

KEY TO THE REFERENCE SOIL GROUPS

Concepts

The *World Reference Base for Soil Resources* identifies diagnostic ‘*soil characteristics*’, ‘*soil properties*’ and ‘*soil horizons*’. See Annex 2 for definitions.

- ***Soil characteristics*** are single-value soil attributes that can be observed/measured in the field or laboratory. Soil characteristics include class attributes such as colour, texture or structure class, and discrete attributes expressed in one numerical value such as ‘soil depth in cm’, ‘soil-pH’ or ‘nominal cation exchange capacity in cmol(+)/kg’.
- ***Soil properties*** are complex soil attributes that involve several soil characteristics and reflect present or past soil forming mechanisms. For example, ‘*gleyic properties*’ refer to soil characteristics such as ‘*rH*-value ≤ 19 ’, ‘dark blue colour if in contact with potassium ferric cyanide’ or ‘strong red colour if sprayed with α, α -dipyridyl solution in 10% acetic acid’ and to dynamic oxidation-reduction processes of a periodic nature.
- ***Soil horizons*** are internally uniform soil layers delimited by gradual, clear or abrupt upper and lower limits (‘boundaries’) and characterized by one or more soil characteristics and/or properties occurring over a specific depth.

The World Reference Base for Soil Resources defines ***Soils*** by the vertical combination of soil horizons, properties and/or characteristics occurring within a defined depth and by the vertical organization (‘sequence’) of soil horizons.

Key to Reference Soil Groups

Soils having a *histic* or *folic* horizon, and

1. ***either*** 10 cm or more thick from the soil surface to a lithic or paralithic contact;
or 40 cm or more thick and starting within 30 cm from the soil surface; ***and***
2. having no *andic* or *vitric* horizon starting within 30 cm from the soil surface.

HISTOSOLS (HS)

Other soils having one or more *cryic* horizons within 100 cm from the soil surface.

CRYOSOLS (CR)

Other soils,

either having a *hortic*, *irragric*, *plaggic* or *terric* horizon 50 cm or more thick;
or having an *anthraquic* horizon and an underlying *hydragric* horizon with a combined thickness of 50 cm or more.

ANTHROSOLS (AT)

2 Annex 1. Key to Reference Soil Groups

Other soils,

1. **either** limited in depth by *continuous hard rock* within 25 cm from the soil surface;
or having a *mollic* horizon with a thickness between 10 and 25 cm directly overlying material with a calcium carbonate equivalent of more than 40 percent;
or containing less than 10 percent (by weight) fine earth from the soil surface to a depth of 75 cm; **and**
2. having no diagnostic horizons other than a *mollic*, *ochric*, *umbric* or *yermic* horizon.

LEPTOSOLS (LP)

Other soils,

1. having a *vertic* horizon within 100 cm from the soil surface; **and**
2. having, after the upper 20 cm have been mixed, 30 percent or more clay in all horizons to a depth of 100 cm or more, or to a contrasting layer (lithic or paralithic contact, *petrocalcic*, *petroduric* or *petrogypsic* horizons, sedimentary discontinuity, etc.) between 50 and 100 cm; **and**
3. having cracks^{1/} which open and close periodically.

VERTISOLS (VR)

Other soils,

1. having a thickness of 25 cm or more; **and**
2. having *fluvic* soil material starting within 50 cm from the soil surface; **and**
3. having no diagnostic horizons other than a *histic*, *mollic*, *ochric*, *takyric*, *umbric*, *yermic*, *salic* or *sulfuric* horizon.

FLUVISOLS (FL)

Other soils,

1. having a *salic* horizon starting within 50 cm from the soil surface; **and**
2. having no diagnostic horizons other than a *histic*, *mollic*, *ochric*, *takyric*, *yermic*, *calcic*, *cambic*, *duric*, *gypsic*, or *vertic* horizon.

SOLONCHAKS (SC)

Other soils,

1. having *gleyic* properties within 50 cm from the soil surface; **and**
2. having no diagnostic horizons other than an *anthraquic*, *histic*, *mollic*, *ochric*, *takyric*, *umbric*, *andic*, *calcic*, *cambic*, *gypsic*, *plinthic*, *salic*, *sulfuric*, or *vitric* horizon within 100 cm from the soil surface.
3. having no *abrupt textural change* within 100 cm from the soil surface.

