



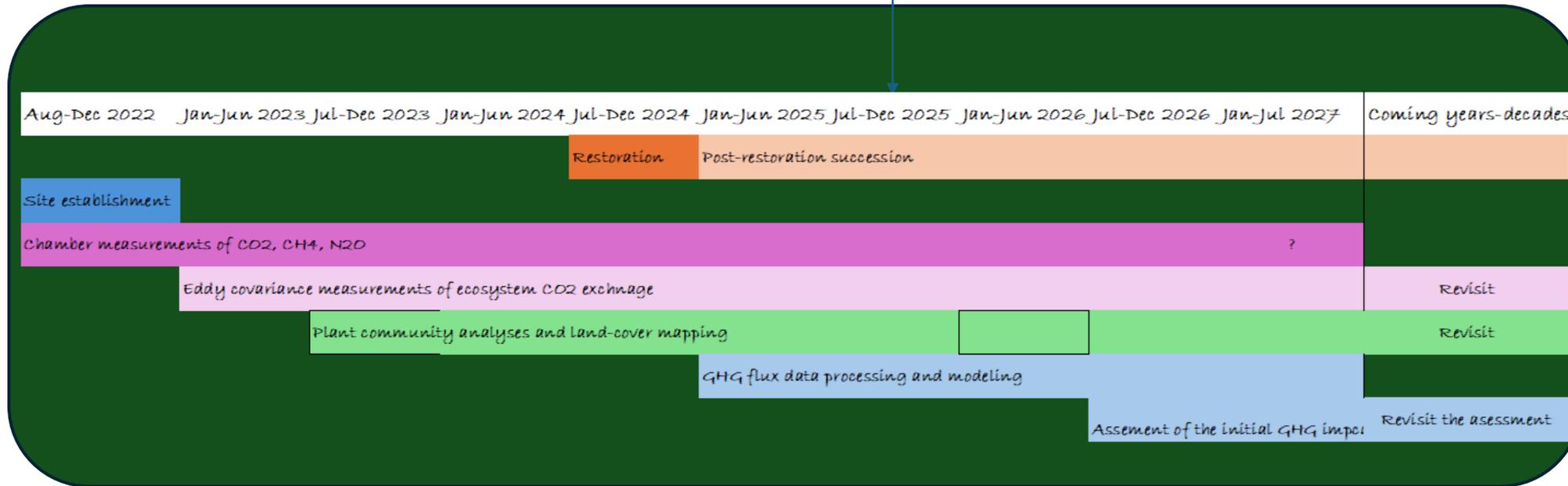
Progress on LIFE Peat Carbon project activities in Finland

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LUKE: A Isoaho, K Peltoniemi, A Korrensalo, P Mäkiranta, I. Mella, H Rokkonen R-K Ruotila, K Pasanen, T Penttilä and UOULU: A Autio, O Nimr, K Jadoon, P Ala-Aho, L Ikkala, A Räsänen

Timeline



We are here



WP2.4 Peatland restoration



Two restoration sites in Northern Finland:

- Matorova Mire (224 ha)
- Välisuo Mire (114 ha)
- Both drained in ~1960

WP2.4. Restoration



- Restoration of Finnish project sites took place in 2024 and lasted about 6 months:
 - removal of trees in winter (50% of the biomass)
 - filling of the ditches, building dams (96 altogether) and directing water to peatland in summer
- Monitoring of restoration impacts continued in 2025: Water table, GHG fluxes, vegetation, microbes



Pre-restoration



Post-restoration works



WP2.4. Restoration

- Pre-drainage, drainage and restoration of Matorovansuo, NLS aerial images
- Changes in tree cover and ditching visible



