

# Threats and Mitigation of Soil Erosion and Land Degradation in South East Nigeria

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## ABSTRACT

The study of land degradation and soil erosion in the south east constitutes one of the difficult phenomenon that have confounded the entire society including intellectuals as the efforts directed at different attempts have not been very successful. Several studies carried out on this problem of land aimed at highlighting causes, implications and remedies have created a wide gap that this study has to fill by proffering causes and solutions through the intensive investigations. The problems are the land devastations that caused citizens of the area to abandon their living abodes, farmlands, social and economic activities especially in earning a living through marketing of their products. This study relied survey and data was from extant literature especially the scientific approaches by world organizations and individual contribution, for findings and decisions reached. The findings were the reduction of land degradation through human intervention and a recommendation that early warning signs be installed at erosion areas.

**Keywords:** Threats, Mitigation, Degradation, Erosion

## Introduction

The threats and subsequent destruction of land by soil erosion and land degradation has been the subject for intensive debate in the literature (scherr, and Satya 1997, and Brabant, 1996). Over the years the destructive process has continued with increased intensity, quantum and rate, such that its devastating effects had subjected the communities to high risks of loss of lives, properties and the natural land that supports their livelihood including extreme difficulties in marketing their products. The land in south East Nigeria has been considered as low lying nature that exposes the surface areas to flooding, coastal and sheet erosion, thus, resulting to the removal of the affected soil (Urama, 2005). This paper examines the extent of threats and mitigation of soil erosion and land degradation in south east Nigeria that may have affected the market potentials of the area in the marketing of their products.

## Statement of Problem

The physical damages to land and soil through land degradation in the South East portend the greatest threats to the lives and properties of the citizens that living a normal life is seen as a war to survive natural land disasters. The exposure of the citizens to unpredictable land disaster and the consequent crises of not cropping with the effect of going without food, sudden evacuation and relocation of inhabitants of the areas especially in planning the marketing of products among others have remained highly disturbing, that prompted the urgent need to investigate these situations empirically.

## Objectives of the Study

The objectives of this study are to determine:

- (i) The causes of land degradation and soil erosion especially between human and natural factors. The human factors of perennial land use, over cropping, earth excavation for use of soil for building are some phenomenon for investigation.
- (ii) The implications of the devastating earth destruction that may impede farming and other social activities is also compelling for empirical investigation.
- (iii) The remediate measures are important to reduce the devastating effects of this menacing problem that has continued to threaten human lives and properties in the affected areas.

## LITERATURE REVIEW

This study is supported with literature on land degradation and soil erosion as presented.

### Perspectives on Land Degradation and Soil Erosion

Land degradation has been severally defined from different perspectives of wearing away of the surface soil, rendering the soil Ineffective for productivity especially in agriculture, the reduction of the natural constituents

of soil structure and the destruction of various components of soil through natural and man made activities. The submissions of Scherr and satya (1997:1), Ball, Campbell, Douglas, Henshall and O'Sullivan (1997, 2000) and Young, Crawford and Rappol (2001) consider land degradation as including depletion of soil nutrients, salinization, agrochemical pollution, soil erosion, vegetable degradation from overgrazing, quality changes relevant to crop production, and the cutting of forests for farm land. These cause decline in productive capacity of land and reducing potential yields. The process that disturbs the essential functions of the soil that prevents it from providing for the requirement of human life could be considered as land degradation, (Brabant et al., 1996)

The following definitions further show that land degradation is always caused by human and natural activities that adversely impact on land with the resultant effects of weakening the soil contents. The United nations Convention to Combat Desertification (UNCCD, (1994) considers land degradation as a reduction or loss of the biological or economic productivity and complexity of rain fed cropland, irrigations cropland or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes including processes, arising from human activities and habitation patterns such as, soil erosion caused by wind/or water; deterioration of the physical, chemical, and biological or economic properties of soil and long term loss of natural vegetation, (Internal FAO(Zero Draft) 2006).

