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Long lasting greenhouse gas emissions beyond abrupt permafrost thaw event in permafrost peatlands

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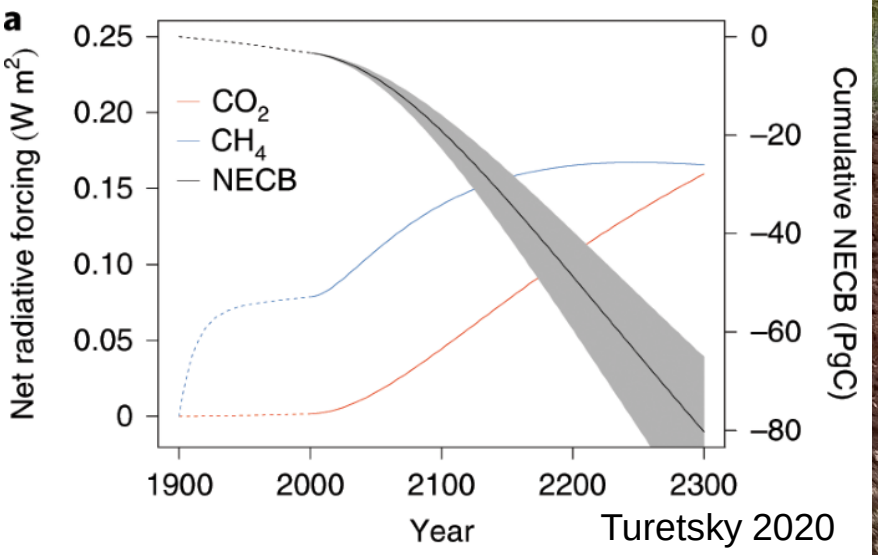
Abrupt permafrost thaw and carbon release

- Abrupt permafrost thawing will release large amounts of CO_2 and CH_4
- CO_2 release will continue to increase but CH_4 release may reach equilibrium over time
- Vegetation succession will increase net C uptake



Permafrost thaw gradient in northern Norway

Research questions

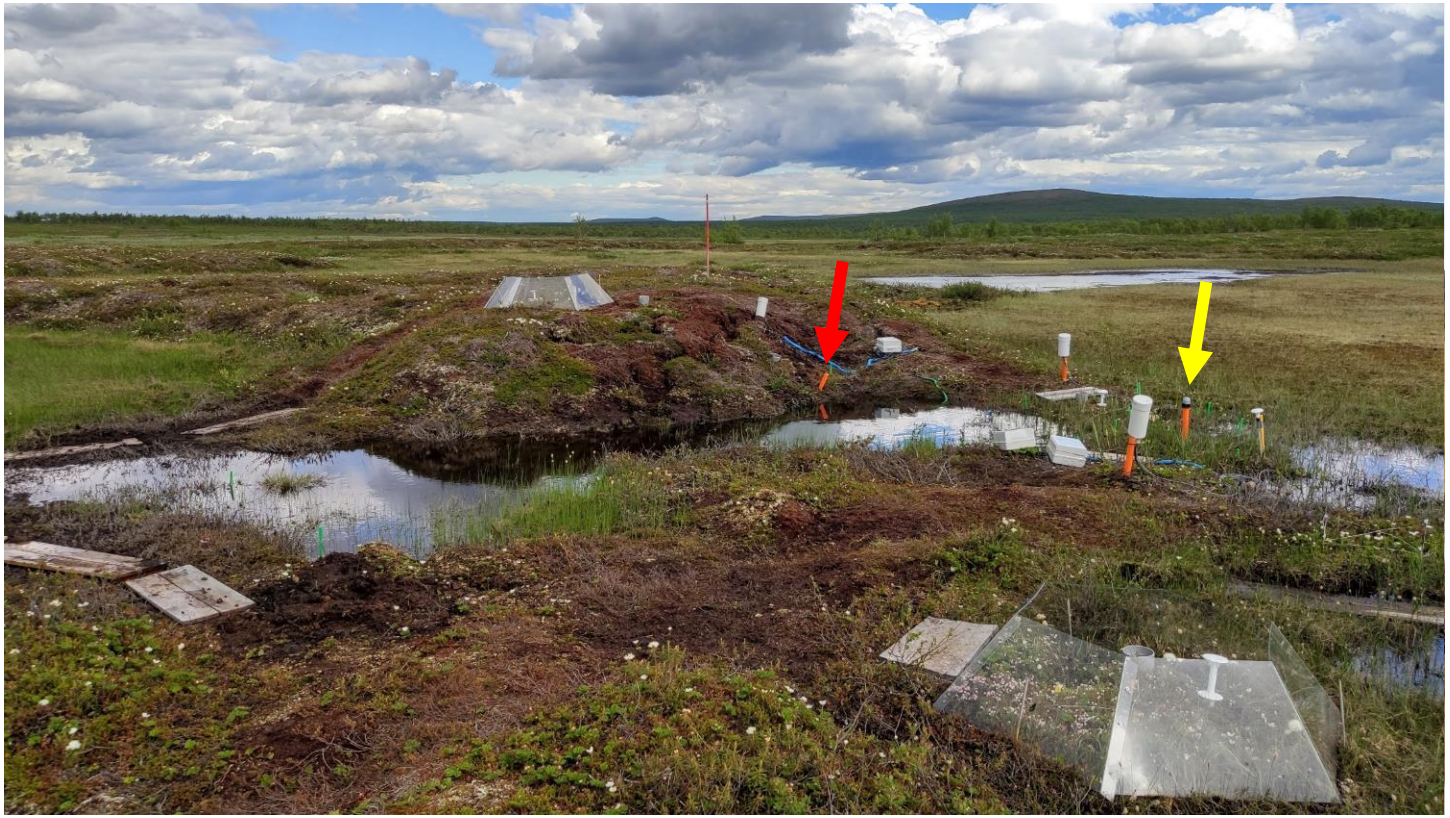
- How does abrupt permafrost thaw affect different greenhouse gas emissions?
- Will succession beyond abrupt permafrost thawing shift the ecosystem from net release to uptake of carbon?

