

# Improving soil data – rules for horizon identification, description and data storage

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Current situation

## 1. Horizon types, differences in information density

Soil profile descriptions as recorded in databases are the raw data for various evaluations. The more explicit and consistent the rules for the description are, the better the data can be evaluated. While attribute parameters and their set of permissible values are well defined, e.g. in the *FAO Guidelines for Soil Profile Description* (FAO 2006), no straightforward, clear procedures for the identification of transitional horizons are given. Their description holds fewer morphological information than that of 'regular' horizons. Distinctness and topography are only described for boundaries between horizons, but not between different domains within horizons. Information on the morphology of transitional horizons of the 'combined' type (fig. 2) cannot clearly be attributed to one of their two domains. Clear conventions on horizon identification, horizonation and object orientation in database design are proposed which would enable better data evaluations.

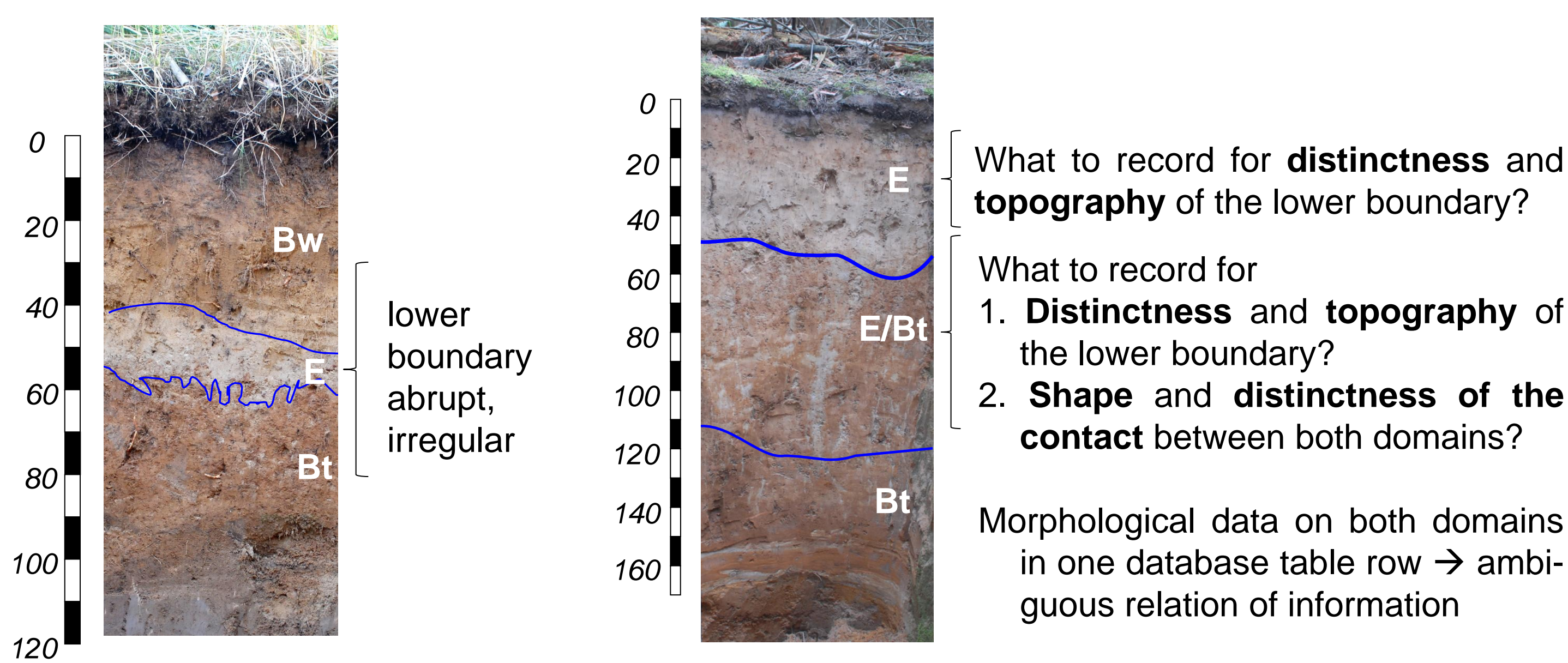


Fig. 1 – 'Regular' horizons and simple horizonation.

