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Does deciduous tree species identity affect carbon storage in temperate soils?

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Forest soils contribute roughly 70 % to the global terrestrial soil organic carbon (SOC) pool and thus play a vital role in the global carbon cycle. It is less clear, however, whether temperate tree species identity affects SOC storage beyond the coarse differentiation between coniferous and deciduous trees. The most important driver for soil SOC storage definitely is the fine mineral fraction (clay and fine silt) because of its high sorption ability. It is difficult to disentangle any additional biotic effects since clay and silt vary considerably in nature. For experimental approaches, the process of soil carbon accumulation is too slow and, therefore, sound results cannot be expected for decades. Here we will present our success to distinguish between the effects of fine particle content (abiotic) and tree species composition (biotic) on the SOC pool in an old-growth broad-leaved forest plots along a tree diversity gradient , i.e. 1- (beech), 3- (plus ash and lime tree)- and 5-(plus maple and hornbeam) species. The particle size fractions were separated first and then the carbon concentrations of each fraction was measured. Hence, the carbon content per unit clay was not calculated, as usually done, but directly measured. As expected, the variation in SOC content was mainly explained by the variations in clay content but not entirely. We found that the carbon concentration per unit clay and fine silt in the subsoil was by 30-35% higher in mixed than in monospecific stands indicating a significant species identity or species diversity effect on C stabilization. In contrast to the subsoil, no tree species effects was identified for the topsoil. Indications are given that the mineral phase was already carbon saturated and thus left no more room for a possible biotic effect. Underlying processes must remain speculative, but we will additionally present our latest microcosm results, including isotopic signatures, to underpin the proposed deciduous tree species identity effect on initial soil carbon accumulation.