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Anthropic Land use impact on Soil Quality Indicators in a typical Rural - Urban Fringe in Southern Edo State

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ABSTRACT

The investigation examined anthropic land use impact on soil quality indicators in a typical rural - urban fringe in southern Edo State. The objectives were to (i) determine the status of soil quality indicators under each anthropic land use, (ii) ascertain the variations among the physicochemical properties of soils in the different anthropic land uses and (iii) evaluate implications of the anthropic land uses on soil quality indicators. Soil samples were collected from nine (9) different anthropic land use types at 0-15cm and analyzed for physicochemical properties using standard laboratory methods. The data obtained was evaluated using descriptive statistics and soil using permissible limits. The findings revealed that Fe > Ca, Mn >SOM, Avl P, CEC, Na, Mg in the soils of the anthropic land uses. The study concluded that SOM, Avl P, CEC, Na and Mg were the deficient soil nutrients. To improve their concentrations, the incorporation of organic manures, conservation agriculture, application of chemical fertilizers and soil erosion control techniques are recommended.

Keywords: Anthropic, Fringe ,Land use, Soil quality, Rural - urban

1.0. Introduction

Soil quality is commonly defined as the intrinsic ability of soil to supply plant nutrients in appropriate proportions essential for maximum flora growth (Jin et al., 2020). Soil quality is a prerequisite for better planning and utilization of land resources (Okon et al. 2019). Soil quality which can be inferred using indicators that interrelate synergistically is affected by varied specific land use types (Mulat et al., 2021). Soil quality indicators are quantifiable soil characteristics that influence the ability of soil to sustain crop production (Orobator et al., 2019). They are those properties and processes that have the greatest sensitivity to the impact of land uses (Armenise et al., 2013) which should be prioritized for evaluation (He et al., 2021).

The rural-urban fringe comprises of open and green spaces and alternate land uses, dissimilar from the densely built-up metropolitan areas (Gundel et al., 2022). It is a region sandwiched between the urban built-up area and agricultural area, with both urban and rural features (Feng et al., 2022). Rural-urban fringe refers to an annular belt connecting a city which is in the process of transformation from rural to urban area and as a dynamic spatial region; it begins and develops as the spatial complement of the urbanization and sub-urbanization process (Kumar and Sinha, 2022). According to Wang et al., (2023), rural urban fringe is the most active and complex space in which land and ecology change under the influence of urban expansion.

Land is a criterion for numerous usages both in urban and rural ecologies (Orobator and Oluku, 2020). As a result, rural-urban fringes are associated with unexpected and unrestrained land uses and occupation of unsuitable sites posing serious environmental ruins. In terrestrial milieus, anthropic activities often leads to changes of land use with shifts from forest to human-facilitated biotas undertaken in cultivation, urban expansion or industrialization (El Khalil et al., 2013). The modifications of soil properties are dependent on anthropoid use of land (Napoletano et al., 2022). Soils are severely influenced by anthropogenic activities such as building and industrial activities, road traffic, disposal of liquid and solid wastes and agriculture practices (Minnikova et al. 2017). The long-term association between humans and soil has considerably influenced and altered the properties of soil by different anthropic activities (Vasu et al., 2018).

Globally, prior investigations show that there is dearth of researches on anthropogenic land use effects on soil quality in rural-urban fringe in southern Edo State. Notable amongst such inquiries are Li et al., 2023; Kuntoji et al., 2021; Nickayin et al., 2021; Jin et al., 2020; etc. In Nigeria, available empirical investigations undertaken by Jimoh et al., 2020; Ukoje, 2016; Olayiwola and Igbavboa, 2014; Essien and Akpan, 2014 etc. also reveal the scarcity of knowledge on soil quality in rural-urban fringe in southern Edo State. Significant portions of the rural – urban fringe areas in southern Edo State contain soils which are appropriate for agricultural activities. However, in contemporary years, urban intrusion on these soils has accelerated the conversion of most agricultural lands into other anthropic land uses. Investigating the impact of anthropic land uses on soil quality properties in rural-urban fringe is inevitable and significant for pedological and biogeographical enquiries.

