APPLICATION OF GEOINFORMATICS IN ASSESSING LANDUSE CHANGES RESULTING FROM DEFORESTATION ON SELECTED VARIABLES IN PARTS OF KOGI EAST, NIGERIA.

Ocholi, I.U.* (Ph.D.) and Idoko, O.

Department of Geography and Environmental Studies, Kogi State University, Anyigba.

* Author for correspondence: Mobile: *+2348051990087, +2348167784761;*

Email: ocholi.i.u@gmail.com, *ocholipeace@yahoo.com*

ABSTRACT

Decline in forest structure and quality prompted the study, essentially to examine the spatial effects of deforestation on the edaphic components of the environment of Kogi East, Kogi State, Nigeria. It focused specifically on soil and vegetation, while it assessed the implication of the destructive interference by humans with the natural ecosystem based on the results of preliminary investigation. Results showed thatt in many parts of the study area, substantial hectares of the forest landscape had been primarily logged and abandoned. Over a 100,000 hectares of vegetation cover was lost annually, most of which were deliberately removed to make way for agriculture, mineral exploitation, urbanization and expansion of settlements, among others. Reforestation efforts reportedly replenished only 25,000 hectares. In order to investigate this trend, Classified Satellite Imageries of Kogi state covering 1990-2010 were acquired to assess land use information. The process involves land use mapping and the detection of changes using remote sensing and GIS techniques. Additional land use information were acquired through field observation and theoretical survey. When categorized and analyzed, the four main land use components (soil, vegetation, water and the built environment) covered in this study demonstrated significant effects relationship with deforestation. Implicatively, the results of this analysis shows that there had been significant increases in the effects of these land uses on the forest landscape thus resulting in forest depletion, soil degradation and observed destruction of the ecosystem. It was thus concluded that land use practices in the study area must be carried out within the limits of forestry standard for a sustainable forest management.

Keywords: *Forest structure and quality, Spatial effects of deforestation, Edaphic components of the environment, Anthropogenic activities.*

INTRODUCTION

Deforestation is a critical environmental problem of many regions in the world. Studies have shown that the extent and magnitude at which the menace grows is worrisome, particularly in the tropical countries of the world. Many developing countries, including Nigeria, are confronted with the effects of deforestation on their environment, particularly now that the issue of sustainable development is top on the agenda of governments.

In deed, the people and their land, including the resources therein, have fallen victims of a number of environmental hazards occasioned by deforestation. Importantly, Hagan (2006) outlined settlement expansion, business establishment and development, industrialization, transport and infrastructure development, mining and agricultural

development as the leading causes of deforestation across the globe. With increased intensity in land use activities (agricultural, industrial, cultural, political, commercial recreational, etc.), substantial hectares of the forest land in many parts of the study area have been lost to the outlined landuses. Prominent components that constitute these landuses include soil, vegetation, water and built environment. The effects of deforestation on these land components and its attendant consequences in this part of the country is worrisome, as substantial environmental resources (forest trees, soil nutrients, soil flora and fauna, fruits, seed fibre) of the people have been lost.

In order to give this study a spatial coverage, the application of Geographic Information System was considered relevant in view of the growing sophistication in spatial analysis of landuse features as well as the nature of the problem that requires data of multivariate structure. Landuse/land cover mapping and detection of changes using remote sensing and the Geographic Information software is of paramount importance to geographers, planners, policy makers and environmentalists.

Preliminary findings have shown that Landuse activities have been seen to constitute the greatest human influence on the ecospace and the most dependable assess to this type of study, particularly because of its multivariate applications. Landuse categorization and planning are indeed crucial to environmental resources management and needed to be embraced.

Studies have shown that an activity that culminates in deforestation remains a critical problem in Kogi East where many families and constituted authorities are constantly faced with the challenge of landscape development. *Encyclopedia Britannica* (2011) reported and confirmed that the world's timberlands have been subjected to astonishing abuse in the 19th century where great quantities of valuable timberland have been disposed off under the public land laws as agricultural lands. There is, therefore, no doubting the fact that the prominence of deforestation in this part of the world proved to be a cause of concern to Kogi East people in view of the immense danger it posses to soil and other land resources to which the tropical forests take the lead.

As FAO/UNEP (2009) put it, deforestation activity that destroys economic trees mean an injury to a nation's soil and economy. This type of development was seen by Ocholi (2015) as a form of disinvestment to affected nations. According to the National Bureau of Statistics (NBS, 2007), between 2000 and 2005, Nigeria witnessed the highest deforestation rate in the world, having lost substantial areas of its primary forests. Reforestation efforts, it says, replenished only 25,000 ha., out of the 600,000 ha. which is just 4% of such efforts.

Our preliminary field survey shows that the indiscriminate felling of trees in the area for fuel wood has caused soil impoverishment, loss of soil nutrients and advanced desertification; destroyed wildlife habitats and numerous damages to a number of land resources. Such human interferences presumably were responsible for persistent damage to the outlined environmental resources on which depends life sustenance (e.g. plants, water, animals and their habitats).

Asthana and Asthana (2005) and Essoka, *et al* (2010) see the destruction of the top soil, habitats of plants and animals and biodiversity losses as a result of deforestation as critical environmental problems in many parts of Nigeria. Deforestation reduces forest structure, soil quality, the biochemical structure of soils and the biomass that sustains the soil's biological resources to an extent that allows for an alternative land use (Ocholi, 2007). In addition to the physiochemical degradation of the soils, Abdulkadir (2007) had recognized loss of food and medicinal herbs, depreciation and outright wiping off of genetic pool, building up of greenhouse gases and drought as general effects of deforestation.

In order for a sustained resource usage and the environmental resources development, efforts must therefore be made to reduce the negative effects of deforestation on these vital components of the environment of Kogi East, essentially in line with the principle of the Millennium Development Goals (MDGs). It is against this backdrop that this research has been agitated.

