

## Our research area of interest

**Systems:** Boreal lake ecosystem s, sediments and peat accumulations, lake and wetland mosses, and arctic soils.

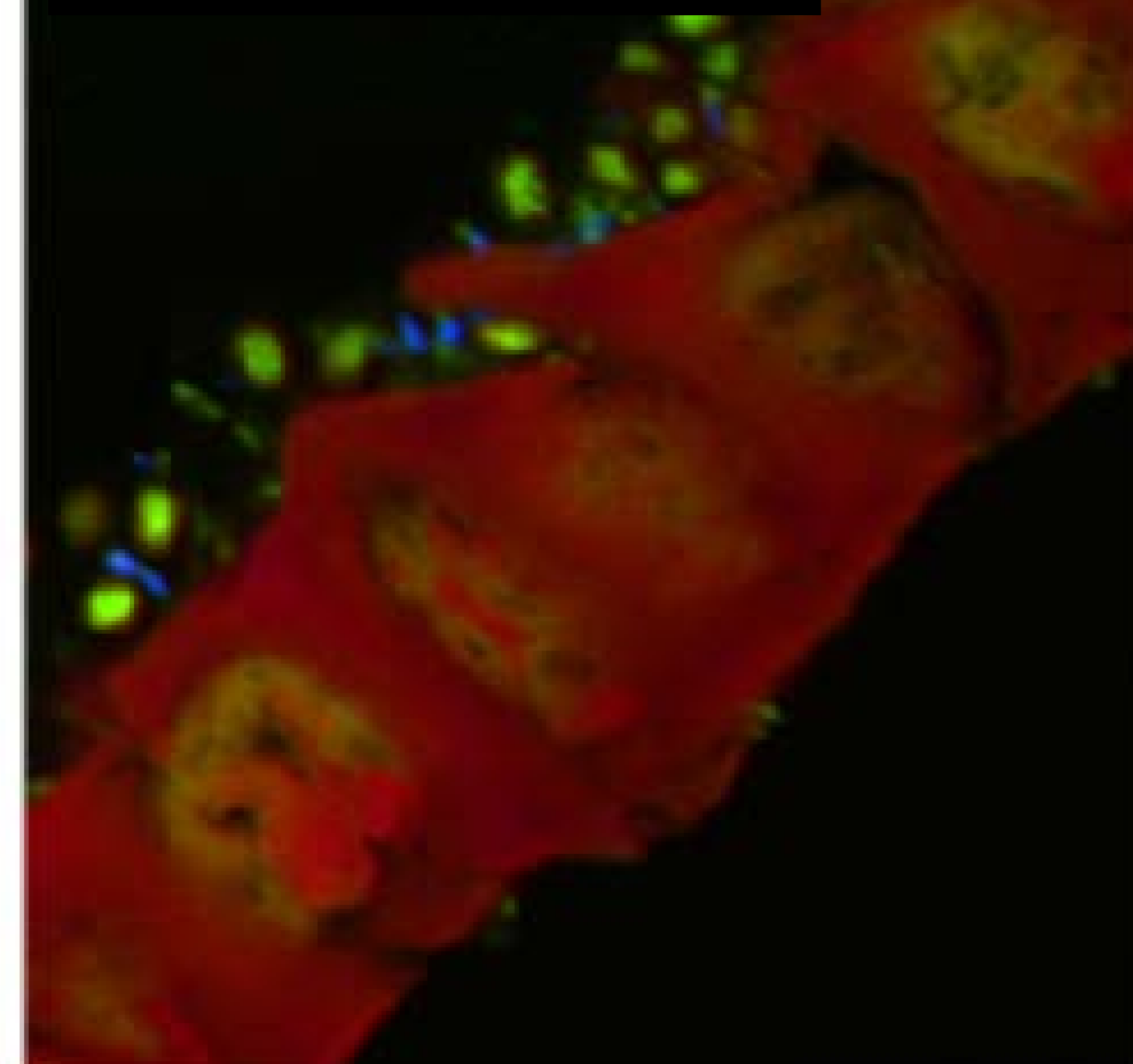
**Processes:**

- Carbon cycling (including stability and fate of DOC)
- Nitrogen cycling (denitrification/DNRA, methanotrophic nitrogen fixation)
- Greenhouse gas emissions (methanotrophy, N<sub>2</sub>O production).

**Organisms:** mainly Bacteria, increasing interest on Archaea, Fungi and Protozoa.

**Interest** on developing high throughput tools for studying microbial functions – developing radioisotope probing (RIP). We welcome new collaborations!

Type II methanotrophs covered 17% of the surface bacteria on the *Fontinalis* stream moss.



## Members of the research group



Marja Tirola (Group leader, University lecturer)  
Hannu Nykänen (Group leader, Academy researcher)  
Sanna Leppänen (PhD student)  
Jatta Karhunen (PhD student)

Anna Taskinen (PhD student)  
Ville Juusela (PhD student)  
Antti Rissanen (Post doc)  
Sukithar Rajan (researcher)  
Miikka Hasari (MSc student)  
Felipe Arrano (MSc student)

## Methods

**Process measurements:**

- Isotope pairing technique (IPT) for nitrification/denitrification
- Other stable isotope tracer methods for nitrogen fixation and methane oxidation
- Gas chromatographic methods

**Experimental approaches**

Bottle and mesocosm experiments

**Molecular techniques**

- Next-generation sequencing
- qPCR
- nanoSIMS localization together with Max Planck (Bremen)

## Resources

**Field sites:**

- Small lakes in Evo region
- Wastewater discharge sites in central Finland lakes
- Kilpisjärvi tundra sites in Lapland

**Special technical facilities: related to the work**

- Sequencing: Ion Torrent PGM (2012->)



- Stable isotope facilities:

- I. Thermo Delta<sup>plus</sup> Advantage Mass Spectrometer (2002->) + Elemental Analyzer and Gas Bench
- II. Isoprime Vmass Spectrometer + Vario Pyro and Trace gas (2013->)

## Key publications

- Männistö, M.K., Tirola, M. and Häggblom, M.M. (2007) Bacterial communities in Arctic fjelds of Finnish Lapland are stable but highly pH-dependent. *FEMS Microbiology Ecology* 59: 452-465.
- Rissanen, A.J., Kurhela, E., Aho, T., Oittinen, T. and Tirola, M. (2010) Storage of environmental samples for guaranteeing nucleic acid yields for molecular microbiological studies. *Appl. Microbiol. Biotechnol.* 88: 977-84
- Tirola, M., Rissanen, A.J., Sarpakunnas, M., Arvola, L and Nykänen, H. (2011) Stable isotope profiles of nitrogen gas indicate denitrification in oxygen-stratified humic lakes. *Rapid Communications in Mass Spectrometry* 25:1497-1502.
- Peura, S., Eiler, A., Bertilsson, S., Nykänen, H., Tirola, M., Jones, R.I. (2012) Distinct and diverse anaerobic bacterial communities in boreal lakes dominated by candidate division OD1. *ISME Journal* 6:1640–1652
- Leppänen, S.M., Salemaa, M., Smolander, A., Mäkipää, R. and Tirola, M. Nitrogen fixation and methanotrophy in forest mosses along a N deposition gradient. *Environmental and Experimental Botany* 90: 62-69.



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