The research aimed to examine anthropic land use impact on soil quality indicators in a typical rural - urban fringe of southern Edo State. The specific objectives are to (i) determine the status of soil quality indicators in each anthropic land use, (ii) evaluate variations among the physicochemical properties of soils and (iii) examine the implications of the anthropic land use types on soil quality indicators. The findings of the investigation will provide contemporary broad scale understanding of varied anthropic land uses impact on soil quality properties in suburbs in southern Edo State and it will also aid better use and management of soil resources.

2.0. Methodology

2.1 Study Area

The study was carried out in a characteristic rural – urban fringe located in Egor Local Government Area of southern Edo State. Egor Local Government Area is one of the three most populated LGAs in Benin City besides Oredo and Ikpoba - Okha Local Government Areas (Kelvin et al., 2015). The rural – urban fringe which consist of of Egbean, Iguadolor and Uhogua communities, is located within 6° 15' 0" N - 6° 45' 0" N and 5° 15' 0" E - 5° 41' 0" E. It lies in the Humid Rainforest belt of Nigeria and experiences the rainforest zone climate categorized by a distinctive dry and wet season, with a mean annual rainfall and temperature of 2,040 mm and 34°C. The topography is comparatively flat while the soils' geology shows the Benin rock formation, underlain by limestone largely made up of lateritic clay sand with reddish brown color. The soils are rich in iron which account for their typical red color (Orobator and Odjugo, 2016).The rural –urban fringe is characterized with different anthropogenic land uses and nine spatially located anthropic land uses (Figure 1) selected for the study include: (i) Mechanic workshop (ii) Secondary forest (iii) Block molding site (iv) Oil palm production site (Palm oil mill) (v) Firewood processing site (vi) Cassava farm (vii) Back house farm (viii) Cooking gas plant (ix) Oil palm plantation.

