



World Soil Map according to WRB2014

Derived from the Harmonized World Soil Database

Technical note 2023/01

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Preparation of aggregated World Soil Map according to WRB2014

Introduction

The Harmonized World Soil Database (HWSD) presents soil types according to the FAO legend (1974 and 1990). There is no updated map of the HWSD for the soils identified in the World Reference Base for soil resources, which is a full system for naming soils with historic roots in the legend of the FAO-UNESCO Soil Map of the World. To meet the demand for such a map an effort was made to derive a WRB2014 map based on aggregation of the soil groups from the HWSD using the 'soil associations' as defined in the short key of the WRB2014 document. The procedure of aggregation and step followed in re-assigning units from the FAO legend to WRB2014 units are described in this document.

Data sources

- Harmonized World Soil Database (HWSD), v1.2 (Fischer et al., 2008).
- World Reference Base for Soil Resources (WRB) 2014 (IUSS Working Group WRB, 2014)

Procedure

Aggregation¹ of the HWSD using the 'soil associations' as defined in the short key of the WRB2014 document followed these steps:

1. Re-assign FAO74 units to WRB2014 units:
 - Podzoluvisols (PD) → Albeluvisols → Retisols (RT)
 - Xerosols/Yermosols → Gypsisols (GY)
 - Greyzems (GR) → Phaeozems (PH)
2. Aggregate soil groups as follows (see table 1 for explanation of the soil abbreviations):
 - HS → Group 1, Soils with thick organic layers
 - AT + TC → Group 2, Soils with strong human influence
 - CR, LP, SN, VR, SC → Group 3, Soils with limitations to root growth
 - GL, AN, PZ, PT, NT, FR, PL, ST → Group 4, Soils distinguished by Fe/Al chemistry
 - CH, KS, PH, UM → Group 5, Pronounced accumulation of organic matter in the mineral topsoil
 - DU, GY, CL → Group 6, Accumulation of moderately soluble salts or non-saline substances
 - RT, AC, LX, AL, LV → Group 7, Soils with a clay-enriched subsoil
 - CM, AR, FL, RG → Group 8, Soils with little or no profile differentiation

¹ Definition query of hswd_polygons layer e.g. "SU_SYMBOL" IN ('AR','LP','FL')



Table 1. WRB reference soil groups and miscellaneous units with abbreviations (source: <https://wrb.isric.org/>)

1. Soils with thick organic layers:	Histosols	HS
2. Soils with strong human influence -		
With long and intensive agricultural use:	Anthrosols	AT
Containing significant amounts of artefacts:	Technosols	TC
3. Soils with limitations to root growth -		
Permafrost-affected:	Cryosols	CR
Thin or with many coarse fragments:	Leptosols	LP
With a high content of exchangeable Na:	Solonetz	SN
Alternating wet-dry conditions, shrink-swell clay minerals:	Vertisols	VR
High concentration of soluble salts:	Solonchaks	SC
4. Soils distinguished by Fe/Al chemistry -		
Groundwater-affected, underwater or in tidal areas:	Gleysols	GL
Allophanes and/or Al-humus complexes:	Andosols	AN
Subsoil accumulation of humus and/or oxides:	Podzols	PZ
Accumulation and redistribution of Fe:	Plinthosols	PT
Stagnant water, abrupt textural difference:	Planosols	PL
Stagnant water, structural difference and/or moderate textural difference:	Stagnosols	ST
Low-activity clays, P fixation, many Fe oxides, strongly structured:	Nitisols	NT
Dominance of kaolinite and oxides:	Ferralsols	FR
5. Pronounced accumulation of organic matter in the mineral topsoil -		
Very dark topsoil, secondary carbonates:	Chernozems	CH
Dark topsoil, secondary carbonates:	Kastanozems	KS
Dark topsoil, no secondary carbonates (unless very deep), high base status:	Phaeozems	PH
Dark topsoil, low base status:	Umbrisols	UM
6. Accumulation of moderately soluble salts or non-saline substances -		
Accumulation of, and cementation by, secondary silica:	Durisols	DU
Accumulation of secondary gypsum:	Gypsisols	GY
Accumulation of secondary carbonates:	Calcisols	CL
7. Soils with clay-enriched subsoil -		
Interfingering of coarser-textured, lighter-coloured material into a finer-textured, stronger coloured layer:	Retisols	RT
Low-activity clays, low base status:	Acrisols	AC
Low-activity clays, high base status:	Lixisols	LX
High-activity clays, low base status:	Alisols	AL
High-activity clays, high base status:	Luvisols	LV
8. Soils with little or no profile differentiation -		
Moderately developed:	Cambisols	CM
Stratified fluvial, marine or lacustrine sediments:	Fluvisols	FL
Sandy:	Arenosols	AR
No significant profile development:	Regosols	RG
9. Miscellaneous units -		
Dunes and shifting sands		DS
Salt Flats		ST
Rock Debris		RD
Inland waters		WR
Glaciers and snow		GG
Urban		UR
Island		IS
No data		NI