Tropical deforestation was responsible for the loss of an estimated 5-15% of the world's species between 1990 and 2002. Between 2002 and 2004, the United Nation's Food and Agricultural Organization estimated that average annual tropical deforestation was 11.4 million hectares per year. Out of this amount, 7.4 million hectares of closed forests were lost per year (FAO/UNEP, 2006). A break down 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 many parts of Nigeria, the forest is primarily logged and then abandoned, timber was cut because there was need for it, and lower grade portions of trees were not used. In this part of the world too, about 600,000 hectares of vegetation cover is lost annually, most of which is deliberately removed to make way for agriculture, shifting cultivation, firewood collection, excessive logging, mineral exploitation, development of infrastructure and expansion of settlements (FAO, 2006; Adedayo et al, 2008; Oroka, 2009).

Farmers have often misused the forests largely due to ignorance of their chemical and physical composition, Considering the consequence thereof, the FAO says that low crop yield in most nation's soil is traceable to the abandonment of the culture of building up of soil organic matter through nutrient restorative bush fallow system or shifting cultivation (Obi, et al, 2005 and Jimme et al, 2010).

It was found that no step towards avoiding forest depletion and degradation had been seriously addressed by the people. The declining state of the forest has indeed been a subject of discussion in many parts and legislative seats in the study area as the people continue to remain victims of many ecological problems connected with deforestation. In deed, farming in the area is the main occupation of the people where nearly over 80% of the population are farmers. Such anthropogenic activities on the forest environment has exposed the land to rapid soil erosion and associated soil degradation visible in the study area. Accelerated water and wind borne erosion, flooding, and threats of extinction on economic trees, are indeed attenuated by the people's quest for ecosystem services that involves deforestation

In Kogi East, the appropriate models to deal with deforestation issues have not yet been developed. Not much work has equally been done on the use of GIS software in soil studies. Unknowingly, the State Forestry Department lacks comprehensive data base on the two most critical variables connected with deforestation: the rate of deforestation and data on degraded edaphic components in the area. It is therefore expected that through this study, we hope to unravel these miseries and basically to advise government on the need to secure a data bank on an environmental issue of this nature. Such advice and information could be used for varied purposes: research activities, strategic planning, advisory roles, project justification and environmental resources management, among others. Objectively, the study relied on two visions in order to critically examine the rate and the spatial pattern of deforestation in parts of Kogi East, and to critically analyse the rate of degradation caused by outlined Landuse practices in the study area.

REVIEW OF RELATED LITERATURE

Kogi East is located between latitudes 06° 05' and 08° 00' N; and longitude 06° 07' and 07° 05' E (Ukwedeh, 2003) (Fig. 8.1). The study area is located in the tropical region, specifically in the middle belt of Nigeria. Kogi East Senatorial District situates in the eastern flank of Kogi State. The study area covers 8 LGAs of Igala land. It is about 89% of the entire Kogi East. It includes Ankpa, Dekina, Ibaji, Idah, Igalamela/Odolu and 0fu. Others are Olamaboro and Omala LGAs. The area, which is mainly dominated by the Igala speaking people, covers an area of 19,200 sq km (Egbunu, 2009). It is the largest senatorial district in Kogi State.

