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Trees are important conduits for emission of methane from temperate and tropical wetlands

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Methane produced in wetland soil generally is thought to be emitted to the atmosphere primarily via diffusion through pore water, release of gas bubbles (i.e., ebullition), and gas phase diffusion through the aerenchyma of herbaceous plants. The role of trees as a conduit for methane export from soil to the atmosphere has received limited attention despite evidence from mesocosm experiments showing that seedlings and saplings of wetland trees have a significant capacity to transport soil-produced gases. Notably ~60% of global wetlands are forested.

We present *in situ* measurements of methane flux from a temperate carr (swamp) composed of alder (*Alnus glutinosa*) and birch (*Betula pubescens*) situated in the United Kingdom and a tropical forested peat swamp located in Borneo. The *in situ* data are complemented by a mesocosm experiment in which methane emissions were measured from alder saplings subjected to two water-regime treatments. In both the *in situ* and mesocosm studies, emissions from trees are compared to methane flux from the ground surface, the latter occurring via pore water diffusion, ebullition or the aerenchyma of herbaceous plants. We show that tree stem emissions are controlled by a number of factors including tree species, soil pore-water concentration and stem lenticel density. Our results demonstrate that the omission of tree-mediated methane fluxes from measurement campaigns conducted in forested wetland can significantly underestimate total ecosystem flux of methane.