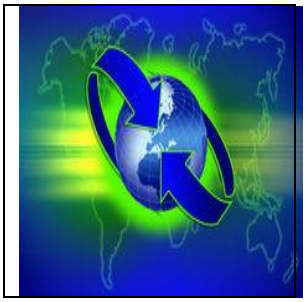

Evaluating Responses by Lithoclimatological Elements to Forest Depletion in Parts of Nigeria with Relevant Theoretical Ideas

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Abstract

Since human domination of space, forest depletion has been a recurrent activity in Nigeria with numerous consequences on its landscape. The magnitude of the effects of this menace on the lithology and climatic elements of the environment of the study area has been a matter of great concern to the people who depend on the forest for their numerous socio-economic benefits. Of particular worry is the extent at which a number of the region's ecological resources, particularly soil, vegetation and climatic resources have been degraded as a result of forest loss. The aim of this study therefore was to evaluate the effects of this phenomenon on these environmental components with a view to assessing the implications of the destructive interference by the people with the natural ecosystem, applying theoretical models from a wide array of geographic interests across diverse geographic background. Data were generated from published literature materials, theoretical survey, projects, technical papers and tertiary documents. Prominent land/environmental resources that were treated in this study included soil profile development and level of degradation, forest/vegetation landscape, surface temperatures, soil temperatures, the changing phenomenon of the various climatic elements, etc. In this study therefore, the relevant effects of the menace on the outlined components across the globe, with emphasis on the Nigerian environment were identified and discussed. They range from soil erosion and impoverishment, loss of vegetation structures, species extinction, ecosystem disruption and the general continuous degradation of the environment. Conclusions were thus drawn from the results of this theoretical search that the effects of forest depletion on the outlined variables are significant but, higher in the depleted forest environment than in the less or non-depleted forest areas. A number of recommendations were made with a bid to reducing forest depletion and losses in the study area. Other than direct government involvement in checking excesses that culminate in the menace, it was recommended that members of the various communities within the study area should consider the forests as a common wealth of the people with inelastic values, which must be protected. It also should understand that the long-term feature of the forests and their environmental health depend largely on how the forests are perceived by them. Stumpage, user fees, tarriffs and other forms of revenue should be paid by users to provide to the government, whose responsibility it is to sufficiently use to manage the forests, to ensure its sustainable use.

Key Words: Lithology, climatic conditions, forest depletion and loss, environment, human influence, soil deterioration, theoretical review.

Introduction

Forest depletion and degradation are critical environmental problems of many countries of the world. Globally, forest depletion is mostly caused by deforestation, an activity that involves the cutting down of forests without simultaneous replacement. This phenomenon is an activity frequently embarked upon by humans which involve the cutting down of trees or vegetation without any simultaneous replanting. The causes are traced to both humans and natural interference with the environment. Abdulkadir (2007), FAO/UNEP (2009) and Ocholi (2015) have shown that activities leading to deforestation across the world grows unabated and the extent at which it grows is worrisome, particularly in the tropical countries of the world where anthropogenic influences on the forest ecosystem is steadily on the increase, with little or less control.

Forest depletion and degradation are not limited to one particular geographic region alone; rather they are shared problems of the international community. Incidentally, this menace respects neither boundary nor defined entropy (FAO/UNEP, 2009). Many developing countries, including Nigeria are confronted with the effects of forest depletion on their environment, even at the time that the issue of sustainable development is top on the agenda of governments. In some parts of the world, several attempts have however been made to reduce the menace but due to persistent human population increase and the quest for livelihood, activities culminating in forest depletion grows steadily, (Ocholi, 2015).

Hagan (2006), Phil-Eze and Ocholi (2008) and Ocholi (2015) outlined settlement expansion, business establishment and development, industrialization, transport and infrastructure development, mining, firewood harvesting and agricultural development programs as the leading causes of forest depletion across the globe. The authors considered this activity as entirely anthropogenic and prehistorically originated. Traditionally, this phenomenon was not

intended to destroy but rather an activity ignorantly embarked upon by the people in their attempt to fulfill their humanistic obligations: provision of shelter, food and wealth creation.

The United Nation's Food and Agricultural Organization (FAO/UNEP, 2006) and the United Nations Environment Program (UNEP 2006) estimated that average annual tropical deforestation destroyed 11.4 million hectares of land per year. A breakdown of this decline in forest structure shows that 4.2 million hectares (10.4 million acres) a year are lost in Latin America, 1.8 million hectares (4.4 million acres) in Asia and 1.3 million acres) in Africa. In Nigeria, the rate of deforestation stood at about 286, 000 ha per annum, this has increased within the last decade to 400,000 ha per annum (Awe, Imoagene, Osadebe and Olufolaji, (2012). More than 90% of Nigerian soils have suffered from various degrees of degradation due to forest depletion, (Abula and Awoyemi, 2010). Such human interference with the environment could cause permanent damage to vital resources of the ecosystem (e.g. plants, water, animals and their habitats). Asthana and Asthana (2005) and Essoka, Essoka and Miginyowa (2010) sees the destruction of the top soil, habitats of plants and animals and biodiversity losses and changing climate as critical environmental problems resulting from forest depletion in many parts of Nigeria.

