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

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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 (Igbodu 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 Nigeria 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 designated as Ilero (The closest settlement to the site of the mapped area).

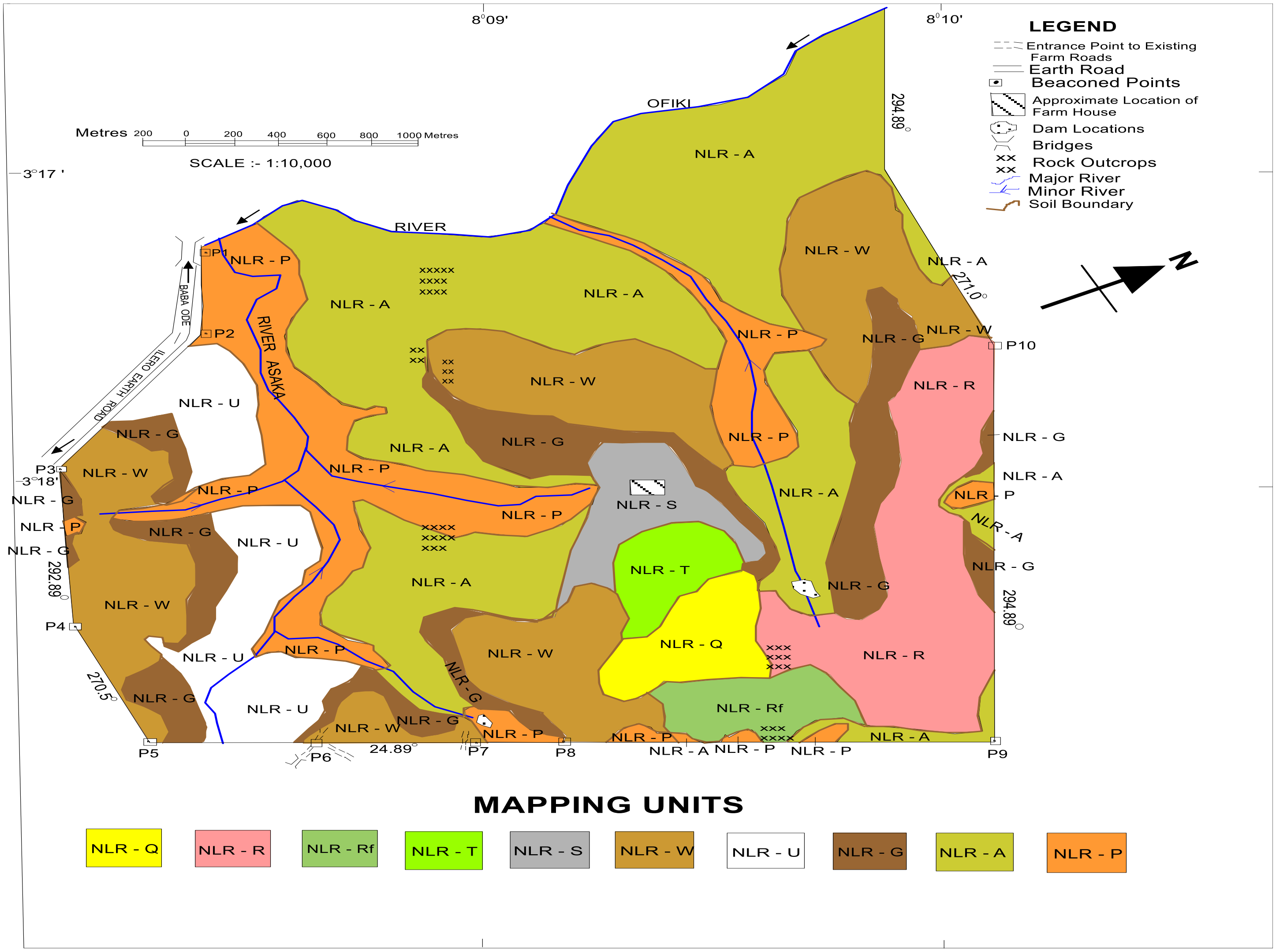

Figure 2: Soil Map of Ilero site in South West Nigeria (Okusami, unpublished soil survey, soil map)

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).

