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INITIAL EFFECTS OF STUMP HARVESTING ON GREENHOUSE GAS FLUXES AND NITROGEN LEACHING

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Clear-cutting and subsequent stump harvesting and site preparation lead to substantial disturbances of the forest ecosystem, including the soil. Increased substrate availability for decomposers following harvest may result in higher carbon dioxide (CO_2) emissions from soils and in increased nitrogen (N) mineralization rates. This may be further enhanced by increased soil temperatures after stump harvest/site preparation. This has the potential to result in significant nitrous oxide (N_2O) emissions and N leaching to the ground water. In addition, removal of trees causes reduced evapotranspiration and subsequently, a raised ground water table. Boreal forest soils are normally sinks of atmospheric methane (CH_4) but changes in ground water level, soil temperature etc. might cause a reduced uptake or even turn the ecosystem into a CH_4 source. The net effects of stump harvest on greenhouse gas fluxes and N leaching were studied at a clear-cut in Norunda, central Sweden. The forest was clear-cut in early 2009 and stump harvested in May 2010. Micrometeorological measurements (i.e. gradient measurements and eddy covariance) during the period 20 May through 30 November 2010 allowed for quantification of CO_2, CH_4 and H_2O fluxes at two stump harvested plots and two control plots. Automatic chamber measurements (CO_2, CH_4) were carried out in the adjacent forest stand during the main growing season and at the clear-cut during October-November 2010. In addition, CO_2, CH_4 and N_2O fluxes were measured with a manual chamber from September through November 2010. Ground water was sampled from 16 ground water pipes and analyzed for $[NH_4^+]$, $[NO_2^-]$ and $[NO_3^-]$. Preliminary results indicate increased mean soil temperatures at disturbed microsites. The clear-cut became waterlogged after harvest and a comparison of preliminary flux-gradient and chamber results indicate a switch from a weak CH_4 sink to a significant source at all plots. Daily average CH_4 fluxes ranged between -6.4 – 204.2 µmol m^{-2} hr^{-1} with mean values of 10.7 – 42.0 µmol m^{-2} hr^{-1}. Daily average CO_2 fluxes were in the order of -0.4 – 9.7 µmol m^{-2} s^{-1}. There are no clear differences between stump harvested plots and control plots. All data (including 2011) will be further analyzed and presented at the conference.