



Nigerian Journal of Soil Science

Journal homepage: www.soilsjournalnigeria.com



Local soil classification [soil association/soil slope–soil series], world reference base, and USDA soil taxonomy: roles in soil survey execution.

*^AOkusami, Temitope A.

*Formerly at The Department of Soil Science and Land Resources Management, Obafemi Awolowo University, Ile-Ife. Osun State. Nigeria.

^APresent address; P.O . Box 2091 , Obafemi Awolowo University Post Office. Ile-Ife. Osun State. Nigeria.

ARTICLE INFO

Article history:

Received November 16th, 2021

Received in revised form June 13th, 2021

Keywords:

Legend

Soil Classification

Soil Map

Corresponding Author's E-mail Address:

okusamita@yahoo.com +2348033886575

njss.2021.300211

ISSN– Online 2736-1411

Print 2736-142X

© Publishing Realtime. All rights reserved.

ABSTRACT

The objective was to do a comparative assessment of the best roles of three classification systems, [the “USDA-Soil Taxonomy”; the “World Reference Base (WRB)”; and the presumably Soil Association/Soil Series Concept of Nigeria] in Soil Survey execution from Soil Mapping through to Soil Survey Report. In this instance the concern of this paper is mostly what is best applicable when mapping legend is being defined during field research and/or field activities for mapping and publication purposes. The soils used are derived from basement complex rocks (Ilero at 08.05N/03.22E) and the coastal sediments (Igboodu at 6.28°13'N/4.19°30' E) in the sub-humid and humid parts of southwest Nigeria respectively. The soils pattern reflects the topo-sequence and/or litho-sequence concepts with a typical sequence of soils on the crest, shoulder and/or upper slope, middle slope, lower slope, fringe and/or valley bottom positions. At the mapping phase, the WRB nearly corroborates the intrinsic qualities of the Soil Association-Soil Series concept. This comparison is fully developed when the characteristics of the different classification units are compared to the morphological expression as shown in the Soil Association-Soil Series concept. However, it should be noted that the philosophy behind these two systems only slightly overlap as classification systems adaptable for soil mapping purposes [field and post field] at the level of soil management requirements – large scale ; while USDA Soil Taxonomy is best at small scale and for better understanding of soil genesis of the mapping units.

1.0. Introduction

Soil map legend and its soil classification are ‘twin concepts’ in a soil survey programme. The soil classification enables the extrapolation of information contained in the soil survey report to other areas with similar/identical environmental data. It also facilitates dialogue among soil scientists (SOILMAPS.htm). The usefulness of the map legend is equally related to the mapping scale and the scale of map publication. Small scale maps (i.e., < 1:250,00) show minor detail and therefore its map legend will obscure less dominant soils not significant for sustainable soil use and its management. It also means that the soil classification to accommodate the lower intensity level of the mapping units will be an aggregating level, i.e., at the higher level of the hierarchy of classification systems. The relationship between the usefulness of soil mapping to

potential users of soil information has been linked to the need to: [1] make maps at a detailed level; and [2] to describe the inherent map units with a structured and coherent legend which is simple, easy to understand, and readily adaptable to local needs (SOIL MAPS.htm). This strongly emphasizes that it is at the detailed level that the legend to soil map is very critical at carrying along with the intrinsic properties of the soil being classified for its desirable maximum benefit to soil information users. Minimum concise words/description are also beneficial for cartographical sake and quick assimilation by other soil scientists and soil information users. The current desire at the national level to map the soils of Nigeria at the detail level [i.e., at 1:25,000] has brought into focus the need to articulate details required especially at the field work level for correlation to be easily but efficiently conducted to bring about the best results in the mapping of soils of Ni-

geria and its subsequent publication. The correlation exercise will also not be limited to the currently used local classification system [i.e., the Soil Association concept] but also in the context of the contemporary mostly used international soil classification systems, viz., World Reference Base [WRB] and USDA Soil Taxonomy. Therefore, the major objective of this review work is to use two previous work of soil survey in evaluating the best system for

soil classification at the field level that will not require or have in existence laboratory data but yet adequately detailed to be able to represent the essential differences in mapping units and repeatable for correlation purposes.

2.0. Materials and Methods.

The areas of referenced study sites are as shown in Figure 1.



Figure 1: Political Location of Soil Map/Sites

As depicted in Figure 2 (Okusami, unpublished Soil Map) the soils are derived from basement complex rocks within the sub-humid parts of southwest Nigeria. This site is des-

ignated as Ilero (The closest settlement to the site of the mapped area).

