TREE CH_4 DYNAMICS IN FORESTRY DRAINED PEATLAND IN SOUTHERN FINLAND

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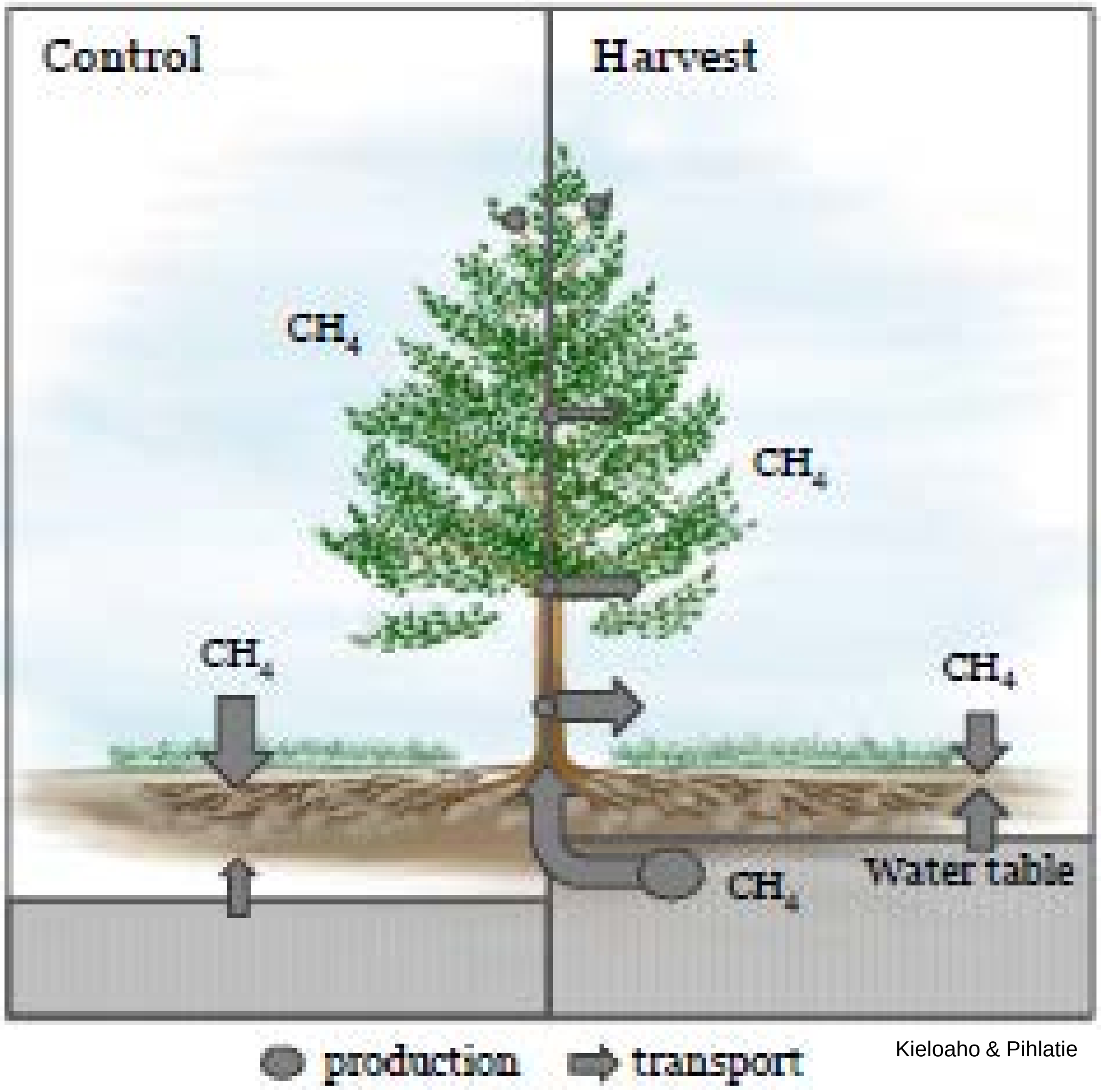
INTRODUCTION

- Trees are capable of emitting CH_4 from their stems and shoots/leaves (e.g. Keppler *et al.* 2006, Machacova *et al.* 2016, Pangala *et al.* 2014)
  - Trees of the boreal forests are among the less studied species in this topic
  - Uncertainties in differences between species and in mechanism behind the emissions
- Tree emitted CH_4 is produced…
  - in anaerobic soil conditions -> CH_4 transport into tree vie transpiration stream and/or by diffusion in aerenchymatic/internal cell space structures
  - within the trees
    - – Rotten wood (”wet wood”) within tree stem (Zeikus & Ward 1974, Lenhart *et al.* 2012)
    - – In leaves under abiotic stress, e.g. UV-radiation (Keppler *et al*. 2006)

