Soil erosion has a wide range of costly off-site impacts including damage to roads, disruption to transport and electricity supply, contamination of wetlands, watercourses and marine environments, and human health impacts caused by raised dust. Soil erosion is a natural geomorphologic process resulting from water and land interactions but accelerated to become an environmental hazard by human activities such as clearing of forests for cultivation, poor farming practices and encroachment into marginal lands. However, since man utilizes the soil to grow food, build shelter and roads, it is thus an essential part of life, which need to be sustained and protected from the threat of soil erosion. The soil needs to be sustained for future generations and to ensure that it does not collapse under the threat of soil erosion. Sustainable development has the great potential to address fundamental issues and challenges of soil erosion. It attempts to combine growing concerns about a range of environmental issues with socio – economic issues. Un – sustainable pattern of production and consumption in the environment yield scarcity of resources, degrade the environment and aid rapid changes in the natural ecosystem which sustain life. This paper aims at providing insight to the sustainable approaches to soil erosion in the South – East Geopolitical zone part of Nigeria. It also addresses the challenges associated with soil erosion such as loss of farmland and biodiversity, land degradation etc. The study concludes that since soil is a major component, from where we obtain our food, build shelter, raise livestock and other life processes, then there is need for it to be sustained. It recommends awareness and enforcing environmental regulations. as some of the ways to address the challenges of soil erosion.*

KEYWORDS: Environment, Land Degradation, Soil Erosion, Sustainable Development, Natural Resources

INTRODUCTION

Soil is a complex and variable system of mineral particles, water, air, organic matter and living organisms. It is a mixture of minerals and organic materials that cover the earth's surface. The importance of soil to both animals and plants cannot be over emphasized. This is so said, because it provides the fundamental ecosystem services which are required for human life, primarily for the production of food by providing the enabling environment for plant growth (Sebastian et al, 2014). Soil provides the medium through which water and



nutrients move to the roots of plants (Powlson et al, 2011). It provides multiple functions, which are essential to human well – being. It is also the basis for human activities and infrastructure, food and biomass production as well as a medium for storage, filtration and transformation of organic and mineral substances. As the process of soil formation is slow, soil has to be considered as a non – renewable resource. Thus, its protection is crucial in order to guarantee its ecosystem services in the future (Jones et al 2012). Though soil is a non – renewable resource which has the capacity to meet the required output, agricultural productivity and sustenance of food security, it is under threat of continuous human exploitation and other natural phenomena, of which soil erosion is one of them.

Soil erosion is recognized as one of the world’s most serious environmental problems which has sculpted the landscapes. It depletes the productive capacity of land as it removes nutrients, organic matter and clay from soil, which are most important for plant growth. Soil erosion describe the process of detachment, entrainment, transport and deposition of soil particles either produced by water, wind, disturbance and translocation, landslides and flood. Jing, Wand and Zheng (2005) were of the opinion that soil erosion is a serious environmental, economic and social problem. It does not only cause land degradation and soil productivity loss, but also threatens the stability and health of the society in general. Shougang and Ruishe (2014) opined that soil erosion is a serious environmental problem threatening the agricultural sector. It degrades the soil that humans depend upon for food, fuel, clean water and for shelter. Quinton (2014) noted that soil erosion is a natural process of soil removal through the agent of denudation, such as running water, wind, gravity and human disturbance.

Since soil plays a very important role in human development, there is need for its protection against threat from soil erosion so that it can be sustained. The World Conference on Environment and Development (WCED) (1987) highlights that sustainable development is “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainability to soil erosion is very important and will aid in reducing the adverse effects of the phenomenon of soil erosion in the south – east geopolitical zone of Nigeria as well as the socio – economic conditions of the affected people. Sequel to it, this study is set to review Sustainability to soil erosion with a view to making recommendations that will aid soil erosion management. Thus, a comprehensive review of the causes, effect and processes of soil erosion in the south – east geopolitical zone of Nigeria is expounded in this study and why it is also necessary to sustain it against soil erosion.