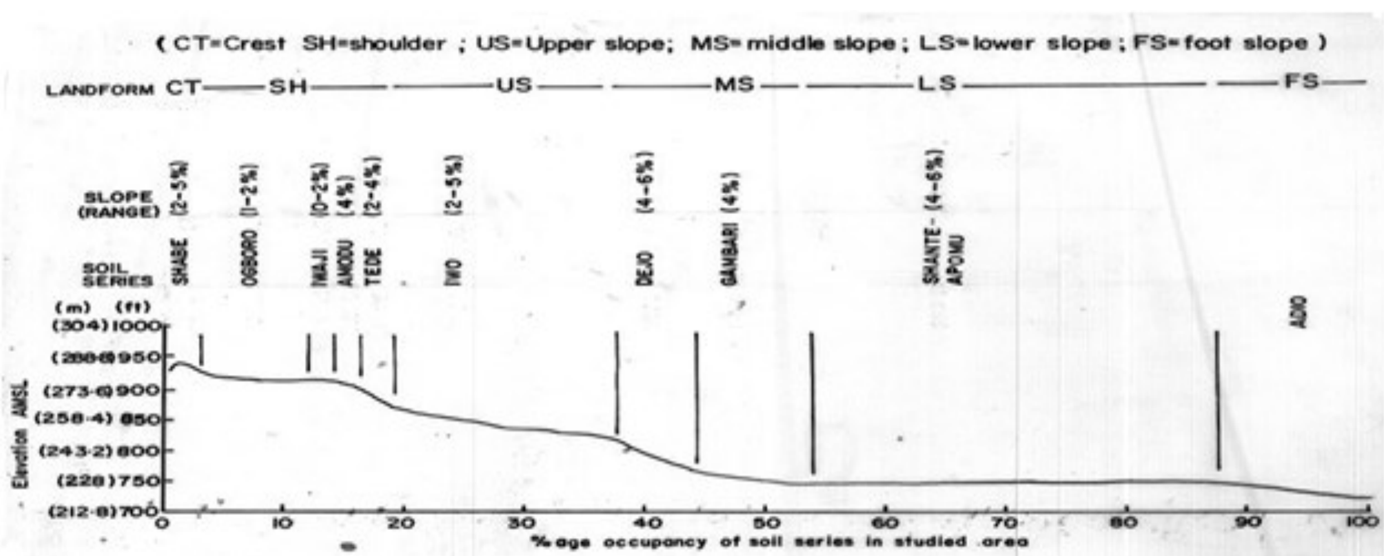

Figure 3: Schematic Soil-Landform Position On a Toposequence in Studied Site at Ilero in Degraded Environment of Derived Savanna in SW-Nigeria (Okusami, 2018)

The second area of interest is Igbodu [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 27C. 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.

