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CONTENTS

Geographic Information System (GIS) assisted mapping and classification of the soils of Akoko Edo Local Government Area, Edo State

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ABSTRACT: This study was carried out in Akoko Edo Local Government of Edo State to identify some of the major soils of the project area, through a geographic information system (GIS) and soil survey. Considering the active soil forming factors in the Local Government, five mapping units were delineated and representative pedons were studied, described and sampled. Soil samples were analyzed using standard methods. Soils were classified according to both USDA soil taxonomy and WRB Systems of Soil Classification. The results showed that Pedon 1 was classified according to USDA soil taxonomy as Loamy Kaolinitic Isohyperthemic Fluventic HumicDystrudept while according to WRB, it was classified as Haplic Fluvic Cambisol (Dystric, Humic) with an aerial coverage of 560.6 ha (0.4%). Pedon 2 occupied an area of 52,715.3 ha (40.7%) and was classified according to USDA soil taxonomy as Loamy Kaolinitic IsohyperthemicFluvaquenticDystrudept and Haplic Fluvic Cambisol (Siltic, Greyic) according to WRB system of soil classification. Pedon 3 occupied an area of 67,189.4 ha (51.8%) was classified as Loamy kaolinitic Isohyperthemic Fluventic Dystrudept according to USDA while WRB classified it as Haplic Fluvic Cambisol (Dystric). Pedon 4 was classified according to USDA soil taxonomy as Loamy Kaolinitic IsohyperthemicOxyaquicEutrudept while WRB classified it as Haplic EndogleyicCambisol (Gleyic Oxyaquic). It occupies an aerial of 8,447.3 ha (6.5%). Pedon 5 on the other hand, occupying an area of 734.2 ha (0.6 %) was classified according to USDA soil taxonomy as Loamy kaolinitic IsohyperthemicHumicdystrudept and Haplic, Fluvic Cambisols (Dystric, Humic) according to WRB system of classification. This research will therefore unveil the different types of soils in the area as well as the aerial extent of each soil type.

Key words: GIS, mapping, soil classification, USDA, WRB

Soil mapping and classification have been important drivers in the advancement of our understanding of soil from the earliest days of the scientific study of soils. Early soil maps were desirable for purposes of land evaluation, valuation for taxation, agronomic planning (Brevik and Hartemink, 2010), and even in military operations (Brevik*et al.*, 2015). Soil mapping required classification systems that would allow efficient communication of mapped information in an easily understandable manner. In turn, classification systems required understanding of the soil system (Marbut, 1922) and gaining that understanding included observing spatial patterns in the field and the development of soil models (Wilding, 1994).

Although many advances in our classification and understanding of the soil system have been made since the late 1800s, when soil science blossomed into a scientific discipline in its own right, there are still many unanswered questions and additional needs in soil mapping and classification. New technologies such as Global Positioning System (GPS), Geographic Information System (GIS), remote sensing, on-site geophysical instrumentation and associated data loggers and the development of statistical and geostatistical techniques have greatly increased our ability to collect, analyze, and predict spatial information related to soils. However, linking all of this new information to soil properties and processes can still be a challenge and at such, ground truthing is still very important to confirm the real status of soils.

The expanding use of soil knowledge to address issues beyond agronomic production, such as land use planning, environmental concerns, food security, energy security, water security, and human health requires new methods for communicating what we know about the soils we map (Sanchez *et al.,* 2009). It is critical that as soil scientists we not only engage in interdisciplinary collaborations with other scientists who work in these areas, but that we also engage in trans disciplinary approaches that directly include the various stakeholders in these areas, not all of whom are scientists (Bouma, 2015). In addition, advancing the use of soils knowledge into these new areas brings forth research questions that were not widely considered in earlier soils studies (Brevik *et al.,* 2015). At present this information is communicated using dozens of national soil classification systems as well as the USDA soil taxonomy and World Reference Base for Soil Resources (WRB), but a more universal soil classification system would facilitate international communication of soils information (Hempel *et al.,* 2013). There are still many significant research needs in the area of soil mapping and classification.

Owing to the fact that the main occupation of the inhabitants of Akoko Edo Local Government Area is mining of minerals and farming coupled with the fact that not much study has been done on the soils of the area, mapping and classification will help reveal information that could be useful in the management and use of the soils on a sustainable manner.

The objective of this research therefore, was to map using GIS procedure and classify the soils of Akoko Edo Local Government Area, Edo State giving the soils names that will be of international acceptance.