METHODS

- Flux measurements from tree stems peatland forest of Lettosuo (seasons 2016 & 2017)
  - Forestry drained peatland in Tammela, Southern Finland
  - Two plots:
    - – Control plot
    - – Treatment plot, where 75% of tree biomass was removed (all pine trees)
      - – > Raise water table level (WTL)
      - – > Change of light conditions in the field layer



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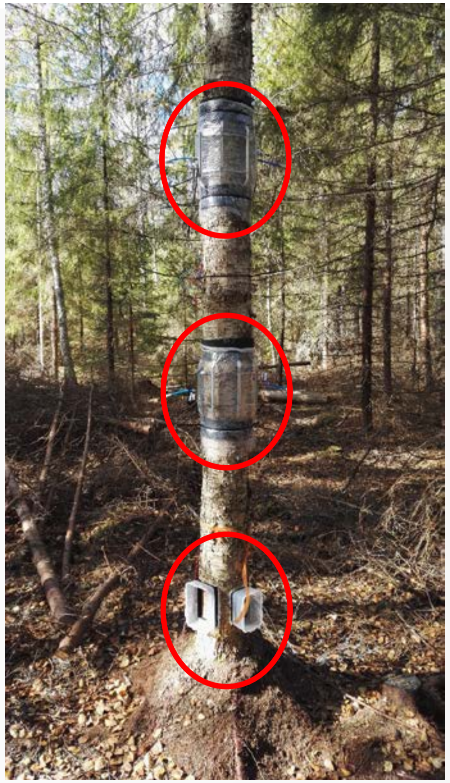
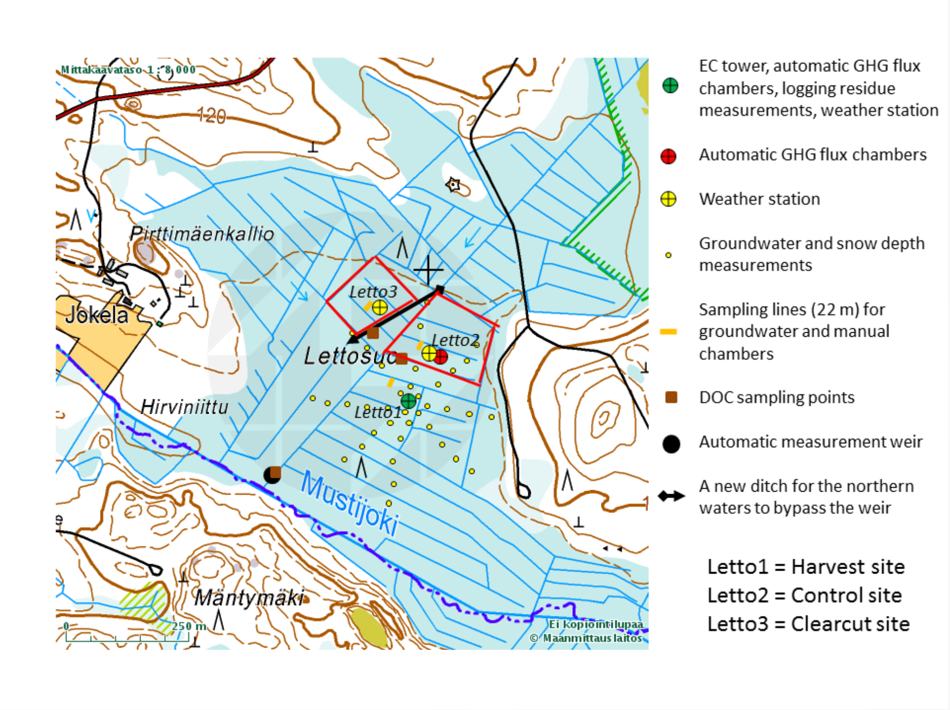
METHODS

- Closed chamber technique
- 25 sample trees (5 trees/ species/ plot)
  - Downy birch (*Betula pubescens*), Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*)
- Three birches were selected for flux measurements in the height profile of the trees
- Soil CH_4 flux measurements with automated chambers