In another definition, Global Environmental Fund (GEF), (2003) explained land degradation to be any form of deterioration of the natural potential of land that affects ecosystems integrity either in terms of reducing sustainable ecological productivity or in terms of reducing its sustainable, resilience. In its definition, Land Degradation Assessment in Dry land (LADA), (2005) considered it as the reduction in the capacity of the land to perform ecosystems functions and services (including those of agro ecosystems and urban systems) that support society and development, (Internal FAO(Zero Draft) 2006).

### **Nature of Soil and Land Degradation in South East Nigeria**

The nature of soil in the south east is the red earth with sand stones loose surface that is easily prone to damages by torrential rain and flood. The Anambra/Imo river basin has been described as undulating and underlain by the Imo Clay Shale of the Tertiary period, (Asadu, Okorji and Onah, 1997:4). The residuum of this shale formation is the present material of the soils. The ground surface elevation ranges from E 1.48m in the north to E 1. 25m in the south, and these soils are significantly homogenous (Urama (2005:4). There are indications that most soils of the south east area are the red sand clay loam soils with or without ferric proprieties (Feric/ Chronic Luvisols, Feric/ Humic Alisoils, Feric Lixi soils, Haplic Acrisols and Eatic Plinthosols), (Igue 2000:2)

The soil in the South East constitutes sandy stones loose surface that makes it vulnerable to attacks by floods and in some areas the steep slopes reinforces the rapid flow of rain water to wash away the soil including the vegetation and other nutrients. FAO (2006) records showed that soils in Africa (Acrisols, Ferral Sols) are generally shallow, acidic and carbon poor when compared with the types in Europe (Luvisols, cambisols, chernozems). Decomposition of biomass is a rapid process in consistently warm temperatures, leaving little time for accumulation of humus. As a result, extensive layers of deep top soil are rare in Africa. The soil structure has been a major factor in the use of land in the south east and any threat to such structure renders the land unproductive and vulnerable to destruction by receding forests. The soil structure is the spatial heterogeneity of the different components or properties of soil, (Dexter 1988). In this regard, Binie, Denis, Dunn, Edwards, Horne, Hill, Hume, Paterson, Langnan and Wynn (2002) suggest that if all the heterogeneous particles of different soil structure are independent particles, then most soils resources can not be used for crop growth and agriculture. Thus, soil structure should be such that some elements of homogeneity and good mixture must exist to support better cropping and sustainability of land.

### **Threats and Impact of Soil and Land Degradation**

The causes of threats to land can not be isolated from the natural and human activities. Land has been subjected to intensive pressure from human uses that induce degradation. The human factors may 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, agricultural activities, mining (open cast and soil excavation, has left deep gulley at various locations). This includes mining of lime stone, quarry sites, coal and other illegal mining of minerals. There is also the borrowed pits for road construction works that are left open and untreated, the exploration for firewood and bad management of forests including pollution of land and natural habitat with chemicals.

The natural factors in land degradation could include wind and water soil erosion, torrential rainfall, floods, land slides, earth quakes, desertification, drought, acid rain, acid and salt accumulation, retreating forests, and sand dunes accumulation as well as pests' attacks that decimates the forests trees. The use of irrigation as potential source of agricultural farming and water supply could have negative effects with improper management. This may result in increased erosion, pollution of surface water and ground water from agricultural biocides, deterioration of water quantity, increased nutrient levels in the irrigational drainage water resulting in algal blooms, proliferation of aquatic weeds, and entrophication in irrigation canals and downstream water ways, (FAO,1997; Urama, 2003).

The danger in the physical damages to soil that rages from structural degradation to actual loss of the soil through various processes, has continued to attract the interests of environmentalist. This may agitate their minds on the consequences in the quality changes relevant to crop production arising from land degradation, (Dexter 1988, Ball, Campbell, Dougls, Henshall, and O'sullivan, 1997, Binie, Denis, Dunn, Edwards, Horne, Hill, Hume, Paterson, Langnan and Wynn, (2002) In the south east of Nigeria, the lands are highly susceptible to three common land degradation including physical, chemical and biological.