MATERIALS AND METHODS

Study Area

Akoko-Edo local government area is bounded to the North: Ogori / Mangogo, Okehi, Adavi and Okene local government areas, all in Kogi state; to the West: Akoko South East, AkokoNorth East and Ose local government areas in Ondo state; to the South: Owan East and Etsakowest; and to the East with Etsako East all in Edo state. It has an area of 1,296.766 km^2 (129,676.6 hectares). It lies between longitude 6° 06' 0" E and latitude 7° 17' 0" N. It is predominantly populated with the Okpamaris, Etunos, Unemes and other tribes in the local government. The major occupations of the people are agriculture, local craft & Blacksmithing, commerce and with few who are civil servants. The map of Akoko-Edo local government area is shown in figure l.

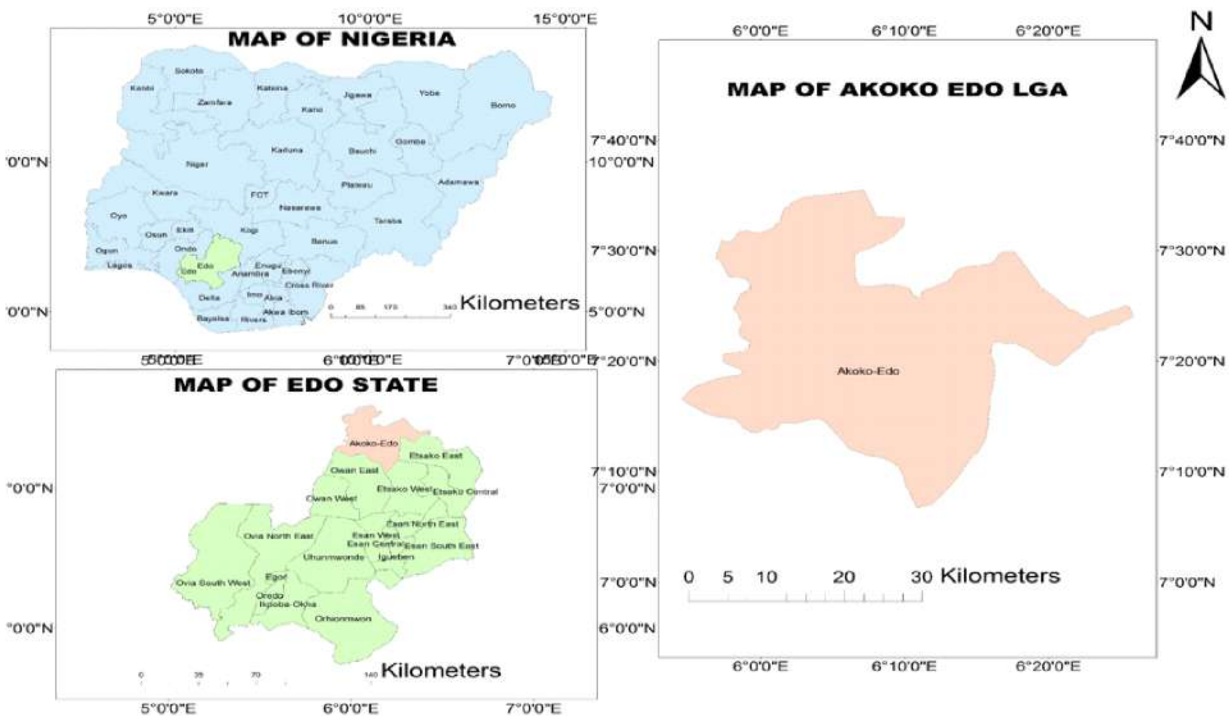


Fig.1: Location Map of Akoko-Edo L.G.A

Table 1: Some morphological features of Pedon 1

Pedons	Horizon Designation	Depth (cm)	Colour (moist)	Texture	RootsAbundance	Structure	Boundary form	Stoniness/coarse fragments
1	Ap	0 – 19	10YR3/2	LS	Medium common size root	Very fine single grain crumb	Smooth-diffused	No stones
	A	19 – 42	7.5YR4/4	SL	Medium common size root	Very fine sub – angular blocky	Smooth-clear	No stones
	BA_1	42 – 76	7.5YR4/4	SL	Very fine few size root	Very fine sub - angular blocky	Smooth-diffused	No stones
	BA_2	76 – 112	7.5YR4/4	SL	Very fine few size root	Very fine sub - angular blocky	Smooth-diffused	No stones
	BA_3	112 – 141	7.5YR5/4	SL	Very fine few size root	Very fine massive granular	Smooth-clear	Stony
	Bwh	141 – 176	7.5YR5/4	SL	Very fine few size root	Very fine sub - angular blocky	-	Stony
2	A	0 – 20	10YR3/3	L	Medium many size root	Very fine single grain crumb	Smooth-diffused	Fairly stony
	AB	20 – 48	10YR5/3	L	Medium many size root	Very fine sub – angular blocky	Smooth-clear	Fairly stony
	B	48 – 75	10YR5/3	SiL	Fine few size root	Very fine sub – angular blocky	Smooth-diffused	Fairly stony