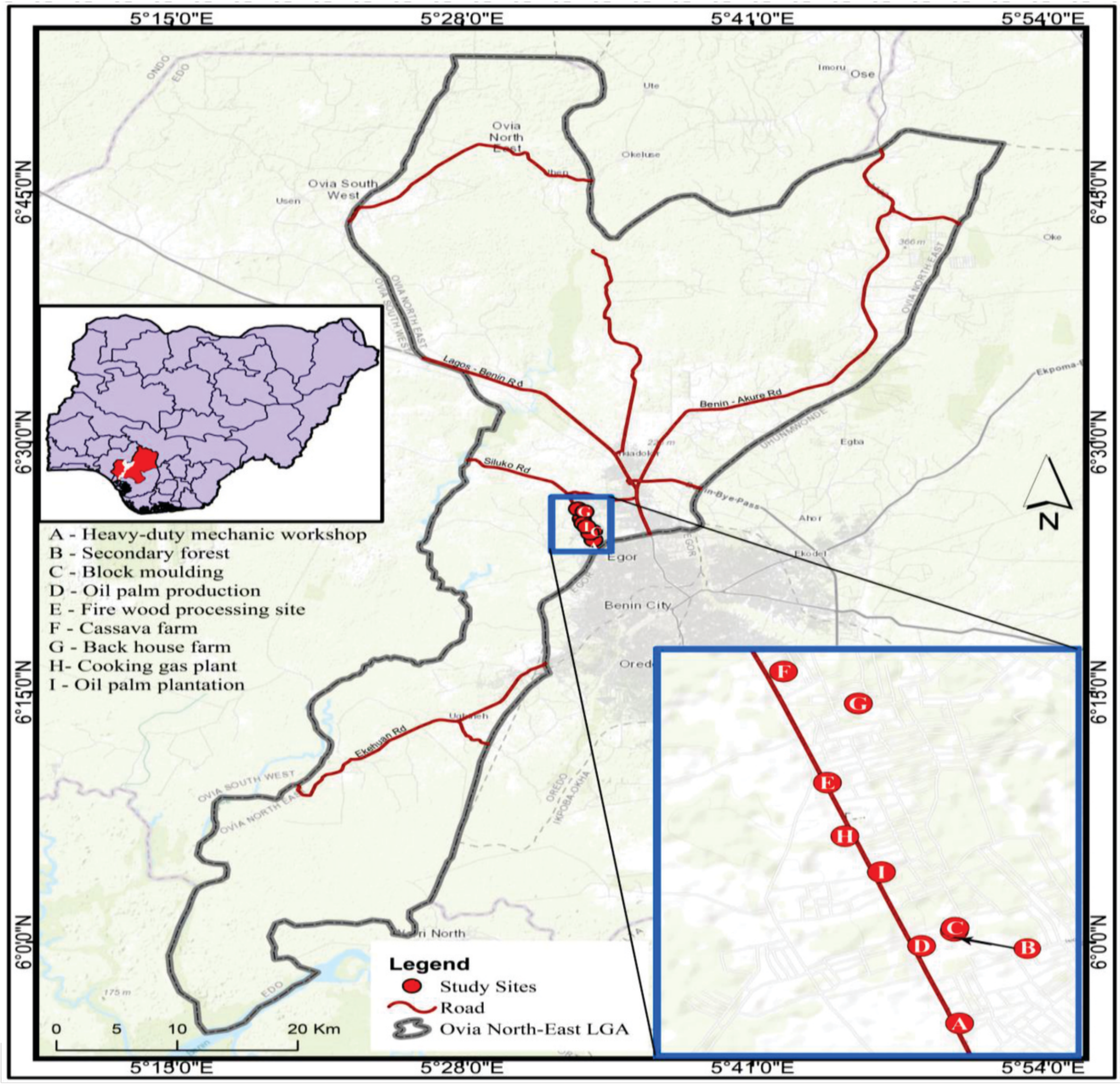

Figure 1: Location of anthropic land uses

2.2 Soil Sampling

Adopting the random sampling technique, one soil sample was collected from each of the nine anthropic land use at 0 -15cm (topsoil) using a soil auger. Thus, a total of nine soil samples were collected for the purpose of this study. The latitudinal and longitudinal coordinates besides elevation of the anthropic land uses were identified with the aid of a hand-held Garmin GPSMAP64st model receiver. All soil samples were dried out naturally at room temperature, handpicked out stones and plant debris, and then passed through a 2 mm soil sieve prior to analysis. The analyzed soil physicochemical properties are sand, silt and clay, bulk density (BD), soil water holding capacity (SWHC), soil pH, soil organic matter (SOM), total organic carbon (TOC), total nitrogen (TN), available phosphorus (Avl P), cation exchange capacity (CEC), exchangeable bases (Na, K, Mg and Ca) and micronutrients (Fe, Mn, Zn and Cu). The description of the study sites are described in Table 1.

Anthropic Land Uses	Site Features	Sampling point	Location of sampling point	Elevation(m)
Mechanic workshop	Heavy duty vehicles, petrol and engine oil spills	A	N06.40206, E005.56455	112
Secondary forest	Tall trees, climbers and bushes.	B	N06.41022, E005.56420	118
Block molding site	White sand and cement.	C	N06.41049, E005.56425	123
Oil palm production (Palm oil mill)	Oil palm trees, palm kernel shaft and milled oil.	D	N06.40889, E005.56205	117
Firewood processing site	Chopped fire wood of different sizes.	E	N06.42330, E005.55586	128
Cassava farm	Cassava florae and soil undergrowth.	F	N06.43327, E005.55292	128
Back house Farm	Annual crops (plantain, cassava and pineapple) and presence of ash from burnt cooking fire wood.	G	N06.43029, E005.55789	130
Cooking gas plant	Large gas tank, gas cylinder and gas pump.	H	N06.41858, E005.55701	124
Oil palm plantation	Oil palm trees and soil undergrowth.	I	N06.41540, E005.55941	125