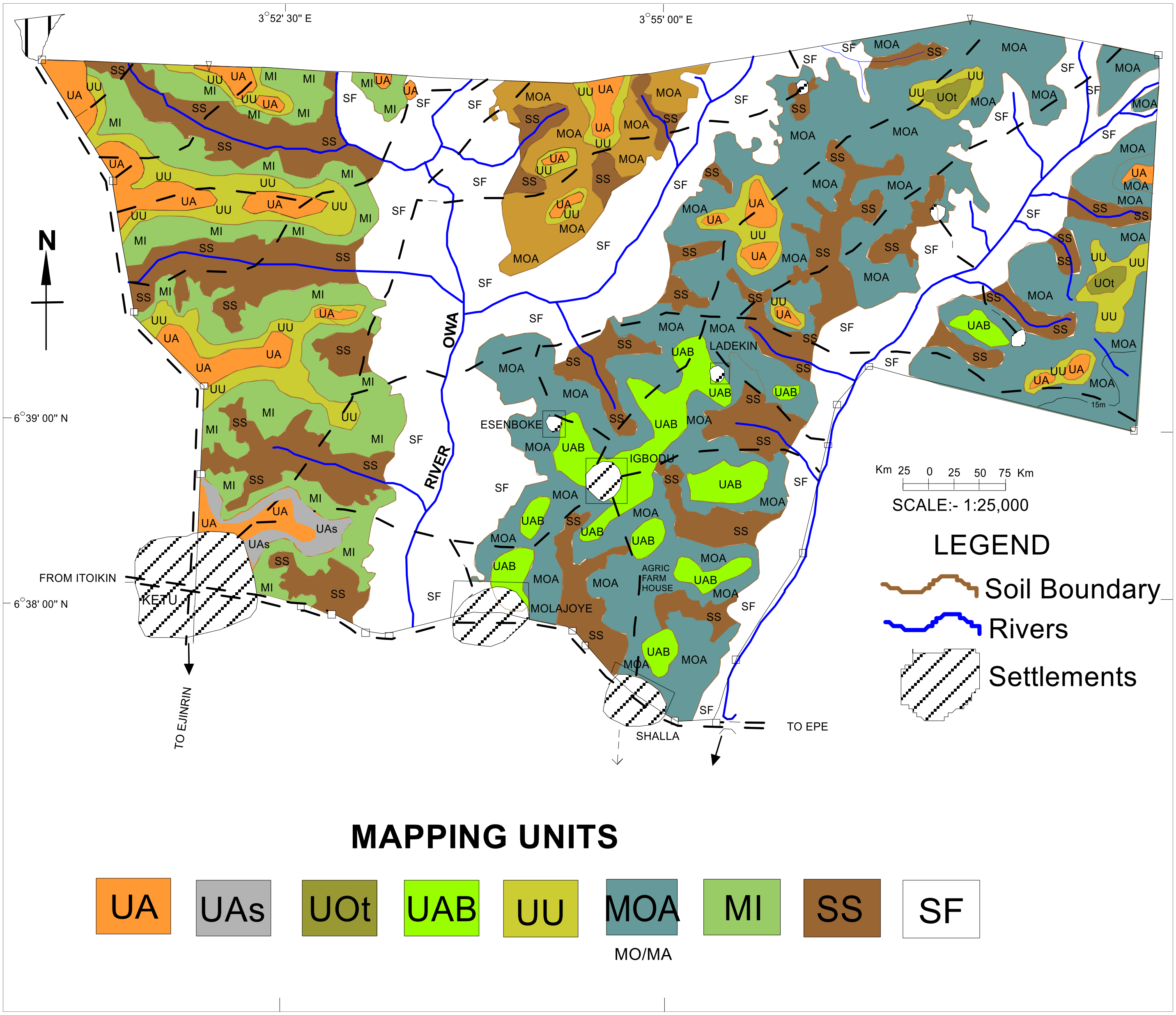

Figure 4. Soil map of Igbodu Site in South West Nigeria, (Adapted from Okusami et al., 1988)

