Progress on LIFE Peat Carbon project activitivies in Finland & modeling

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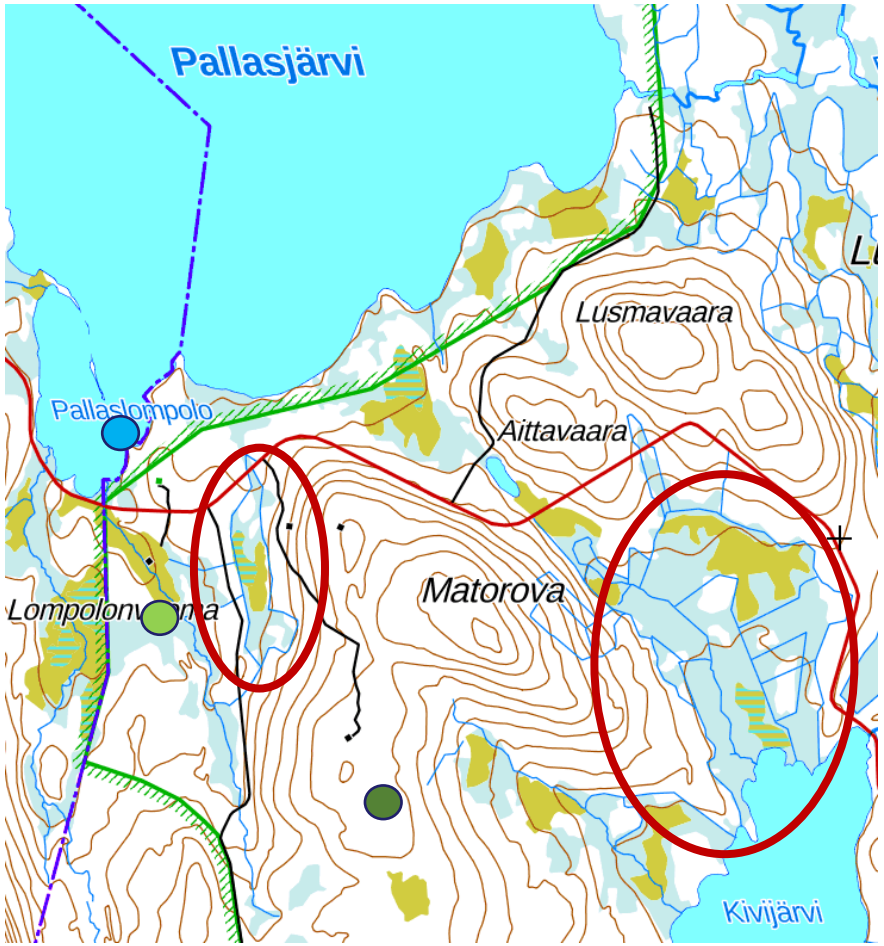
15.4.2025 **LIFE Peat Carbon**

WP2 T4 Restoration



Two restoration sites in Northern Finland:

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

WP2 T4 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

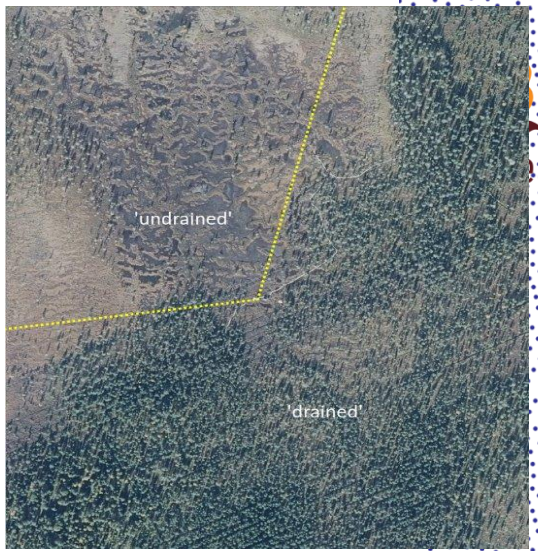
- Communication activities involved: Restoration video shooting, visits by project partners, news published by FMI, LUKE, Metsähallitus and LIFE project

