



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Greenhouse gas monitoring and ecosystem modelling in Finland

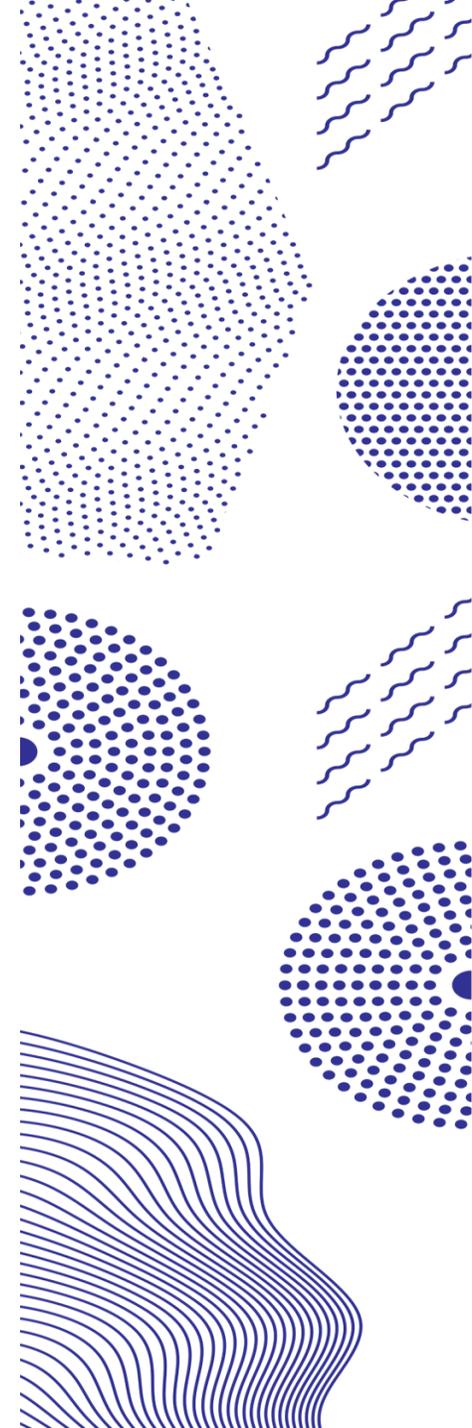
K. Isomäki, J. Chapman, A. Isoaho, T. Markkanen, M. Aurela, S. Gerin, S. Juutinen, A. Korrensalo, A. Leppänen, M. Raivonen, A. Räsänen, T. Aalto.

14.11.2025

Nimi



Measurements





Timeline

↓ We are here



Matorovansuo

Pre-drainage

Pre-restoration

Pre-restoration

Post-restoration

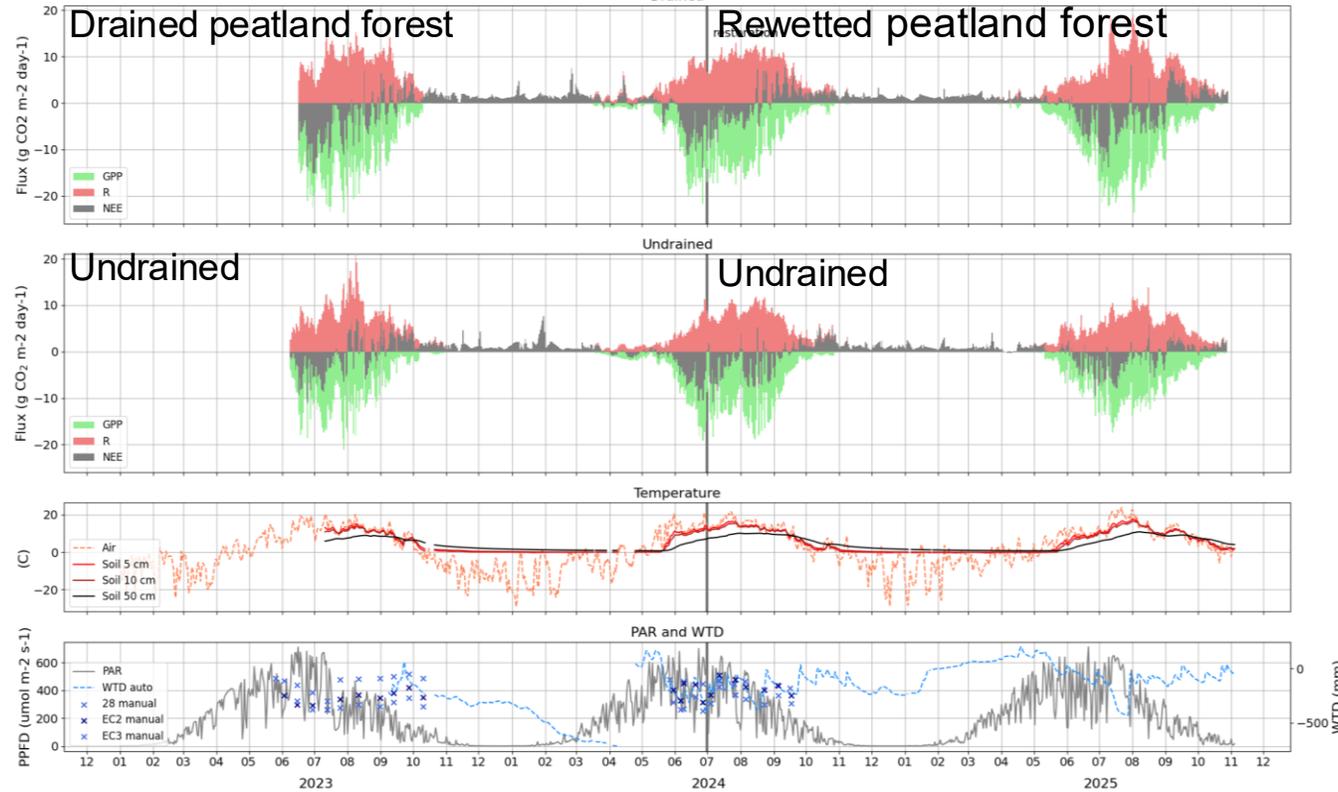
Photos Jack Chapman



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Daily ecosystem exchange of CO₂ before and after rewetting and harvest