Permafrost thaw gradient in northern Norway

September 2016

Permafrost thaw gradient in northern Norway

June 2020



Permafrost thaw gradient in northern Norway


Bare soil palsa


Vegetated palsa


Thaw slump


Thaw pond


Vegetated pond

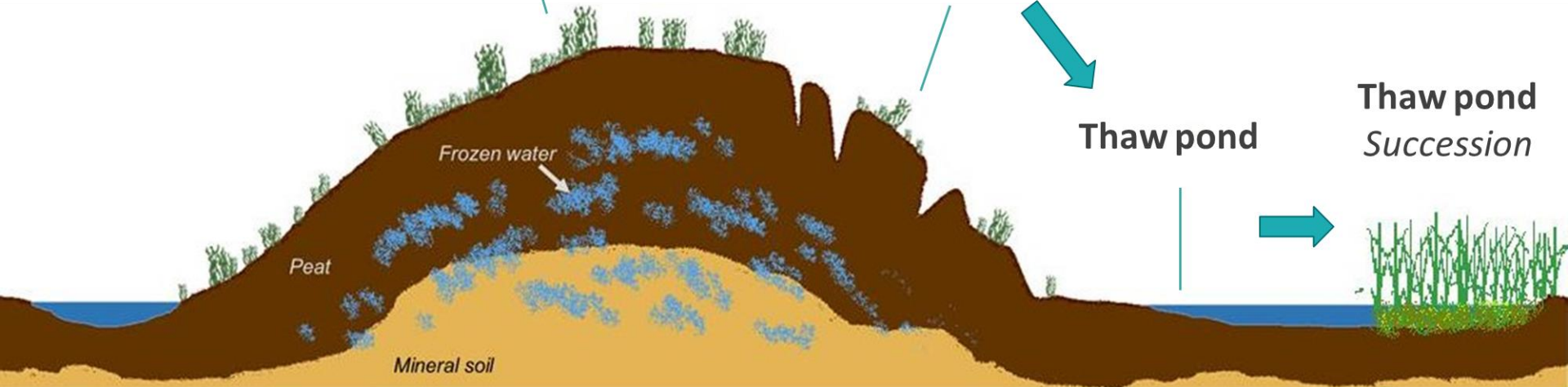
Palsa
Intact permafrost

Thaw slump
Permafrost thaw

CO_2 CH_4 ?