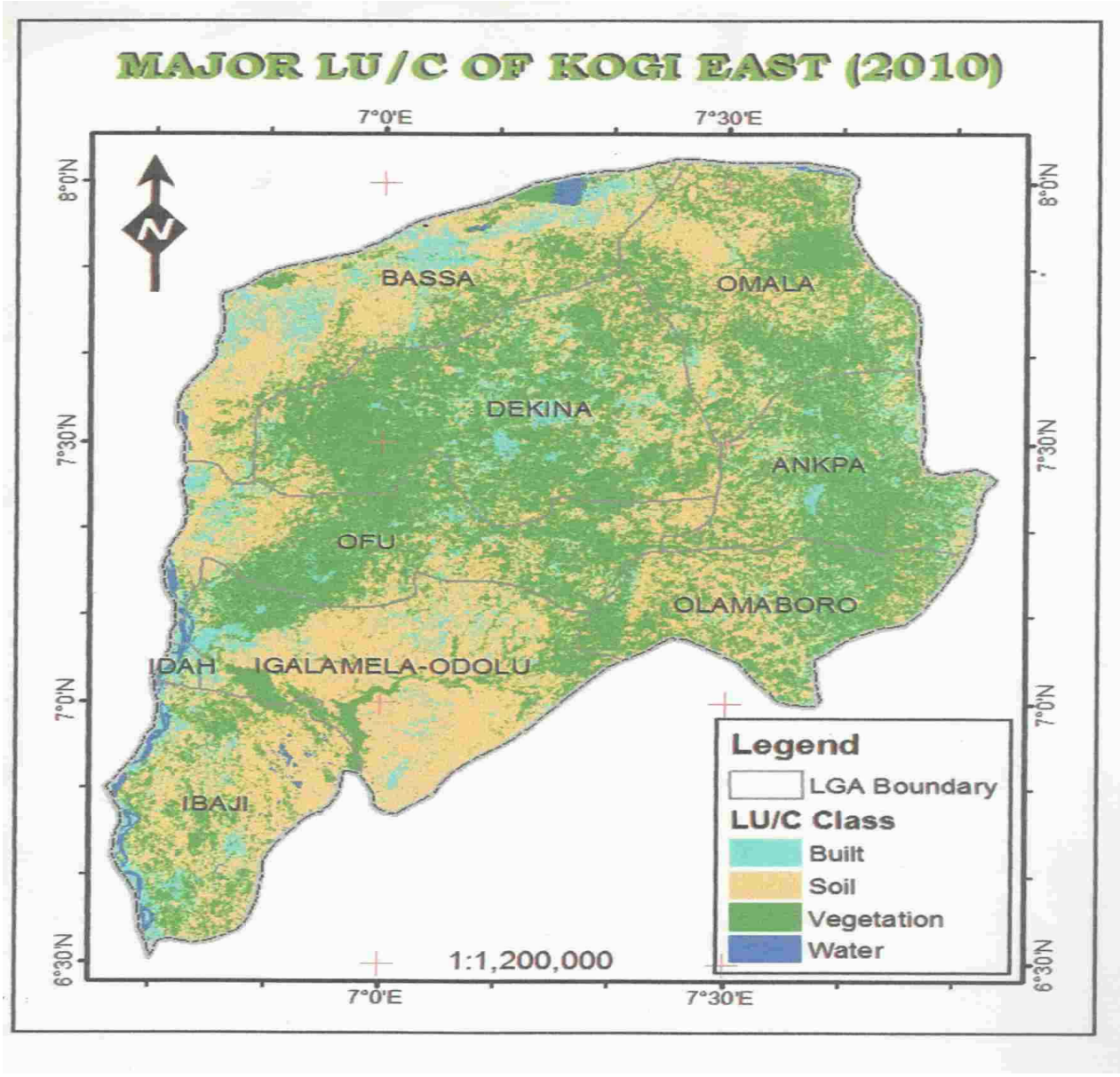


Fig.8.1: Land use/Land cover of Kogi East
Source: NARSDA, ABUJA. (2010).

Kogi East is drained by the two giant rivers: the Niger to the West and the Benue to the north. It is also drained by numerous rivers and streams (e.g., Imaboro river, and streams such as Okura, Inachalo, Ofu, Itemie, Onne, etc.). It shares boundary with the Federal Capital Territory in the north, Benue state in the East, Enugu state in the south and with its neighbors, the Central and Western senatorial districts in the West.

The region lies within the warm humid climatic zone of Nigeria with a distinctive wet-dry season dichotomy. The climate of the area is thus affected by two main air masses: the tropical maritime, Mt, and the tropical continental, cT. Rainfall is heavy within the rainy months with an average of about 1500-2000mm annually (Ocholi, 2007).

Kogi East has a mean annual temperature of 24.5^{o}C. Ocholi (2010) defined the rocks of Kogi East as older sedimentary rocks of the secondary age. These comprise limestone, sandstones, shale and coal. Also present are tertiary rocks comprising of sands and clays dominating parts of the study area, particularly the axis of Ankpa, Omala and Dekina LGAs. The general relief of the area comprises essentially of highlands and lowlands. In the northern and central axis, occur numerous chain of hills and ridges at considerable heights.

The dominant vegetation communities remain the tropical savanna woodland of secondary types and mixtures of scattered tropical trees and grasses formations. Vegetation distribution in this area follows a pattern that is similar to that of rainfall distribution (Ekwedeh, 2003). The floristic composition of the area is derived from three principal features: as a natural transition zone between the tropical grassland of Northern Nigeria and the rain forest down south (preferably called the middle belt region); cultivation in this zone is extensive; and conspicuously consistent and clearly rampant burning which regardless of its purposes, gives grasses propagative edge over herbaceous species (Musa and Ocholi, 2016).

There are numerous socio-economic, social, cultural, political and judicial activities going on in the region. These have engaged a significant number of the people to an extent that the population remains an active one all the year round. The population of the region is unevenly distributed. While some areas are densely or thickly populated, particularly the built up areas, others are moderately or scantily populated. Based on the projected 2006 Population Census figure, the total population of Kogi East is estimated at 1,659,269 persons (NBS, 2007).

MATERIALS AND METHODS

The nature and category of data required to address the basic objectives of the study involve data acquired from satellite images covering 1990-2010 (a 21-year period). The data provided would be used for planning and management purposes and for taking corrective measures against environmental problems prominent among which is soil deterioration, soil erosion, vegetation loss and general degradation of the soil (Ogidiolu, 2003). Scientific study of soil too is a pre-requisite for realistic development because through such study, the genesis, the distribution, classification, capability and suitability, use and management of information can be documented.

The need to work on soil as a land resource and as one of the major components of the biophysical environment was considered from a wide array of backgrounds. It is in that regard that the Agenda 21 of the UN General Assembly did emphasize global land degradation and pollution thence the increased demand for soil data in order to inform the development of environmental policies (FAO/UNEP, 2009).

Reconnaissance Survey

Preliminary sample surveys were carried out from which the people testified that a number of human activities related to land /soil degradation are ongoing. These include farming activities, lumbering, plantations establishment and settlement expansion among others. The sampled population has agreed that farm outputs have reduced and a number of useful forest products (wood, fruits, nuts, fibers and leaves) have disappeared and many settlement areas have emerged and taking over the previously existing forest lands.

Research Design and sources of data

Land use/cover study of the area was conducted with base maps and satellite imageries. These base maps were digitized into the GIS environment with the application of on screen digitization. These tools were used to determine the extent of forest lands that have been cut, changed or lost during the period of study. Information acquired from this study process was primarily meant to assess the extent of degradation caused by deforestation on these edaphic components in the study area. The Google Earth Images of 1990, 2000 and 2010 years were acquired from the internet for this purpose. The analyses involved the use of computer assisted interpretation of the maps and the imageries.

Land use and management practices have major impact on natural resources including soil nutrients, plants, animals and water (Ati, 2008). Similarly, land use information can be used to develop solutions for natural resource management, such as soil salinity and quality, vegetation and water quality. With the advent of earth mapping technology and computerization, it was possible to monitor and manage both rural and urban land use changes in view of the connection they have with deforestation. Scientists use GIS images as models, making precise measurement, classification of data and the analysis thereof becomes more relevant in order to discover significant areas of degradation of the earth resources as they are brought about by deforestation. The imageries in question have been graphically expressed in Figures 2-4 to account for the distribution of these components during the period of study.