2.3 Laboratory Analysis

Sand, silt and clay contents were determined by Bouyoucous Hydrometer method (Day, 1965). Bulk density was determined from undisturbed soil samples using core samplers (Kowalenko, 1985). Soil water holding capacity (SWHC) was determined using the soil pedostructure-based method (Assi et al., 2018). Soil pH values were analyzed using a glass electrode pH meter with soil–water ratio of 1:2.5 (Mclean, 1982). Soil organic matter was calculated by multiplying the organic carbon value with the Van Bemmelen factor of 1.724 (Ross, 1993). To analyze organic carbon, the Walkley and Black (1934) method was used in which the carbon was oxidized under standard conditions with potassium dichromate ($K_2Cr_2O_7$) in sulfuric acid solution. Total nitrogen in the soil was determined using the Kjeldahl method which involves digesting the soil samples at 390 °C in a digestion tube with 5 ml 98% conc HCl (Subbiah and Asija, 1956). Available phosphorus was measured following Bray II method using 0.03 M NH4F and 0.10 M HCl solution (Lindsay and Norvell, 1978).Cation exchange capacity was extracted by using sodium acetate at a pH 8.2 (Anderson and Ingram, 1993). Exchangeable bases (Ca, Mg, K and Na) were extracted in 1N NH4OAc at pH 7. DTPA extractable Fe, Mn, Zn and Cu (mg kg^{-1}) were determined following Khodadoust et al., (2004) procedure.

2.4 Data Analysis

The statistical analysis was performed using the Microsoft Excel. In order to attain the objectives of this study, descriptive statistics and soil fertility indicators permissible limits (Table 2) were used to analyse the data. The variation in the physicochemical properties of soils among the nine anthropic land uses was obtained using tables. Soil fertility indicators permissible limits were adopted to reveal the status (high, medium or low) of each soil quality property in the anthropic land uses.

Soil Parameter	Very Low	Low	Medium	High	Very High
pH		<5.5*	5.5 - 7.0*	>7.0*	
ECEC (cmol kg^{-1})	<5*	5 - 15*	15 - 25*	25 - 40*	>40*
SOM (g kg^{-1})		<4*	4 - 10*	>10*	
Avl P (mg kg^{-1})		<5*	5 - 15*	>15*	
TN (g kg^{-1})	<0.1**	0.1 - 0.2**	0.2 - 0.5**	0.5 - 1.0**	>1.0**
Ca (cmol kg^{-1})		<4*	4 - 10*	>10*	
Mg (cmol kg^{-1})		<0.5*	0.5 - 4.0*	>4.0*	
K (cmol kg^{-1})		<0.2*	0.2 - 0.6*	>0.6*	
Fe (mg kg^{-1})		<0.1**	0.1 - 10**	>10**	
Mn (mg kg^{-1})	<1**	1 - 10**	11 - 100**	>100**	
Zn (mg kg^{-1})		<1**	1 - 10**	>10**	
Cu (mg kg^{-1})		0 - 0.4***	0.4 - 0.6***	>0.6***	
Na (cmol kg^{-1})				<6****	
TOC (g kg^{-1})		<1**	1 - 5**	>5*	

*Landon (1991), ** = Amacher et al. (2007), *** = Havlin et al. (1999); **** Holzapfel et al., (2011)*

Source: Adapted from Holzapfel et al., (2011) and Orobator (2019)

3.0. Results and Discussion

The values of the physicochemical properties for the soils sampled from the nine different anthropic land uses at 0-15cm (topsoil) soil depth are presented in Table 3.