Other than fluctuating climate, forest depletion reduces forest structure and soil quality, the density and structures of the trees, the ecological services supplied by biomass of plants and animals, species diversity and the genetic diversity, (Morris, Miller, Orson an Froud-williams 2007). In addition to the physico-chemical degradation of the Nigerian soils, Abdulkadir (2007) had recognized loss of food and medicinal herbs, depreciation and outright wiping off of the genetic pool, building up of greenhouse gases and drought as general effects of forest depletion in the region. Profoundly, Nigeria happens to be a large geographical region in West Africa where the size and density of its population and human activities are relatively high and with greater consequences on its soils, climate and related edaphic components.

Ocholi, (2015) considered Nigeria as a fragile vegetation ecotone which houses soils and climatic environments that are critically degraded. The National Bureau of Statistics 'NBS' (2007), confirmed that between 2000 and 2005, Nigeria witnessed the highest forest depletion rate in the world having lost substantial areas of its primary forests. Reforestation efforts it says replenished only 25,000 hectares. Consequently, the forests tend to vary in character with changes in the nature of edaphic components, and climatic properties, relief conditions and socio-economic activities of the people.

In Nigeria, despite the numerous literatures covering forest depletion and its attendant effects on edaphic and climatic components of the environment, the people and policy makers alike tend to be ignorant of the hazards caused by the menace, and as such lack access to possible solution procedures. Farmers have often misused the forests largely due to ignorance of their physical, chemical and climatic consequences in the phase of socio-economic challenges. Very practical indeed, the country's timberlands have been subjected to astonishing abuse since the 19th century, where great quantities of its valuable timberlands have been disposed off under the public land laws as farmlands. In this country, the forest is primarily logged and then abandoned, timber was cut because there was need for it, and lower grade portions of trees were used due to over exploitation.

Existing plantations and reserves meant to cushion the effects of deforestation in strategic areas have greatly been tempered with and new plantations are however limited in the study area. With increase intensity of use of the forest land beyond the carrying capacity, there seems not to be a lasting solution to the problem, as efforts made by various stakeholders to compensate for these loses have not yielded the desired results.

The most critical problem is that the appropriate models to deal with forest depletion and degradation have not yet been developed. Generally, the nations' Forestry departments lacks comprehensive data base on these critical issues; such information could be used for varied

purposes: research activities, strategic planning, advisory roles, project justification and environmental resources management, among others.

The specific objectives therefore are to:

1. review existing literatures relating to Nigerian inherent conditions, with a view to deducing solution.
2. Recommend measures with a bid to addressing forest depletion activities in the study area.

The Study Area: Nigeria

Nigeria, with its capital at Abuja situates in West Africa, specifically between latitudes 9.08200 N and longitude 8.67530 E. The country has a total land area of about 923,768 square kilometers, (nationsencyclopedia.com, 2019).

The climate varies from equatorial in the south, tropical in the center to arid (desert) in the north. Specifically, the tropical monsoon climate, designated by the Koppen Climatic Classification as "AM", is found in the southern part of the country, the climate that is influenced by the monsoon originating from the south Atlantic Ocean, brought into the country by the tropical maritime MT air mass, (Wikipedia.org, 2019). Rainfall decreases from 4000mm in the Niger Delta to less than 250mm in the extreme North East.

The topography of Nigeria consist of numerous eroded surfaces occurring as high Plateau at elevation between 2000 and 4000 feet with low lands between them forming basins of the major rivers. Landforms in the north central and western parts are characterized with high plains, with broad, shallow valleys, studded with numerous dome-shaped isolated hills and elongated ridges.

The major soil types in Nigeria, which vary in their potentials for farming or agricultural purposes are fluvisols, rigosols, gleysols, acrisols, ferrasols, alisols,lixisols, cambisols, luvisols, nitosols, arenosols and vertisols, (FAO.org, 2013).

According to the United States Census Bureau (2018), Nigeria currently houses a population of about 206,158,244 million people as of Monday July 6 2020. The population of Nigeria is estimated at 206,139,589 people at midyears, equivalent to 2.64% of the total world population.

Resource Potentials

Being the largest country in the West African sub-region and acclaimed giant of Africa, It is well known for her crude petroleum, and a wide range of national resources. The nation relies heavily on crude petroleum as its major source of foreign exchange. Other than crude petroleum, other mineral resources that are available are non-metallic minerals such as clays, kaolin, talc, ilmenite, barites, feldspar, dolomite, gypsum, bentonite and soda ash. Others are phosphate, mica, limestone and metallic minerals such as iron ore, gold, uranium, bauxite, etc.

Vegetation and Forest Cover

Nigeria is covered by three types of vegetation: the forests, savannahs and grasses and flowers, (Wkipedia.org, 2019). The southern parts of the country are mostly dominated by the Mangrove forests vegetation. North of it is the fresh water swamp followed by the rain forest? The savannah zone's three categories are the Guinea forest savannah mosaic, the sudan (housing shorter grasses and trees, and the Sahel savannah.

Effects of forest depletion on soil

Soils are considered as relevant components of the environment that requires careful management. Any damage done to them jeopardizes their existence. In the work of Ocholi (2015), people's attention has been drawn on the need to understand the behavior of soils generally: in their support for the growth of crops, trees, grasses and numerous vegetal life forms. This measure was introduced with a view to enlighten the people on the danger associated with the wrong use of soils.