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 imperfectly 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 (cm)	COLOUR	GRAVEL (%)
●NLR-Q ●STq ●WRBq	●Shabe ●Rhodic Kandiustults ●Haplic Skelectic RhodicAcrisols (clayic, cutanic)	UPLAND, CRESTAL/RIDGE POSITION (2-5%)	Brownish sandy clay loam over yellowish red and dark red, very gravelly sandy clay subsoil; Quartz vein [possibly granite] - source of quartz and plentiful 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 fraction.	A1 Bt1 Bt2 BC1 BC2 C1 C2	0-10 10-30 30-70 70-123 123-150 150-175 175-200	10YR3/4 5YR 4/6 2.5YR3/6 2.5YR3/6 2.5YR3/6 ND ND	20 15 62 67 51 36 34
●NLR-R ●STr ●WRBr	●Ogboro ●Typic or Dystric Haplustepts ●Ferralic Cambisols (ochric)	UPLAND, SHOULDER-LIKE (MAY BE UPPER SLOPE POSITION BUT SLOPING) (1-2%)	Shallow soils; brownish and coarse sandy loam over dark red/red extremely gravelly, Gravels are both quartz and concretionary-45-80% by volume. Deeper subsoils could be very hard and ferruginized (saprolite).	A1 A2 2C1 2C2 3C	0-10 10-30 30-52 52-75 75-120	10YR3/3 10YR4/4 2.5YR3/6 2.5YR3/6 2.5YR4/6	4 80 73 47 31
●NLR-Rf ●STrf ●WRBrf	●Iwaji ●Oxic (?) Typic Haplustepts ●Skeletic Ferralic Cambisols (Ferric)	UPLAND, UPPER SLOPE/PLATEAU -LIKE (SHOULDER, ELEVATION ALMOST AS THAT OF OGBORO-ASSOCIATED WITH SHABE) (2-4%)	Very shallow soils; black/ brownish topsoils over dark red and variegated red loamy, subsoil horizons; ferruginised saprolitic material with possible tiny muscovite mica; Gravels could be platy and angular-stones, cobbles with few rounded concretions. Moderately well-drained.	ND ND ND ND (dry)	0-10 10-20 20-50 50+	5YR2.5/1 5YR3/2 2.5YR3/6 10YR4/8(dry) 2.5YR5/8	3 77 24 8
●NLR-T ●STq or t ●WRBq or t	●Amodu ●Rhodic Kandiustults ●Haplic Acrisols (clayic)	UPLAND, UPPER SLOPE, GRADUALLY SLOPING; LOWER ELEVATION RELATIVE TO SHABE (SHOULDER) (4%)	Brownish, coarse sandy loam over dark red sandy clay sitting on thin stone line (at 150-160cm) mostly fine quartz gravels; colluvial over granitic (amphibole) parent materials. Kaolinite is dominant.	A BA Bt1 BCt1 2C	0-18 18-35 35-62 62-150 150-160	10YR3/4 5YR3/4 2.5YR3/6 10YR3/6 ND	- - - - 41