Gross photosynthesis, ecosystem respiration, and net CO₂ exchange

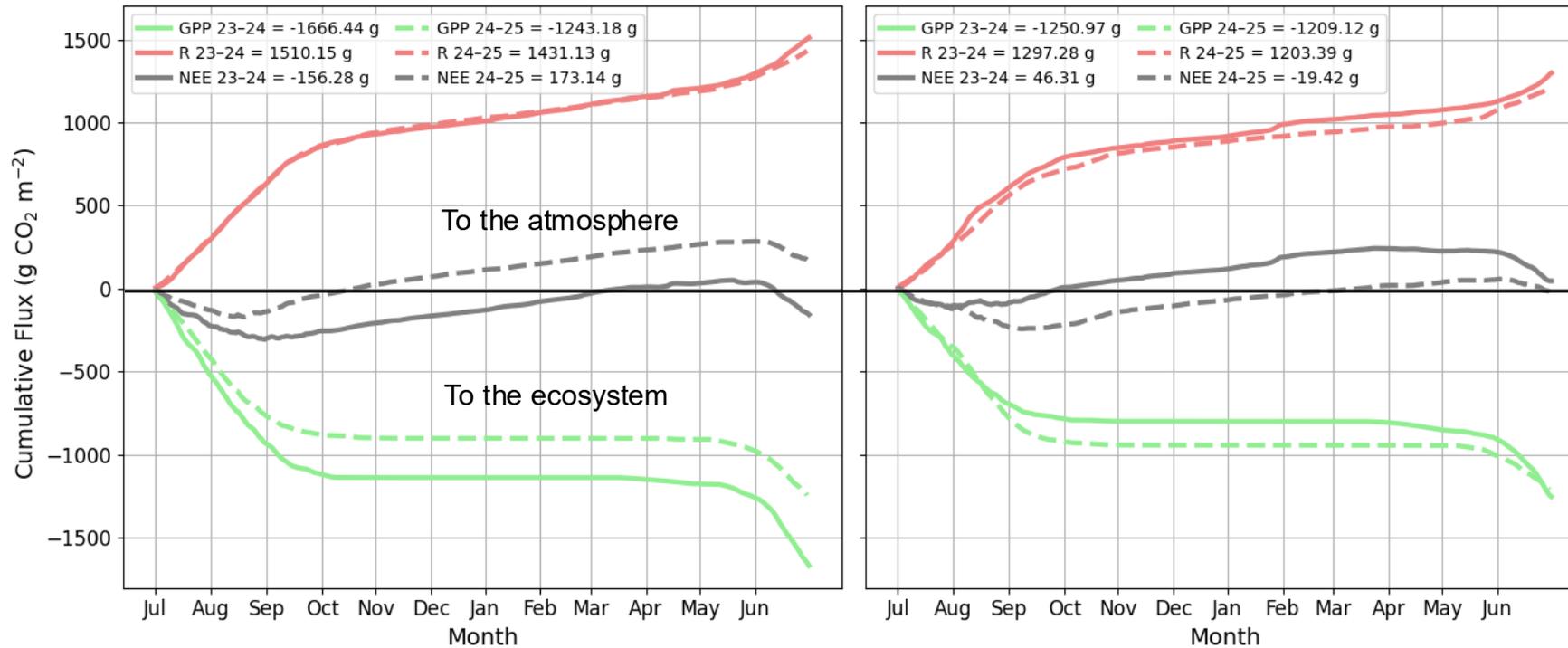


Approximate source areas

Cumulative ecosystem CO₂ fluxes before and after rewetting

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

Undrained



Before rewetting

- R_{tot} and GPP were larger in the drained site
- NEE ~-156 (drained sink) vs ~46 g CO₂ m⁻²y⁻¹

After rewetting

- R_{tot} slightly larger in the rewetted than non-drained site
- GPP similar in both sides
- NEE ~170 (source, rewetted) vs -20 (sink) g CO₂ m⁻²y⁻¹



