Guidelines for constructing small-scale map legends using the World Reference Base for Soil Resources

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Abstract
The World Reference Base for Soil Resources (WRB) is a tool for classifying soils (pedons) and an instrument to help communication between soil scientists using different national soil classification systems. However, there is an increasing demand to use it as a legend for soil maps, at least at smaller scales. To satisfy that need, in January 2010, the IUSS Working Group WRB published the "Guidelines for constructing small-scale map legends using the World Reference Base for Soil Resources" as an addendum to the WRB. These Guidelines are presented here.

Key Words
World Reference Base for Soil Resources, soil classification, soil maps, map legends, scale.

Main text
In January 2010 an addendum to WRB 2006, first update 2007 (IUSS Working Group WRB 2007), was published electronically (IUSS Working Group WRB 2010). In this addendum guidelines are provided to construct map units (or soil typological units) and map legends for scales of 1:250 000 and smaller. For terms and definitions in these guidelines the user is referred to IUSS Working Group WRB (2007)**.**
When classifying soils, the WRB is capable of indicating most of the soil's properties, and in most cases the result is a quite satisfactory and informative soil name. However, when generalization is required, e.g. in mapping, important information may not show, depending on how the generalization is carried out. Although WRB was not primarily designed to serve mapping purposes, it is increasingly used for that. This addendum has been developed to serve the need for small-scale mapping.

In IUSS Working Group WRB (2007) it is suggested to use for small-scale maps the prefix qualifiers only and for large-scale maps additional suffix qualifiers. If this approach is taken with the current configuration of the qualifiers, important information on certain soil characteristics may not be revealed for small-scale maps. For example, the occurrence of clay skins (Cutanic) is recognized at prefix level, and, when generalizing, Luvisols (and related soils) become Cutanic Luvisols or Cutanic other soils, which for temperate and subtropical regions does not give satisfactory differentiation. Similarly, Rhodic in Ferralsols and Nitisols, and Xanthic in Ferralsols, important qualifiers to indicate their environmental setting and geological relationship, are suffix qualifiers, yielding in generalizations only Haplic Ferralsols and Nitisols. These guidelines (IUSS Working Group WRB, 2010) are based on the following considerations:

- The soil units and their ranking in the FAO-UNESCO Legend (FAO 1974) and Revised Legend (FAO 1988) of the Soil Map of the World (SMW);
- The occurrence and significance of soil properties in other classification systems;
- The relevance of differentiation characteristics for environmental and management functions;
- The availability of soil information (legacy and modern);
- The mappability of soil characteristics at scales of 1:250 000 and smaller.

Intergrade qualifiers are excluded from the map unit qualifier list once the RSG is passed in the Key, unless a specific exclusion is made or the feature is considered to be very important. All qualifiers have been taken into account, regardless whether they are prefix or suffix qualifiers for classification purposes. It must be emphasized that no new definitions and no new qualifiers are introduced; only the ones that are listed in the above-mentioned WRB publication will be used. However, in order to obtain consistent lists, the obligatory "Endo-" specifier has been removed in some cases.

In this addendum, for every Reference Soil Group, the qualifiers are given that can be used to construct small-scale map units and map legends. They are divided into lists of main map unit qualifiers and optional map unit qualifiers. The main map unit qualifiers are ranked and have to be used in the given order. The optional map unit qualifiers are listed alphabetically and may be added according to the need of the user. Some of the optional map unit qualifiers may not be mappable on the scales under consideration.
The following rules apply:

