Geophysical Research Abstracts
Vol. 21, EGU2019-1058, 2019
EGU General Assembly 2019

What controls moss-associated nitrogen fixation in the Arctic?

Kathrin Rousk
Copenhagen, Biology, Copenhagen, Denmark (kathrin.rousk@bio.ku.dk)

Nitrogen (N2) fixation performed by moss-associated cyanobacteria is one of the main sources of new N in pristine, high latitude ecosystems like boreal forests and arctic tundra. Here, mosses and associated cyanobacteria can contribute more than 50% to total ecosystem N input. However, N2 fixation in mosses is strongly influenced by abiotic factors such as moisture and temperature, as well as nutrient availability, in particular phosphorus (P) and molybdenum (Mo). I will present results from a range of field and laboratory assessments of moss-associated N2 fixation in response to climate change by manipulating moisture and temperature, as well as from a long-term field addition of Mo and P, all in subarctic and arctic systems.

While temperature lead to increased N2 fixation in mosses, the effect was strongly dependent on moss-moisture. Hence, these two major climate change factors should be considered in unison when estimating climate change effects on key ecosystem processes such as N2 fixation. The temperature optimum of N2 fixation in mosses was 25 °C, even though the samples were collected in the Subarctic with a low mean annual temperature (∼0.5 °C). Thus, increased temperatures in a future climate will likely lead to an increased N input via the moss-N2-fixation pathway if mosses are not outcompeted by shrubs expanding into these ecosystems, and if moss-moisture does not fall below a certain threshold.

In regard to the nutrient additions (Mo, P), moss-associated N2 fixation was promoted by Mo additions in the short-term (1 day), but this effect disappeared over time, and P became more important in a longer time frame (several weeks), and towards the end of the growing season, indicating a shift in P availability through the growing season. Hence, increased shrub cover in a future climate due to warming will also lead to shifts in nutrient input and availability, and will thereby ultimately exert strong controls over moss-associated N2 fixation.