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Response of forest soil organic matter to different amounts of Norway spruce logging residues

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In final felling, forest soil can receive a large pulse of fresh organic material consisting of green branches and stem tops of the trees. Currently forest biomass, including these logging residues, is increasingly being used as a source of energy in Europe. This means that at least part of the logging residues are more commonly harvested, instead of leaving them on the site for gradual decomposition and nutrient release. Our aim was to find out the response of soil organic matter properties to different amounts of this fresh plant material.

The study sites had originally been two Norway spruce dominated stands, located in Southern Finland on *Vaccinium myrtillus* site type. There were three logging residue treatments which were done in connection to final felling of the stands: 0, 10 and 40 kg/m² of fresh spruce logging residues. Samples were taken from the humus layer six years after the final felling. Logging residues increased the concentrations of dissolved organic C, water-soluble total phenolic compounds and certain types of terpenes in the organic matter. However, soil C-to-N ratio and pH were not dependent on the amount of residues. Logging residues decreased the amount of N in the microbial biomass, increased microbial biomass C-to-N ratio, rates of net N mineralization and net nitrification, and concentration of NO₃-N. Microbial biomass N as percentages of soil total N varied between 2.1-4.3 % and residues decreased the proportion. Residues increased the net N mineralization/ microbial biomass N ratio. The dependency on the amount of residues was most clear with net N mineralization and nitrification.

In conclusion, the effect of Norway spruce logging residues on soil organic matter properties was strong six years after the soil had received different amounts. The large spatial variation in forest soil properties can be partly explained by the very uneven distribution of logging residues, even more usual in current harvesting techniques leaving residues in piles on the clear-cut.