Rewetted flark by the EC



Wetting happening



Open again

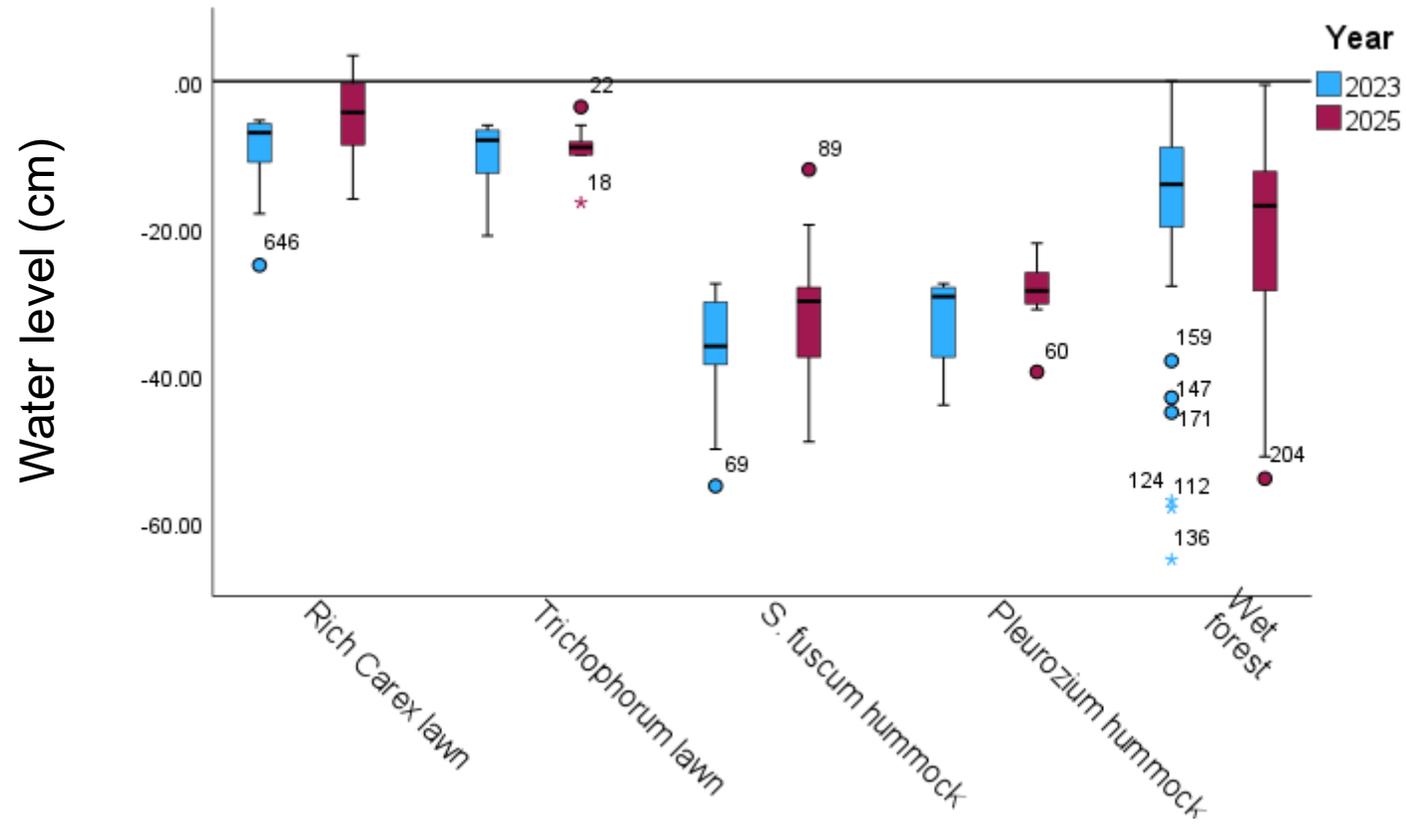


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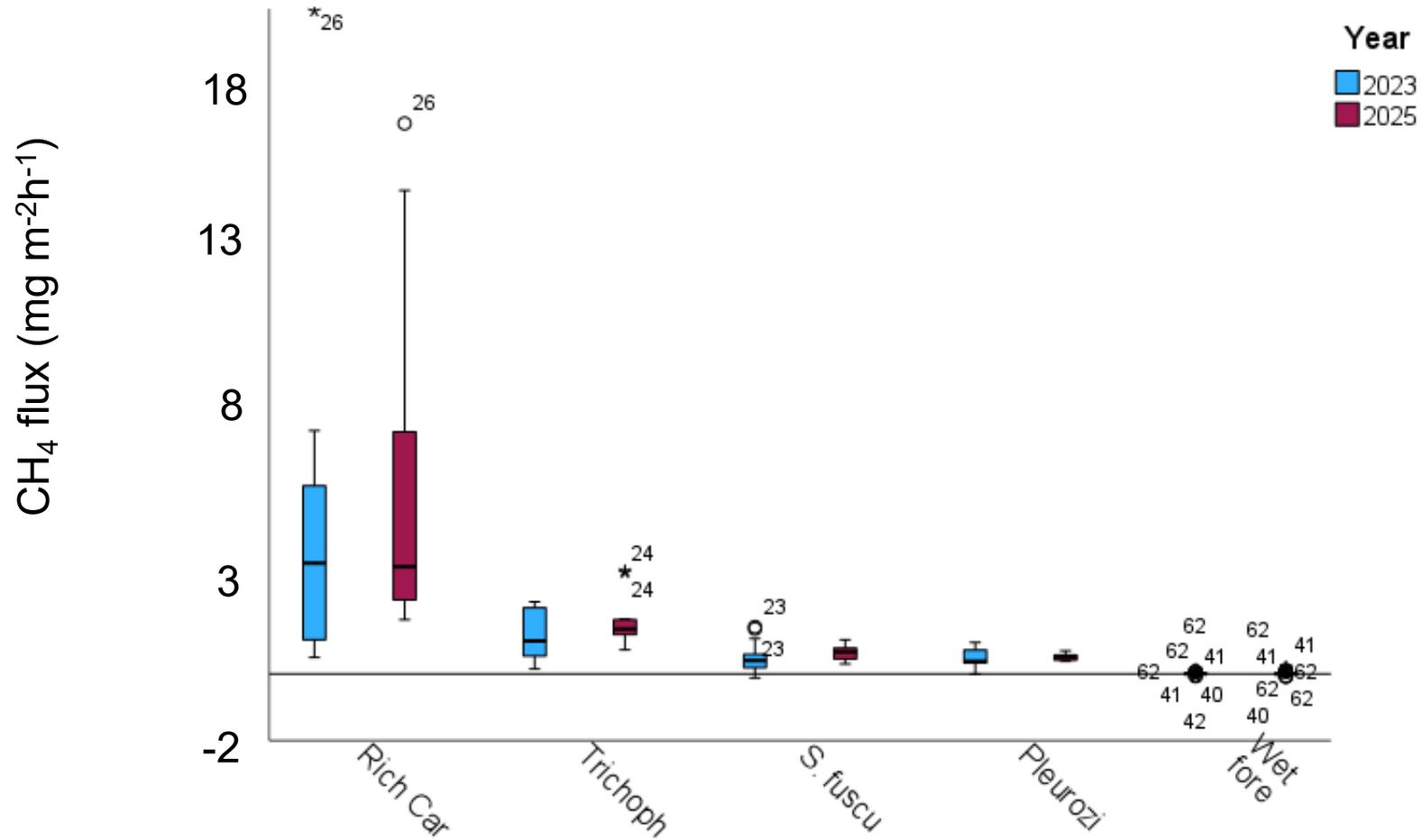
Mara and Līga validating the GESTs

Water level in 2023 and 2025 in the NOT REWETTED undrained and wet forest



Not much difference in mean cluster specific WT between the years (before and after rewetting)

