SOIL TEMPERATURE REGIMES

Classes of Soil Temperature Regimes

Following is a description of the soil temperature regimes used in defining classes at various categoric levels in this taxonomy.

Cryic (Gr. *kryos*, coldness; meaning very cold soils). Soils in this temperature regime have a mean annual temperature lower than 8 ^{oC} but do not have permafrost.

Frigid. A soil with a frigid temperature regime is warmer in summer than a soil with a cryic regime, but its mean annual temperature is lower than 8 ^{oC} and the difference between mean summer and mean winter soil temperatures is more than 6 ^{oC}

Mesic. The mean annual soil temperature is 8 ^{oC} or higher but lower than 15 ^{oC}, and the difference between mean summer and mean winter soil temperatures is more than 6 ^{oC}.

Thermic. The mean annual soil temperature is 15 ^{oC} or higher but lower than 22 ^{oC}, and the difference between mean summer and mean winter soil temperatures is more than 6 ^{oC}.

Hyperthermic. The mean annual soil temperature is 22 ^{oC} or higher, and the difference between mean summer and mean winter soil temperatures is more than 6 ^{oC}.

ISO

If the name of a soil temperature regime has the prefix *iso*, the mean summer and mean winter soil temperatures differ by less than 6 ^{oC}.

SOIL CLASSIFICATION

International Soil Classification Systems

There are two major world soil classification systems. These are the United State Department of Agriculture (UDSA) taxonomic system and the World Food and Agricultural Organization (FAO) World Reference Base System (USDA, 2003; FAO, 2006). These are systems designed

for universal application. They should classify any soil, and serve to **correlate** experiences on similar soils all over the world.

USDA SYSTEM OF SOIL CLASSIFICATION

The USDA classification system is a multi- categorical and hierarchical system. Thus the classes in the highest categories are divided into smaller classes in the lower one and continue to the lowest level, which is the soil series.

The USDA system comprise a hierarchy of 6 levels

- Orders (12) (surface and subsurface diagnostic horizons)
- Suborders (55) (Soil temperature. and moisture regimes)
- Great group (238) (subsurface diagnostic horizon)
- Subgroup (1243) (drainage, lithic contact, PM, clay type)
- Family (7504) (Texture of diagnostic surface horizon)
- Series (about 19,000) in U.S.

The most common soil orders in Nigeria are Alfisols, Entisols, Inceptisols, Oxisols and Ultisols.

❖ The formative name for each order is usually a two or three letter prefix. The prefixes are: Alfisols = ALF, Andisols = AND, Aridisol = ID, Entisols = ENT, Gelisols = EL, Histosils = IST, Inceptisols = EPT, Mollisols = OLL, Oxisols = OX, Spodosols = OD, Ultisols =ULT, Vertisols = ERT.

❖ **Alfisols:** Alfisols refers to soils with either an argillic B or textural B horizon, kandic, or natric horizon and with a base saturation by sum of cation greater than 35%.

❖ Andisols: Form from P.M. of volcanic origin. Soil forms by rapid weathering of volcanic ash to produce poorly crystallized aluminosilicates (allophane & imogolite). Andisols are young soils (and they have high OM). In dry climates, can be susceptible to wind erosion and can have unusually low bulk densities

❖ **Aridisols :** Aridisols are primarily soils of the arid region occurring in area where there is no water in the soil as long as 90 consecutive days when soil temperature is greater than 6°C.

❖ **Entisols** : They are young soils recently developed and their main characteristic is the lack of any diagnostic horizon.

❖ **Gelisols:** Presence of permafrost layer within 100 cm of soil surface defines this soil class. Young soils with little profile development, Cold temperatures and frozen conditions for much of the year slow the process of soil formation. May show evidence of cryoturbation, physical disturbance of soil material caused by freezing and thawing.

❖ **Histosols** : These are soils with high organic matter containing between 20% to 30% organic matter within 80cm of the soil surface.

❖ **Inceptisols:** Soils with cambic B horizons and with textures finer than loamy fine sands

❖ **Mollisols:** Typically form under grasslands. They are soils with a mollic epipedon, thick humus-rich surface horizon, high % base saturation throughout profile, slightly leached and very fertile soils

❖ **Oxisols** : They are soils with oxic B horizon. Usually they are highly weathered and lacking minerals other than quartz, kaolinite and sesquioxides.

❖ **Spodosols:** *Have a spodic horizon, f*orm in humid, cool climates and occur most often in conifer forests (New England, Mich., Canada), form in acid, coarse, quartz (sandy) bearing P.M. Low fertility

❖ **Ultisols** : These are soils with argillic B horizons but with base saturation by sum of cation less than 35%

❖ **Vertisols** : Vertisols are heavy clay soils containing swelling and shrinking montmorillonite or smectite type of clay. The common feature of this soil is cracking but these cracks must be as wide as 1cm and must progress as far as 50cm depth to qualify as a true vertisol. Other noticeable features of vertisols are gilgai and slickensides.

Sub-Order: The sub-orders are the next categories to the soil order and are differentiated from each other within the order on basis moisture and temperature regimes, diagnostic surface horizon (epipedon), parent material, drainage and vegetation effects. Formative elements used at the sub-order level includes: - UD = udic moisture regime; UST = ustic moisture regime; XER = Xeric moisture regime; AQU = aquic moisture regime, HUM= presence of humus etc. Example ustalf = UST + ALF; ALF= Alfisol, UST = Ustic moisture regime; Ustalf= Alfisol under ustic moisture regime.

Great Group: Sub orders are divided into great groups on the basis of close similarities in the kind, arrangement and degree of expression of horizon, close similarities in soil temperature and moisture regimes, similarities in the base status.

regime.

Formative element used at the level of great group includes: Plinth = Plinthite, Cry = cryic temperature regime, Dur = Duripan, Natr = Natric horizon, etc. Example Plinthaqualf = PLINTH + AQU + ALF = Plinthite + Aquic moisture regime + Alfisol. Thus plinthaqualf is an alfisol under aquic moisture regime and has a plinthic horizon.

Sub-group: Sub-groups are sub – division of the great group. Criteria for differentiating the sub groups are:

- presence of diagnostic horizons or features
- properties that are subordinate to those used in differentiating great groups
- properties that tend towards other great groups

The sub group name is derived from the great group name to which an adjective is attached indicating the major property of the sub group;

e.g. calcic Rhodxeralf = Calcic + Rhod + Xer + Alf. Calcic = calcic horizon; Rhod = Red colour (hue 2.5YR or redder); Xer = xeric moisture regime; Alf = Alfisol; Thus, calcic rhoxeralf means a red coloured alfisols having a calcic horizon under xeric moisture.

Family: This is a user oriented category. Thus the criteria for separation are soil properties that influence the response of soil to management and manipulation. These include:

- ❖ particle size distribution
- ❖ mineralogy of the horizon
- ❖ temperature regime
- ❖ the thickness of the soil penetrable by plant root
- ❖ cation exchange capacity
- ❖ presence of cutans
- ❖ presence of vertic property
- ❖ a few other definitive soil properties.
- ❖ For example **clayey calcic rhodxeralfs** means calcic rhodxeralfs with clayey soil texture

Series: It is a sub division of the soil family and is a more user oriented class than the family. Separation of the family into series involves more detailed properties of the soil profile. Soil series is given name after the place where it was first encountered. For example, Ibadan series, Iwo series, Apomu series etc.