

Review Paper

Major Drivers and Effects of Land degradation in Nigeria: A Review

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Received: 18/Oct/2023; **Accepted:** 02/Dec/2023; **Published:** 31/Dec/2023

Abstract—Land degradation is the process of land destruction, which is usually prompted by both anthropogenic and natural activities. It is one of the major environmental problems especially in developing countries. The focus of this paper is to review the studies on the main drivers and effects of land degradation phenomenon in Nigeria. Some of the major causes are discussed including deforestation and forest degradation, overgrazing, bush burning, and mining. This study also indicate that land degradation has severe negative effects on the ecosystem some of which are desertification and drought, loss of agrarian land, low crop production, and soil erosion, etc. Furthermore, the approach to manage land degradation is presented, and it was pointed out that the advantage of using remotely sensed data in land degradation assessment is that it provides a cost-effective, timely, and consistent evidence of degraded lands regularly.

Keywords—Anthropogenic, conservation, land, LULC, productivity, sustainable

1. Introduction

Land is of great importance as it provide many important needs in our ecosystem such as food, shelter, water, breathable air, biodiversity conservation and others. Yet, the human-induced negative impact on land is apparent and has led to land degradation. However, it has been subjected to various kinds of degradation in many places and over the historic time and in contemporary time. Land degradation is a result of human-induced actions including agricultural practice, pastoralism and fuel-wood extraction [1] or natural process such as inconsistent rainfall and land-atmosphere feedbacks.

Land degradation (LD) is the long-term damage of ecological function and efficiency due to disturbances from which the land cannot recover without assistance. LD manifests itself in severe biophysical problems. These biophysical aspects can be observed and assessed in objective terms. Also, proper land degradation assessment and monitoring normally involve space, time, and anthropogenic activities. Thus, including LULC pattern in the meaningful assessment of anthropogenic LD is important.

Land degradation (LD) persistently reduces or eliminate the biotic output [2-4]. LD occurs almost in all regions of the world with diverse impacts on ecosystems. It is a particularly significant issue in parts of Asia and Africa. Of course, land is linked with natural wealth in Sub-Saharan Africa (SSA), [6]. For instance, a significant population in Nigeria depend

largely on agriculture and the use of natural resource (see Omali [7]). Thus, 60 percent of the people relying on land for their living implies that ownership of degraded land is the same as being poor. This is predominantly for many persons depend on land-based resources [8,9]

Several researches in SSA evaluated LD [10] identifying its subnational forms. Such researches corroborate the significance of subnational and agro-ecological components for establishing national Land Degradation Neutrality (LDN) goals [11]. Effecting the LDN outline significantly depends on this elements [12,13]. Nevertheless, the coarse and general nature of earlier assessment [10] overshadow the delicate subnational and local LD. Consequently, it stimulate past debates on the exact status and inclination of ecological degradation in West Africa [14]. The purpose of this study is to review the studies on land degradation in Nigeria with specific focus on the major cause and effect of the phenomenon.

In this paper, section I presents the introduction of the study, section II covers review of the related work, section III deals with the theory of land degradation. Also, the study methodology is contained in section IV, the results and discussion is covered in section v, and section VI concludes study.

2. Related Work

Land degradation occurs in several forms [15] at gradual pace and cumulatively. Its impact on the global ecosystem has

given rise to several studies and assertions. Desertification is seen as the most severe form of LD [16], which usually results from several influences such as climate change and anthropogenic actions.

Jibril, Aule and Idris, [16] examine the spatiotemporal characteristics of land degradation of Dambatta LGA using Land Cover (LC), NDVI, and LST. Abdulkadir, and Kumar [17] conducted a research in Trends using Earth tools, and soil data for LD assessment. The result indicate that the magnitude of degraded land is 12,952.3 sq.km. Summarily, the tools used validate the fact that remote sensing is fast becoming the most valued means for carrying out diverse kinds of observations [18]. Of course, remotely sensed data can be used to produce different kinds of thematic maps that covers various topics such as settlement, population approximations, climate, poverty, and pollution [19] etc. Danjuma and Karkarna [20] examined the indigenous methods of LD management in Northwestern Nigeria. It was shown that degeneration in crop yield is the principal parameter of LD in the study area (56.89 %) followed by soil erosion (31.03 %).

3. Materials and Method

This review began with a literature search through electronic databases using explicit search terms to identify relevant papers (see Omali [21]). The search terms include 'Major Drivers of Land degradation in Nigeria' AND 'Effects of Land degradation in Nigeria'. Relevant articles were prudently selected with due considerations to hierarchical topics. Also, search terms as well as the criteria for inclusion/exclusion of papers were formulated in line with Omali [22]. After subjecting the search results to exclusion and inclusion criteria, a total of 44 studies were retained, reviewed in full detail, and evaluated.

4. Results and Discussion

4.1 Drivers of Land degradation in Nigeria

Generally, several assessments have associated global environmental change to both anthropological activity and climate variability [23,24]. In that regard, LD in Nigeria is influence by various factors as highlighted in the following subsections.

Deforestation:

Fast population expansion and the consequential human actions have wielded substantial stresses on the environments [25]. Majority of these activities such as farming, urban sprawl, industrialization among others are causing global deforestation and forest degradation [26]. Deforestation is mostly caused by the transformation in Land use and Land cover (LULC). The major driver of LULC changes occur through clearing forests for agricultural activities and urban expansion leading to land degradation. When the forest is removed, the degree of soil loss subsequently increases and the size and regularity of mass movement also increases.

