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A Review of the menace of soil erosion in Nigeria with specific reference to Southeastern States

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Abstract

Erosion is recognized as one of the world's most serious environmental problems. In Nigeria, most especially the southeastern part, agricultural productivity, sustainability, and management for food security/sustenance have been undermined by the menace posed by soil erosion. This in itself entails the danger of soil exhaustion, of which accelerated erosion is often only a symptom in Nigeria. Soil erosion by, definition, is a systematic removal of soil, including plant nutrients, from the land surface by the various agents of denudation which occurs in several parts of Nigeria under different geological, climatic, and soil conditions. The degree of occurrence varies considerably from one part of the country to the other. Equally varied are the factors responsible for the inception and development of erosion, as well as the types that exist in several parts of the country. Through a productive review of existing research and field observations, this paper presents a comprehensive review of soil erosion in Nigeria regarding the Southeastern region as well as control measures aimed at reducing and mitigating the threats posed by soil erosion within the region. From these studies, the major causes of soil erosion across Nigeria are mainly human activities, climatic factors (rainfall), inherent geology, undulating topography, and soil nature while control measures such as provision of vegetative cover, proper soil and water conservation practices, use of adequate crop management techniques, community-based campaigns and enactment of laws with strict penalties against any activities that favour soil erosion have been widely suggested. Also, the Federal Government of Nigeria in collaboration with the World Bank have intervened by the establishment of the program NEWMAP (Nigeria Erosion and Watershed Management Project) whose primary objective is to reduce vulnerability to soil erosion in targeted sub-watersheds with a portfolio of US $508 million-plus additional financing of $400 million.

Keywords: Soil; Soil erosion; Environmental problems; Southeastern Nigeria.

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1.0. Introduction

Globally, about 80% of the current degradation of agricultural land is caused by soil erosion (Angima et al., 2003). This in itself entails the danger of soil exhaustion, of which accelerated erosion is often only a symptom because it seriously threatens natural resources and the environment (Rahman *et al*., 2009). Therefore, according to Ofomata (2009), soil erosion is simply a systematic removal of soil, including plant nutrients, from the land surface by the various agents of denudation which occurs in several parts of Nigeria under different geological, climatic, and soil conditions. Soil erosion can also be regarded as merely a geomorphological process, whereby the surface layer of weathering rock is loosened and carried away by wind or running water and the lower horizon of the soil is exposed. The availability of farmlands for agricultural production and construction activities has been greatly reduced by losses caused by the attendant issues of soil erosion (Okorafor *et al*., 2017). Besides, agricultural productivity, sustainability, and management for food security/sustenance in Nigeria, most especially the southeastern part, have been greatly limited by the menace posed by soil erosion.

In Nigeria, the impact of soil erosion when formed expand rapidly coupled with exceptional storm or torrential rain down the stream by head-ward erosion gulping up arable lands, economic trees, homes, lives, and sacking of families and valuable properties that are worth millions of naira (Umudu, 2008). Soil erosion is an ecological issue that is of great concern in the southeastern region of Nigeria in general and the Anambra, Enugu, Abia, Imo, and the Akwa Ibom States in particular. Anambra is famous for its Agulu-Nanka-Oko-Ekwulobia gullies (Obi and Okekeogbu, 2017) and gullies of about 120m depth and 2km width have been recorded in this area. Active gully erosion sites across the country are put at 2000 sites (Jaiyebo, 2002).

Seasonally, figures put active erosion sites in Imo and Anambra States to be about 1.9 percent of landmass. In these areas, soil erosion is due mainly to the action of flood or running waters (Nwafor, J.C., 2006).In other words, gully erosion is the most peculiar type of soil erosion that exists in Anambra State. Almost all communities in the State are affected by one form of erosion or the other. According to recent media reports, over 70 percent of the land of the state is ravaged by or threatened by erosion at various levels (Oranye, 2013). Available statistics indicate the presence of about 500 gully erosion sites spread across the rural communities. Notable among them are Aguata/Orumba L.G.A's with about 78 gullies, Nnewi with 60, Njikoka/Aniocha with 50 gullies, Idemili with 46, Ihiala with 40, Awka with 30, Onitsha with 22, Anambra/Oyi with 16 gullies. While these communities are under the threat of erosion menace, some notable erosion sites as noted in this study are however in the process of being controlled by the State government. They include erosion sites at Nimo, erosion sites at Umuchiana-Ekwulobia, Nnewi-Okigwe highway, Omagba, Inyaba Umudim Nnewi, Mbanabo-Nnewi-Ichi Nnewi, Utuh/ Osumenyi, Umuchu-Uga-Igboukwu highway, Umueze-Uga, Nawfijah, Obieze, Ifite-Dunu, and Ndiagu-Ogidi erosion sites. The Nanka erosion site is so terrifying that it has been declared a national disaster. The yearly heavy rainfall has very adverse impacts altering existing landscape and forms. Such landforms create deep gullies that cut into the soil. The gullies spread and grow until most of the soil is removed from the sloping ground.

