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Organic matter characteristics in boreal forest soils under stands of silver birch, Norway spruce, and Norway spruce with a mixture of silver birch

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The aim was to study how tree species and a tree species mixture affect microbial C and N transformations and two major plant secondary compound groups, terpenes and phenolic compounds in soil. The study site was a tree-species experiment in middle-eastern part of Finland containing plots of 43-year-old silver birch, Norway spruce and Norway spruce with a mixture of silver birch (22 and 37 % birch of the total stem number). Soil was podzol and humus type mor. Samples were taken from the organic layer. C and N in the microbial biomass, rates of C mineralization (CO_2 evolution), net N mineralization and nitrification, and concentrations of total water-soluble phenolic compounds, condensed tannins and different kind of terpenes were measured. Amounts of C and N in the microbial biomass and the rates of C mineralization and net N mineralization were all lower under spruce than birch, and particularly net N mineralization was stimulated by birch mixture. Concentrations of total water-soluble phenolic compounds were on a similar level, irrespective of tree species. However, there were less low-molecular-weight phenolics and more high-molecular-weight phenolics under spruce than birch. Concentrations of condensed tannins and both sesqui- and diterpenes were all higher under spruce than birch but the concentrations of triterpenes were similar in all soils. The difference between tree species was greatest with monoterpenes which were measured from both organic layer and soil atmosphere: high concentrations under spruce and negligible under birch. Birch mixture tended to decrease the concentrations of condensed tannins and mono-, sesqui- and diterpenes.