Fig. 2 – Transition 'Type 2' (E/Bt) with two properties separate, i.e. two domains combined.

## 2. Current horizon identification and description

Three types of horizons are distinguished. Simple 'regular' horizons (Fig. 1) and two types of transitional horizons, type 1 with "properties of two horizons superimposed" and type 2 with "two properties separate" (fig. 2). The contact of horizons (but not of domains within horizons of type 2) is described by noting **distinctness** (Tab. 1) and **topography** (fig. 3). No rules exist when to describe a transitional horizon, usually in addition to regular ones. As a consequence, the same soil profile can be described in different ways (fig. 5). Data evaluation is hampered.

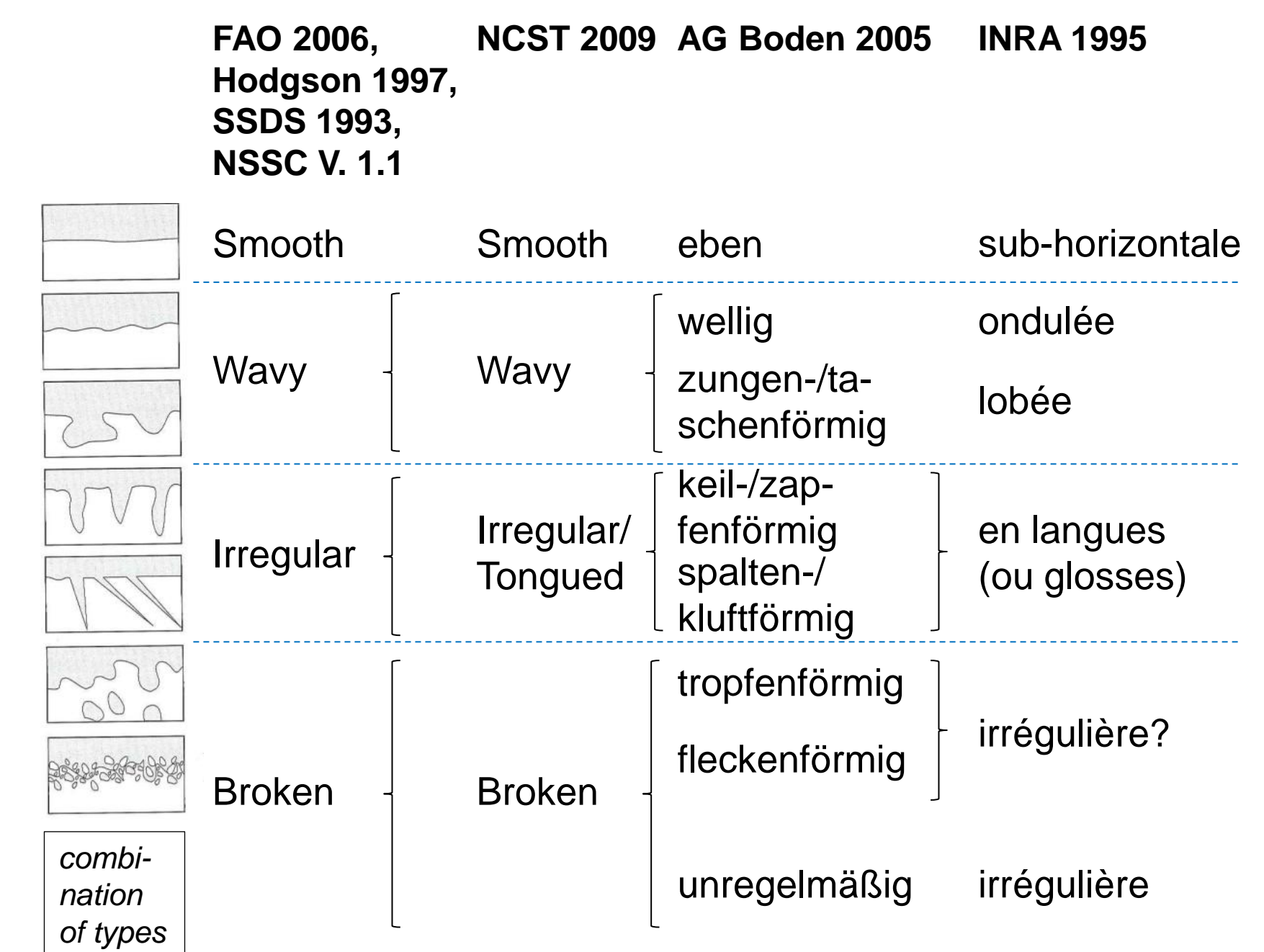


Fig. 3 – Description of topography according to various guidelines (Sketch from AG Boden 2005).

Tab. 1: Recording distinctness of the lower horizon boundary.

