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## WATERLOGGING AFTER CLEAR-CUTTING TURNS BOREAL FOREST SOILS INTO SOURCES OF METHANE

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Clear-cutting and subsequent site preparation is common forest management practice in Sweden. According to the Swedish National Forest Inventory [1], final fellings were carried out on 170.000 ha during 2009. The net effects of final fellings on greenhouse gas fluxes are not well understood.

Increased substrate availability for decomposers following harvest may result in higher carbon dioxide (CO<sub>2</sub>) emissions from soils and in increased nitrogen mineralization (e.g. [2]). This may be further enhanced by increased soil temperatures after site preparation. 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<sub>4</sub>) (e.g. [3]; [4]), with soil water content, nitrogen availability [5] and soil temperature (see review [6] and references therein) as main factors controlling CH<sub>4</sub> exchange between the biosphere and the atmosphere.

The net effects of clear-cutting on CH<sub>4</sub>, CO<sub>2</sub> and H<sub>2</sub>O fluxes were studied at Norunda forest in central Sweden. Micrometeorological measurements (i.e. flux-gradient and eddy covariance) allowed for quantification of CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O fluxes at two plots at a new clear-cut during the growing season of 2010. Soil chamber measurements (CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O) were carried out in the adjacent forest stand during the main growing season and at the clear-cut during October-November 2010.

The clear-cut became waterlogged after harvest and preliminary results indicate a switch from a weak CH<sub>4</sub> sink to a significant CH<sub>4</sub> source at both plots. Daily average fluxes during the period 20 May through 30 November were in the order of -6.3 – 142.5  $\mu$ mol m<sup>-2</sup>hr<sup>-1</sup> (fig.1) with mean values of 39.0  $\mu$ mol m<sup>-2</sup>hr<sup>-1</sup> (plot 1) and 16.3  $\mu$ mol m<sup>-2</sup>hr<sup>-1</sup> (plot 2). The preliminary results also indicate increased soil temperatures at disturbed microsites and enhanced CO<sub>2</sub> emissions. Data will be further analyzed and presented at the conference.

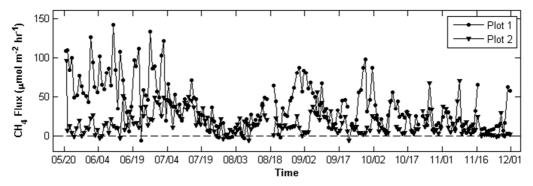


Fig 1. Daily average  $CH_4$  fluxes at plot 1 (circles) and plot 2 (triangles) measured with the flux-gradient technique at the Norunda clear-cut during the period 20 May through 30 Novemver 2010. Both plots are, on average, significant  $CH_4$  sources. The decreasing trend from mid-June through late July coincides with a period with low amounts of precipitation and decreasing soil water content.

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