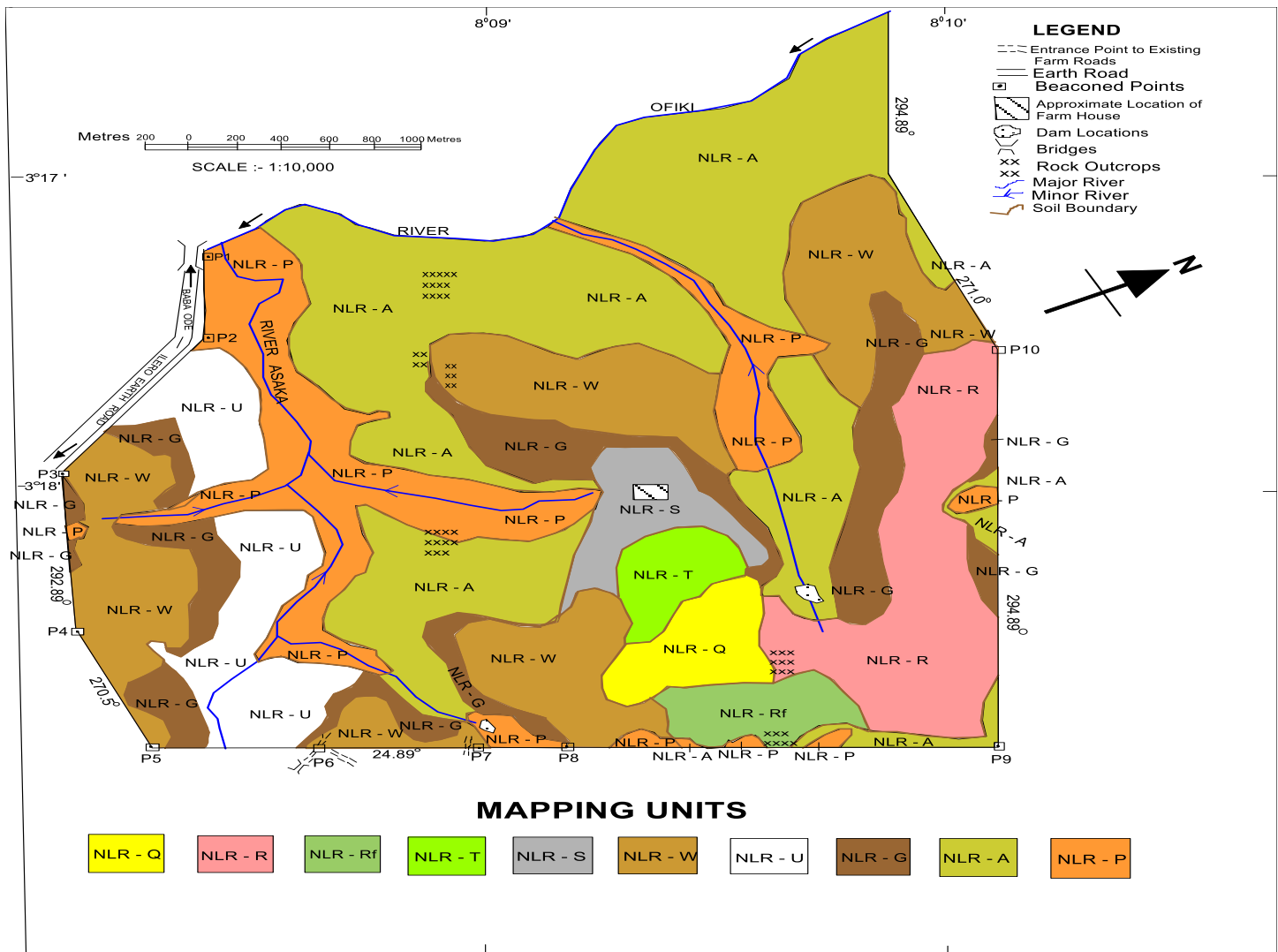


Figure 2: Soil Map of Ilero site in South West Nigeria (Okusami, unpublished soil survey, soil map)

Ilero (08.05N/03.22E) has a bimodal rainfall pattern with an estimated average annual rainfall of 1105mm. The parent rock lithology is commonly granitic gneiss, igneous and ultrabasic and the soil pattern is adapted to the toposequence and lithosequence concepts with soil-

landscape typically consisting of soils located on the crest, shoulder and upper slope, middle slope, lower slope, fringe and valley bottom positions (Figure 3), (Okusami 2018).

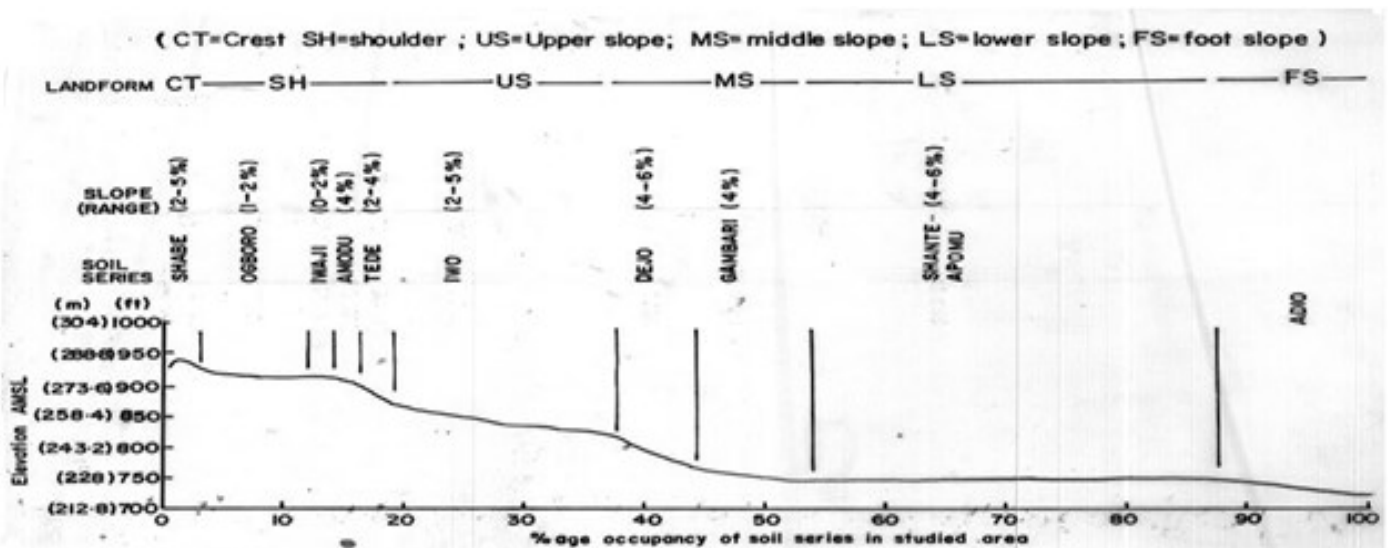


Figure 3: Schematic Soil-Landform Position On a Toposequence in Studied Site at Ilero in Degraded Environment of Derived Savanna in SW-Nigeria (Okusami, 2018)