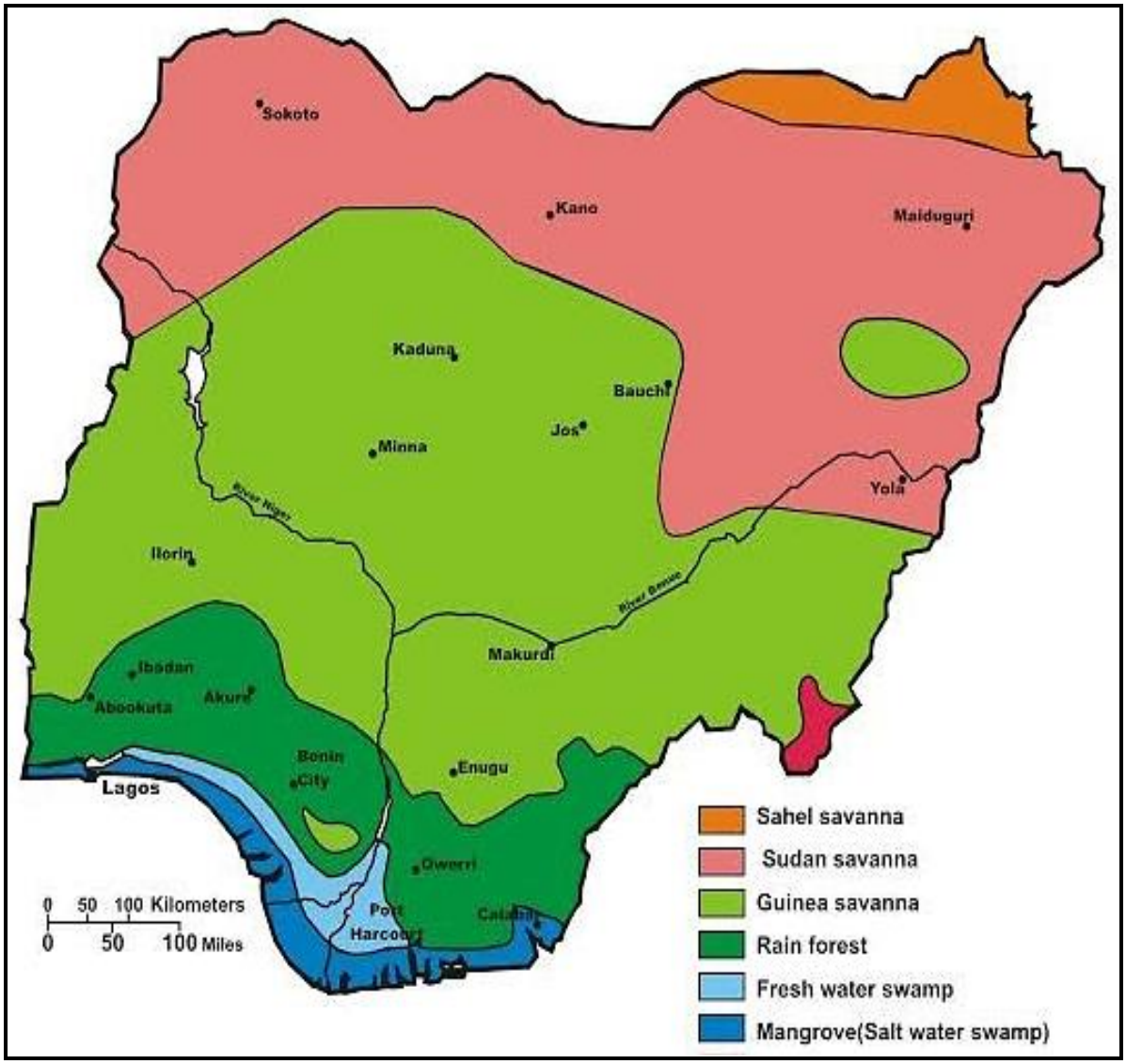

Figure 1: Vegetation/forest Regions of Nigeria, (*Source: nationsencyclopedia.com).*

A negative relationship exists between soil and forest depletion. The more the magnitude of forest depletion, the more the soil degrades (Wild, 2006). Morgan (2005) threw light on the need for people to understand that an intricate relationship exist between soil erosion and forest depletion activities across nations of the world. The author remarked that forest depletion results in greater run off and that if the velocity of the runoff surpasses threshold level, gullies will occur. For example, the threshold value varies from 3.3 to 32.2 pg on cultivated silt-loam soils in Belgium and 16.8 to 74.4 pg on cultivated stony sandy barns in Alentejo area of Portugal. The author proved that attempt to relate gullying solely to changes in external factors has not proved

entirely successful, because not all gullies in an area appear to respond in the same way. Morgan (2005) further explained that hardly can there be any such soil under undisturbed cover. The author emphasized that man require the soil for his cultivation. He also burns the vegetation and has the need to graze his animals to satisfy his socio-economic requirements. Each of these activities the author says leads to exposure of the soil to accelerated soil erosion and deterioration. The author emphasized that there is the need for stakeholders and farmers to adopt conservation practices on soils that are put under continuous cropping to enable it regain its lost fertility. Soil erosion is a disastrous form of environmental degradation under different geological, climatic and soil conditions, (Ofomata, 2001). Increases in weeds infestation, a decline in soil pH, and a corresponding increase in soluble and exchangeable Al and declining crop yield attest to the intense forest depletion in several parts of the world, (Ogidiolu, 1999) and (Kolawole, Tian, and Tijani, 2005).

