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Tree species effects on stocks and vertical distribution of soil carbon: Links to mycorrhizal association, soil fauna and soil microbial characteristics

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Tree species with leaf litter traits driving slow rates of leaf litter decomposition have traditionally been associated with accumulation of higher SOC stocks than tree species with fast litter decomposition rates. This hypothesis has mainly been based on observations of thick C-rich forest floors under tree species associated with ectomycorrhizae (ECM). However, a recent hypothesis suggested that tree species with foliar litter traits conducive to fast decomposition will lead to more pronounced microbial transformation and stabilization of litter C. The latter tree species are often associated with arbuscular mycorrhizae (AM) and may enhance deeper incorporation of C by more active soil fauna communities and by higher belowground rates of litter input.

The Danish common garden tree species experiments include ECM and AM tree species that differ widely in traits such as foliar litter chemistry. Six common European tree species formed distinct groups that largely reflected their mycorrhizal association. Forest floor C stocks were consistent with the traditional perception of slowly decomposing ECM species being conducive to high SOC stocks, but an intriguing pattern of more C in the mineral soil in AM tree species supported the recent microbial stabilization hypothesis and suggested deeper incorporation of C in more stable forms.

Based on new results on microbial, macro- and mesofauna communities, fine root dynamics and repeated soil sampling, this talk will revisit Danish common garden tree species experiments for a synthesis of processes and patterns in organic matter formation that may explain observed patterns in SOC stocks and vertical SOC distribution.