The second area of interest is Igboodu [6.28°13" N/4.19°30" E], close to Epe in Lagos state of Nigeria. This area also has a bimodal climate with peaks in June and September with an annual average rainfall of 1800mm and an annual average temperature of 27°C. The parent rock has been described to be “basically sandstone with bands of slightly ferruginized clay outcropping occasionally”. Further environmental information indicates that the “landscape has a moderate relief and is moderately rolling. It consists of the crest, shoulder, middle slope, valley fringe and valley-bottom physiographic units. There are three surfaces that constitute the crest. The shoulder has

been described to be sloping but short. The soil distribution is shown in Figure 4 (Okusami *et al.*, 1988), with some selected cross-sections showing the complexity of the landscape (Figure 5, Okusami, 1997). The comparisons were made with the concepts as contained in Smyth and Montgomery (1962) and Moss (1957) for the Local Classification (Series); Soil Survey Staff (2014) for Soil Taxonomy (ST); and (2014) for the World Reference Base (WRB) as referenced in Okusami 1997, 2018. The soil map studies were conducted in response to the demands of clients to the Obafemi Awolowo University Consultancy unit.

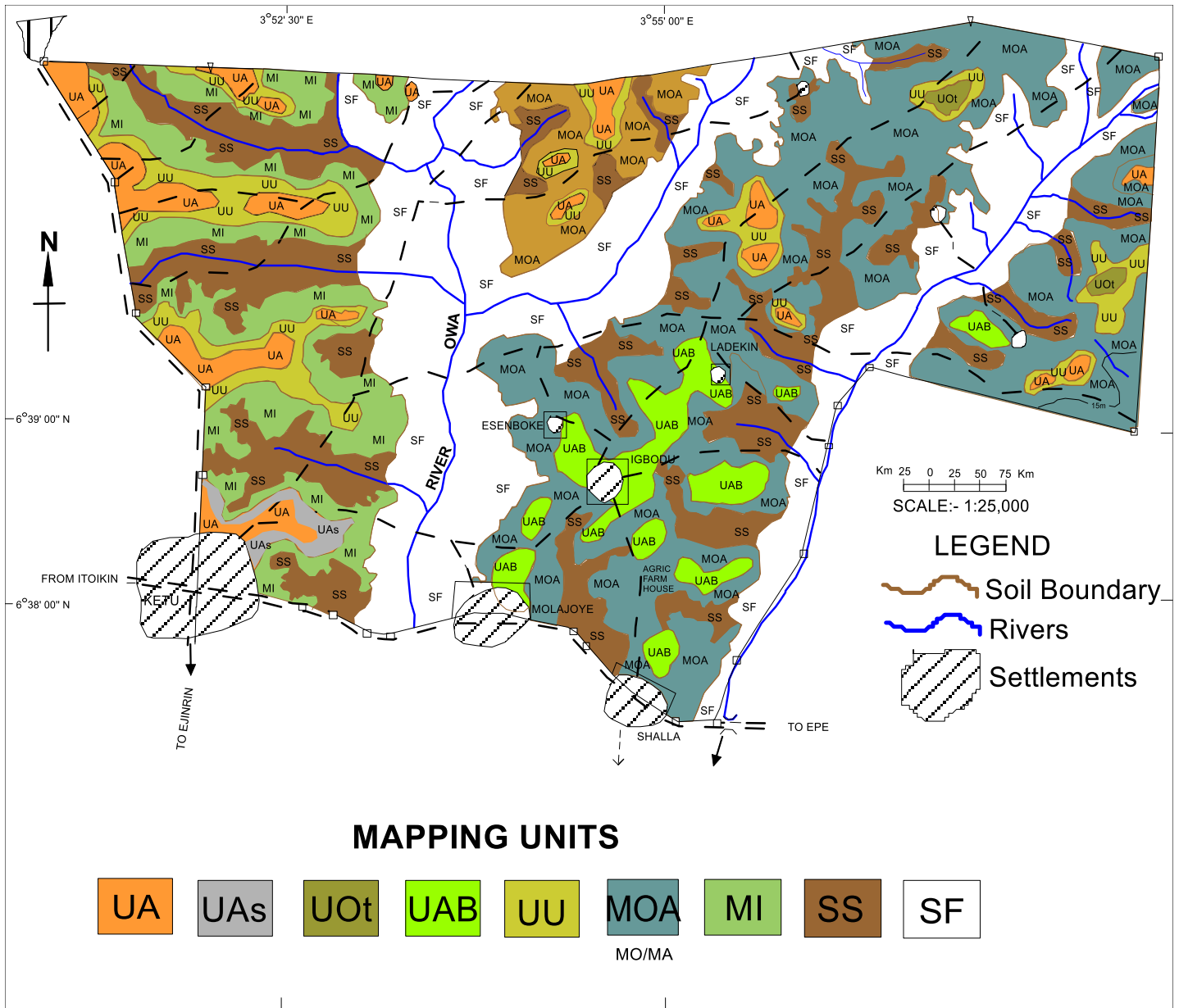


Figure 4. Soil map of Igboodu Site in South West Nigeria, (Adapted from Okusami *et al.*, 1988)

