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Effects of long-term experimental nitrogen and sulfur additions and greenhouse enclosures on microbial C mineralization in a boreal peatland

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Boreal peatlands are important long-term sinks of atmospheric carbon (C; Frolking & Roulet 2007). Peatlands in general have relatively low rates of C fixation, but even lower rates of C mineralization. Microbial mineralization of organic C is thus one important control on the net C accumulation of peatlands. Climate change as well as anthropogenically derived pollutants such as deposition of nitrogen (N) and sulfur (S) may have significant effects on microbial activity in peat, directly through increased temperature and changed nutrient status , but also indirectly through changes in plant community composition, litter chemistry and water table levels (Limpens et al. 2008). We used a long-term, factorially designed, field manipulation experiment in a boreal peatland in northern Sweden to evaluate the effects of 12 years of N and S additions (30 and 20 kg ha-1 yr-1, respectively) and greenhouse enclosures on microbial C mineralization . In laboratory incubations, microbial CO_2 evolution in peat was measured using an automated respirometer (Respicond V). The high resolution of the measurements combined with additions of glucose, N and phosphorous (P) to the incubations made it possible to evaluate treatment effects on both catabolic components (basal respiration (BR) and substrate induced respiration (SIR)) and anabolic components ((lag time (h), exponential growth (μ) and maximum respiration rate (Rmax)) of the microbial metabolism. We found significant stimulations in BR from the long-term N additions, but no effect on SIR, suggesting that N additions have improved the quality of organic matter rather than changed the microbial population. This is in line with previously found changes in the vegetation composition of the same experiment, where the plant community has shifted from being Sphagnum dominated to being dominated by more easily decomposable sedges and dwarf shrubs (Wiedermann et al. 2007). Both the long-term N additions and greenhouse enclosures significantly improved μ, thus stimulated the potential growth of the microbial populations after N and P additions to the incubations. This study also showed that the long-term N additions have lead to P limitation among the microbial population. We found no significant effects of the long-term S additions. In conclusion, long-term nitrogen deposition has stimulated microbial C mineralization, most likely as an effect of changed organic matter quality. However, to be able to draw conclusions on C accumulation of peatlands, also changes in the NPP and C runoff needs to be considered.

References

Frolking S. & Roulet N.T. (2007). Holocene radiative forcing impact of northern peatland carbon accumulation and methane emissions. Global Change Biology, 13, 1079-1088.

Limpens J., Berendse F., Blodau C., Canadell J.G., Freeman C., Holden J., Roulet N., Rydin H. & Schaepman-Strub G. (2008). Peatlands and the carbon cycle: from local processes to global implications - a synthesis. Biogeosciences, 5, 1475-1491.

Wiedermann M.M., Nordin A., Gunnarsson U., Nilsson M.B. & Ericson L. (2007). Global change shifts vegetation and plant-parasite interactions in a boreal mire. Ecology, 88, 454-464.