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ASSESSMENT OF THE VARIATION OF SOIL PHYSIOCHEMICAL PROPERTIES ON DIFFERENT LANDUSE IN MBAYEGH DISTRICT, USHONGO LOCAL GOVERNMENT AREA, BENUE STATE, NIGERIA.

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Abstract

This research aimed at assessment of the variation of soil physiochemical properties on different land use in Mbayegh District, Ushongo Local Government Area, Benue State. The research was conducted during the rainy season (May to July 2019) with the objective of evaluating the effects of three-land use practice on soil physiochemical properties. Three major land use types: natural forest, grazing and cultivated lands were selected while 15 soil samples were randomly collected from 0-20cm depth. All soil samples from the land use types were subjected to laboratory analysis and statistical tools such as Analysis of Variance (ANOVA) were used for hypothesis testing. The result reveals that, Soil pH values ranged from (6.10–6.44), moisture content ranged from (19.86-21.52 %), bulk density ranged from 1.58-1.70 gcm-3, and porosity range from (35.77-40%). The soils were deficient in nitrogen (0.24-0.24 gkg^{-1}), potassium 0.24-0.66 Cmol/kg, calcium 2.84-3.10 Cmol/kg, organic carbon ranged from (0.45-1.46gkg^{-1}, magnesium 2.40-2.76 Cmol/kg and low cation exchange capacity (6.71-7.43 Cmol/kg) due to low levels of organic matter (0.78-2.47 %,). Sand and clay particles, bulk density, silt, pH, total nitrogen, available magnesium, calcium, cation exchange capacity and exchangeable iron were significantly affected ($p<0.05$) by land use. In contrast, total porosity, bulk density, moisture content, organic carbon organic matter, potassium exchangeable Ca, and sodium were not significantly ($p<0.05$) affected by land use. The study also recommended the need for use of set-aside programmes, land use zoning policies that encourage productive and sustainable land use practices should be implemented for sustainable agricultural productivity in the study areas.

Keywords: Soil, Physiochemical Properties, Landuse and Landuse changes

1. Introduction

Soils are indispensable resources that have been exploited for thousands of years for several purposes resulting in their degradation (Eswaran et al., 2001; Junge and Skowronek, 2007). Soil is a mixture of organic matter, minerals, gases, liquids and organisms that together support life (Kang and Fox, 1981). Soil degradation is the physical, chemical and biological decline in soil quality. It can be the loss of organic matter, decline in soil fertility, decline in structural condition, erosion, adverse changes in salinity, acidity or alkalinity and the effects of toxic chemicals, pollutants or excessive flooding (Adaikwu, Obi and Ali, 2012).

Land use concerns the products or benefits obtained from use of the land as well as the land management actions (activities) carried out by humans to produce those products and benefits. Land use is categorized as follows:

Pasture/range, Forest, Cropland, Urban and others. Land use and land management practices have a major impact on natural resources including water, soil, nutrient, plants and animals. More recent significant effects of land use include urban sprawl, soil erosion, soil degradation, salinization and desertification (FAO, 1995). Soil degradation is one of the greatest challenges facing humanity. Its extent and impact on human welfare and the global environment is more severe now than ever before. Due to its enormous impact, soil degradation leads to political and social instability. It is associated with enhanced rate of deforestation, intensive use of marginal and fragile soil, accelerated runoff and erosion, pollution of natural waters and emission of greenhouse gases into the atmosphere (Adaikwu, Obi and Ali, 2012).

In Nigerian Savanna region, nitrogen is reported as the most limiting nutrient for crop production and this problem has been compounded in recent times by difficulties farmers faced in obtaining nitrogen fertilizers (Muhr *et al*., 2001; Odunze, 2006). These reasons made the effort by farmers to replenish soil fertility in the Nigerian Savanna area thereby encouraging continued degradation of soils in the area. In the Southern Guinea savanna, particularly Benue State which is regarded as the "Food Basket of the Nation", farming is the predominant economic activity. The continuous unguided use of the soils for agricultural production, pasture/range, forest, urban and others and other benefits had exposed the soils to different forms of degradation (Muhr *et al*., 2001; Odunze, 2006).