WP2. 4. Restoration



- Matorovansuo flux tower before and after restoration

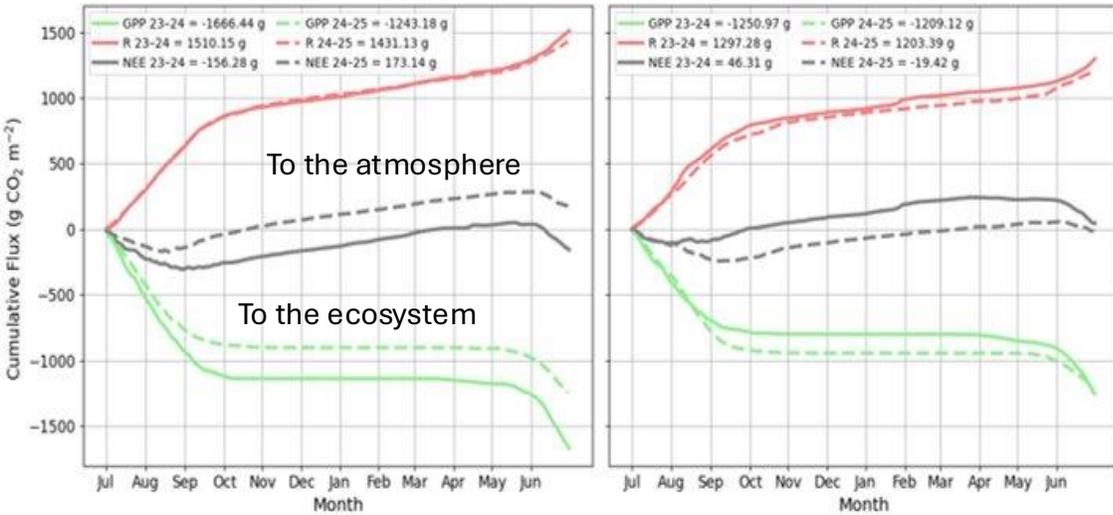


WP3.4. GHG measurements

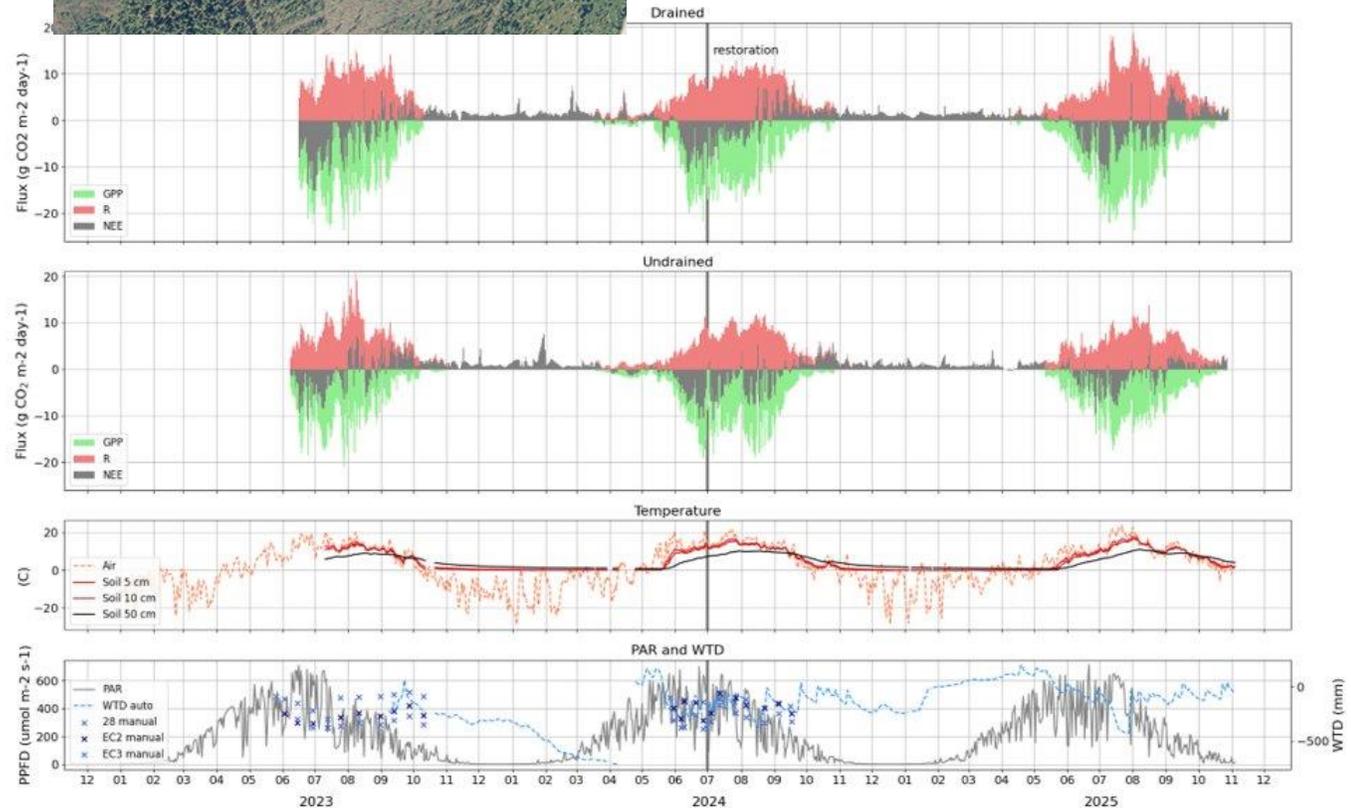
- Continuing CO₂, CH₄, and N₂O measurements in Välisuo and Matorovansuo
- Eddy covariance tower at Matorovansuo

Drained (Jul 2023 to Jul 2024)
Rewetted (Jul 2024 to Jul 2025)

Undrained



PeatCarbon

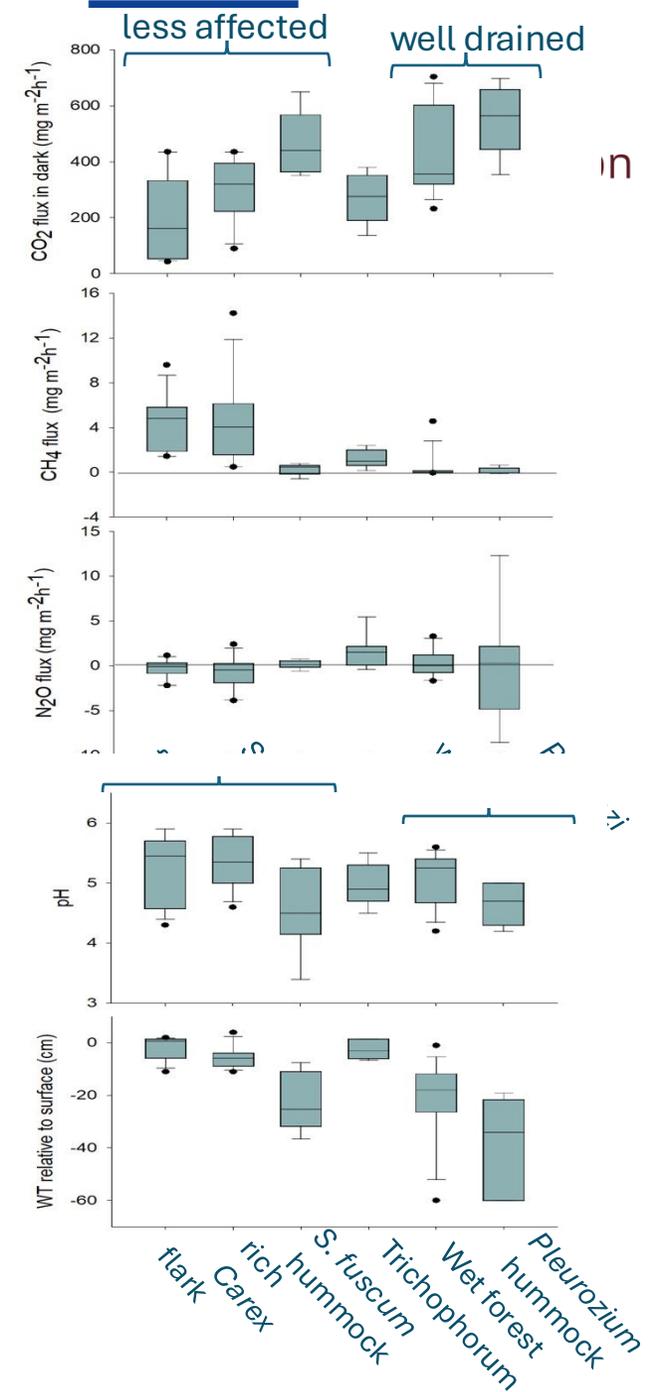
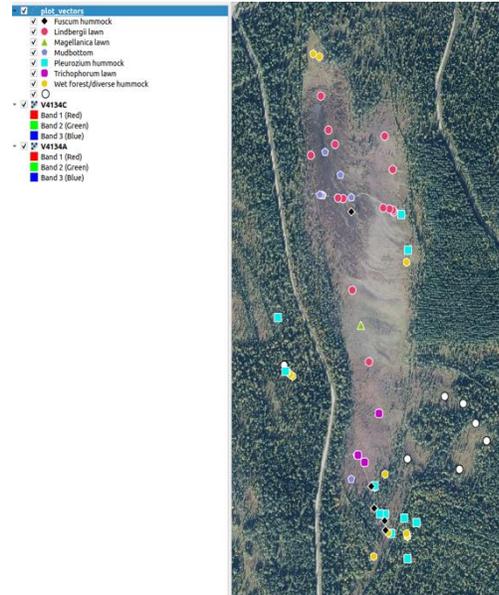


- See presentation by Kiello Isomäki/FMI



WP3.2. GHG and Vegetation measurements

- Chamber flux measurements at 60 points
- Visits in Pallas 2025 for GHGs and vegetation: Last week of May, Mid-June, first and last week of July, August, September, October
- Vegetation inventory in the GHG-collars: Clustering of plots to six microhabitats