3.1 Soil physical attributes

Soil texture (sand, silt and clay) impacts the fitness of the soil as a medium for rooting (Barnes et al., 2003). Sand values vary from 60 – 85 gkg^{-1}. Higher sand value (85 gkg^{-1}) was observed in firewood processing site, backhouse farm and gas plant respectively. This suggests incidences of larger pore spaces between their sand particles (Bruand et al., 2005). However, mechanic workshop had the lowest sand value (60 gkg^{-1}). The results infer the influence of the anthropic land uses on sand.
Silt values ranged from 5-25gkg^{-1}. Highest silt value (25 gkg^{-1}) was observed in cassava farm and may be attributed to incidences of soil undergrowth which helps to reduce soil erosion effect. However, block molding and oil palm production sites had the lowest values (5 gkg^{-1}). The result suggests the impact of the land uses on silt. Clay content is a significant factor for soil fertility as well as nutrient accessibility (Al-Hamed et al., 2014). Clay values ranged from 5-30gkg^{-1}. Mechanic workshop had the highest clay value (30 gkg^{-1}) whereas firewood production, cassava farm and backhouse farm each had the lowest clay value (5 gkg^{-1}). The highest clay value of mechanic workshop may negatively influence the structural and hydrological properties of the soil (Al-Hamed et al., 2014). The result infers the impacts of the land uses on clay.

Soil BD is a basic but vital physical soil property connected to soil porosity, soil moisture and hydraulic conductivity which are fundamental to soil quality assessment and land use management (Shan, et al., 2019). BD values ranged from 1.38-1.47mgm^{-3}. Mechanic workshop, block molding and firewood processing site each had the highest BD value of 1.47mgm^{-3} and may be ascribed to the crushing effects of different types of vehicles, block molding machineries and large chopped wood on the topsoils. The lowest BD value of 1.38mgm^{-3} observed in oil palm mill, cooking gas plant and oil palm plantation are an indication that their soils are not frequently disturbed. The results imply the influence of the land uses on BD. SWHC describes the capability of a soil to hold water (Sujatha et al., 2016). SWHC values ranged from 44-54gkg^{-1}. SWHC value was highest in cassava farm (54) and lowest in mechanic workshop (44). This reveals the differences in SWHC among the anthropic land uses. The higher value of SWHC in cassava farm infers the effects of the incidences of tillage activities.

Table 3: Concentrations of physicochemical properties of soils under different anthropic land uses in the rural-urban fringe

Soil parameter	Mechanic workshop	Secondary forest	Block molding	Oil palm production site	Firewood processing	Cassava farm	Back house farm	Cooking gas plant	Oil palm plantation
Sand (gkg^{-1})	60	80	80	80	85	70	85	85	70
Silt (gkg^{-1})	10	10	5	5	10	25	10	10	15
Clay (gkg^{-1})	30	10	15	15	5	5	5	5	15
BD (mgm-3)	1.47	1.42	1.47	1.38	1.47	1.42	1.42	1.38	1.38
SWHC	44	48	52	52	52	54	52	52	52.4
Soil pH	7.9	5.4	5.1	5.5	6.3	5.0	5.7	5.4	6.4
TOC (gkg^{-1})	3.48	3.83	3.83	3.13	5.58	3.25	4.53	3.37	4.88
SOM (gkg^{-1})	5.98	6.58	6.58	5.38	9.59	5.59	7.79	5.79	8.39
TN (gkg^{-1})	0.29	0.27	0.28	0.23	0.45	0.25	0.39	0.3	0.41
Avl P (gkg^{-1})	0.92	0.85	0.83	0.61	1.12	0.58	0.96	0.60	1.10
CEC (cmolkg^{-1})	2.11	2.35	2.17	0.19	2.32	2.50	2.59	2.12	2.14
Ca (cmolkg^{-1})	1.50	1.62	1.50	0.56	1.50	1.87	1.87	1.50	1.62
Mg (cmolkg^{-1})	0.34	0.38	0.35	0.13	0.44	0.36	0.38	0.31	0.42
Na (cmolkg^{-1})	0.12	0.15	0.14	0.12	0.13	0.11	0.14	0.14	0.16
K (cmolkg^{-1})	0.15	0.20	0.18	0.10	0.25	0.16	0.18	0.17	0.21
Fe (mgkg^{-1})	422	410	418	424	409	407	148	408	152
Mn (mgkg^{-1})	21.7	45.3	35.5	52.6	44.3	42.3	70.2	27.3	70.1
Zn (mgkg^{-1})	6.7	6.9	6.8	5.6	12.4	5.8	9.2	6.0	10.5
Cu (mgkg^{-1})	1.2	0.5	0.4	0.5	0.4	0.4	0.5	0.5	1.3