3.0. Results and Discussion.

For Ilero sequence: The crest/shoulder positions contain soils with gravels/stones/cobbles (quartz rubbles) at various depths including concretions, nodules, and stone lines. Upper slope positions also have the latter soil materials replicated. The middle slope position contains poorly to imperfectly drained soils and soils with an iron pan at shallow depths. The lower slope position contains imper-

fectly drained soils while the valley bottom is occupied with both colluvial and alluvial materials and is u-shaped and therefore highly eroding. Using the systems as itemized below, the dominant soils (mostly >90% by volume) are classified into (Soil Series (local)/USDA Soil Taxonomy (ST)/ World Reference Base (WRB), respectively [Table 1].

Table 1: Comparative Soil Classification for Soils of Ilero

MAPPING UNITS (symbol): ●Local ●Soil Taxonomy (ST) ●World Reference Base [WRB]	SOIL CLASSIFI- CATION ●Local [series] ●Soil Taxonomy ●World Reference Base	PHYSIOG- RAPHY (Slope, %)	BRIEF MORPHOLOG- ICAL CHARACTERIS- TICS	OTHER SIGNIFICANT / RELATED PROPERTIES.			
				HOR. DEPTH	COLOUR	GRAVEL	
				(cm)		(%)	
●NLR-Q	●Shabe	UPLAND, CRESTAL/RIDGE	Brownish sandy clay loam	A1 0-10	10YR3/4	20	
●STq	●Rhodic Kandiustults	POSITION (2-5%)	over yellowish red and dark red, very gravelly sandy clay subsoil; Quartz vein [possibly granite] - source of quartz and plen- tiful muscovite mica; it diffuses at Bt2 (123- 150cm) depth. Profile lacks concretions. Roots, although few and very fine, occur at or > than 150cm. kaolinite and muscovite dominant in the clay frac- tion.	Bt1 10-30	5YR 4/6	15	
●WRBq	●Haplic Skelectic Rhodic Acrisols (clayic, cutanic)			Bt2 30-70	2.5YR3/6	62	
				BC1 70-123	2.5YR3/6	67	
				BC2 123-150	2.5YR3/6	51	
				C1 150-175	ND	36	
				C2 175-200	ND	34	
●NLR-R	●Ogboro	UPLAND, SHOULDER-LIKE	Shallow soils; brownish and coarse sandy loam	A1 0-10	10YR3/3	4	
●STr	●Typic or Dystric Haplustepts	(MAY BE UPPER SLOPE POSITION BUT SLOPING)	over dark red/red extreme- ly gravelly. Gravels are both quartz and concre- tionary-45-80% by vol- ume. Deeper subsoils could be very hard and ferruginized (saprolite).	A2 10-30	10YR4/4	80	
●WRBr	●Ferralic Cambisols (ochric)	(1-2%)		2C1 30-52	2.5YR3/6	73	
				2C2 52-75	2.5YR3/6	47	
				3C 75-120	2.5YR4/6	31	
●NLR-Rf	●Iwaji	UPLAND, UPPER SLOPE/PLATEAU	Very shallow soils; black/ brownish topsoils over dark red and variegated red loamy, subsoil hori- zons; ferruginised saprolit- ic material with possible tiny muscovite mica; Gravels could be platy and angular-stones, cobbles with few rounded concre- tions. Moderately well- drained.	ND 0-10	5YR2.5/1	3	
●STrf	●Oxic (?) Typic Haplustepts	-LIKE (SHOULDER, ELEVATION AL- MOST AS THAT OF OGBORO- ASSOCIATED WITH SHABE)		ND 10-20	5YR3/2	77	
●WRBrf	●Skelectic Ferralic Cambisols (Ferric)	(2-4%)		ND 20-50	2.5YR3/6	24	
				ND 50+	10YR4/8(dry) 2.5YR5/8	8	
●NLR-T	●Amodu	UPLAND, UPPER SLOPE, GRADU- ALLY SLOPING;	Brownish, coarse sandy loam over dark red sandy clay sitting on thin stone line (at 150-160cm) most- ly fine quartz gravels; colluvial over granitic (amphibole) parent materi- als. Kaolinite is dominant.	A 0-18	10YR3/4	-	
●STq or t	●Rhodic Kandiustults	LOWER ELEVA- TION RELATIVE TO SHABE (SHOULDER)		BA 18-35	5YR3/4	-	
●WRBq or t	●Haplic Acrisols (clayic)	(4%)		Bt1 35-62	2.5YR3/6	-	
				BCt1 62-150	10YR3/6	-	
				2C 150-160	ND	41	
●NLR-S	●Tede	UPLAND/ PLATEAU-LIKE BUT GRADUAL- LY SLOPING AT LOWER ELEVA- TION RELATIVE TO OGBORO;	Colluvial over granitic derived parent material; thick stone line at 16- 130cm with frequent an- gular quartz stones/ cobbles/gravel sizes and very frequent, angular and rounded concretions (10YR3/1); at 130-160cm, black irregularly shaped regular gravel size nodules existed; variegated sapro- lite has no concretions or nodules; moderately well- drained. Kaolinite dominant	A 0-16	10YR4/2	1	
●STs	●Fluventic Dystrustepts	STANDS AS AN ISLAND ONTO ITSELF; (UPPER SLOPE)		2BC1 16-65	10YR4/3	85	
●WRBs	●Chromic Cambisols (colluvic)			2BC2 65-95	10YR5/4	91	
				3BC1 95-130	2.5YR4/8; 10YR6/4	80	
				3BC2 130-160	2.5YR4/8 10YR6/8; 10YR5/3	9	
				3C 160190-	5YR5/8 10YR6/8 10YR6/3	2	

Table 1: Cont.

