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Sphagnum mosses as methane traps in two northern mires

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Sphagnum cuspidatum Hoffm. was recently shown to have methane (CH4) oxidation capacity due to inhabiting methanotrophic bacteria (Raghoebarsing et al. 2005). This is an significant finding as peatlands are a major natural source of CH4, an important greenhouse gas to the atmosphere. Emissions from Sphagnum-dominated mires are generally lower than those from Carex-dominated ones. One reason for this may be the CH4 oxidation associated with these mosses. According to this postulate the carbon released in decomposition would be efficiently refixed in moss photosynthesis and the moss layer would mitigate the release of CH4 and carbon dioxide to the atmosphere. To study the importance of Sphagnum as a habitat for CH4 oxidizers, we addressed the following questions.1. Is the variation in CH4 oxidation in Sphagnum mainly regulated by the abiotic environment or by the hosting moss species? 2. What is the contribution of CH4 oxidation in Sphagnum to net CH4 flux from an entire mire to the atmosphere?
The study was carried out at Siikaneva fen in Finland and at Sallie's Fen in New Hampshire, USA. These sites have several Sphagnum species in common but provide contrasting CH4 flux environments, as the flux is twofold at the latter site. To answer question 1, we collected the dominant coexisting Sphagnum species from hummock, lawn and flark habitats and determined the potential in mosses to oxidize CH4 using flask incubations and gas chromatography. To answer question 2, we removed Sphagnum from selected plots, measured CH4 flux using chamber technique and used stable carbon isotopes to determine associated processes.
Water level was the key environmental control of methanotrophy in Sphagnum. Both sites showed similar response to water level, which was more important than species differences: the potential rate to oxidize CH4 in the top 10 cm of the moss layer was 0.01 to 0.5 mmol m-2 h-1 in different habitats along the moisture gradient, which is up to 95 % the net CH4 flux to the atmosphere from the same sites. Moss removal could increase the actual net flux of CH4 by up to 50%. Our results suggest that CH4 oxidation in the Sphagnum layer is potentially an important control for CH4 release from a mire ecosystem.

Reference. Raghoebarsing, A.A., A.J.P. Smolders, M.C. Schmid, I.C. Rijpstra, M. Wolters-Arts, J. Derksen, M.S.M. Jetten, S. Schouten, J.S. Sinninghe Damsté, L.P.M. Lamers, J.G.M. Roelofs, H.J.M. Opden Camp and M. Strous 2005. Methanotrophic symbionts provide carbon for photosynthesis in peat bogs. Nature 436: 1153^{-1}156.

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