3.2 Soil chemical attributes

Soil pH is described as the master soil variable that impacts soil biological, chemical and physical properties and processes which influence plant growth and biomass yield (Minasny et al., 2016). Soil pH values ranged from 5.0-7.9. Soil pH value was highest in mechanic workshop (7.9). This indicates alkalinity and may be due to high clay content. The lowest pH value in cassava farm (5.0) may be due to the poor clay content. The results of this study agree with the findings of Yifru and Taye (2011) that the pH in savanna and forest soil falls within the range 4.5-7.5. Comparing the values of pH with permissible limits, the status of pH for mechanic workshop was high while firewood processing site and backhouse farm were medium. However, secondary forest, block molding, oil palm production site (palm oil mill), cassava farm and gas plant were low. These results denote the varied influences of the anthropic land uses on pH.

TOC is an essential soil quality parameter and the ease and speed with which it becomes accessible is connected to the SOM fraction in which it exists in (USDA, 2009). TOC values ranged from 3.13-5.58 gkg^{-1}. TOC value was highest in fire wood processing (5.58 gkg^{-1}) and may be due to the observed low acidity and high SOM. TOC value was lowest in oil palm production site (palm oil mill) (3.13 gkg^{-1}) and may be due to lower SOM. This result suggests the varied impact of the land uses on TOC. SOC largely originate from the residues and secretions of plants and microorganisms (Kgel-Knabner and Rumpel, 2018). Matching the values of TOC with the permissible limits, the status of TOC for firewood processing site is high while the remaining land uses were medium. The medium status may be attributed to the non-cultivation of non-exhaustive crops, non-availability and lack of frequent use organic manures like farm yard manure (FYM), dearth of practices like crop rotation and green manuring in the vicinity of anthropic land uses. Differences in TOC values could be ascribed to variances in the input of organic materials from the associated land use (Iwegbue, 2014). The statuses of TOC infer the mixed effects of the anthropic land uses.

SOM is an important characteristic of soil and environmental quality because it is a significant sink and source of focal plant and microbial nutrients (Nieder and Benbi, 2008). SOM values ranged from 5.38-9.59gkg^{-1}. SOM value was highest in fire wood processing (9.59 gkg^{-1}) and may be due to the decay of wood into the soil, high TOC and low acidity. The least SOM value in oil palm production site (palm oil mill) (5.38 gkg^{-1}) can be attributed to the low TOC. The findings of the current study do not support the research of Zhao et al., (2013), who reported that the highest value of SOM was observed in the roadside-tree soils. Comparing the values of SOM with permissible limits, the status of SOM for investigated land uses is low. This suggests the impacts of the anthropic land uses. The outcome of this inquiry also shows the variation in SOM amongst the anthropic land uses.

TN is the major determining factor and indicator of soil fertility and quality (Li et al., 2022). TN values ranged from 0.23-0.45gkg^{-1}. TN value was highest in firewood processing site (0.45 gkg^{-1}) and may be due to high SOM, TOC and low acidity. The lowest TN value in oil palm production site (palm oil mill) (0.23 gkg^{-1}) may be due to low SOM, TOC and high acidity. TN is heterogeneously distributed in soils and its variation is triggered majorly land use (Wang et al., 2009). Aghasi et al., (2010) affirmed that disturbing the soil via anthropogenic activities leaves negative impacts on soil structure and infiltration rate, and leads to the loss of amounts of TN from the soil. The findings of this investigation disagrees with Kerenku et al., (2010) who reported average TN percentage of 0.11 in soils of Tarhembe settlement area of Benue state. Comparing the values of TN with permissible limits, the status of TN for cassava farm was low while other land uses were medium. The results imply the impacts of the anthropic land uses and show the variations of TN in the anthropic land uses.