MAPPING UNITS (symbol): ●Local ●Soil Taxonomy(ST) ●World Reference Base [WRB]	SOIL CLASSIFI- CATION ●Local [series] ●Soil Taxonomy ●World Reference Base	PHYSIOG- RAPHY (Slope, %)	BRIEF MORPHOLOGI- CAL CHARACTERIS- TICS	OTHER SIGNIFICANT / RELATED PROPERTIES.			
				HOR. DEPTH COLOUR (cm)		GRAVEL (% of the whole soil)	
●NLR-W	●Iwo	LOWER UPPER SLOPE, EXTENDS INTO SHOULDER POSITION BUT ALSO PLATEAU- LIKE (2-5%)	Brownish loamy or sandy clay topsoil horizons over a mid-profile very gravelly (stone line), granite-like clay horizon with coarse materials that are of gravel, cobble, and stone sizes and angular; concretions are frequent (15-45% by vol- ume) and mostly angular but gravel size with 5YR2.5/2 interior; few patches, thin clay mineral cutans at 3BCt3 and few (5 -15% by volume) nodules at 3BCt4. Dominant clay mineralogy are kaolinite and mica.	A	0-13	10YR4/4	-
●STw	●Typic Paleustults OR Kandic Paleustalfs			BA	13-28	7.5YR4/4	-
				Bt1	28-55	7.5YR4/4	4
				2BCt2	55-100	5YR4/6	74
●WRBw	●Pisoplinthic Alisols (clayic, colluvic)	3BCt3	100-120	5YR4/6	21		
		3BCt4	120-160	5YR4/6	-		
					27		
				7.5YR5/8			
				3C	160-190	ND	
●NLR-U	●Dejo	MIDDLE SLOPE (LOWER BACK- SLOPE POSITION BUT CLOSER TO THE MAJOR RIV- ER) (4-6%)	A greyish brown, loamy topsoil over gravelly con- cretionary sandy clay on grey, gravelly sandy clay matrix horizons with yel- lowish brown mottles; the middle horizons are slight- ly to highly gravelly (with very frequent concretions and quartz); mostly quartz at 80-110cm; shallow wa- ter table at 90cm during the beginning of the dry sea- son; somewhat poorly drained. Kaolinite clay dominant.	A	0-15	10Yr3/2	68
●Stu	●Fluvaquentic Epiaquept			AB	15-30	10YR4/3	5
				2BC1	30-80	10YR5/3	8
●WRBu	●Pisoplinthic Cambisols (oxyaquic)			3BC2g	80-110	10YR5/1; 10YR6/8	60
		3C	110-150	10YR5/1 10Yr6/1; 10YR5/8	37		
●NLR-G	●Gambari	MIDDLE SLOPE (4%)	Shallow soils; brownish sandy topsoil (topsoil grav- els are of cobble and stone sizes) with gravelly sand clay on petroplinthites at shallow depth (60 ±20cm); few dark con- cretions; Soil [colluvial in origin] varies from loamy sand to greater depth to those with sand over quartz/ concretions at 60-80cm to those with sand sitting on plinthites at 65cm; greyish sandy topsoil horizons over brownish and yellowish red mottles in subsoil horizons; moderately well-drained. Kaolinite clay mineral.	A	0-12	10YR3/3	2
●STg	●Lithic Haplustepts			AC	12-25	10YR4/3	10
				2C	25-60	10YR4/4	75
●WRBg	●Petroplinthite Cambisols (geoabruptic)						60+
●NLR-A	●Shante/Apomu	LOWER SLOPE (BACKSLOPE POSITION) (4-6%)	Black/gray clay loam to sandy clay; fine gravel size quartz/concretions may be present with mostly few concretions ; Colluvial and alluvial parent materials; somewhat poorly drained. Kaolinite is dominant.	A1	0-5	10YR3/1	-
●STa[s/a]	●Ustoxic Quartzimments OR Aquic Quartzipsamments			A2	5-35	10YR3/1	-
				A3	35-45	10YR4/3	-
				C1	45-90	10YR4/6	9
●WRBa[s/a]	●Albic Arenosols OR Gleyic Arenosols (colluvic)	C2	90-140	?	-		
		C3	140-190	10YR6/4	1		
●NLR-P	●Adio	FRINGE/VALLEY BOTTOM (COULD OCCUR AT ANY LEVEL OF THE LAND- SCAPE FROM THE SHOULDER TO THE FRINGE)		A1	0-12	7.5YR2/0	5
●STp	●Aquic Ustifluvents			A2	12-24	10YR3/1	1
				2BA	24-36	10YR3/1	43
●WRBp	●GleyicFluvisols (loamic)			3BC	36-118	2.5Y4/0; 10YR6/8	7
		4C	118-135	2.5Y4/0; 10YR6/8 5YR5/8	12		
		5C	135+	2.5Y4/0; 10YR6/8	13		

For Igboodu sequence: As previously done, the soil classification is expressed on a sequence of Soil Series (local)/

USDA Soil Taxonomy (ST)/World Reference Base (WRB) as shown in Table 2.

