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In Situ Denitrification and Biological Nitrogen Fixation Under Enhanced Atmospheric Reactive Nitrogen Deposition in UK Peatlands

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Dinitrogen (N_2) and nitrous oxide (N_2O) losses due to denitrification and biological N_2 fixation (BNF) are the most uncertain components of the nitrogen (N) cycle in peatlands under enhanced atmospheric reactive nitrogen (Nr) deposition. This uncertainty hampers our ability to assess the contribution of denitrification to the removal of biologically fixed and/or atmospherically deposited Nr in peatlands. This uncertainty emanates from the difficulty in measuring *in situ* soil N_2 and N_2O production and consumption in peatlands. *In situ* denitrification and its contribution to total N_2O flux was measured monthly between April 2013 and October 2014 in peatlands in two UK catchments. An adapted ^{15}N-Gas Flux method[1] with low level addition of ^{15}N tracer (0.03 ± 0.005 kg ^{15}N ha^{-1}) was used to measure denitrification and its contribution to net N_2O production (DN_2O/TN_2O). BNF was measured *in situ* through incubation of selected sphagnum species under $^{15}N_2$ gas tracer. Denitrification[2] varied temporally and averaged 8 kg N-N_2 ha^{-1} y^{-1}. The contribution of denitrification was about 48% to total N_2O flux[3] of 0.05 kg N ha^{-1} y^{-1}. Soil moisture, temperature, ecosystem respiration, pH and mineral N content mainly regulated the flux of N_2 and N_2O. Preliminary results showed suppression of BNF, which was 1.8 to 7 times lower in peatland mosses exposed to $\sim$15 to 20 kg N ha^{-1} y^{-1} Nr deposition in the UK than in peatland mosses in northern Sweden with background Nr deposition. Overall, the contribution of denitrification to Nr removal in the selected peatlands was $\sim$50% of the annual Nr deposition rates, making these ecosystems vulnerable to chronic N saturation. These results point to a need for a more comprehensive annual BNF measurement to more accurately account for total Nr input into peatlands and its atmospheric loss due to denitrification.

References

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