Wwite and Nnoke, (2005) proved that organic matter loss in tropical soils is rapid, it is attributed the constant loss of this component to high rainfall, high rate of mineralization, bush burning and high carbon losses accompanying tillage operation, and therefore makes sustainable agriculture permanently difficult.

. Organic matter does not only contain plant nutrients that are released when the organic matter is broken down by micro–organisms, but it also holds some of the plant nutrients that are easily available to plants (Egbenda and Sam, 2011). Light fraction organic matter comprising of plant residues, the authors remarked, contain high concentrations of oligosaccharides, polysaccharides and hemicelluloses and thus serves as a readily decomposable substrate for micro and macro faunae in soil. It was further revealed that more than half of the microbial population and enzyme activities may be associated with the light fraction organic matter 'LFOM'. The LFOM has been shown to be a useful indicator of soil quality, and in particular may be sensitive to changes in labile organic matter. LFOM is enriched in carbon and Nitrogen,

relative to fractions dominated by mineral constituents. In consequence, the amount of total soil organic carbon and Nitrogen present as the light fraction may be between 40 to 30% respectively, (Olajide, O. 2006). Soil organic matter is to soils like what blood pressure is to humans (Verma and Kishan, 2012). Organic matter level indicates the health of the soil; it is measured in percentage and ranges from less than 0.2% in desert soil to over 80% in peat soil. Organic matter provides the nutrient source for all the living organisms. It was observed that since organic matter contains about 50% carbon, 40% oxygen, 5% Hydrogen, 4% Nitrogen and 1% sulphur, the amount of organic matter in soils is a predictor of the amount of carbon in soils. Organic matter is influenced directly by temperature; hence soils in warm climates loose organic matter faster with tillage, (Verma and Kishan, 2012).

Soil organic matter has many beneficial effects on forests and crop productivity because of its influence in water holding capacity, soil fertility, microbial activity, erodibility, pesticide sorption and many other soil properties, (Angelo, Kevzelove. and Karathasis, 2009). They however regretted that considerable amount of Organic Carbon and associated beneficial effects can be lost when native soils are cultivated or disturbed. Organic compounds are considered to be biochemically protected from biodegradation when they posses chemical and physical characteristics that make them difficult for micro- organisms to take up and degrade, such as low water solubility and high molecular weights. As noted by Angelo, Kevzelove, and Karathasis, (2009), the amount of biochemically protected organic carbon in soils is likely to be strongly dependent on the nature of organic carbon input to the ecosystem. Examples of biochemically protected organic compounds include fungal melanin, plant waxes, Lignin and humid substances. The vision statement in this regard therefore is to fashion out strategies towards sustainable development that would address the main objectives of the Millennium Development Goals "MDGs", covering specifically ecosystem security, economic efficiency and social equity. However, not all the environmental factors are cardinal even though they may create an effect.

For example, rainfall patterns, soil morphological and pedological properties, vegetation and land use practices, all influence the extent of land degradation, (Ajibade, 2003) and (Ocholi, 2007).

For a more appreciation of the position of soil in the environment and the need to be educated on the relationship it has with deforestation, a brief discussion on the agro-meteorological state of the soil environment is paramount. Knowledge of the characteristics of soil is an integral part of soil quality studies. (Fasina, 2005). Forest depletion promotes rock weathering too. Similarly, parent material is considered an important soil forming factor that exert a strong force that produces changes in soil properties. Nsor and Ibanga (2008), in their study on the influence of parent materials on physico-chemical properties of soil in Central River State of Nigeria reports that parent materials affect soil properties such as color, texture, structure and nutrient status. They established a comparison of soils formed from the weathering of basalt and granite showing that most minerals present in basalt weathered into Kaolinite, Ferric Hydroxides (hydrous oxides) and some Aluminum Hydroxides. Such soils they say will be low in sand, high in clay and well structured. Such soils have poor textures and are less suitable for farming purposes. In them, leaching occurs rapidly.

In an intensively managed farmland, considerable phosphorus fertilizers, both commercial inorganic fertilizers and animal manure have been used to the extent that the soils capacity to keep a balance between additions and crop requirements have become compromised, (Asthana and Asthana, 2005).

Soil water is an important element to contend with in this discussion. Soil water potential play significant role in the prolong effect of forest degradation on trees. It was noted by Nadezhdina, et al (2010) that the upward movement of water due to transpiration drops when soil water potential (ψ) drops below leaf water potential. Transpired water moves from roots to foliage (acropetal direction) when leaf water potential (Nil) is substantially lower than soil water potential, (Nadezhdina, et al 2010). This transpiration process seldom explains the viability of

conducive soil and water environments occurring when deforestation activity is not intense and the unviable condition when the reverse is the case. The position of the last authors was supported by Hallet; et al (2010) when these authors hypothesized that water movement through hydraulic redistribution may be quite frequent in forest ecosystem in response to tree adaptation to the constantly varying distribution of water status in leaves, shoots, roots and soil.

