Characterisation of soil aggregates developed under various land use in the Marchfeld

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Introduction and Methods

Soil formation has a very strong influence to the water infiltration, root penetration, availability of nutrients and aeration in the soil.
This study characterises micro aggregates (<0.25mm) and macro aggregates (0.25-0.5, 0.5-1, 1-2, 2-5, 5-10 mm) in Fluvisols and Chernozems in the „Marchfeld“ (Lower Austria) impacted by different land use (forest, grassland, cropland) and time-scales (ca. 10 to 4500 years, determined through OSL - Optical Stimulated Luminescence and historical maps). The aggregates were collected by dry sieving in the field in autumn 2011 from 5-10 cm soil depth.

Soil characteristics measured:
- Particle size distribution (sand, silt & clay content)
- C/N ratio, moisture content, bulk density
- Dry aggregate size distribution
- STA – Simultaneous thermogravimetric analysis
- Greenhouse gas fluxes (CO_2, CH_4, N_2O, NO_x)
- Particulate organic matter and (hydro-) oxides

Hypothesis

I) Aggregate size classes developed under forest, grassland and cropland show different quantity distributions and properties caused by various organic matter inputs and microbial activities.
II) Aggregates get more stable along the soil chronosequence due to a higher humification of the SOM and an increase of oxides (compare Figure 1).

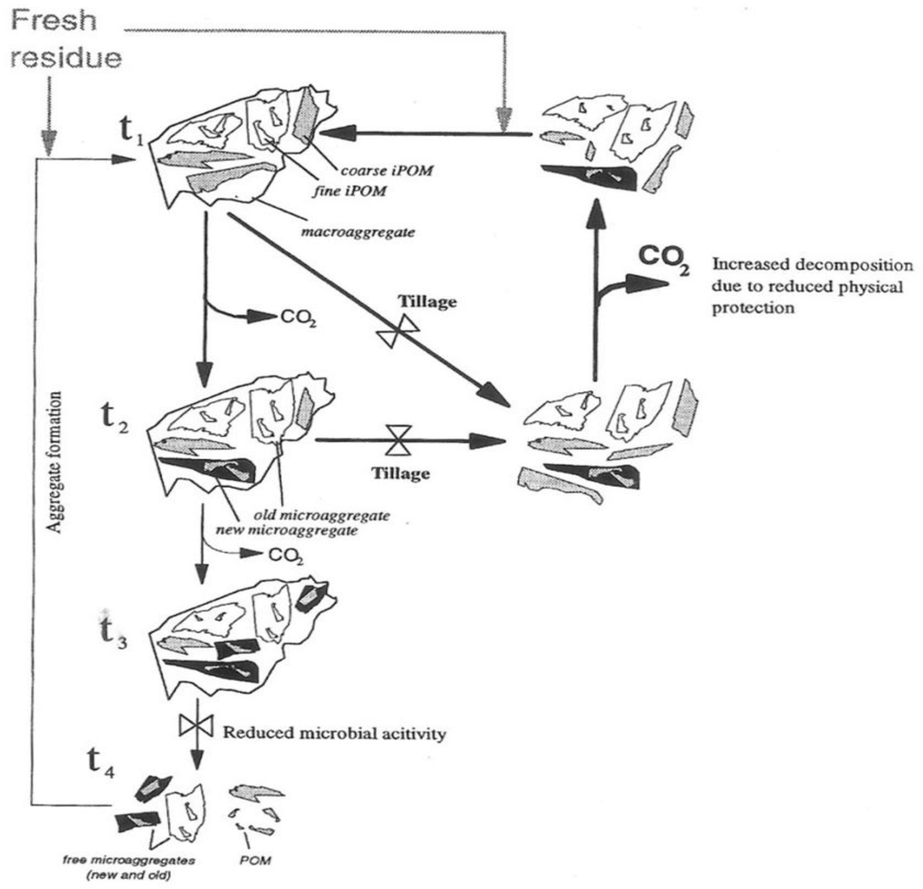
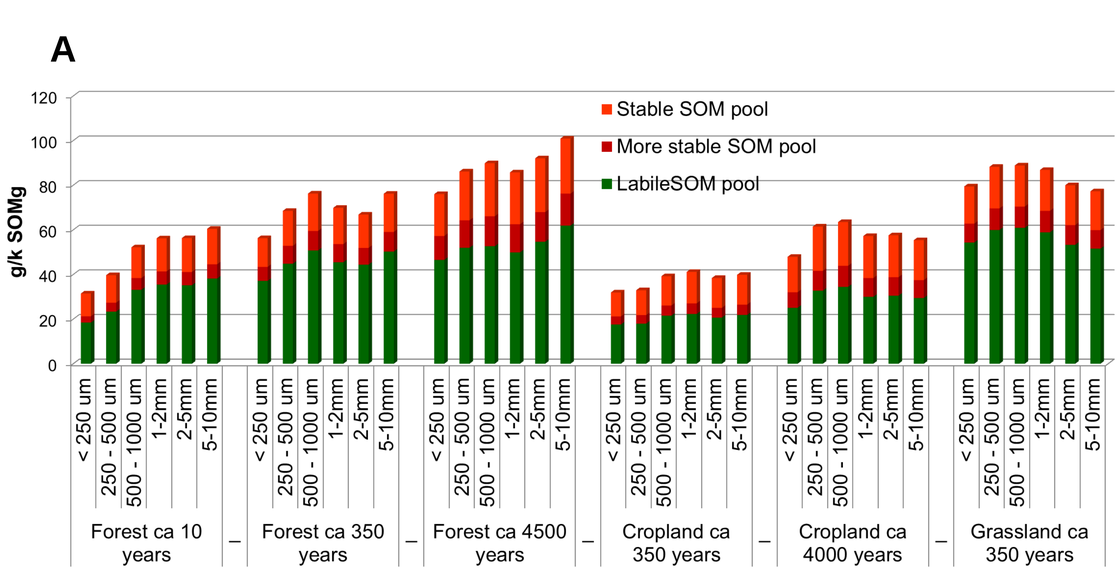
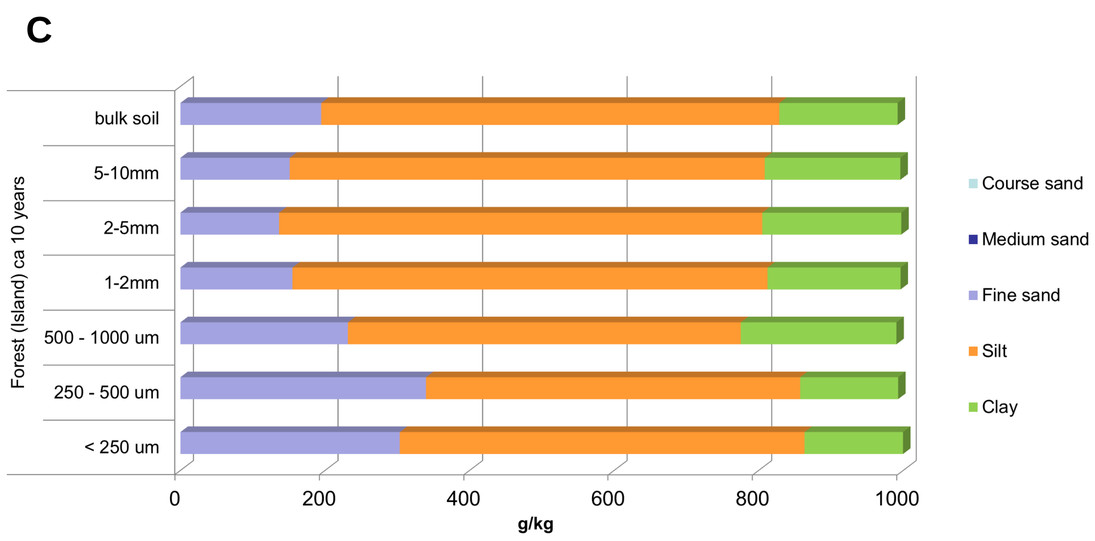


