Methane exchange in forests

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Methane (CH₄) is the second most important anthropogenic greenhouse gas (GHG) after carbon dioxide (CO₂), globally responsible for more than 20% of the additional radiative forcing since 1750. Well-drained forest soils are considered as one of the most important biological CH₄ sinks. Net CH₄ exchange in forest soils depends on the balance of two contrasting microbial processes, i.e. CH₄ production and CH₄ oxidation, which are controlled by the population and activity of methanogens and methanotrophs, respectively. Additionally, recent reports have shown that living stems and shoots of trees in forests may produce and emit substantial quantities of CH₄, which can offset CH₄ consumption by soils; potentially switching the forest from a net CH₄ sink to a net source.

Tree-emitted CH₄ in forests may result from biological production in soils which is subsequently absorbed by roots and then transported in stems and emitted from stems and leaves. However, there is also evidence that CH₄ emissions from living tree stems may be biologically produced in situ within tree stems themselves. Long-term and high-frequency measurements of stem CH₄ flux in various individuals, tree species and forest ecosystems are needed to unravel the potential underlying mechanisms and pathways of stem CH₄ exchange.

This research compares CH₄ exchange from tree stem fluxes and soil in forest stands of English oak (Quercus robur) and Japanese larch (Larix kaempferi) and tries to understand the underlying mechanism of stem CH₄ exchange in temperate forests. High-frequency measurements of tree stem CH₄ exchange across various individuals were carried out in 2020 and the results will be presented from this study to help inform forest management and how to promote this globally important forest CH₄ sink under climate change.