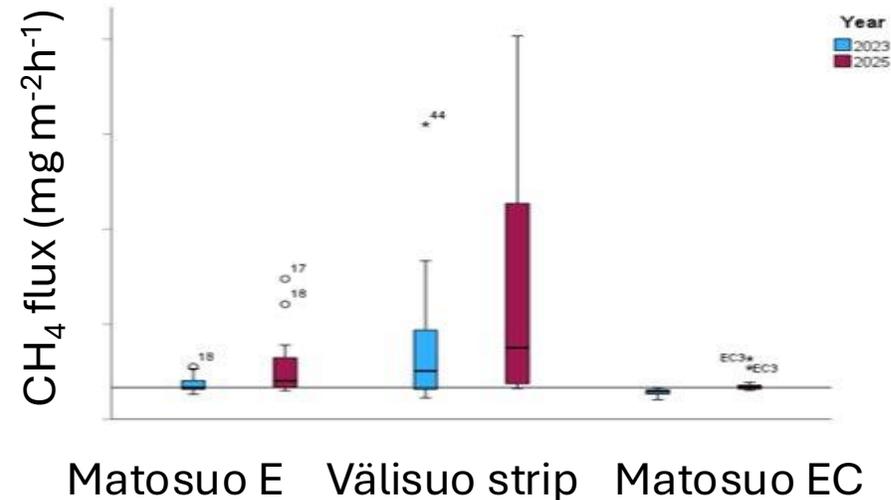
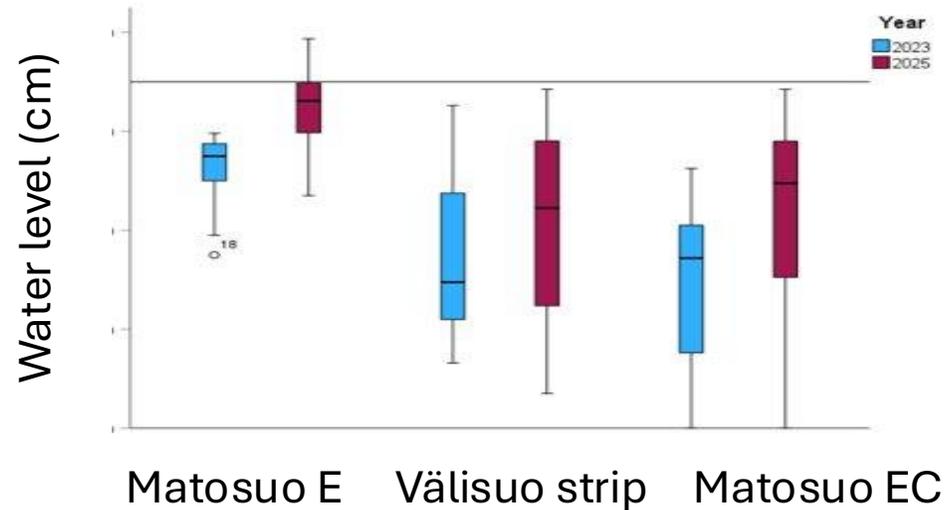


WP3. 4. GHG measurements

Chamber measurements:

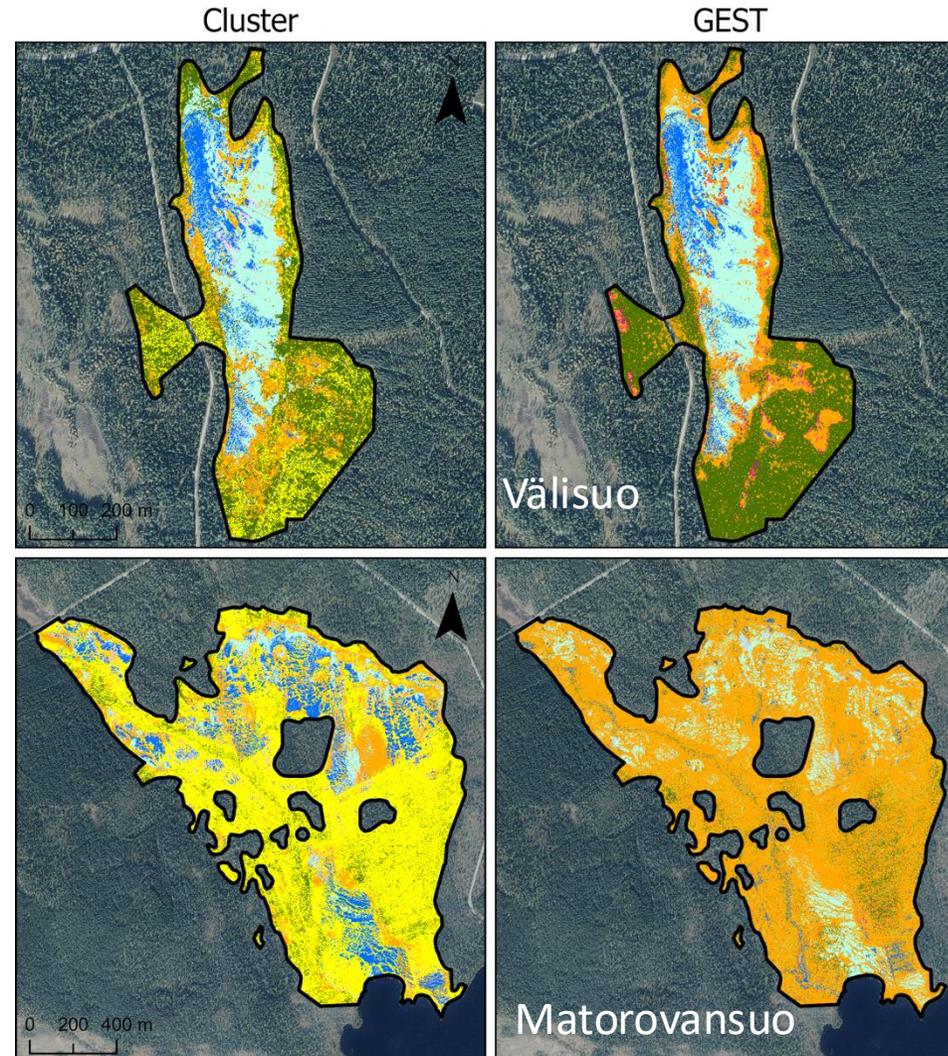
- Undrained sites: No difference in mean cluster specific WTD or CH₄ flux before and after rewetting
- All drained: No significant changes in CH₄, some in WTD for the driest locations
- Drained sites that had changed most after ~1970: Median WT and CH₄ fluxes increased from 2023 to 2025

Sites with large drainage impact: Before rewetting (2023, blue) and after (2025, red)



WP3. 7. Vegetation studies

- August 2025: Water table measurements from vegetation plots
 - Vegetation inventories: 206 plots, linked to FMI clustering
 - Drone flights (UEF): Multispectral and thermal imagery, drone LIDAR for topography
 - NLS aerial images
 - Upscaling of microhabitats and comparison to upscaled GEST types
- > see presentation by Aleksi Isoaho



Cluster

- (1) Flark
- (2) Trichophorum lawn
- (3) Rich carex lawn
- (4) Pleurozium hummock
- (5) S. fuscum hummock
- (6) Wet forest