	Bh	75 – 113	10YR5/3	SiL	Fine few size root	Very fine massive granular	-	Fairly stony
3	Ap	0 – 22	10YR3/2	LS	Medium common size root	Very fine single grain crumb	Smooth-diffused	Fairly stony
	A	22 – 56	10YR3/4	LS	Coarse many size roots	Very fine single grain crumb	Smooth-abrupt	Fairly stony
	AB	56 – 84	10YR6/6	SL	Very fine few size root	Very fine sub - angular blocky	Smooth-diffused	Fairly stony
	BW_1	84 – 118	10YR6/6	SL	Very fine few size root	Very fine sub - angular blocky	Smooth-abrupt	Fairly stony
	BW_2H	118 – 144	7.5YR5/6	SL	No root	Very fine massive granular	Smooth-diffused	Fairly stony
	BW_2	144 – 175	7.5YR5/6	SL	No root	Very fine massive granular	-	Fairly stony
4	A	0 – 26	10YR3/1	SL	Medium many size root	Very fine single grain crumb	Smooth-diffused	Fairly stony
	BW_1	26 – 49	10YR3/2	SCL	Fine many size root	Very fine sub – angular blocky	Smooth-clear	Fairly stony
	BW_2	49 – 83	10YR3/2	SCL	Fine few size root	Very fine sub - angular blocky	Smooth-clear	Fairly stony
	BW_3	83 – 114	10YR3/610YR6/6	SCL	Fine few size root	Very fine sub - angular blocky	Smooth-diffused	Fairly stony
	BW_4	114 – 144	10YR3/610YR6/6	SCL	Fine few size root	Very fine sub - angular blocky	Smooth-diffused	Fairly stony
	BW_5	144 – 187	7.5YR3/4	SCL	Fine few size root	Very fine sub - angular blocky	-	Fairly stony
5	A	0 – 23	10YR3/2	SL	Medium common roots	Medium sub – angular blocky	Smooth-diffuse	Fairly stony
	BW_1	23 – 52	10YR5/4	SCL	Fine few size roots	Medium sub – angular blocky	Smooth-clear	Fairly stony
	BW_2	52 – 88	10YR5/4	SCL	Fine few size roots	Medium sub – angular blocky	Smooth-clear	Fairly stony
	BW_3	88 – 117	10YR4/4	SCL	Fine few size roots	Medium sub – angular blocky	Smooth-clear	Fairly stony
	BW_4	117 – 144	10YR5/4	SL	Fine few size roots	Medium single grain crumb	Smooth-diffused	Fairly stony
	BW_5	144 – 173	10YR5/4	SL	Fine few size roots	Medium single grain crumb	-	Fairly stony