NSSC Version 1.1		Hodgson 1997		NCST 2009		FAO 2006, SSSS 1993		AG Boden 2005		INRA 1995	
Class	cm	Class	cm	Class	cm	Class	cm	Class	cm	Class	cm
Very Abrupt	0-<0.5	Sharp	0-0.5	Sharp	<0.5	Abrupt	0-<2	scharf	0-<2	nette (abrupte)	0-2
Abrupt	0.5-<2	Abrupt	0.5-2	Abrupt	0.5-2						
Clear	2-<5	Clear	2-5	Clear	2-5	Clear	2-<5	deutlich	2-<5	distincte	2-5
Gradual	5-<15	Gradual	5-15	Gradual	5-10	Gradual	5-<15	diffus	≥5	gradueller	5-12
Diffuse	≥15	Diffuse	>15	Diffuse	>10	Diffuse	≥15			diffuse	≥12*

\* Recommendation to describe an independent horizon when transition is thicker than 12 cm

## 3. Determinability of horizon boundaries

Considering the standard profile pit width of 80 to 100 cm, a diffuse or even gradual irregular or broken boundary can hardly be determined properly. The same applies to diffuse smooth or wavy boundaries. Fig. 4 gives an idea of boundary field determinability, from which criteria can be derived for defining horizon boundaries and hence horizonation of the soil profile.

