Pētījums “Lēmumu pieņemšanas atbalsta rīka izstrāde integrējot informāciju no vecām daļēji dabiskām mežaudzēm precīzākai oglekļa bilances novērtēšana” (Nr. 1.1.1.1/19/A/130)

13.12.2022. Pētījuma rezultāti prezentēti Eiropas Komisijas Directorate-General for Agriculture and Rural Development (DG AGRI) pārstāvjiem

Ziņojums: Āris Jansons “*Climate change mitigation potential of forests on organic soils: ditch or no ditch?*” (skat. prezentāciju pielikumā).

LVMI Silava un Eiropas Komisijas DG AGRI

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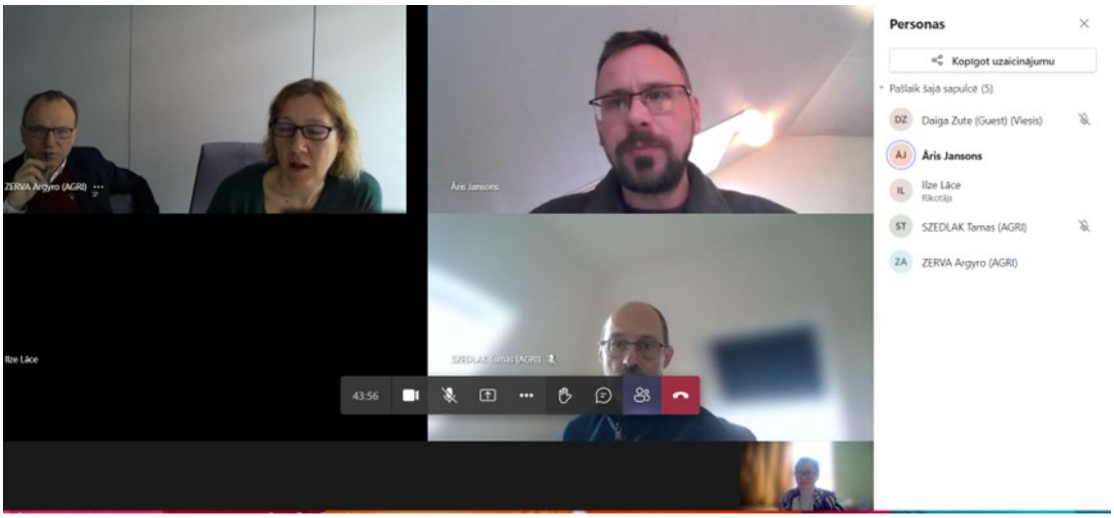

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LATVIJAS MEŽU ĪPAŠUMI

SILAVA

Development of a decision support tool integrating information from old-growth semi-natural forest for more comprehensive estimates of carbon balance”
(ERDF No. 1.1.1.1/19/A/130)

Climate change mitigation potential of forests on organic soils: ditch or no ditch?

MEŽA ADAPTĀCIJA

Āris Jansons

Old-growth Forests in the Context of Climate Policy: discussion with EC
13.12.2022

Topicality

- Old forest stands in the study corresponds to FAO classification n6 category – *old-growth forest* (Buchwald 2005).
- Soils, especially organic soils are stated as large source of greenhouse gas emissions in forest ecosystems. Thus, climate strongly affects carbon exchange in soil and carbon cycle after drainage.
- Growing role of climate change mitigation and old-growth forests have triggered interest of empirical data on drained organic soils, especially in hemiboreal Latvia

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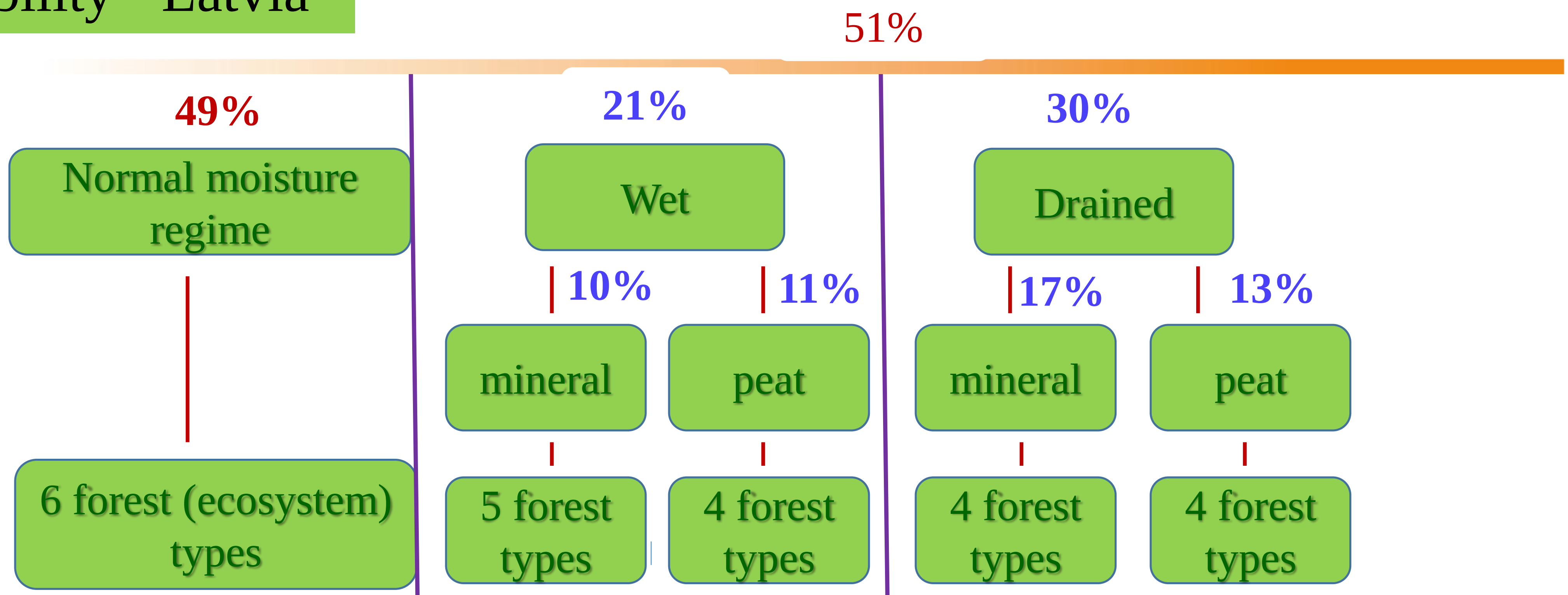
Forest drainage: Sustainability - Latvia