Climate

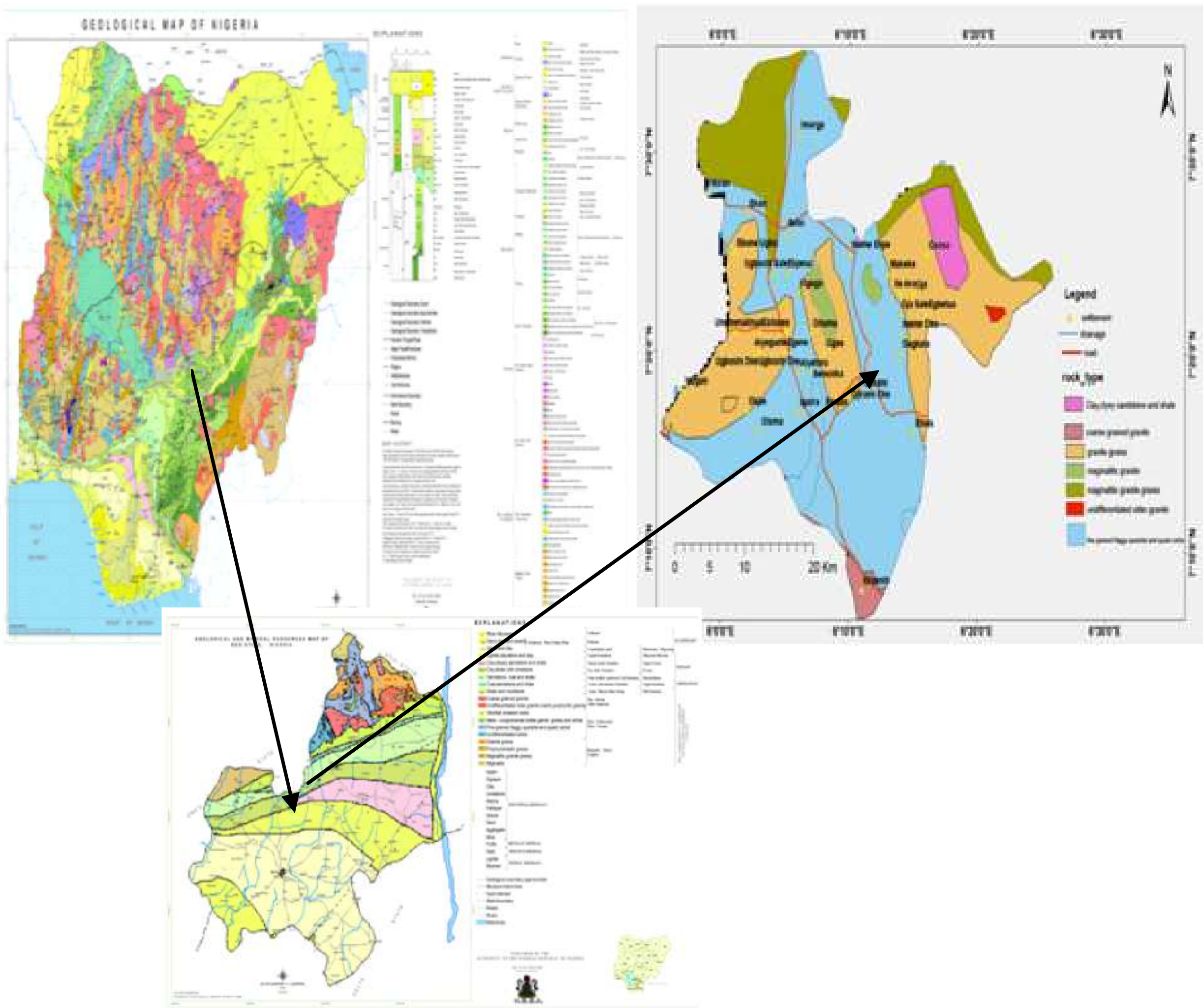
Akoko Edo Local Government lies within the Northern belt of derived savanna, characterized by tropical climate with an annual average rainfall amount of 1200 - 1500 mm, mean annual temperatures range of 27° C to 32° C and mean annual relative humidity ranging from 30.5 % to 94.0 % (Weppa farms, 2013). The study area is characterized by two distinct seasons: the wet and the dry. The rainfall is at its peak in July and August with a short break in mid-August. The dry season begins early November and ends by March.

Geology and Physiography

The project area lies within the basement complex formation, which consists of various minerals like shale, coarse grained granite and granite gneiss etc. with some outcrops visiblearound the entire local government area. Physiographically, the project area can be described as situated on gentle plains of low relief in some areas of the local government while other areas are quite steep due to the presence of high hills visible in the area.

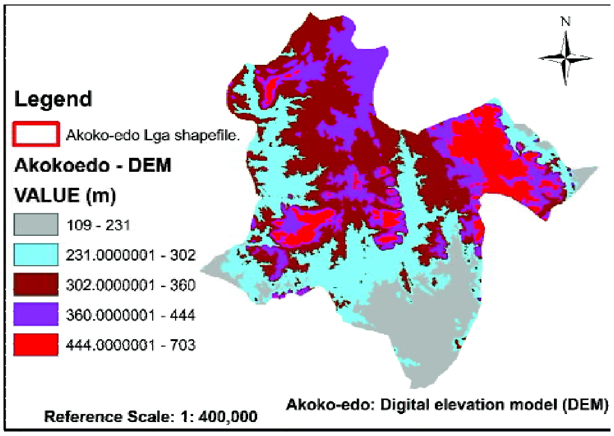
Topography

The land area is quite undulating with the highest points at the north east flank of the land. More details are as expressed in the digital elevation model below.



Source: An extract from the Geological map of Nigeria.

Fig.2: Geological map of study area.



Source: SRTM – Shuttle Radar Topographic Mission.

Fig.3: Akoko-Edo Digital Elevation Model (DEM)

Fig.4: Google imagery of study area

Land use

The land use includes settlements, forest, cultivation, riparian forests, water bodies and wood land. Extensive agricultural activities which incorporate shifting cultivation, arable farming, crop rotation, continuous cropping, cocoa /cashew/oil palm farming and mixed cropping, primitive ranching, firewood and lumbering are practiced by the indigenous farmers.

Vegetation

Akoko-Edo falls within the derived savanna vegetation zone of Nigeria and it is characterized with grasses, dispersed forest trees of economic importance, arable and plantation farms.

Pre-field and field work.