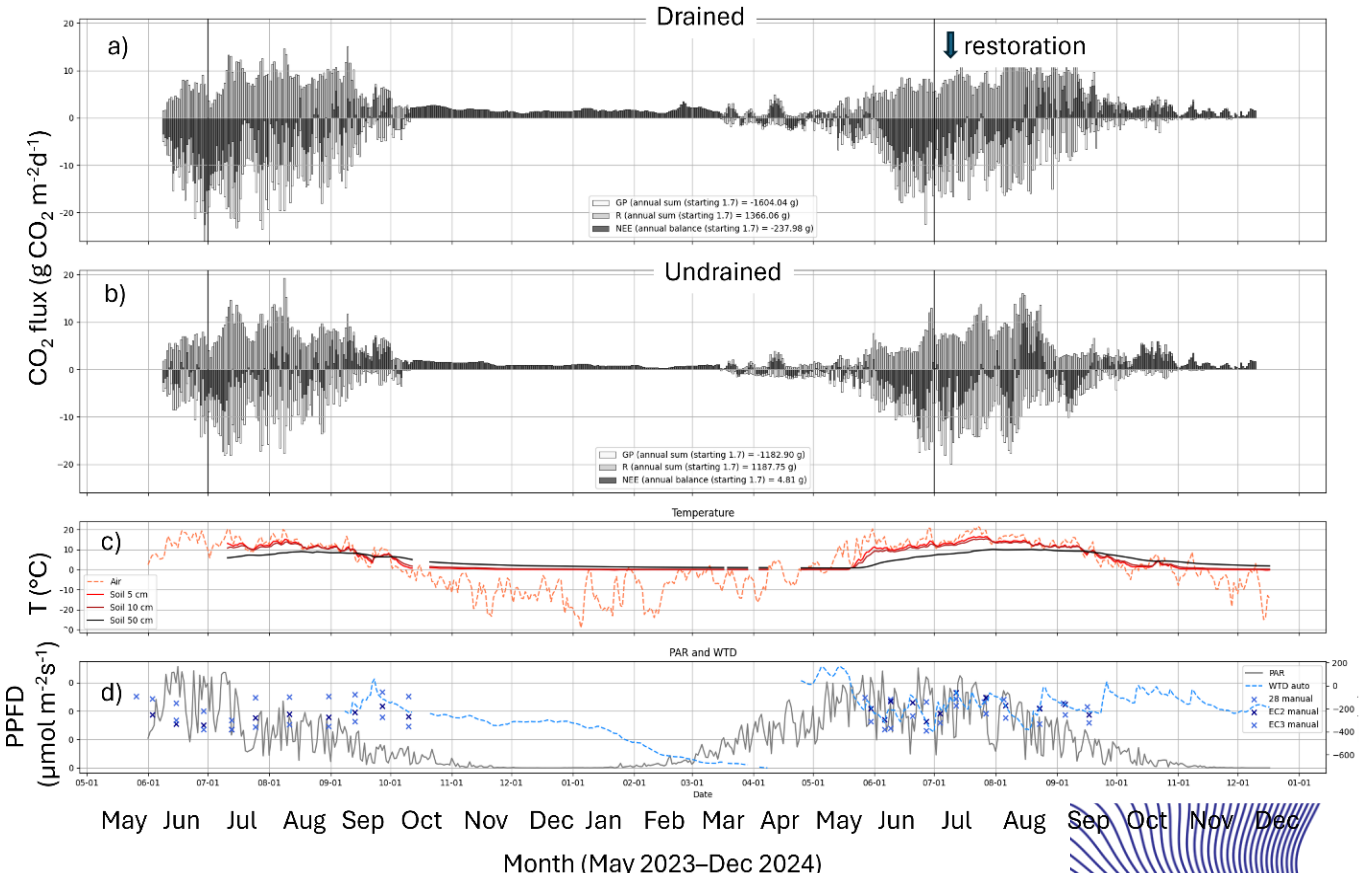
- See presentation by Jenni Hultman / LUKE

WP3 T4 GHG measurements

- Continuing CO2, CH4, and N2O measurements in Välisuo and Matorovansuo
- Ecosystem level CO2 flux from eddy covariance tower at Matorovansuo
- Chamber flux measurements at 60 points