Total 3.3 mil ha



Drained mineral soil – organic layer less than 20cm, drained peat soil – organic layer more than 20cm

The aim

- We aimed to assess soil greenhouse gas flux exchange in old-growth Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*) stands on fertile periodically waterlogged and drained organic soils with contrasting groundwater levels
- To achieve it, we need data characterizing:

1) carbon storage
2) GHG emissions

Study sites: emphasis on long-term effects!

- Forests stands were pre-selected and checked in field for actual occurrence of a chosen forest type, age group (>150 years), dominance of target tree species(>60% from basal area), old trees, no human intervention.
- Drainage systems in selected stands have been established more than 60 years ago

stands on wet (periodically waterlogged) organic soils with high groundwater level **(High GWL)**

stands on drained organic soils with low groundwater level **(Low GWL)**

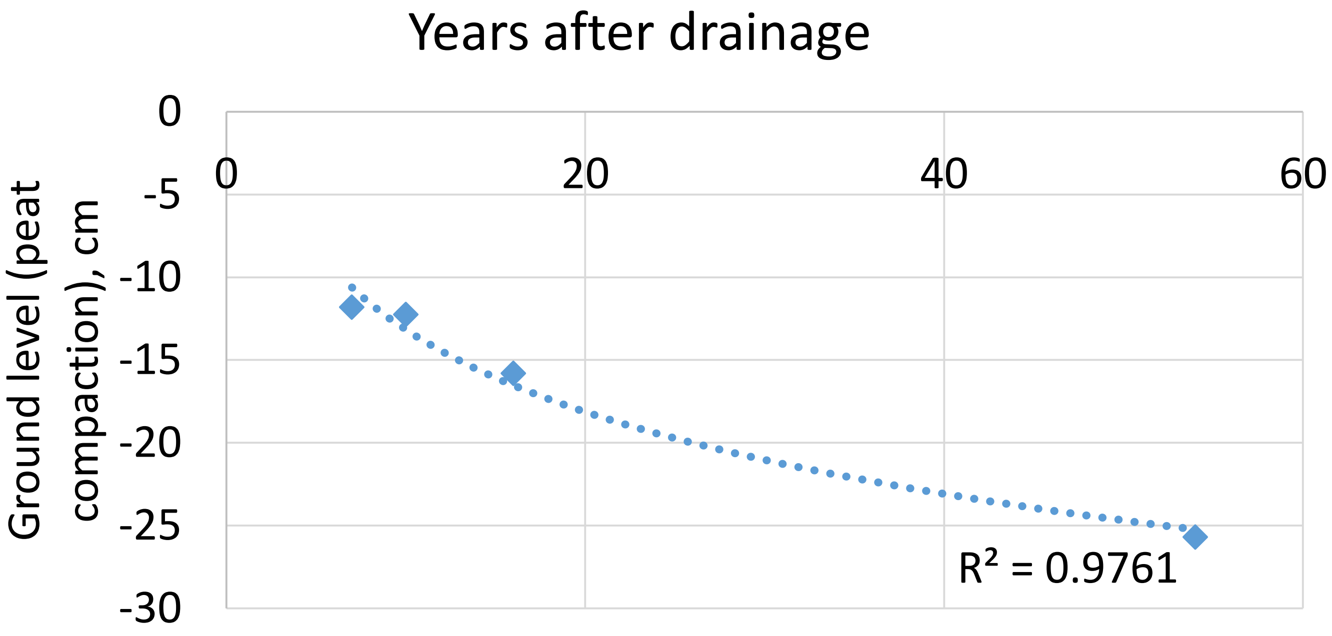
High GWL = season average groundwater level <50cm from ground surface
Low GWL = season average groundwater level >50cm from ground surface