METHODS

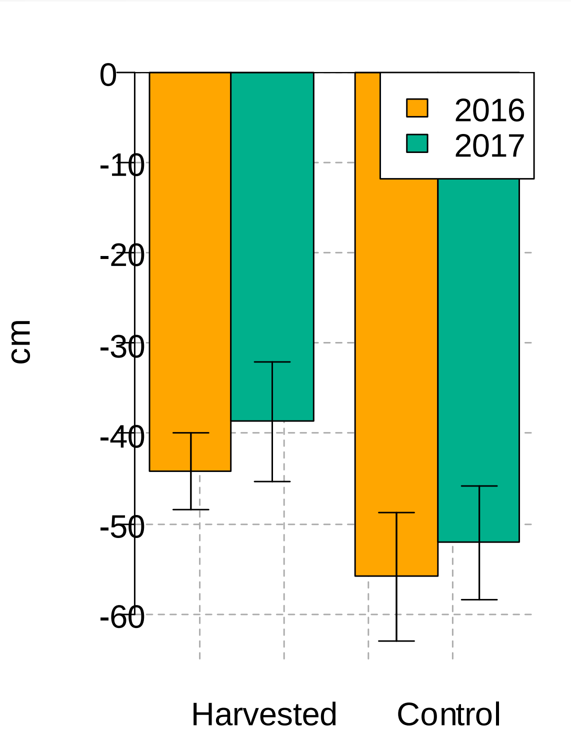
- Measurements among the peat profile:
  - Methane concentration samplings
  - Quantification of methanogenic (and methanotrophic) functional genes
  - Potential production and consumption of CH_4
- Tree CH_4 concentration samplings



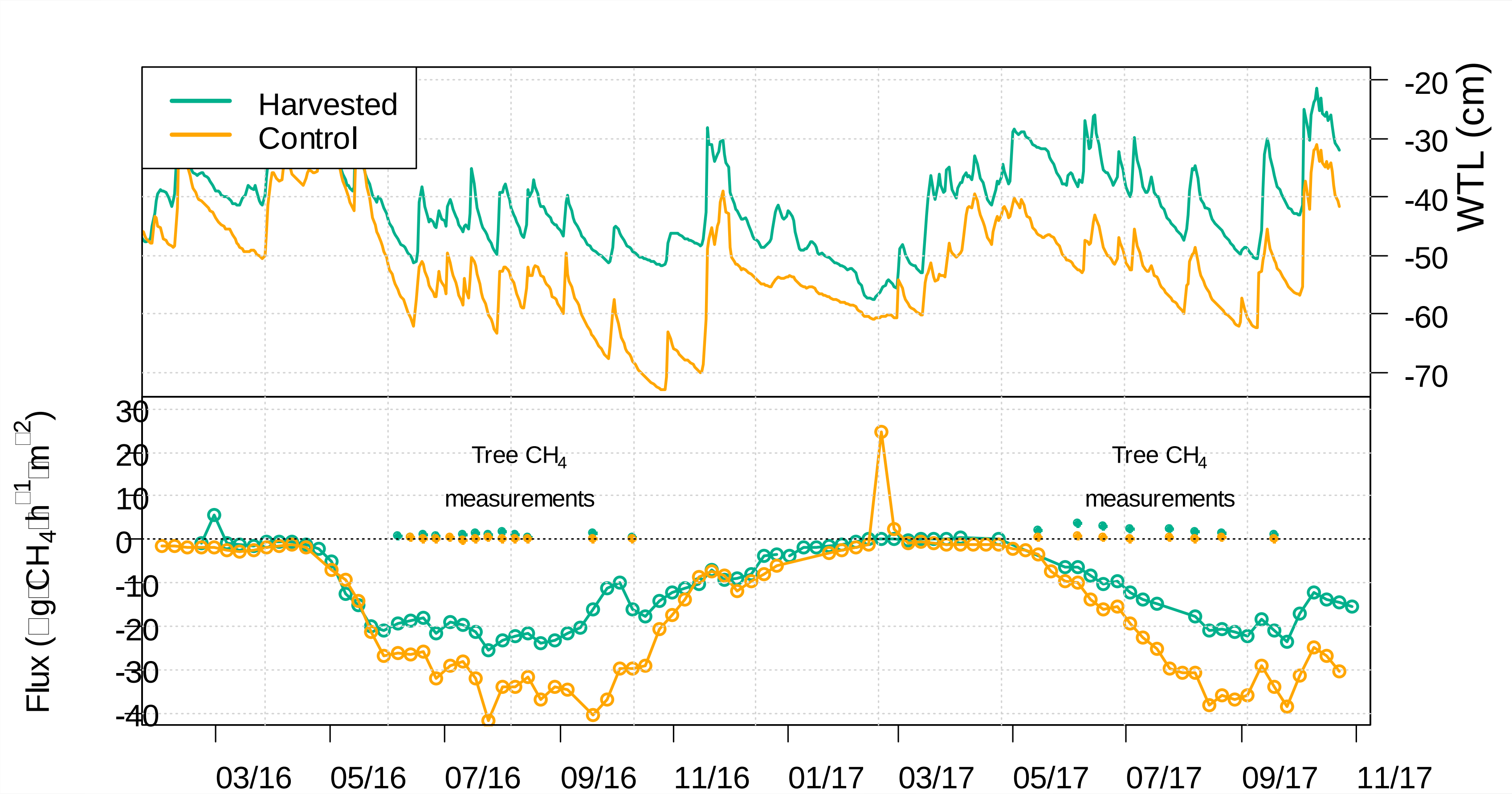
RESULTS

Partial harvest decreased the CH_4 sink of forest floor

Partial harvest increased the WTL



WTL (16.5.- 12.10.)