Thaw pond

Thaw pond
Succession



Experimental setup

Bare Soil palsa | Vegetated palsa | Thaw slump | Thaw pond | Vegetated pond

1

2

3

4

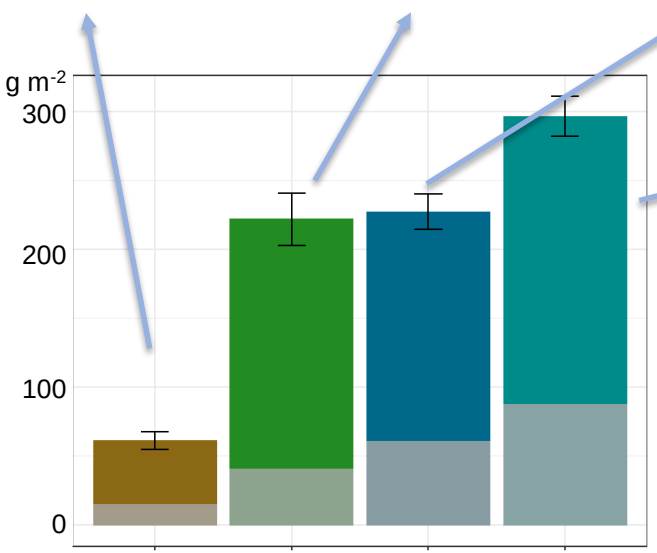
5

6

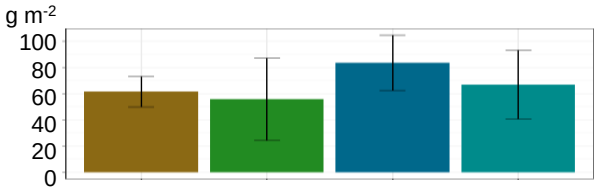
Three more transects

Greenhouse gas balance: CO_2

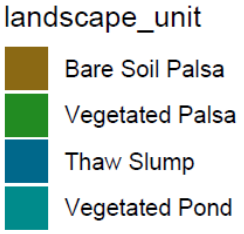
Bare soil palsa | Vegetated palsa | Thaw slump | Thaw pond | Vegetated pond



Ecosystem respiration



Net ecosystem exchange

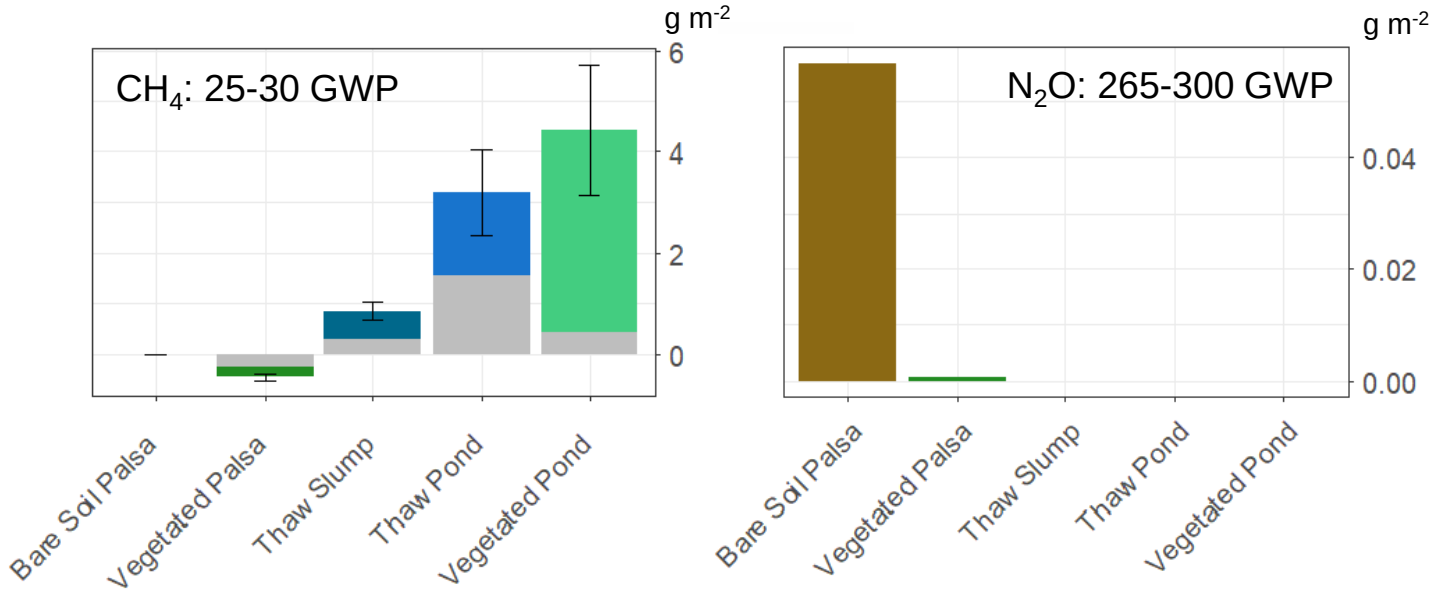


Net CO_2 balance is similar at all sites

Photosynthetic uptake at vegetated pond large

Greenhouse gas balance: CH_4, N_2O

Bare soil palsa | Vegetated palsa | Thaw slump | Thaw pond | Vegetated pond



Continued emissions of CH_4 beyond abrupt permafrost thawing

N_2O emissions from bare soil

Summary

- CO_2 balance similar across landscape types
- CH_4 emissions continue to increase beyond abrupt permafrost thawing
- N_2O need more investigation