



# METHANE (CH<sub>4</sub>) EMISSIONS FROM TREES IN BOREAL UPLAND AND DRAINED PEATLAND FORESTS

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## BACKGROUND

Upland forest ecosystems are considered as a sink of atmospheric methane (CH<sub>4</sub>). Recent evidence shows that trees may emit CH<sub>4</sub> from their stems and canopies, however, the mechanisms are still poorly understood.

## MOTIVATION

We have found that boreal Scots pine (*Pinus sylvestris*) shoots and stems emit small amounts of CH<sub>4</sub>, and that the stem CH<sub>4</sub> emissions increase with soil water content.

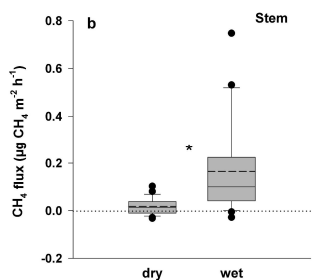


Figure 1. Stem and forest floor fluxes of CH<sub>4</sub> from dry and wet plots of boreal forest dominated by Scots pine (*Pinus sylvestris*). From Machacova et al., 2016, Sci. Rep.

## RESEARCH QUESTIONS

- 1) Do all tree species emit CH<sub>4</sub>?
- 2) What are the drivers of tree CH<sub>4</sub> fluxes?
- 3) What are the mechanisms behind the CH<sub>4</sub> fluxes?
- 4) What is the role of microbes (bacteria, fungi, archaea) in tree-CH<sub>4</sub> fluxes?
- 5) Are the tree CH<sub>4</sub> emissions significant at the ecosystem and regional scale?

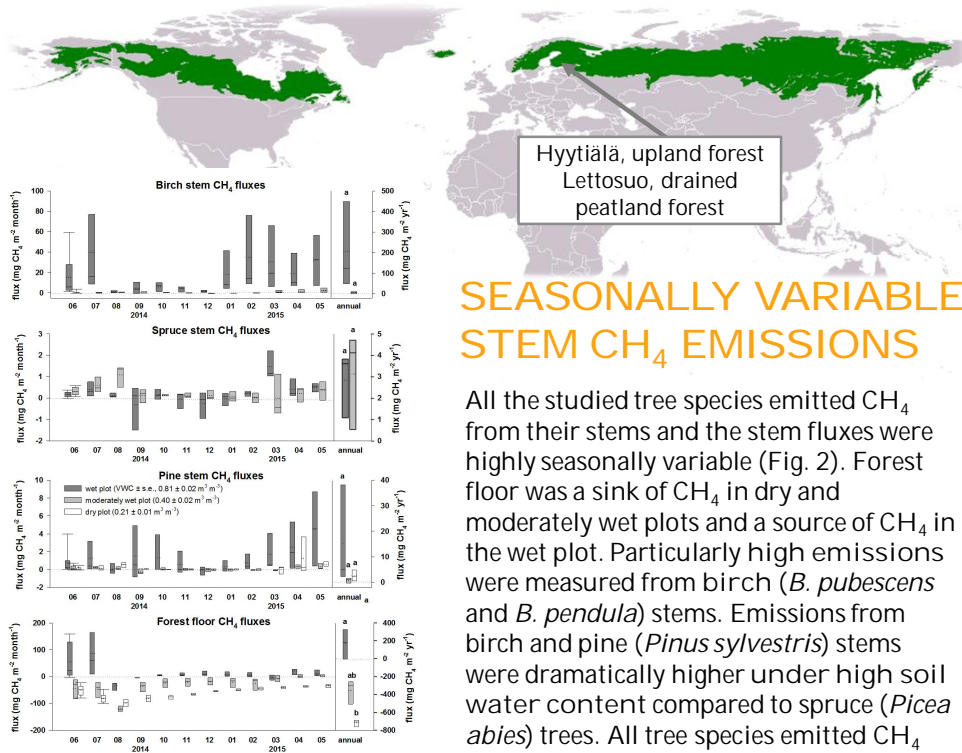


Figure 2. Stem and forest floor fluxes of CH<sub>4</sub> from wet, moderately wet and dry plots of boreal forest at Hyytiälä, Finland.

## SEASONALLY VARIABLE STEM CH<sub>4</sub> EMISSIONS

All the studied tree species emitted CH<sub>4</sub> from their stems and the stem fluxes were highly seasonally variable (Fig. 2). Forest floor was a sink of CH<sub>4</sub> in dry and moderately wet plots and a source of CH<sub>4</sub> in the wet plot. Particularly high emissions were measured from birch (*B. pubescens* and *B. pendula*) stems. Emissions from birch and pine (*Pinus sylvestris*) stems were dramatically higher under high soil water content compared to spruce (*Picea abies*) trees. All tree species emitted CH<sub>4</sub> during winter months indicating that the CH<sub>4</sub> emissions are not connected to physiological activity of the trees.

## MEASUREMENTS

Leaf level, stem and forest floor chamber measurements.

Laboratory experiments to partition fluxes between aboveground (shoots) and belowground (roots and soil) parts and to test drivers of the CH<sub>4</sub> fluxes.

Microbial community analysis in the trees and soil: methanogens and methanotrophs (qPCR).

Tree wood anatomy.

Environmental drivers (e.g. radiation, temperature, photosynthesis, sapflow, transpiration, soil water content, soil temperature, soil and tree [CH<sub>4</sub>]).

