Geophysical Research Abstracts
Vol. 21, EGU2019-4860, 2019
EGU General Assembly 2019

Impacts of logging residue piles of different tree species on soil N cycling and losses after final felling

Tiina Törmänen (1), Antti-Jussi Lindroos (1), Veikko Kitunen (2), Juha Heikkinen (1), and Aino Smolander (1)

(1) Natural Resources Institute Finland, Helsinki, Finland (tiina.tormanen@luke.fi), (2) Natural Resources Institute Finland, Espoo, Finland

There is an increasing interest to utilize forest bioenergy, as it is thought to moderate climate change by replacing fossil fuels. However, the overall impacts of forest bioenergy utilization are not fully understood. With current harvesting practices, either whole-tree-harvest or stem-only-harvest, piles of logging residues are left on the forest floor. Both logging residue harvesting and uneven distribution of logging residues influence decomposition in forest soils and release of nutrients from organic matter.

The aim of this study was to understand how logging residues of Norway spruce (Picea abies), Scots pine (Pinus sylvestris) and silver birch (Betula pendula) affect main processes of N cycling in boreal forest soil after clear-cutting as well as N losses. A spruce-dominated stand was clear-cut in September 2014. Plots with fresh logging residue piles of different tree species, and control plots without logging residues, were subsequently established using random block design. Effects of logging residue piles on N and also C cycling were monitored; net N and C mineralization and net nitrification with incubation experiments, the amount of N and C in the microbial biomass with with fumigation-extraction, leaching as N concentrations in soil percolating water, and N2O emissions with closed chamber technic. Soil temperatures were detected simultaneously. Soil denitrification activity and the contribution of nitrification and denitrification to N2O production were determined in laboratory experiment, as well as nitrogenase activity in the logging residues.

Logging residue piles stimulated N and C cycling: net N and C mineralization and net nitrification were accelerated in humus layer. Some changes due to logging residues were also observed in mineral soil. Nitrate (NO_3-N) concentrations increased in soil percolation water. Dissolved organic matter in soil percolation water was dominated by small-molecular size fractions. In addition logging residues piles tended to stimulate N2O fluxes although in general the fluxes were low. Logging residues showed some nitrogenase activity. There were signs of differences between tree species.

To summarize, on clear-cut area under logging residue piles, soil N cycling processes can be accelerated, especially net nitrification. When N is transformed to more mobile form, the risk for N losses via leaching or nitrous oxide (N2O) emissions from the forest floor increase.

Currently we study the effects of large logging residue storage piles on N mobilization and losses.