●NLR-S ●STs ●WRBs	●Tede ●Fluventic Dystrustepts ●Chromic Cambisols (colluvic)	UPLAND/ PLATEAU-LIKE BUT GRADUALLY SLOPING AT LOWER ELEVATION RELATIVE TO OGBORO; STANDS AS AN ISLAND ONTO ITSELF; (UPPER SLOPE)	Colluvial over granitic derived parent material; thick stone line at 16-130cm with frequent angular 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 saprolite has no concretions or nodules; moderately well-drained. Kaolinite dominant	A 2BC1 2BC2 3BC1 3BC2 3C	0-16 16-65 65-95 95-130 130-160 160190-	10YR4/2 10YR4/3 10YR5/4 2.5YR4/8; 10YR6/4 2.5YR4/8 10YR6/8; 10YR5/3 5YR5/8 10YR6/8 10YR6/3	1 85 91 80 9 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 (cm)**	**COLOUR**	**GRAVEL (% of the whole soil)**
●NLR-W ●STw ●WRBw	●Iwo ●Typic Paleustults OR Kandic Paleustalfs ●Pisoplinthic Alisols (clayic, colluvic)	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 volume) 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 BA Bt1 2BCt2 3BCt3 3BCt4 3C	0-13 13-28 28-55 55-100 100-120 120-160 160-190	10YR4/4 7.5YR4/4 7.5YR4/4 5YR4/6 5YR4/6 5YR4/6 7.5YR5/8 ND	- - 4 74 21 - 27
●NLR-U ●Stu ●WRBu	●Dejo ●Fluvaquentic Epiaquept ●Pisoplinthic Cambisols (oxyaquic)	MIDDLE SLOPE (LOWER BACK-SLOPE POSITION BUT CLOSER TO THE MAJOR RIVER) (4-6%)	A greyish brown, loamy topsoil over gravelly concretionary sandy clay on grey, gravelly sandy clay matrix horizons with yellowish brown mottles; the middle horizons are slightly to highly gravelly (with very frequent concretions and quartz); mostly quartz at 80-110cm; shallow water table at 90cm during the beginning of the dry season; somewhat poorly drained. Kaolinite clay dominant.	A AB 2BC1 3BC2g 3C	0-15 15-30 30-80 80-110 110-150	10Yr3/2 10YR4/3 10YR5/3 10YR5/1; 10YR6/8 10YR5/1 10Yr6/1; 10YR5/8	68 5 8 60 37
●NLR-G ●STg ●WRBg	●Gambari ●Lithic Haplustepts ●Petroplinthite Cambisols (geoabruptic)	MIDDLE SLOPE (4%)	Shallow soils; brownish sandy topsoil (topsoil gravels are of cobble and stone sizes) with gravelly sand clay on petroplinthites at shallow depth (60 ±20cm); few dark concretions;	A AC 2C	0-12 12-25 25-60 60+	10YR3/3 10YR4/3 10YR4/4	2 10 75
●NLR-A ●STa[s/a] ●WRBa[s/a]	●Shante/Apomu ●Ustoxic Quartzimments OR Aquic Quartzipsamments ●Albic Arenosols OR Gleyic Arenosols (colluvic)	LOWER SLOPE (BACKSLOPE POSITION) (4-6%)	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.	A1 A2 A3 C1 C2 C3	0-5 5-35 35-45 45-90 90-140 140-190	10YR3/1 10YR3/1 10YR4/3 10YR4/6 ? 10YR6/4	- - - 9 - 1
●NLR-P ●STp ●WRBp	●Adio ●Aquic Ustifluvents ●GleyicFluvisols (loamic)	FRINGE/VALLEY BOTTOM (COULD OCCUR AT ANY LEVEL OF THE LAND-SCAPE FROM THE SHOULDER TO THE FRINGE)	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 A2 2BA 3BC 4C 5C	0-12 12-24 24-36 36-118 118-135 135+	7.5YR2/0 10YR3/1 10YR3/1 2.5Y4/0; 10YR6/8 2.5Y4/0; 10YR6/8 5YR5/8 2.5Y4/0; 10YR6/8	5 1 43 7 12 13