Soil Erosion in the South – East Geopolitical Zone of Nigeria

Soil erosion is one of the prominent environmental hazards ravaging the land surface of the south – east geopolitical zone of Nigeria. According to Akpokodie et al (2010), this hazard is not new and effort aimed at checking it dates back to 1929 with the establishment of Udi forest reserve. Idowu and Oluwatosin (2008) were of the opinion that in the study area, the soil possesses high soil erodibility and are said to be structurally unstable. The researchers further noted that the physical, socio-economic and anthropogenic factors are believed to have aggravated high erodibility of the soil in the study area. Oguike and Mbagwu (2009) highlight that soil in the south – east geopolitical zone of Nigeria is naturally prone to soil erosion due to their fragile nature and ease of leaching being mainly ultisols and alfisols. Nwachukwu and Onwuka (2011) stated that soil erosion in the study area is mostly attributed



to bush burning, continuous cultivation and mining, all of which are common practices observed in the south – east geopolitical zone of Nigeria. Junge et al (2008), Lai (2001) and Eswaram et al (2001) opined that the massive soil loss in the south – east geopolitical zone of Nigeria often result in ecological damage, soil infertility, loss of soil structure, reduction of soil biodiversity, soil compaction, decline in agricultural productivity, poverty, food insecurity and social disorder. George et al (2008), Osadebe and Akpokodje (2007) stated that the south – east geopolitical zone of Nigeria is susceptible to soil erosion due to the nature of the soil, topography and geology. Chiemelu et al (2013) stated that the type of erosion that is predominant in the study area is gully. Igbokwe et al (2003) and Egboka (2004) observed that the magnitude of gullies in the study area is indeed great. Their studies showed that about 700 gully sites exist in Anambra state, 300 in Abia, 250 in Ebonyi, 600 in Enugu and a total of 450 in Imo State. Table 1 shows the distribution of these gullies within the study area.

Table 1: Distribution of Gullies Erosion Sites in South – Eastern Part of Nigeria

States	Number of Gully Sites	%	Condition	Control measure
Anambra	700	30.43	Mostly active	Not successful
Abia	300	13.04	Some active/some dormant	Not successful
Ebonyi	250	10.86	Mostly minor gully sites	No records
Enugu	600	26.08	Some active/some dormant	None
Imo	450	19.56	Some active/some dormant	Not successful
Total/Ave	2300	100		

Source: Igbokwe et al 2003, 2008; Egboka, 2010

Description of the Study Area

The area under study is the south – east geopolitical zone of Nigeria. This zone comprises of five states, namely: Abia, Anambra, Ebonyi, Enugu and Imo states, which are regarded as the Igbo land (Anejionu et al 2013). The area covers about 29095km² which is about 3.19% of the total area of Nigeria. The area is found within longitudes 5⁰30' and 9⁰30'E and latitudes 4⁰30' and 7⁰00'N and bordered by the Cross-River State to the east, Akwa Ibom to the south, Edo and Delta States to the west and Kogi and Benue States to the north. The zone has a tropical climate. Dry season occurs between November and March, rainy season begins in April and ends in October and there is a hazy harmattan in December. The mean minimum and maximum temperatures within the study area ranged from 21 – 30⁰C in the coast and 29 – 33⁰C in the interior or inlands (Chukwu, 2007). Within the study area, the vegetation stretches from the mangrove swamp in the coast through to the derived savanna in the interior, but the area is found in the lowland rainforest natural vegetation belt with evergreen trees in the south.