Avl P is important to both plant yield and soil organic matter (SOM) input (Somavilla, 2021). Avl P values ranged from 0.58-1.12gkg^{-1}. Avl P was highest in firewood processing site (1.12 gkg^{-1}) and may be ascribed to high TN, SOM, TOC and low acidity. Avl P was lowest in cassava farm (0.58 gkg^{-1}) and may be attributed to low TN, SOM and TOC. Result of this study is consistent with the of findings Chimdi et al., (2012), who observed variations in Avl P content in soils and reported that the variations are related with the intensity of soil disturbance. Comparing the values of Avl P with the permissible limits, the status of Avl P for the examined land uses was low. This low status can be credited to non-application of fertilizers especially as the use of high value commercial fertilizers is restricted to typical rural land uses which are commonly under rainfed and crops under cultivation are conventional agriculture crops (Kuntoji, et a1. 2021). The results infer the impacts of the anthropic land uses on Avl P.

CEC is a parameter of soil which denotes the ability of soil to attract, retain and hold exchangeable cations (Tomašić et al., 2013).CEC values ranged from 0.91-2.59 $cmolkg^{-1}$. CEC value was highest in backhouse farm (2.59 $cmolkg^{-1}$) and could be attributed to domestic practices whereby house owners usually dump kitchen wastes, ashes from burnt firewood and other degradable materials generated from their houses into the back house farm. CEC value was lowest in oil palm production site (palm oil mill) (0.91 cmolkg^{-1}). Ash serves as a good liming material and so increases soil pH which favors the availability of exchangeable bases in back house farm more than other land uses. The result of the inquiry contradicts past research of Cornwell (2014) which found that the value of CEC was lowest in banana and pineapple monocultures, intermediate in the pasture, and greatest in *cacao*. Comparing the values of CEC with permissible limits, the status of CEC for the investigated land uses was low. The result implies the impacts of the anthropic land uses and indicates the variations in CEC among the anthropic land uses.

Exchangeable bases are usually defined as the alkali and alkaline earth metals which are principally calcium (Ca), magnesium (Mg), potassium (K) and sodium (Na) attached to the clay and organic components of soils (Sarah et al., 2019). Ca values varied from 0.56-1.8.7 Cmolkg^{-1}. Ca value was highest in cassava farm and backhouse farm (1.87 Cmolkg^{-1}) and lowest in oil palm production site (palm oil mill) (0.56 Cmolkg^{-1}). The outcome shows the variations in Ca among the anthropic land uses. Matching the values of Ca with the permissible limits, the status of Ca for the examined land uses was medium. The observed statuses depict the impact of the land uses on Ca.

Mg values ranged from 0.13-0.44cmolkg^{-1}.The value of Mg was highest in fire wood processing (0.44 Cmolkg^{-1}) and lowest in oil palm production site (palm oil mill) (0.13 Cmolkg^{-1}). The outcomes denote the variation of Mg among the land uses. Comparing Mg values with the permissible limits, the status of Mg for the studied land uses was low. This status shows the influences of the land uses on Mg. Na values ranged from 0.11-0.16cmolkg^{-1}.The value of Na were highest in oil palm plantation (0.16 cmolkg^{-1}) and lowest in cassava farm (0.11 cmolkg^{-1}). The result infers the impacts of the land uses on Na. Comparing Na values with the permissible limits; the status of Na for the examined land uses was low. The result demonstrates the variations in Na among the anthropic land uses.

K values ranged from 0.10-0.25cmolkg^{-1}. K value was highest in fire wood processing (0.25 cmolkg^{-1}) and lowest in oil palm production site (palm oil mill) (0.10 cmolkg^{-1}). Comparing the values of K with permissible limits, the status of K for secondary forest, firewood processing site and oil palm plantation were medium while other land uses examined were low. The statuses infer the impacts of the land uses on K and the result indicates the variations in K amongst the anthropic land uses. The different levels of Mg, Ca, Na and K in the anthropic land uses may be due to the top layer of the soils being covered with guest soils from the prevailing anthropogenic activities on the land uses (Li et al., 2023).