GLEYSOLS (GL)

¹ A crack is an open space between gross polyhedrons. Cracks may be filled mainly by granular materials from the soil surface but remain open in the sense that the polyhedrons are separated.

Annex 1. Key to Reference Soil Groups 3

Other soils,

1. having a *vitric* or an *andic* horizon starting within 25 cm from the soil surface; **and**
2. having no diagnostic horizons (unless buried deeper than 50 cm) other than a *histic*, *fulvic*, *melanic*, *mollic*, *umbric*, *ochric*, *duric*, or *cambic* horizon.

ANDOSOLS (AN)

Other soils,

having a *spodic* horizon starting within 200 cm from the soil surface, underlying an *albic*, *histic*, *umbric* or *ochric* horizon, or an *anthropedogenic* horizon less than 50 cm thick.

PODZOLS (PZ)

Other soils,

either having a *petroplinthic* horizon starting within 50 cm from the soil surface;
or having a *plinthic* horizon starting within 50 cm from the soil surface;
or having a *plinthic* horizon starting within 100 cm from the soil surface underlying an *albic* horizon or a horizon with *stagnic* properties.

PLINTHOSOLS (PT)

Other soils,

1. having a *ferralic* horizon at some depth between 25 and 200 cm from the soil surface;
and
2. having no *nitic* horizon within 100 cm from the surface; **and**
3. having no layer, which fulfils the requirements of an *argic* horizon and which has 10 percent or more water-dispersible clay within 30 cm from its upper boundary **unless** the soil material has *geric* properties or contains more than 1.4 percent organic carbon.

FERRALSOLS (FR)

Other soils,

having a *natric* horizon within 100 cm from the soil surface.

SOLONETZ (SN)

Other soils,

1. having an eluvial horizon or materials having loamy sand or coarser textures, the lower boundary of which is marked, within 100 cm from the soil surface, by an *abrupt textural change* associated with *stagnic* properties; **and**
2. having no *albeluvic tonguing*.

PLANOSOLS (PL)

4 Annex 1. Key to Reference Soil Groups

Other soils,

1. having a *mollic* horizon with a moist chroma of 2 or less if the texture is finer than sandy loam, or less than 3.5 if the texture is sandy loam or coarser, both to a depth of at least 20 cm, or a mollic horizon which has these chromas directly below a plough layer; **and**
2. having concentrations of *secondary carbonates* starting within 200 cm from the soil surface; **and**
3. having no *petrocalcic* horizon between 25 and 100 cm from the soil surface; **and**
4. having no secondary gypsum; **and**
5. having no uncoated silt and sand grains on structural ped surfaces.

CHERNOZEMS (CH)

Other soils,

1. having a *mollic* horizon with a moist chroma of more than 2 to a depth of at least 20 cm or directly below any plough layer; **and**
2. having concentrations of *secondary carbonates* within 100 cm from the soil surface; **and**
3. having no diagnostic horizons other than an *argic*, *calcic*, *cambic*, *gypsic*, *petrocalcic*, *petrogypsic* or *vertic* horizon.

KASTANOZEMS (KS)

Other soils,

1. having a *mollic* horizon; **and**
2. having a base saturation (in 1 M NH₄OAc at pH 7.0) of 50 percent or more and having no secondary carbonates to at least a depth of 100 cm from the soil surface, or to a contrasting layer (*lithic* or *paralithic* contact, *petrocalcic* horizon) between 25 and 100 cm; **and**
3. having no diagnostic horizons other than an *albic*, *argic*, *cambic* or *vertic* horizon.

PHAEZEMS (PH)

Other soils,

1. having a *gypsic* or *petrogypsic* horizon within 100 cm from the soil surface; **and**
2. having no diagnostic horizons other than an *ochric* horizon, a *cambic* horizon, an *argic* horizon permeated with gypsum or calcium carbonate, a *vertic* horizon or a *calcic* or *petrocalcic* horizon underlying the *gypsic* or *petrogypsic* horizon.