Geology of the Study Area

The study area consists mainly of heterogeneous materials of which include the basement complex, beach sands, coastal plain sands, mangrove swamp deposits, sandstones, shale, sombrero Warri deltaic deposits, recent and sub – recent alluvium (FDLAR, 1990). Egede (2013) was of the opinion that the soil of the south – eastern part of Nigeria is heterogeneous

in nature, made of loose red – earth with sands, sandstones, clayey – loam with or without ferric properties underlain by shale formation. Ogbonna et al (2011) highlights that soil in the south – eastern part of Nigeria is categorized into the following classes: Eutric fluviols, hystic fluvisols, dystric fluvisols, rhodic ferrosols, lithosols, dystric gleysols, eutric gleysols, eutric nitosols, dystric cambisols and gleyic cambisols. Ufot et al (2016) further stressed that the south – eastern soils are low in organic matter content and water storage capacity with high susceptibility to promote erosion activities.

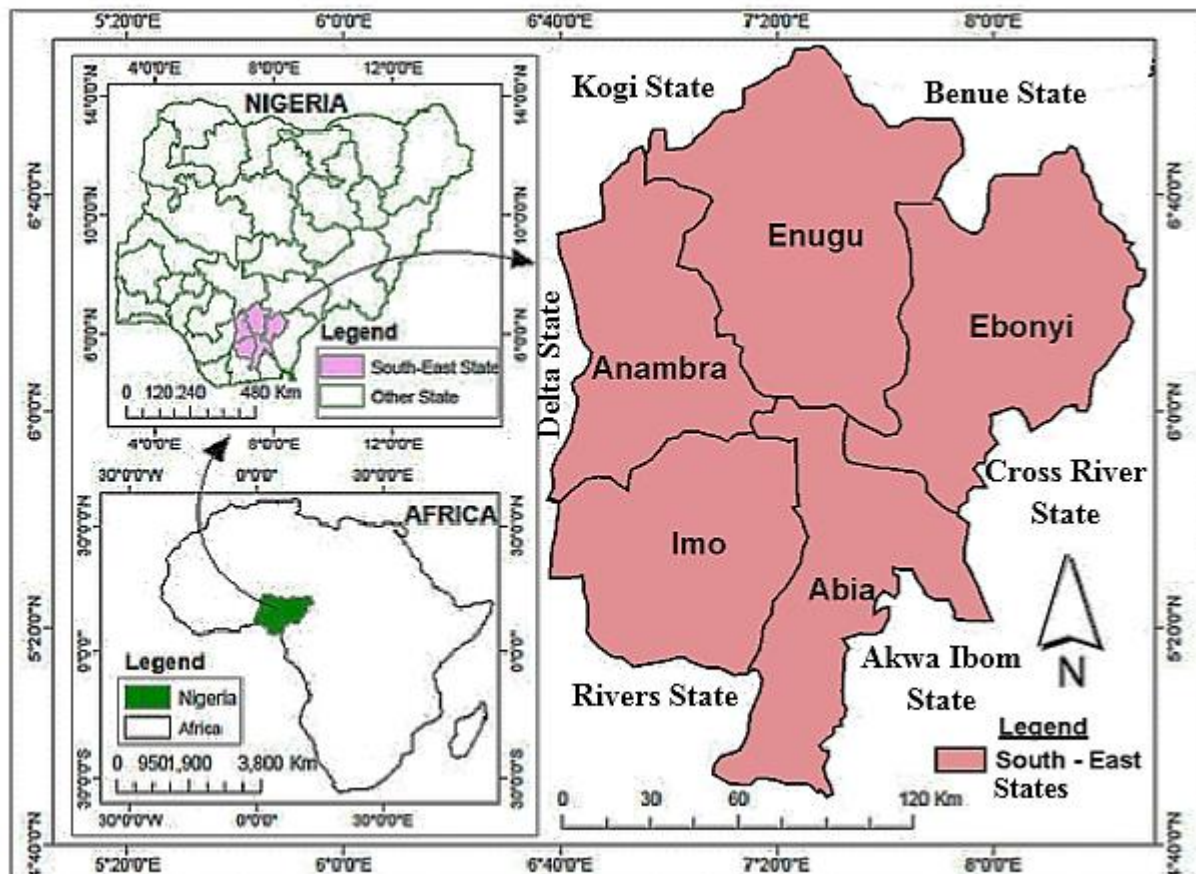


Figure 1: The Study area (Author, 2019).

