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Methanotrophs Contribute to Peatland Nitrogen

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Atmospheric nitrogen (N2) fixation is potentially an important N input mechanism to peatland ecosystems, but the extent of this process may have been underestimated because of the methods traditionally used inhibit the activity of methanothrophs. We examined the linkage of methane (CH4) oxidation and N2 fixation using 15N2 technique. Dominant flark and hummock Sphagnum species were collected from twelve pristine peatlands in Siikajoki, Finland, which varied in age from 200 to 2,500 y due to the postglacial rebound. The mosses were incubated in a two-day field 15N2 and 13CH4 pulse labelling experiment and the incorporation of 15N2 and 13CH4 in biomass was measured with Isotope Ratio Mass Spectrometer. The rates of Sphagnum-associated N2 fixation (0.1-2.9 g N m-2 y-1) were up to 10 times the current N deposition rates. Methane-induced N2 fixation contributed to over 1/3 of moss-associated N2 fixation in younger stages, but was switched off in old successional stages, despite active CH4 oxidation in these stages. Both the N2 fixation rates and the methanotrophic contribution to N2 fixation during peatland succession were primarily constrained by phosphorus availability. Previously overlooked methanotrophic N contribution may explain rapid peat and N accumulation during fen stages of peatland development.

Reference. Larmola T., Leppänen S.M., Tuittila E.-S, Aarva M., Merilä P., Fritze H., Tiirola M. (2014) Methanotrophy induces nitrogen fixation during peatland development. Proceedings of the National Academy of Sciences USA 111 (2): 734-739.