Northern Peatlands and their Feedback to Climate Change: A microcosm study to evaluate the effect of temperature increase and water-table drawdown on the emission of greenhouse gases from a Danish Raised Bog

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Abstract

Northern peatlands are crucial for the global budget of greenhouse gases (GHGs) e.g. carbon dioxide (CO_2) and methane (CH_4). These ecosystems have accumulated large amounts of atmospheric carbon (C) over the Holocene and acted as a sink of atmospheric CO_2 on a long term but as a source of CH_4 on short time horizons. As the processes of C cycle as well as the CH_4 source and CO_2 sink functions of northern peatlands are low temperature and high water level dependent, increased surface air temperatures and evapotranspiration due to climate change are assumed to alter their contributions to GHG emissions in near future. In order to understand the impact of increased temperatures and water level reductions on a northern bog's CH_4 and CO_2 emission levels, a laboratory experiment is conducted where 3 intact background peat samples and 16 semi-intact peat samples differentiated by high water (HW) and low water (LW) levels are incubated at 3 temperature levels: 4°C, 17°C and 25°C over a total period of 28 days. The underlying assumption is higher temperature will cause higher CH_4 and CO_2 fluxes but lower water table will cause lower CH_4 and higher CO_2 fluxes. At 4°C, CH_4 emissions are low in semi-intact cores and higher in the intact-cores. At 17°C, LW cores have produced more CH_4 and CO_2 emission than the HW cores. At 25°C, CH_4 and CO_2 fluxes have increased but the emission of LW cores are still higher than the HW cores. Compared to the expected range of emissions from northern raised bogs at high temperatures, the CH_4 and CO_2 fluxes obtained have been low, though no significant trend of change in the CH_4 and CO_2 emissions with increased temperatures and reduced water levels can be derived due to the limited number of samples and length of measurement time.

Keywords—*Raised bog, Climate change, Organic Carbon, Gas Chromatography*

Professional Biography (100-150 words)

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