Fig.1: Source: J.Six et al./ SBB (2000)- „Life cycle“ of a macroaggregate and the formation of microaggregates

Preliminary results





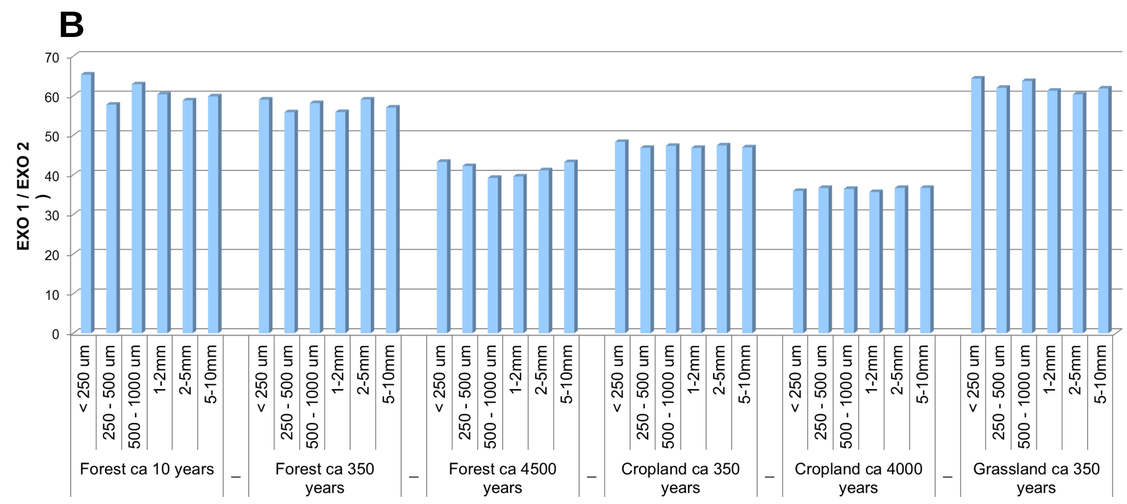


Fig.2: (A) SOM increases with increasing aggregate size in the forest soils as well as the “stabile”, humified SOM increases with soil age (forest and cropland). No clear trend in SOM contents among aggregates was found in the cropland and grassland.
(B) The high values in the younger forest sites and the grassland site indicate the accumulation of more “labile” SOM (EXO1) in the aggregates as compared to the older cropland and forest site. Accumulation of more stabile SOM (EXO2) appears in longer time-scales. No trends among the various aggregate size classes suggest a short life-cycle of the aggregates in the studied soils.
(C) Sand (here mainly fine sand) is decreasing with increasing aggregate size, which demonstrates the importance of finer particles (i.e. clay, fine silt) for the build-up of larger aggregates in the Marchfeld.

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