The links between vegetation and the hydrological properties of soi1 as shown in a considerable number of studies is important in this study, particularly that no meaningful biochemical process can take place in the soil in the absence of water. Deforestation through cultivation promotes run-offs and infiltration (Ofomata, 2001).

Forest depletion has many significant ecological consequences. In addition to the outlined impacts, stem flow is accelerated and management techniques like weeding increase surface run-off. According to Smithson, Addison and Atkinson, (2009), this trend along with harvesting could cause large losses of nutrients (Danica and Catherines (2013).

The removal of vegetation results in increased erosion of soil sediments, which are many times deposited in water bodies, consequently depositing soil particles and nutrients. Such a phenomenon corresponds with a reduction in nutrient uptake in the soil, resulting in an increased rate of nutrient leaching in the soil. The leached nutrients are often deposited in water bodies. Both types of nutrient inputs subsequently alter physical stream characteristics as well as rates of productivity and ecological components of the water bodies. Forest soils store more carbon than the trees above. It was stressed however that soils can become sinks or sources of greenhouse gases as a result of climate change and cultural practices and that only modeling enable the assessment of stocks and their change based on long and structural data set.

The consequence of this phenomenon and its associated degradation in some parts of the world has led to an inexorable increase in the need for land resource information, (Tranter, Minasny, McBrantney, Murphy, McKenzie, Grundy, and Brough, 2007). It leads to increased

soil erosion and depletion of the nutrients contained in them. This means that, not only has the original forest been destroyed, but it becomes effectively impossible for the trees to be replaced and for new environments to grow.

The soil is as important to vegetation as blood is to humans; hence it houses virtually almost all bioresources of the landscape. Essoka, et al (2010) evaluated the position of soil in their discussion on the relevance of this component to human wellbeing thus:

> *Soils constitute a natural resource base for agriculture. The Nigerian economy which is principally agrarian constitute small scale producers in the rural areas (small holders) who account for over 90% of the total domestic supply using traditional method under basically rain-fed conditions and irrigation, especially in the northern part of the country. Studies have shown that substantial hectares of land is cultivated annually, mainly in mixed cropping and less than 1% of' the cultivated land is under irrigation. The cultivation of tropical soils is often accompanied by changes that are unfavorable for further crop production.*

Virtually all essential plant nutrients except Carbon, Hydrogen and Oxygen are obtained from the soil (Adeleke, 2002). Forest trees require favorable soil conditions to grow and, just in the same way they require climate. The soil can only be considered productive if the soil has adequate water (both intake and holding capacity), good aeration, adequate depth and adequate supply of essential nutrients (Ogidiolu, 2003). The understanding of soil properties and processes by man is needed to address the behavior of this component in the scientific study of the earth.

Effects of forest depletion on Climate:

Forest vegetation and climate are two prominent physical factors with significant roles to play in ecosystem functioning. For this ecosystem functioning to be fully established, the soil has an intermediary role to play in its way to regulate the growth and productivity of vegetation but climate is the prominent determinant of this phenomenon. Studies have shown that today's climatic change is as a result of human influence, which include fossil fuel burning, forest depletion and exhausts from automobile industries and power plants (Ladan, 2011). These are associated with extremities in weather characteristics. Ladan listed extreme weather events to

include blizzards, floods, extreme heat, extreme cold, heavy rainstorm, fires, hurricanes, tropical storms and severe droughts.

Forests are highly sensitive to climatic changes, (Jacinther, Dick and Owens, 2002). Forest removal often leaves a large expanse of land bare and to the direct impact of insolation, (Alakpodia, Jimoh, Ogidiolu and Ajewole, 2011). The authors maintained that up to one third of currently forested areas could be affected by climate change. Olugonorisa (2011) attributed the causes to both human and natural influences. The effects of forest depletion on tropical climate are critical since tropical forests play an important part in the global carbon cycle; their conversion through land use change practices can significantly alter carbon dioxide fluxes between the atmosphere and biosphere to which soil is a major component, (Ocholi, 2015).

Forest depletion by burning releases vast quantities of carbon (iv) oxide into the atmosphere. Forests hold carbon in them and when they are burnt, the carbon is released into the atmosphere. This has been an important global concern as such fires contribute to the warming of the atmosphere and ultimately generating greenhouse effect. These fires generate gases such as nitrogen oxides and methane that create acid rain and contribute to the depletion of the ozone layer. Ladan (2011) estimates that forest fires release at least 2 billion tons of carbon (iv) oxides per year into the atmosphere, increasing global warming. The author stressed further that smoke generated by wild fires creates air pollution, health hazards such as breathing difficulties, loss of habitat and biodiversity, significant degradation on the structure and composition of the majority of tropical forests, increased wind erosion and displacement of settlements.

