Greenhouse Gas Fluxes From Nutrient-rich Organic In Estonia

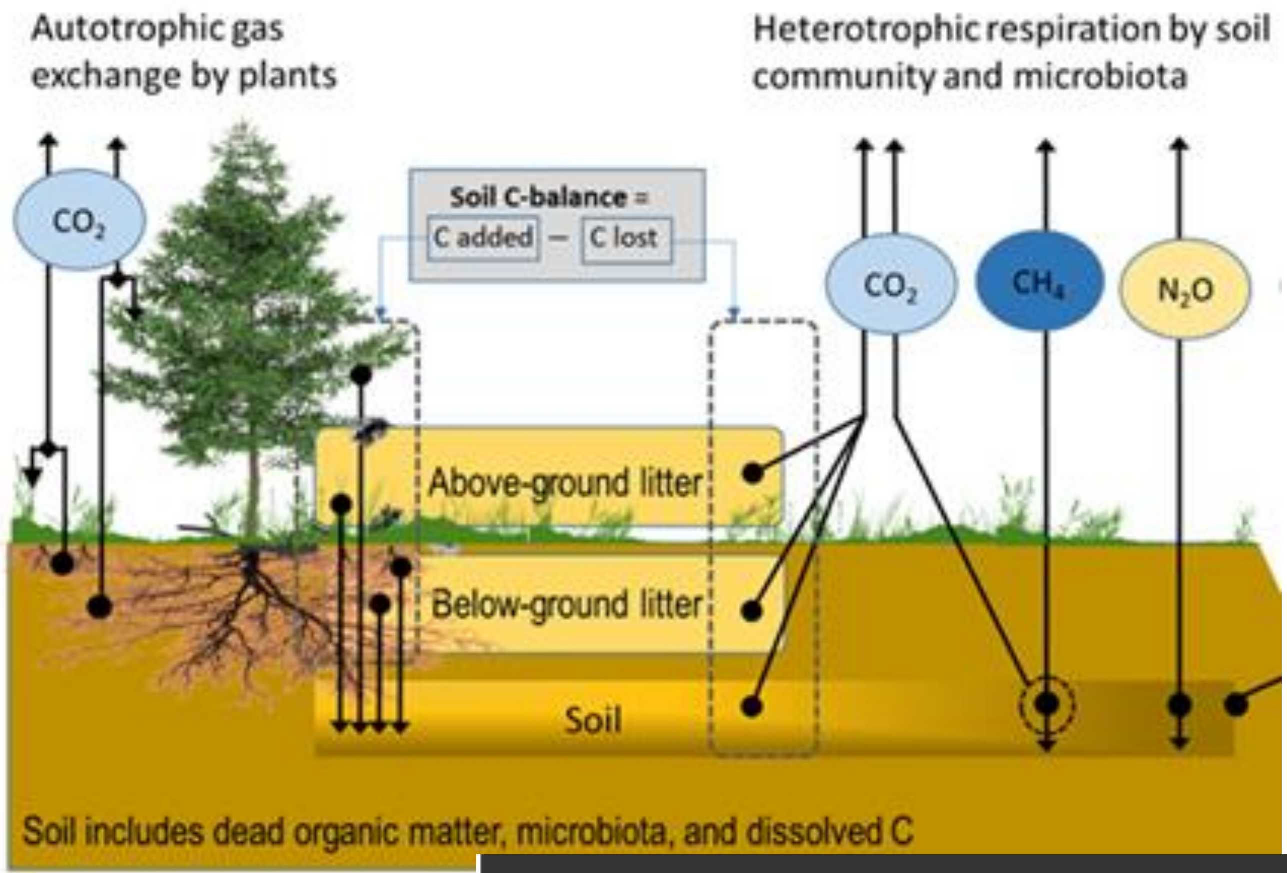
MUHAMMAD KAMIL SARDAR ALI

Thomas Schindler, Ain Kull, Hanna Vahter, Ülo Mander, and Kaido Soosaar

Department of Geography, Institute of Ecology & Earth Sciences, University of Tartu, Estonia