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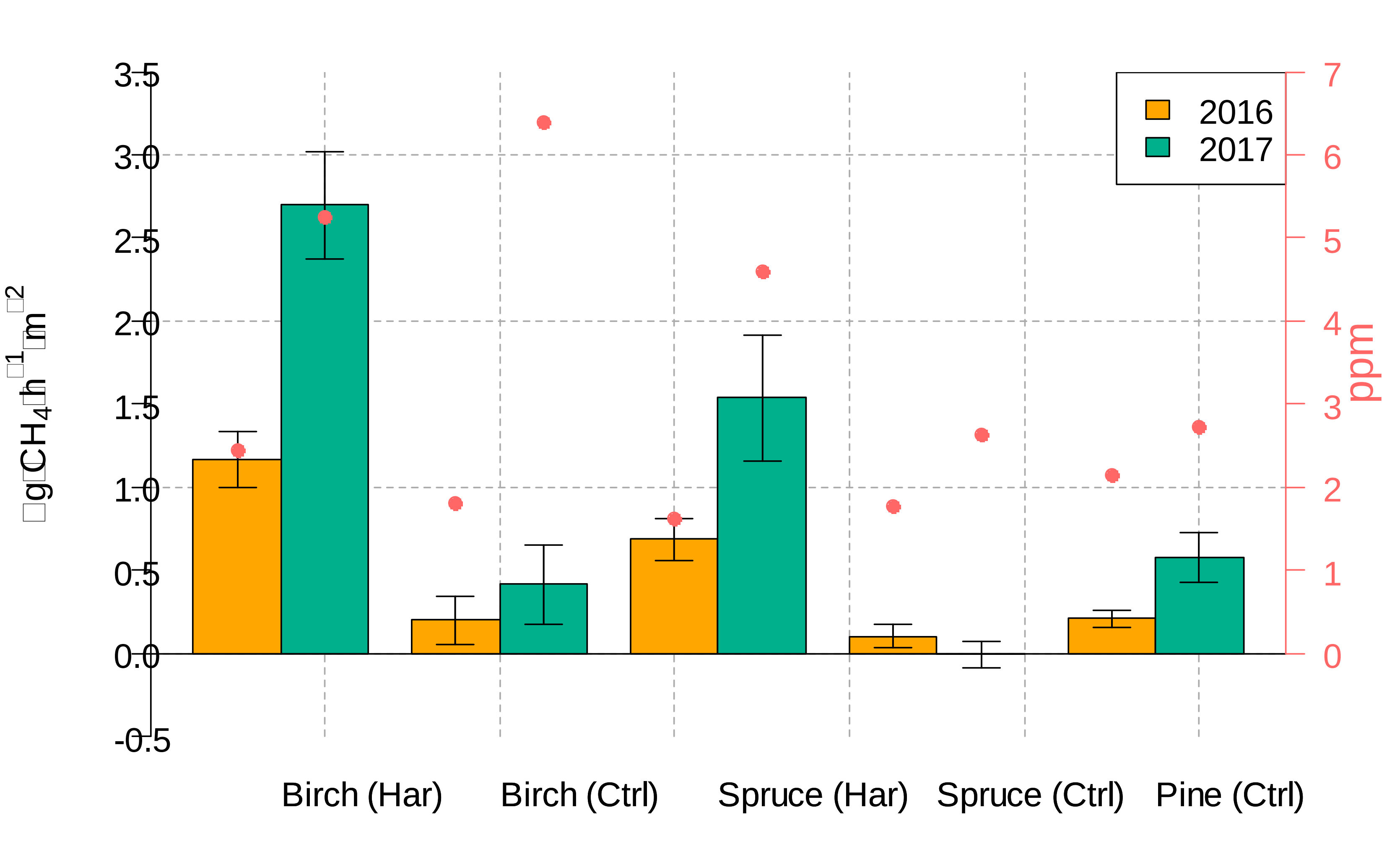
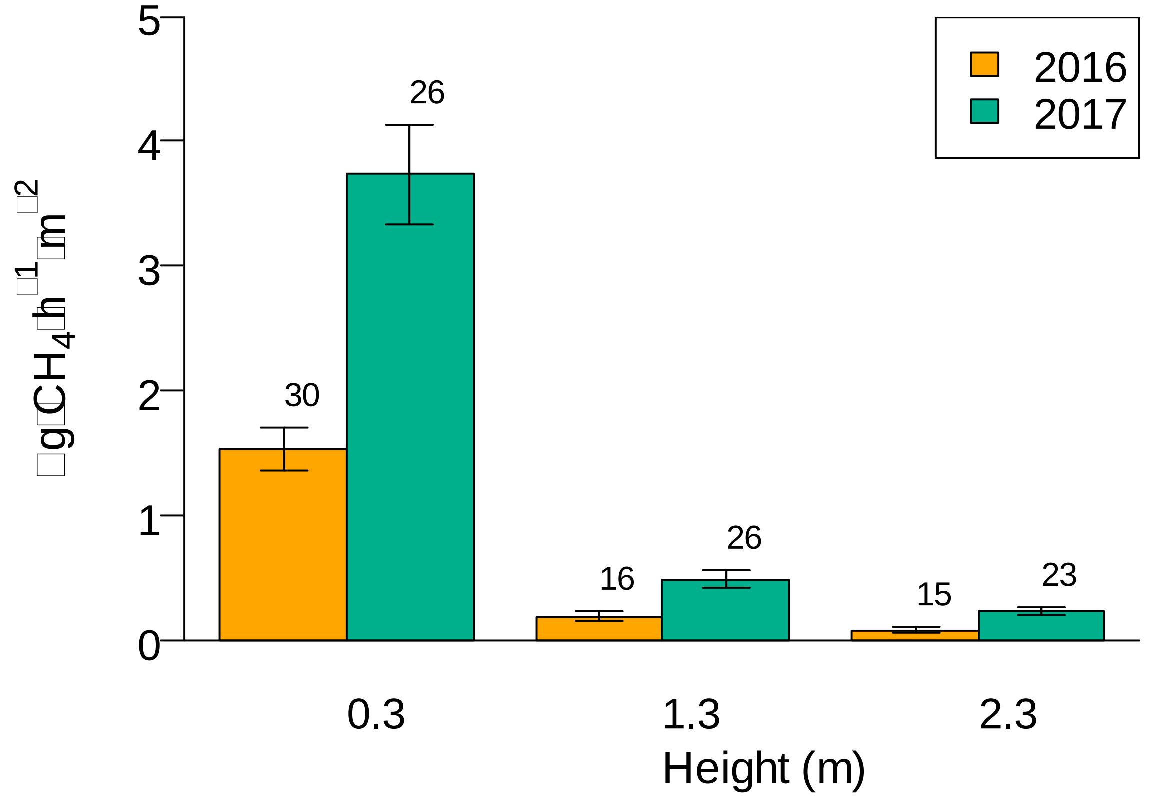
RESULTS