Micronutrients, also known as trace elements are obligatory in micro quantities (Gupta et al., 2008). Fe values vary from 148-424 mgkg^{-1}. Fe value was highest in oil palm production site (palm oil mill) (424 mgkg^{-1}) and lowest in back house farm (148 mgkg^{-1}). Comparing the values of Fe with permissible limits, the status of Fe for all the investigated land uses was high. The results imply the impacts of the anthropic land uses on Fe and indicate the variations in Fe amid the anthropic land uses. Variable concentrations of Fe have been reported in soils with important anthropogenic activities in soils in southern Nigeria (Iwegbue et al. 2010). The high status of Fe in soil of mechanic workshop is due to contributions of metallic parts deposited at the site (Iwegbue, 2014).

Mn values ranged from 21.7-70.2 mgkg^{-1}. Mn value was highest in backhouse farm (70.2 mgkg^{-1}) and lowest in mechanic workshop (21.7 mgkg^{-1}). Matching Mn values with permissible limits, the status of Mn for all the examined land uses was medium. The medium Mn status for mechanic workshop is associated with fuel and diesel spillage (El Hassan et al. 2006). The statuses of Mn infer the effects of the anthropic land uses and the result indicates the variations in Mn amongst the anthropic land uses. A widespread concentration range of Mn has been reported in soils under various land uses (Iwegbue, 2014).

Zn values ranged from 5.6-12.4 mgkg^{-1}. Zn value was highest in firewood processing site (5.6 mgkg^{-1}) and lowest in oil palm production (palm oil mill) (12.4 mgkg^{-1}). Comparing the values of Zn with

permissible limits, the status of Zn for firewood processing site and oil palm plantation were high whereas the remaining land uses were medium. The medium status of Zn in mechanic workshop could be due to attrition of motor vehicle tyres and the use of lubricating oil which may have Zn as additive in the form of zinc diphosphate (Iwegbue et al. 2012). However, the medium status of Zn in cassava and backhouse farms is connected with the use of manure, composted materials and agrochemicals such as fertilizer and pesticide in agriculture (Gowd et al. 2010). The result implies the effects of the anthropic land uses and shows the variations in Zn amongst the anthropic land uses.
Cu values varied from 0.4-1.3mgkg^{-1}. Cu value was highest in oil palm plantation (1.3 mgkg^{-1}) while it was lowest in block molding, firewood processing site and cassava farm (0.4 mgkg^{-1}). Matching the values of Cu with permissible limits, the status of Cu for mechanic workshop and oil palm plantation were high while the other investigated land uses were medium. The high status of Cu in mechanic workshop could be due to leaching from waste deposited around the workshop. Cu has been utilized in vehicular braking system and in Cu-brass automotive radiators (Benhaddya and Hadjel, 2014). The statuses of Cu suggest the influences of the anthropic land uses and reveal the variations in Cu. Cu usually accumulates in the topsoil, an occurrence instigated by anthropogenic land uses (Machender et al. 2011).

4.0. Conclusions

The study examined anthropic land use impacts on soil quality indicators in a typical rural - urban fringe in southern Edo State. The findings revealed that generally in the soils of the anthropic land uses, only Fe had high status. Whereas Ca and Mn were medium, SOM, Avl P, CEC, Na and Mg had low status. The variations in the concentrations of the physicochemical properties of soils in the different anthropic land uses inferred the impacts specific anthropic land use type. In order to enhance the low status of SOM, Avl P, CEC, Na and Mg, suitable soil management measures such as the integration of organic manures, conservation agriculture, cautious use of chemical fertilizers and soil erosion control methods are advocated. In advancing research in suburb soils in southern Edo state, Nigeria, the study recommended that future investigations focusing on pollution and contamination assessment of heavy metals in rural – urban fringe soils should be undertaken.

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