Despite these and similar studies, it could easily be said that erosion remained a localized problem that gained attention on an isolated and ad-hoc basis from the affected communities and the relevant Ministries of Agriculture. However, since the middle 1970s, soil erosion has continued to attract wider attention than before and has formed a topic for spirited speeches by former legislators, government functionaries, and private individuals (Ofomata, 1985). The situation is that there is now some degree of general awareness of the problems of soil erosion in the country and fortunately some measures are being taken to combat these problems. However, it would appear that despite some of these otherwise well-meaning attempts, our management strategy for these projects remains faulty (Ofomata, 1985).

This paper presents a comprehensive review of the soil erosion menace in Nigeria with particular reference to the Southeastern region as well as control measures that aim at reducing and mitigating the threats posed by soil erosion within the region. The study also seeks to explore the possibility of using the operational mechanisms or existing control measures based on different studies to combat this environmental problem that is more prevalent in one part of the country than in the other.

2.0. Soil Erosion in Southeastern Nigeria

In Nigeria, desertification and aridity are the major environmental problems of the Northern part of the country while the high torrential rainfall of southern Nigeria creates an enabling environment for catastrophic soil erosion in the region. The situation of soil erosion is particularly pronounced and ecologically viable in areas of southeastern Nigeria where population densities and least land per capita ranks among the highest in rural Africa, (Onu, 2006; Eboh and Lemchi, 1994). The menace of soil erosion, especially gully, no doubt represents a major ecological challenge facing most states in Nigeria especially Anambra, Imo, Ebonyi, Abia, and other states in the humid tropical regions (Ume *et al*., 2014) and this is as a result of Soils of southeastern Nigeria having high soil erodibility which are classified as structurally unstable, (Idowu and Oluwatosin, 2008). Also, the soils are naturally prone to erosion due to their fragile nature and ease of being leached being mainly ultisols and alfisols and that is the reason gully erosion is prevalent in this southeastern zone (Oguike and Mbagwu, 2009). Both physical, socioeconomic, and anthropogenic factors, as well as deficient agricultural production practices, are believed to have aggravated the high erodibility of the soils in the region. Chiemelu *et al*., (2013). It is also believed that gully erosion is most predominant in the region and is considered an environmental degradation with a lot of disastrous consequences caused mainly by floods as a result of high precipitation, which is the fallout of climate change. The development of gullies causes the loss of a great number of soil materials and can be considered as one of the principal causes of geo-environmental degradation in Southeastern Nigeria.

Researches previously conducted in Imo, Abia, and the Anambra States show that gully incidences generate between 4.2 and 10cm^3/ha/year of sediments, which constitute about 45–90 % of total sediment production on agricultural lands (Ogbonna and Ijioma, 2010). Erosion predominates in areas that have been subjected to bush burning, continuous cultivation, and mining on hillside slopes, all of which are common and long-term traditional practices in southeastern Nigeria, (Nwachukwu and Onwuka, 2011). Asiabaka and Boers, (1988) had estimated over 1970 gully sites in Imo and Abia states and a conservative assessment shows the distribution of known gully sites in different stages of development which are as follows; Abia (300), Anambra (700), Ebonyi (250), Enugu (600) and Imo (400), (Igbokwe *et al*., 2003; Egboka, 2004). The statistics are not exhaustive enough as new sites are developing during each rainy season due to flooding and torrential rainfall. Of all the states in the southeastern region, Anambra has the highest concentration of active gully sites; in fact, every community in the state has tales of woes as a result of expanding gullies, (Igbokwe *et al*., 2008). The massive soil loss in Southeastern Nigeria results in severe ecological damages, soil fertility depletion, loss of soil structure, reduction of soil biodiversity, soil compaction, the decline in agricultural productivity, low farm income, poverty, food insecurity, and social disorder (Junge, *et.al*., 2008; Lal, 2001; Eswaram, *et al*., 2001).