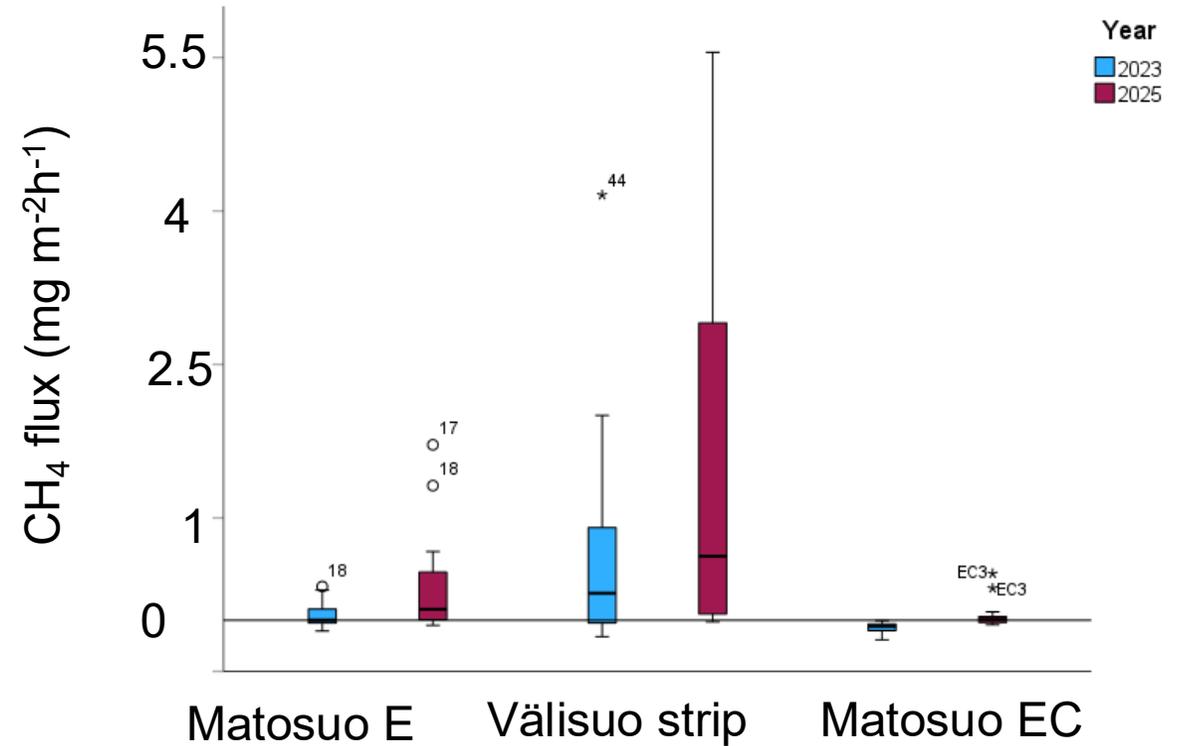
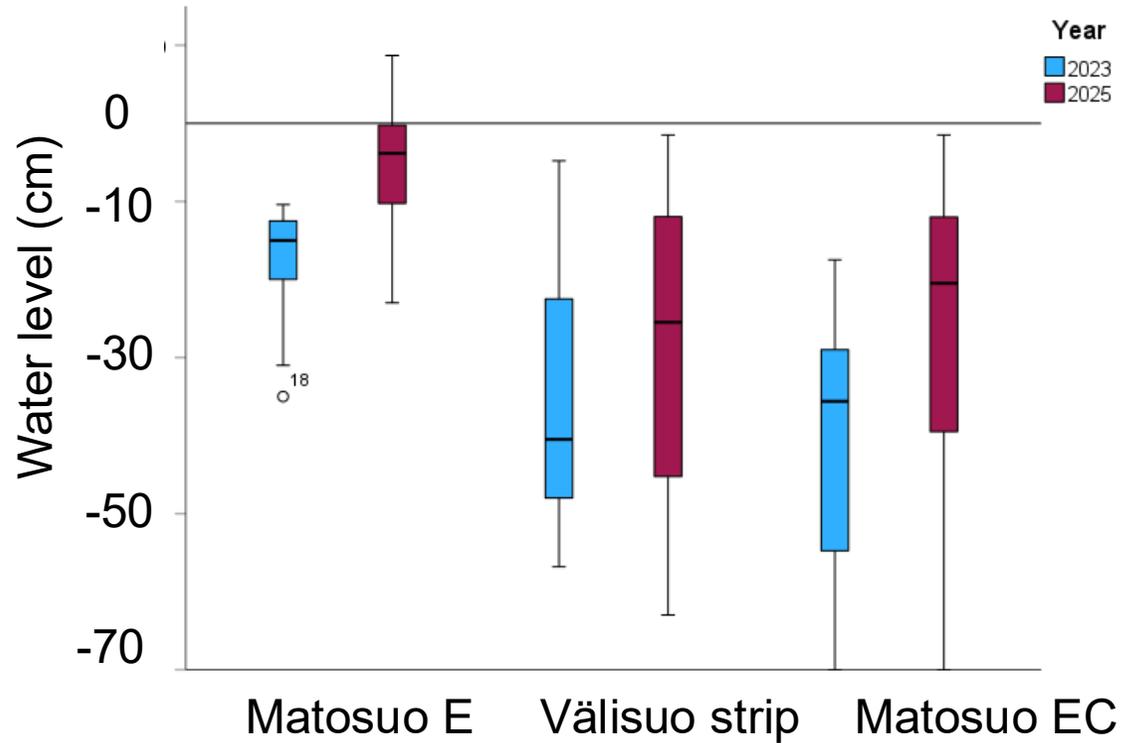
Mean CH₄ fluxes in 2023 and 2025 in the NOT REWETTED undrained peatland and wet forest



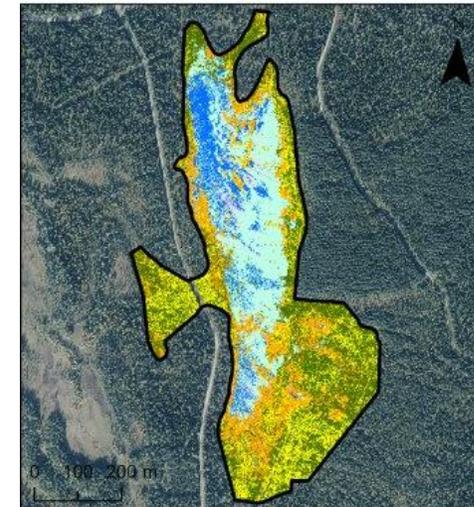
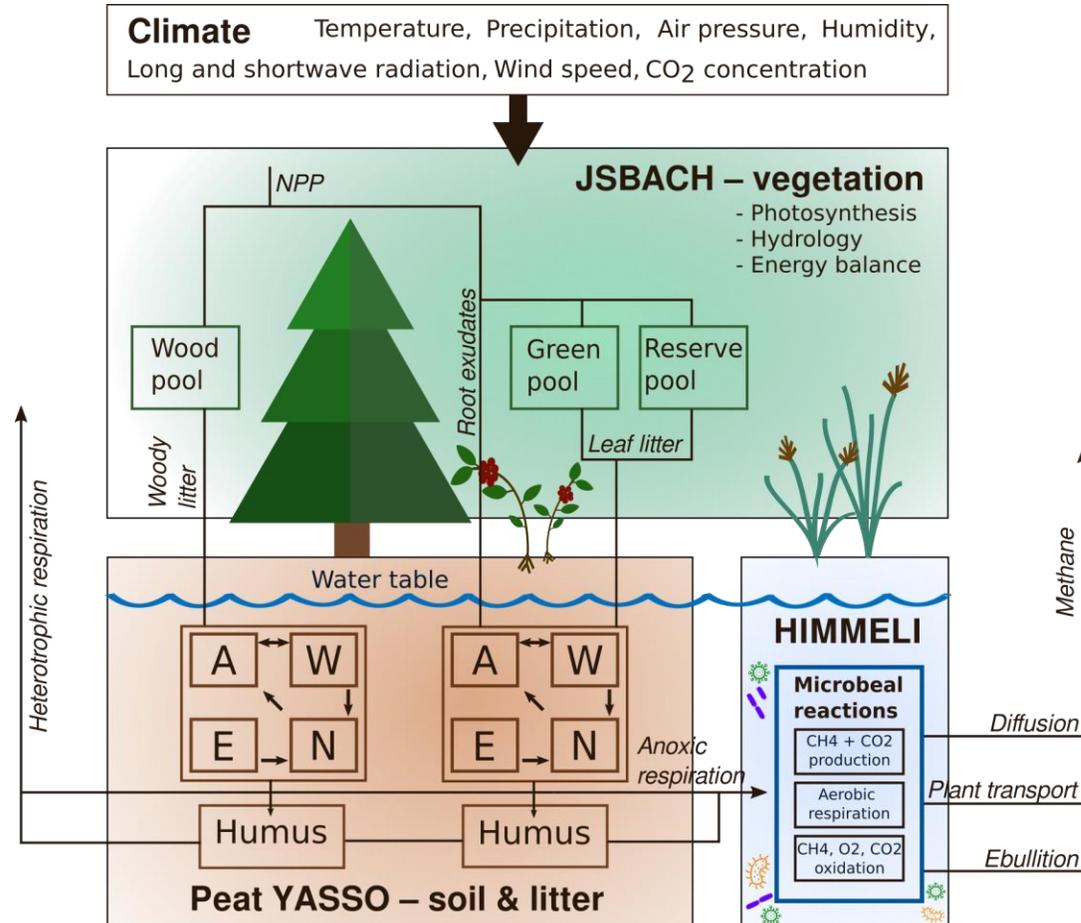
No difference in mean cluster specific CH₄ flux between the years (before and after rewetting)