GYPSISOLS (GY)

Other soils,

having a *duric* or *petroduric* horizon within 100 cm from the soil surface.

DURISOLS (DU)

Annex 1. Key to Reference Soil Groups 5

Other soils,

1. having a *calcic* or *petrocalcic* horizon within 100 cm of the surface; **and**
2. having no diagnostic horizons other than an *ochric* or *cambic* horizon, an *argic* horizon which is calcareous, a *vertic* horizon or a *gypsic* horizon

CALCISOLS (CL)

Other soils,

Having, within 100 cm from the soil surface, an *argic* horizon with an irregular upper boundary resulting from *albeluvic tonguing* into the argic horizon.

ALBELUVISOLS (AB)

Other soils,

1. having an *argic* horizon, which has a cation exchange capacity (in 1 M NH₄OAc at pH 7.0) of 24 cmol(+) kg⁻¹ clay or more, either starting within 100 cm from the soil surface, or within 200 cm from the soil surface if the argic horizon is overlain by loamy sand or coarser textures throughout; **and**
2. having *alic* properties in most of the layer between 25 and 100 cm from the soil surface; **and**
3. having no diagnostic horizons other than an *ochric*, *umbric*, *albic*, *andic*, *ferric*, *nitic*, *plinthic* or *vertic* horizon.

ALISOLS (AL)

Other soils,

1. having a *nitic* horizon starting within 100 cm from the soil surface; **and**
2. having gradual or diffuse horizon boundaries; **and**
3. having no *ferric*, *plinthic* or *vertic* horizon within 100 cm from the soil surface.

NITISOLS (NT)

Other soils,

1. having an *argic* horizon, which has a cation exchange capacity (in 1 M NH₄OAc at pH 7.0) of less than 24 cmol(+) kg⁻¹ clay in some part, either starting within 100 cm from the soil surface, or within 200 cm from the soil surface if the argic horizon is overlain by loamy sand or coarser textures throughout; **and**
2. having less than 50 percent base saturation (in 1M NH₄OAc at pH 7.0) in the major part between 25 and 100 cm.

ACRISOLS (AC)

6 Annex 1. Key to Reference Soil Groups

Other soils,

having an *argic* horizon with a cation exchange capacity (by 1 M NH₄OAc at pH 7.0) equal to or greater than 24 cmol(+) kg⁻¹ clay, either starting within 100 cm from the soil surface, or within 200cm from the soil surface if the argic horizon is overlain by loamy sand or coarser textures throughout.

LUVISOLS (LV)

Other soils,

having an *argic* horizon starting within 100cm from the soil surface, or within 200 cm from the soil surface if the argic horizon is overlain by loamy sand or coarser textures throughout.

LIXISOLS (LX)

Other soils,

1. having an *umbric* horizon; **and**
2. having no diagnostic horizons other than an *anthropogenic* horizon less than 50 cm thick, an *albic* horizon or a *cambic* horizon.

UMBRISOLS (UM)

Other soils,

either having a *cambic* horizon;

or having a *mollic* horizon;

or having one of the following diagnostic horizons:

- an *andic*, *vertic* or *vitric* horizon starting between 25 and 100 cm below soil surface, **or**
- a *plinthic*, *petroplinthic*, *salic* or *sulfuric* horizon starting between 50 and 100 cm below soil surface, in the absence of loamy sand or coarser materials above these horizons.

CAMBISOLS (CM)

Other soils,

1. having a texture which is loamy sand or coarser **either** to a depth of at least 100 cm from the soil surface, **or** to a *plinthic*, *petroplinthic* or *salic* horizon between 50 and 100 cm from the soil surface; **and**
2. having less than 35 percent (by volume) of rock fragments or other coarse fragments within 100 cm from the soil surface; **and**
3. having no diagnostic horizons other than an *ochric*, *yermic* or *albic* horizon, or a *plinthic*, *petroplinthic* or *salic* horizon below 50 cm from the soil surface.

ARENOSOLS (AR)

Other soils.

REGOSOLS (RG)