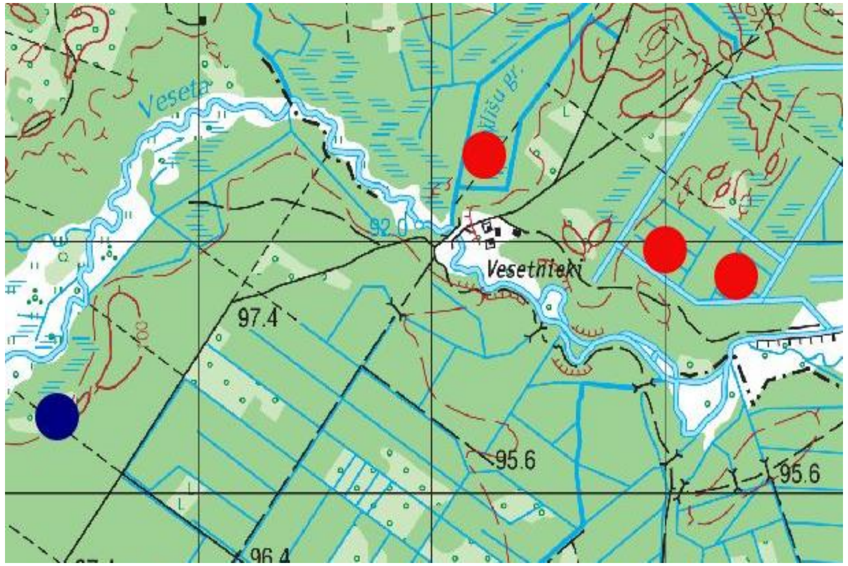
I Carbon storage

Vesetnieki study site

Carbon storage: changes of ground level

- Drainage (ditch) system established in 1960. Ground level measurements in 1966, 1970, 1975, 1977, 2014.
- 54 years after drainage the ground level has decreased by 26 cm