A pre-field work was undertaken; firstly, GIS was used to extract information from remotely sensed imageries like differences in relief, vegetation, parent material and other morphological features that are likely to influence a soil change, create thematic layers out of them and perform an overlay operation to create a soil map using a perimeter plan of Akoko Edo as shapefile. The map was produced with the help of a GIS software (Arc map 10.3). Following the active soil forming factors in Akoko Edo LGA, that is, geology, topography, and climate using drainage parameters of the area, arranged into thematic layers, which were overlaid to produce the soil map of Akoko Edo LGA which eventually gave rise to 5 mapping units. Each mapping unit was represented by standard profile pits-the pedon, to depths ranging from 180 - 200 cm and was described and sampled according to FAO (1991) for laboratory analysis.

Laboratory studies

Soils collected from each horizon were air-dried and passed through a 2 mm sieve. The sieved samples were analyzed for some physical and chemical properties. Particle size distribution was determined by the hydrometer method (Bouyoucos, 1962) after the removal of organic matter content with hydrogen peroxide and dispersion with sodium hexametaphosphate (International Institute for Tropical Agriculture - IITA, 1979). Available P was determined by Bray-1 method (Murphy and Riley, 1962). The pH was determined with glass electrode pH meter in soil: soil and water at ratio 1:1 (Maclean, 1982). Exchangeable Bases (Na, K, Ca and Mg) were extracted with neutral normal ammonium acetate (NH_4OAC at pH 7.0); Na and K were determined by flame photometer while Ca and Mg were determined by atomic absorption spectrophotometer (Thomas, 1982). Total N was determined by Macro Kjedhal method (Bremner and Mulvaney, 1982). Exchangeable Acidity was determined by titration method (Anderson and Ingram, 1993). Organic Carbon was determined by Walkley Black method (Page, 1982). Effective Cation Exchange Capacity (ECEC) was obtained by the summation of Exchangeable Bases and Exchangeable Acidity (Tan, 1996). Base Saturation was calculated by dividing the sum of Exchangeable Bases (Na, K, Ca and Mg) by the ECEC and multiplying the quotient by 100. ECEC clay was obtained by dividing ECEC soil by percentage clay and multiplying the quotient by 100.

RESULTS AND DISCUSSION

The results of physical and chemical analysis as well as the morphological results from the study area is shown in Tables 1 and 2 below. The results shows that the various chemical elements in the various mapping units were not regular down the profile pits. Morphologically, the area also shows variation in the properties for the various mapping units in Akoko Edo Local Government Area.

Soil classification

The soils were classified using both USDA soil taxonomy (Soil survey staff, 2014) system of soil classification and World Reference Base for Soil Resources (IUSS, 2006) with data collected from the field and laboratory analysis of each mapping unit.

The three active soil forming factors in the area; (geology, DEM and Drainage Pattern) were overlaid with the help of GIS to produce the soil map of Akoko Edo LGA. Ground truthing was done to ensure that the table work is also found in reality on ground.

Geological Map

The geological map was extracted from geological map of Nigeria. Edo state geological map was extracted from the geological map of Nigeria and then Akoko Edo LGA geological map was further curled out of the geological map of Edo State.

Typical soil minerals are; Quartz: SiO_2, Calcite: $CaCO_3$, Feldspar: $KAlSi_3O_8$, Mica (biotite): K $(Mg,Fe)_3AlSi_3O_{10}(OH)_2$. Most of these materials are very common in Akoko Edo LGA, hence the need to generate a Parent Material map. The map is as shown in Fig 5 below.

The map above shows about 5 different mineral materials in Akoko Edo (Migmatite, Granite, undifferentiated schist, meta-conglomerate and Claystone) which can influence a soil change within the area. Parent material as a key soil forming factor when developed into a thematic layer, can be overlaid with other parameters to generate a soil map using a GIS software.

Topography or DEM Map

Digital elevation model (DEM) for Akoko Edo was extracted from the SRTM of Nigeria through the help of a GIS software; arc map 10.3 and developed into a thematic layer. The topography is characterized by the inclination (slope), elevation, and orientation of the terrain. Mineral accumulations, plant nutrients, type of vegetation, vegetation growth, erosion, and water drainage are dependent on topographic relief. Akoko Edo LGA has and undulating topography with different mineral rocks, hence the different heights of 101 m – 703 m as clearly shown in the DEM map below.