Table 2: Comparative Soil Classification for Soils of Igboodu.

MAPPING UNIT [symbol] ●Local ●Soil Taxonomy (ST) ●World Reference Base (WRB)	SOIL CLASSIFICATION ●Local (Series) ●Soil Taxonomy ●World Reference Base	PHYSIOGRAPHY SLOPE (%)	BRIEF MORPHOLOGICAL CHARACTERISTICS	OTHERS			
				HOR. (cm)	DEPTH	COLOUR	GRAVELS (% of whole soil)
●UA ●STua ●WRBua	●Alagba ●Typic Kandiusults ●Rhodic Ferralic Acrisols (cutanic)	SUMMIT/CREST (1-2%)	Very dark greyish brown, dark yellowish brown or reddish-brown topsoil over red (2.5YR 4/8) subsoil; sandy loam over sandy clay subsoil; friable to firm, blocky subsoil; no mottles, no gravels nor concretions or quartz; well- drained	A	0-5	10YR3/4	-
				A2	5-14	5YR3/4	-
				BA1	14-30	5YR3/4	-
				BA2	30-50	2.5YR4/4	-
				Bt1	50-101	2.5YR4/8	-
				Bt2	101-135	2.5YR4/8	-
				Bt3	135-180 180-200	2.5YR4/8	-
●UAs ● ●	●Alagba, sloping phase	UPPER MIDDLE SLOPE (4-7%)	Dark brown/dark- reddish brown topsoil over yellowish red (5YR4/6) and red (2.5YR4/8) subsoils; friable and blocky subsoil horizons; horizon with angular and mineral type concretions (yellowish-red) exist; Well-drained	A1	0-8	10YR3/3	-
				A2	8-25	5YR3/4	-
				B	25-48	5YR3/4	-
				2Bc	48-67	5YR4/6	-
				3B	67-97	2.5YR4/8	-
					97-117	2.5YR4/8	-
					117-140	2.5YR4/8	-
●UOt ●STuot ●WRBuot	●Oteyyi ●Typic Kandiusults ●Ferric Acrisols (cutanic, Differentic)	SUMMIT/CREST, SHOULDER (0-9%)	Plateau-like summit; formed in sandstone (now residual); dark greyish brown/yellowish brown surface soil over mottled concretionary subsoil at 30cm with dominant brownish yellow and yellowish red colours; loamy sand topsoil with increasing clay content to sandy clay; few iron concretions increasing in size and content with depth; few gravels.	Ap	0-10	10YR3/2	-
				BA	10-34	10YR4/4	-
				Bt	34-50	10YR3/6; 5YR5/8	g
				BC	50-78	5YR4/6; 2.5YR4/8	-
				C1	78-105	10YR6/8; 2.5YR4/8	-
				C2c	105-140	2.5YR4/8, 10YR6/8 5YR5/8	g
●UAB ●STuab ●WRBuab	●Asaba ●Typic Kanhaplustults ●Skeletal Acrisols (cutanic)	SUMMIT/CREST, PLATEAU -LIKE (3-5%)	Variable depth to broken or consolidated petroplinthites, about 90cm to the surface; brown topsoil [10YR3/3 – 4/4] over yellowish-red [5YR5/8] sitting on mottled petroplinthites; well-drained	Ac	0-7	10YR3/3	Vg
				BAC	7-21	10YR4/4	Vg
				Btc	21-55	5YR3/4	g
				BCc	55-95	5YR5/8	g
				Cc	95+	10YR6/8	
●UU ●STuu ●WRBuu	●Ugbolu ●Typic Kanhaplustults ●Haplic Lixisols (cutanic)	SHOULDER [2-6%]	Greyish brown or yellowish-brown topsoil over strong brown subsoil; mottling at about 70-90cm from the surface; gravelly sandy loam topsoil over gravelly sandy clay subsoil; gravels mostly concretionary	A1	0-10	10YR3/3	-
				A2	10-21	10YR3/6	-
				A3	21-31	10YR3/6	-
				Bt1	31-60	7.5YR4/4	-
				Bt2	60-91	7.5YR4/6	-
				C1	91-144	7.5YR5/8; 2.5YR3/6	-
				C2	144-180	2.5YR4/8 10YR6/8	-

