

# Tree stem-atmosphere greenhouse gas fluxes in a boreal riparian forest

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## Citation

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## Creator/Principal investigator(s)

[Marcus Klaus](#) - Swedish University of Agricultural Sciences, Department of Forest Ecology and Management

[Mats Öquist](#) - Swedish University of Agricultural Sciences, Department of Forest Ecology and Management

[Kateřina Macháčová](#) - Global Change Research Institute of the Czech Academy of Sciences, Department of Ecosystem Trace Gas Exchange

## Research principal

[Swedish University of Agricultural Sciences](#) - Department of Forest Ecology and Management

## Principal's reference number

SLU.seksko.2024.4.4.IÄ-2

## Description

Forests are active components of the global greenhouse gas cycle, but greenhouse gas fluxes between tree stems and the atmosphere remain poorly constrained. Here, we provide field data on tree stem atmosphere fluxes of carbon dioxide, methane and nitrous oxide in 14 spruce trees (*Picea abies*) and 14 birch trees (*Betula pendula*) in a Swedish boreal riparian buffer zone. The data was collected at Trollbergets Experimental Area, Vindeln municipality, Sweden, roughly on a monthly basis between May 2021 and May 2023. Stem fluxes were measured at 30 cm above ground in all trees and along height profiles at 80 and 160 cm in four selected trees. For ecosystem context, data on forest floor - atmosphere fluxes of carbon dioxide, methane and nitrous oxide from 12 plots are provided. Data on carbon dioxide and methane fluxes are from in situ measurements of flux chambers and data on nitrous oxide fluxes is from manual grab sampling of flux chambers. Ancillary data include carbon dioxide, methane and nitrous oxide partial pressures in soils, groundwater level, groundwater temperature, snow depth, tree diameter at breast height, tree height, distance to a nearby stream, and sampling sites coordinates. The data are described in detail in the scientific paper: Klaus, M., Öquist, M. and Machacova, K (in prep.): Tree stem-atmosphere greenhouse gas fluxes in a boreal riparian forest.

## Data contains personal data

No

## Language

[English](#)

## Time period(s) investigated

2021-05-15 – 2023-10-30

## Variables

42

## Data format / data structure

[Numeric](#)

[Text](#)

## Species and taxons

[Betula pendula](#)

[Picea abies](#)

## Data collection 1

- Mode of collection: Physical measurements and tests
- Description of the mode of collection: Snow depth at 24 sampling sites
- Time period(s) for data collection: 2021-02-18 – 2023-05-10
- Instrument: Folding ruler (Technical instrument(s))
- Temporal resolution: 14 day

## Data collection 2

- Mode of collection: Physical measurements and tests
- Description of the mode of collection: Measurement of groundwater level and temperature in four groundwater wells (120 cm deep). The data includes means and standard deviations over all wells.
- Time period(s) for data collection: 2021-05-16 – 2023-05-29
- Instrument: Levellogger® 5, Solinst Canada Ltd. - pressure sensor dataloggers

## Data collection 3

- Mode of collection: Physical measurements and tests
- Description of the mode of collection: Measurements of carbon dioxide and methane fluxes between tree stems and the atmosphere, and the forest floor and the atmosphere using the flux chamber technique. Gas concentrations inside the chambers were monitored with an online laser spectrometer. Sampling was done at 28 trees and 12 soil locations.
- Time period(s) for data collection: 2021-05-26 – 2023-10-30
- Instrument: Ultraportable Greenhouse Gas Analyzer, Los Gatos Research (Technical instrument(s)) - Laser spectrometer
- Temporal resolution: 1 month

## Data collection 4

- Mode of collection: Physical measurements and tests
- Description of the mode of collection: Sampling of soil gas at 24 sampling sites using soil gas probes and subsequent analysis on carbon dioxide, methane and nitrous oxide partial pressures.
- Time period(s) for data collection: 2021-05-27 – 2023-05-08
- Instrument: Clarus 580, PerkinElmer - Gas chromatograph (Clarus 580, PerkinElmer, Shelton, CT,

USA) by separation on a Elite-PLOT Q 30m, 0.53mmID, 20µm df column. CO<sub>2</sub> and CH<sub>4</sub> was detected with a Flame ionization detector containing a methanizer. N<sub>2</sub>O was detected with an Electron capture detector