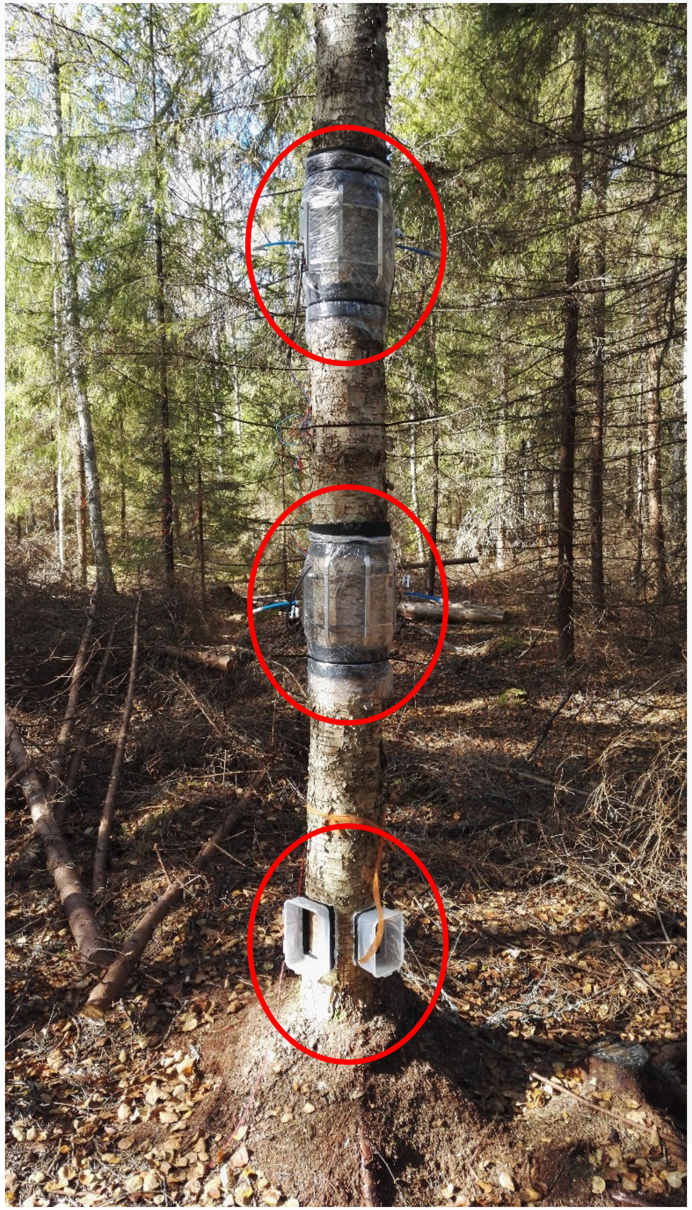
- Higher emission rates from the trees in harvested plot compared to the control
- Stem emissions also increased between the seasons
- No seasonal pattern in stem fluxes



