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Long term consequences of disturbance on soil organic matter storage in temperate forests

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The significance of soils in temperate broadleaved forests as a carbon sink of global importance is well recognized. However, the overall effects that control soil organic matter (SOM) storage in these forests are still not well understood. Intrinsic factors such as physical, chemical or biological stabilization offer mechanistic understanding for SOM storage. However, on the plot scale additional factors such as, historic land use, soil profile depth and disturbance frequency are often more important for the overall SOM stocks than intrinsic factors. In order to prove the effect of external factors we went to a unique field site in Iphofen, Germany maintaining coppice-with-standard forests with a 40 year rotation period since the medieval. We compared the total SOM stocks of the whole depth profile for plots with 1, 40 and 60 years re-growth time. Most interestingly our results indicate that over the rotation period the SOM storage rate for carbon and nitrogen was only about 4.4 g C m-2y-1and 3,5 g N m-2 y-1 respectively. In contrast plots with ongoing timber growth store 73 g C m-2y-1. Our results highlight that disturbance frequency is the main control of SOM storage on the plot scale. Obviously undisturbed systems create spatial structures, like the rhizosphere, that allow ongoing SOM storage whereas after disturbance SOM in these structures is mineralized and new structures create new locations for carbon storage.