Table 2: Contd

MAPPING UNIT [symbol] ●Local ●Soil Taxonomy (ST) ●World Reference Base (WRB)	SOIL CLASSIFICATION ●Local (Series) ●Soil Taxonomy ●World Reference Base	PHYSIOGRAPHY SLOPE (%)	BRIEF MORPHOLOGICAL CHARACTERISTICS	OTHERS			GRAVELS
				HOR. (cm)	DEPTH	COLOUR (% of whole soil)	
●MO ●STmo ●WRBmo	●Owode ●Typic Kandistults ●Skeletal Abruptic Acrisols (colluvic)	UPPER MIDDLE (7%)	Colluvial over in-situ all formed in sandstone derived parent material; dark brown shallow surface horizons with sandy loam texture followed by dark yellowish- brown/ brown and yellowish-red/ red clay subsoils; mottling comes in at depth greater than 100cm; concretions occur in the subsoil; Well-drained.	Ap B1 Bt1 Bt2 2BC 2C	0-7 7-30 30-46 46-87 87-115 115-130	10YR3/3 10YR4/6 7.5YR5/6 5YR5/8 5YR5/8 5YR5/6; 2.5YR5/8 10YR6/8	- - - - g -
●MA ●STma ●WRBma	●Agege ●Typic Kanhaplustults ●Plinthic Acrisols (cutanic)	LOWER MIDDLE (7%)	Deeper surface horizons with dark brown and dark and dark yellowish- brown colours with sandy loam texture; mottling comes in between 70—90cm, usually red in a matrix of strong brown; subsoils are clayey; Well-drained	Ap A2 BA1 BA2 Bt BC C1 C2	0-4 4-18 18-38 38-63 63-79 79-97 97-132 132-160	10YR4/3 10YR3/3 10YR3/6 10YR4/6 7.5YR5/6 7.5YR5/6; 10R4/8 10YR6/8 7.5YR5/6; 10R4/8 10YR7/8 10YR5/4; 10R4/8 10YR8/4	- - - - - - g g
●MI ●STmi ●WRBmi	●Ibeshe ●Typic Kanhapludults ●Haplic Acrisols (cutanic)	LOWER MIDDLE (7%)	Wood charcoal found in the upper to middle horizons [0-81cm]; formed in loose sandstone parent material; greyish brown/ yellowish surface soils with sandy loam/loamy sand texture; the subsoil horizons are clayey with brown colour over yellowish- red parent material; Well-drained	A1 A2 Bt1 Bt2 Bt3 C	0-5 5-21 21-58 58-81 81-126 126-180	10YR3/3 10YR3/4 7.5YR4/6 7.5YR4/6 7.5YR5/6 5YR5/8	- - - - - -
●SS ●STss ●WRBss	●Atan ●Tropic Fluvaquents ●Gleyic Fluvisols (cutanic)	VALLEY BOTTOM, UPPER. FLOODPLAINS (0-1%)	Very dark grey (10YR3/1) surface soil horizon over very dark greyish brown (10YR3/2) or great grey subsoil horizons; loam to sandy loam; mottling may come in at about 50cm or shallower; Poorly drained to very poorly drained.	A1 A2 Bt1 Bt2g 2C1 2C2 3ACb 3C	0-5 5-18 18-32 32-45 45-64 64-80 80-100 100+	10YR3/2 10YR5/3 10YR6/4 10YR6/2; 10YR5/8 10YR6/2; 10YR5/6 10YR6/1; faint 10YR3/2 5YR7/1; 10YR7/4	- - - - - - - -
●SF ●STsf ●WRBsf	●Mesan ●Humaqueptic Psammaquents	VALLEY BOTTOM TERRACE	Mostly colluvial; dark brown (10YR3/3) top soil over light yellowish brown (10YR6/4) and light grey (10YR7/1) with mottles at 90cm; the texture is loamy sand to sand; Somewhat poorly drained.	A1 A2 A3 A4 C1 C2	0-6 6-12 12-35 35-65 65-90 90+	10YR3/3 10YR3/3 10YR4/3 10YR4/3 10YR6/4 10YR7/1; 10YR6/8	- - - - - -

Table 2: Contd.

MAPPING UNIT [symbol] ●Local ●Soil Taxonomy (ST) ●World Reference Base (WRB)	SOIL CLASSIFICATION ●Local (Series) ●Soil Taxonomy ●World Reference Base	PHYSIOGRAPHY SLOPE (%)	BRIEF MORPHOLOGICAL CHARACTERISTICS	OTHERS		GRAVELS
				HOR. (cm)	DEPTH COLOUR (% of whole soil)	
●IP ●STip ●WRBip	●Ipaja ●Typic Kandiusults ●Haplic Acrisols (cutanic)	LOWER MIDDLE (7-9%)	Wood charcoal at 21-48cm	Ap 0-21 Bt1 21-48 Bt2 48-74 2BCt 74-120 2C1 120-170 2C2 170-200	10YR3/2 10YR5/4 10YR5/4 7.5YR5/6 5YR5/8 5YR5/8 Faint mottles	- - - - - -
●IJ ●STij ●WRBij	●Iju ●Typic Hapludox ●Haplic Ferralsols (oxyaquic)	FRINGE (7%)		A 0-5 A2 5-13 BA1 13-27 BA2 27-49 Bt1 49-68 Bt2 68-135 Bt3 135-148 C1 148-159 C2 159-180	10YR3/3 10YR3/3 10YR3/3 10YR5/3 10YR5/4 2.5YR6/4 2.5Y6/4 2.5Y6/4; 10YR5/8 2.5Y7/2; 10YR5/6	- - - - - - - - - -

*: g=gravelly; vg=very gravelly; ● gravel refers only to non-concretionary materials

The Soil Association-Soil Series concept (as expressed in Smyth and Motgomery, 1962; and Moss, 1957) is strongly dependent on the soil-landscape (physiographic unit) and has always adequately identified mapping units on the land and amenable for further delineation as a basis for land use plan and the soil use management (Okusami, 1997). Although at the family level [not identified here] for USDA Soil Taxonomy, slope dictates the particle size class, being skeletal on the upper slope and sandy to loamy on the lower. So may not be very relevant for the design of a map legend at the mapping phase level and may cartographically be unacceptable even for publication purposes. This is equally true for the isohyperthermic soil temperature class and the soil mineralogy class, is ubiquitously kaolinite and micaceous [not also indicated herewith but in Okusami, 2018]. And except for the Fluventic and Fluvaquentic subgroup (human-influenced), there is a deficiency in the USDA Soil Taxonomy for use as a field mapping legend when it comes to the soils of the unglaciated tropical regions as exemplified by soils of Nigeria. The WRB tries to catch this aspect through qualifier elements such as colluvic and skeletal [Table 2]. Similar ob-

servations ensued on the soils formed on the Upper Coastal plains of Nigeria as shown above from soils of Igboodu [Table 4]. At the mapping phase, the WRB will nearly corroborate the intrinsic qualities of the Soil Association-Soil Series concept as a conceptual model ideal for developing mapping legend especially at the field mapping level. This comparison is fully developed when the characteristics of the different classification units are compared to the morphological expression as shown in the Soil Association-Soil Series concept. However, it should be noted that the philosophy behind these two systems only slightly overlap as classification systems adaptable for soil mapping purposes at the level of soil management requirements.