The physical involves removal of surface layers of soil though water erosion, destabilization of the aggregate structure in the surface soil that may give rise to cervices, land slides, deforestation through mass movement of sandy soil, cracks in the earth crusts that encourages run off water thereby widening the gulley that can result to deep land sliders. The rotation of farm land at an average of two years leaves the bush without due fallowing process and sufficient length of time. The continuous cultivation of land can be very devastating as most lands do not grow trees but shrubs. The increase in bush burning has been a remarkable threat to land that homes are even ravaged and devastated.

The chemical sources of land degradation could be highly attributable to lack of good land management and natural effects of loss of plant nutrients and acid attacks. In Anambra area, the land for cropping is over 60 percent but the practices had left it in wastes, devoid of soil improvement, lack of soil maintenance with little or no manure, soil productivity decreases, (Igue, 2000:2) As Brabant, Darracq, Egue and Simoneaux (1996) put it, when the land is cropped continuously productivity declines fast. The biological form of degradation has to do with the decrease in the organic content of the soil.

### **Impact of Land Degradation and Soil Erosion**

The immediate impact of land degradation is the abandonment by members of the communities, forcing automatic or emergency migration on the people or their means of livelihood. The consequences of land degradation can hardly be fully quantified considering the deposits of debris in rivers, water paths, fertile lands over taken by sand deposits or sand dunes or eroded soil, and pollution of water from used agrochemical materials. It has been estimated that over 38 percent of 1.5 billion hectares of cropland worldwide is degraded fully or partially, with Africa and Asia having the highest portion of agriculture and forest land. Thus, soil erosion creates one of the greatest problems in south East Nigeria, (Scherr and Satya,(1997).

The following table I shows the impact of land Degradation in sub Saharan Africa.

**Table 1: Process of land Degradation**

Process of land Degradation	Extent and indicative Measurements
Water Erosion	Affects 46% of total land area. Estimated losses of soil on agricultural land of 7 tons/hectre/year (Lesotho); 72 t/ha/yr (Kenya); 3-35t /ha/yr (Burkinafaso); 14-221t/ha/yr (Nigeria); (De graff, soil conservation and sustainable land use: an economic approach 1993).
Wind Erosion	Affects 38% of total land area
Decline in soil fertility Nutrient loss	Affects 16% of total land area Average annual loss of 23kg / ha (1983 – 1990) increasing to 48 kg/ha (2000)
Deforestation salinization of irrigated land water log of irrigated land	3.7 million ha/yr (0.7% Kenya (30% of irrigated areas) Namibia (17%). Nigeria (3 4 %). Sudan (27%); Tanzamia (27%) Dr congo (20%) Manitamia (50%) and gambia (10%).

**Source:** FAO (2006) Assessment of Land Use Pressure State and Response in Sub – Saharan Africa. Internal FAO (zero Draft) SIP Activity May 2006 (PDF-B- Activity 1-1WIP V8.doc)

The impact of land degradation can hardly be quantified satisfactorily when it is put into loss of live, financial drains and total losses, social and economic in poverty induced consequences, ecological and ecosystem implications and investment deprivations.

### Mitigation.

There is no replacement of any life lost in the occurrence of land slides, floods and other forms of land degradation incidents. The mitigation could merely be considered as palliatives. Considering the nature of soil in the south East, curtailment of cultivation of vegetation to curb soil erosion is a reasonable venture to be encouraged, including an average of 4 – 5 years for rotational cropping and faming on any land as well as avoidance of overgrazing

**Terracing, Contour Bunds and Rides:** These are agricultural practices carried out on sloppy ground to reduce erosion. The essence of this form of farm cultivation is to protect the land, avoid soil erosion as water is easily absorbed by the soil, while some could furrow at the end of the slope. Barrier could also be erected to wedge gullies that may have been formed, as well as reduce the speed of running water that may wash off the surface soil on its route. The construction of channels, increasing the organic matter in the soil, planting of trees, avoidance of bush burring, use of manure to increase the humus content of the soil are all necessary to reduce land degradation and soil erosion.