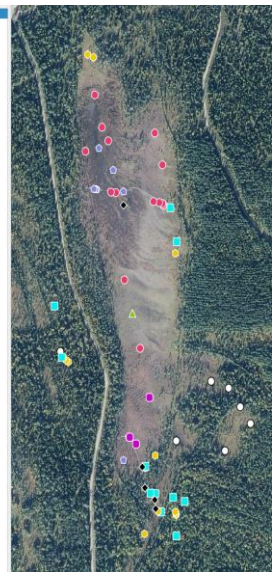
- See presentation by Sari Juutinen/FMI

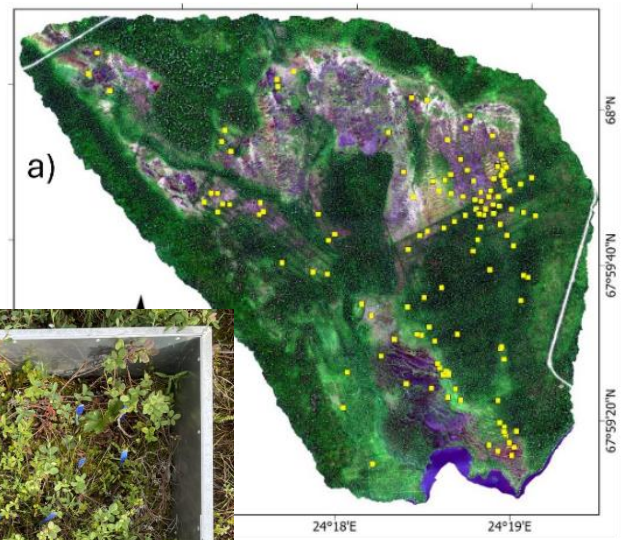


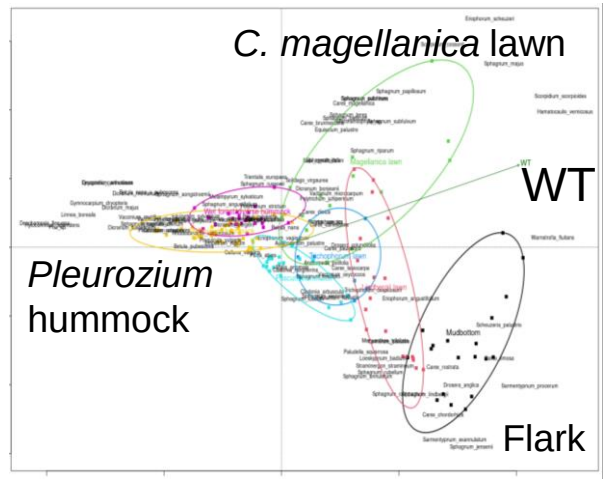


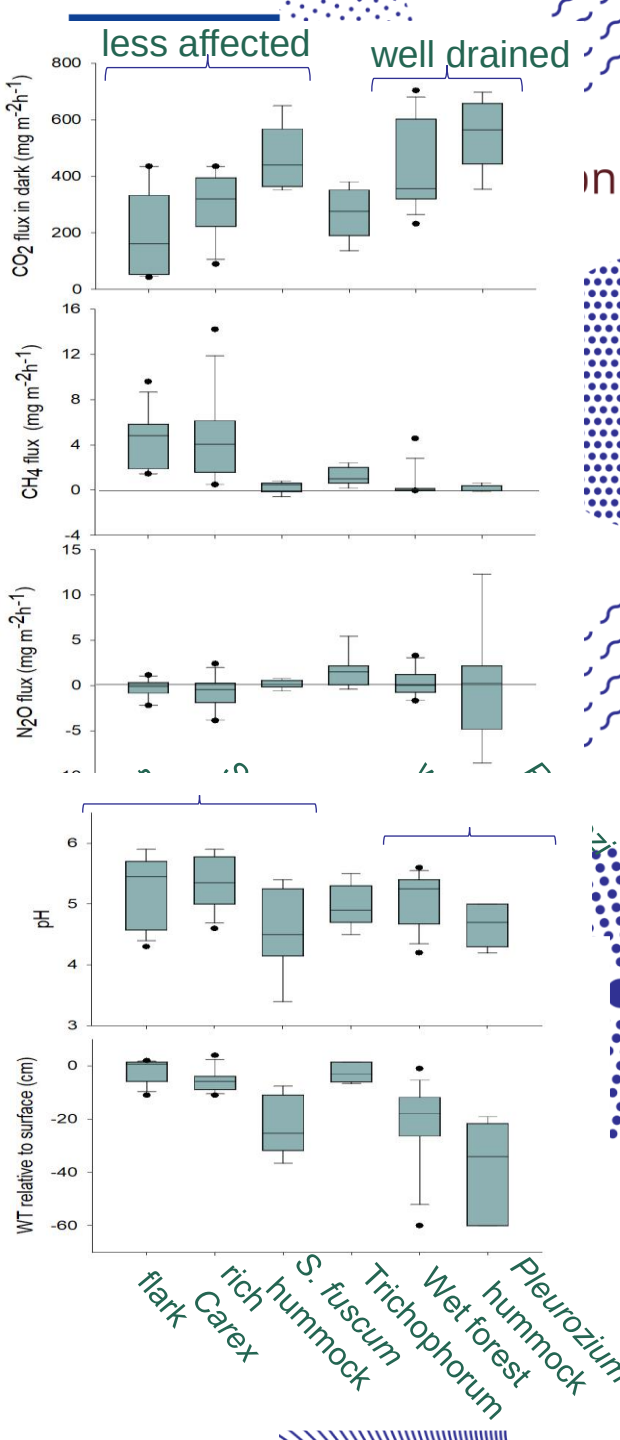
WP3 T2 Vegetation measurements

- 2024: Vegetation inventory in the GHG-collars, coordinated with the larger vegetatio inventory
- Clustering of plots: six microhabitats with distinct vegetation (and water table and pH characteristics