RESULTS

Emissions decreased in tree vertical profile



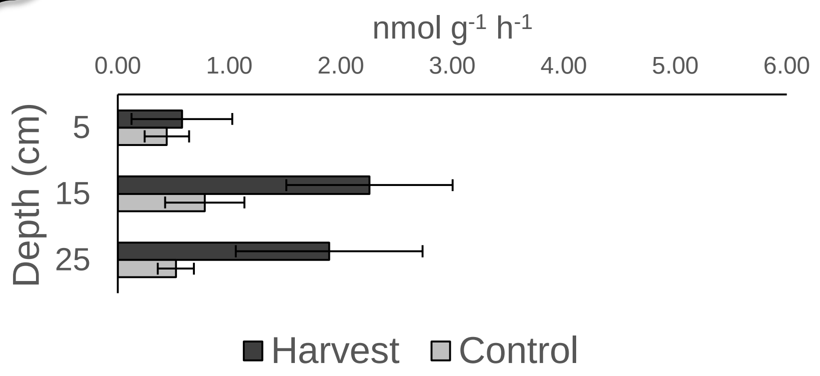


RESULTS

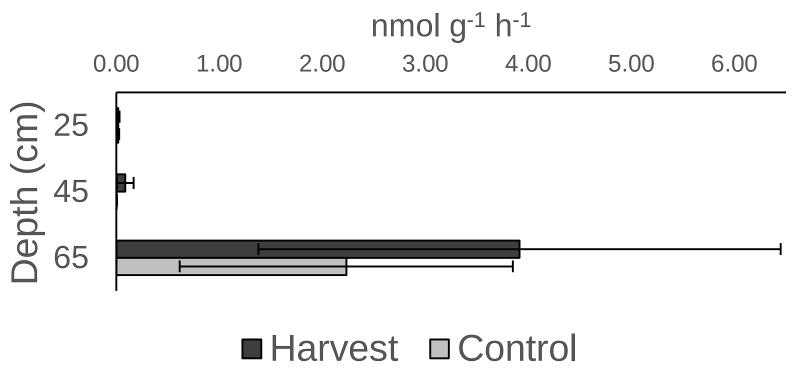
Soil profile CH_4 concentration (ppm), HARVESTED			Soil profile CH_4 concentration (ppm), CONTROL		
depth (cm)	2016	2017	depth (cm)	2016	2017
25	62.2 ± 17.5	91.7 ± 38.4	25	8.7 ± 5.8	48.1 ± 24.6
45	79.5 ± 23.7	2496.3 ± 2132.6	45	4.7 ± 1.6	5.6 ± 0.8
65	20595.9 ± 2745.1	128636.7 ± 11293.0	65	1448.4 ± 647.3	308.7 ± 194.9

- Potential of anoxic CH_4 production and oxidation were higher in the peat of the harvested site
- Increment of CH_4 concentration in 45 cm depth because of increased WTL in 2017?