Peatlands are drained for cultivation
and peat extraction

- Increased peat mineralization
- Water level fluctuation
- GHG emissions

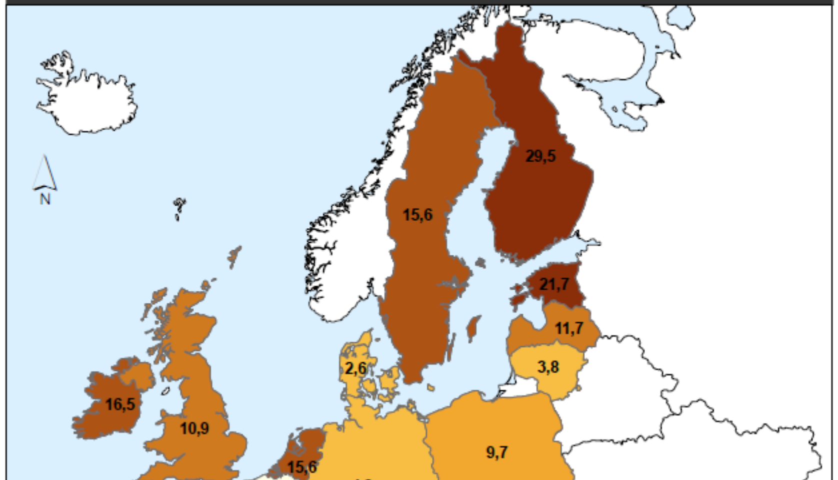


modified from Jauhiainen et al. (2019)

<u>Research question:</u>

- **How drainage will impact GHG emissions from cropland, grassland and forest land on nutrient-rich organic soils**
- C and N budget

Relative cover (%) of peat soils (0–30cm), per country



Study Areas

South-Estonia (hemiboreal zone)

<u>Different land-use types:</u>

(i) Forest sites (Downy birch, Norway spruce, Scots pine, black alder)

(ii) Grasslands (dry, moderate (field), wet)

(iii) Cropland (maize) and Fen.






Methods

GHG flux measurements: twice per month, Jan-Dec 2021 – ongoing

- Manual static closed dark chamber method for CH_4, N_2O, analysis by GC
- Dynamic chamber (with EGM-5) for heterotrophic respiration (CO_2)

Auxiliary parameters: Tsoil, Tair, soil water content, soil moisture, water chemistry