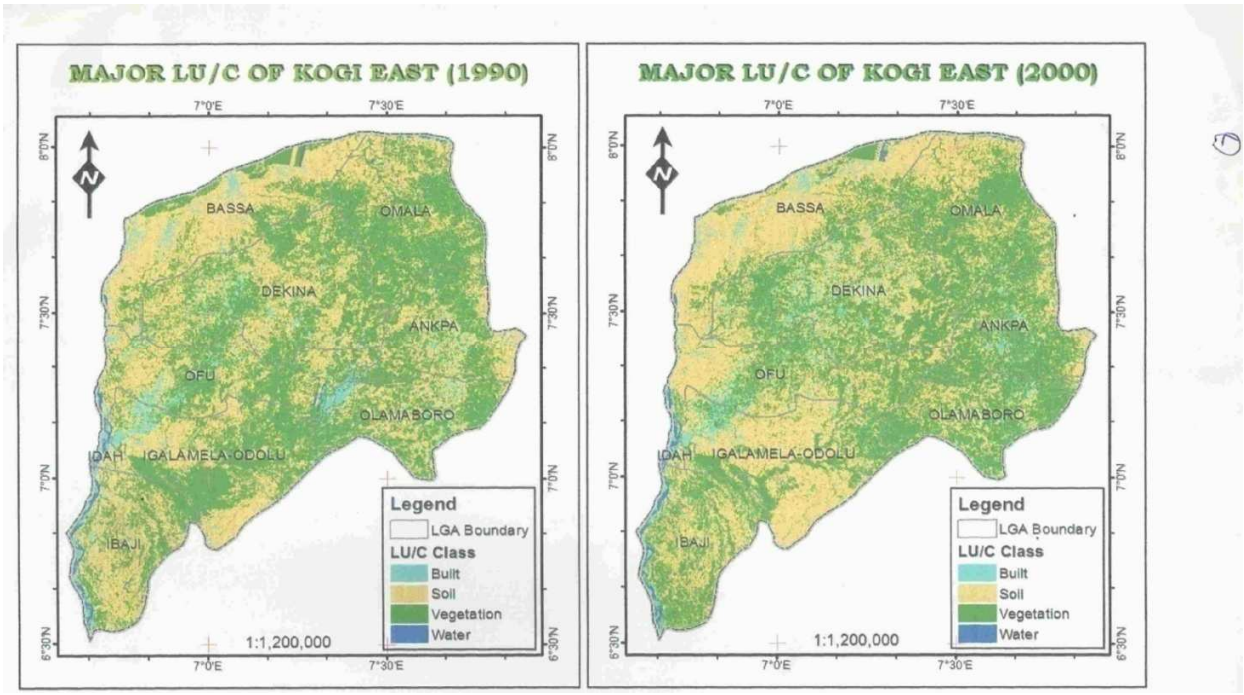
For the GIS analysis, the study depended on the computer assisted interpretation of the maps and satellite imageries. Likewise, field survey was performed throughout the study area using Global Positioning system (GPS) in other to obtain and measure the accurate location points. The adoption of these techniques is paramount; first for originality of data and second for reliability of results hence data on soil provides a forum for an original access to the edaphic environment in which deforestation activities has the greatest effects. We therefore consider this technique as the most relevant scientific process through which objective results could be acquired.

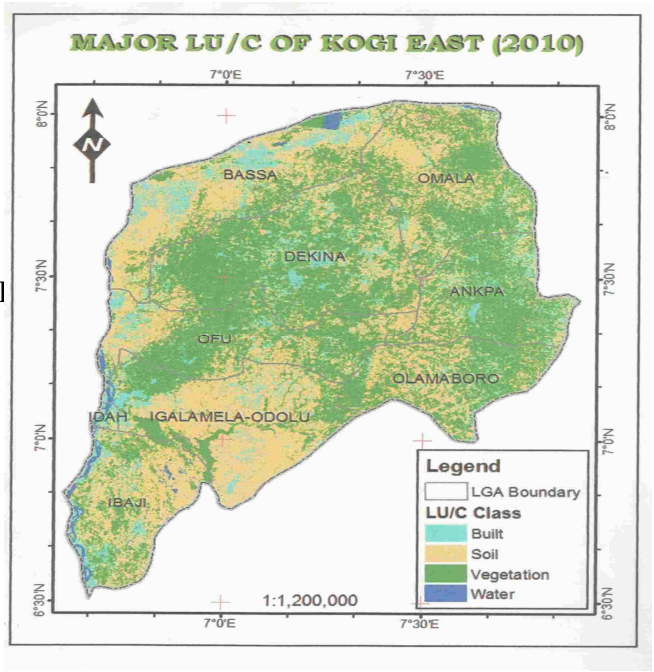
RESULTS AND DISCUSSON

Land Use Study and Socio-Economic Survey of Kogi East

Land Use Study of Kogi East with Satellite Imageries

The period of study covered twenty one years (i.e. 1990-2010). The analysis essentially focused on four prominent environmental components: soil, vegetation, water and built environment. The components in question assume to have intricate relationship with themselves, hence what affects one segment affects the other. In other words, the variables/components are interconnected and the mechanism with which they relate involves exchange of organic nutrients, a prominent feature of biological growth. The use of this model is entirely complimentary to the other techniques used in this study.