Land use changes, especially cultivation of natural lands in tropical areas have led to negative effects on soil organic matter components in which Nigeria is not exceptional (Fallahazade and Hajabbasi, 2011). With continuous cultivation, physical properties and productivity of soils commonly decline due to decrease in organic matter content and soil pH (Oguike and Mbagwu, 2009). Intensive cropping has also been recorded to lead to disaggregation in surface soil due to decrease in organic matter. But bush fallowing has been proved by Juo *et al*., (1995) as an inevitable method to restore the physico-chemical and biological properties of soil while Ewel (1986) considered it to be efficient for nutrient recycling and biomass accumulation because it consist of many plant species with different type of root system. Yemefack and Nounamo (2002) in their work on the effect of fallow period on topsoil in Southern Cameroun stated that humus content increases and consequently increased the organic carbon and this correlated with the result of Kirchlof and Salako (2000) in Southern Nigeria. The system of mono cropping of trees has been discouraged because of the rate of nutrient uptake with fewer returns to the soil (Padley and Brown, 2000). In a homogenous plant community, the stage of development of plant communities affects both the nutrients uptake and nutrient return which causes differentiation of soil properties (Ogunkunle and Awotoye, 2011).

Assessing land-use induced changes in soil properties is essential for addressing the issue of agro-ecosystem transformation and sustainable land productivity. It is against this background that this study is carried out in order to evaluate the effects of different soil physicochemical properties on different land use on soils of Mbayegh District of Benue State with a view to recommending better management strategies that will enhance suitable use of the soil resources under continuous cultivation (rain fed and irrigated agriculture) in the area By determine the soil physical properties under the different land use surfaces in the study area, determine the soil chemical properties under the different land use surfaces and access the variability and compare the influences of physiochemical properties of soils on different land use surfaces in the study area.

2. Literature Review

2.1 Soil

Soil is the foundation for nearly all land uses (Herrick, 2000). Together with water, soil constitutes the most important natural resources of our physical environment. The wise use of this vital resource is essential to promote sustainable development, feed the growing world population through agricultural activities and maintain environmental health (Arshad and Martin, 2002; Chimdi *et al.*, 2012). The manner in which soils are managed has a major impact on agricultural productivity and sustainability (Chimidi *et al.*, 2012). In the past few decades alone, the global grain production growth rate has dropped from 3% in the 1970s to 1.3% in the early 1990s, which is one of the key indicators of declining soil quality on a global scale (Steer, 1998). Many agree that no agriculture system can be claimed to be sustainable without ensuring the sustainability of soil quality (Arshad and Martin, 2002). Indeed, the maintenance of enhancement of soil quality is considered a key indicator of sustainable agricultural system (Wosen and Sheleme, 2011).

There are centuries-old reports of agrarian peoples comparing the relative productivity of land and soil as they used them for crop production (Warkentin, 1995). Early delineation of landscape, based on productive potential was largely a process of trial and error. Location of the best soils and some of the factors associated with good soil productivity became indigenous knowledge that was passed to succeeding generations. Delineating the natural productive potential of soils became more precise and a matter of record as taxonomic, survey and mapping systems were fully developed in the last century.

Productive changes within a field or soil type due to management were recognized later, especially with the advent of post-WW-II agricultural development (Schoenholtz, Van and Burger, 2000). Changes in soil productivity were positive due to drainage, tillage and addition of time and fertilizer and negative due to soil erosion, loss of organic matter and physical structure and other degrading processes. Both positive and negative processes occurred simultaneously, making it difficult to associate changing yields with certain cultural practices. Differences in soil due to natural or human-induced change were measured indirectly using relative crop yield, but factors such as draft requirements for tillage, or the cost of inputs required to achieve a certain yield were equally important (Warkentin, 1995). Farmers manipulate soils intensively. Therefore, a comparative measure of soil quality has traditionally included more than a simple measure of yield.

Foresters usually define soil productivity as the ability of a soil to produce biomass per unit area per unit times (Ford, 1983). On the other hand, agronomist and farmers most often define soil quality as the suitability of soil to function for different uses (Warkentin, 1995), which illustrates a broader concept and the fact that agriculture has traditionally been more soil-interactive than silviculture. Soil quality includes a measure of a soil ability to produce plant biomass, maintain animal health and production, recycle nutrients, store carbon, partition rainfall, buffer anthropogenic acidity, remediate added animal and human wastes and regulate energy transformations (Schoenholtz *et al.*, 2000).

Evaluating and measuring the quality of soil resource was promoted by this increasing awareness that soil serves multiple functions in maintaining worldwide environmental quality (Doran and Parkin, 1994). Public awareness was raised when the National Academy of sciences published soil and water quality; An Agenda for Agriculture (National Research Council, 1993). In response, a group within the soil science society of America set about to define soil quality, examines its rationale and justification and identify methods for evaluating it (Karlen *et al.*, 1997).

