

Short-term response of in situ C fluxes in treeline ecosystems to experimental warming

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The effects of climate change on soil carbon stocks are controversial. If carbon stored belowground is transferred to the atmosphere by a warming-induced acceleration of its decomposition, a positive feedback to climate change would occur. Conversely, if increases of plant-derived carbon inputs to soils exceed increases in decomposition, the feedback would be negative. Despite much research, a consensus has not yet emerged on the temperature sensitivity of soil carbon decomposition.

Classically, the temperature responsiveness has been determined by sampling soils and incubating them at different temperatures in the lab. The response is, however, time-dependent. Alternatively, temperature dependency was estimated by monitoring C fluxes over different seasons. In this case, other parameters such as litter and/or rainfall may limit a simple interpretation of data. Our approach was to warm soils in situ by stepwise increasing the soil temperatures up to 8K and to measure the response of soil's CO₂ effluxes and DOC leaching. In treeline ecotones, we have laid out heating cables on the ground of 20 plots, which allowed a controlled warming of soils, but also of the air of dominating dwarf-shrub communities. Soil moisture as a potential co-driver was kept constant by adding water on a daily basis. Half of the plots received ¹³C labelled CO₂, which enabled us to quantify the contribution of roots to soil respiration. First results indicated that DOC leaching and soil respiration responded differently to the warming with the CO₂ effluxes showing the greater temperature responsiveness.