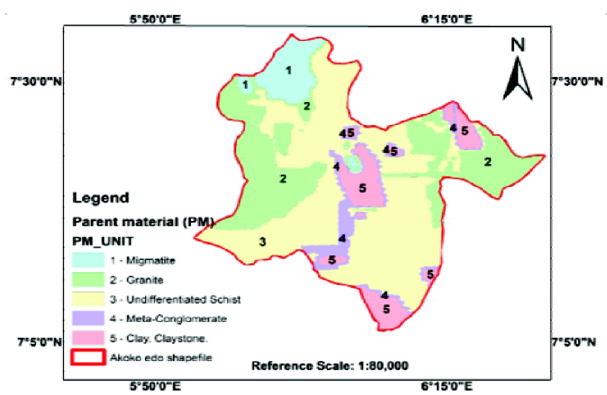


Fig 5: Akoko Edo Parent Material Map.

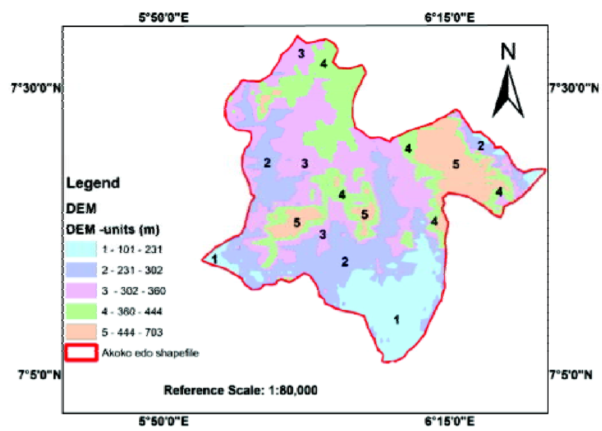


Fig 6: DEM map of Akoko Edo LGA.

Table 2: Physical and chemical properties of Pedons 1-5

Pedon ID	Horizon	Horizon Depth	Ph	EC µS/cm	Org.C	Org.M gkg^{-1}	T.N	Av. P mg/kg	Al^{3+}	H^{+}	Na	K cmolkg^{-1}	Ca	Mg	ECEC	ECEC	BS (%)	Clay	Silt gkg^{-1}	Sand Clay	Textural Class	Gravel (%)
1	Ap	0-19	4.5	29.80	0.24	0.41	0.02	1.30	1.10	0.50	0.03	0.20	0.70	0.30	2.83	28.30	43.46	100	55	845	LS	20.42
	A	19-42	6.2	43.80	0.97	1.67	0.09	2.68	0.40	0.30	0.30	0.50	3.00	1.10	5.60	38.62	87.5	145	55	800	SL	17.82
	BA_1	42-76	6.0	23.40	0.93	1.60	0.09	5.04	0.40	0.30	0.50	1.00	3.80	2.50	8.50	53.13	91.76	160	100	740	SL	14.56
	BA_2	76-112	5.8	55.40	0.78	1.34	0.07	2.54	0.70	0.30	0.20	0.40	3.20	0.90	5.70	38.00	82.46	150	55	795	SL	19.24
	BA_3	112-141	5.6	45.30	0.74	1.27	0.06	4.36	0.80	0.30	0.20	0.40	3.50	1.80	7.00	35.90	84.29	195	85	720	SL	28.77
	BWh	141-176	6.3	85.20	1.20	2.06	0.11	6.80	0.50	0.30	0.60	1.50	4.50	3.00	10.40	49.52	92.31	210	106	690	SCL	59.84
2	A	0-20	5.7	41.20	0.93	1.60	0.09	3.44	0.70	0.30	0.20	0.60	2.90	1.30	6.00	37.5	83.33	160	420	420	L	29.95
	AB	20-48	6.4	38.50	0.89	1.53	0.08	6.26	0.40	0.20	0.10	0.40	3.20	1.00	5.30	33.13	88.68	160	490	350	L	40.02
	B	48-75	4.6	18.80	0.09	0.15	0.01	1.64	1.10	0.60	0.03	0.10	0.70	0.30	2.83	70.75	39.93	40	520	440	SiL	8.55
	Bh	75-113	4.8	34.10	0.11	0.19	0.01	1.42	1.00	0.50	0.03	0.10	0.90	0.30	2.83	70.75	39.93	40	520	440	SiL	10.34
3	Ap	0-22	4.8	24.90	0.09	0.15	0.01	1.42	1.20	0.60	0.03	0.10	0.70	0.40	3.03	33.67	40.59	90	55	855	LS	23.40
	A	22-56	4.9	20.80	0.27	0.46	0.03	1.92	1.20	0.50	0.10	0.20	0.80	0.30	3.10	31.00	45.16	100	75	825	LS	17.19
