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Effects of greenhouse warming and N-fertilization on carbon accumulation rates in a nutrient-poor boreal mire: decadal effects assessed using 210Pb

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Boreal peatlands represent a major long-term reservoir of atmospheric carbon (C) and play an important role in the global C cycle. How C accumulation in these peatlands responds to changing temperature and nutrient conditions is under debate. In this study, we assessed how peat and C accumulation rates have responded to increased annual nitrogen additions (30 kg ha-1 yr-1) and increased air temperatures (+3.6ºC) in the longest ongoing boreal mire manipulation experiment. Accumulation rates for the uppermost 40 cm of peat in nitrogen and temperature treated plots (n=11) were assessed by 210Pb dating covering the last ∼100yrs. A reference surface, installed in 1995 was used as independent validation of the dating model. An empirically based model of organic matter accumulation/degradation was applied to evaluate changes in both peat inputs and organic matter decay rates in response to the treatments. A significant increase in C-accumulation (15 g C m-2 yr-1) was observed in peat subjected to nitrogen additions, while greenhouse warming did not seem to significantly affect C-accumulation or decay rates. Based on our findings we argue that C-accumulation in nutrient poor boreal mires is mainly altered in near-surface peat layers (∼15 cm) in response to nitrogen additions and that the uppermost peat layers (<40 cm) in nutrient poor boreal peatlands will continue to function as net C-sinks during the first decades of global warming.