2.1.1 Physical Properties as Indicators of Soil Quality

Productive soil have attributes that promote root growth, hold and supply water, cycle mineral nutrients, promote optimum gas exchange; promote biological activity and accept, hold and release carbon (Burger and Kelting, 1999). All of these attributes are in part, a function of soil physical properties and processes. Some of these soil physical properties are static in time and some are dynamic over varying time scales. Some are resistant to changes by different management practices, while some are change easily in positive and negative ways if change, some properties and processes will recover at varying rates while others irreversible. All of these factors will determine the extent to which each soil property or processes is useful for measuring soil quality and monitoring the maintenance of soil quality through time. Basic physical indicators that have been proposed by researchers as soil quality indicators include soil texture, soil structure, soil bulk density and soil colour.

2.1.2 Chemical Properties as Indicators of Soil Quality

Soil chemical indicators are used mostly in the context of nutrient relations and may therefore be referred as indices of nutrient supply (Power *et al.*, 1998). They express to some extent, the dichotomy between the need for simplicity and practicability, which tends to favour static parameters (that is point in time) that are easily and routinely measured. Hierarchically, several chemical properties of soils levels are measured from soil function and the desire remove from accurately represent the dynamic process that underlie site productivity, which tend to involve more laborious and or costly assays (Schoenholtz *et al.*, 2000).

2.2 Concept of Land

This is a delineable area of the earth's terrestrial surface, encompassing all attributes of biosphere immediately above or below this surface, including those near-surface climate, soils and the terrain forms, surface hydrology (including shallow lakes, rivers, marshes and swamps), near surface sedimentary layers and associated ground water reserve, plant and animal populations, human settlement pattern and physical results of past and present human activity (UN 1994; FAO/UNEP, 1994). Agricultural land is the land that is arable and regularly tilled for the production of annual field crops, with or without irrigation (UN 1994; FAO/UNEP, 1994). It provides direct benefits for humanity through the production of food, fibre, forage and fodder, bio-fuel as well as timber. It does not however include deserts, barren land, non-managed wetlands, forests and built-up areas (FAO, 1995).

2.3 Concept of Land Use

Land use is defined as the arrangement, activity and input people undertake in a certain land cover type to produce, change or maintain it (FAO, 1984; FAO, 1997). It involves the management and modification of natural environment or wilderness into built environment; such as fields, pastures and settlements (FAO, 1984). It is also often used to refer to the district land zoning which is a device of land use planning used by local governments in most developed countries (FAO, 1997). Land use could be derived from the practice of designating permitted uses of land based on mapped zones and which separates one set of land use from another. Land zoning may be use-based and may regulate building height, coverage and similar characteristics or their combinations.

2.4 Effects of Land Use on Soil Properties and Soil Erodibility

Land use changes affect many natural resources and ecological processes such as surface runoff, erosion and changes to soil resilience (Fu *et al.*, 2000). The increasing intensity of land use may cause erosion and soil compaction through changes in soil physical and chemical properties (Qygard *et al.*, 1993; Islam and Weil, 2000; Chen *et al*., 2001; Caravaca *et al.*, 2002; Wang *et al*., 2006; Misir *et al.*, 2007).

2.4.1 Properties

Physical properties vary from one land use type to another and include morphological properties such as colour, texture, structure and consistency. Soil texture shows proportional distribution of soil particle size fractions and affects soil water characteristics, erosion potential and nutrient budgets. For instance, it has been noted that land use changes affect soil texture through modification in the sand, silt and clay contents (Lal, 1996). Its influence on bulk density include increase in value of soils under continuous cultivation and residential layouts relative to those under natural forest as evidenced by low compaction in the later than the former (Kim *et al*., 2010). Also due to compaction from certain land use types, pore volumes are reduced resulting to depressed infiltration and soil porosity (Charma and Murphy, 2007). Land use equally affects soil moisture content. In studies by Charma and Murphy (2007), soil moisture content was reported to vary in the order: arable land use > oil palm/cocoyam > grassland > forestland. They attributed the variation to differences in soil textural attributes. Influence of land use on soil hydraulic conductivity includes depression in value due to increased soil compaction and which affect water drainage down the soil (Taylor and Ashcroft, 1972). In studies of the influence of land use on soil properties; saturated hydraulic conductivity (Ksat), bulk density; and water stable aggregates, higher values of hydraulic conductivity (Ksat) were reported in the top soils of natural forests compared to those of grassland soils (Gol, 2009).

2.4.2 Chemical Properties

Effect of land use on soil chemical properties; especially, soil organic matter quantity and quality varies. It has been reported that conversion of forests into other land uses caused a decline in soil organic carbon (Allmaras *et al.*, 2000). This manifested as a depression in soil aggregation or structure (Kourtev *et al.*, 2003) and other chemical and physical soil properties (Dexter, 1998). Organic carbon serves as an important tool in determining soil health, quality and stability against degradation. Onasanya (1992) and Akamigbo (1999) reported that organic carbon has significant positive influence on soil pH, colour, buffering capacity, water holding capacity, base saturation and cation exchange capacity.