### Models

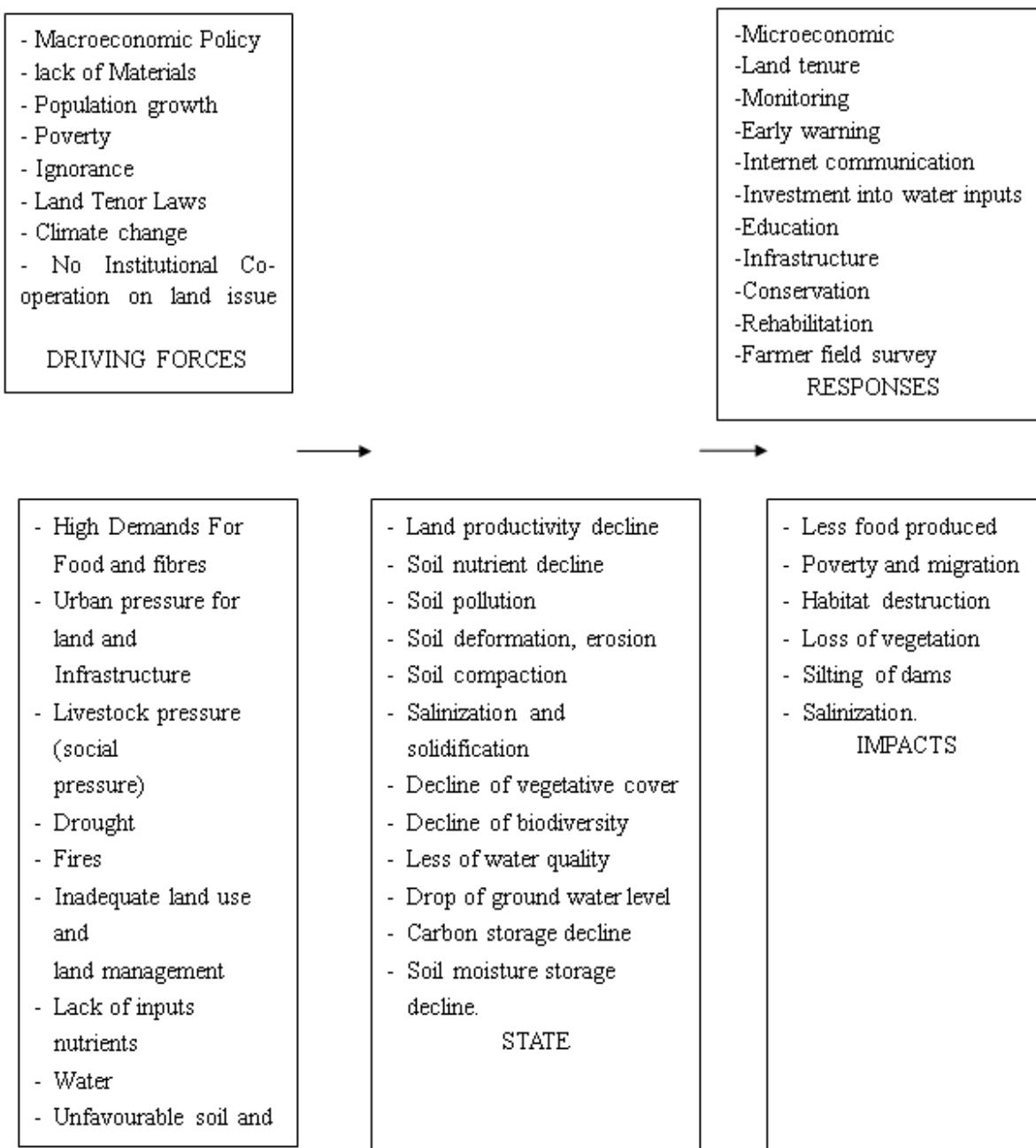
The models reviewed here were based on the previous work done by other authors as a guide to this study. The available Models for approaching land degradation and soil erosion are varied in scope and application, including the study by “The European Commission that launched the idea of soil monitoring network for Europe Forest Resource Assessment,” (Ranst, 1999). The suggestion of Nachtergael (2006) shows that analytical tools available for land degradation assessment is presented in table I, including their advantages and disadvantages.