There are three geo-political zones in Imo State namely *Orlu*, *Owerri,* and *Okigwe* zones respectively. Out of all the zones, the *Orlu* zone has the highest number of active gully erosion sites. The major erosion sites in Imo State are all situated in the *Orlu* zone and this is a result of anthropogenic interference by human activities, the geological formation of the soil, and the variation in slope/ topography of the zone. According to Ume *et al*.,(2014), the average depth of gullies existing in *Ideato* North and South L.G.As ranges between 15-35 m, with a cross-sectional area of about 80metres in some places and covering a distance of about 3 km. According to Ogbonna, (2012), the erosion rate in the *Orlu* zone between 1984-2008 has progressed from 6.58 km^2 to 31.07 km^2 and it is projected to reach 34.07 km^2 by 2018. Abia State is equally not left out from the menace of soil erosion as cata-

strophic gullies occur at *Amucha*, *Isuikwuato*, *Ohafia*, *Abriba,* and *Arochukwu* Local Government Areas respectively resulting in the dissection of major roads and loss of productive lands meant for agriculture. Food security and agricultural productivity within southeastern Nigeria have been adversely affected due to the prevalent occurrence of

Table 1: Distribution of Erosion sites in Southeastern Nigeria

S/No	States	No. of Gully Sites	Condition	Control Measures
1	Anambra	1000	Mostly active	Not successful
2	Abia	300	Some active/some dormant	Not successful
3	Ebonyi	500	Mostly minor gully sites	No records
4	Enugu	600	Some active/some dormant	None
5	Imo	500	Some active/some dormant	Not successful

(Source: Igbokwe *et al*., 2003; Egboka, 2004)

2.1 Different Soil Erosion Sites in Nigeria

Figure 1: Typical Gully cutting in Nanka, Anambra state (Source: News agency of Nigeria, 2011)

Figure 2: Typical gully site in Agulu, Anambra state (Source: News agency of Nigeria, 2011)

Figure 3: Typical erosion sites in Isukwuato/Iga-Abia, Abia state (Source: News agency of Nigeria, 2011)

Figure 4: Typical erosion sites in Njikoka/Anaocha, Anambra state (Source: News agency of Nigeria, 2011)

Figure 5: Typical erosion sites in Nguzu Ohafia/Edda, Ebonyi state (Source: News agency of Nigeria, 2011)

Figure 6

Figure 6: Typical erosion sites in Iyiuzo, Ogberuru, Ihioma and Orlu, Imo state(Source: News agency of Nigeria, 2011)

Figure 7: Typical erosion sites in Onuiyi-Nsukka, Udi, Enugu state (Source: News agency of Nigeria, 2011)

soil erosion. A conservative report on the distribution of erosion sites in southeastern Nigeria is shown in table 1 below:

2.2 Causes of Soil Erosion in Nigeria

Generally, from field observations, productive works, and reports of other researches carried out within Nigeria, the major causes of soil erosion are summarized as follows;

a. *Human Factors:* Soil/land has been subjected to intensive pressure from human uses which induce degradation, soil loss, and erosion; such human factors include overgrazing, excessive farm activities, tillage, clearing of bushes, extractive industries, road construction, bush burning, over-population, lumbering, residential buildings, development of urban centers, industrialization, fumigation with pesticides, mining (open cast and soil excavation) e.t.c according to Egede (2013). Ibitoye and Adegboyega (2012) also maintained that human activities such as construction works involving haphazard erection of buildings on steep terrains, ineffective or uncompleted drainage projects encouraged the concentration of runoff and gullies. According to Ubuoh *et al*., (2013), Ukpor, in Nnewi-South L.G.A of (Anambra State) has land-use patterns and practices such as arable farming, clean weeding, housing, bush burning, tree felling, sand and stone quarrying which are human-induced and are the major causes of soil erosion and decreased soil quality. In most states within the southeastern region of Nigeria, human interference with the environment through the continuous excavation of borrow-pits and anthropogenic activities resulting in distortion/removal of soil vegetative cover which is pivotal to soil erosion.
b. *Climatic Factors***:** According to FAO, (1990), soil erosion results from the action of heavy rainfall on surface earth materials under reduced or altered vegetative cover. Igwe (2012) emphasized that soil erosion in the southeastern region of the country heightens, elevates, and increases during the rainy season as a result of streams of runoff water generated within this period. Salako (2006) also reported that land degradation in many tropical regions occurs because of high rainfall erosivity and poor soil conservation practices within the rainy season.
c. *Soil Nature and Topography:* The southeastern region of Nigeria is susceptible to gully erosion due to the nature of the soil, topography, and geology (George *et al*., 2008, Osadebe and Akpokodje (2007), Onu (2005) and Teme and Youdeowei (2004). The formation of gullies in the southeast is directly related to the underlying geology and severity of surface processes operating in the surface geology and soil cover (Ezechi and Okagbue, 1989). Observations have also shown that soil erosion in Nigeria is prevalent in sedimentary terrains and this accounts for gully occurrences that are more skewed to southeastern Nigeria where the soil formations are loosely consolidated (Abdulfatai *et al*., 2014). The colour of the soils in the southeast is red earth with sandstones, the loose surface that is easily prone to damages by torrential rainfall and flood (Egede, 2013).