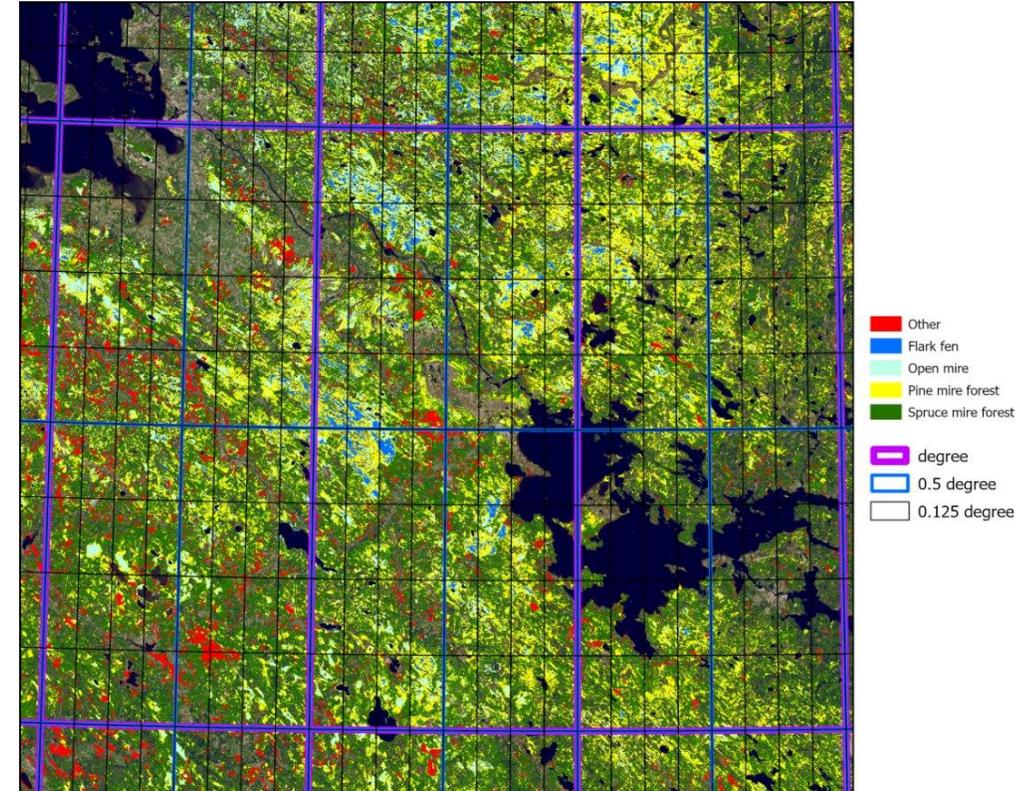
GEST

- Moderately moist forest and shrubberies (OL)
- Moist forests and shrubberies (OL)
- Very moist bog heath
- Very moist forests and shrubberies (OL)
- Wet meadows and forbs
- Wet peat moss hollows resp. flooded peat moss lawn
- Wet peat moss lawn with pine trees
- Wet small sedges reeds mostly with moss layer

WP3. 7. Vegetation studies



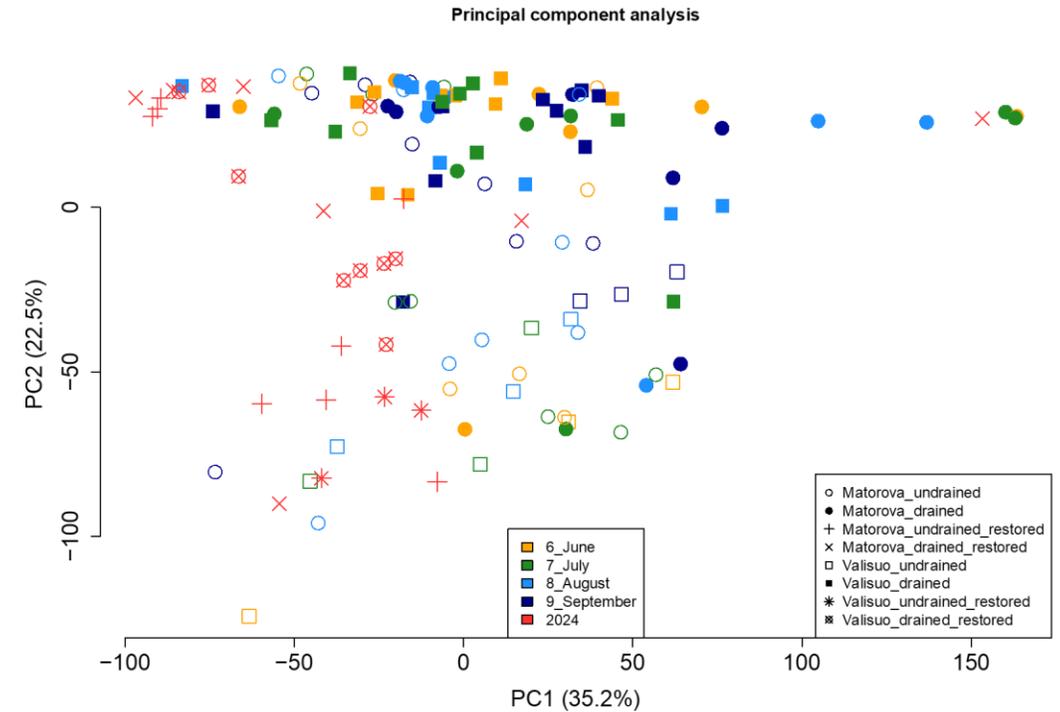
- Upscaling to country level using four habitats:
flark fen, mire, spruce mire forest, pine mire forest
- Water table statistics for the habitats from University of Oulu
-> see presentations by Aleksi Isoaho and Kielo Isomäki



WP3 T6 Microbial and soil studies



- Samples for microbial community composition and activity from 53 GHG points before and after restoration
- Right after restoration: microbial response on functional level. The samples with red color are the ones after restoration and a shift from the before restoration samples can be seen.
- Soil sampling for analysis for testate amoeba and radio carbon dating in August
- Soil decomposition experiment started in September, running for two years