3. Methodology

3.1 The Study Area

Mbayegh District is one of the eleven Districts in Ushongo Local Government Area. It is located within Ushongo Local Government Area of Benue State which lies between latitude 6^0 48'N and $7^0$15''N of the equator and longitude $8^0$40'E and $9^0$13'E of the Greenwich Meridian (Directorate of information, 2016). The district bounder to the North by Mbagwaza and Utange District, to the West by Vandeikya L.G.A, to the East by Ikov District and to the South by Kwande L.G.A. Mbayegh district is occupying a total land area of about 125 square kilometres.

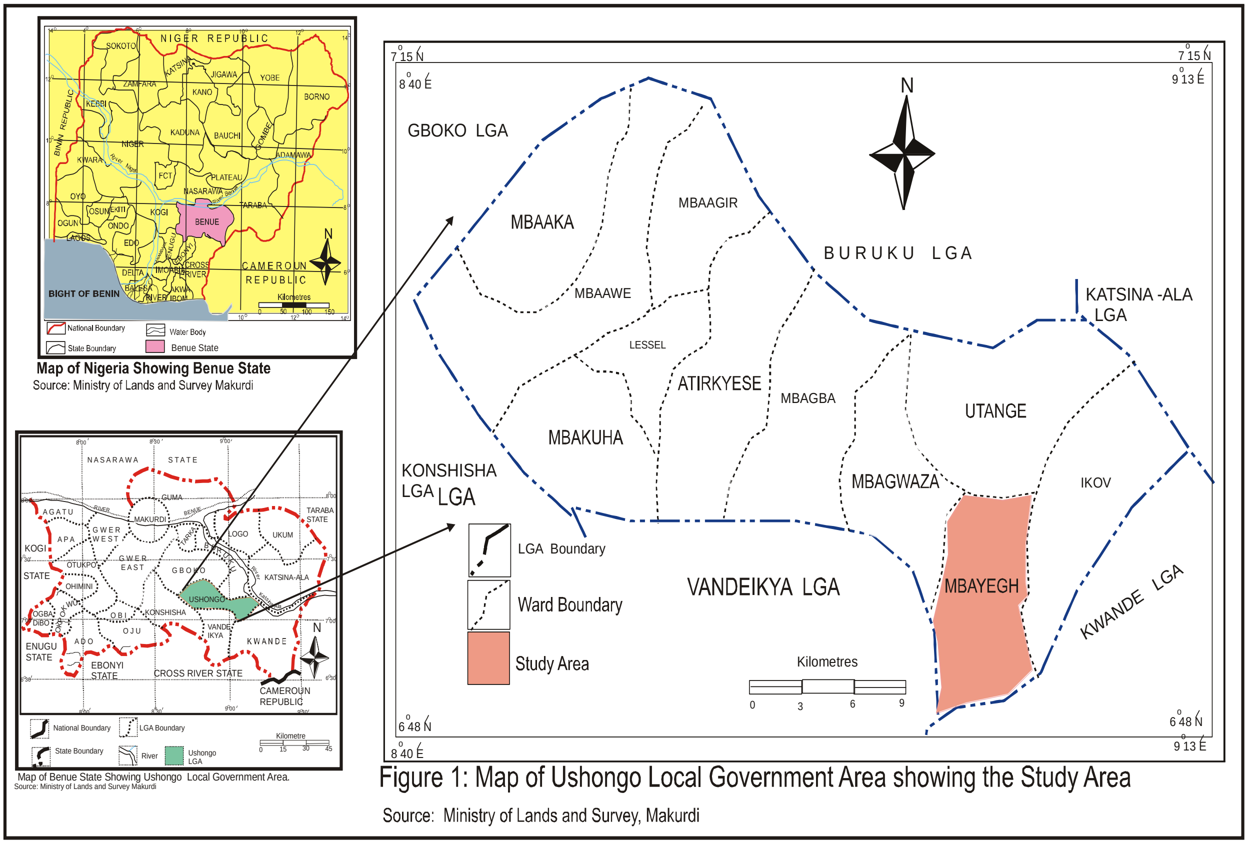

Figure 1: Map of Ushongo Local Government Area showing the Study Area

Source: Ministry of Lands and Survey, Makurdi

Figure 1. Map of Ushongo Local Government Area Showing the Study Area
Source: Ministry of lands and survey, Makurdi

3.2 Sample and Sampling Technique

Field survey and soil sampling was carried out using the quadrate approach. In each identified and delineated land use cover, five plots of 5 m by 5 m were established, after which soil samples were randomly collected from the 0-20 cm layer of the soil using a soil auger. In all, soil samples covering the three study sites collected was carefully labelled and store in polythene bags and placed in a cooler to keep the samples at moderate temperature. 15 samples were collected from the field 5 from the cultivated lands, 5 samples from forested area and the 5 from grazing land as indicated in Table 1.