Figs.2-4: Major LU/LC of
SOURCE: MASRDA, Al

Table 8.1: Classified landuse/landcover of Kogi East 1990-2010 ((km^2)

S/N	Year (km^2)	Built	Relative (%)	Water	Relative (%)	Vegetation	Relative (%)	Soil	Relative (%)
1	1990	733.4	23	178.6	34.8	6049.8	34.1	6889.5	34.2
2	2000	810.6	26	148.9	29	5813.1	32.8	7078.7	35.1
3	2010	1612.9	51	186.2	36.2	5862.2	33.1	6190.1	30.7
	Total	3156.9	100	513.7	100	17725.1	100	20158.3	100
	% Diff.		7		1		43		49

Source: Field work (2012)

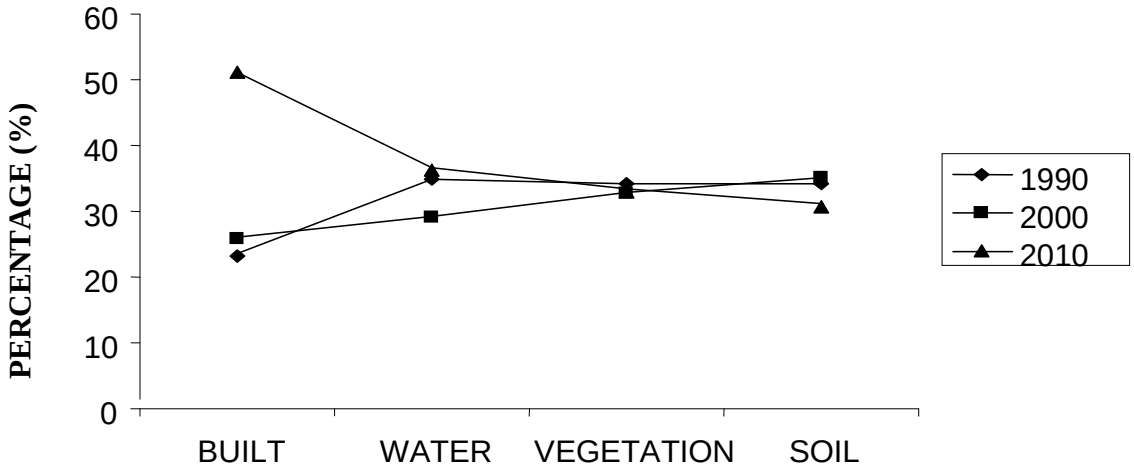


Figure 5: Classified Landuse/Land cover of Kogi East (1990-2010) Km^2
Source: Field Work (2012)

Description of the Land uses

The four main land uses in the study area have been described as follows:

Vegetation: Vegetation in this usage refers to all categories of plant species such as trees, shrubs, herbs, grasses and creepers. Vegetation is represented by green color. It occupies about 6049.8km^2 representing 34.1% of the total land mass of the study area in 1990. By 2000, vegetation covered an area of about 5, 813.1km^2 representing 32.8% of the land area. In 2010 it occupied about 5,862.2km^2 representing 33.1% of the total land area. By this analysis, vegetation structure and composition significantly showed a decline in the year 2000 than in the previous and later years. That means it declined in 2000 and rose again in 2010, an indication of significant afforestation practices and reforestation programmes.

Soil: This feature is represented by pink color. It includes undeveloped soil and rocky landscapes. It covers an area of about 6889.5km^2 in 1990 representing 34.2% of the land. In 2000, soil covered 7078.7km^2 representing 35.1% of the entire land area. In 2010, it was 6190.1km^2 representing 30.7% of the total land area. By this analysis, it was noticed that the Kogi East land area covered with soil was higher in 2000 by 35.1% than the other years. Between 2000 and 2010, this Landuse occupied less proportion of the land

area than the year 2000, less by 0.9% in 1990 and by 4.4% in 2010.. This shows a significant rise in soil usage by the people and thus culminating in soil degradation within the last 11 years and between 1990 and 2010, the early years of the study.

Built up areas: In this category, the facilities/features include socio-economic features such as houses, markets, shops, inland ports, playing fields, farms, stadia, educational, health and cultural institutions. These features are represented by light green color and they constitute 733.4 square kilometers, constituting about 23% of the total land area in 1990. In 2000, built up areas covered about 810.6 square kilometers and this covered 26% of the total land area of Kogi East. In 2010 built up areas covered about 1,612.9 square kilometers representing 51% of the total land mass. When ranged, the built environment component ranked first with $28km^{2,}$ the water component ranked 2^{nd} with 7.2 km^2, soil, 3rd with 4.4 km^2 and vegetation 4^{th} with 1.3 km^2 respectively. This ranging attested to the fact that in the last 21 years, there has been a drastic reduction in vegetation cover, perhaps, the original vegetation hence the lowest range. The results of this analysis thus show that there has been a significant rise of the effects of this land use in the last 21 years in the study area. By this we mean, more houses and perhaps new settlements have emerged. With this trend increase, the effects of this expansion or increase means a reduction of available land/soil space for farming purposes. The increase in urbanization means increased deforestation, perhaps a reduction in vegetal cover.

Water Body: This includes rivers, streams, lakes and ponds. Water bodies are represented by blue color on the map. It covers about $179km^2$ in 1990 representing 34.8% of the total area. However, the most significant of the hydrologic features in the study area are the rivers and streams. In 2000, the size was $149km^2$, but less than that of 1990 and it represents 29% of the landscape. In 2010, it covered an area of $186.2km^2$ and represents 36.2% of the total landuse.

Having analyzed thus, it was confirmed that, among the four landuses covered in this study, soil and vegetation scored the highest proportion at 49.7% and 43.7% in 1990; 51% and 42% in 2000; and 44.7% and 42.3% in 2010 respectively. Both land uses put together covered 93.4% in 1990; 93% in 2000; and 87% in 2010 respectively. Due to human activities, these landuses declined between 1990 – 2010. When all the land uses were compared, it shows that the landscape of Kogi East degraded due to intensity of use. The area of coverage by vegetation and soil at 6049.8 km^2 (43.7%) and $6889km^2$ (49.7%) in 1990 respectively shows a decline of structures and composition of these prominent components of the environment, in this case attributed to high deforestation rate. The proportions of $179km^2$ (1.3%) and $733.4km^2$ (5.3%) were covered by water and built environment for the same period.

