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Admixing other tree species to European beech forests: Effects on soil organic carbon and total nitrogen stocks. A review.

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Drought-sensitive European beech forests are increasingly challenged by climate change. Admixing other, preferably more deep-rooting, tree species has been proposed to increase the resilience of beech forests to summer drought. This might not only alter soil water dynamics and availability, but also soil organic carbon (SOC) and total nitrogen (TN) storage in soils. Since information of these effects is scattered, our aim was to synthesize results from studies that compared SOC/TN stocks of beech monocultures with those of mixed beech stands as well as of other monocultures. We conducted a meta-analysis including 40 studies with 208, 231 and 166 observations for forest floor, mineral soil and the total soil profile, respectively. Pure conifer stands had higher SOC stocks compared to beech in general, especially in the forest floor with up to 200% (larch forests). Other broadleaved tree species (ash, oak, lime, maple, hornbeam) showed in comparison to beech lower SOC storage in the forest floor, with little impact on total stocks. Similarly, for mixed beech-conifer stands we found significantly increased SOC stocks of >10% and a small increase in TN stocks of approx. 4% compared to beech monocultures, which means a potential SOC storage increase of >0.1 t ha⁻¹yr⁻¹ (transformation of mineral soil to 100 cm depth). In contrast, mixed beech-broadleaved stands did not show a significant change in total SOC stocks. Currently, the influence climatic and soil parameters on SOC changes due to admixture of other tree species is analyzed based on this dataset. This is expected to facilitate an assessment which mixtures with beech have the largest potential towards increasing SOC stocks.