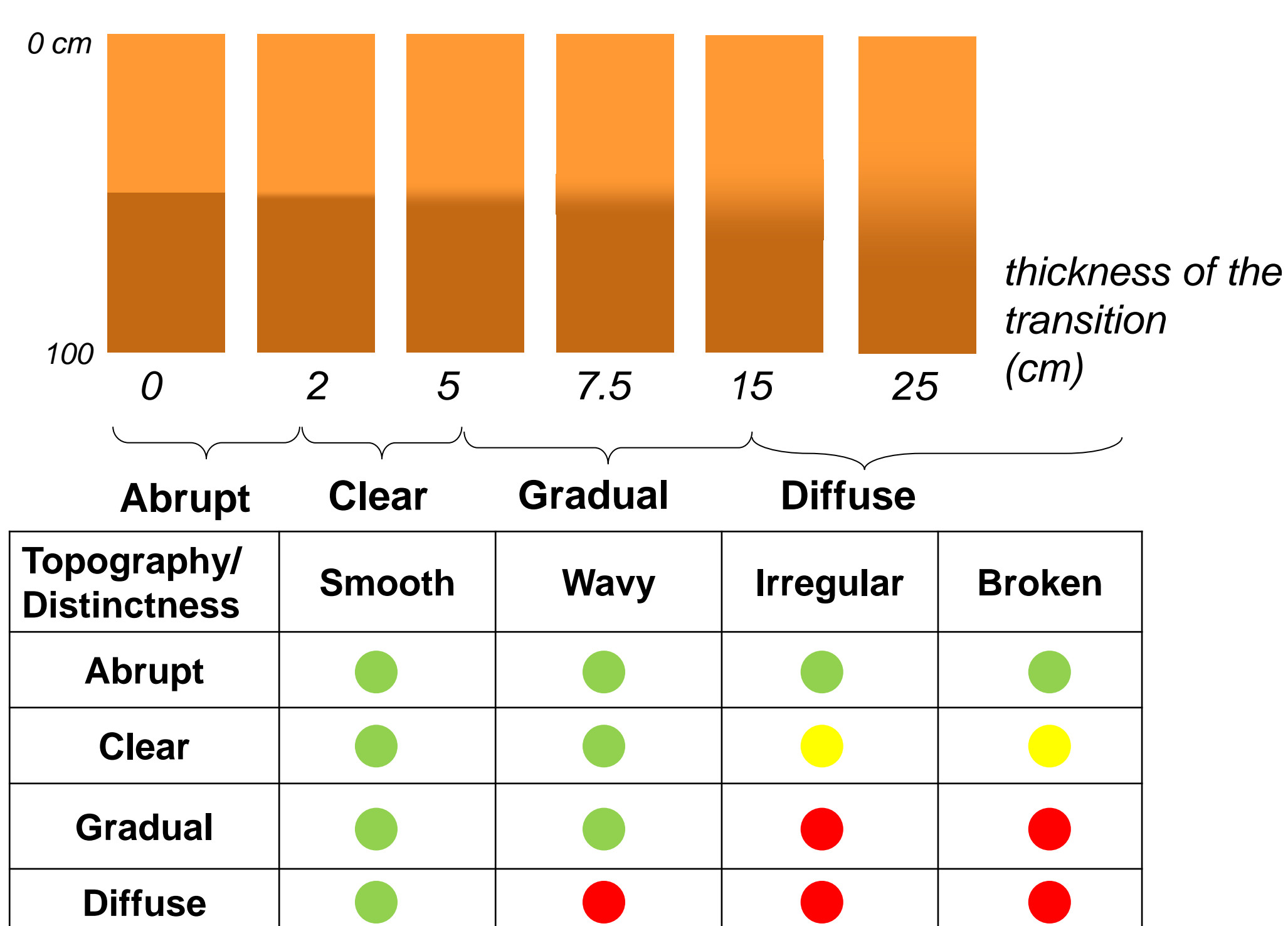


Fig. 4 – Determinability of horizon boundaries as related to topography and distinctness.