Table 1 Sampling locations and their coordinates in Mbayegh District of Ushongo LGA

S/N	SAMPLE LOCATION	LAND USE TYPE	LATITUDE	LONGITUDE
1	Mbatsumba	Cultivated Land	6.946638	9.209730
2	Ukum	Cultivated Land	6.949673	9.204297
3	Ukum	Forested Land	6.953088	9.207673
4	Mbatsumba	Cultivated Land	6.958275	9.213238
5	Mbahilagh	Cultivated Land	6.928673	9.211452
6	Mbaibugh	Grazing Land	6.976652	9.265853
7	Ushongo Hill	Grazing Land	6.978443	9.266543
8	Mbaibon	Forested Land	6.980410	9.257175
9	Ushongo Hill	Grazing Land	6.979042	9.255474
10	Ushongo Hill	Grazing Land	6.980528	9.253130
11	Ushongo Hill	Grazing Land	6.978648	9.248523
12	Gbatse	Forested Land	6.991988	9.259873
13	Gbatse	Forested Land	6.992803	9.263870
14	Gbatse	Forested Land	6.987908	9.266545
15	Mbaibon	Cultivated	6.991172	9.254692

Source; Field studies 2019

3.3 Type and Sources of data required

The data needs of this study were the physical and chemical properties of three-land use (secondary forest, grazing and cultivated land) of the study area. For the purpose of this research, data were collected in primary sources. The primary source is basically on the field work.

The following are the specific variable;

i. Physical properties: soil structure, colour, particle size distribution (soil texture), bulk density, porosity as well as moisture content.
ii. Chemical properties: organic matter, pH values, exchange capacity, phosphorus, calcium, magnesium, potassium, Nitrogen, sodium, iron manganese, copper and Aluminum.

3.4 Methods of Data Analysis

i. Laboratory Analysis

The samples collected were taken to the laboratory air dried and sieved for analysis. The treated soil samples were subjected to analysis based the following: Physical properties: Soil colour, Soil Structure, Soil Texture, Bulk Density and Moisture Content. Chemical properties: Cation Exchange Capacity (CEC). Organic Matter, Nitrogen (N), Phosphorus (P), Calcium (Ca) and Magnesium (Mg), Sodium and Potassium, Iron (Fe), (Kang and Fox, 1981; Belay and Dextel, 2003).

ii. Statistical Analysis

Result of the soil analysis obtained was subject to simple descriptive statistics of tables, averages and one-way analysis of variance (ANOVA). The one-way analysis of variance was performed to determine the properties of soil varied significantly among the various land covers and compare the influence of the use types on the measured soil properties in the study area.

4.0 Results and Discussion

4.1 Soil Physical Properties under different land use

The Table 2 show the laboratory result of Soil Physical Properties under different land use at the depth of 0-20cm from the study area.

Table 2: Soil Physical Properties under different landuse

Land Surface	colour	Bulk density (g/cm^3)	porosity %	sand %	silt %	clay %	moisture Content %	Hue	Value	Chroma
Cultivated Land	Pale Redclay	1.58	40.07	69.61	9.38	21.00	21.52	10R	6	2
Grazing Land	Dark Gray	1.70	35.77	70.81	8.89	20.20	20.28	10R	4	1
Forested Land	light Brown	1.68	36.52	71.77	11.08	17.14	19.86	7.5R	7	1

CL=Cultivated Land, GL=Grazing Land, FL=Forest Land.
Source: Authors Analysis (2019)

The physical properties of soils studied in the three-land cover is presented in Table 2.The result from Table 4.1 indicate that soil in the cultivated land are generally pale red with 10R hue, 6 value and 2 chroma in color and those of grazing land are dark gray with 10R hue, 4 value and 1 chroma while in the forested area, the soil are light brown in color 7.5R hue, 7 value and 1 chroma. Clay content in the surface layer (0-20 cm) of the soils varied significantly ($P < 0.05$) among the land use types (Table 2). Its content was significantly high in cultivated land (21.00%) as compared to the forest (17.14%) and grazing lands (20.20%). Similarly, Alemayehu, and Sheeme (2013) ported lower clay content in cultivated land than the adjacent soils under natural forest. The reason for low clay in surface layers of cultivated lands might be due to selective removal of clay from the surface by erosion. The silt content was significantly ($P < 0.001$) higher in cultivated land (9.38%) than the other land uses (Table 2), implying cultivated land is more susceptible to erosion than the adjacent forest (11.08%) and grazing lands (8.89%). On the other hand, sand showed non-significant ($P > 0.05$) difference among the land uses (Table 2).