	AB	56-84	5.3	43.80	0.69	1.19	0.06	3.44	0.80	0.20	0.10	0.60	3.80	1.60	7.10	45.81	85.92	155	55	790	SL	7.00
	BW_1	84-118	5.6	32.80	0.64	1.10	0.06	4.64	0.60	0.30	0.60	0.60	3.40	1.80	7.30	50.34	87.67	145	86	769	SL	9.87
	BW_2H	118-144	6.1	39.70	0.90	1.55	0.08	6.90	0.50	0.30	0.30	0.60	4.40	1.80	7.90	61.72	89.87	128	65	807	SL	63.05
	BW_2	144-175	6.6	40.10	0.69	1.19	0.06	7.48	0.50	0.20	0.40	0.70	4.20	1.70	7.70	66.96	90.91	115	76	809	SL	35.07
4	A	0-26	5.5	49.50	0.79	1.36	0.07	3.34	0.60	0.40	0.30	0.40	3.70	2.20	7.60	63.33	90.79	120	95	785	SL	46.18
	BW_1	26-49	5.5	40.10	0.80	1.38	0.07	2.86	0.80	0.40	0.03	0.60	5.00	2.20	9.03	44.05	95.24	205	89	706	SCL	59.37
	BW_2	49-53	5.1	29.30	0.78	1.34	0.07	3.82	0.60	0.40	0.20	0.60	5.00	2.10	8.90	37.39	88.76	238	80	682	SCL	53.07
	BW_3	53-114	5.6	37.40	0.69	1.19	0.06	3.01	0.80	0.30	0.30	0.70	5.50	2.20	9.80	34.03	88.78	288	75	637	SCL	52.99
	BW_4	114-144	5.2	31.70	0.79	1.36	0.07	3.22	0.70	0.40	0.30	0.60	4.90	2.40	9.30	42.27	92.47	220	185	595	SCL	55.76
	BW_5	144-187	5.3	28.40	0.64	1.10	0.06	4.42	0.70	0.30	0.30	0.80	5.20	2.10	9.40	32.98	89.36	285	70	645	SCL	51.11
5	A	0-23	5.8	55.70	0.93	1.60	0.09	4.70	0.50	0.30	0.40	1.10	5.40	2.50	10.20	63.75	92.16	160	85	755	SL	36.29
	BW_1	23-52	5.2	38.20	0.65	1.12	0.06	2.24	0.70	0.30	0.50	1.20	4.60	2.40	9.70	43.11	89.69	225	165	610	SCL	52.05
	BW_2	52-88	5.8	29.40	0.63	1.08	0.06	2.94	0.70	0.40	0.60	1.40	5.20	2.40	10.70	41.96	89.72	255	71	674	SCL	36.05
	BW_3	88-117	5.3	34.70	0.61	1.05	0.06	3.16	0.90	0.40	0.30	1.20	4.70	2.00	9.50	38.78	86.32	245	55	700	SCL	38.67
	BW_4	117-144	5.3	68.00	0.64	1.10	0.06	2.34	0.80	0.30	0.50	1.10	4.30	2.20	9.20	46.46	88.04	198	57	745	SL	40.63
	BW_5	144-173	5.9	62.50	0.92	1.58	0.08	2.78	0.60	0.30	0.40	0.90	4.80	2.00	9.00	47.87	90.00	188	60	752	SL	20.19

