Dynamics of litterfall and decomposition in peatland forests

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Boreal and subarctic peatlands have been a significant sink of carbon (C) from the atmosphere. C accumulation has been a result of a relatively small disproportion of production and decay. High water levels and consequent anoxia are considered the major causes for the disproportion. As such, the C sink of a peatland is labile, and sensitive to variations in environmental conditions.

Changes in peatland ecosystem functions may be mediated through land-use change, and/or climatic warming. In both cases, drawdown of the water level is a key factor. Earlier research has given highly contrasting results on the changes induced by water-level drawdown: a peatland site may become a source of C into the atmosphere, remain a sink, or become a stronger sink. To some extent, the switches between these options may be linked to peatland type and climatic conditions. The mechanisms controlling this variation remain unresolved, however.

An extended lowering of the water level induces several changes in a peatland ecosystem. These changes are partly dependant on the (initial) peatland type and its nutrient regime. When the vegetation adapts to the new moisture conditions, litter quality may change drastically. In the soil, increased aeration is not the only change, but also lowered temperatures, increased acidity, and increased probability of drought may follow. With the changing substrate (litter) quality and environmental conditions, the soil microbial community is also like to change. All these factors have their effects on decay rates of organic matter.

We present results on the inputs and decay rates of different litter types in pristine and drained peatland forests. Further, we show how these sum up into C emissions, and compare those with measured CO_2 emissions. Finally, we present the early stages of a simulation system with which the impacts of vegetation composition on C emissions under different environmental conditions may be estimated. The ultimate goal of the work is to produce more refined predictions of C emissions from peatland forests with varying vegetation, and to estimate how changes in vegetation affect the sink/ source function of these ecosystems.