Geophysical Research Abstracts
Vol. 16, EGU2014-2839, 2014
EGU General Assembly 2014


# Changes in nitrogen fluxes and stocks after clear-cutting and site preparation in a boreal forest

Sirpa Piirainen (1), Leena Finér (2), Marjo Palviainen (3), and Mike Starr (4)

(1) Finnish Forest Research Institute, Joensuu Unit, Finland (sirpa.piirainen@metla.fi), (2) Finnish Forest Research Institute, Joensuu Unit, Finland (leena.finer@metla.fi), (3) University of Helsinki, Faculty of Agriculture and Forestry, Finland (marjo.palviainen@helsinki.fi), (4) University of Helsinki, Faculty of Agriculture and Forestry, Finland (mrstarr@mappi.helsinki.fi)

In mature undisturbed and also often nitrogen (N) limited boreal forests, N cycling is closed, with little leaching losses to groundwater and surface waters and stocks in biomass and soil increase very slowly. However, upon harvesting the N cycle is dramatically altered; a large amount of N is removed from the site with timber and possibly also with branches and stumps, depending on whether stem-only or whole tree-harvesting is practised. If logging residues remain on-site, then this material can become incorporated in to the soil, along with the severed roots and understorey vegetation. We studied changes in the N stocks and fluxes after stem only clear-cutting followed by site preparation in a mature boreal forest in eastern Finland for 10 years. The Norway spruce (Picea abies (L.) H. Karst.) dominated forest was harvested in 1996, soil harrowing with a disc-plower carried out in 1998, and one-year-old pine seedlings planted in 1999. We measured atmospheric deposition and leaching of N, N mineralization from decomposing logging residues, and changes in soil (organic layer+ 20 cm mineral soil) and vegetation N stocks. After clear-cutting and soil harrowing the main findings were 1) deposition of N from the atmosphere to the soil became dominated by inorganic N as organic N leached from the canopy was eliminated , 2) leaching of organic and inorganic N compounds below the rooting zone increased, especially after soil harrowing, but annual leaching losses remained smaller than annual deposition inputs, 3) no net release of N from logging residues occurred during the first 3years, 4) the stock of organic N bounded in litter and woody debris increased 279% 5) recovery of ground vegetation was rapid and the associated N stock was already 70% of that in uncut forest 5 years after soil harrowing, and 6) soil N stock (organic layer+0-20 cm mineral soil) were 20% smaller 10 years after clear-cutting than that of uncut forest. We conclude that after harvesting and harrowing: 1) the development of new vegetation is the most important process restabilizing the N fluxes and preventing leaching losses, 2) N released from logging residues enable the rapid recovery of ground vegetation and 3) N released from logging residues is not incorporated to the soil stocks.