2.3 Impact/Effects of Soil Erosion in Nigeria

The impact of soil erosion in Nigeria is enormous and similar to that obtainable elsewhere in the world and they include:

a. *Effect on Properties***:** By this menace of soil erosion, several soil properties whose value cannot be quantified accurately here have been destroyed and others are under threat especially houses and other properties located on the floodplain (Abdulfatai *et al*., 2014). About 10 houses have been lost in a single event of erosion in the Auchi area of Edo State. Besides, it was reported recently that over 450 buildings are lost in the Edo State of Nigeria as a result of erosion (NTA News, Sunday 6th July 2013). On a separate note, the Senate Committee on Erosion and Ecological funds recently discovered about 15 erosion sites in Bida, Niger State of Nigeria (NTA Minna News, Wednesday 17th July 2013). Apart from untimely evacuation from these erosion sites, infrastructural facilities such as pipelines, utility cables, roads, and houses also suffer from these hazardous events.
b. *Effect on Life:* Many lives have been lost as a result of the problem of soil erosion. Some either fell into these gullies and sustained various degrees of injury or died. Some instances have also been reported where people drowned in some of the gully erosion sites. About 23 people have been reported in the past few years to have lost their lives in a single event of gullying activities in Ibori, Ugbalo, Ewu-Eguare, Idogalo, and Oludide communities of Edo State, Nigeria (Abdulfatai *et al*., 2014). Millions of people have been displaced and have been evacuated from their homes as a result of the gully incidences. According to Abdulfatai *et al*., 2014, the erosion site in the Oko community in Anambra State has created a deep gully and wide crater, threatening to sweep away the homes of about 826 families as this channel is continuously expanding at an alarming rate.
c. *Isolation of Villages and Towns***:** Erosion has resulted in the separation of adjacent villages and towns as it may involve the collapse of bridges linking them together. This has had negative impacts on such areas since some facilities such as schools, hospitals and water supplies shared by the affected neighboring communities may become inaccessible. Transportation of farm produce has also been affected and this also often leads to loss of agricultural products especially the perishable ones. Traders who also go to these areas for their trade are also cut off from their normal day-to-day business.
d. *Loss of Vegetation:* Soil erosion in Nigeria has resulted in a loss of vegetation as its continuous expansion encroaches into areas that are hitherto forest leading to falling of trees and exposure of more surface areas to gully activities (Abdulfatai *et al*., 2014). This phenomenon, if allowed to continue and remains unchecked, may ultimately lead to climatic changes locally or globally.
e. *Loss of Farmland:* A vast area of farmlands has been lost due to the menace of gully erosion while others are at their various stages of destruction leading to a drastic decrease in agricultural productivity and ultimately food shortage that can lead to extreme food insecurity.
f. *Bad Land:* Soil erosion has given rise to the infertile and barren land that may need to be reclaimed. This usually brings untold hardship to the inhabitants of the land is still inhabitable but has been severely affected. According to Abdulfatai *et al*., 2014, Anambra State has lost over 30 percent of its land area, and over 40 percent of the total area of land and homes are being threatened by the menace of soil erosion, according to the Anambra State Ministry of Environment.

3.0. Modeling and Prediction of Erosion Processes

3.1 Mathematical models and predictive equations: Several authors have applied mathematical and predictive models to determine the rate of soil losses and erosion processes (Wischmeier and Smith, 1960; Rouse et., 1973). The Univer-

sal Soil Loss Equation (USLE) is a mathematical model used to describe soil erosion processes in an area(Wischmeier and Smith, 1960; Wischmeier and Smith, 1978).

$$A = RLSKCP \ldots\ldots\ldots\ldots\ldots 1$$

Where: A = average annual soil loss in tons per acre, R = rainfall and runoff erosivity factor, L = slope length factor, S = slope steepness factor, K = soil erodibility factor, C = cover and management factor, and P = supporting and conservation practices factor.