- Sampling vegetation species-level leaf area index, tree biomass, height, diameter
- More about GHG measurements and vegetation clustering in a presentation by Sari Juutinen/FMI









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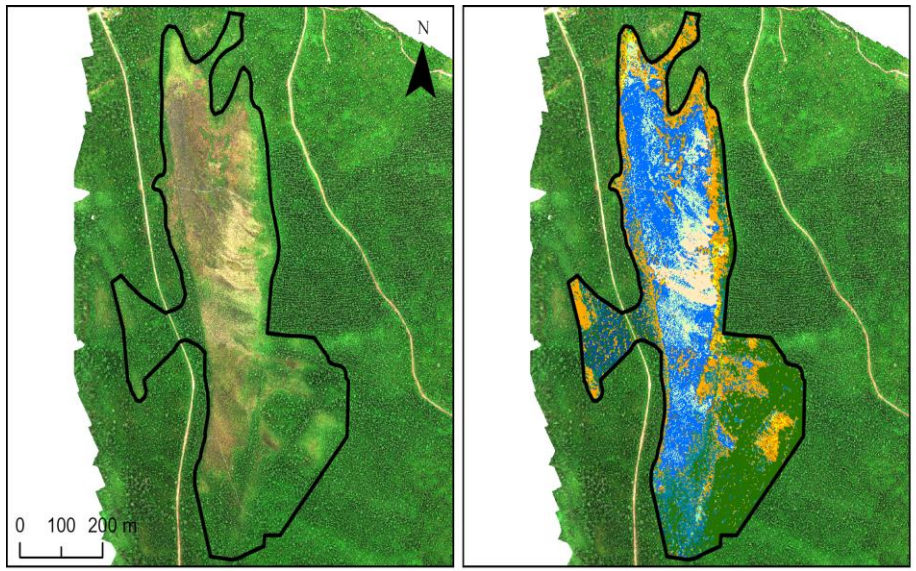
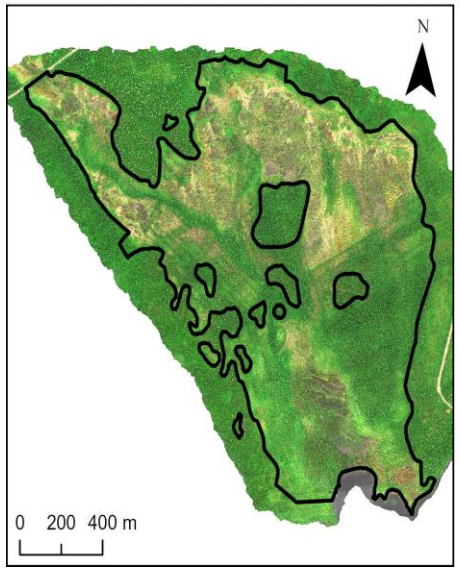
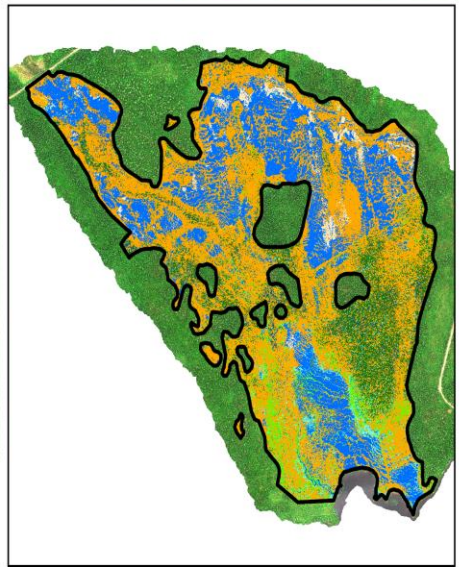
WP3 T7 Vegetation studies