Soil CO_2 (heterotrophic respiration) fluxes

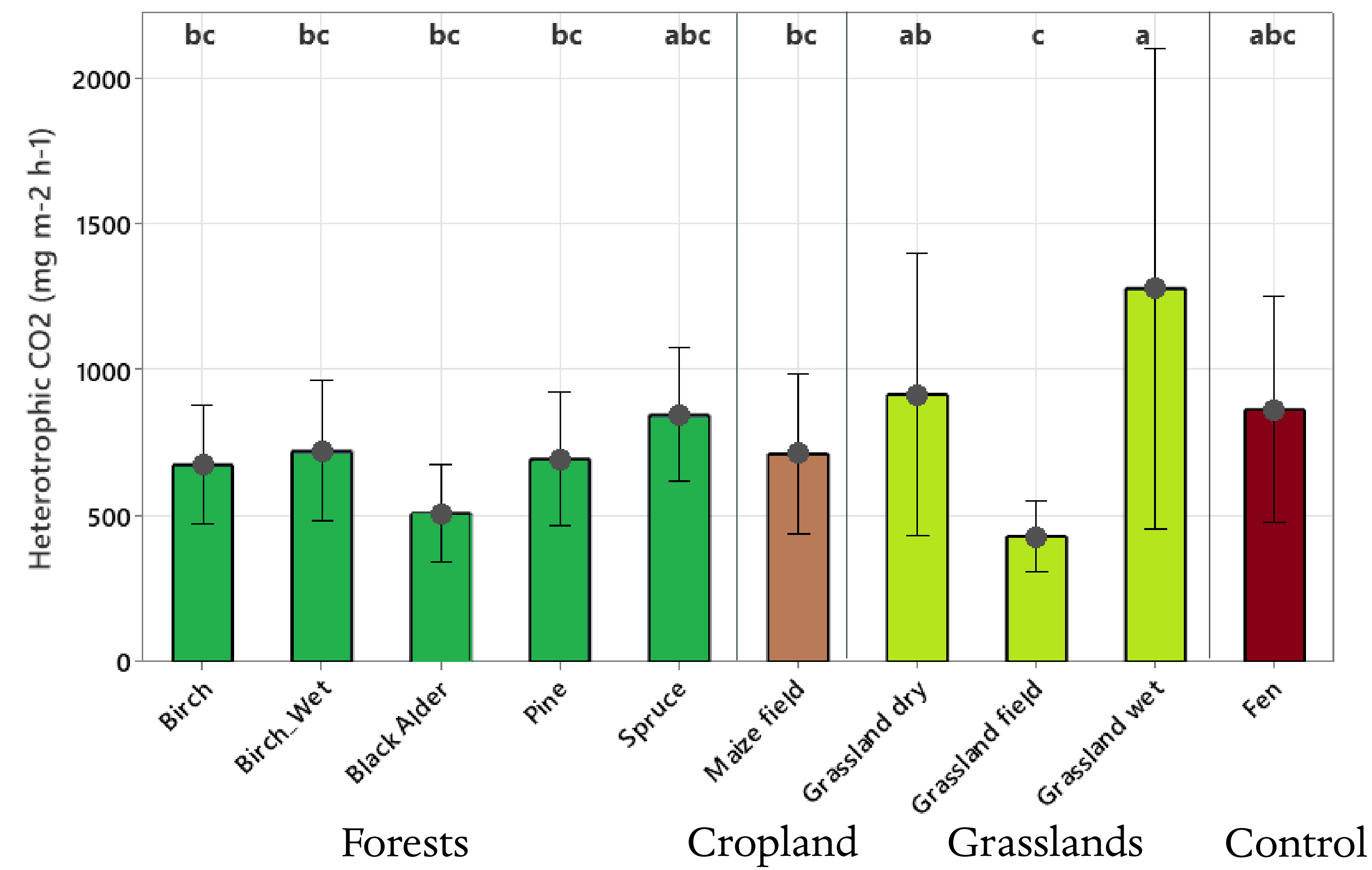