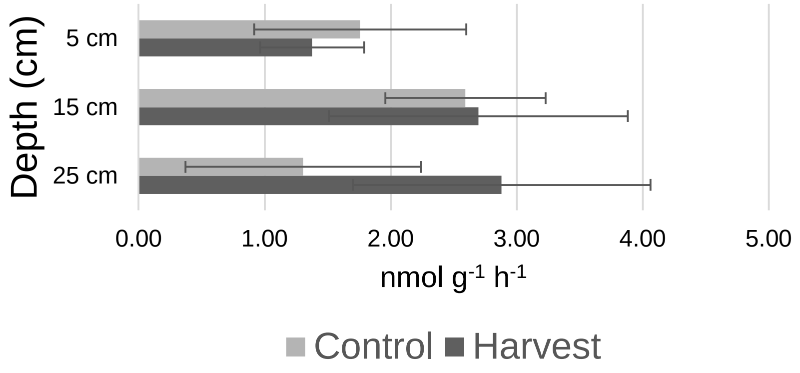
CH_4 oxidation potential in 2016 (1000 ppm)



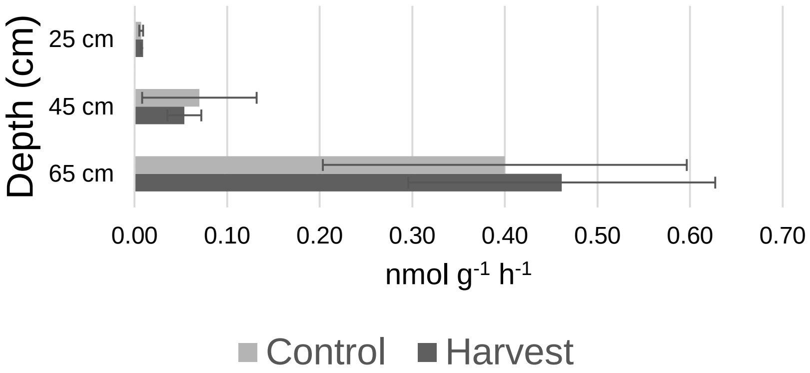
CH_4 production potential in 2016



CH_4 oxidation potential in 2017 (1000 ppm)

