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# The role of lichen on peatland development in the Hudson Bay Lowlands, Canada

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Lichen (Cladina stellaris) can be a dominant vegetation cover on bogs within the extensive peatland landscape of the Hudson Bay Lowlands (HBL), northern Ontario, Canada. The unique characteristics of lichens (growth structure and function as a symbiotic organism), their ability to form thick, dense mats across the HBL bogs, and their increased tolerance of extreme environmental conditions, points to their importance as a distinct plant functional type. However, the role of lichen within the peatland ecosystem is poorly understood, particularly ecosystem interactions (vegetation associations) and peatland development (including microtopography) and the resulting carbon sink. Many studies consider the role of different plant functional types on peatland $CO_2$ and CH4 exchange (e.g. Bubier et al., 2003; Strack et al., 2006), and this understanding is included in peatland growth and climate change models. As far as we are aware lichens are currently omitted from these models.
We suggest that lichens represent a distinct plant functional type with $CO_2$ exchange characteristics (NEE and respiration) that are quite different to vascular plants and mosses. In this study we measured lichen $CO_2$ exchange in both natural and modified moisture conditions at field sites in the HBL over two field seasons. Our results indicate that lichen productivity is strongly influenced by abiotic factors that affect lichen moisture content, with very dry lichen exhibiting little or no photosynthetic capacity. We suggest that the low productivity of lichen mats results in lower rates of peat accumulation compared to Sphagnum-dominated peatland areas, and that this has consequences for the development of peatland microtopography (hummocks and hollows) and feedback mechanisms. To better understand the role of lichen mats on peat accumulation and to test possible feedback mechanisms we developed a model, the parameters of which are supported by data from field sites in the HBL.
This dependence of lichen productivity on environmental conditions not only impacts peatland development but is also likely to have consequences for peatland growth and climate change models. If warmer, drier summers become more common (with prolonged periods of drought) as is currently predicted by climate change models then this will change the frequency and length of time that lichen mats are at the optimal conditions for photosynthesis. This not only affects lichen establishment and growth, but also peatland carbon dynamics with possible feedbacks to global climate.