If looking at drained sites with greatest change after the drainage in ~1970

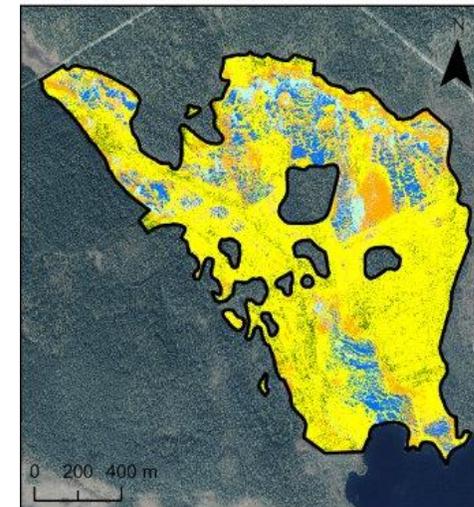
- Seems that median WT and CH₄ fluxes increased from 2023 to 2025
- Note small CH₄ fluxes in the Matosuo EC location, relative to the WT



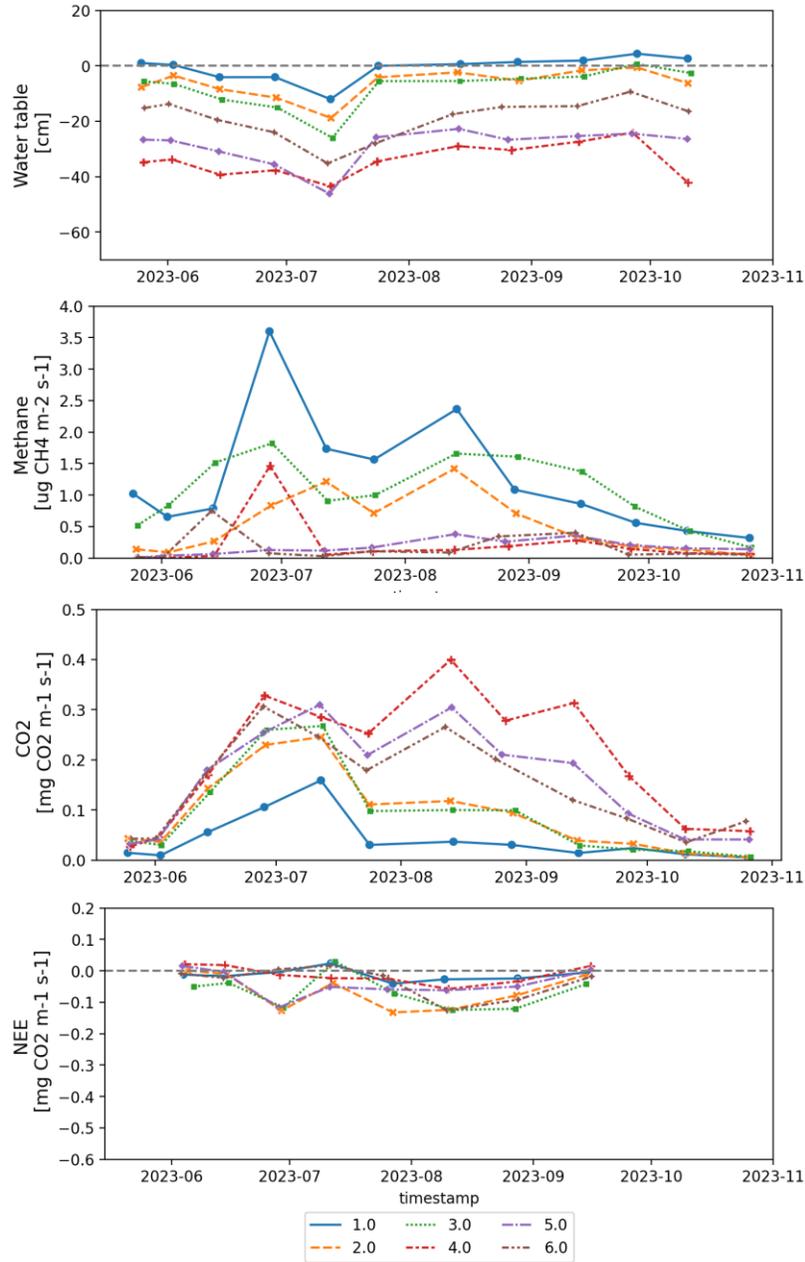