Summary and Conclusion

Tables 3 and 4 are summaries of Tables 1 and 2 respectively. The essence is to give an eye-bird's-view of the larger Tables 1 and 2. The summaries place side-by-side and in a sequence depicting the order in a toposequence pattern. It, therefore, vividly enables ease of comparing the mapping units and their corresponding taxonomic units.

Table 3: Summary of comparative classification for Ilero site [in Southwest Nigeria] mapping units

Symbol	NLR-Q	NLR-R	NLR-Rf	NLR-T	NLR-S	NLR-W	NLR-U	NLR-G	NLR-A	NLR-P
Series	Shabe	Ogboro	Iwaji	Amodu	Tede	Iwo	Dejo	Gambari	Shante/ Apomu	Adio
Soil Taxonomy [ST]	Rhodic Kandiusults	Typic or Dystric Haplustepts	Oxic[?] Typic Haplustepts	Rhodic Kandiusults	Fluventic Dystrustepts	Typic Paleusults[or] Kandic Paleustalfts	Fluvaquentic Epiaque-pt	Lithic Haplustepts	Ustoxic/Aquic Quartzipsamments	Aquic Ustifluvents
World Reference Base [WRB]	Haplic Skeletic Rhodic Acrisols [Clayic, cutanic]	Ferralic Cambisols [ochric]	Skeletal Ferralic Cambisols [Ferric]	Haplic Acrisols [clayic]	Chromic Cambisols [colluvic]	Pisoplinthic Alisols [clayic, Colluvic]	Pisoplinthic Cambisols [oxyaquic]	Petrop-linthite Cambisols [geoabruptic]	Albic/Gleyic Arenosols [colluvic]	Gleyic Fluvic-isols [loamic]

Table 4: Summary of comparative classification for Igbodu site [Southwest Nigeria] mapping units

Symbol	UA	UAs	UOt	UAB	UU	MO	MOA	MOA-iju/Ipaja	MI	SS	SF
Series	Alagba	Alagba, Sloping phase	Oteyyi	Asaba	Ugbolu	Owode	Agege	Iju Ipaja	Ibeshe	Atan	Mesan
Soil Tax- onom-y [ST]	Typic Kandi- ustu-lts	Typic Kandius- tults	Typic Kandius- tults	Typic Kanhap- lustults	Typic Kanhap- lustults	Typic Kandius- tults	Typic Kanhap- lus-tults	Typic Hapludox	Typic Kandi- ustults	Tro-pic Flu-vaq- uen-ts	Huma- quep- tic Psam- maqu- ents -----
World Referenc-e Base [WRB]	Rhodic Ferralic Acrisols [cutanic]	Rhodic Ferralic Acrisols [cutanic]	Ferric Acrisols [cutanic, Differen- tic]	Skeletal Acrisols [cutanic]	Haplic Lixisols [cutanic]	Skeletal Abruptic Acrisols [colluvic]	Plinthic Acrisols [cutanic]	Haplic Ferralso-ls [oxyaqui- c]	Haplic Acrisols [cuta- nic]	Haplic Acrisols [cutani-c]	Gle-yic Flu-vis- ols [cut-ani- c]

Overall, the map legend based on WRB fulfilled its evolving role as units amenable /designed for mapping purposes. In contrast, the USDA Soil Taxonomy is vital for its genetic significance and may be more adaptable at the low intensity (small scale) soil map designation (i.e. Order To Great Group Categories/Classes).

References.

- IUSS Working Group WRB. 2014. World Reference Base for Soil Resources 2014. International Soil Classification System for Naming Soils and Creating Legends for Soil Maps. [3rd Edition] Rome. FAO. ISBN 978-92-5-108 370-3
- Moss, R.P. 1957. Report on the Classification of the Soils Found Over Sedimentary Rocks in Western Nigeria. Government of Western Nigeria. Unpublished
- Okusami, Temitope A. 2018. Soils of Toposequences in a Degraded Savanna-Forest Ecotone of Southwest Nigeria II. Pedogeomorphology and Clay Mineralogy. Nigeria Journal of Soil Science (In Press).
- Okusami, T. A. 1997. The characterization, classification and evaluation of acid soils on upper coastal plains of Lagos State. Ife Journal of Agriculture 19:92-116.
- Okusami, T. A., E. A. Aduayi and A. A. Jayeola 1988. Soil Survey, Soil Fertility and Land Suitability Evaluation for Upland Rice Production at Igbodu-Ketu in Epe Local Government Area of Lagos State. UNIFECS Consultancy Services Centre, Obafemi Awolowo University, Ile-Ife. V+75p. and 4 Figures.
- Soil Survey Staff 2014. Keys to Soil Taxonomy. 12 Edition. United States Department of Agriculture. Natural Resources Conservation Service. Lincoln. 97923. 287
- Smyth, A. J. and R. F. Montgomery. 1962. Soils and Land Use in Central Western Nigeria. Govt. Printer, Ibadan, Nigeria. p. 265.