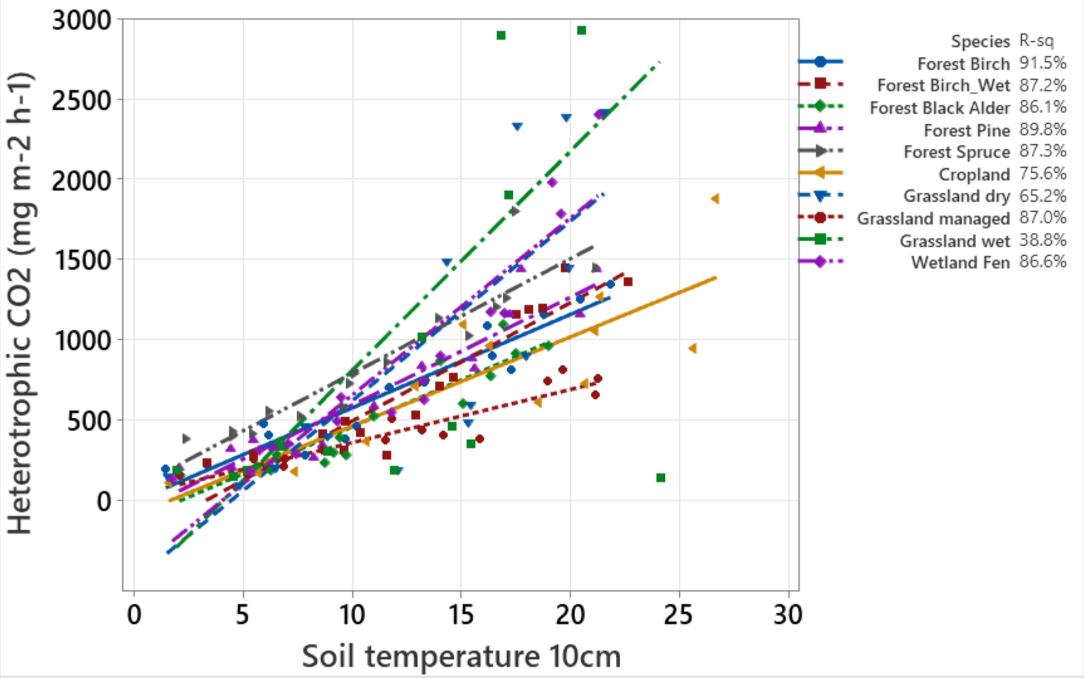
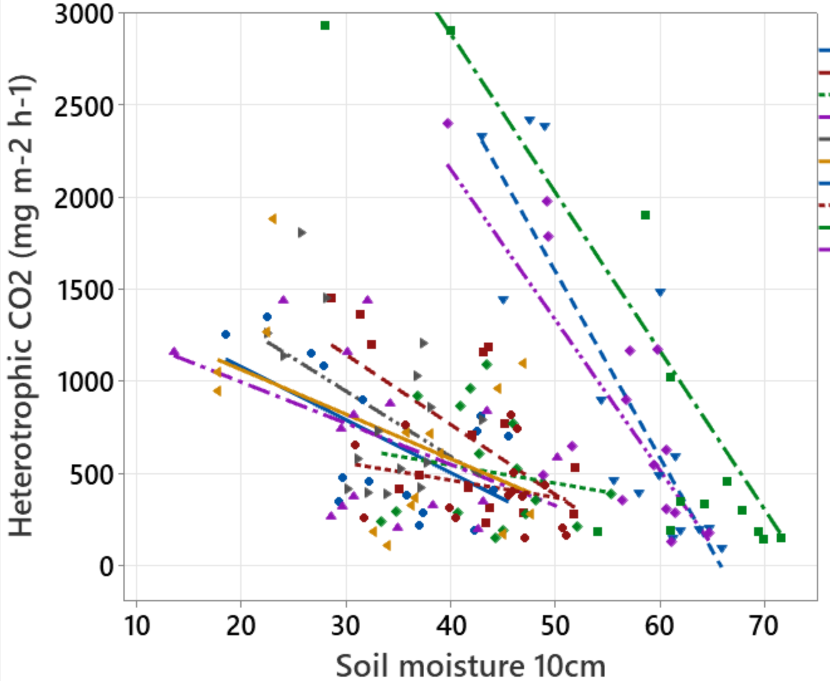