Overgrazing:

Overgrazing due to the rise in the livestock population, and the dependence of the livestock sector on natural pastures and poor development of pasture lands have given rise to pressures on land resources. The structural deformation of the soil can be determined by the impact of Grazing animals and agricultural machinery [27]. Of course, this impact can decrease the porosity of soil and also intensify the bulk density of soil [28]. The compaction of soil in turn reduces the infiltration capacity [29] and stimulates surface runoff [30]. Furthermore, the combination of soil compaction and the decline in vegetation as a result of overgrazing usually leads to faster soil erosion [31] and it also considerably lessens the capacity of soil water storage. Summarily, the degree of soil loss through surface-water erosion can be controlled by vegetation cover [32].

Excavation and construction activities:

Construction activities are sources of soil disturbance posing a threat to ecological and food security [33]. The rates of soil erosion resulting from construction activity are 2 to 40,000 times more than pre-construction conditions. Usually, constructions transforms the landforms, vegetation, and waterways. As a consequence, it leads to surface runoff, soil erosion, and sedimentation [34], which are evidence of LD.

Mining Activities:

Mining requires excavating several tons of Earth materials [21] and it is usually accompanied by removal of both minerals and waste dumping at the working site [35]. The Nigerian mining has caused LD in the areas where they are being undertaken. The open cast method of mining are commonly employed in Nigeria. This approach usually destroys the top level of the soil and the soil profile. Equally, the method produces material remains (overburden). This material are piled on the land and they decreases the land quality.

Land Pollution:

Land can be used for diverse purposes. Yet, the inappropriate use of land usually reduces its quality and output [36]. This is referred to as land pollution. Land pollution with insecticides, and shifts in vegetation causes shifts in soil microbial and meso-faunal composition. It modifies numerous soil roles such as rates of respiration and the emission of carbon into the atmosphere.

Climate factor:

The increase in rainfall variability, drop in rainfall, and temperatures influence the increased chances of droughts and floods. In areas with little or no vegetation, there could be physical destruction of arable land through the development of gully erosion due to the force of raindrops, surface and sub-surface run-off, and river flooding. Also, coastal erosion can be influenced by the rise in sea level.

4.2 Effects of Land Degradation

The foremost effects of LD are:

- i. *Soil Erosion*
- ii. *Desertification*

- iii. *Loss of Arable land*
- iv. *Low Agricultural Production*
- v. *Poor Land Quality*
- vi. *Reduced Income and Increasing Poverty*

Abdel Rahman [37] discussed the effect of LD under four important factors including *economic impact, climate change, water scarcity, and rights of individual people*. First, land degradation impacts the livelihood of the rural people as it threatens farming productivity and also lessens soil health. Second, LD is aggravating climate change events. This in turn, causes greater degradation. For instance, degraded land loses its capacity to absorb carbon dioxide, which is the major element in global warming. Third, LD has caused the decline in the quantity and quality of groundwater. Fourth, land tenure insecurity affects limits the people and communities in the fight against climate change. This is further threatened by LD.

By and large, LD is essentially a huge global issue because of its adverse impact on farming efficiency. Also, it can negatively affect the environment and food safety [38]. LD affects environmental growth, dividing the adverse effects on social and economic situations [39]. It also shows a gap between high soil value and land use [40].

4.3 Management of Land Degradation

Land degradation may be controlled through conservation tillage. Additionally, the Integrated Soil Fertility Management (ISFM) reestablishes unproductive land areas and enhances their yield. Crop yields have been improved using ISFM services [41]. Furthermore, management of irrigation water serve as a strategic factor of improving the soil quality [42,43].

The conventional approach for mapping land degradation is field surveys, which are characterized by many limitations. Nevertheless, the application of remote sensing now predominates in land degradation mapping and monitoring. Remote sensing deals with extracting earth's information based on the interaction between electromagnetic radiations and earth. The temporal, spatial, and spectral resolutions characterizes the remote sensing system. Thus, it is possible to monitor the earth's processes in past, present, and near real-time. By and large, the biophysical parameters of LD are defined concerning soil characteristics (e.g., fertility, yield, compaction, and loss of soil), erosion (e.g., shifting sand over fertile soils, water turbidity and sedimentation, soil loss and gully incidence), land cover (e.g., land cover change, and agricultural and grazing intensity), and landform (e.g., topography). The satellite-based mapping of these indicators depends on the spectral properties of the target features. Summarily, the advantage of using remotely sensed data in land degradation assessment is that it provides a cost-effective, timely, precise, and consistent information on degraded lands at definite time intervals.

6. Conclusion

Land is the basic resource used for agricultural purpose, raw materials, shelter and infrastructure. Unfortunately, both human-induced and natural factors is causing land degradation especially in the developing nations. This paper is focused on the main drivers and effects of land degradation in Nigeria. The present situation of land degradation in the Nigeria is very alarming and needs a proper land use planning and management. The main causes of land degradation in Nigeria include deforestation and forest degradation, overgrazing, bush burning, and mining. Also, land degradation in Nigeria has severe negative effects on the ecosystem such as desertification and drought, loss of agrarian land, low crop production, and soil erosion, etc. Active degradation resulting from various factors makes the degraded area to be unstable ecosystem.

Furthermore, land degradation in Nigeria is an ecological issue that must be tackled to conserve the land for both the present and future generations. The advantage of using remotely sensed data in land degradation assessment is that it provides a cost-effective, timely, and consistent evidence of degraded lands regularly.

Data Availability

None.

Conflict of Interest

None.

Funding Source

None.

Authors' Contributions

K.U. researched literature, conceived the study, and implemented data analysis. K.U. wrote and reviewed the manuscript, and approved the final version.

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