The bulk density values ranges from 1.58 to 1.70 gkm^3. Bulk density in grazing land was higher with about 1.70 gkm^3 as compare with secondary forestland and cultivated land, which has value of relatively 1.68 gkm^3 and 1.58 kgm^3 respectively.

4.2 Soil chemical Properties under different landuse

The Table 3 present the laboratory result of Soil chemical Properties under different land use at the depth of 0-20cm from the study area.

Table 3: Soil chemical Properties under different landuse

Land Surface	pH (1:1)	O.C %	O.M %	N %	P (mg/kg^{-1})	K	Na (cmol/kg^{-1})	Mg	Ca	CEC	Fe ppm
Cultivated Land	6.10	0.45	0.78	0.38		0.24	0.24	2.54	2.84	6.93	0.33
Grazing land	6.24	1.46	2.47	0.54		0.28	0.24	2.76	3.10	7.43	0.41
Forested land	6.44	1.15	1.98	0.49		0.66	0.24	2.40	2.88	6.71	0.31

O.C= Organic Carbon, O.M= Organic Matter, N= Nitrogen, P= Phosphorus, K= Potassium, Na= Sodium, Mg= Magnesium, Ca= Calcium, CEC= Cation Exchange Capacity, Fe= Iron

Source: Authors Analysis (2019)

As indicated in Table 3, the soils of the area are milky acidic with a pH ranges between of 6.10 to 6.44. The acidic nature of the studied soil is attributed to the high rainfall resulting to the leaching of some basic cations; especially calcium from the surface horizon of the soil in the study area. As reported by Ndukwu *et al*., (2009) low pH values of the various land use types could be ascribed to inorganic fertilizer application and severe base leaching by the high tropical rainfall (Lal, 1996; Ndukwu *et al*., 2009). It could also be due to the abundance of iron and aluminum ions and the resultant net reduction in the soil pH (Olson and Sommers, 1990). The general low levels could be as a result of management practices involving high burning and intensive land use as well as the reduction in fallow period (Akinrinde and Obigbesan, 2000 ;Anikwe 2010). Soil organic carbon ranged from 0.45 % on the cultivated land to 1.15 % on the forested land to 1.46 % on grazing land (Table 3). Low organic carbon content in the study area were found to be due to rapid decomposition and depletion of plant materials. Reduction in soil organic carbon due to conversion of forests into more intensive land uses have been reported (Anikwe, 2003; Ndukwu *et al*., 2009; Anikwe, 2010). The general low levels could be as a result of management practices involving high burning and intensive land use as well as the reduction in fallow period (Akinrinde and Obigbesan, 2000; Anikwe 2010).

The nitrogen content of soils of the study sites range from 0.38-0.54 % (Table 3). The low N content in the soils could be as a result of rapid rate of organic matter decomposition, excessive leaching of nutrients down the soil profile and crop removal and erosion during the rainy season. Most savannah soils of Nigeria have very low total N content (0.04 – 0.05%) as against the normal range of 1-6 % N (Adetunji and Adepetu, 1990). The soil is considered suitable for agriculture even though they have low N content but due to moderate organic matter content in the soils, the N would be supplied to the soil through decomposition of organic matter. It has been found that total N constitutes the bulk of soil organic carbon in the tropics (Akamigbo 1999; Igwe *et al*., 1999; Noma *et al*., 2005; Anikwe, 2010).

The Cation Exchange Capacity (CEC) is low in all soils of the study area and ranged from 6.71-7.43 cmolkg^{-1}(Table 4.2). The low CEC was because of the combined effect of the organic matter, total exchangeable bases and exchangeable acidity of the soils (Hamin *et al*., 2005). The CEC of the soils were low. The CEC values are less than 12 Cmol/kg soil considered minimum values for fertile soil (Kparmwang *et al.*, 2001). Soil CEC has been classified into low, medium and high with values as < 6, 6-12 and > 12 cmolkg^{-1} respectively (Adepetu *et al.*, 1979). This shows that for the soils studied, CEC is low attributable to their high weather ability and low organic matter content (Noma *et al*., 2005).The low CEC of the soils implies that with continuous cultivation (rainfed and irrigated agriculture), the soils would undergo rapid degradation physically and chemically. The incorporation of organic matter and addition of bases under fertilizer programme would raise CEC of these soils.