Modelling – Pallas



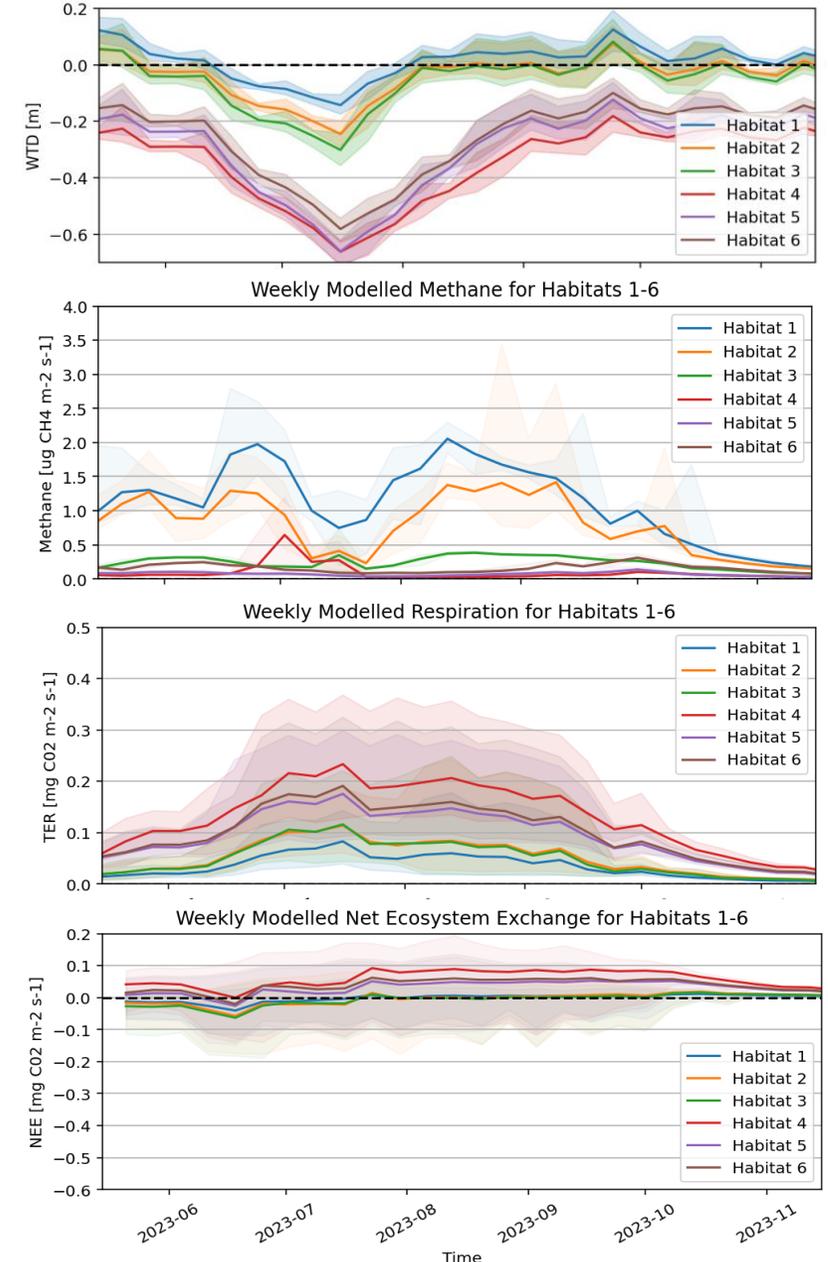
- (1) Flark
- (2) Trichophorum lawn
- (3) Rich carex lawn
- (4) Pleurozium hummock
- (5) S. fuscum hummock
- (6) Wet forest



Habitats – Chamber measurements

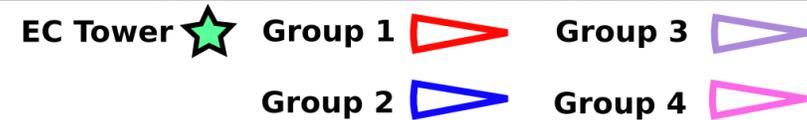
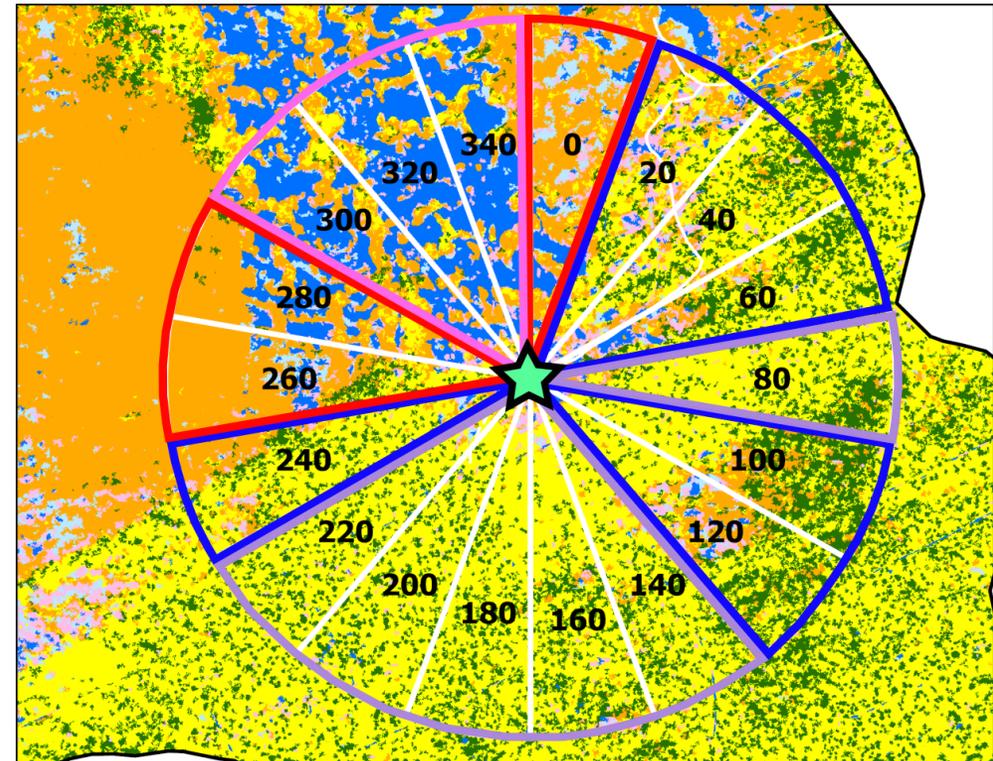


