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Silvicultural thinning does not alter soil C and N stocks of a typical mountainous beech forest in Southern Germany under present and future climate conditions

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Forest management practices to use wood for energy production or production of industrial goods are usually thought to be neutral in terms of greenhouse gas balances. However, this applies only if silvicultural management is not reducing soil carbon (C) and nitrogen (N) stocks on the long term. Beech forests on shallow calcareous soils cover wide regions of Central Europe and are frequently managed by thinning. Recently some studies have shown for these ecosystems that thinning can lead to an initial short-term opening of the N cycle and lead to losses of soil organic carbon in the first years after tree harvest. However, the medium- to long-term effects of thinning on soil C and N turnover and –stocks remained unclear. To evaluate if thinning reduces C and N turnover and stocks over a time scale longer than 10 years, an experiment was conducted at replicated sites in a typical beech forest in Southern Germany, where initial short-term losses of soil C and N due to thinning had been documented. The sites are characterized by different microclimates due to different slope exposure: North exposures represent a cool-moist model climate for present-day conditions, while the South exposures represent warm-dry model climate of future decades. Soils of untreated control plots and thinned plots were re-sampled 9-13 years after thinning and analyzed for C and N stocks in soil and δ13C and δ15N natural abundance isotopic signatures to investigate whether the short-term effect of thinning on C and N stocks and cycling was persistent also at a longer time scale.

No differences in C and N stocks and isotopic signatures were found between control plots and thinned plots neither under cool-moist nor under warm-dry microclimate 9-13 years after thinning. This suggests that thinning is an appropriate measure with regard to maintaining soil C and N stocks if conducted at timescales of more than a decade. Results found for the S exposures imply that the resistance of the investigated forest ecosystem to thinning-induced long-term soil C and N losses may also persist under projected future climatic conditions, suggesting that thinning is a sustainable silvicultural measure for such beech forests with regard to the protection of soil C and N stocks.