- A map unit consists either of the dominant soil only or of the dominant soil plus a co-dominant soil or one or more associated soils; dominant soils represent 50% or more of the soil cover, co-dominant soils 25% or more, and associated soils are mentioned only if they represent 5% or more of the soil cover or are of high relevance in the landscape ecology; instead of one dominant soil, a combination of at least two co-dominant soils is also possible; if co-dominant or associated soils are indicated, the words "dominant:", "co-dominant:" and "associated:" are written before the name of the soil; the soils are separated by semicolons;
- The number of qualifiers specified below refers to the dominant soil; for co-dominant or associated soils, smaller numbers of qualifiers (or even no qualifier) may be appropriate;
- For map scales of 1 : 5 000 000 and smaller, either the Reference Soil Group (RSG) name or the RSG name plus the first applying qualifier of the main list is used; the qualifier is placed before the RSG name;
- For map scales from 1 : 1 000 000 to 1 : 5 000 000, the RSG name plus the first two applying qualifiers of the main list is used; the qualifiers are placed before the RSG name; the first applying qualifier stands closest to the RSG name;
- For map scales from 1 : 250 000 to 1 : 1 000 000, the RSG name plus the first three applying qualifiers of the main list is used; the qualifiers are placed before the RSG name; the first applying qualifier stands closest to the RSG name, the second one stands in the middle;
- Additional qualifiers of the main list or qualifiers of the optional list may be used in brackets behind the RSG name; if two or more qualifiers behind the RSG are used, the following rules apply: (a) the qualifiers are separated by commas, (b) the additional qualifiers from the main list are placed first and out of them the first applying qualifier stands first, (c) the sequence of the qualifiers from the optional list is according to the preference of the soil scientist who makes the map;
- In case two or more main map unit qualifiers are listed separated by a slash (/), only the dominant one is used;
- If there are less qualifiers applying than described above, the smaller number is used;
- Redundant qualifiers (the characteristics of which are included in a previously used qualifier) are not added; the qualifier Haplic cannot be used in combination with other qualifiers before the RSG name.
- The use of the specifiers Epi- (the qualifier applies only between 0 and 50 cm from the mineral soil surface) and Endo- (the qualifier applies only between 50 and 100 cm from the mineral soil surface) is encouraged, where applicable.

In the following, we give an example with Leptosols and Regosols:

LEPTOSOLS

Main map unit qualifiers	*Optional map unit qualifiers*
Nudilithic/Lithic	Andic
Hyperskeletic	Aridic
Rendzic	Brunic
Folic/Histic	Calcaric
Mollic/Umbric	Cambic
Dystric/Eutric	Drainic
	Gelic
	Gleyic
	Greyic
	Gypsiric
	Humic
	Novic
	Ornithic
	Oxyaquic
	Placic
	Protothionic
	Salic
	Skeletic
	Sodic
	Stagnic
	Technic
	Tephric
	Vertic
	Vitric
	Yermic

REGOSOLS

Main map unit qualifiers	*Optional map unit qualifiers*
Leptic/Skeletic	Arenic
Gleyic	Aric
Gelistagnic/Stagnic	Aridic
Thaptovitric/Thaptandic	Brunic
Tephric	Clayic
Colluvic	Densic
Gypsiric/Calcaric	Escalic
Dystric/Eutric	Folic
	Gelic
	Humic
	Hyperochric
	Hyposalic
	Ornithic
	Oxyaquic
	Siltic
	Sodic
	Takyric
	Technic
	Transportic
	Turbic
	Vermic
	Yermic

Example: In a map unit, 80% of the surface is covered by a severely eroded calcareous soil with 50% gravel over hard rock starting at 80 cm, in the other 20% the soil above the hard rock has 90% gravel. This unit will be denominated

- at map scales of 1 : 5 000 000 or smaller
  dominant: Regosol; associated: Leptosol or *dominant: Skeletic Regosol; associated: Hyperskeletic Leptosol* (the option *Leptic Regosol* was not chosen, because the hard rock starts only at 80 cm)
- at map scales from 1 : 1 000 000 to 1 : 5 000 000
  dominant: Calcaric Skeletic Regosol; associated: Hyperskeletic Leptosol
- at map scales from 1 : 250 000 to 1 : 1 000 000
  dominant: Calcaric Skeletic Regosol; associated: Hyperskeletic Leptosol
- (redundant qualifiers are not used; in this example the next applying qualifier for the Regosols is *Eutric*, however *Calcaric* already indicates the high base saturation; therefore at this map scale only two qualifiers are applicable)

As in this example for the Regosols a choice had to be made between *Leptic* and *Skeletic*, which are not mutually exclusive, the non-chosen qualifier may be added in brackets after the name of the RSG:

Skeletic Regosol (Leptic)
Calcaric Skeletic Regosol (Leptic)

Conclusion

The authors are convinced that these guidelines provide a viable tool for constructing small-scale map legends using the WRB.

References

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