Geophysical Research Abstracts
Vol. 19, EGU2017-3179-1, 2017
EGU General Assembly 2017

Impact of simulated atmospheric nitrogen deposition on nutrient cycling and carbon sink via mycorrhizal fungi in two nutrient-poor peatlands

Tuula Larmola (1), Heikki Kiheri (1), Jill L. Bubier (2), Netty van Dijk (3), Nancy Dise (3), Hannu Fritze (1), Erik A. Hobbie (4), Sari Juutinen (5), Raija Laiho (1), Tim R. Moore (6), and Taina Pennanen (1)

(1) Natural Resources Institute Finland, Helsinki, Finland (tuula.larmola@gmail.com), (2) Environmental Studies Department, Mount Holyoke College, United States, (3) Centre for Ecology and Hydrology, Penicuik, Edinburgh, United Kingdom, (4) Earth Systems Research Center, University of New Hampshire, United States, (5) Department of Environmental Sciences, University of Helsinki, Finland, (6) Department of Geography, McGill University, Canada

Peatlands store one third of the global soil carbon (C) pool. Long-term fertilization experiments in nutrient-poor peatlands showed that simulated atmospheric nitrogen (N) deposition does not enhance ecosystem C uptake but reduces C sink potential. Recent studies have shown that a significant proportion of C input to soil in low-fertility forests entered the soil through mycorrhizal fungi, rather than as plant litter. Is atmospheric N deposition diminishing peatland C sink potential due to the suppression of ericoid mycorrhizal fungi? We studied how nutrient addition influences plant biomass allocation and the extent to which plants rely on mycorrhizal N uptake at two of the longest-running nutrient addition experiments on peatlands, Whim Bog, United Kingdom, and Mer Bleue Bog, Canada. We determined the peak growing season aboveground biomass production and coverage of vascular plants using the point intercept method. We also analyzed isotopic δ^{15}N patterns and nutrient contents in leaves of dominant ericoid mycorrhizal shrubs as well as the non-mycorrhizal sedge Eriophorum vaginatum under different nutrient addition treatments. The treatments receive an additional load of 1.6-6.4 N g m^{-2} y^{-1} either as ammonium (NH_4) nitrate (NO_3) or NH_4NO_3 and with or without phosphorus (P) and potassium (K), alongside unfertilized controls. After 11-16 years of nutrient addition, the vegetation structure had changed remarkably. Ten of the eleven nutrient addition treatments showed an increase of up to 60% in total vascular plant abundance. Only three (NH_4Cl, NH_4ClPK, $NaNO_3PK$) of the nutrient addition treatments showed a concurrent decrease of down to 50% in the relative proportion of ericoid mycorrhizal shrubs to total vascular plant abundance. The response to nutrient load may be explained by the water table depth, the form of N added and whether N was added with PK. Shrubs were strong competitors at the dry Mer Bleue bog while sedges gained in abundance at the wetter Whim bog. Our results also suggest that the impacts of reduced and oxidized N on above ground biomass of ericoid shrubs differ and that plants have become increasingly P limited under high simulated atmospheric N deposition. Combined with mycorrhizal abundance and foliar isotopic δ^{15}N patterns, the data will allow us to estimate the extent to which plants rely on mycorrhizal N uptake and whether mycorrhizal responses are linked to diminished C sink potential. This evidence is needed to establish critical loads for C sink potential in peatlands.