Persistent Landuse/Land Cover of Kogi East

Having classified the landuses of the study area during the study period, the level of changes have been configured and compressed for two persistent years (i.e. between 1990 and 2000 and between 2000 and 2010) against the preceding years. The need for this compression and classification was meant to marginally assess the levels or rates of changes that have occurred in order to mark out the critical periods of greater and specific effects of the land uses in the area during these study periods. In this classification therefore, soil and the built environment components showed positive trends in their effects relationship with the environment. That means more human influence in terms of farming, urbanization, infrastructure development; settlement expansion, plantations agriculture, etc were wrought on the environment than the vegetation and water component, which demonstrated negative effects relationship. By 2010, ten years later, perhaps in the later years,

more of the landuses (vegetation, built and water components) positively demonstrated effects relationships with human influence. The soil was negatively affected. But when the records of the previous (+) and later years (-) were compared, a difference of 5.0% shows that the soil still remains critically depleted. However, some levels of soil restoration practices were been put in place in the area during the study period. Nevertheless, the higher levels of degradation was shown by vegetation (42.3%, +), urbanization /built (1.6% +) and water (1.4% +) components than the soil component (44.7 %-).

Table 8.2 and figures 6 and 7 below have been acquired to show the cumulative percentage distribution of the prominent landuses in the study covering 1990-2010.

Table 8.2: Persistent LU/C of Kogi East (1990 – 2010)

LU/LC Class	1990		2000		2010	
	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%
Built	733.4	5.3	810.6	5.9(+)	1612.9	11.6(+)
Water	179	1.3	148.9	1.1(-)	186.3	1.4(+)
Vegetation	6049.8	43.7	5813.1	42(-)	5862.3	42.3(+)
Soil	6889.5	49.7	7078.7	51(+)	6190.2	44.7(-)
Total	13851.7	100	13851.7	100	13851.7	100

Source: adopted from NARSDA, Abuja (2010)

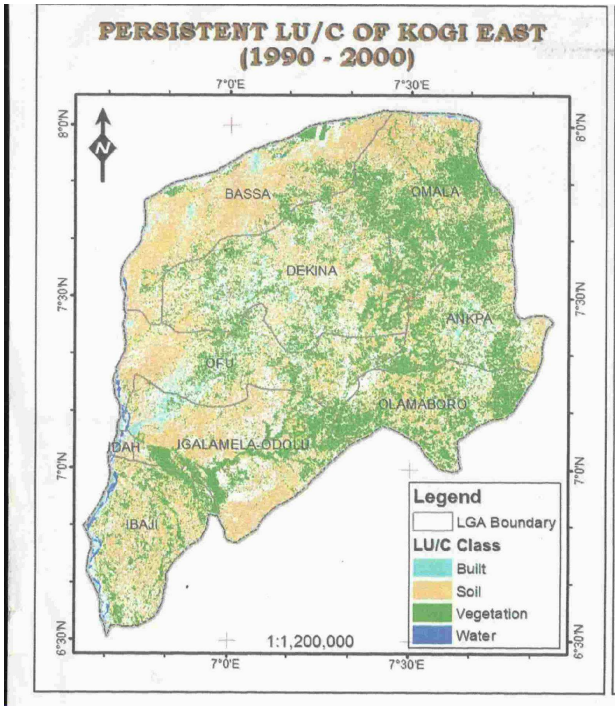


Fig. 8.6: Persistent LU/C of Kogi East (1990-2000)
Source: **NASRDA ABUJA (2010)**

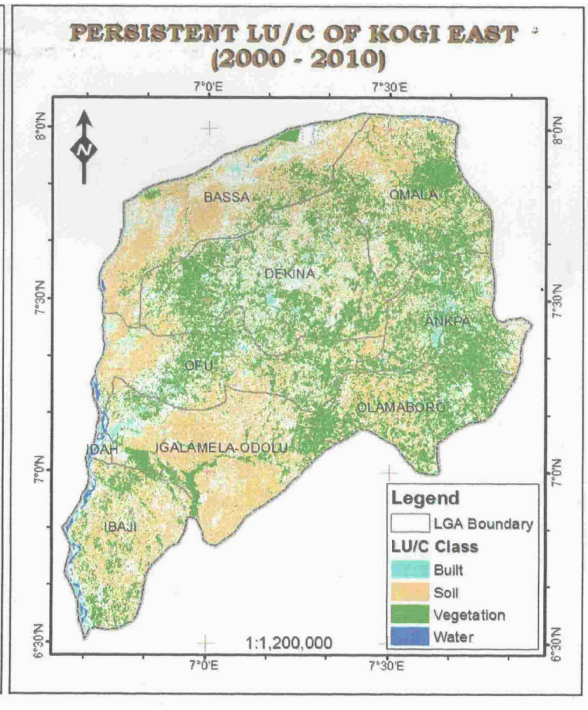


Fig. 8.7: Persistent LU/C of Kogi East (2000-2010)
Source: **NASRDA ABUJA (2010)**

Trend Description of Land uses (1990 -2010)

Table 8.3 and Figure 8.8 below have been used to demonstrate these levels of changes that have occurred in the study area over the last 21 years considering four outstanding landuse components. The adoption of the trend description was meant to analyze the sequence of changes (positive and negative), in the land use categories with a view to determining the rate of changes that have taken place during the study period.

The + and - signs in the analysis shows alternate changes in land use characterization. The + sign means a positive change which invariably means an increase in the number or size of a variable. The - sign means a negative change which in other words means a decrease in the number or size of a variable. On this basis, the changes in the first class or category (Built-up areas) are positive all through. The interpretation is that, the people were actively involved in setting up structures, expanding settlement and engaging in rapid urbanization. In effect, the more the rate of such development, the more they deforest. Likewise, the more the level of deforestation, the more degrading the edaphic components become. This has been significantly proved by the computation on land use analysis.

Table 8.3: Trends Description of Land uses (1990-2010)

	A	B	Range (km^2)	
Land use	1990-2000(km^2)	2000-2010(km^2)		Trend Description
Built	77.2	802.3	730	Higher in B than A
Water	30	37.3	7.3	Higher in B than A
Vegetation	236.7	49.1	188	Higher in A than B
Soil	189.2	888.6	699.4	Higher in B than A

A = Year (1990 – 2010)
B = Year (2000 – 2010)
Source: Field work, 2012.

