

# BOREAL UPLAND AND DRAINED PEATLAND FORESTS

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## BACKGROUND

Upland forest ecosystems are considered as a sink of atmospheric methane ( $\text{CH}_4$ ). Recent evidence shows that trees may emit  $\text{CH}_4$  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  $\text{CH}_4$ , and that the stem  $\text{CH}_4$  emissions increase with soil water content.

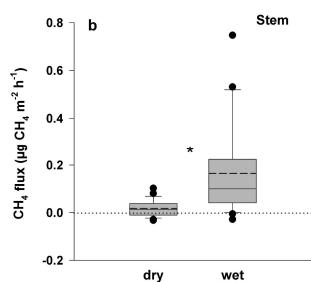


Figure 1. Stem and forest floor fluxes of  $\text{CH}_4$  from dry and wet plots of boreal forest dominated by Scots pine (*Pinus sylvestris*). From Machacova et al., 2016, Sci. Rep.

## RESEARCH QUESTIONS

- 1) Do all tree species emit  $\text{CH}_4$ ?
- 2) What are the drivers of tree  $\text{CH}_4$  fluxes?
- 3) What are the mechanisms behind the  $\text{CH}_4$  fluxes?
- 4) What is the role of microbes (bacteria, fungi, archaea) in tree- $\text{CH}_4$  fluxes?
- 5) Are the tree  $\text{CH}_4$  emissions significant at the ecosystem and regional scale?

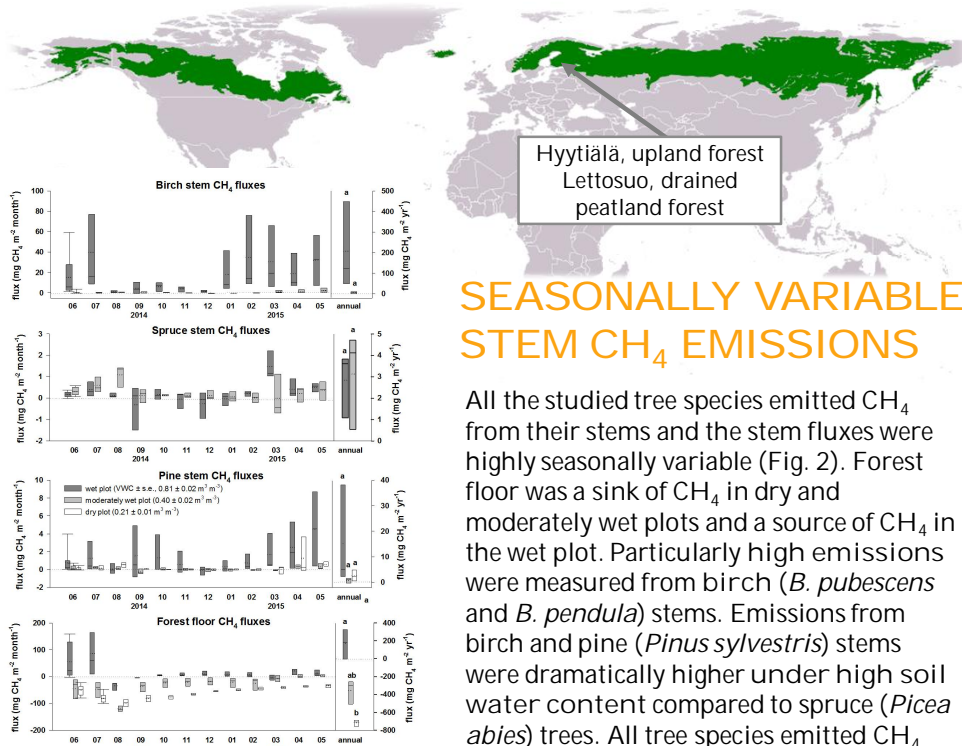


Figure 2. Stem and forest floor fluxes of  $\text{CH}_4$  from wet, moderately wet and dry plots of boreal forest at Hyytiälä, Finland.

## SEASONALLY VARIABLE STEM $\text{CH}_4$ EMISSIONS

All the studied tree species emitted  $\text{CH}_4$  from their stems and the stem fluxes were highly seasonally variable (Fig. 2). Forest floor was a sink of  $\text{CH}_4$  in dry and moderately wet plots and a source of  $\text{CH}_4$  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  $\text{CH}_4$  during winter months indicating that the  $\text{CH}_4$  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  $\text{CH}_4$  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 [ $\text{CH}_4$ ]).