Ca ratio ranged from 2.84-3.10. According to Landon (1991), Ca/Mg values less than 12.0 indicate low fertility. This shows that soils under the land uses are of low fertility probably due to intense land use practice and excessive loss of Ca through leaching by the high tropical rainfall (Landon, 1991, Onweremadu, 2007). Addition of lime and organic manure can be used to supply Ca and improve soil fertility under the land use types (Uzoho *et al*., 2007).

4.3 Variability and Comparison of Influence of Physiochemical Properties of Soils under Different Landuse

The data presented on Table 2 and 3 shows that there is a significant difference in soil properties except in soil porosity, bulk density, potassium and sodium on different land use. It indicates land use land cover change is active determinant of soil properties. If geology, climate and soil type are significant factors for change in soil properties, we could not have found this much difference in soil properties within this small difference of depth.

ANOVA comparisons firmly show that there is a significant difference (P<0.01) of soil OC and OM content in different land use/land cover types. The results show that there is a significant difference between forestland and grazing land in the study area. They are relatively highest on soils of grazing land (the overall mean being 1.46 % for OC and 2.47 % for OM) and forestlands (the overall mean being 1.15 % for OC and 1.98 % for OM) than soils in cultivated lands (0.45 % for OC and 0.78 % for OM). It implies that there is more supply of litters and return of OM to the soils under grazing land and forestland s with low OC on cultivated lands due to; overgrazing and over cultivation in the study area. It was found that forestland of the study area has high soil OC content of soils in the study area. This might be because the top soil was where more biological processes take place. This might be due to relatively more tillage practices on cropland and tillage practice is responsible for reduction in organic matter of the soil (FAO 2005).

In the study area, TN content of the surface soil is greater than 0.1% and it varies among different land uses types. The result from ANOVA showed there is significant difference (P< 0.01) in TN among land use types. Low TN is observed on cultivated lands. The result of this study agrees with several studies conducted in elsewhere (Yifru and Taye, 2010; Eyayu *et al.*, 2009). That more tillage without addition application of fertilizer to replace the removed TN by continuous tillage to replace it led to low TN in an area.

The finding shows that Potassium content of soils in the study area have slightly lower available potassium with the average value of

0.66 Cmol/kg less than Potassium content of tropical soils with the average value of 1.65 Cmol/kg (Hartemink, 2006). The ANOVA analysis revealed that there is no significant difference (P<0.01) of K among land use types. It is low in the three land use types.

Based on this research, it was found that the overall pH value of the studied area ranges from moderately acidic (pH 6.10 on cultivated land) to neutral (pH 6.44 on forest land). ANOVA comparisons revealed that there exists a significant variation (at 0.01 probability level) in pH value of soils found on different land use type with average CEC. In tropical region, soils of forested land and permanent cropping have CEC of 12.5 Cmol/kg and 8.8 Cmol/kg respectively on the top 15 cm depth (Hartemink, 2006). CEC of soil of the study area ranges from 6.71in forestland and 7.43 on the grazing lands of the Area. The ANOVA tested yield significant difference at 0.01 probability levels among land use types.

In the cultivated lands of the study area, the soil constitutes on the average 21.00 % clay, 69.61 % sand and 9.38 % silt. In the forestlands, the soil constitutes on the average 71.77 % sand, 17.14 % s clay and 11.08% silt. ANOVA further confirms that soil texture in the study area varied significantly within land uses. This finding was similar studies, for example, Agoumé and Birang (2009) concluded that land used land cover changes (LUCC) significantly determine soil texture on their study in Cameron but contrary to the report by Brady (2002) which found that soil texture is the property of soil which is not subject to easy modification.

Soil color helps to indicate OM content, water content and oxidation states of iron and manganese oxides in the soil. In the study area, it was found that soil colour differs between different land uses. The cultivated land were generally pale red colour (10R 6/2) and those of grazing land are dark gray (10R 4/1) while in the forested area, the soil are light brown colour (7.5R 7/1). The result reveals that the soil colour was dark gray on forestland with high organic matter content and cultivated land with pale red soil. It seems that there is oxidation of iron on cropland use. The soil colour was dark gray on grazing land. This finding was supported by the research conducted by Maranon *et al.*, (1997) which found that vegetation cover type was among the principal factors of soil color change and soil color is correlated with texture, organic carbon content and Cation Exchange.

5. Conclusion

The study conclude that: based on the outcome of the study/research, it was found that the different land use systems differ in their soil properties due to conversion of one land use to another and its environment. The study revealed that changes in land use cover have significant impact on the availability of nutrients in the soil as noticed in cultivated land, which indicates that the soils were characterized with low vegetation and spares cover result in low O.C and Nitrogen. The secondary forest has high values of OC and N content. Moreover, the variation in the distribution of exchangeable bases depends on the elements present, particle size distribution, degree of weathering, soil management, the intensity of cultivation and the parent material from which the soil were formed.