Habitats – Simulations



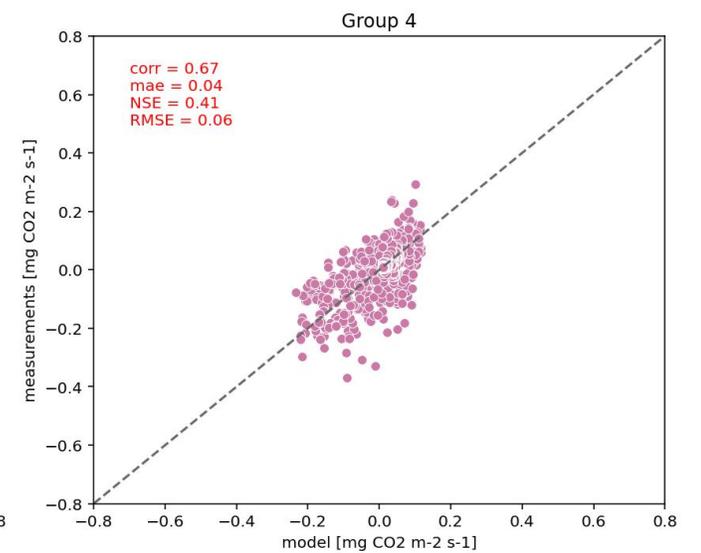
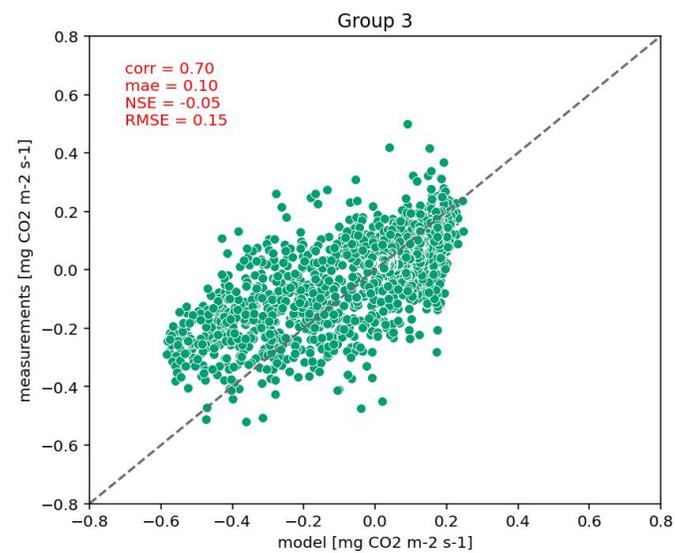
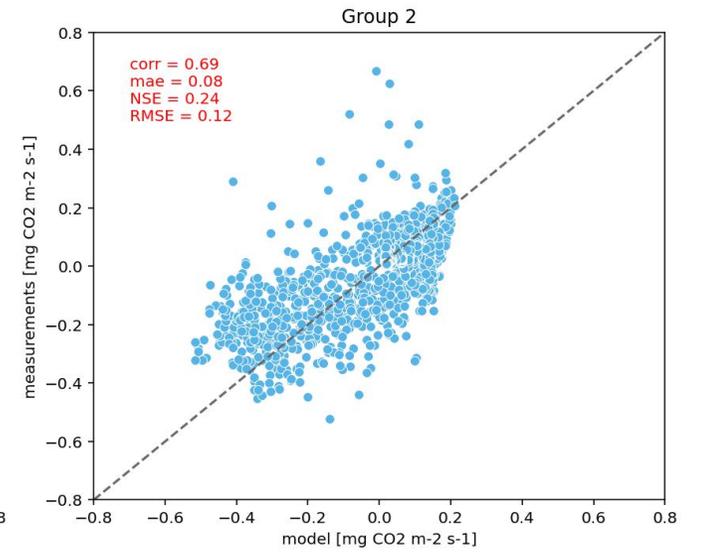
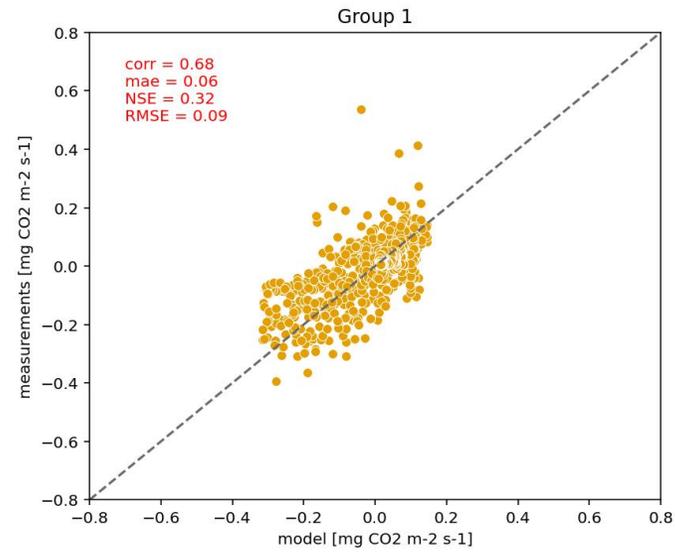
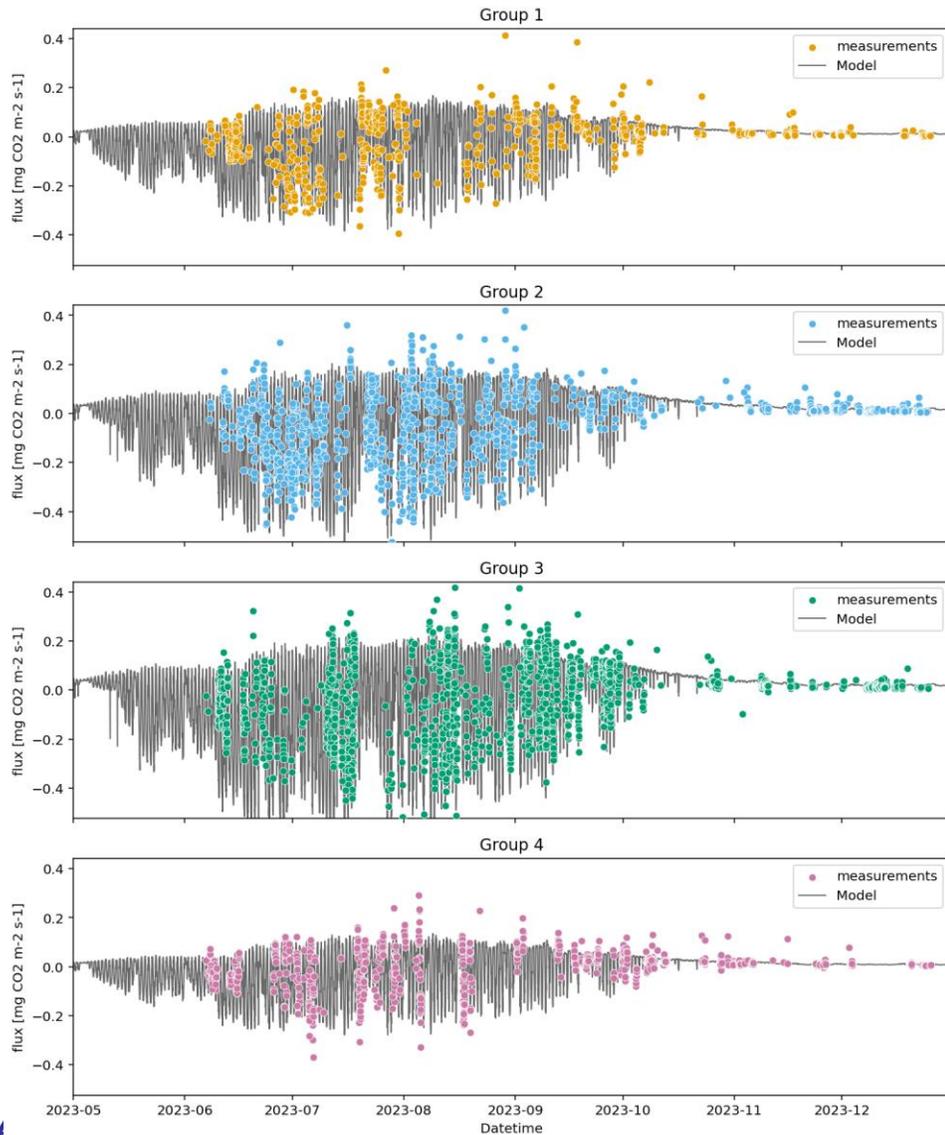
Ecosystem level CO₂ fluxes from Matorova Mire

- Bridging the gap between habitat and ecosystem level fluxes
- Validation of simulations against Eddy Covariance measurements
- 170m radius
- 20-degree sectors combined to 4 groups that have similar share of habitats

