CHARACTERISTICS AND CLASSIFICATION OF SAMPOU SOILS IN BAYELSA STATE.

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ABSTRACT
Studies on the soils of Sampou in Bayelsa State were carried out to evaluate their physical and chemical characteristics for the purpose of classifying them for various uses. Soil samples were analyzed in the laboratory using routine techniques. Soils were classified using USDA Soil Taxonomy. The study revealed that the soils are deep well drained to poorly drained, soil surface textures ranged from sandy clay, loam to sandy loam, subsoil textures loamy sand, loam to sandy clay. Soil pH values ranged from 4.5 to 5.5 which is slightly to moderately acidic. Effective Cation Exchange capacity ranging from 1.85 to 21.33 cmol/kg low to moderately high. The Organic Carbon values range from 1.30 to 16.66 g/kg low to high. The soils are classified as Pedon 1 is classified as Phlinthic kandiudalf/Phlinthic lixisols, Pedon 2 Fluvaquenticdystrudept/stagnicfluviccambisols (dystric, endomangsniferric), Pedon 3 phlinthic kandiudalf/stagnic phlinthic, Lixisols (siltic,entric).And Pedon 4 as Fluvaquentic dystrudept /Stagnic endoplinthic fluvic cambisol (Siltic,dystric,Manganniferric) .The soils see qualified for agricultural land, but are currently under utilized. The use of early maturing cassava cultivars, swamp rice production, sugar cane and vegetables are recommended for optimal economic returns.

INTRODUCTION

The soils of Sampou is located in Kolokuma/opokuma Local government Area in Bayelsa State, and lies within latitude 4.50 to 5.00 N and longitude 6.11 to 6.09 E. The soils are saturated with water during the rainy season in most years and very dry during the dry season. They occur in the lowlying to gentling sloping fresh water alluvial zone of the meander belt area of the Niger delta region of Nigeria. Which are divided by network of tributaries and is frequently flooded in the raining season. The levees are relatively higher in elevation at about 30-40 m above sea level with 2-3% slope and the lowlying area is about 10-20 m above sea level with slope of 0-2% Anderson (1968). Prior to the state creation of Bayelsa state 1996, most of the settlement and farming activities were carried out at well drained levees. The lowlyingvareas are used for fish farming (fish ponds) . Since the creation of the state, the land has become competitive for urban development and expanding facilities, there are influx of people of varying interests for urbanization Ayolagha (1998). The population grew and the land is under pressure, to the effect that the lowlying area reserve for fish farming and other agricultural used were under encroachment for urbanization . Coupled with reported cases of serious annual flooding and other environmental problems in the area. Min. of Environ. (2012). Some of these problems are direct consequences for unguided land use information. These call for the need to study the Agriculture potential of Sampou soils for Agriculture purposes. The objectives of this study therefore, is to characterize and classify the sampou soils and identify their appropriate use of the soils of the Area.

MATERIAL AND METHODS

The Area lies between latitude 4^0 50 to 5^000 N and 6^O11 to 6^025 E, at the north is edoni community of the Sagbama, on the South is the East/ West road and the West is kalama community and on the East is the koso river (Taylor creek) which is the boundary b/w Yenegoa and Kolokuma/Opokuma Local Government Area.

The area a humid tropical climate and covers a land mass of about 9818 hectares. It lies within the low lying, broad and gently sloping upper deltaic plain of the Niger delta. It has two major seasons. The rainy season from April- October with annual rainfall of about 2565mm, the mean monthly temperature is lowest 28^oc, during the period of heavy rainfall in July-sept and highest 32^oc in December to March prior to the onset of rainfall. The vegetation of the study area consist of hydrophilic shrubs and elephant grasses, raphia palms, oil palm and other species of tropical rainforest trees.

Field Study

The map of the sampou was culled out from kolokuma/Opokuma Local Government Area map. A semi detailed survey of the area was carried out by delineating the area and a shapefile of the Area was created using Geographical Information System(GIS). The area was geo referenced and a rigid grid format of 1000mX 500m was obtained. The coordinates of each points were recorded and loaded into hand held Garmin GPS (global position system) for groundtruthing and auger boring. The auger boring was done to identify soil boundaries. Two mapping units were identified, In each of the mapping unit two profile pits were sunk, described according to the guidelines of soil survey staff (1998) and soil samples collected from identified horizons for laboratory analysis. Observation were also taken as to the current land uses in the area using topography and existing mapping units.

