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Tree species functional group is a more important driver of soil properties than tree species diversity across major European forest types

Lars Vesterdal (1), Seid Muhie Dawud (1,2), Karsten Raulund-Rasmussen (1), Leena Finér (3), Timo Domisch (3), and Sophia Ratcliffe (4)

(1) University of Copenhagen, Geosciences and Natural Resource Management, Frederiksberg C, Denmark (lv@ign.ku.dk), (2) Wollo University, Dessie, Ethiopia (seid.muhie@wu.edu.et), (3) Natural Resources Institute Finland (Luke), Joensuu, Finland, (4) Institute of Biology, University of Leipzig, Leipzig, Germany

The influence of tree species diversity and functional group on soil properties (carbon stock, pH and C/N ratio) has not been explored across major European forest types. We evaluated the relative importance of tree species diversity and functional group on soil carbon (C) stocks, C/N ratio and pH in major European forest types in the six regions Finland, Poland, Germany, Romania, Italy and Spain. We sampled soils in 209 permanent plots along a species diversity gradient from monocultures to 5-species mixtures in the exploratory platform of the FunDivEurope project.

Carbon stocks in the topsoil (forest floor (FF), 0-10 cm, and FF+0-10 cm) were positively, but weakly, related to diversity across the regions. While the C/N ratio in the FF+0-10 cm layer decreased significantly with increasing diversity in the Spanish region, pH was unrelated to species diversity across the regions. Tree species functional group (conifer proportion) explained a larger proportion of the variability in soil properties than species diversity. Conifer admixture increased C stock and C/N ratio, and decreased pH, but the impacts differed between the regions for some soil layers. Differences in mean annual temperature, actual evapotranspiration and soil texture between the regions were possible driving factors behind the different functional group effects in Finland, Spain and Germany.

The results suggest that targeted selection of tree species with desired characteristics, e.g. complementary traits for resource use, is a preferred management approach for influencing soil C stock, C/N ratio and pH in mixed forests rather than increasing tree species diversity per se.