In general, the USLE model estimates soil erosion by raindrop impact and surface runoff.

a. Runoff erosivity (R) index

$$R = \frac{EI30}{100} \ldots\ldots\ldots\ldots\ldots 2$$

R is the rainfall and runoff erosivity index which is given as: EI for a given rainstorm equals the product: total storm energy (E) multiplied by the maximum 30-min intensity (I30), E is the kinetic energy in the rainfall and I30 is in inches per hour. R depends on the amount of raindrop energy and rainfall intensity.

b. Slope length factor: L factor is the slope length factor. Slope length determines the concentration of water. Therefore, the greater the length of the slope of a field the greater the concentration of water and runoff. A Digital Elevation Model data (DEM) if used together with ArcGIS tools, flow direction and flow accumulation of the study area can be computed [30]. The equation used for computing slope length is:

$$\left(DEM > FlowDirection > FlowAccumulation * Cellsize/22.13\right)^{0.4} \ldots\ldots 3$$

c. Slope steepness factor: S factor is the slope steepness factor. This is the steepness of the area of study. As a rule, the greater the slope steepness the more erosion that can be expected. DEM data is also used to compute the S factor in ArcGIS. The equation used to compute the slope steepness is:

$$\left(DEM > Slope > *3.14/180 > \text{Sin } Slope/0.0869\right)^{1.3} \ldots\ldots 4$$

*d. Soil erodibility factor***:** K factor is the soil erodibility factor. This is an estimate of the ability of soils to resist erosion, based on the physical characteristics of each soil. It depends on soil structure, texture, and composition. In this project, the K factor is based on values established in the literature. A high K factor indicates a lower water infiltration rate thus more prone to erosion. K factor was derived from tables provided by Roose [33].

e. Cover and management factor: Cover and management factor (C factor) indicate the influence of cropping systems and management variables on soil erosion. This factor depends on four sub factors: Prior land use, canopy cover, soil surface cover, and surface roughness.

f. Normalized difference vegetation index (NDVI): The normalized difference vegetation index (NDVI) is a simple numerical indicator that can be used to analyze remote sensing measurements, to ascertain whether the target being observed contains live green vegetation or not [31,32]. The NDVI is calculated as follows.

$$NDVI = \frac{P_{nir} - P_{red}}{P_{nir}} + P_{red} \ldots\ldots\ldots 5$$

g. Correlation model: The Pearson Product Moment Correlation model can be used to determine the relationship between soil erosion loss and NDVI value. The correlation model is expressed as follows [30]:

$$Risk = H * V \ldots\ldots\ldots 6$$

H = Hazard, and V = Vulnerability

The soil erosion risk was determined from Equation (6)

h. Multivariate analytic model: Logistic regression is a multivariate analytic model useful for predicting the presence or absence of a characteristic or outcome based on values of a set of predictor variables [34].

Quantitatively, the relationship between the occurrence and its dependency on several variables can be expressed as [13]:

$$P = 1/(1 + e^{-z}) \ldots\ldots\ldots\ldots 7$$

Where p is the probability of an event occurring. The value p is the estimated probability of gully occurrence. The probability varies from 0 to 1 on a sigmoidal (S) curve and z is the linear combination. It follows that logistic regression involves fitting an equation of the following form to the data:

$$Z = b_0 + b_1X_1 + b_2X_2 + \ldots.b_nX_n \ldots\ldots\ldots 8$$

Where: b0 is the intercept of the model, the b1 (i = 0, 1, 2… n) are the slope coefficients of the logistic regression model, and the x1 (i= 0, 1, 2… n) are the independent variables. The linear model formed is then a logistic regression of the presence or absence of gullies [13] on the independent variables.

3.2 Uses for predicting rates of sediment removal and soil loss

Mathematical and predictive models are applied to the following:

- to estimate the amount of soil loss to erosion in tons per acre per year;
- Determine the impact of vegetal cover in the soil erosion process using NDVI;
- Develop erosion vulnerability index for an area;
- Develop a risk index and determine possible affected places; and
- Determine the role of causative factors (slope, distance from drainage, land use, and vegetation) on the frequency of gully occurrences.

