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Soil organic matter dynamics under Beech and Hornbeam as affected by soil biological activity

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Organic matter dynamics are highly affected both the soil fauna as well as the source of organic matter, having important consequences for the spatial heterogeneity of organic matter storage and conversion. We studied oldgrowth mixed deciduous forests in Central-Luxemburg on decalcified dolomitic marl, dominated by high-degradable hornbeam (Carpinus betulus L.) or low-degradable beech (Fagus sylvatica L.). Decomposition was measured both in the laboratory and in the field. Litter decomposition was higher for hornbeam than for beech under laboratory conditions, but especially in the field, which is mainly to be attributed to macro-fauna activity, specifically to earthworms (Lumbricus terrestris and Allolobophora species). We also investigated differences between beech and hornbeam with regard to litter input and habitat conditions. Total litter input was the same, but contribution of beech and hornbeam litter clearly differed between the two species. Also, mass of the ectorganic horizon and soil C:N ratio were significantly higher for beech, which was reflected in clear differences in the development of ectorganic profiles on top of the soil. Under beech a mull-moder was clearly present with a well developed fermentation and litter horizon, whereas under hornbeam all litter is incorporated into the soil, leaving the mineral soil surface bear in late summer (mull-type of horizon). In addition to litter quality, litter decomposition was affected by pH and soil moisture. Both pH and soil moisture were higher under hornbeam than under beech, which may reflect differences in soil development and litter quality effects over longer time scales. Under beech, dense layers of low-degradable litter may prevent erosion, and increase clay eluviation and leaching of base cations, leading to acid and dry conditions, which further decrease litter decay. Under hornbeam, the soil is not protected by a litter layer, and clay eluviation and acidification may be counteracted by erosion, and earthworms bringing clay and base cations back to the surface. It may be concluded that beech and hornbeam stands show clear differences in both input and decomposition rates. They are also fixed to habitat conditions that can be clearly differentiated in the field allowing for a spatial analysis of organic matter dynamics and input.