- Vegetation inventories: 206 plots, mostly species level, linked to FMI clustering
  - Ground vegetation, indicative for wetness
  - Tree abundance will be added
- Drone flights (UEF) before restoration in July 2023, after in August 2024
  - Multispectral and thermal imagery, drone LIDAR for topography
- NLS aerial images
- Upscaling of microhabitats and comparison to upscaled GEST types
- Water table: Combining manual water table measurements, drone imagery and satellite-based moisture index

WP3 T7 Vegetation studies

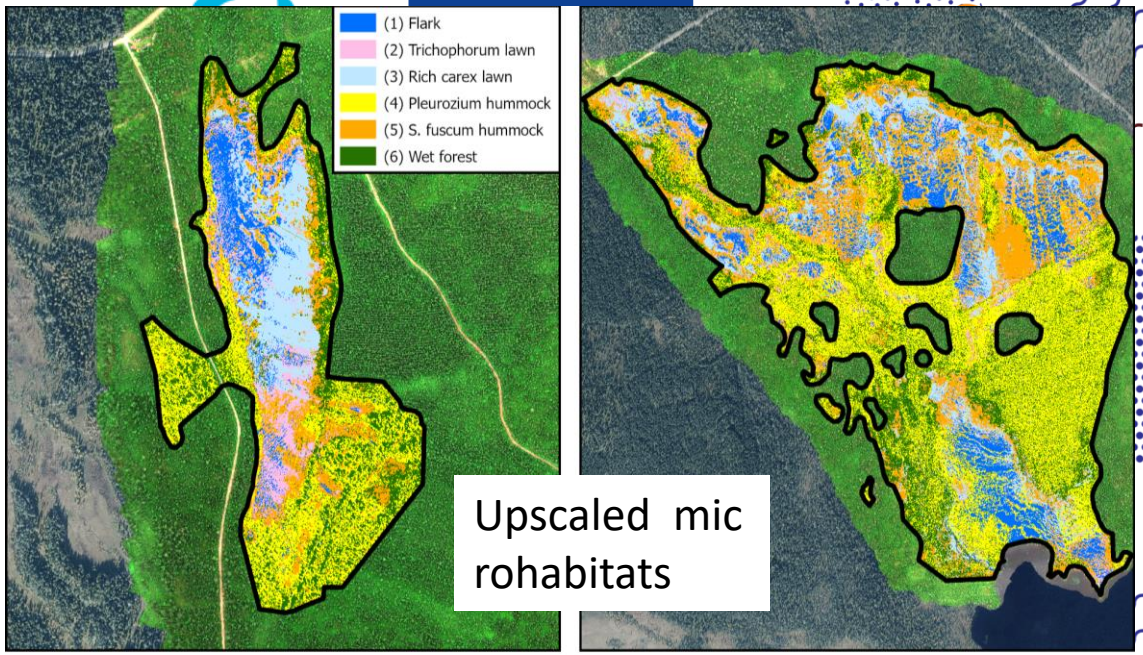




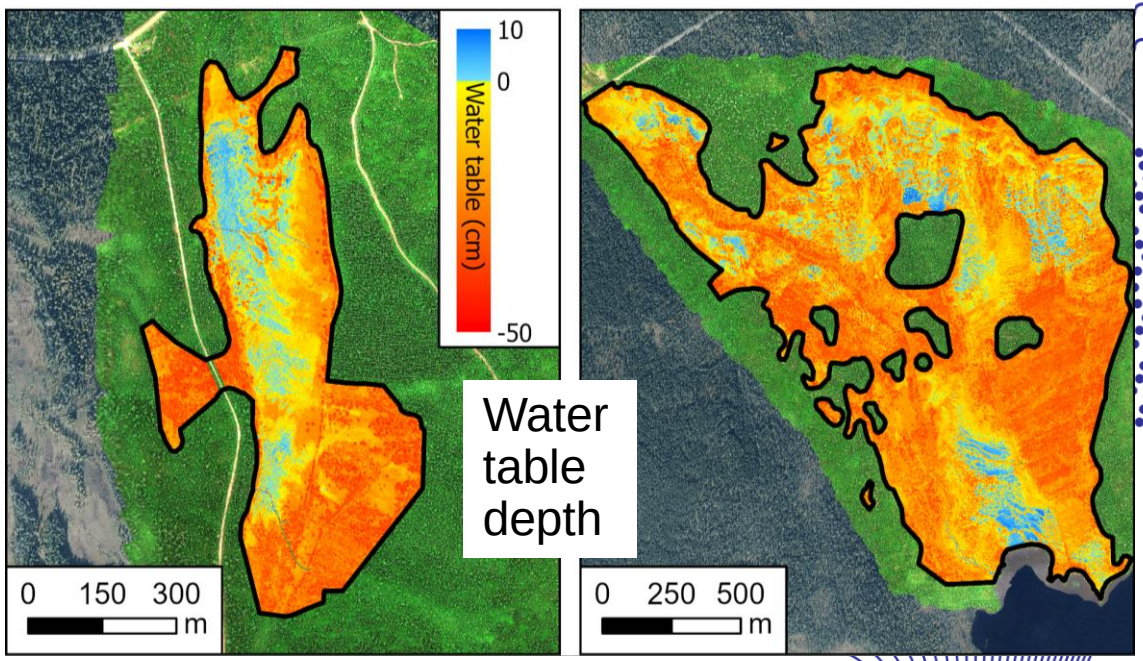


GEST types

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



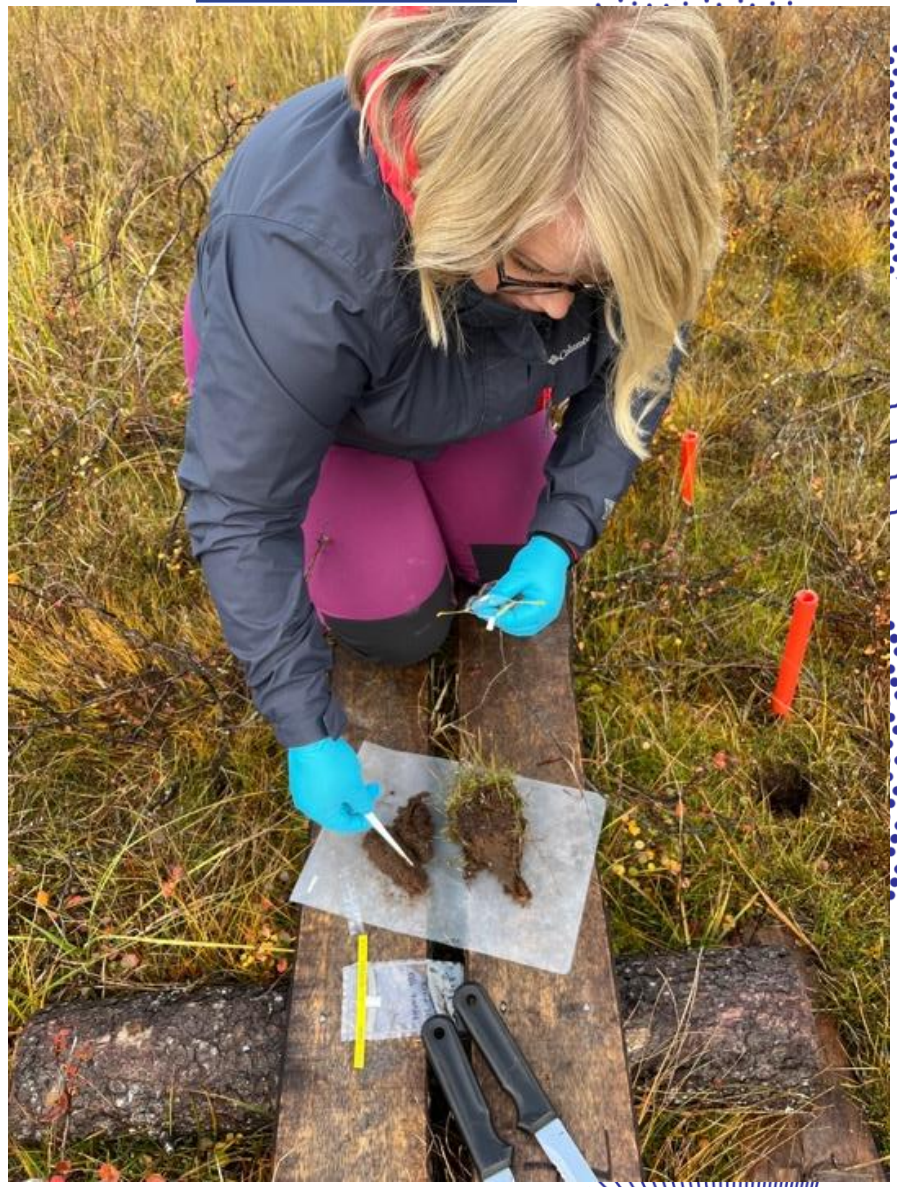
Upscaled mic rohabitats



Water table depth

WP3 T6 Microbial studies

- Samples for microbial community composition and activity from 53 GHG points -> relationships between methane producing and oxidizing taxa