Fig.1 show 95% CI for the Mean. Individual standard deviations are used to calculate the intervals.





Variable water level

Soil N_2O fluxes

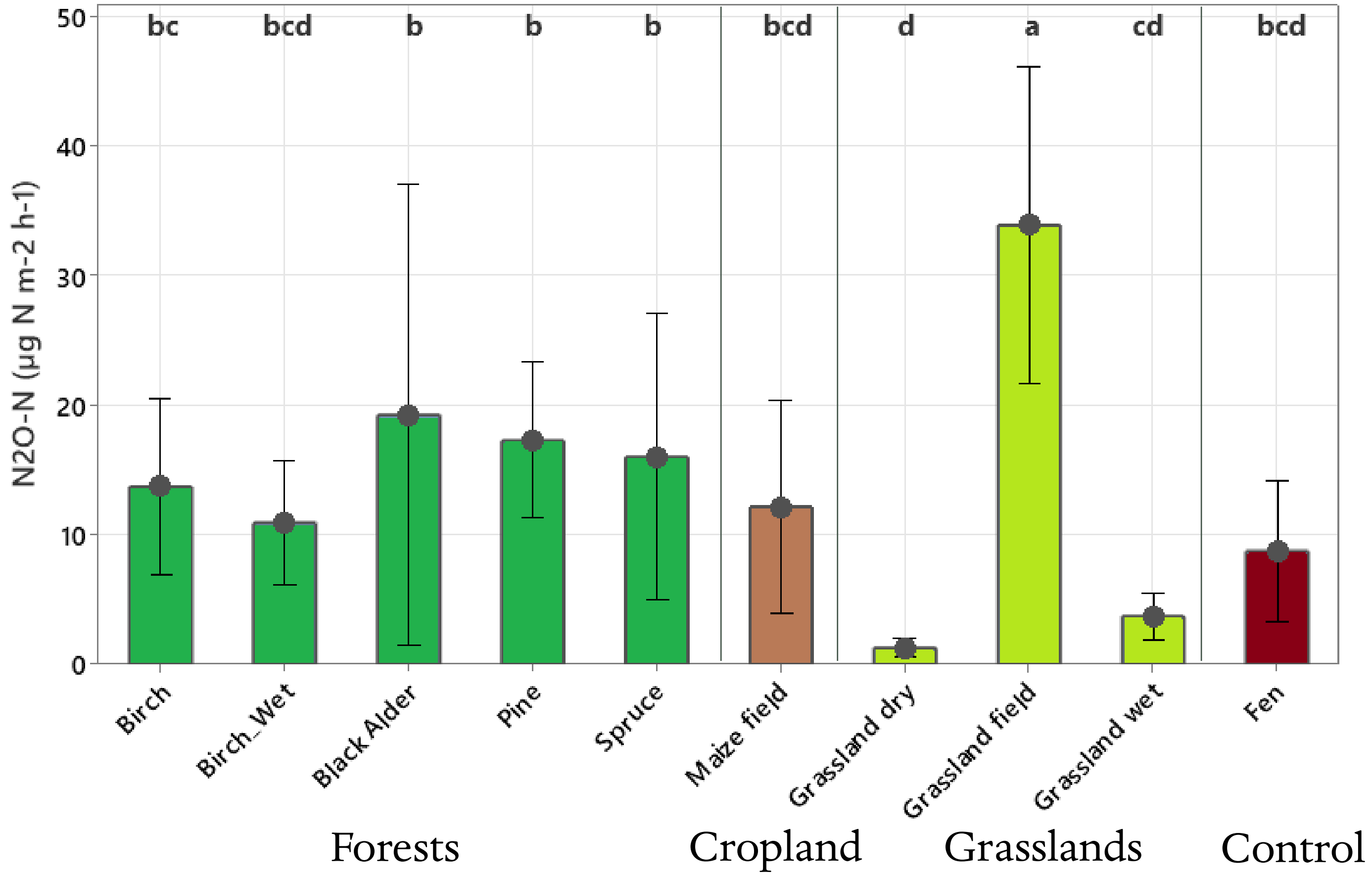
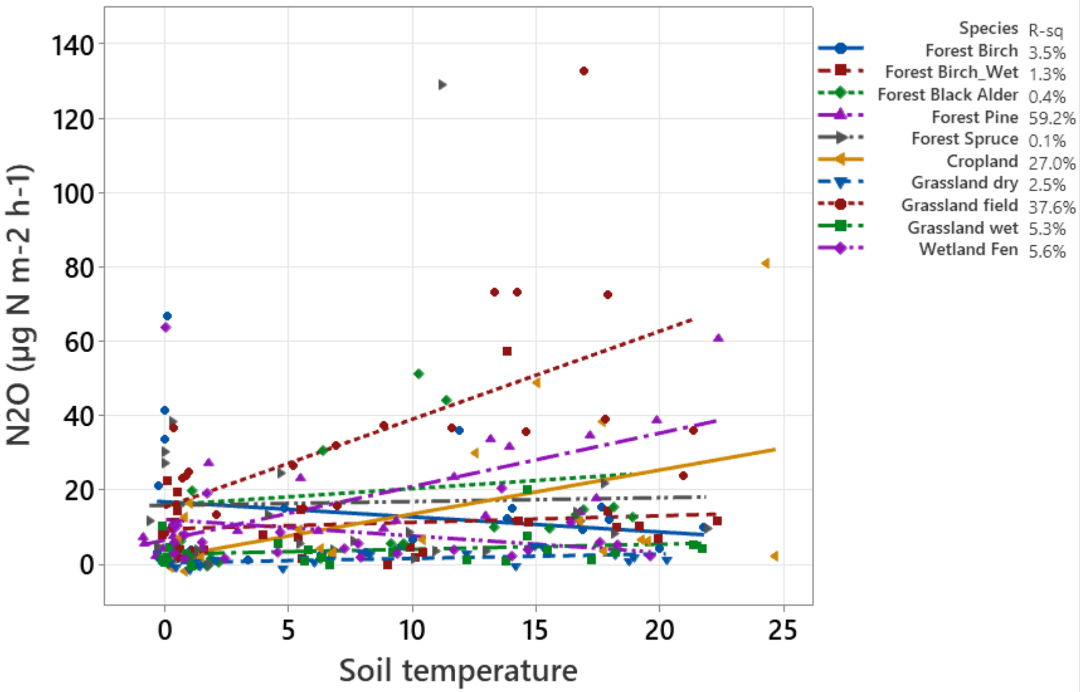
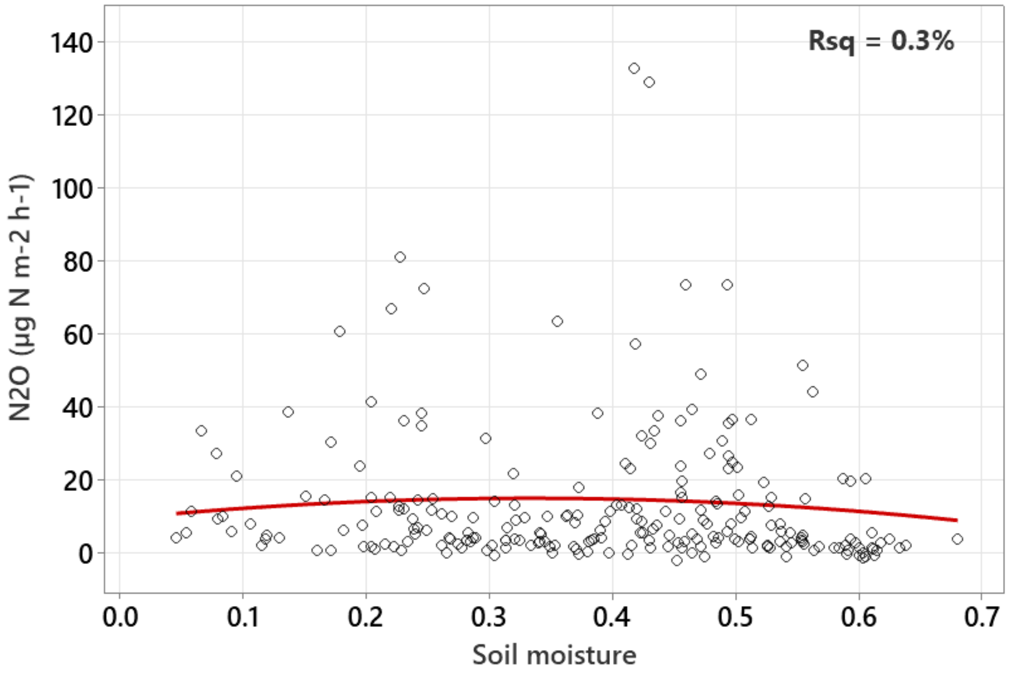


