A concept for a consolidated humus form description in forest soil investigations in Europe

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Introduction

The Humus form (HF) is an integrate multi-dimensional phenomenon where key soil processes and services are delivered. The HF characterizes the morphology of the litter and humus layer and the mineral top soil. Occurrence and thickness of these horizons lead to different humus forms, indicating different allocation and quality of the organic matter in a soil profile. Different humus forms develop due to the interaction of various soil forming factors. Thus, the HF is an indicator of distinct organism communities and abiotic site characteristics. Furthermore, changes of humus forms are a sensitive indicator of anthropogenic impact on soils.

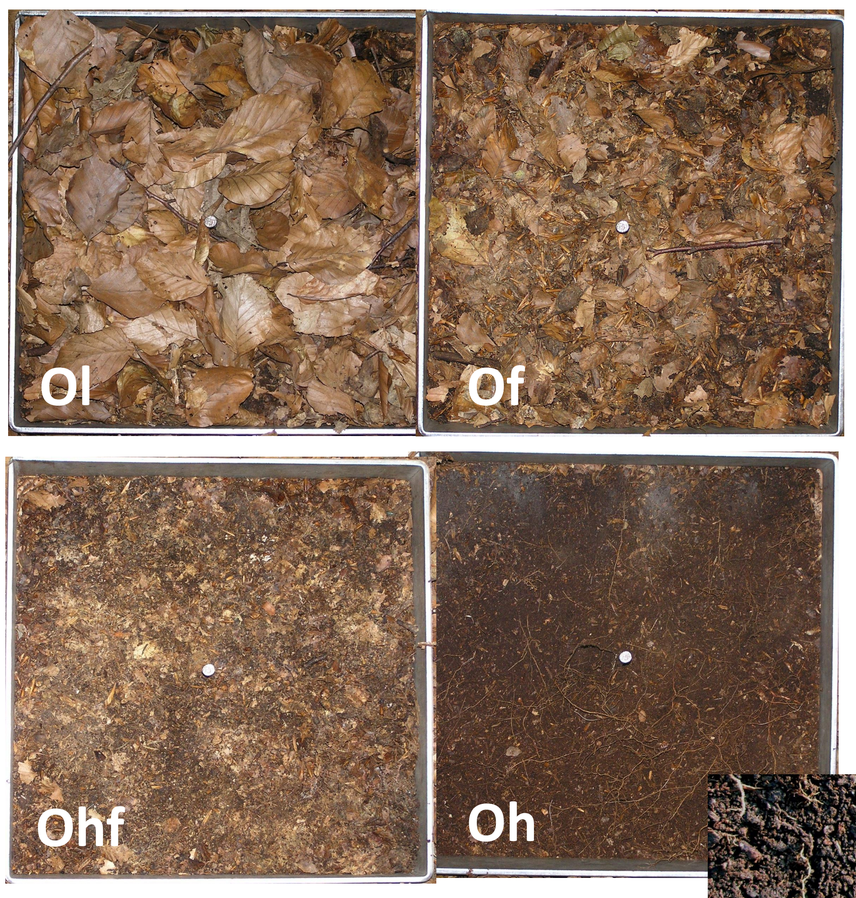
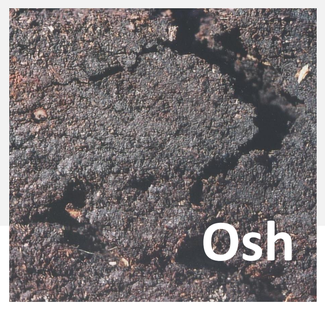


Figure 1: Litter and humus layer horizons



Problem

Classification of humus forms has a long tradition and was concurrently developed in different countries. Description is based on elements of different European and North American classifications. The attempts to find a common language in the humus form description (Broll et al. 2006, Jabiol et al. 2013, Zanella et al. 2011) failed due to the absence of an agreement between international stakeholders. A validation of classifications for broader range of climatic regions and vegetation types is necessary.

Proposal

Humus forms well describe the habitat of the majority of soil organisms. Physical and chemical properties of litter horizons and topsoils are dependent on the percentage of fine humus, structure and bulk density. Therefore, morphological distinct horizons must be described, sampled and analyzed.

For Terrestrial humus forms:

- Differentiation of litter horizons by percentage of fine humus (humified organic matter without macroscopically visible plant residues (Fig. 1 L - Oh) and
- fine humus by morphological features (structure) and compactness (Fig. 1 Obh, Osh)
- Consideration of impact of living roots in organic layers as drivers on C-dynamics (Fig. 1 Odh)
- Consideration of the water status of the site by morphological features (colour of leaves and mottling in mineral top soil) and vegetation

Classification of humus forms

- Should be based on several morphological features and verified by chemical (Tab. 1) and physical analysis
- Criteria should be based on observations in the field
- The highly dynamic nature of humus forms should be considered by defining subtypes and transitional forms (Fig. 2)

Tab. 1: Means of organic carbon (OC), quotients of C/N- and C/P of aeromorphic humus forms (modified after Zezschwitz 1980). Samples taken in A-horizons of Mull (3 cm below mineral soil surface) and Oh horizons of moder and mor

Type	Subtype/*Variety*	OC (mg g^{-1})	C/N	C/P
Mull	L-Mull	20 - 60	10 - 14	10 - 80
	F-Mull	30 - 70	14 - 17	50 - 100
Moder	Mull like Moder	40 - 100	17 - 20	80 - 180
	Fine humus poor M.	140 - 270	20 - 24	180 - 380
	Fine humus rich M.	200 - 340	22 - 26	260 - 560
Mor	Moder like Mor	240 - 410	25 - 31	420 - 740
	Mor	330 - 470	29 - 38	600 - 1100

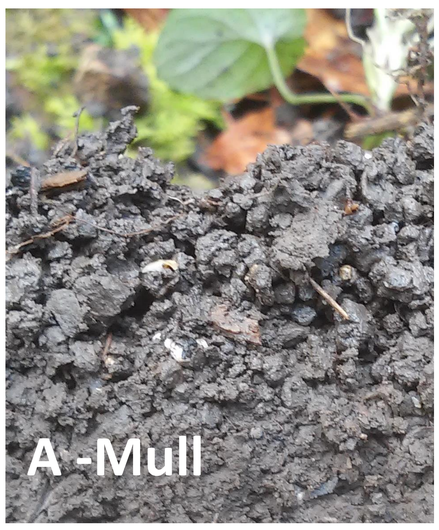


Figure 2: Subtypes & transitional humus forms

Conclusion

We propose to create a new process where the participating countries agree on the definition of diagnostic horizons and differentiate the main terrestrial humus forms mull, moder, amphi and mor on the basis of diagnostic mineral and organic horizons.

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