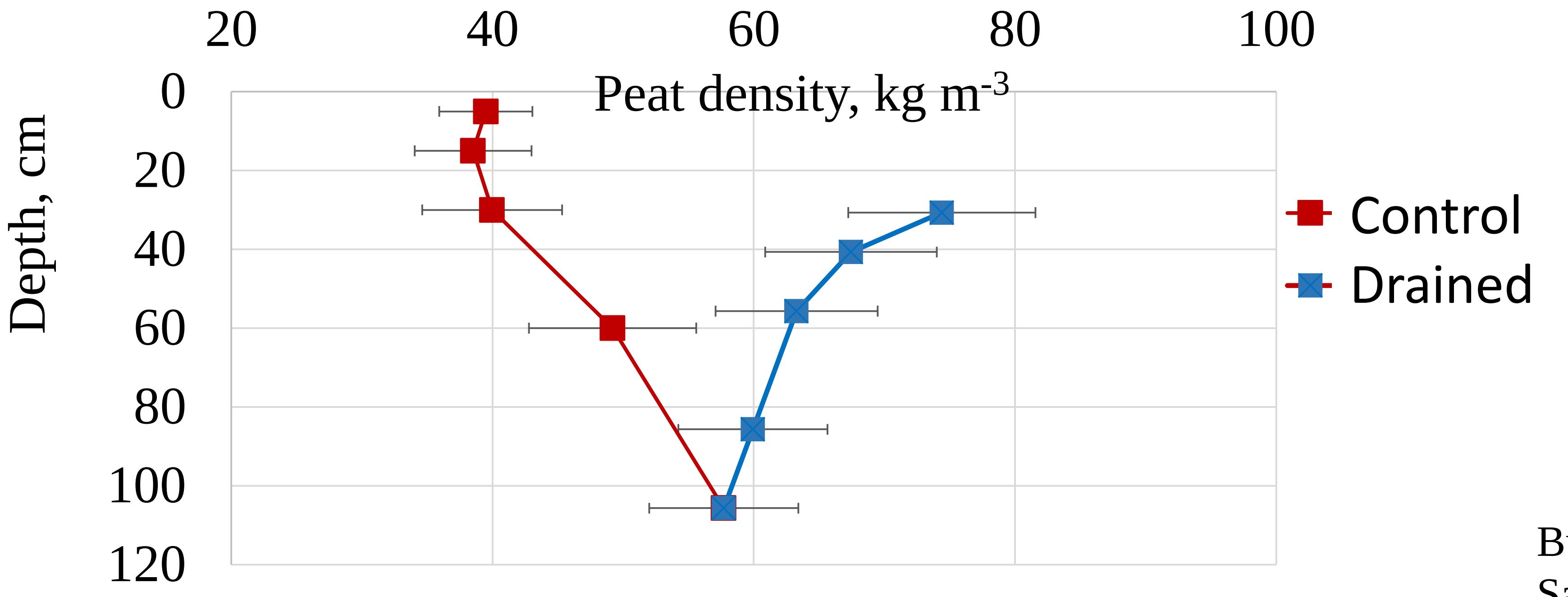




Vesetnieki study site

Lupiķis et al., 2016

Carbon storage: peat soil density



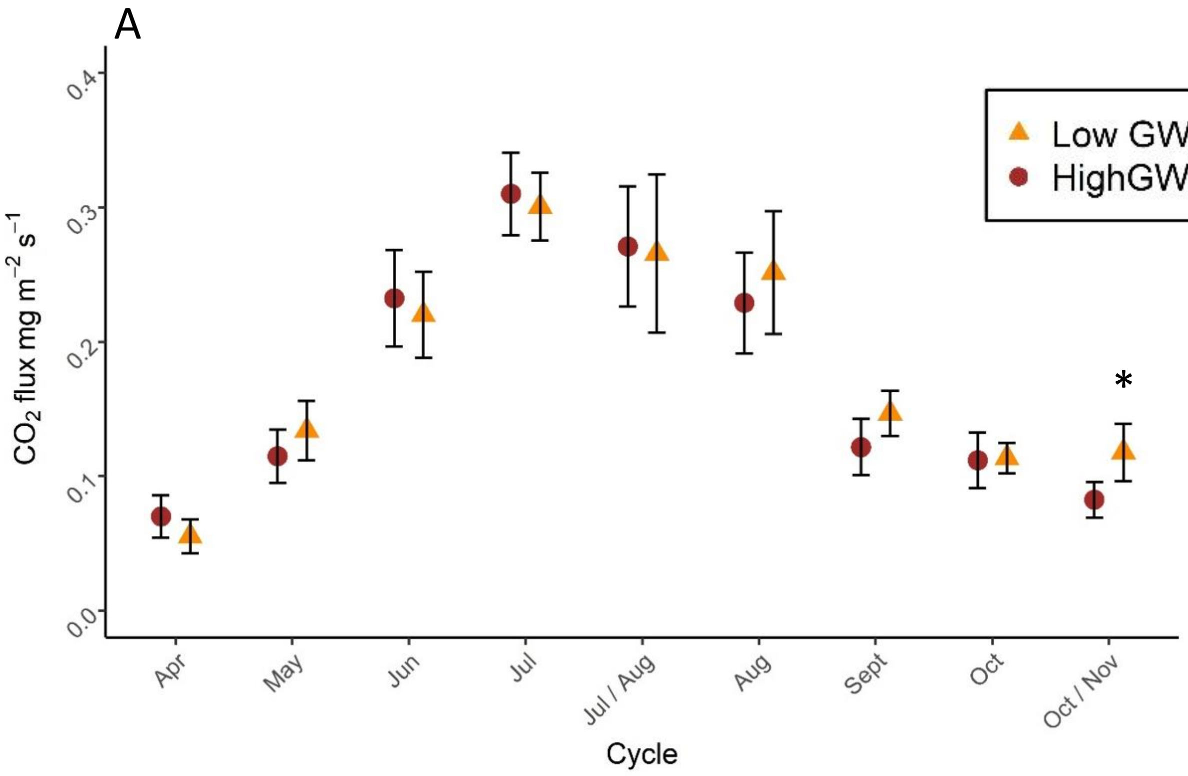
Butlers et.al., 2021
Samariks et al., 2022

- In the analyzed layers peat density (kg m^{-3}) increases significantly
- **No significant differences between soil carbon stock in drained and undrained stands** (60 years after drainage system establishment)
- Significant increase was observed in accumulated tree biomass carbon and deadwood carbon content
- **In one forest rotation cycle stands with a drainage system has accumulated significantly more carbon (additional 71 t C ha^{-1}) compared to forest stands without drainage systems**