For Igbodu 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 Igbodu.

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.	**DEPTH (cm)**	**COLOUR**	**GRAVELS (% of whole soil)**
●UA ●STua ●WRBua	●Alagba ●Typic Kandiustults ●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 A2 BA1 BA2 Bt1 Bt2 Bt3	0-5 5-14 14-30 30-50 50-101 101-135 135-180 180-200	10YR3/4 5YR3/4 5YR3/4 2.5YR4/4 2.5YR4/8 2.5YR4/8 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 A2 B 2Bc 3B	0-8 8-25 25-48 48-67 67-97 97-117 117-140	10YR3/3 5YR3/4 5YR3/4 5YR4/6 2.5YR4/8 2.5YR4/8 2.5YR4/8	- - - - - - -
●UOt ●STuot ●WRBuot	●Oteyyi ●Typic Kandiustults ●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 BA Bt BC C1 C2c	0-10 10-34 34-50 50-78 78-105 105-140	10YR3/2 10YR4/4 10YR3/6; 5YR5/8 5YR4/6; 2.5YR4/8 10YR6/8; 2.5YR4/8 2.5YR4/8, 10YR6/8 5YR5/8	- - g - - g
●UAB ●STuab ●WRBuab	●Asaba ●Typic Kanhaplustults ●Skeletic 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 BAc Btc BCc Cc	0-7 7-21 21-55 55-95 95+	10YR3/3 10YR4/4 5YR3/4 5YR5/8 10YR6/8	Vg Vg g g
●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 A2 A3 Bt1 Bt2 C1 C2	0-10 10-21 21-31 31-60 60-91 91-144 144-180	10YR3/3 10YR3/6 10YR3/6 7.5YR4/4 7.5YR4/6 7.5YR5/8; 2.5YR3/6 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 HOR.	DEPTH (cm)	COLOUR	GRAVELS (% of whole soil)
●MO ●STmo ●WRBmo	●Owode ●Typic Kandiustults ●Skeletic 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	0-7	10YR3/3	-
				B1	7-30	10YR4/6	-
				Bt1	30-46	7.5YR5/6	-
				Bt2	46-87	5YR5/8	-
				2BC	87-115	5YR5/8	g
				2C	115-130	5YR5/6; 2.5YR5/8 10YR6/8	-
●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	0-4	10YR4/3	-
				A2	4-18	10YR3/3	-
				BA1	18-38	10YR3/6	-
				BA2	38-63	10YR4/6	-
				Bt	63-79	7.5YR5/6	-
				BC	79-97	7.5YR5/6; 10R4/8 10YR6/8	-
				C1	97-132	7.5YR5/6; 10R4/8 10YR7/8	g
				C2	132-160	10YR5/4; 10R4/8 10YR8/4	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	0-5	10YR3/3	-
				A2	5-21	10YR3/4	-
				Bt1	21-58	7.5YR4/6	-
				Bt2	58-81	7.5YR4/6	-
				Bt3	81-126	7.5YR5/6	-
				C	126-180	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 grely subsoil horizons; loam to sandy loam; mottling may come in at about 50cm or shallower; Poorly drained to very poorly drained.	A1	0-5	10YR3/2	-
				A2	5-18	10YR5/3	-
				Bt1	18-32	10YR6/4	-
				Bt2g	32-45	10YR6/2; 10YR5/8	-
				2C1	45-64	10YR6/2; 10YR5/6	-
				2C2	64-80	10YR6/1; faint	-
				3ACb	80-100	10YR3/2	-
				3C	100+	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	0-6	10YR3/3	-
				A2	6-12	10YR3/3	-
				A3	12-35	10YR4/3	-
				A4	35-65	10YR4/3	-
				C1	65-90	10YR6/4	-
				C2	90+	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 HOR.	DEPTH (cm)	COLOUR (% of whole soil)	GRAVELS
●IP	●Ipaja	LOWER MIDDLE	Wood charcoal at 21-48cm	Ap	0-21	10YR3/2	-
●STip	●Typic Kandiustults	(7-9%)		Bt1	21-48	10YR5/4	-
				Bt2	48-74	10YR5/4	-
●WRBip	●Haplic Acrisols (cutanic)			2BCt	74-120	7.5YR5/6	-
				2C1	120-170	5YR5/8	-
				2C2	170-200	5YR5/8 Faint mottles	-
●IJ	●Iju	FRINGE		A	0-5	10YR3/3	-
●STij	●Typic Hapludox	(7%)		A2	5-13	10YR3/3	-
●WRBij	●Haplic Ferralsols (oxyaquic)			BA1	13-27	10YR3/3	-
				BA2	27-49	10YR5/3	-
				Bt1	49-68	10YR5/4	-
				Bt2	68-135	2.5YR6/4	-
				Bt3	135-148	2.5Y6/4	-
				C1	148-159	2.5Y6/4; 10YR5/8	-
				C2	159-180	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 observations ensued on the soils formed on the Upper Coastal plains of Nigeria as shown above from soils of Igbodu [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 Tax-on-omy [ST]	Rhodic Kandiustul -ts	Typic or Dystric Haplustepts	Oxic[?] Typic Hap-lustepts	Rhodic Kandiustults	Fluventic Dystrustepts	Typic Paleus-tults[or] Kan-dic Paleustalfs	Fluvaq-uentic Epiaque-pt	Lithic Haplus-tepts	Ustoxic/ Aquic Quartzip-sam-ments	Aq-uic Ust-iflu-ven-ts
World Refer-ence Base [WRB]	Haplic Skeletic Rhodic Acrisols [Clayic, cutanic	Ferralic Ca-mbisols [ochric]	Skeletic Ferralic Cambisols [Ferric]	Haplic Acr-isols [clayic]	Chromic Cambisols [colluvic]	Pisoplinthic Alisols [clayic, Colluvic]	Pisoplin-thic Ca-mbisols [oxyaqu-ic]	Petrop-linthite Cambis-ols [geoab-ruptic]	Albic/ Gleyic Arenosols [colluvic]	Gley-ic Fluv-isols [loa-mic]

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	Typic Kanha-pludults	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, Differe-ntic]	Skeletic Acrisols [cutanic]	Haplic Lixisols [cutanic]	Skeletic Abruptic Acrisols [colluvic]	Plinthic Acrisols [cutanic]	Haplic Ferralso-ls [oxyaqui-c]	Haplic Acris-ols [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).

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