6. Recommendations

Based on the findings of the research, there should be a detailed soil survey and land use approach in order to know the appropriate land use that is most suitable for the land, having known its capacity and constraints. Use of set-aside programmes, land use zoning policies that encourage productive and sustainable land use practices should be implemented. In addition, the research recommends afforestation, which will help in carbon sequestration, and the maintenance of nutrient in the soil for continuous energy fluxes for proper land conservation and nutrient retention in the soil. Also recommended the used of remote sensing and Geographic Information System (GIS) to monitor dynamics of physiochemical properties of land uses for a better decision making.

References

Agboola S. A., (1979). An Agricultural Atlas of Nigeria. Oxford Uni. Press Great Britain

Akinrinde, E.A and Obigbesan G.O. (2000).Evaluation of fertility status of selected soils for crop production in five ecological areas of Nigeria. Proc. *26th Annual Conf. Soil Sci. Soc. Nig Ibadan, Oyo State.* pp 279 – 288

Alagappa, M.A., Alice, E.C. (2007): *Advance in Environmental Sciences*, GEMS, Tiruchirappalli.

Alemayehu, K., Sheeme, B. (2013). Effects of Different Land Use System on Selected Soil Properties in South Ethiopia. *Journal of Soil Science and Environment*, Vol. 4 (5), Pp. 100-107.

Anikwe, M.A.N., (2010). Carbon Storage in Soils of South eastern Nigeria under different management practices. *Carbon Balance and Management Journal*:5:5-8.

Arhad, M.A., and Martins, R.T. (2002). Identifying Critical Limits for Soil Quality Indicators in Agroecosystems. *Agriculture, Ecosystem and Environment* 88,153-160

Aune, J.B., Lal, R. (1997). The Tropical Productivity Calculator. A model from Assessing the Effect of Soil Management of productivity, *Advanced soil science, Lewis Publishers, London, UK*, pp. 499-520.

Awotoye, O.O, Adebola, S.I., and Mathew O.J. (2013). The Effect of Land Use Changes on Soil Properties in a Humid Tropical Location; little-Ose Forest Reserves, South Western Nigeria. *Research Journal on Agricultural and Environmental Management.* 2(6), 176-182.

Awotoye, O.O, Ogunkunle, C.O., and Adeniyi, S. (2012). Assessment of Soil Quality Indicators on a Loessial Soil Goleston Province Iran. *Journal of Agriculture Science and Technology Emiru, N.*, vol. 13:727-742.

Belay, Dextel, A.R. (2003). Soil Physical Quality. Part 1.Theory, Effects of Soil Texture, Density, and Organic Matter and Effects on Root Growth. Geo Derma 120(314)201-214

Bouyoucous, G.H. (1951). A recalibration of the hydrometer method for making

the mechanical analysis of soils. Agronomy Journal, 43: 434-438.

Eswaran,H Lal,Rand Reich,P.F.(2001).L and degradation:anover view .www.ncrs.usda.geotechnicalworldsoils papers land-degradation .

Gebeyaw Tilahun Yeshaneh. (2015). Assessment of Soil Fertility Variation in Different Land Uses and Management Practices in Maybar Watershed, South Wollo Zone, North Ethiopia. *International Journal of Environmental Bioremediation & Biodegradation*, Vol. 3, No. 1, 15-22

Hamin J.L. Tisdale, S.L., and Nelson, W.L. (2005). Soil fertility and fertilizers: an introduction to nutrient management. Prentice-Hall PLC. New Delhi, India. P. 519.

Hurni(1988) Effect of land use on soil degradation and soil productivity decline on Alfisols and Ultisols in Ogun State

Junge and Skowronek(2007). The influence of parent materials on the soils of Southeastern Nigeria, East Africa.

Kang, B.T. and Fox, R.L. (1981). Management of soils for continuous production and controlling nutrient status.

Lanbin (2011). The causes of land-use and Land cover Change. Moving Beyond the Myths. *Global Environmental change* 11,261-209.

Muhr, L.S., Tarawali, A.,Peters, M., and Schulze-Kraft, R. (2001). Acceptability of forage legumes for improved fallows: first experience of agro pastoralist in sub-humid southwest Nigeria. Experimental Agriculture, 37: 495-507.

Odunze, A.C., Tarawali, G. and Tanimu, J(2003). Effect of in-situ grazing and stocking density of goats on soil management: a southern Guinea

savanna of Nigeria experience. Nigeria Journal of Soil Research4: 9-15.

Odunze, A.C. (2006). Soil properties and management strategies for some sub-humid savanna zone.