- See talk by Jenni Hultman



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WP3 T3 Hydrological monitoring

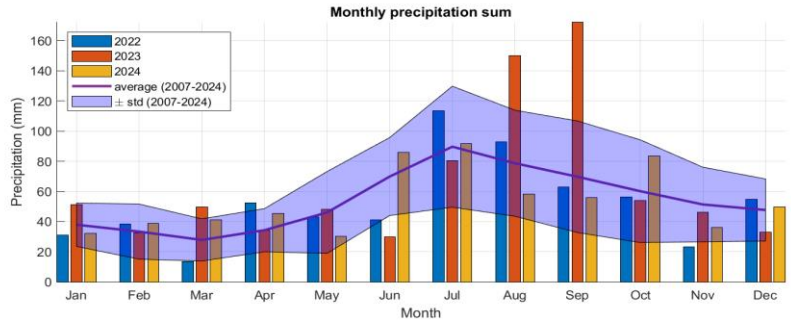
Field work activities:

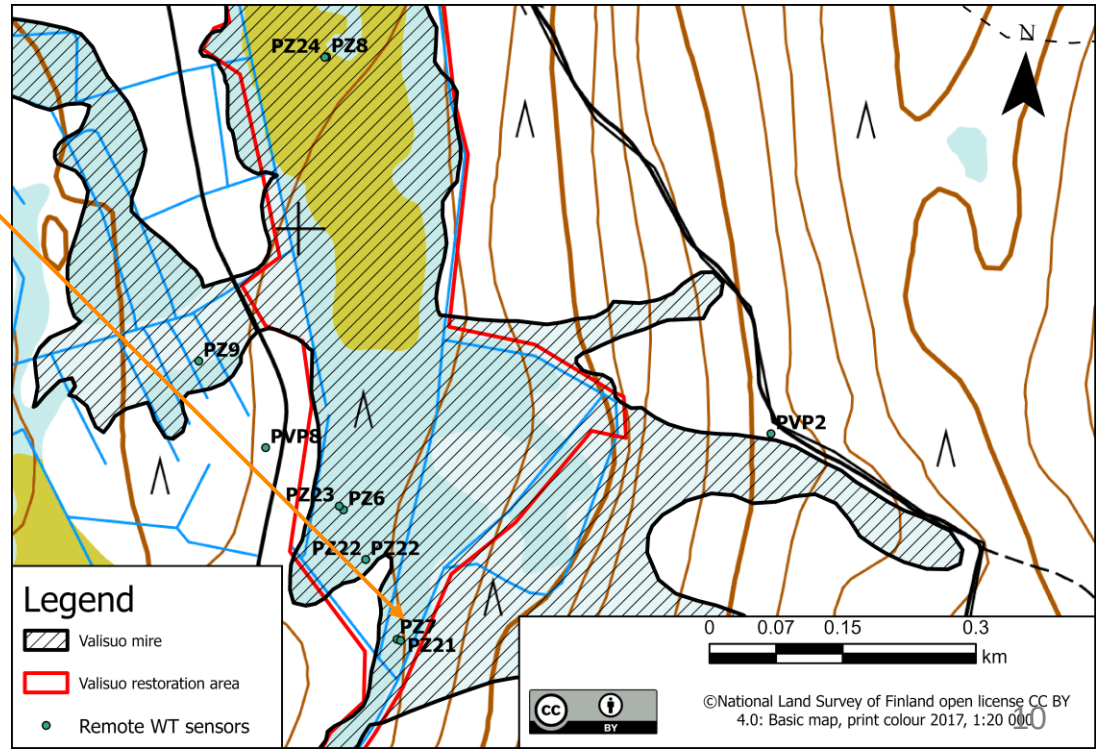
- Winter and summer Ground Penetrating Radar (GPR) campaigns on the 4th-8th April and 9th-13th June, 2024
- Installation of remaining monitoring wells and sensors in May 2024
- Autumn manual GW monitoring and piezometer mapping campaign 23rd- 27th September

