UNIVERSITY OF GOTHENBURG

# Greenhouse gas fluxes between drained forested peatlands and the atmosphere

## – influence of nutrient status and wood ash fertilization

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2009

Akademisk avhandling för filosofie doktorsexamen i Naturvetenskap, med inriktning mot Miljövetenskap, som enligt Naturvetenskapliga fakultetens beslut kommer att offentligen försvaras fredagen den 15 maj 2009, kl 9.00 i föreläsningssalen, Institutionen för växt- och miljövetenskaper, Carl Skottsbergs gata 22b, Göteborg.

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Göteborg, februari 2009

# Abstract

The management of peatlands for wood production involves drainage and, sometimes, fertilization with, for example, wood ash. The effects of these measures on greenhouse gas fluxes, in relation to the nutrient status of the peat, were studied at three sites in southern Sweden. The carbon dioxide ($CO_2$) fluxes from a well drained nutrient rich peatland, with an agricultural history, were found to be high (71 000 kg $ha^{-1}$ $a^{-1}$), in comparison to earlier studies of similar sites. There was also a net uptake of $CH_4$ (-4.4 kg $ha^{-1}$ $a^{-1}$) and a net emission of $N_2O$ (2.7 kg $ha^{-1}$ $a^{-1}$). At two nutrient poor sites, one of which was well drained and one poorly drained, there were net $CH_4$ emissions (5.1 and 8.5 kg $ha^{-1}$ $a^{-1}$, respectively; averaged over three years) and no fluxes of $N_2O$. The $CO_2$ flux values measured at the nutrient poor sites (9 500 and 13 000 kg $ha^{-1}$ $a^{-1}$, respectively; averaged over three years) were considered to be underestimates, due to the measurement technique used. The $N_2O$ fluxes from all three sites where gas fluxes were measured agreed well with predictions made on the basis of the C:N ratio of the peat. At a nutrient poor site, ash fertilization did not result in any changes in greenhouse gas emissions over a period of five years after the treatment. However, signs of increased tree growth, and thereby increased $CO_2$ uptake, were detectable in the fifth year. At a nutrient rich site, which was studied over a period of two years after ash fertilization, $CO_2$ and $N_2O$ emissions from the treated plots decreased, but no changes in tree stand growth were detected. The decrease in $N_2O$ emissions was attributed to an increase in pH in the ash fertilized plots, which affected the $N_2O$ winter fluxes. The preliminary conclusion was that wood ash fertilization has a positive influence on the greenhouse gas balance of drained peatlands. Analyses of soil samples from three drained peatlands – two treated recently with wood ash and one that was treated 25 years earlier – supported this conclusion by showing no major changes in microbial processes, community structure or biomass, apart from decreases in net nitrogen mineralization and microbial biomass (as indicated by PLFA) at the nutrient poor sites. The studies upon which this thesis is based were mainly short-term; for definitive conclusions to be drawn, gas fluxes must be studied over the long-term.



### Keywords

Greenhouse gases, peatlands, wood ash, nutrient status

ISBN 978-91-85529-25-4