Similarly, hot and dry weather conditions which are resultant consequences of forest depletion leads to large losses of nutrients, (Asthana and Asthana, 2005). They emphasized that drought incidence; desertification, coastal flooding and crop failures are critical effects of forest degradation in the tropical regions of the world. Forest management could as well increase the carbon capture of boreal forests and could also increase the risk of releasing carbon stored in

boreal forests, (FAO/UNEP, 2009). Clear cut logging, the most common harvesting method in the boreal forest, removes almost all commercially sized trees (i.e. those trees greater than 9cm diameter at breast height-"DBH", it largely results in considerable carbon losses not only by direct export of wood biomass, but also by respiration losses if rates of heterotrophic respiration (litter fall and soil organic carbon decomposition) exceed net primary productivity (NPP) in the years following a clear cut. The position of the last researchers was supported by the idea of Zeng, (2008), that deforestation has an effect on the carbon circle also known as the Greenhouse gas effects and global warming. The researchers maintained that trees and forest balance the amount of carbon in the atmosphere through the process of photosynthesis in which plants make their own food with carbon dioxide. That means any destruction on this system negatively affects the carbon composition of the earth. It was further noted that negative Net Ecosystem Productivity (NEP) may last for several years to decades in the early stages of stand development after clear cuts, (Zhao, 2004). The implications in terms of carbon losses highlights the importance of including harvesting for a better understanding of regional and global carbon cycling.

Studies by Asthana and Asthana (2005), FAO/UNEP, (2009) and Olugonorisa (2011) and have shown that droughts threaten not only forest productivity, but also forest carbon sink ability as a result of massive abnormal tree mortality. In consequence, the acid deposition and loss of available calcium from tropical soils with low acid buffering capacity have resulted. Black carbon 'BC', it was stressed, is produced like weathering of graphic rocks, incomplete combustion of fossil fuels and vegetation, including coal, coke, soot, fly ash and charcoal. However, the chemical and physical properties of BC vary differently but generally comprise three dimensional structures with high carbon contents and relatively few functional groups. Although BC commonly represents between 1 and 20% of total soil organic carbon and less than

1% of total sediment mass, it may be responsible for between 80 and 97% of Polycyclic Aromatic Hydrocarbon 'PAH' sequestration in soils and sediments, (Santra, 2010).

In furtherance of this evaluation, it is currently been discovered that the relations between sorption of BC and biological processes have mainly focused on their uptake by benthic organisms and much less on their microbiology and bioremediation in soils and sediments. Orimoogunje, Ekanade, and Adesina, (2011) suggests that soil 'BC' microbe interaction should be more fully evaluated as their interactions needs a better understanding in order to gain improved knowledge about the effects of organic contaminants on soil microbial activity and community structure. Likewise, a range of phospholipids, fatty acids that are indicative of major microbial groups can be extracted from soil, e.g. fungi, gram positive and gram negative bacteria and actinomyceties. Changes in soil profiles have thus been widely used to determine shifts in the microbial community structure in soils and to compare the effects of different land use systems on crop management practices and environmental stress, (Ocholi, 2015). It thus requires that, agricultural management practices, especially the application of large amounts of manure and Mg containing fertilizers need to be evaluated as to determine their negative environmental effects in agricultural watersheds.

Soils and the vegetation they supported have important socio–ecological functions in the environment, particularly in the urban environment, modulating flows of water, nutrients, heat and fugitive emissions. In this process, urban pollutants such as heavy metals may be captured and attenuated in the soils, of which industrial wastes, vehicular emissions; fugitive discharges of coal burning, power generating stations are notable anthropogenic sources, (Morris, Miller, Orson and Froud-Williams, 2007). When timber deteriorates, dust particles, volatile organic compounds 'VOCs', hyphae and conidia particles are released into the environment while aesthetics; and other properties are lost leading to enhancement of nutritional value of timbers for insect attacks (Hassan and Stephen, 2011). The resultant effects they say are sick building

syndrome, building related illnesses, degradation of building materials, emission of toxic gases and moisture, littering and pollution, as well as uneconomically managed buildings, reduction in resiliency and durability of the entire building.

Researchers from the Smithsonian Tropical Research Institute in Panama and the National Institute for Amazonian Research in Brazil, respectively, have found a link between the increasing levels of forest depletion that are occurring and global warming, suggesting that 2.4 billion tons of greenhouse gases were being emitted as a direct result of forest depletion each year. Tim (2004) remarked that forests suck in carbon dioxide from the atmosphere and release oxygen into it, so if there are fewer forests, then the amount of carbon dioxide in the atmosphere will increase.

Loss of forests, irrespective of the causes, hastens the depletion of the ozone layer (Santra, 2010). Out of 400 hectares (988 acres) of forests in Nigeria for example, only about 26 hectares (64 acres) as little as 6.7% were reforested on an annual basis. Forest depletion caused by deforestation takes away a potential sink for the carbon dioxide mankind is pumping into the atmosphere and is the number two cause of green house gas emissions after the burning of fossil fuels, (Smithson, Addison, and Atkinson, 2009) and (Olugonorisa,2011). Similarly, forests removed by slash and burn farming return to the atmosphere carbon 'locked up' in the timber, a product of the forests. The destruction of forests by man is reducing carbon pool stored on the earth, (Santra 2010). From an assessment on the activities of man on the anthropogenic carbon budget, it was estimated that the resultant cumulative emissions from changing land from 1850 to 1900 were 122 40 GtC, (https://www.wikipedia.org 2011). It was also reported that the largest source of $C0_2$ emissions from changing land use is currently from the tropics.