Active microbial genes

WP3.3. Hydrological monitoring



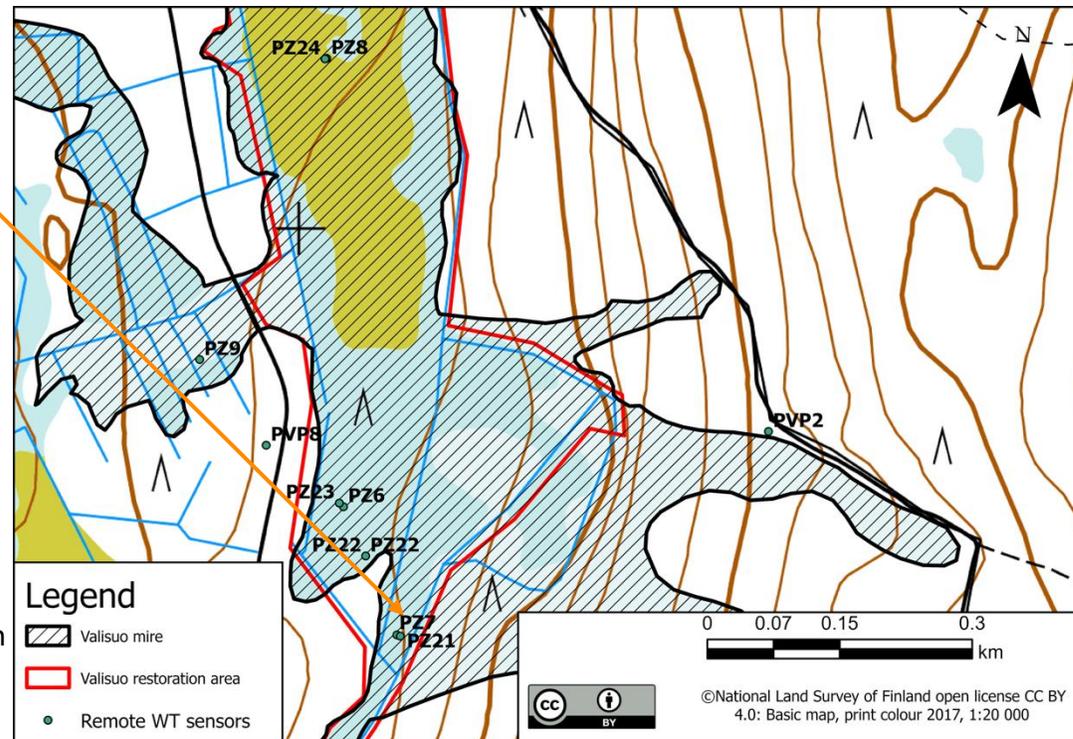
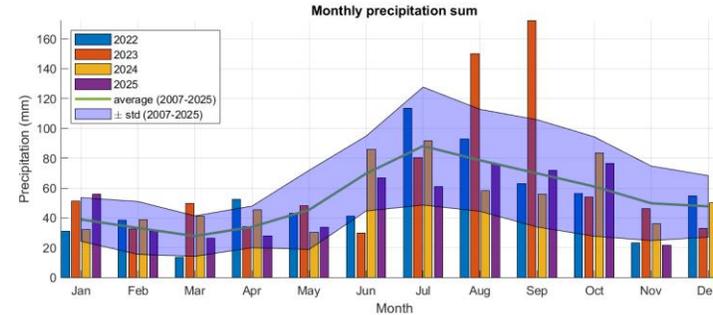
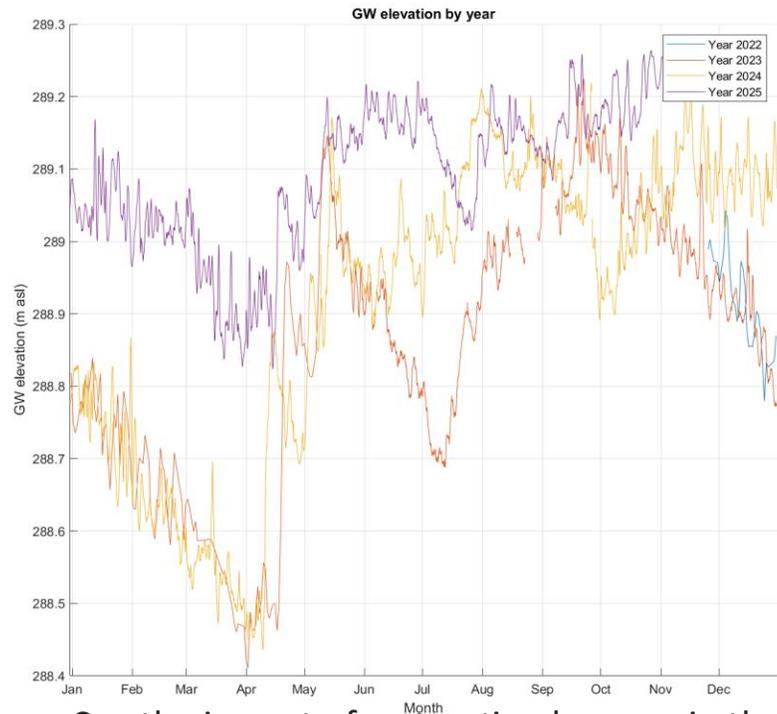
Field work activities:

- Installation of the water level sensor in the Mato-oja stream
June 2025
- Summer GW monitoring campaign 8-10th July 2025

Modelling and data analysis:

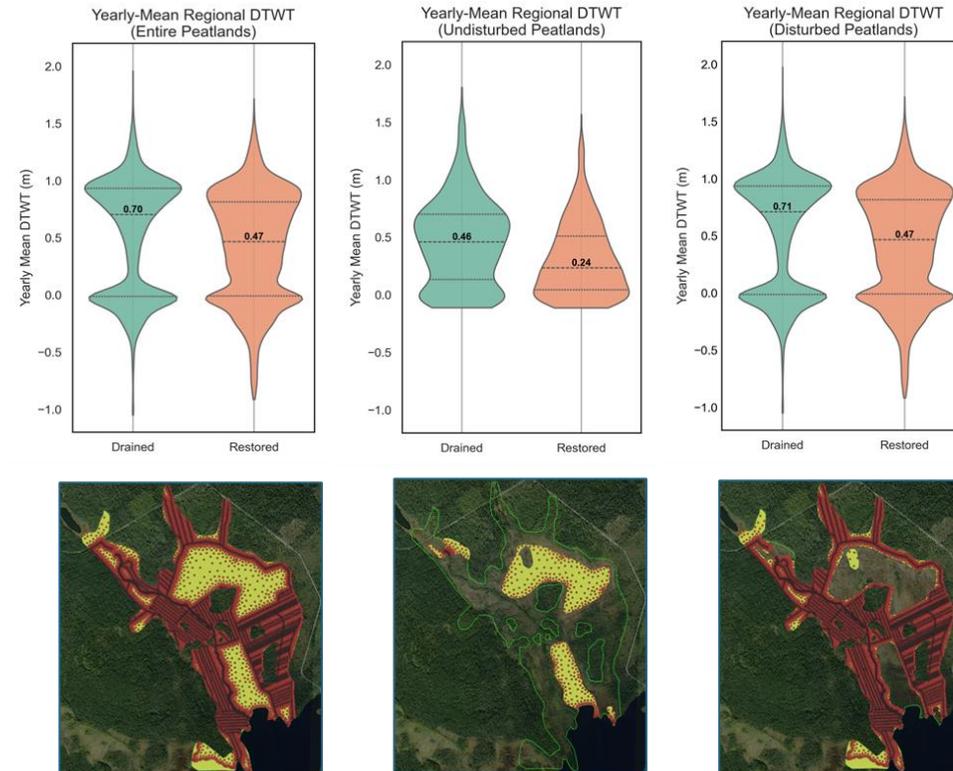
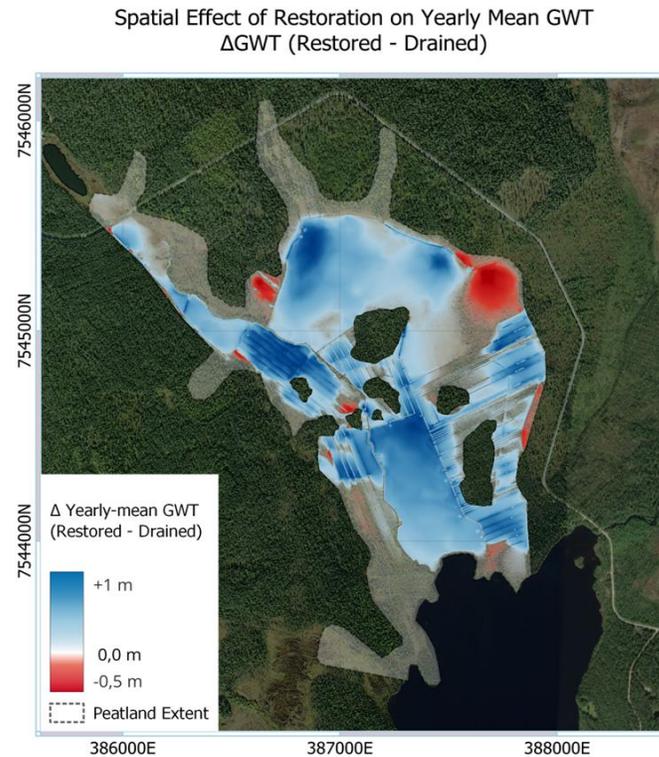
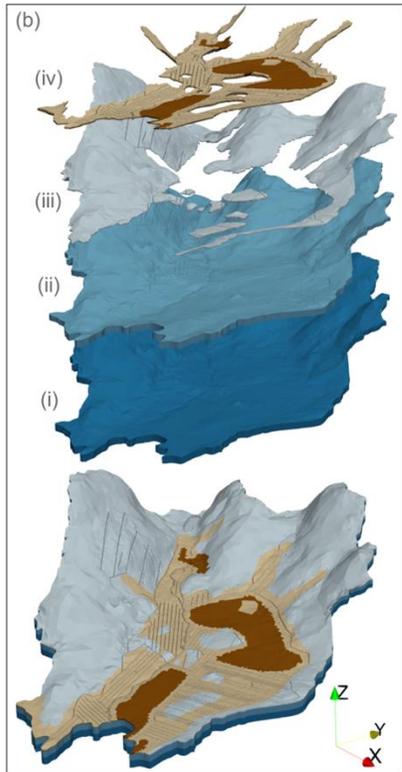
- Continuous GW measurements
- Steady-state/transient models for the drained and restored cases in Matorovasuo