**Table 1: Tools for Land Degradation Assessments.**

Tools	Advantages	Disadvantages
Expert opinion	Rapid, low cost	Subjective, Unreplicable
Remote sensing	Mod. Rapid /mod.low cost	Focused on land cover only
Field monitoring	Objectives, direct	Slow, High cost
Productivity measurements	Direct observation of effects	Variation due to the factors
Participatory surveys	Grass roots, driving factores	Subjective, mod High cost

**Source:** Nachtergael(2006) Land Degradation Assessment Indicators and the LADA project. LWDD, FAO, Rome Italy.

In another model based on the Land Degradation in Dry lands (LADA) framework, the factors for assessment were the degradation status(S), impact (I), on the people, the productivity and environment. Other factors were response undertaken to combat the degradation that should be evaluated on the socioeconomic, political driving forces (D) resulting in pressure (P) as in the following figure 1.



**Source:** Nachtergaele (2006) Land Degradation Assessment Indicators and the LADA project, Rome, Italy  
 PP 11, 12, 13.

Various tools are available to assess land degradation but all have advantages and disadvantages and show close complementarities as already shown in table1. Therefore a combination of these tools should be employed and defined within a Driving Force; Pressure; Status; Impact; and Response". LADA is official tools of the UN-CCD and GEF to develop standard methodology in the subject matter.

However, Oldeman et al., (1992), FAO, (2002) observe that " Global Assessment of Soil Degradation (GLASOD) was the first attempt to map land degradation globally using standardized criteria, when international soil reference and information centre (ISRIC0), in conjunction with UNEP under took a global inventory of the status of human induced soil degradation. GLASOD is based on "expert opinion" (i.e. on the perception of experts on the type, kind, extent, and severity of land degradation including the causes in a country or region that they know well."

The various models for Land Degradation Analytical Framework have been suggested by Internal FAO (zero Draft, 2006) as follows:

- “Driving Force, Pressure, State, Impact, and Response (DPSIR Framework)
- Millennium Ecosystem Assessment (MA)
- Strategic Environmental Analysis Approach (SEA)
- Sustainable Rural Livelihoods Approach (SRL)

These models and framework can serve as baseline or bench mark against which the success of policies and techniques can be measured, and a programming tool, to identify and prioritize the most important interventions,” (Internal FAO (zero Draft) 2006)

“The Sustainable Rural Livelihoods (SRL) approach provides the useful guide for understanding the resource base on which rural livelihoods rely- natural, physical, financial and social assets.

The physical capital- are the infrastructure including roads, electricity, irrigation works and machinery. Natural capital- are land, water, biological resources such as soil, pasture, trees, and wildlife, productivity of land, biodiversity.

Human capital- are the quality of human labour, available household demographics, skills, health, lands and water and management practices.

Financial capital consists of income, assets, savings and debts. Social capital includes the rights and claims, supports and all interests derivable from the effects,” (Internal FAO (zero draft 2006). The suggestion is the combination of SRL/DPSIR as in Fig2.