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Laboratory Study

Soil samples collected were air dried and crushed and sieved through 2mm sieve for the following laboratory Investigation, particle size distribution was determine by the buoyocous hydrometer method (Gee and bander 1986) bulk density, soil reaction was determine 1:2.5 soil/water ratio by using glass electrode, pH metre, organic carbon was determine by walkey and black (1934), Total Nitrogen was determine macro Kjedale digestion methods, available Phosphorous was by bray 1 method, Exchangeable cations were extracted with 1N NH_4OAc (pH7); Ca and Mg were determine by the EDTA titration method while K and Na were by flame photometer(black *et al*1965) exchangeable H^+ and Al^{+++} Acid were determined by leaching the soils with 1N KCl and titrating aliquots with 001M and NaOH. The ECEC was obtained by the summation of exchangeable of bases plus H^+ and Al^{3+}, while % Base saturation was obtain by dividing the sum of exchangeable catons by the ECEC multiply by 100.

RESULTS AND DISCUSSION

Morphological

Four soil profiles units are deep and are beyond 150 cm, table 1-4 shows some morphological characteristics of the soils. The soils were poorly to moderately well drained dominated by mottles and grey colour. The dominant, hue is 10YR and 7.5YR and the soil colour from Dark Brown both the surface and subsurface horizons, this is due to the flat and lowlying topography in which these soils are found making them liable to flooding Anderson (1968). Reddish Brown ($5YR^4/_4$) Fe_2O_2 concretions were also observed, indicating these soils undergo alternate dry and wet cycles annually due to flooding. The soil structure generally are massive, weak to medium to thin sub angular blocky and weakly developed structure in lower horizons are attributed to the effect of ground water table reflecting the poor drainage condition of the profiles. The poorly drained soils shows some characteristics of accumulated silts content and the soil are mostly sandy clay loam and slightly sticky.

Table 1: Morphological characteristics of Pedon 1

Horizon	Depth cm	Munsellcolour	Textural class (field)	Structure	Consistence	Roots	boundary
A	0-18	7.5YR 4/2	Silty clay	Crumbs	Friable	Medium common	Smooth Wavy
Bt	18-28	7.5YR 5/3	Clay loam	Medium Sub Angular Blocky	Firm	Few medium	Wavy diffused
Bt_2	28-76	7.5YR 5/6	clay	Medium Sub Angular Blocky	Very firm	None	Gradual diffused
Bg	76-180	7.5YR 6/3	Sandy clay loam	Sub Angular Blocky	Very Firm	None	

Table 2: Morphological characteristics of Pedon 2

Horizon	Depth cm	Munsellcolour	Textural class (field)	Structure	Consistence (moist)	Roots	Boundary
A	0-26	10YR 5/3	Loam	Thin Granular	crumbs	Medium Common	Wavy Clear
B	26-48	10YR 7/6	Loam Sand	Medium sub angular blocky	Hard	Few. Medium	Smooth diffused
B	48-67	10YR 6/6	Sandy Loam	Medium sub angular blocky	Hard	Few. Medium	Smooth diffused
Bw	67-102	7.5YR 6/6	Sandy Loam	Medium sub angular blocky	Hard	Very Few	Smooth diffused
Bwg	102-128	10YR 7/3	loamy Sand	Thin sub angular blocky	Hard	None	Smooth diffused
Bcg	128-180	10YR 7/2	Sand	Thin sub angular blocky	Very firm	None	Smooth diffused

Table 3: **Morphological characteristics Pedon 3**

Pedon 3	Depth cm	Munsell colour	Textural Class (field)	Structure	Consistence (moist)	Roots	Boundary
Ap	0-30	10YR 4/3	Sandy clay loam	Medium granular	Friable	Common	Clear diffused
Bv	30-75	7.5YR 4/3	Loam	Thin sub angular blocky	Friable	Few Fine	Clear gradual
Bv_2	73-143	7.5YR 4/3	Loam	Thin sub angular blocky	Friable	Very Few	Smooth Clear

Table 4. Morphological characteristics Pedon 4

Horizon 4	Depth cm	MUNSELL COLOUR	Textural Class	Structure	Consistence	Roots	Boundary
Ap	0-16	10YR4/6	Loam	Crumbs	Friable	Common Medium	Wavy Clear
B	16-37	10YR 5/4	Sandy Loam	Thin Sub Angular Blocky.	Firm	Few	Wavy Clear
Bt	37-63	10YR 6/3	Sandy Loam	Thin Sub Angular Blocky	Firm	Very .Few	Smooth Clear
Bc	63-79	10YR6/4	Sandy Loam	Thin Sub Angular Blocky	Firm	Very Few	Smooth Clear
Cg	79-124	10YR 7/6	Sand	Single Grains	Loose	None	Smooth Clear
2Cg	124-160	10YR 7/3	Sand	Fine Sand	Loose	None	

Physical and Chemical characteristics of the soils

The physical and chemical characteristics of the soils are shown in tables 5-8.