Drainage map as a function of Climate

This was developed from the SRTM (Shuttle Radar Topographic Mission) of Nigeria and also developed into a thematic layer for soil map production through overlay with other active soil forming factors in Akoko Edo LGA.

The three active soil forming factors/maps above were overlaid with the help of GIS to produce the soil map of Akoko Edo LGA.

SOIL MAP OF AKOKO EDO LGA USING GIS

LEGEND FOR GIS SOIL MAP.

1. Lower slope, migmatite well drained area, Loamy sand to Sandy loam, 560.6 ha.
2. Granitic, well drained, lower slope, Loam to Silt loam, 52,715.3 ha
3. Fairly well drained, midslope, undifferentiated schists, Loamy sand to Sandy loam, 67,189.4 ha
4. Lower slope, meta-conglomerate below alluvium, poorly drained, Sandy loam to Sandy clay loam, 8,447.3 ha.
5. Upper slope, clay / clay stone, deposits of flooded conditions Sandy loam to Sandy loam, 734.2 ha.

Soil Classification

The USDA soil taxonomy (Soil Survey Staff, 2014) and World Reference Base for Soil Resources (FAO, 2006) were used to classify the soils of Akoko Edo LGA, using GIS procedure. Pedon 1 was classified according to USDA soil taxonomy (Soil Survey Staff, 2014) as Loamy Kaolinitic

Table 3: Classification of Akoko Edo Soils

Pedons	USDA	WRB	Area Coverage	Percentages (%)
1	Loamy Kaolinitic Isohyperthemic Fluventic humicDystrudept	Haplic Fluvic Cambisol (Dystric, Humic)	560.6	0.4
2	Loamy Kaolinitic Isohyperthemic Fluvaquentic Dystrudept	Haplic Fluvic Cambisol (Siltic, Greyic)	52,715.30	40.7
3	Loamy kaolinitic Isohyperthemic Fluventic Dystrudept	Haplic Fluvic Cambisol (Dystric)	67,189.40	51.8
4	Loamy Kaolinitic IsohyperthemicOxyaquicEutrudept	Haplic EndogleyicCambisol (Gleyic Oxyaquic)	8447.3	6.5
5	Loamy kaolinitic IsohyperthemicHumicdystrudept	Haplic, Fluvic Cambisols (Dystric, Humic)	734.2	0.6

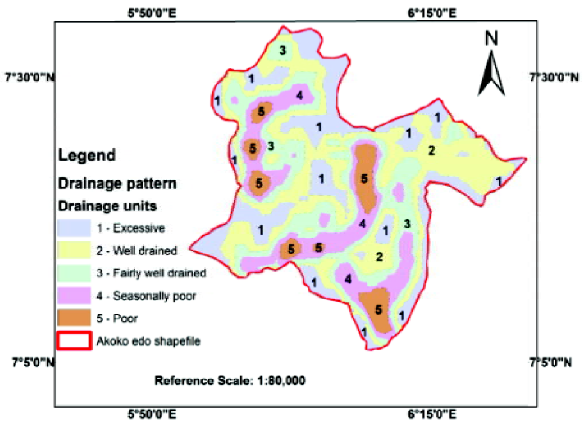


Fig 7. Drainage Pattern Map of Akoko Edo LGA.

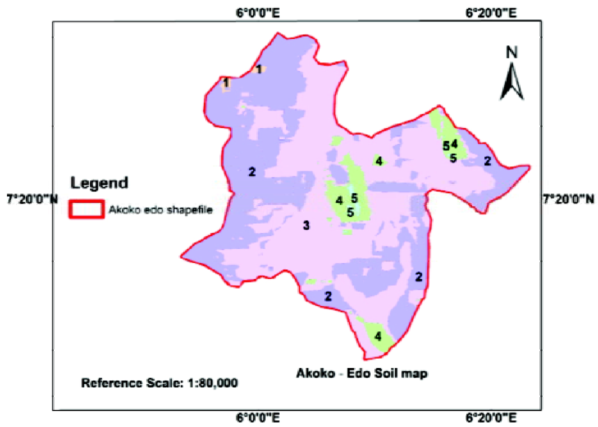


Fig. 8: Soil Map of Akoko Edo, GIS procedure.

Isohyperthemic Fluventic humicDystrudept while according to WRB, it was classified as Haplic Fluvic Cambisol (Dystric, Humic) with an aerial coverage of 560.6 ha (0.4%).

Pedon 2 occupying an area of 52,715.3 ha (40.7%) in Akoko Edo LGA, was classified according to USDA soil taxonomy (Soil Survey Staff, 2014) as Loamy Kaolinitic Isohyperthemic Fluvaquentic Dystrudept and Haplic Fluvic Cambisol (Siltic, Greyic) according to WRB system of soil classification.

Pedon 3 occupying an area of 67,189.4 ha (51.8%) was classified as Loamy kaolinitic Isohyperthemic Fluventic Dystrudept according to USDA while WRB classified it as Haplic Fluvic Cambisol (Dystric).

Pedon 4 was classified according to USDA soil taxonomy as Loamy Kaolinitic Isohyperthemic Oxyaquic Eutrudept while WRB classified it as Haplic Endogleyic Cambisol (Gleyic Oxyaquic). It occupies an aerial of 8,447.3 ha (6.5%).

Pedon 5 on the other hand, occupying an area of 734.2 ha (0.6 %) was classified according to USDA soil taxonomy (Soil Survey Staff, 2014) as Loamy kaolinitic Isohyperthemic Humic dystrudept and Haplic, Fluvic Cambisols (Dystric, Humic) according to WRB (FAO, 2006) system of classification. Table 3 below shows the summary table for the classification of Akoko Edo soils using GIS procedure.

CONCLUSION

Soil identification on the area was done using GIS technology. Considering the soil forming factors in Akoko Edo LGA, five mapping units were conspicuous from the use of GIS technology.

Profile pits were sunk to represent the identified mapping units. Profile pits were properly read, sampled and analysed for routine soil parameters.Laboratory results and morphological properties were used to classify the soils. The study has brought out clearly relevant soil information that can guide decision on the use and management of soils of the area on a sustainable basis. The study has successfully spelt out the different types of soils in Akoko Edo as well as the aerial extent of each of the soil type on the landscape which will serve as a guide to land users in the entire Local Government Area.

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