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Climate change effects on moss abundance and associated nitrogen (N) fixing cyanobacteria in pristine ecosystems

Aya Permin and Kathrin Rousk
University of Copenhagen, Biology, Denmark (aya.permin@bio.ku.dk)

In many northern ecosystems, such as boreal forests and arctic tundra, mosses account for an important component of the vegetation community, with impact on several ecosystems processes, including nutrient mineralization. Furthermore, many mosses host nitrogen (N)-fixing bacteria that have been shown to contribute for a large part of the N input in these pristine northern ecosystems. Nitrogen fixation activity in mosses is highly controlled by temperature and moisture – factors that are predicted to be affected by climate change, and thus, N fixation activity will likely be altered in a future climate. Yet, only few studies have investigated this. We examined the effects of several climate change factors, including manipulated warming and change in plant community structure, on moss abundance and moss associated N fixation in a birch forest, N Sweden. In particularly, we linked the abundance of moss cover with N fixation activity. Moreover, we investigated the temperature sensitivity of N fixation in two common feathermosses, Hylocomium splendens (Hedw.) Schimp. and Pleurozium schreberi (Brid.) Mitt. Our results show a clear relationship between moss cover and N fixation activity, highlighting the importance of mosses as ecosystem N sources. Furthermore, we found changes in the vegetation composition, including a dramatic decline in total moss cover in response to 10 years of manipulated warming. Interestingly, our results show that the moss H. splendens is more sensitive than P. schreberi to increased warming in terms of both cover and N fixation activity. Our study suggests that climate warming will affect the vegetation composition in northern ecosystems, with a strong decline in moss cover, that will lead to lower N input to these ecosystems and consequently affect the nutrient turnover and ecosystem productivity and ultimately, the ecosystem carbon budget.