Global warming, Ifabiyi (2003) and Hagan (2006) had shown is incidence on forest depletion and degradation. These two phenomena are juxtaposed as forest depletion, leads to global warming and in the same vein, global warming worsens forest depletion. The negative

consequences are many often with catastrophic increases in drought and desertification hazards, crop failures, coastal flooding and the destruction of major vegetation belts (Phil-Eze and Ocholi, 2008). The authors ascribed climatic variation to human activities: alteration in the earth's albedo due to forest degradation; land clearing for cultivation or construction and grazing; interference with the ozone layer by pollution, deriving from human activities.

Incidentally, increase concentration of greenhouse gases would lead to a rise in global temperature and indeed global mean temperatures have increased by 0.3 to 0.7K over the last century. At times, such a situation results in hot and dry weather conditions. Hot and dry weather conditions are significant products of forest degradation anywhere in the tropics.

The National Geographic (2012) explained that the problem arising from climatic change caused the CFC to spread out in the stratosphere, and this could lead to the development of a hole in the ozone layer. Further destruction of the forests causes ozone depletion. Widespread concern about global climate has generated interest in forest carbon balance and the carbon sink capacity of forest under both current and future climates. Similarly, most soils in the humid tropics are often subject to high degree of leaching mainly of the exchangeable bases due to high precipitation (Egbenda and Sam, 2011). In the more advanced regions, harmful contaminants may be inadvertently released into the atmosphere and latter deposited in the soil that has a large capacity for retaining persistent organic pollutants such as Polycyclic Aromatic Hydrocarbons 'PAHs', (Orimoogunje, Ekanade, and Adesina, 2011).

Olugonorisa (2011) had remarked that the influence climatic factors have on plants could be modified by edaphic and biological factors of any given place or environment.

The vagaries of climate in many regions of the globe is because of its effects relationship with the soil and vegetal properties, hence the soil affects the rate of gaseous exchange between it and the atmosphere. Several processes operating simultaneously in the soil are responsible for the soil atmosphere which is constantly in a dynamic state. The living population in the atmosphere

converts the available O_2 of the soil into CO_2 and the fresh O_2 subsequently diffuses down from the soil surface. According to Duta (2010), CO_2 on the other hand diffuses from the soil into the atmosphere. The relative proportion of the two gases, according to the author will depend upon the rate of production of CO_2 and on the ease of diffusion. The biochemical reaction and the output of these reactions is governed by the favorable conditions of the soil atmosphere, and therefore the soil must be protected, if possible, to reduce the effects of forest depletion on the soil and its component parts.

The 'PAHs' are ubiquitous environment contaminants produced by incomplete combustion of organic substances, and some are human Carcinogeous prevalent in the modern cities. It has been found that PAHs accumulation in urban soils may have a direct impact on public health as they are readily transferable into human body via ingestion, inhalation and dermal contact. In furtherance of this, they may exhibit toxic effects towards plants and soil biota (Chi, et al, 2012). The authors reported that the US Environmental Protection Agency (USEPA) identified 16 priority PAHs as targets of regulatory attention that have become focuses of metal investigations worldwide. Once released, the distribution and fate of PAHs in the emission are affected by factors including ambient temperature, intensity and direction of prevailing wind, precipitation pattern, vegetation and physicochemical properties and microbial activities of soils. Soils of greater PAH concentrations are found in the proximity of emission sources that are susceptible to high rates of air borne depositions (Chi, et al, 2012). It is thus clear that the urban land uses that determine locations of emission sources, patterns of transport and deposition, and characteristics or receptors are crucial factors influencing PAHs accumulation in the soils. Constant organic pollutants (COPs) like chlordane and polychlorinated biophenyls (PCBs) are human induced pollutants present in the tropical countries.

The related effects include the disappearance of herbaceous plants and shrubs in the under-story structures and reduction in habitats for some wild species, (Boyle, Hart, Kaye, and

Waldrop, 2005). Medicinal plants, shrubs and trees are also victims of large scale forest loss in the region. The Indian's forest lands for example, abound with medicinal plants numbering over 4,000 species. Out of these, 2500 to 3000 species are in general use in some form or the other (Duta, 2009). The effects of forest depletion on these species are manifold, to an extent that a good number of these species are cultivated in various states on an experimental and commercial basis.

Changes brought about by forest degradation or bush clearing results in changes in soil moisture, soil density and temperature. Soil temperature is an important agro meteorological parameter. Generally, the flow of heat through the soil is of considerable importance in plant growth and distribution. According to Ojo, et al, (2009), extreme levels of temperature of soil as well as air affect plant life. The removal of the vegetation for farming purposes exposes the soil to the intensity of the tropical sun and torrential rains (Aruleba and Ogunkunle, 2006). In effect, soil properties inevitably will be changed. At the global scale, climate change is driven by increasing atmospheric concentrations of 'greenhouse gases' such as carbon dioxide (CO_2) and methane (CH_4). As a result, it is expected that the mean temperature of the Earth's surface could rise as much as 1.5-4.5°C over the next 100 years, Ocholi (2015). Although the local impacts of global warming are difficult to predict with certainty, significant shifts in the mean and seasonal variation of air temperature as well as in the total and seasonal distribution of rainfall are likely to perturb the agricultural ecosystems. The impact of a global increase in temperature will be unevenly spread on both space and time. Some of the impacts include: (1) new precipitation patterns in which today's wet regions get wetter and dry regions get drier; (2) migration northward of boreal and hardwood forests; (3) melting of ice sheets, sea ice, and glaciers, with concomitant rise in sea level and flooding of coastal soils; and (4) melting of permafrost in northern latitudes and oxidation of organic matter now stored in cold-region soils. For example, the temperature increase has the potential to markedly shrink the extent of approximately 11