- Temporal resolution: 1 month

## **Data collection 5**

- Mode of collection: Measurements and tests
- Description of the mode of collection: Measurements of nitrous oxide fluxes between tree stems and the atmosphere, and the forest floor and the atmosphere using the flux chamber technique. Gas concentrations inside the chambers measured using manual gas sampling and subsequent lab analysis with a gas chromatograph. Sampling was done at 28 trees and 12 soil locations.
- Time period(s) for data collection: 2021-06-01 – 2022-10-11
- Instrument: Clarus 580, PerkinElmer - Gas chromatograph (Clarus 580, PerkinElmer, Shelton, CT, USA) by separation on a Elite-PLOT Q 30m, 0.53mmID, 20µm df column. N<sub>2</sub>O was detected with an Electron capture detector
- Temporal resolution: 2 month

## **Geographic spread**

Geographic location: [Sweden](#), [Västerbotten County](#), [Vindeln Municipality](#)

Geographic description: Riparian buffer experiment in the Trollberget Experimental Area, near Vindeln, Västerbotten, Sweden

## **Responsible department/unit**

Department of Forest Ecology and Management

## **Contributor(s)**

Matthias Peichl - Swedish University of Agricultural Sciences, Department of Forest Ecology and Management

## **Funding 1**

- Funding agency: Carl Trygger Foundation
- Funding agency's reference number: CTS 20:226

## **Funding 2**

- Funding agency: The Ministry of Education, Youth and Sports of CR
- Funding agency's reference number: LUC23162
- Funding information: funded within the LU - INTER-EXCELLENCE II (2022 - 2029) program

## **Funding 3**

- Funding agency: Swedish Forest Society Foundation
- Funding agency's reference number: 2019-657-Steg 2 2018

## **Funding 4**

- Funding agency: Stiftelsen Fonden för Skogsvetenskaplig Forskning

## **Funding 5**

- Funding agency: The Geological Survey of Sweden (SGU)
- Funding agency's reference number: 36-2788/2021

## Funding 6

- Funding agency: Stiftelsen Extensus

## Funding 7

- Funding agency: The Ministry of Education, Youth and Sports of CR
- Funding agency's reference number: LM2023048
- Funding information: Project AdAgriF - Advanced methods of GHGs emission reduction and sequestration in agriculture and forest landscape for climate change mitigation (CZ.02.01.01/00/22\_008/0004635); funded within the CzeCOS program

## Research area

[Climate research](#) (Standard för svensk indelning av forskningsämnen 2011)

[Environmental sciences](#) (Standard för svensk indelning av forskningsämnen 2011)

[Geosciences, multidisciplinary](#) (Standard för svensk indelning av forskningsämnen 2011)

[Physical geography](#) (Standard för svensk indelning av forskningsämnen 2011)

[Meteorology and atmospheric sciences](#) (Standard för svensk indelning av forskningsämnen 2011)

[Oceanography, hydrology and water resources](#) (Standard för svensk indelning av forskningsämnen 2011)

[Ecology](#) (Standard för svensk indelning av forskningsämnen 2011)

[Forest science](#) (Standard för svensk indelning av forskningsämnen 2011)

[Soil science](#) (Standard för svensk indelning av forskningsämnen 2011)

[Climatology / meteorology / atmosphere](#) (INSPIRE topic categories)

[Environment](#) (INSPIRE topic categories)

## Keywords

[Gas flux](#), [Atmospheric conditions](#), [Environmental monitoring facilities](#), [Habitats and biotopes](#), [Hydrography](#), [Soil](#), [Seasonal variation](#), [Forest trees](#), [Carbon dioxide](#), [Nitrous oxide](#), [Riparian zones](#), [Boreal forests](#), [Greenhouse gases](#), [Soil air](#), [Environmental impact](#), [Bark](#), [Methane](#), [Manual observation](#), [Spatial variations](#), [Soil hydrology](#)

## Publications

Klaus, M., Öquist, M., & Macháčová, K. (2024). Tree stem-atmosphere greenhouse gas fluxes in a boreal riparian forest. In Science of The Total Environment (p. 176243).

**DOI:** <https://doi.org/10.1016/j.scitotenv.2024.176243>

## Polygon (Lon/Lat)

19.832214, 64.17332

19.850074, 64.17332

19.850074, 64.178181

19.832214, 64.178181

19.832214, 64.17332

## Accessibility level

Access to data through SND

Data are freely accessible

## **Use of data**

[Things to consider when using data shared through SND](#)

## **License**

[CC0 1.0](#)

## **Versions**

Version 1. 2024-09-16

## **Contact for questions about the data**

Marcus Klaus

[marcus.klaus@slu.se](mailto:marcus.klaus@slu.se)

## **Download metadata**

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