Issues encountered

- No Cryosols in HWSO (“Gelic Regosols”); soils on the margins of Greenland, e.g., appear in Group 8 rather than Group 3.
- → extracted gelic soil types from FAO74 column and FAO90 column, and merged into one Cryosols feature class.
- → used ArcGIS Erase Tool to adjust the 8 aggregated soil groups as above (subtracting the Cryosols feature class from all groups²)
- → merged adjusted Group 3 features with Cryosol features (Group3_Adjusted_CR).
- Some feature groups are too small (contain not enough features) to display properly at global scale. Decision were taken as follows:
 - DS Dunes and shifting sand
 - ST Salt flats: not included
 - RK Rock debris: included
 - WR, FP Inland water: included (no FP features detected)
 - GG Glaciers and permanent snow: included
 - NI No Data: included
 - UR Urban: included
 - IS Islands: not included (32 features only)
 - Not detected: FP, NS, HD, MA, FP, and PS.

Legend items

Group 1: Soils with thick organic layers

Contains organic soils only.

Group 2: Soils with strong human influence

Contains soils with long and intensive agricultural use; and soils containing significant amounts of artefacts.

Group 3: Soils with limitations to root growth

Contains permafrost-affected soils; thin soils or soils with many coarse fragments; soils with a high content of exchangeable sodium; soils under alternating wet-dry conditions with shrink-swell clays; and soils with high concentration of soluble salts.

Group 4: Soils distinguished by iron/aluminum chemistry

Contains groundwater-affected soils, underwater soils and soils in tidal areas; soils with allophanes or aluminum-humus complexes; soils with subsoil accumulation of humus and/or oxides; soils with accumulation and redistribution of iron; strongly structured soils with low-activity clays, P fixation, and many Fe oxides; soils with dominance of kaolinite and oxides; soils with stagnating water and abrupt textural difference; and soils with stagnating water, and a structural difference and/or moderate textural difference.

Group 5: Pronounced accumulation of organic matter in the mineral topsoil

Contains mineral soils with a blackish topsoil and secondary carbonates; soils with dark topsoil and secondary carbonates; soils with a dark topsoil, no secondary carbonates, and high base status; and soils with dark topsoil and low base status. Contains “steppe” soils with a blackish, dark topsoil and a subsoil that grades from high contents of secondary carbonates (climatic “wet end”) to low base status (“dry end”).

² Has to be performed every time new groups are being created



Group 6: Accumulation of moderately soluble salts or non-saline substances

Soils with non-saline accumulations (gypsum, silica, lime) in semi-arid/arid climates. Contains soils with accumulation of, and cementation by, secondary silica; soils with accumulation of secondary gypsum; and soils with accumulation of secondary carbonates.

Group 7: Soils with a clay-enriched subsoil

Soils with clay enriched subsoil. A further subdivision can be made depending on the base status and/or type of clay minerals. Contains soils with retic properties; soils with low-activity clays and low base status; soils with low-activity clays and high base status; soils with high-activity clays and low base status, and soils with high-activity clays and high base status.