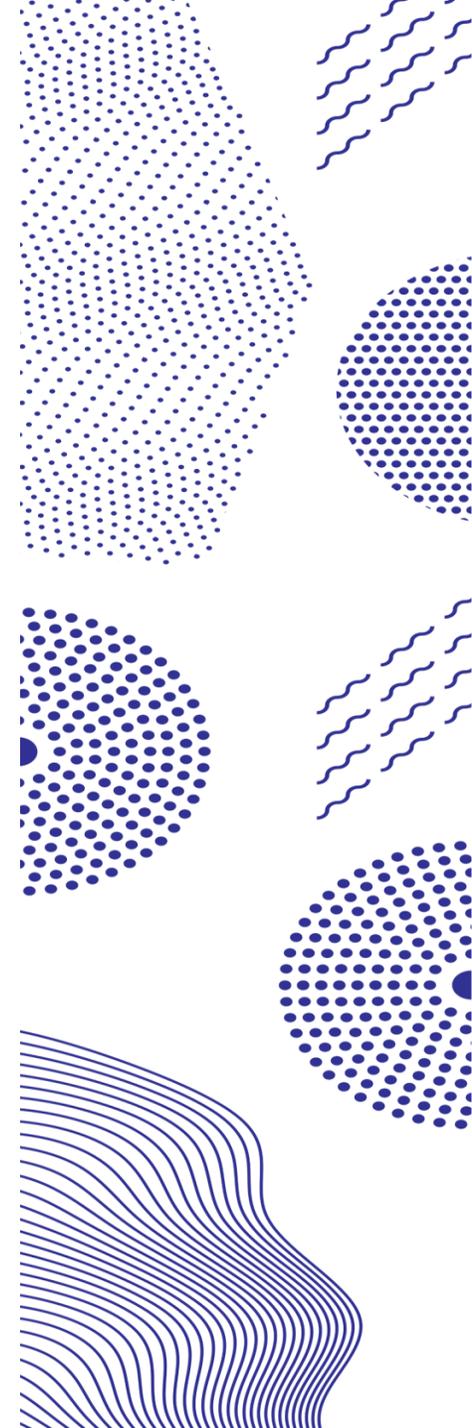


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Habitat simulations vs EC tower measurements



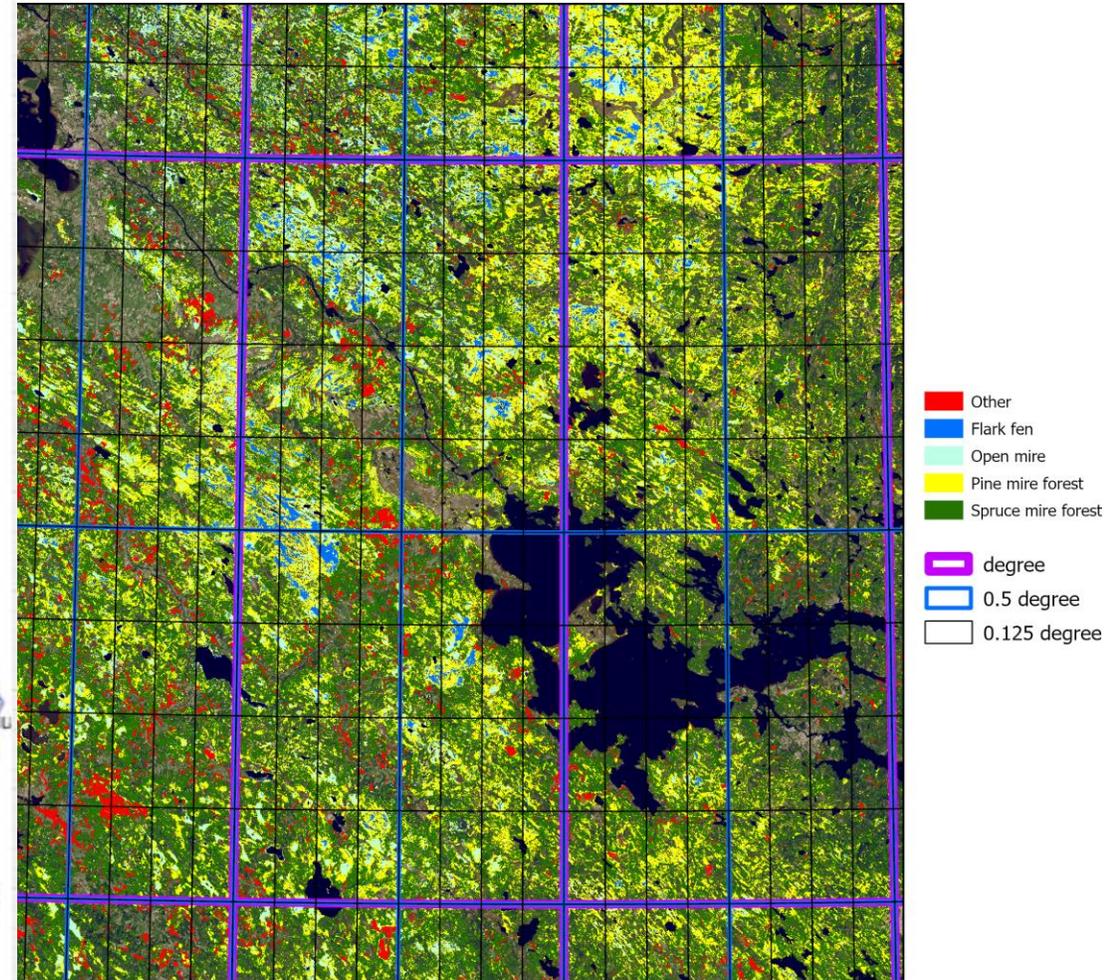
Towards national estimates



Peatland types in Finland

- Based on peatland classification provided by Geological Survey of Finland
- Uses machine learning together with openly available spatial and remote sensing data

Spruce Mire Forest
Pine Mire Forest
Open Mire
Flark fen



Water table depths for each peatland type

Peatland type	Land use	Mean	Median	Min	Max
Open mire	Drained	22.7	21.0	-1.6	89.5
Pine mire forest	Drained	32.7	32.2	-6.9	85.8
Spruce mire forest	Drained	52.4	54.0	5.6	95.2
Open mire	Pristine	12.9	12.2	-30.9	81.3
Pine mire forest	Pristine	12.2	10.8	-21.2	60.9
Spruce mire forest	Pristine	20.8	17.6	-12.5	97.2
Open mire	Restored+Pristine	13.9	13.0	-36.7	81.3
Pine mire forest	Restored+Pristine	15.7	13.1	-21.2	81.3
Spruce mire forest	Restored+Pristine	19.3	15.4	-29.2	97.2

- Unpublished data from Lassi Päckilä.
- We will additionally have one more open mire class
- PFT distributions under development