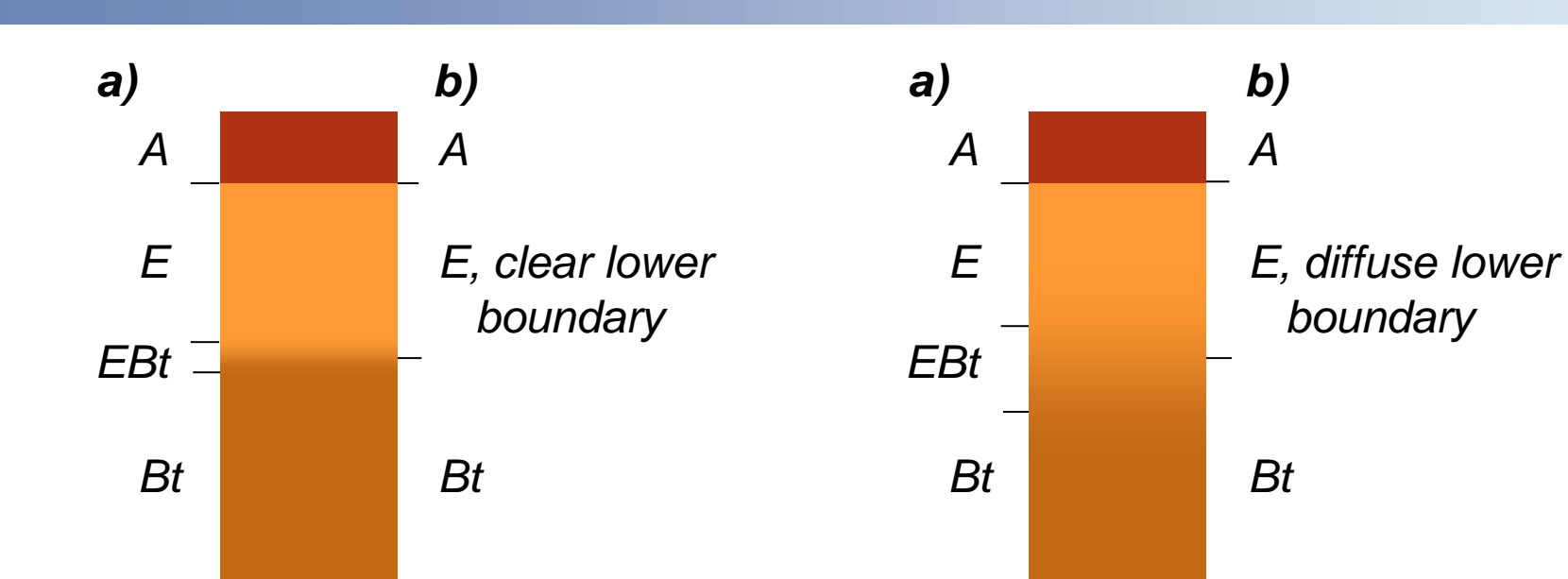


Fig. 5 – Two different soils with the same valid possibilities for horizonation. According to the proposed rules, the horizonation of the left profile should be b), for the right a).

## 4. Proposed changes for horizonation and horizon description

### Horizonation

- Link the decision whether to describe
  - a regular horizon, e.g. Bt,
  - an (additional) transitional horizon type 1 (superimposed), e.g. BtE, or
  - an (additional) transitional horizon type 2 (separate domains), e.g. E/Bt,

to the topography and distinctness criteria as stated in tab. 2. Figure 5 shows how these criteria reduce ambiguity in profile description.

- Distinctness 'diffuse' is not used any longer. For transitional horizons (type 1), distinctness and topography are set to 'not applicable'. The same applies to the horizon above a type 1 horizon.

### Information density for transitional horizon description

- Each domain of a type 2 transitional horizon is recorded in a separate row of the horizon table (fig. 6), with the same depth information. Any piece of data explicitly relates to only one of the domains (e.g. Munsell colors in the E/Bt horizon).
- Distinctness and topography relate to the contact between both domains. Topography is noted for the part of the horizon notation for which a topography type applies best (e.g., for the E/Bt horizon of the soil in fig. 2, for the E domain of the E/Bt 'tongues' or 'irregular' would be recorded), while the other domain functions as the matrix (here Bt) and topography is recorded as 'combined with above'. Topography of the horizon above a type 2 horizon is by default 'smooth', distinctness 'not applicable'.

Tab. 2: Criteria for horizonation rules.

Topography/Distinctness	Smooth	Wavy	Irregular	Broken
Sharp/Very Abrupt	Regular horizon (only)			
Abrupt				
Clear				
Gradual	(additional) Transition type 2 horizon			
Diffuse	(additional) Transition type 1 horizon			

No	Upper depth	Lower depth	Horizon notation	Topography	Distinctness	Munsell dry
2	17	35	E	---	---	10YR7/4
3	35	48	E/Bt	---	---	10YR5/6; 10YR7/4
4	48	72	Bt	Wavy	Gradual	10YR5/6

a)

No	Upper depth	Lower depth	Horizon notation	Topography	Distinctness	Munsell dry
2	17	35	E	Smooth	n.a.	10YR7/4
3	35	48	E/	Irregular	Abrupt	10YR7/4
3	35	48	/Bt	Combined with above	n.a.	10YR5/6
4	48	72	Bt	Wavy	gradual	10YR5/6

b)

Fig. 6 – a) Typical current horizon dataset for a transitional horizon type 2. For any attribute value, it is not explicitly clear to which domain it relates.

b) Proposed dataset handling: each domain of the transitional horizon is independently described in an own data table row. Topography and distinctness relate to the domain for which a shape of the contact can better be described, and upper and lower boundary of the complete transition horizon are set to 'not applicable'. The slash position in the horizon notation show the order in the combined.

Rationale and Proposal

### References

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