WP3. 3. Hydrological monitoring



- Can the impact of restoration be seen in the measured groundwater levels?
- Some of the wells show significant gw level rise like in the example above
- Overall, the impact of the restoration can be seen clearly in Välisuo in most of the wells, but this is not in the case Matorovasuo

WP3. 3. Hydrological modelling



Restoration effects reach beyond their local boundaries, influencing areas far from where actions occur.

- See presentation by Omar Nimr/ University of Oulu

WP3 T8-9 JSBACH ecosystem model: Pallas habitats

- Six habitats for the sites
- PFTs assigned to each habitat

Boreal evergreen coniferous trees
Boreal deciduous broadleaf trees
Evergreen shrubs
Deciduous shrubs
Mosses
Sphagnum
Herbs
Aerenchymatous plants

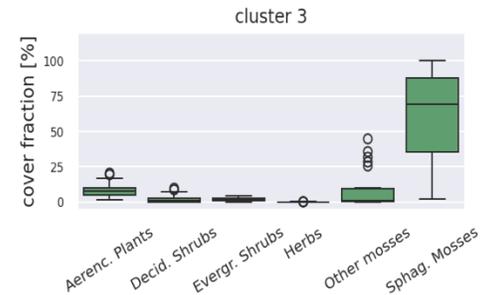
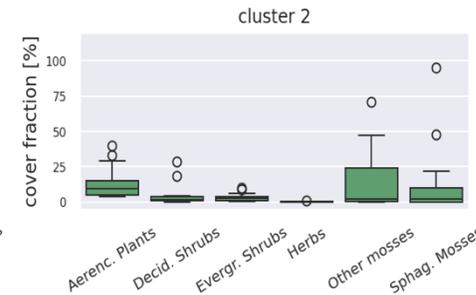
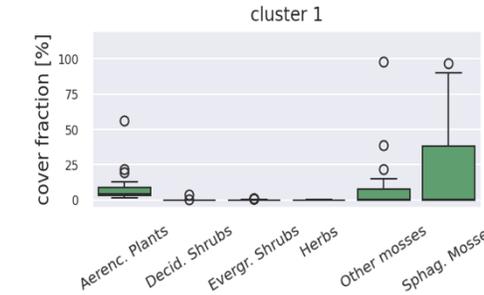
Habitat 1:
Flark



Habitat 2:
Trichophorum
lawn



Habitat 3:
Rich
carex lawn



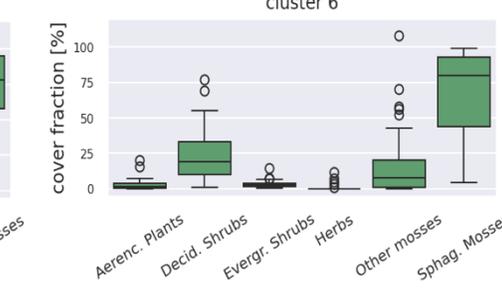
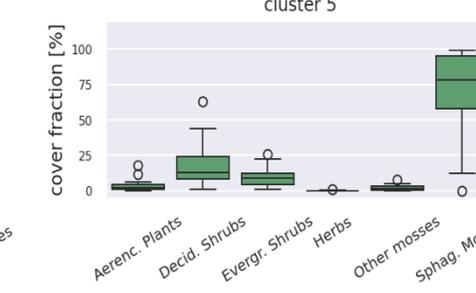
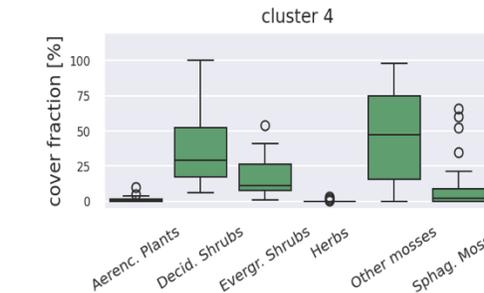
Habitat 4:
Pleurozium
hummock
+ tree cover