3.3 Proposed Control Measures to Soil Erosion in Nigeria

i. Prevention of the processes or mechanisms that result in advanced soil erosion should be of paramount importance to all the stakeholders on environmental management in Nigeria because prevention they say is better than cure. Thus, Control measures to stem incipient gully erosion are most effective when erosion is still at an early stage (Obidimma and Olorunfemi, 2011). According to available literature, organic carbon, chemical properties, textural characteristics and moisture content of the soil have been suggested as the most useful factors to be considered in a detailed survey and control of erosion (Osadebe and Enuvie, 2008). Thus, these factors and others should be carefully examined in the erosion-prone regions of the country in a bid to better design preventive measures. Other methods that could be used to curb the menace of erosion in Nigeria are suggested as follows:

ii.Reduced human activities such as bush clearing, clean weeding, and tree felling/lumbering will initiate deforestation and removal of soil cover and expose the soils to uncontrolled climatic influence that will degenerate into land deg-

radation and soil erosion.

iii.Practice of proper soil and water conservation methods: Depending on the nature of soils and topography of the area, certain soil and water conservation methods should be adopted to prevent further soil erosion occurrences. Such practices include the use of terraces on steeply sloped farmlands to reduce soil movement along slopes, the creation of proper drainage channels to conduct large runoffs to safe outlets, slope stabilization and protection using wire-meshes, rip-rap, wood-chips, gabions e. t. c, use of mulches to reduce root zone evaporation, intercropping with legumes to ensure nitrogen fixation in the soil to maintain soil organic matter content, and other soil conservation practices.

iv.According to Abdulfatai *et al*., 2014, the use of sensitization campaigns through workshops, seminars, agricultural extension workers, and farm co-operative units to elucidate and educate rural farmers on the influence/impact of soil erosion on agricultural productivity and yield as well as simple cultural method(s) which can be of use in reducing the menace soil erosion poses.

v.Cultivation of close-growing vegetation/grasslands such as carpet grass (*Axonopus compressus*), Bahama grass (*Cynodon Dactylon*) e. t. c and trees such as oil palm (*Elias guinensis*), *Gmelina Arborea*, *Acacia Albida,* and other shed growing trees to serve as vegetative cover to reduce the kinetic energy of raindrops, intercept runoff and induce infiltration on bare soils. According to Okorafor *et al*., (2017) soils in Imo State require intensive re-vegetation and afforestation activities to reduce the tendencies of erosion by water and rainfall erosivity.

vi.Bad cropping techniques such as bush burning clean weeding, over-grazing, continuous cropping, over-cropping, and deforestation should be avoided to reduce dryness of the soil, soil compaction, and breakages that will ensure movability and transportability of soil particles by agents of denudation.

vii.Government assistance through repairs of existing erosion sites, the establishment of soil erosion research centers, provision of proper climate data especially rainfall characteristics, and support of forest regeneration can also help reduce and control the effects of soil erosion(Abdulfatai *et al*., 2014). However, the Federal government of Nigeria has been prompted by seeking urgent support from the World Bank to tackle the challenge in seven states on a pilot basis: Abia, Anambra, Cross River, Ebonyi, Edo, Enugu, and the Imo States. The bank responded through the US $500 million IDA-financed Nigeria Erosion and Watershed Management Project (NEWMAP) and has mobilized a strong coalition at national and international levels to tackle and reduce soil erosion but some additional activities are needed to be implemented by both State and Federal Governments of Nigeria.

4.0 Conclusion and Recommendations

Based on the outcome of other findings and that of the literature review, it can be concluded that there is, therefore, a need for continuous research on the problems associated with soil erosion resulting from human and climatic factors such as the poor nature of the soils, topography, and geology of the area and equally the action of heavy rainfall on surface earth materials under reduced or altered vegetative cover. From the available literature, it appears that the problems of soil erosion in Nigeria are readily increasing. This means that if the erosion problems do not receive adequate attention, it is likely that the soil erosion menace in Nigeria would continue for generations to come.

It is therefore recommended that government at all levels in Nigeria should take it as matter of urgency to urgent issues relating to erosion by the enactment of strong regulations to tackle the numerous land degradation issues in Nigeria. The government, at all levels, is encouraged to put in place such programs as NEWMAP to cover other geo-political zones in the country where the menace of soil erosion has begun to rear its ugly head. By this action, the loss of lives and property would be avoided.

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