The Causes of Soil Erosion Within the Study Area

From field observation and reports have shown that erosion within the south – eastern part of Nigeria is influenced due to the following:

Climatic Factors:

Federal department of land resources (FDLAR) (1990) was of the opinion that soil erosion is mainly triggered by heavy rainfall. According to Igwe (2012), the southern and south – eastern parts of Nigeria often experience heavy rainfall which promotes soil erosion. Egbai et al (2012), stated that lack of vegetation cover exposes the soil to high intensity rainfall, resulting to poor structure and increases the rate of run – off, which detaches the soil particles



and causes soil erosion. Egede (2013), Ezeabasili et al (2014) and Abdulfatai et al (2014) observed and reported that soil erosion within the south – eastern part of Nigeria is increased during the rainy season. Salako (2006) also expressed that land degradation in many tropical regions occur, due to high rainfall erosivity and poor soil conservation practices during the rainy season.

Soil Nature and Topography of the Study Area:

George et al (2008) and Osadebe and Akpokodje (2007) were of the opinion that the south – eastern part of Nigeria is susceptible to soil erosion due to the nature of the soil, the topography and the geology. Soil erosion and gullies in the study area are directly related to the underlying geology and severity of surface processes occurring in the surface geology and soil cover. Observations have shown that the nature of the soils in the study area is red – earth with sandstones, loose surface that is easily prone to damages, erosion and flooding (Egede, 2013). Ezezika and Adetona (2011) were also of the view that the Imo and Anambra basin is predominated by the Awka Orlu cuesta which is an area susceptible to ground surface cracks, landslides, mass movement and tectonic movements during the rainy season that results to all kind of land degradation and soil erosion predominantly.

Human Factors:

Egede (2013) noted that the soil within the study area is subjected to intensive pressure from human uses, which induces degradation, soil loss and erosion. Such human factors include overgrazing, excessive farming activities and tillage, clearing and burning of bushes, extractive industries, road construction, over – population, lumbering activities, residential buildings, development of urban centres, industrialization, fumigation with pesticides and mining. Ibitoye and Adegboyega (2012) were of the opinion that human activities such as haphazard erection of buildings on steep terrains and ineffective drainage projects often promote concentration of run – offs and gullies. Within the study area, human interference with the environment through continuous mining activities and other anthropogenic activities often result in the removal of vegetative cover, thus promoting soil erosion.

Effects of Soil Erosion:

The effects of soil erosion in our environment cannot be overemphasized. Apart from influencing agricultural land, and thus resulting in food scarcity, soil erosion promotes air pollution, water pollution and landslides which affect the land in which we live (Salako, 2006). As sediments are being transported, they end up in streams, rivers, lakes and oceans, thereby making the water un-suitable for consumption. Soil erosion also influences the air we breathe. Abdulfatai et al (2014) stated that soil erosion is a major problem in the south – eastern part of Nigeria. The researchers summarized the effect of soil erosion as follows:

- i. Reduction of agricultural productivity and removal of plant nutrients due to erosion.
- ii. Destruction of soil structure and biota meant to support plant root.
- iii. Depletion of soil quantities due to large volumes of surface run-off as a result of heavy rainfalls.



- iv. Deposition of debris and contamination of aquatic ecosystem through direct run – off from farmland.
- v. Siltation and sedimentation of water reservoirs, thereby limiting the life expectancy of dams which may lead to eventual failure.
- vi. Destruction of life and property.
- vii. Loss of vegetation and soil cover, and thereby exposing the soil to further environmental devastation.
- viii. Reduction of lands available for siting residential buildings, industries and other structures.