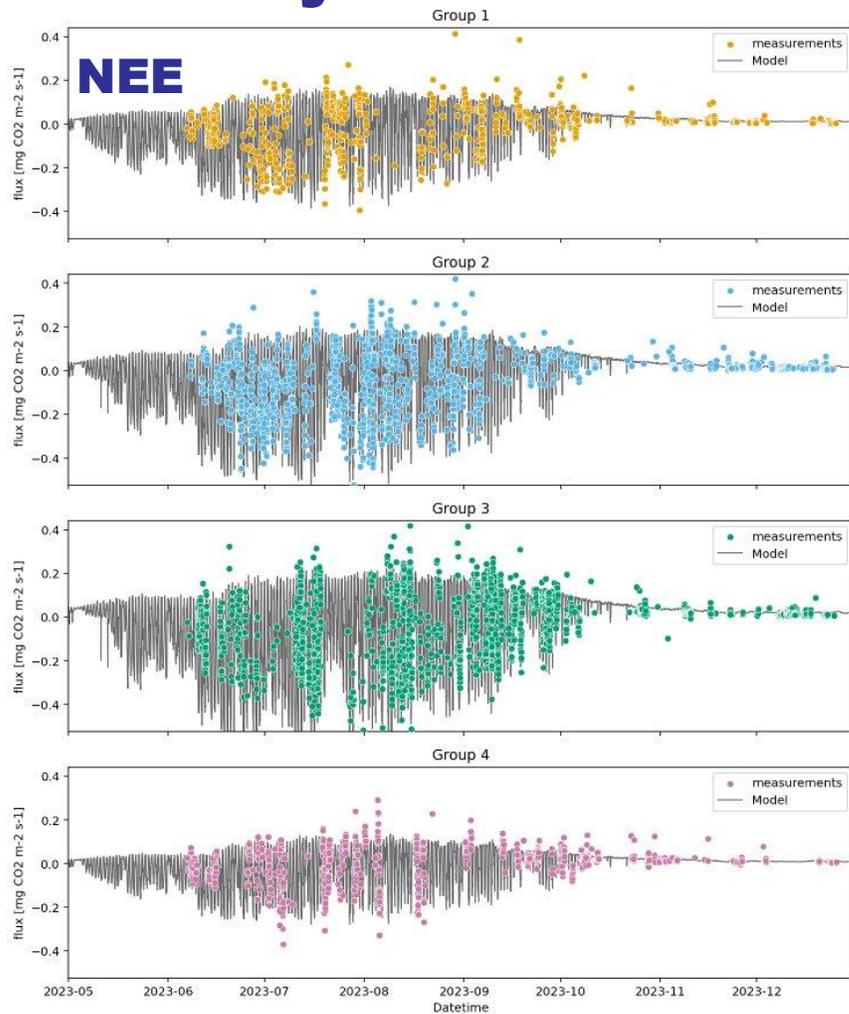
Habitat 5:
S. fuscum
hummock
+ tree cover



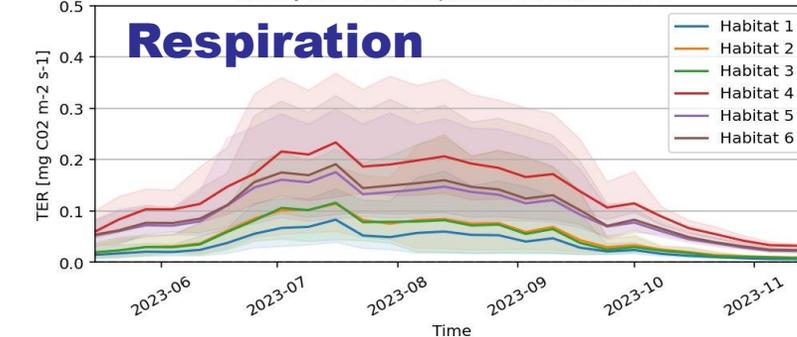
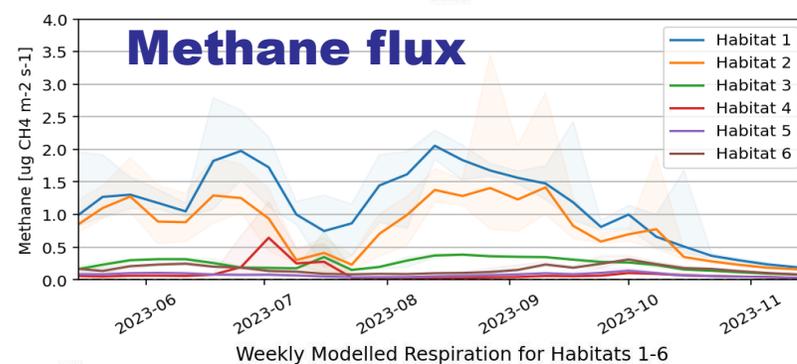
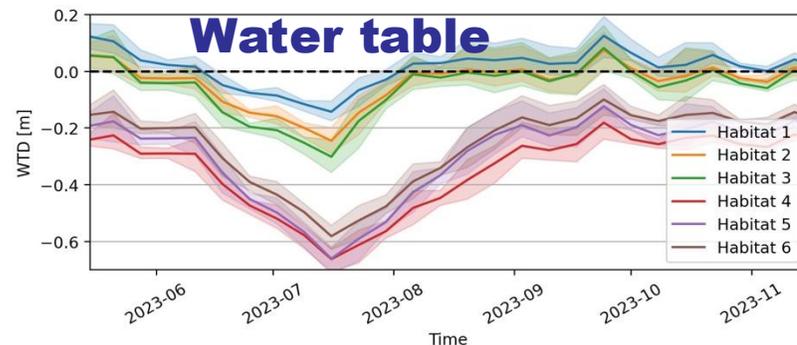
Habitat 6:
Wet forest
+ tree cover



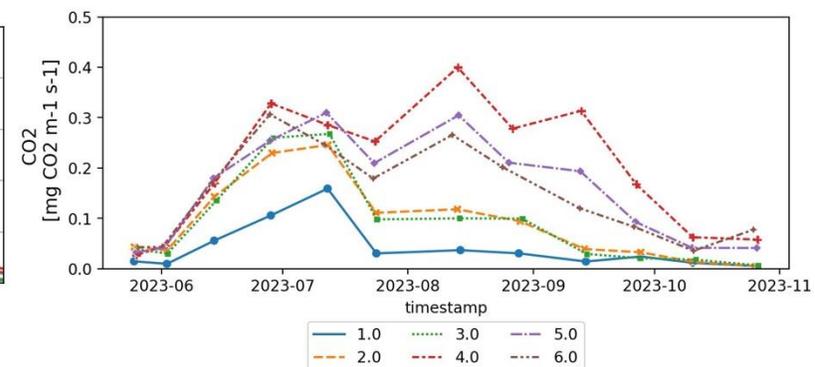
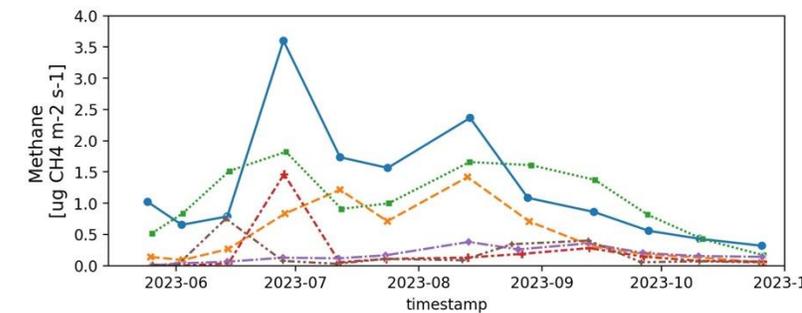
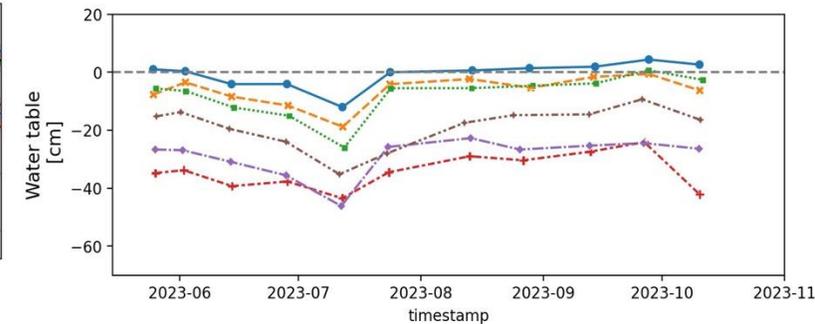
Comparison against Matorova eddy covariance fluxes by wind sector