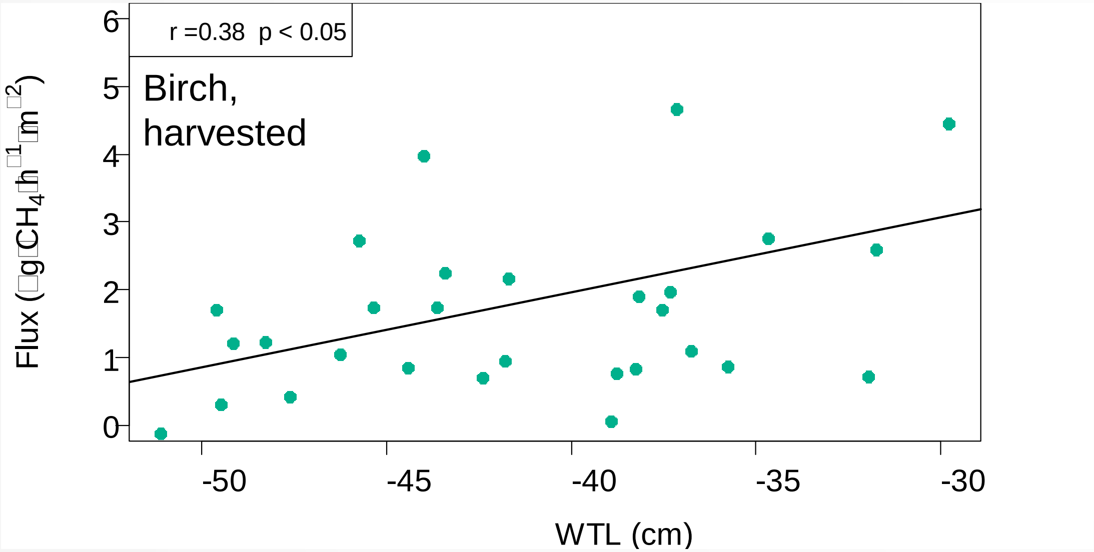


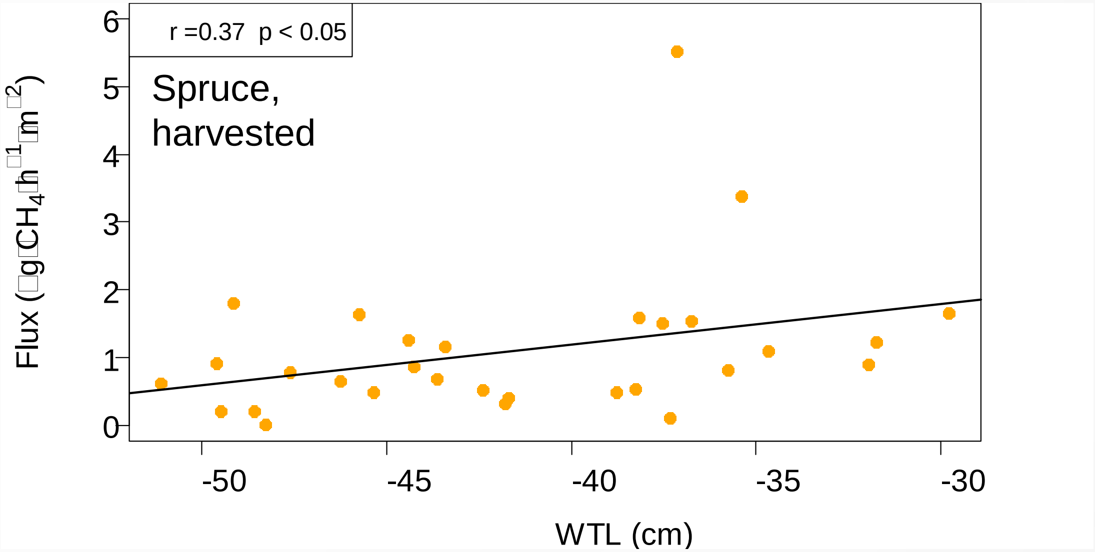
CH_4 production potential in 2016



RESULTS

- Correlations between daily averages of stem CH_4 fluxes and WTL (both years)
- No similiar correlation on the control site





CONCLSIONS

- Increasing water table level (WTL) seem to have an important effect on CH_4 concentration within the peat profile and trees
  - Need for furher investigations
- Elevated WTL results in decreased CH_4 uptake of forest floor and higher CH_4 emissions from the tree stems
  - Importance of WTL -> Soil origin of CH_4
- Lower emissions from higher parts of trees indicate soil origin of stem emitted CH_4
- Lower soil CH_4 sink of the forest floor on the harvested site might be caused by a higher CH_4 production in the peat profile, not compensated by higher CH_4 oxidation

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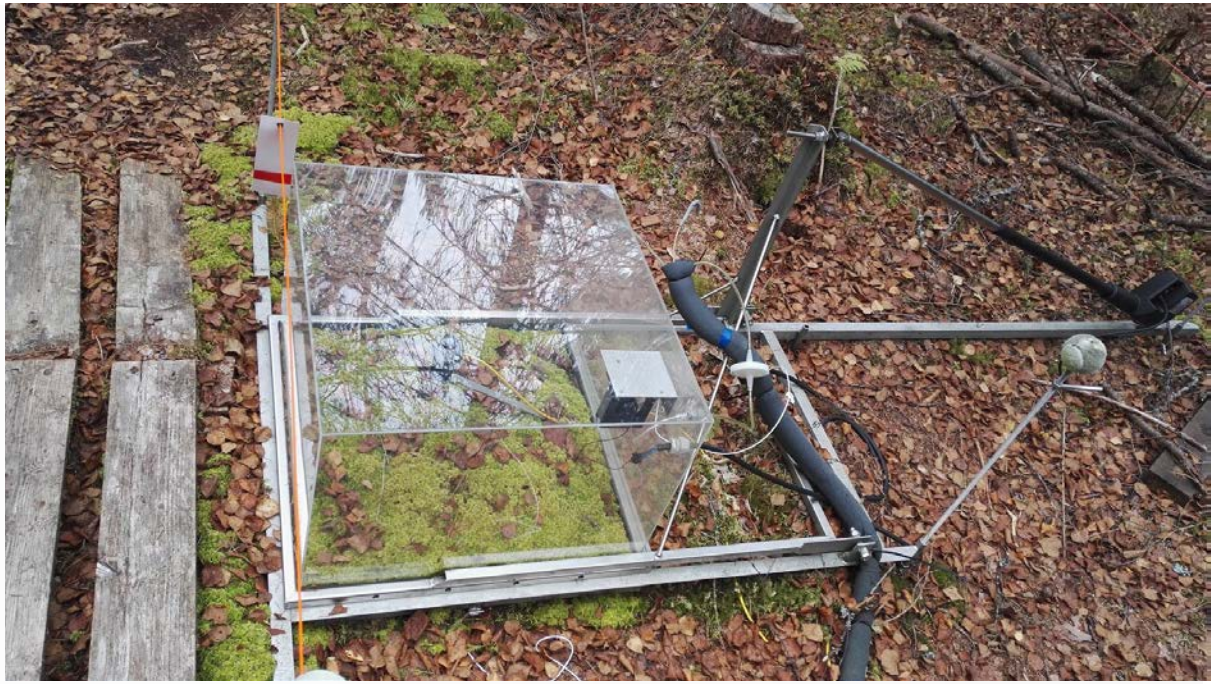
THANKS!



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