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# Rhizosphere activity and methane oxidation in a temperate forest soil

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Methane ($CH_4$) concentrations in the Earth's atmosphere have increased dramatically over recent decades. An abundance of studies indicate that the magnitude of natural methane efflux from wetlands is likely to increase due to climate change. However, the role of vegetation and soils in upland methane oxidation are less well understood. Well-aerated soils are known to be sites of methane oxidation, and amongst a range of abiotic environmental parameters, soil moisture has been identified as critical regulator of the methane oxidation rates. However, the role of microbial activity within the soil, particularly C turnover in the plant rhizosphere, has not been investigated as a means for regulating methanotrophy.

We combined a continuous soil $CO_2$ efflux system (Li-Cor Biosciences, LI-8100) with a Cavity-Ringdown-Spectroscopy Fast Greenhouse Gas Analyser (Los Gatos Research Inc.) to measure soil $CH_4$ oxidation in a pine forest in NE England. The soil has a shallow organic layer overlaying a well-draining sandy gley soil. Fluxes were measured from three different collar treatments: (1) excluding both root and ectomycorrhizal (EM) hyphae by trenching using deep collars, (2) excluding roots but allowing access by EM hyphae, and (3) unmodified forest soil (i.e. including both roots and EM hyphae). All collars were protected from natural throughfall, and received weekly–averaged amounts of throughfall based on collections in the stand.

Data from two months in early summer 2009 indicate that $CH_4$ oxidation in collars with an intact rhizosphere is more than twice that of either of the exclusion treatments (averaging approx. 90 g $ha^{-1}$ $d^{-1}$ in that period). We observed higher fluxes when soils were dryer (i.e. with increasing time since watering), indicating a significant influence of moisture. Despite the confounding effects of soil moisture associated with root water uptake in the unmodified soil collars, we argue that rhizosphere activity is an overlooked component in methanotrophy in aerated soils. C supply from plants by both roots and EM hyphae appears to be linked to the rate at which methanotrophs oxidise methane with potential feedbacks on methane oxidation rates following altered plant productivity driven by climatic change.