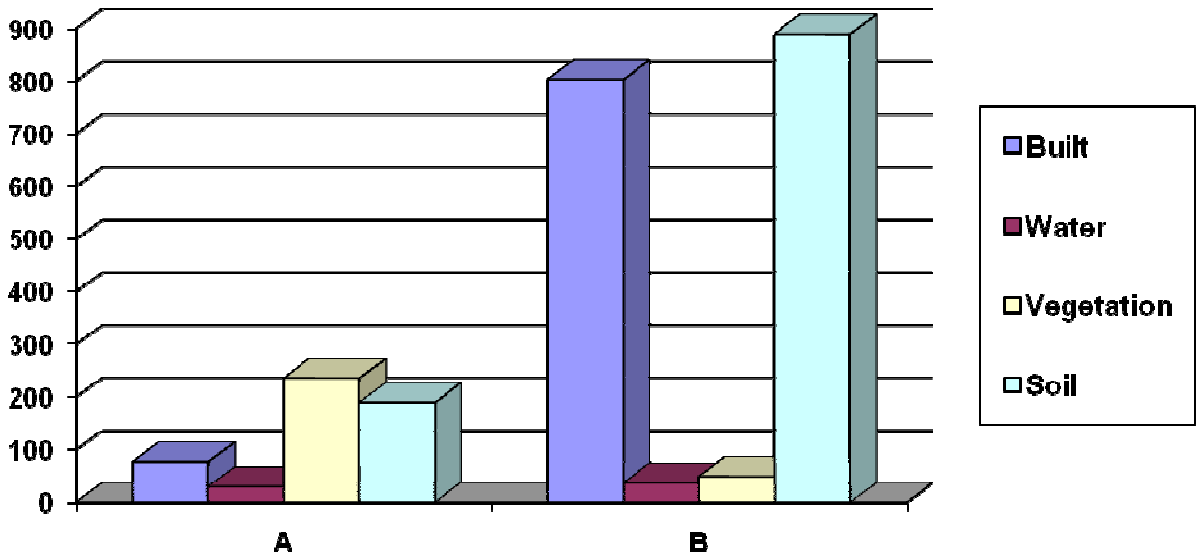


Figure 8.8: Trends Description of the land uses (1990-2010)

Having exhaustively analyzed the results of the landuse studies and in comparative terms, it was discovered that among the land uses, the built environment witnessed the highest effects of deforestation at the rates of 9.2 (+)% and 49.7(+)% between 1990-2000 and 2000-2010 respectively. Between 2000 and 2010, soil ranked first or highest among the land uses. Though, the other variables (water and vegetation) demonstrated some measures of effects relationships with deforestation, these effects were minor and thus insignificant when compared with 'built' and 'soil' components. We can thus conclude from this particular analysis that human settlements or habitation and soil which are linked with these other land uses constitute the most important segments of the environment that caused significant environmental degradation in the study area in the last 21 years. When all the land uses are compared for 1990 – 2000, it shows that 'built' component consumed more forest land than the other land uses at 9.2%. It was followed by water at 5.8%. The third and fourth components are vegetation scoring 1.3% and soil scoring 0.9% respectively. Between 2000-2010, the 'built' component consumed 49.7%, while water consumed 7.2% of the forest land of Kogi East to rank first and second in the category of the most influential variables on deforestation in the later years respectively.

Vegetation and soil components ranked third and fourth at 0.3% and 0.10% respectively. Comparatively, the trend description shows that the influence of this land uses are higher in the last ten years (i.e. 2000-2010) than in the previous years (1990-2000).They could mean that landuse characterization in the study areas grows correspondingly with population increase and expansion of settlements. This trend differences are 75% higher in the last ten years of study than the previous years (i.e. 1990-2000 = 23%; 2000-2010 = 75%). When all the landuses were put into consideration, it was found that 12% of the total landscape of the study area was degraded. This calculated rate of change was computed by subtracting the negative values of the trends analysis from the positive ones. The difference now becomes the calculated rate of change thus: [15550.8km^2(+), 56% - 12152.2km^2(-), 44%] = 3398.6km^2(12%). This trend is indeed reflected in the built, water and soil components of the environment. However this rate is indeed substantial enough to confirm the ongoing human impact on the edaphic components of the environment of Kogi East.

CONCLUSIONS AND RECOMMENDATIONS

This study has shown that the results of the analysis on the effects of deforestation on the edaphic components of the environment in parts of Kogi East are the products of the interaction of a significant number of forces. It was thus confirmed that in most parts of the study area, deforestation has been a recurrent event and its effects on the edaphic components have become pronounced over the last 21 years.

The result also shows that the effects of deforestation on soils in the most habited areas are more pronounced than those in the less habited areas. This thus explains that human activities that constitute deforestation demonstrated higher effects in the deforested areas than in the non- deforested areas, hence landuses in this usage involves deforestation.

These findings prove to be a testimony to the age long deforestation in the study area. Realistically, 12% of the Kogi East landscape or forest land (comprising of vegetation, soil, water and built environment) suffered degradation in the last 21 years based on the results obtained from the classified imageries. Deducting from this study, it is therefore imperative for the people to focus on forest management policy in order to establish more plantations, develop existing ones which houses both indigenous and exotic species of forest products.