II Emissions: soil CO_2 emissions

Scots pine

Norway spruce



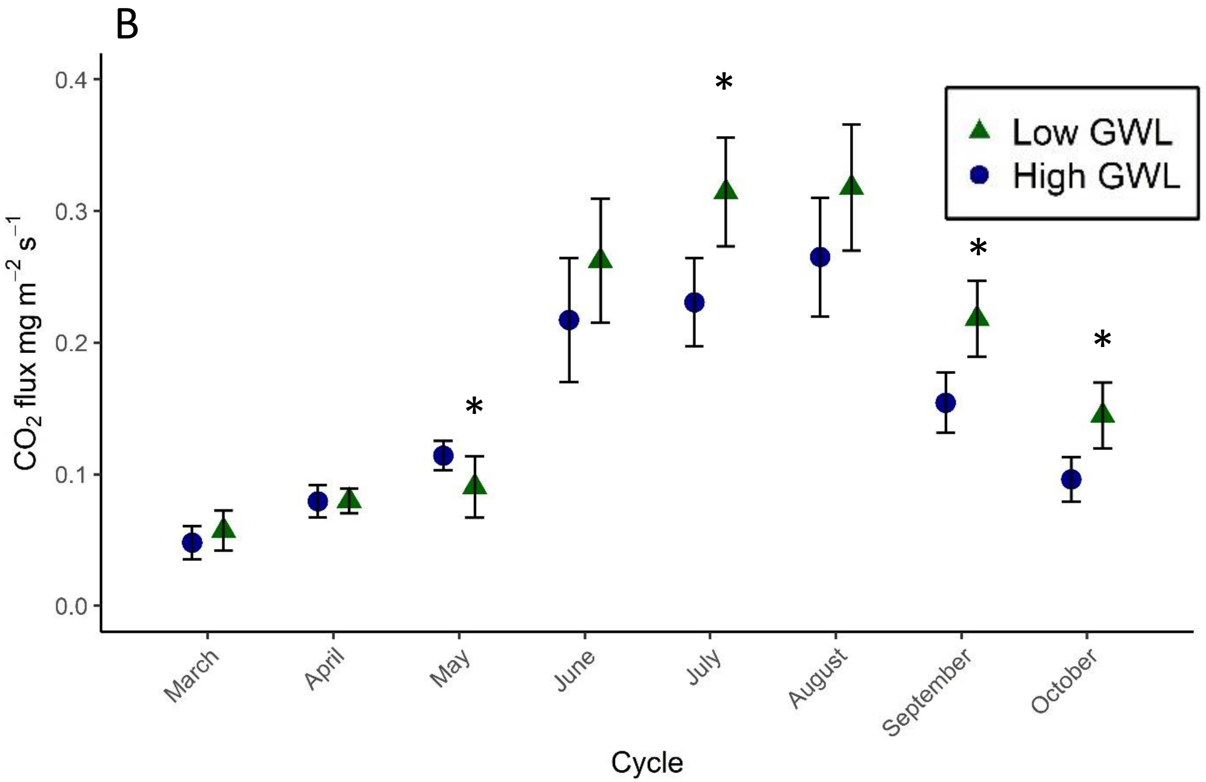


Fig.1 Soil total CO_2 emissions in old-growth Scots pine (A) and Norway spruce (B) stands per measurement month and groundwater level category. Whiskers denote 95% confidence interval. * - significant differences between site categories

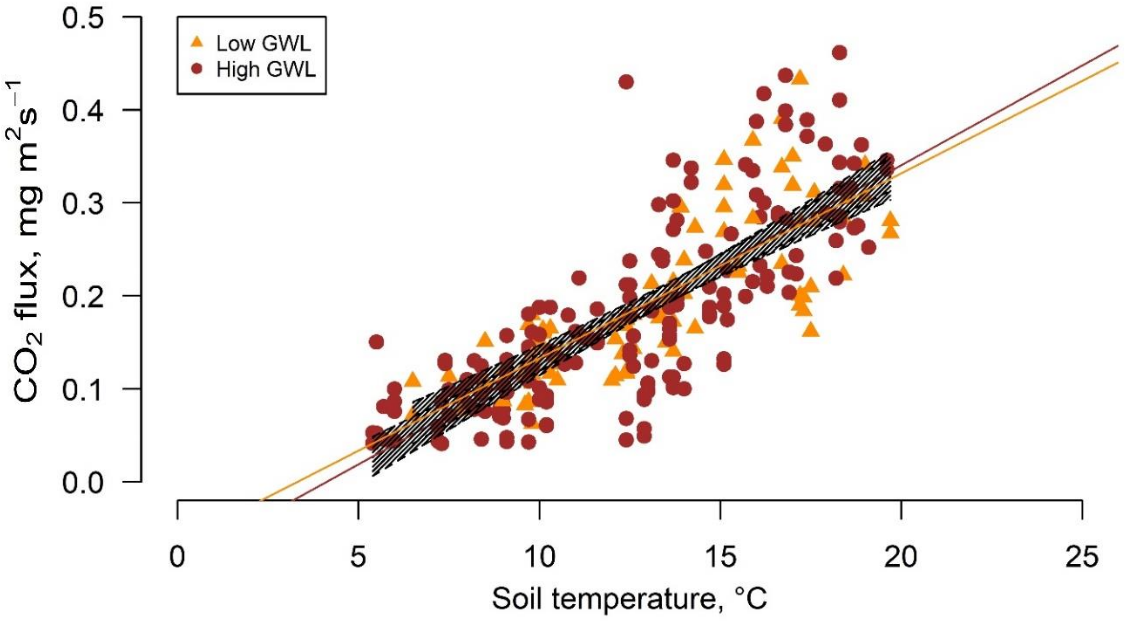
Samariks, Jansons et al., 2022, submitted