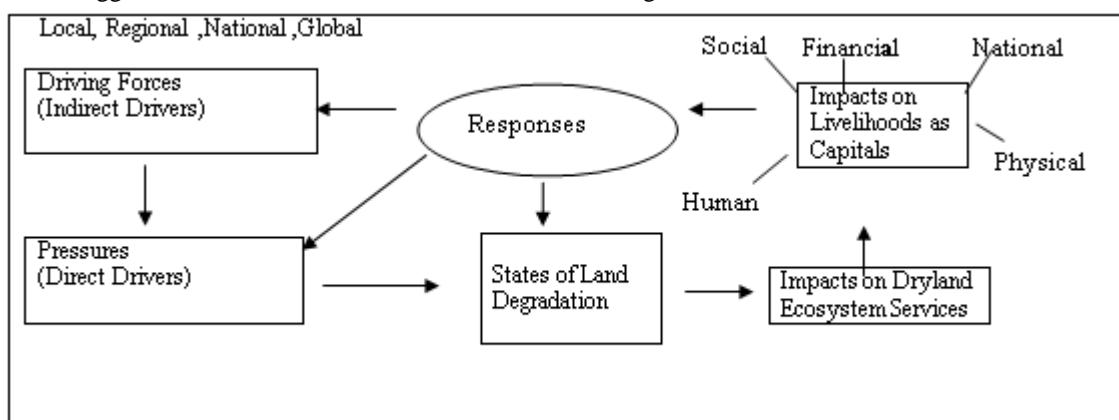


Fig 2: Integration of the SRL Approach with the DPSIR framework. Source: Internal FAO (zero draft) 2006. The SRL and the DPSIR are useful complement interms of assessing human impacts of land degradation. Information on assessment programme available at <http://www.fao.org/forestry/fo/fra/>

### Methodology

This study was covered by use of survey design that incorporated the degraded sites, the communities affected by land degradation, the farm sites, crop yields and vegetation of the areas in South East. These included all the erosion sites, degraded areas and core locations in Anambra, Abia, Ebonyi, Enugu and Imo States.

### Discussions of Findings

The findings in this study were very revealing as it was found that the main natural causes were the devastating effects of rainfall which has double maximum between the months of June and July and also between the months of August and September when the rains are at peak in both periods of these months in the year. There is also the natural factor of the soil in the east being composed of sandy stones loose surface that makes it vulnerable to attacks by floods and in some areas these effects are reinforced by steep slopes that allow rapid flow of water on the surface soil thereby wearing away every soil on its path.

The heterogeneity of the different components of soil in the south east has been a causative factor and this is even worsened by the high level of illiteracy among the inhabitants of these areas who believe that the gods and deities are to blame for the land woes in the area. Other natural causes include wind and water soil erosion, floods, landslides, earthquakes of minor proportions, desertification, drought acid rain and sand dunes all of which occur in destructive proportions.

The human causative factors are the rotation of farm land at average rate of one and a half yearly periods against

the five yearly rotation period considered safer than the first option. There is also the bush burning that had caused the total removal of entire land vegetation leaving the soil vulnerable to attack by rain. There have been losses of lives and properties in these areas though of minimal occurrences. The natural felling of trees for house construction, timber and other uses constitute serious threats to the land in the affected areas of Anambra and Imo states while this is less in the Abia and Ebonyi states.

### Recommendations

The heavy rainfall in the South East is a great cause of natural disaster in land degradation and efforts should be intensified to direct the flood by construction of channels to lead to rivers, lakes and dams. This could serve as sources for irrigation water to encourage farming in areas with least rainfall. The planting of trees is a non negotiable value for erosion control that must be embarked upon by all the inhabitants especially the citizens of the South East Nigeria.

The need for intensive campaign on enlightenment of the citizens, through NGOs and other social groups in the areas is highly emphasised. The government should embark on the introduction of measures to create early warning signs of erosion likely or prone areas or spots, rather than wait till it has occurred. The involvement of technocrats and environmentalists for continuous surveillance of the areas should be encouraged and enforced by the government. The government should make provisions in the annual budgets for erosion control than wait to provide only when the emergencies are beyond control while the supervisory agencies should ensure that the money is properly utilized.

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