million square kilometers of Gelisols, the cold-region soils with permafrost, where an estimated 20% of the world's soil organic carbon is stored, Scanlon, Reedy, and Bronson, (2008)

Other than the effects mentioned above, forest depletion continues to impact negatively on the human environment, business communities and private organizations that have a role to play on forest resources degradation (Gbedeyan, 2003). The social effects of deforestation often have long-term implications. For indigenous communities, the arrival of civilization usually results in the destruction of their cultural and traditional life styles and may be responsible for a breakdown of their social institution", Wagh (2001).

The misuse of the forest is a symptom of the people's inability to get a grip on other fundamental development problems (FAO/UNEP, 2009). These problems include: agricultural stagnation, grossly unequal land tenure, growing unemployment, incapacity to regulate private enterprise to project the public interest and the spread of diseases. Further losses leads to the non-availability of raw materials from forests and a reduction in the quality and suitable wood products for consumers. The indigenous people of Brazil, the Amazons and Rondonias, for example, fell victim of the menace and have been frequently encroached upon by slash and burn farmers as well as ranchers and gold miners. This development has often resulted into violent confrontations. Such a situation could lead to further destruction of lives and properties. In consequence, substantial amount of money used in the purchase, installation and the replacement of degraded ones are lost (FAO/UNEP, 2009). Similarly, the sociological and psychological implications are that affected individuals are seldom faced with frustration and psychological repression (Phil- Eze and Ocholi, 2008). The authors expressed the fear that this development was capable of negatively transforming affected persons to social rejectees, morons and imbeciles. Such persons are perpetual agents of criminality, oppression and numerous social vices. The economic problems associated with this type of problems were noted by them and

ranges from poor income and low profit margin for most agricultural crops produced from the forests.

Food security and the issue of sustainable development has become a matter of serious concern throughout the world and in deed of more immediate importance in the tropical environment with so much loss of biological wealth and increasing urbanization (Essoka, et al, 2010). In parts of Africa, the last authors also reported that ritual killings have been reported in several places during conflicts between illegal harvesters of forest products and officials of the Forestry Departments. It was also reported that, in most recent times, an average of 30 forest guards lost their lives in gun battles annually in Africa (FAO, 2009). In the West African sub-region, several cases of illegal exploitation of wood and forest products have been reported. The development of forest reserves in Ghana for example generated much local opposition; it was responsible for the delay in the passage of the proposed forestry laws in late 1900, a time when significant destruction had been done to the country's forest estates (FAO, 2006). Implicatively, large proportion of agricultural lands became less fallow and degraded, and has resulted in declining crop yield. A similar trend translated into rising poverty level of the people (Oyekale 2007). Morgan (2006) and Wild (2006) agreed that uncontrolled collection of firewood in Sokoto state in the northern part of Nigeria for example, exposed a great deal of the arable soil to destruction and degradation.

Ajibade (2003) and Odenbaugh (2006) recognized loss of fertile agricultural land, decreasing access to housing needs, dwindling business opportunities, high cost of living, poverty and aesthetic degradation as related socio-economic consequences of forest depletion in Nigeria.

In the rain forest district of Eket in Akwa Ibom State, for example, during the preparation of the land for farming, usually at the onset of the rainy season, the bush is cleared and the trees are felled and the bush is burnt. According to Mishra (2000), this clearing and burning had

resulted in the death of useful plant species in the zone. In this rain forest zone, the death of these plants degraded the forest ecosystem and caused migration. The instability and economic losses due to this migration were enormous. Grazing, whether intensive or geospatial may remove much of the land to further loss of soil nutrients. When grazing is pronounced, various useful products such firewood, timber, honey, fruits, seeds, nuts, resins and medicinal plants are scarce and in some regions, a total loss is recorded (Asthana and Asthana, 2005).

Soil degradation under continuous cultivation based on mechanical and manual tillage practices has become a problem worldwide. Conservation tillage practices leave organic soil residues on the soil surface which minimizes soil erosion. It was also investigated that the organic matter which is also called humus is about 5% of the total volume of the soil. However, the organic residue in the soil left during conservation tillage practices provides a continuous decomposition substrate and consequent gradual input of soil organic matter, thereby improving the soil physically, chemically and biologically, (Iwena, 2008) and (https://en.m.wikipedia.org, 2010). Conservation tillage systems are based on the principle of Mulch farming and they usually conserve soil and water simultaneously by controlling run-off (Fasina, et al 2005). Essentially, the primary and most effective land conservation method, according to Fasina, et al (2005) is appropriate allocation of lands to uses for which they are most suitable.

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