Soil textures are variable, surface soils texture range from siltyloam to sandy clay loam. Subsurface soils texture are commonly sand clay to sandy loam.

Pedon 1, has sandy clay from surface horizons and clay to sandy clay at the subsurface horizons. Soil textures of Pedon 2 varied from loam to sandy loam,while pedon 3 has sandy loam at surface soil and loam at subsurface horizons. Soil textures in pedon 4 has sandy loam in all horizons. These variations shows the features of floodplain soils due to differences annual deposition of materials from flooding. The tables below shows the physical and chemical characteristics of the soils. The soils are slight to moderately acidic with pH values ranging from 4.5 to 6.0, there is general trend of increasing pH with depth followed by a slight decrease in lower horizons. Organic Carbon content varies from 1.50 to 7.18% at surface soils and 1.30 to 16.66 g/kg at subsurface soils, these irregular decrease of organic carbon indicate the characteristics of floodplains soils. Total Nitrogen values ranged from0.030 to 0.523 at surface soils and 0.009 to 1.201 g/kg at subsurface soils, the low values in pedon 2 and are relatively high values in pedon 3 could be due to the influence in soil texture. Available Phosphous values are relatively high ranged from 11.3 to 33.7 at surface soil and 14.0 to 39.2 at subsurface soils, other research works also show these high results Dickson and ayolagha (1996) and also the activities of fishing and earthen fish ponds which attracts seabirds and egrets in the area could be attributed to nthehig levels of phosphouors that the exchange sites of the soils are dominated by Ca and Mg as observed by earlier researches Ayolagha and Dickson 1996), Anderson . in the profile, distribution of total bases, ECEC and % base Saturation seem to be correlated with the distribution pattern of colloidal materials

such as clay and organic matter. The % BS values are high ranging from 75-97% in all pedons from surface soil to subsurface.

TABLE 5 : PHYSICAL AND - CHEMICAL CHARATERISTICS FOR PEDON (1)

		g/kg	g/kg	mg/kg	cmol/kg							%	g/kg			
Horizon Depth cm	**pH**	**Org. C**	**T N**	**Avl.P**	**Ca**	**Mg**	**Na**	**K**	**EH$^+$**	**EAl$^+$ $^+$**	**ECE C**	**B S**	**Sand**	**Silt**	**Clay**	**Textural Class**
0—18	4.7	7.18	0.60	28.60	9.1	3.10	1.133	1.154	4.26	2.68	21.33	67	556.8	80	363.2	S C
18—28	4.8	2.19	0.22	30.1	5.9	1.17	1.219	1.307	4.20	3.00	16.79	50	526.8	120	353.2	S C
28—70	5.5	5.59	0.46	39.2	2.8	2.31	2.315	1.931	1.24	trace	10.59	72	364.0	60	576,0	C
70—180	5.0	4.59	0.46	11.9	1.4	1.25	1.230	0.854	4.60	2.08	11.42	62	544.0	60	396.0	S C

Table 6: Physical and Chemical Characteristics for Pedon 2

Horizon		g/kg	g/kg	Mg/kg	cmol/kg							%	%	g/kg			
Depth cm	**pHw**	**Org. C**	**T N**	**Avl.P**	**Ca**	**Mg**	**Na**	**K**	**CEC**	**TEA**	**ECEC**	**ESP**	**B S**	**Sand**	**Silt**	**Clay**	**Textural Class**
0—26	5.1	4.09	0.118	28.9	2.24	2.35	0.282	3.301	8.17	0.46	8.63	3.2	94	490	302.8	207.2	L
26—48	5.0	1.50	0.030	33.7	2.28	1.24	0.574	0.263	4.36	1.12	5.48	10.4	79	746	206.8	47.2	L S
48—67	5.2	16.66	0.054	34.8	1.96	0.45	0.463	0.290	3.16	1.02	4.18	11.0	75	746	206.8	47.2	L S
67--102	5.7	1.30	0.154	35.5	0.96	0.81	0.459	0.320	2.55	2.10	4.65	10.0	54	728	134.8	117.2	S L
102--128	4.5	4.99	0.040	35.7	0.64	0.50	0.385	0.296	1.82	0.73	2.55	15.0	64	830	102.8	67.2	S
128--180	5.8	3.49	0.009	36.4	0.64	0.13	0.265	0.265	1.30	0.55	1.85	14.0	59	880	82.8	37.2	S L