Group 8: Soils with little or no profile differentiation

Contains moderately developed soils; soils with no significant profile development. They include relatively young soils with little or no profile differentiation, such as extremely sandy soils, or soils of flood plains and tidal areas; soils with stratified fluvial, marine and lacustrine sediments.

Dunes and shifting sand

Glaciers and permanent ice

Rock debris

Urban areas

Inland water

No Data

Availability

The map (Figure 1) is available in GIS format at data.isric.org (<https://data.isric.org/geonetwork/srv/metadata/wrb2014-map>)



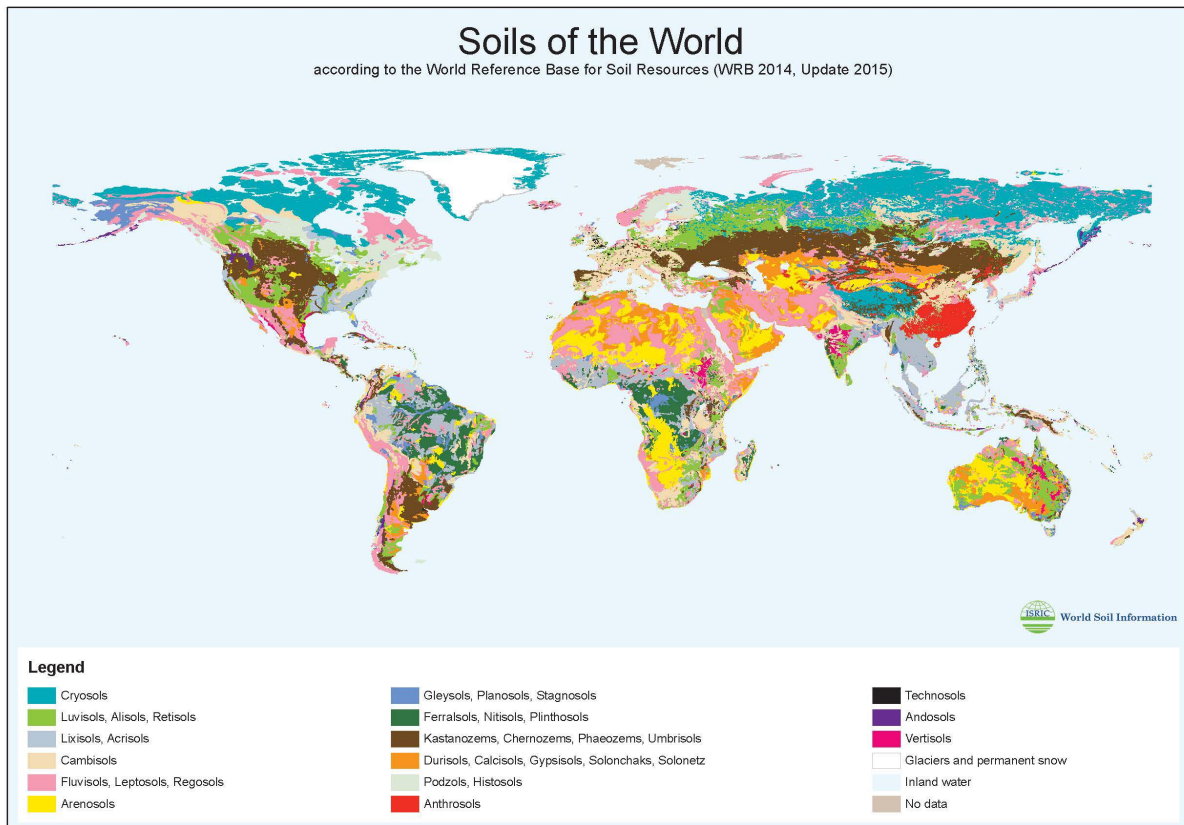


Figure 1 World Soil Map according to WRB2014

Acknowledgements

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