



Figure 1. Aerial photo of the palsa site showing intact palsas (pale green) and waterlogged, collapsed palsas surrounded by small ponds.

Greenhouse gas emissions along a thaw gradient in Icelandic permafrost soils

Context and objectives:

Permafrost soils are a major stock of soil organic carbon, storing an estimated 1300 Pg of carbon. However, this carbon stock is vulnerable to thaw; a process which releases large quantities of carbon in the form of greenhouse gases (CO_2 and CH_4). Recent research suggests that the iron biogeochemical cycle is a principal drivers of carbon release in thawing permafrost soils. However, little is known about coupled iron and carbon dynamics in permafrost soils in Iceland, where high rates of aeolian deposition lead to uniquely iron mineral-rich soils. Understanding mineral controls on the dynamics of soil organic carbon is key to predicting the effects of climate change on these carbon reservoirs. This project will investigate the role and importance of mineral-bound organic carbon across a thaw gradient at Orravatnsrústir; a palsa landscape in the Icelandic highlands.

Techniques / What to expect:

This project will measure the release of greenhouse gases (CO_2 and CH_4) along a thaw gradient at the Orravatnsrústir palsa site. A broad range of field methods will be applied, including sampling of soil cores, soil porewater, and streamwater. Collected samples will be analyzed in the Environmental Chemistry laboratory at UNINE. Planned analyses include gas measurements and mineral and elemental analysis of soil samples and water samples.

Working place:

Environmental Chemistry Group, UNINE, Av. de Bellevaux 51, 2000 Neuchâtel.

Timeline:

Field work is planned for July/August 2026, processing of samples will begin in September at UNINE.

Collaboration:

The project will be supervised by Prof. Laurel ThomasArrigo (laurel.thomas@unine.ch) and a Postdoc/PhD student in the Environmental Chemistry group (to be determined)

Literature:

Patzner, M. S.; Mueller, C. W.; Malusova, M.; Baur, M.; Nikeleit, V.; Scholten, T.; Hoeschen, C.; Byrne, J. M.; Borch, T.; Kappler, A.; Bryce, C. (2020) *Nature Commun.*, 11(1).