Sustainable Practices to Limit Soil Erosion in the South – Eastern Part of Nigeria

Soil is very important to both plants and animals (Salako,2006). This is so said, because it is a medium from which we obtain our food, built our houses and raise livestock. Since soil is very important to us, it therefore becomes necessary that we sustain and protect it from the threat of erosion. Sustainability measures to stem soil erosion in the South – Eastern part of Nigeria are most effective when erosion is still at an early stage (Obidimma and Olorunfemi, 2011). Egede (2013) observed that the suitability of a soil conservation depends on the soil, rainfall (amount and distribution), soil type and depth, water holding capacity, location of impervious layer, agricultural practices, land-use/land cover and economics. Soil erosion suitability and conservation practices in the south – eastern states of Nigeria include techniques such as crop rotation, mulching, liming, contour bonds and terracing. The researchers noted that farmers that practiced crop rotation and mulching had a significant increase in their crop yield and this conservation practice was encouraged for increased production, income for farmers and enhanced food security for the nation. It was also noted that some of the sustainable approaches to reduce the effects of soil erosion in the south – eastern part of Nigeria includes shifting cultivation, ridging across slopes, planting on raised mounds and avoidance of deep ploughing. The researcher's work further revealed that farmers who successfully applied the traditional methods improved upon their output levels per land area and the standards of living of their families.

This study has expounded that sustainability measures that could be used to curb the menace of soil erosion are as follows:

- i. Cultivation of vegetation and grasslands such as carpet grass (*Axonopus Compressus*), Bahama grass (*Cynodon Dactylon*) and trees such as oil palm (*elais guinensis*) and other shed growing trees to serve as vegetation cover so as to reduce kinetic energy of raindrops, intercept run – off and induce infiltration on bare soils. According to Jones et al (2012), soil in Imo State requires intensive re – vegetation and afforestation so as to reduce the tendencies for soil erosion.
- ii. Practice of proper soil and water conservation methods should be adopted so as to further prevent the occurrence of soil erosion. Such practices include, the use of terraces on steep sloped farmlands to limit soil movement along slopes, creation of proper drainage channels, which promotes large run – off, slope stabilization and protection with the aid of wire – meshes, rip – rap, wood – chips, gabions.



- iii. Proper crop management should be encouraged. This practice involves the use of undulating farmlands, crop rotation technique which aid soil cover on farmlands, manuring and use of organic fertilizers to sustain nutrient levels of soil, use of mulches to encourage decomposition and organic matter content replenishment and proper tillage practices so as to sustain soil quality.
- iv. In – appropriate cropping techniques such as bush burning, over – grazing, continuous cropping, over – cropping and deforestation should be avoided, so as to minimize soil compaction and dryness.
- v. Human activities such as bush burning, clean weeding and deforestation should be discourage, as these acts expose the soil to un – controlled climatic influence which promotes land degradation and soil erosion.
- vi. Relevant authorities should intervene by repairing existing erosion sites, establishing soil erosion research centres, provision of proper climatic data especially rainfall characteristics and support of forest regeneration for erosion control and management.

CONCLUSION AND RECOMMENDATION

The study shows that the south – east geopolitical zone of Nigeria suffers from the havocs of soil erosion, which are caused by both natural and anthropogenic sources. Soil erosion reduces soil quality and diminishes the productivity of natural, agricultural and the forest ecosystem. These impacts affect the soil in our environment and thus, the way we enjoy our available resources. For the continuing enjoyment of available resources, there is need to adopt measures required to sustain the soil from the menace of soil erosion. If there is commitment to attain population stabilization and resources conservation, the world would be better to meet the challenges of sustainable development. Adopting sustainable development requires adopting improved farming techniques, cultural method of soil erosion control and enactment of laws against any activities which will promote erosion growth. The government at all levels in the south – eastern part of Nigeria and the stakeholders in environmental management such as State Ministry of Environment and the Federal Ministry of Education should also sensitized Nigerians on the causes, impacts and problems of soil erosion. Seminars and conferences should be organized locally and internationally to showcase the importance of sustaining our soil against soil erosion so as to avoid its continuous challenges and threat.

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