In order to fully realize this goal, the growth of wood must at least equal the amount of timber felled, hence the people constitute the greatest degraders of the forest landscape. It is important therefore to advise that forest exploiters should be mandated to ensure that where they cut one tree, two or more trees should be planted to replace the ones cut. It has thus been posited in this work that human influence in the geospace grows correspondingly with the dangers posed to environmental resources. Likewise, the edaphic components of the environment of Kogi East seems to be the worse hit among all other environmental resources of the study area as substantial parts of the forest environment have been depleted thereby subjecting a significant proportion of the soil and vegetation to profusely degraded state. The need for this study was of course predicated on the dear need of the people that recognize their forests and the resources they contain as resources of great value. They are therefore regarded as less productive for further use unless serious reforestation efforts are embarked upon to restore the degraded components; hence an increase in human influence corresponds with increase effects on the forest ecosystem. Such measures could only succeed within the framework of ecological security, social equity and ecosystem sustainability which indeed must be in line with the principle and standards set by the Millennium Development Goals (MDGs). In order to realize these objectives and perhaps the vision 2020, any fight against deforestation in Kogi East must be a collective one and a task that must be done considering the fact that these edaphic components have crucial roles to play in sustaining the life of the people.

REFERENCES

Abdulkadir, A. (2007): An Appraisal of the people's Perception of Environmental Degradation Issues in Minna, Niger State, Nigeria; *The Abuja Journal of Geography and Development;* Vol. 1, No. 2, pp 104-105.

Abula, M. and Awoyemi, T.T. (2010): Forest Dependency in a Rural Economy as a Strategy for Poverty Reduction in Kogi State; *Confluence Journal of Environmental Studies*, Vol. 5, pp1&2.

Adedayo, A. G; Sale, F.A. and Kekeh, O. (2012): Household Wood Energy Utilization Patterns and its Impact on Deforestation in Akoko South West LGA, Ondo State, Nigeria; *Forests and Forests Products Journal* Vol. 1. pp 51-57.

Adeoye, N. O.(2006): Temporal Analysis of Land use /Land cover Change in Ijesa-Ekiti.

Region of South Western Nigeria; Journal of Geography and Planning Sciences, Vol. 1, No. 2, pp 33.

Aiyelari, E.A. and Oshunsanya, S.O.(2008): Preliminary Study of Soil Erosion in a Valley Bottom in Ibadan under some Tillage Practices; *Global Journal of Agricultural Sciences,* Vol. 7. No. 2, pp 221-222.

ANON, (2011): *The New Encyclopedia Britannica;* Encyclopedia Britannica Inc; U.S.A.; Vol. 16, pp 599-620.

Asthana, D.K. and Asthana, M. (2005): *Environment: Problems and Solutions;* S. Chand and Co. Ltd, Ran Nagar, Naw Delhi.

Ati, F.O; Danjuma, A. and Mohammed, O.S. (2008): The Application of Geoinformatics in Assessing Land use Changes in Kaduna South, Kaduna, Nigeria; *The Zaria Geographer*; Vol. 17, No. 1, pp 45.

Banyuy, P.N.(2006): The Environmental Impact of the Chad -Cameroon Pipeline within the Ocean Division in the Republic of Cameroon; *Unpublished M.Sc Thesis*, Department of Geography, University of Nigeria, Nsukka.

Essoka, P.A. Essoka, A.N., and Miginyawa, A.S. (2010 :) Assessment of soil

properties under holder farming practices for food Security and sustainable Enviromental in a Sudan Savanna Region; in Ogidiolu A; Musa, S.D. and Ifeatimehin. O.O; *Contemporary issues in Infrastructural Development and Management Nigeria;* Being a conference proceedings Published by the Department of Geography and Planning, Kogi State University, Anyigba, Nigeria; pp 358-359.

FAO/UNEP, (2006): *Deforestation in Africa; Microsoft Encyclopedia*, Encarta Suite.

Hagan, K.I. (2006): *Deforestation: an International Analysis;* Unpublished Research Paper, Number X21, Unemoni, XDEFOR.

Ifatimehin, O. O. and Ufuah, M.E. (2009): Analysis of Urban Expansion and Loss of Vegetation Cover in Lokoja Using GIS Techniques; *The Zaria Geographer, Vol. 17, No. 1, pp 28-29.*

Jimme, M.A; Kagu, A. and Yahya, S.A.(2010): Environmental Resources Management in Borno State, Nigeria: Religious Perspectives; *Journal of Environmental Issues and Agriculture in Developing Countries; Vol.2, No.1, pp 1-6.*

Musa, S.D. and Ocholi, I.U. (2016): Analysis of Effects Responses by the Chemical Properties of Soil to Deforestation Phenomena in Parts of Kogi East; Being a *Conference Paper presented at the Association of Nigerian Geographers' Conference* holding at the University of Lagos, April 10^{th} – 15^{th}, 2016.

National Bureau Of Statistics (2007): *Social Statistics in;* N.B.S-Abuja, Nigeria.

Obi, C.O. Nnabude, P.C. and Onuoha, E. (2005): Effects of Kitchen Wastes Composts and Tillage on Soil Chemical Properties; *Nigerian Journal of Agriculture, Vol. 3, pp 69-70.*

Ocholi I.U; (2007): "Environmental Impact of Deforestation in Dekina LGA of Kogi State" *Unpublished M Sc. Degree Project, Department of Geography, University of Nigeria, Nsukka.*

Ocholi, I.U; (2010): Socio-economic significance of Forests to the people of Dekina LGA, Kogi State; *PG Seminar paper 1, Department of Geography and Planning, Kogi State University, Anyigba.*

Ocholi, I. U. (2015): Analysis of the Effects of Deforestation on Edaphic Components in Parts of Kogi East; Unpublished Ph.D. Thesis, Department of Geography and Environmental Studies, Kogi State University, Anyigba, Nigeria.

Ogidiolu, A. (2003): "Field Methods in Vegetation Studies"; in Jimoh, H.I; *Techniques in Environmental Studies,* Nathadax Publishers, Ilorin, Nigeria.

Sills, E.O. and Pattanayak, S.K. (2010): *Tropical Forests;* Wikipedia Encyclopedia.

Ukwedeh, J.N. (2003): *History of Igala Kingdom;* Ahmadu Bello University Press Ltd; Zaria- Nigeria.