Soil CO_2 emissions

Scots pine

Norway spruce

A



B

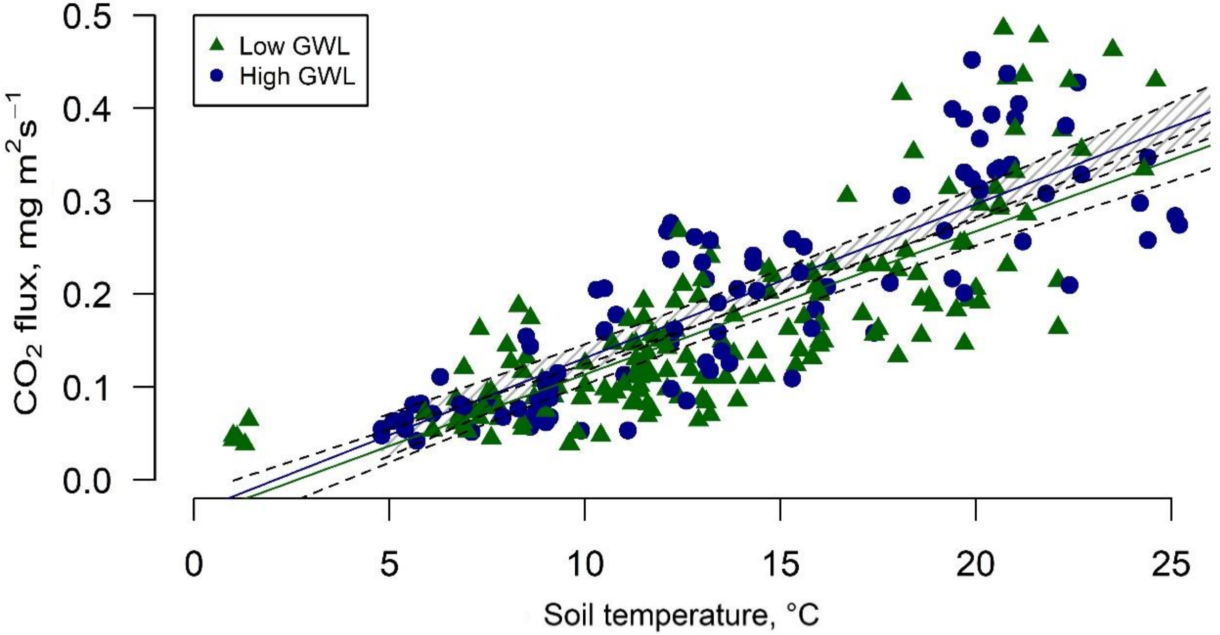


Fig.2 Soil total CO_2 emissions and soil temperature relationship in old-growth Scots pine (A) and Norway spruce (B) stands per groundwater level category. Grey area denotes 95% confidence interval.

Samariks, Jansons et al., 2022, submitted

Soil CH_4 emissions

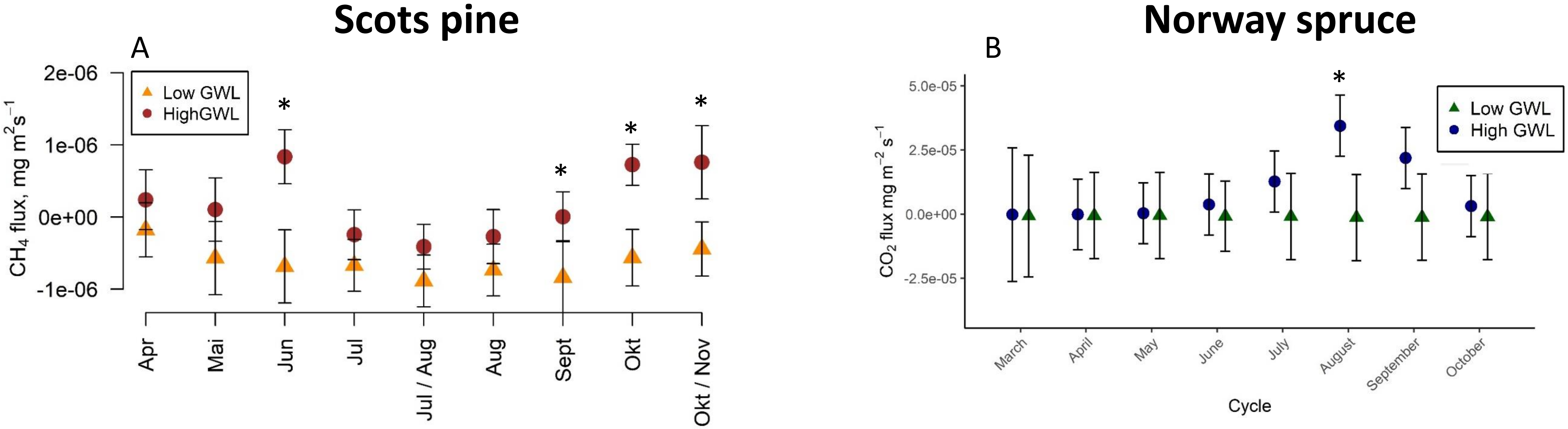


Fig.3 Soil CH_4 emissions in old-growth Scots pine (A) and Norway spruce (B) stands per measurement month and groundwater level category. Whiskers denote 95% confidence interval. * - significant differences between site categories