Table 7. PHYSICAL AND CHEMICAL CHARATERISTICS FOR PEDON (3)

Horizon		g/kg	g/kg	mg/kg	cmol/kg							%	%	g/kg			
Depth cm	**pHw**	**Org. C**	**T N**	**Avl.P**	**Ca**	**Mg**	**Na**	**K**	**CEC**	**TEA**	**ECEC**	**ESP**	**B S**	**Sand**	**Silt**	**Clay**	**Textural Class**
0—30	5.4	6.18	0.130	11.34	3.36	1.01	0.118	0.103	4.99	0.676	10.14	2.2	93	603.6	200	196.4	S L
30--73	5.6	2.18	0.130	14.00	10.28	4.02	0.086	0.057	14.44	1.020	15.46	0.5	94	453.6	330	176.4	L
73—143	4.7	12.97	1.145	25.46	9.23	3.24	0.156	0.081	12.71	1.505	14.21	1.1	89	423.6	310	266.4	L

Table 8 : Physical and Chemical Characteristics For Pedon 4

Horizon		**g/kg**	**g/kg**	**mg/kg**	**cmol/kg**							**%**	**%**	**g/kg**			
Depth cm	**pHw**	**Org. C**	**T N**	**Avl.P**	**Ca**	**Mg**	**Na**	**K**	**CEC**	**TEA**	**ECEC**	**ESP**	**B S**	**Sand**	**Silt**	**Clay**	**Textural Class**
0--16	4.7	3.49	0.66	82	3 36	1.33	0.583	0.779	6.36	0.50	6.56	8.2	92	522.7	340	137.3	S L
16--37	5.1	0.740	0.18	10.6	2.72	1.08	0.528	0.283	5.29	0.90	5.51	9.5	84	650	222.8	127.2	S L
37--63	5.6	6.09	1.07	11.6	3.64	1.16	0.492	0.295	7.03	2.33	9.36	6.2	70	662.0	262.	75.2	S L
63--79	5.2	3.25	0.36	176	4.08	1.00	0.437	0.296	6.34	0.86	7.20	6.5	87	542.8	312	145.2	S L
79--124	6.3	0.68	0.12	28.5	1.20	0.94	0.437	0.259	3.64	1.07	4.71	10.3	71	928	5.2	2.0	S
124--160	6.1	2.19	0.28	36.4	2.68	1.25	0.257	0.293	4.89	0.48	5.37	4.7	87	862.8	62	75.2	LS

Soil classification

The soils of the 4 location were classified according to USDA Key to Soil TaxonomyUSDA key to Soil Taxonomy, Twelfth Edition, Soil Survey Staff, (2014). Two major soil types were identified Viz Alfisols/Lixisols and Inceptisols/Cambisols.

Pedon 2 and 4 fell under the soil Order Inceptisols as they did not possess any of the other diagnostic horizons except Cambisols subsurface horizons on the basis of udic soil moisture regime with the resultant effect on colour, organic carbon content and base saturation, they are placed in suborder udepts. Pedons 2 and 4 fitted into dystrudepts great group because characteristically have low ECEC values, they are lower than 24cmol/kg for all pedons. Furthermore pedons 2 and 4 fitted into fluvaquentic subgroup because they all have fluvic properties that is irregular decrease of Organic Carbon.

Pedons 1 and 3 qualified for Alfisols because it has layer of that has 20% lower clay content and below that layer it increases in 3% or more in fine earth fraction. They also possess plinthic properties in one or more horizons within the 150cm of the mineral horizons, Pedon 1 fitted for plinthaquic Kandiudalf because it has saturated water condition, while Pedon 3 fell into subgroup Plinthic kandiudalf .

In terms of World Reference Base for soil resources).. Pedon 1 correspond to Stagnic Plinthic Lixisol (Clayic, Oxyaquic) it has plinthic propertiePedon 2 correspond to Stagnic fluvic cambisol(dystric, manganiferric) Pedon 3 correspond to .Stagnic Plinthic Lixisols (clayic, oxyaquicsPedon 4 correspond to Stagnic Fluvic cambisols (skeletic,dystric).

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