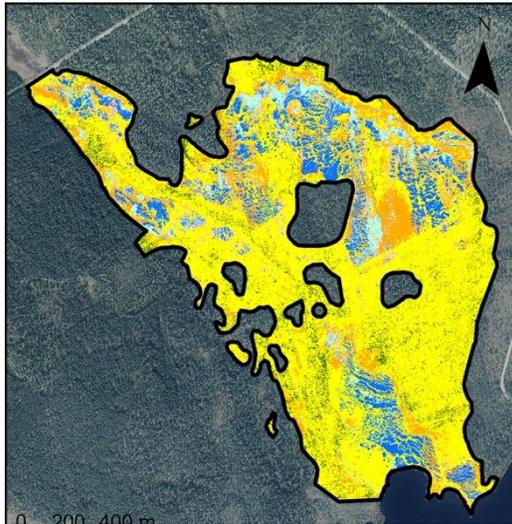
Habitat simulations



obs



Matorovansuo growing season (June-August) GHG balances



Cluster

- (1) Flark
- (2) Trichophorum lawn
- (3) Rich carex lawn
- (4) Pleurozium hummock
- (5) S. fuscum hummock
- (6) Wet forest

Habitat	Area [ha]	CH ₄ [gC m ⁻²]		CO ₂ [gC m ⁻²]	
		Model	Chamber	Model	Chamber
Flark	18.2	8.7	10	-13	-13
T. lawn	8.3	5.5	4.9	-29	-
R. carex lawn	19.1	1.6	7.8	-31	-28
P. hummock	60.7	0.8	1.7	124	-
S. fuscum hummock	35.7	0.4	1.0	57	-
Wet forest	33.9	0.8	1.0	80	-

Aggregated balances from JSBACH and GESTs

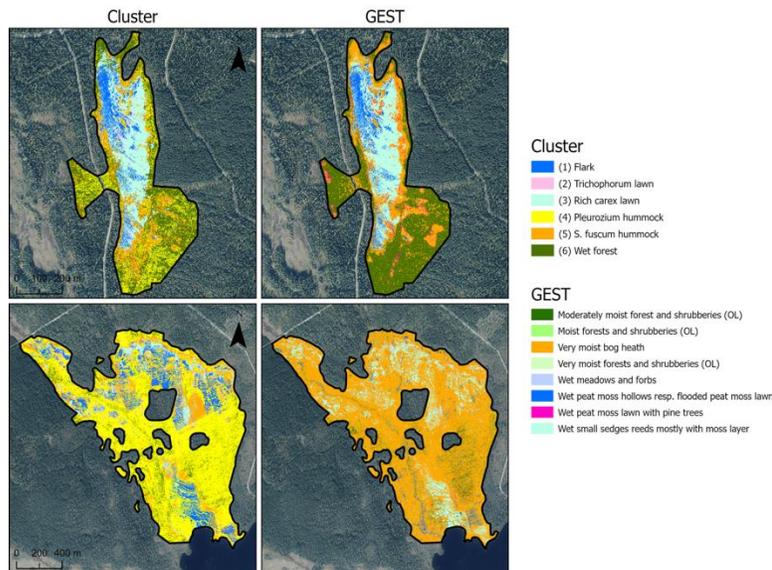


Välisuo

	Area [ha]	Annual CH4 [t CO2 -eq.]	Annual CO2 [t CO2 -eq.]
JSBACH	28.4	15	-33
GEST	28.4	128	144
Chambers	28.4	35	Not ready

Matorovansuo

	Area [ha]	Annual CH4 [t CO2 -eq.]	Annual CO2 [t CO2 -eq.]
JSBACH	175	88	-224
GEST	175	878	435
Chambers	175	201	Not ready



- Chamber balance includes only June-August, other values are annual
- GEST balances were computed using values for ground vegetation only.
- JSBACH simulations include tree biomass which explains the CO2 sink capacity
 - Comparable to the forest CO2 from eddy covariance data

The comparability between the values is approximate at best, but the differences are logical when taking the differences into account.

-> Further development of JSBACH PFT descriptions

-> Regional simulations of climate change mitigation potential of peatland restoration in Finland and Latvia: Future scenarios with four new habitats

WP5-6 Outreach

- **Project meetings**

- Remote meetings related to vegetation analysis, remote sensing, modeling, upscaling

- **Conferences and meetings**

- Scientific meeting of Finnish environmental infrastructures (ACTRIS, AnaEE, eLTER & ICOS), April 2025
- Visit to MPI Hamburg for JSBACH development, July 2025
- INTECOL Wetlands conference, Tartu, July 2025
- Remote meetings with VU regarding peatland model development

- **Communication with policy makers and stakeholders**

- A meeting with inventory makers at FMI (April 2025)



WP5-6 Outreach

• Web-stories and news

- Related to restoration, meetings and visits
- LIFE Finnish pages in FMI, LUKE, UOulu webpages:
 - <https://www.ilmatieteenlaitos.fi/peatcarbon>
 - <https://www oulu.fi/en/projects/peatland-restoration-for-greenhouse-gas-emission-reduction-and-carbon-sequestration-baltic-sea>
 - <https://www.luke.fi/en/projects/lifepeatcarbon>
- Peatland-project focused web-page at FMI with info on LIFE Peat Carbon in english:

<https://en.ilmatieteenlaitos.fi/climate-impacts-of-peatland-land-use>



WP5-6 Outreach

- LIFE PMT V Project meeting, June 10-12, Helsinki
 - Programme of the meeting included the following topics:
 - Evaluation of ecosystem services
 - Remote sensing, GEST types, vegetation analysis and habitats, microbes
 - Ecosystem and hydrological modeling
 - Upscaling, replication, exploitation of results
 - Communication activities
 - Invited Guest Lecture by Igors Semjonovs ' Peatland restoration and carbon crediting: experiences in Latvia' for FMI personnel (~50 researchers at site and remotely)
 - One day field trip (~18 pers) to restoration sites near Helsinki (restored Rottasniitunsuo, undrained Tervalaminsuo)
 - After meeting visit to Pallas for vegetation analyses and GHG sampling with Latvian colleagues