Fig.2 show 95% CI for the Mean. Individual standard deviations are used to calculate the intervals.





Soil CH_4 fluxes

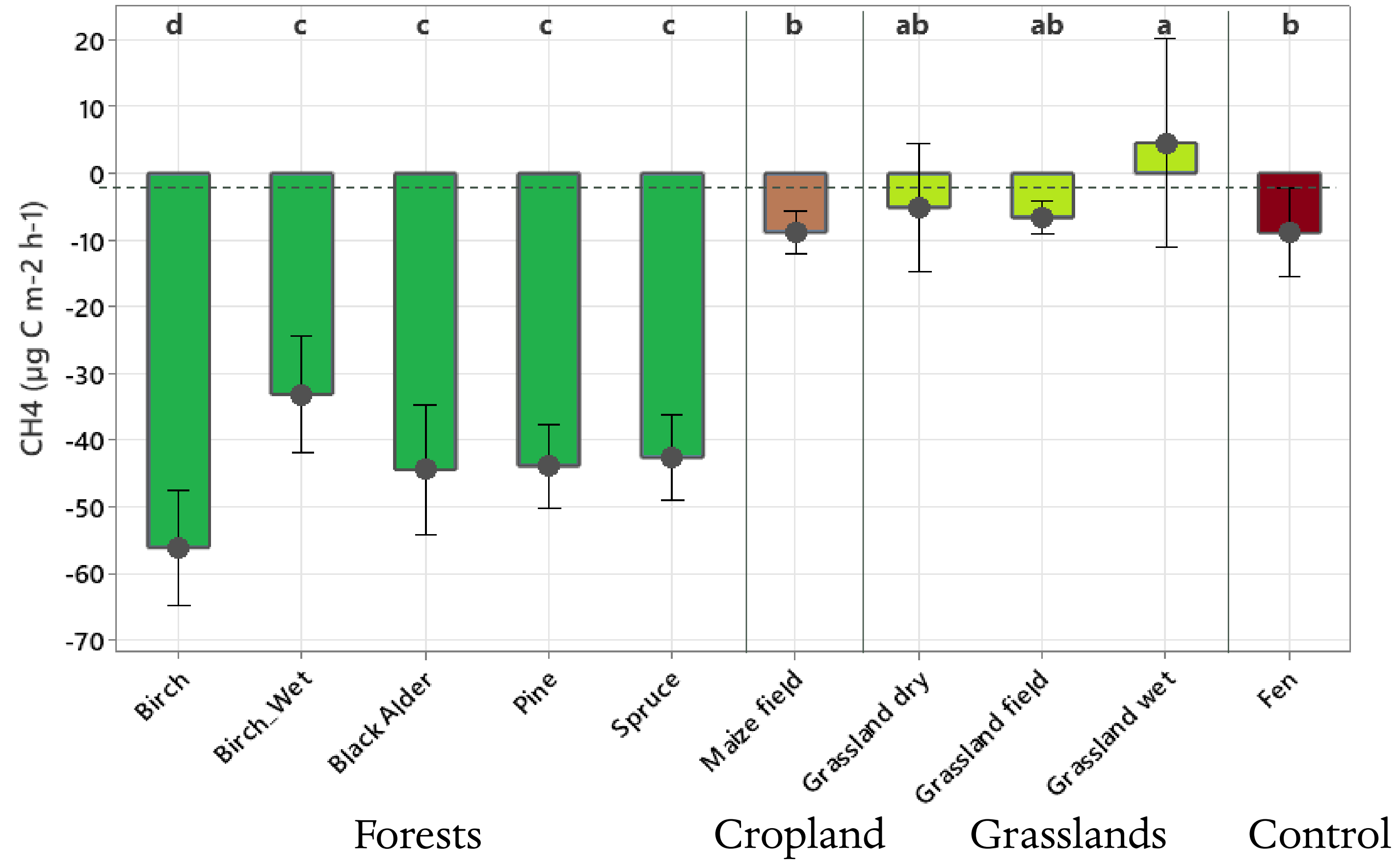
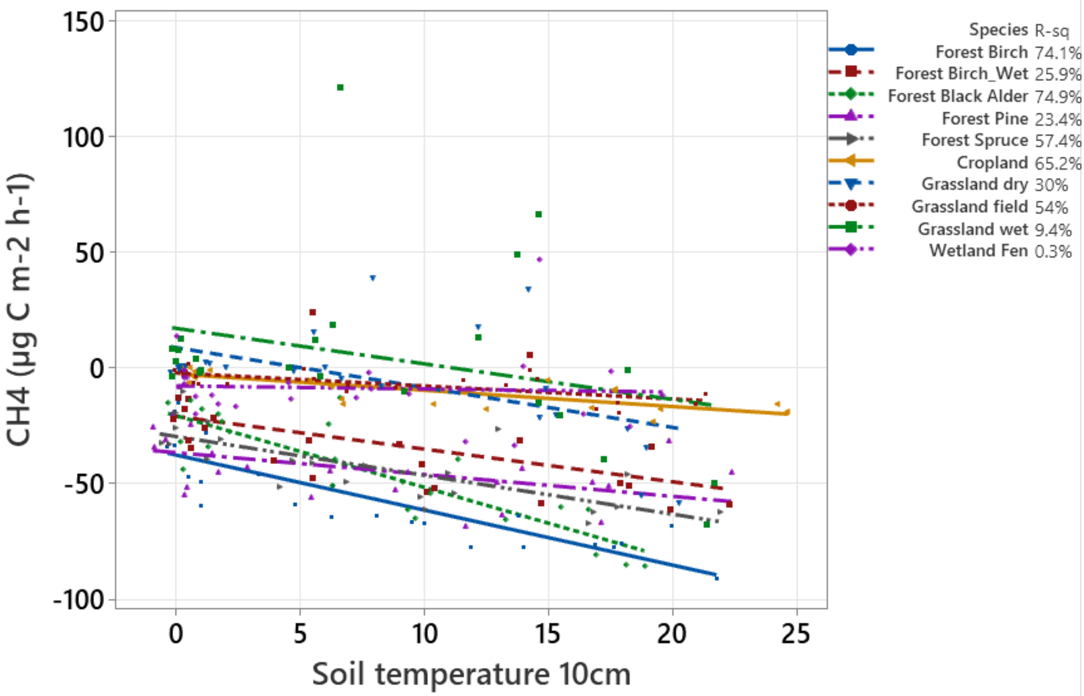
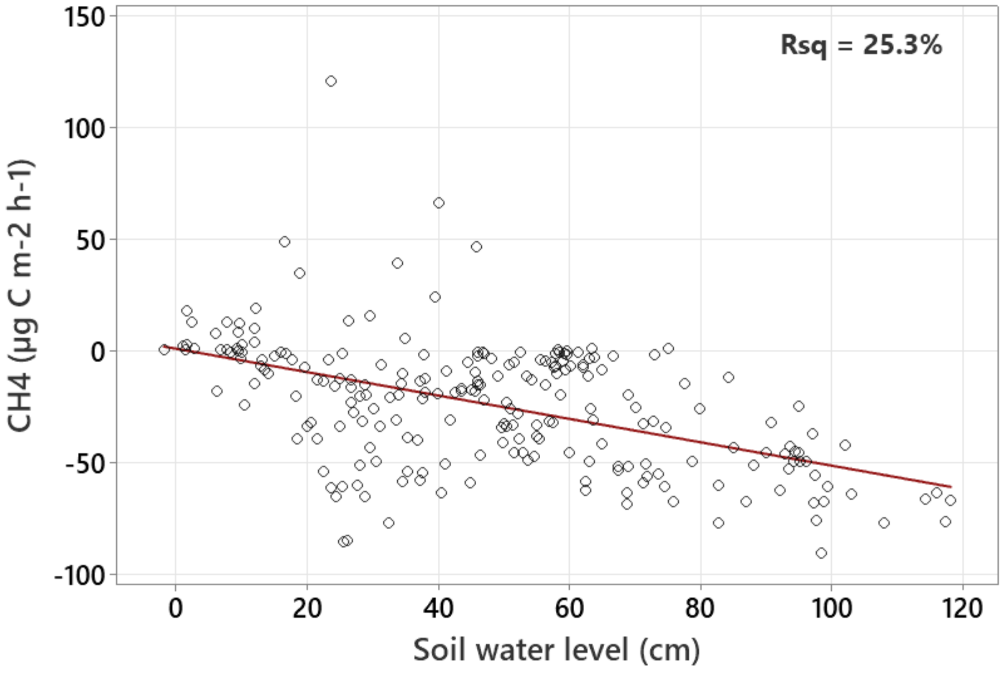


Fig.3 show 95% CI for the Mean. Individual standard deviations are used to calculate the intervals.





Next steps

Microbial gene analysis (soil processes)

Accounting annual litter fall (C/N input into soil)

Soil profile analysis (C/N storage)

Litter decomposition (C/N input into soil)

Above and belowground biomass (C/N input)

Take a home message

- GHG emissions - large seasonal and spatial variabilities
- Soil CO_2 balance similar across land-use types. Higher emissions with higher temperature and lower water level
- CH_4 consumption is greater in forest sites - fluctuating water level cause emissions
- High N_2O emission in forest sites than other land-use types, emphasizing the complexity of underlying soil nutrient status.


Thank you
kamil.sardar@ut.ee