Season average soil CH4 flux

-6.1e-07 ± 9.43e-08 mg m2 s^{-1}

1.67e-07 ± 1.5e-07 mg m2 s^{-1}

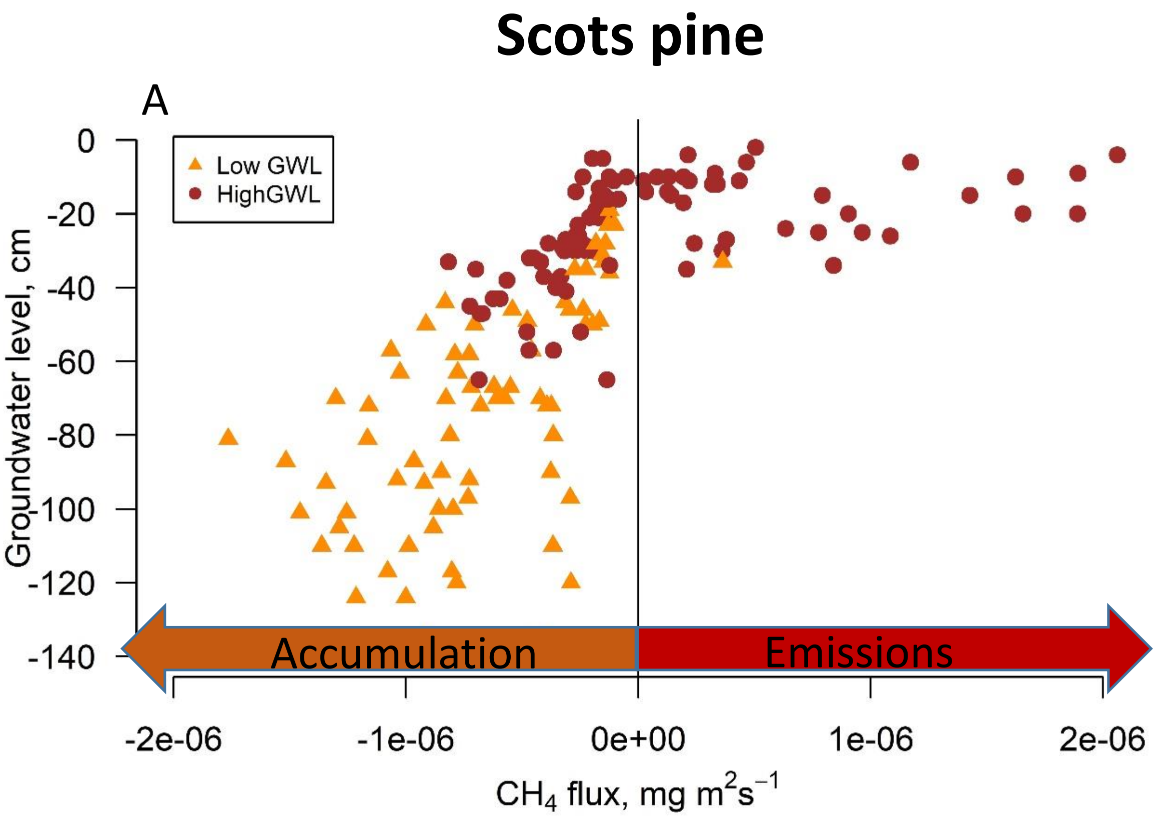
Season average soil CH4 flux

-9.25e-07± 5.95e-06 mg m^2 s^{-1}

1.13e-05 ± 4.51e-06 mg m^2 s^{-1}

Samariks, Jansons et al., 2022, submitted

Soil CH_4 emissions



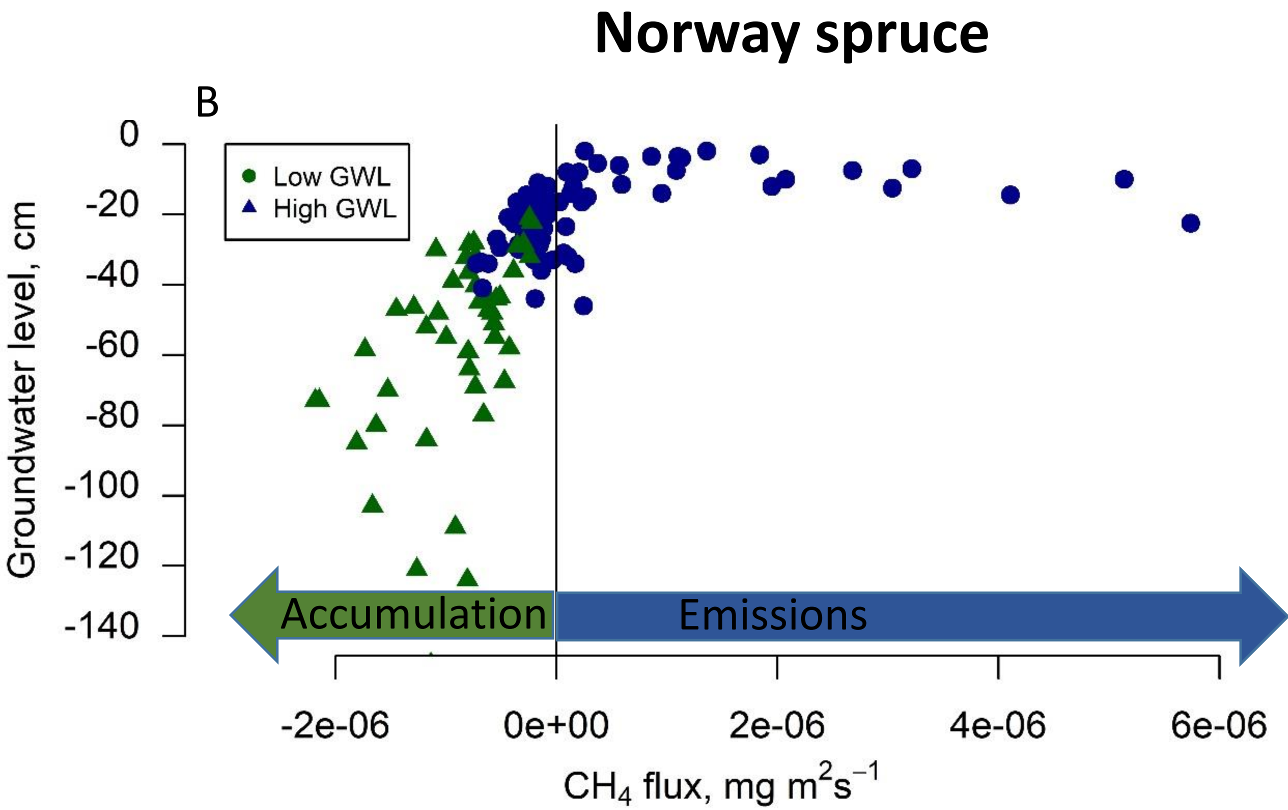
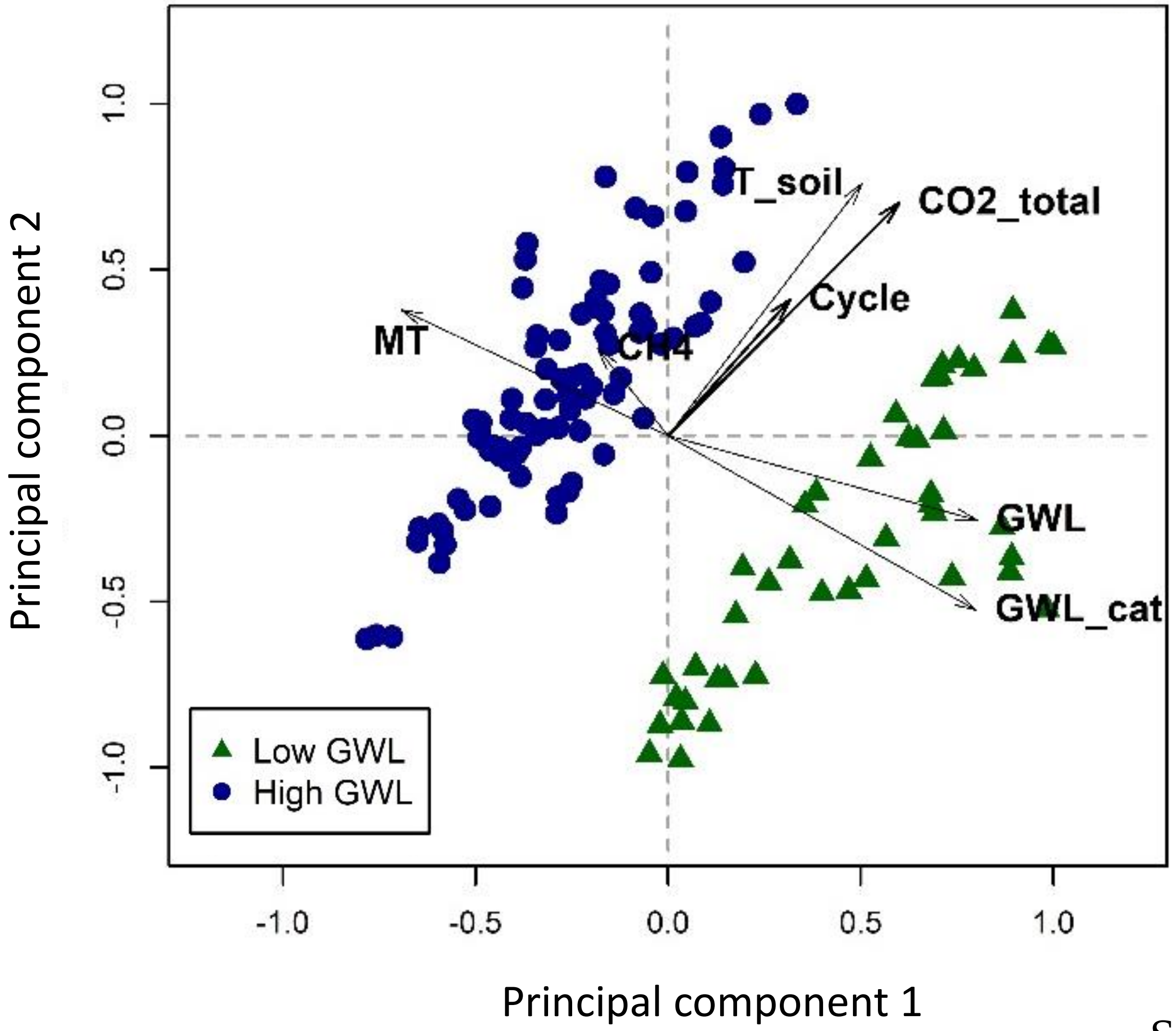


Fig.4 Soil CH_4 emissions and soil temperature relationship in old-growth Scots pine (A) and Norway spruce (B) stands per groundwater level category

Samariks, Jansons et al., 2022, submitted

GHG emission PCA analysis



Samariks, Jansons et al., 2022, submitted

Take-home messages

- Soil is relatively stable carbon pool with minor fluctuations after forest drainage in the long-term
- CO_2 flux has seasonal trend and close relationship with soil temperature.
- Forest drainage reduces CH_4 flux and low/regulated groundwater level can ensure CH_4 accumulation
- Forests on drained organic soils are significant to achieve climate mitigation targets (climate neutrality)

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Thank you for your attention! ☺

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