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Changes in SOM composition and stability to microbial degradation over time in response to wood chip ash fertilisation

Mette Hansen (1), Anna Saarsalmi (2), and Clément Peltre (3)

(1) IGN, University of Copenhagen, Copenhagen, Denmark (metha@ign.ku.dk), (2) Natural Resources Institute Finland (Luke), Vantaa, Finland (anna.saarsalmi@luke.fi), (3) PLEn, University of Copenhagen, Copenhagen, Denmark (peltre@plen.ku.dk)

Recirculation of nutrients from wood chip combustion by ash fertilisation of forest systems can be used to re-introduce nutrients that are otherwise lost, counteracting nutrient depletion due to whole tree harvesting. However, the effects of ash application on soil organic matter (SOM) composition, turnover and stability are unknown. The aim of the study was to investigate how ash fertilisation of forest soils affects SOM composition and stability to microbial degradation over time. O-horizon and 0-5 cm mineral soil samples were collected from two coniferous forest sites, one in Finland and one in Denmark,
where ash had been spread at different times. Changes in SOM biodegradability were estimated based on an incubation experiment, expressed as percentage of initial carbon. Changes in SOM composition were characterised using thermal analysis and Fourier transform mid-infrared photoacoustic spectroscopy (FTIR-PAS) analysis of bulk soil samples. Ash fertilisation of forest soils affected SOM composition in the O-horizon, but not in the top 5 cm of the mineral soil. The pH and biodegradability of SOM were increased in the O-horizon. The changes in SOM composition consisted of enrichment of Fe- and Al-oxides/
hydroxides, depletion of carboxylic and aromatic groups and lower thermal stability in soils with older and greater ash application. Ash fertilisation increased soil pH, either right after ash application
or through a buffering effect of the ash on acidification caused by decomposing needles over time. The increased pH due to ash fertilisation together with the nutrient inputs from the ash most likely
stimulated SOM turnover. This in turn increased the labile fraction of SOM, whereby the thermal stability of SOM decreased as simpler compounds were formed.