Modelling and data analysis:

- Steady-state and transient model of Matorovansuo construction and management scenario modelling (pristine/pre-management, drained, restored)
- Building Pallaslompolo model and geological model
- Geophysical and monitoring data processing and analysis

WP3 T3 Hydrological monitoring





- Can the impact of restoration be seen on the ground water depth?
- See presentation by Anna Autio and Omar Nimr / University of Oulu

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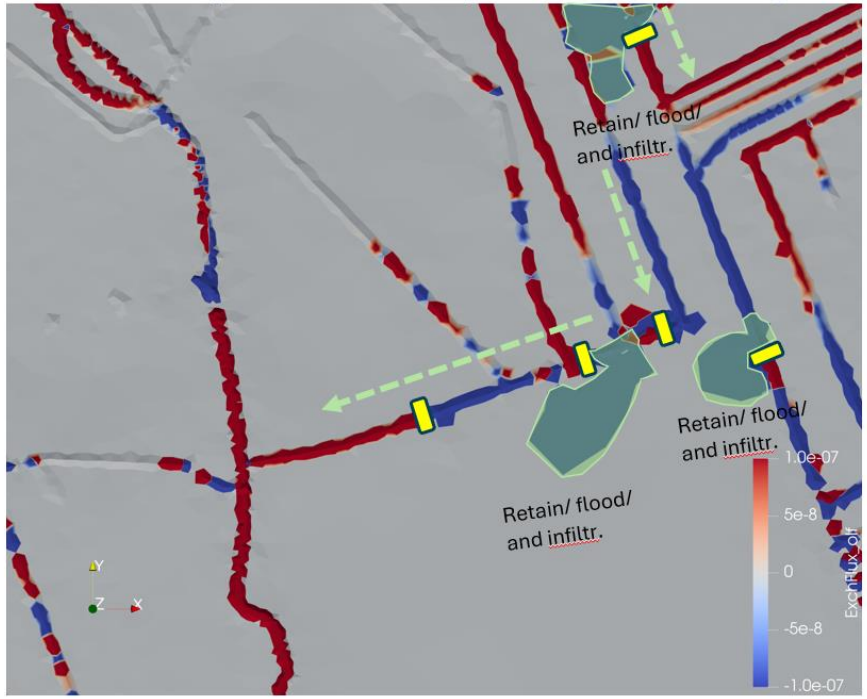
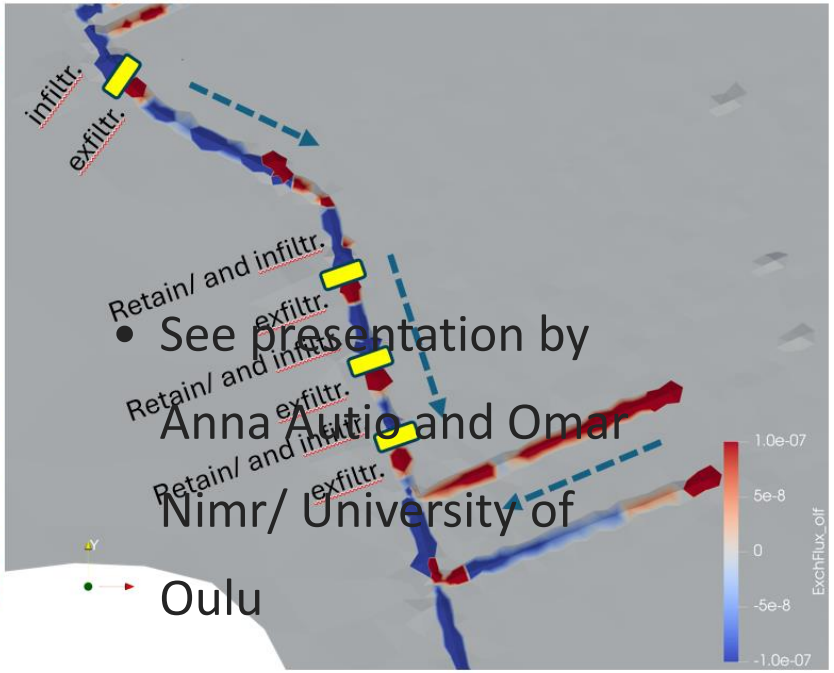
WP3 T3 Hydrological modelling

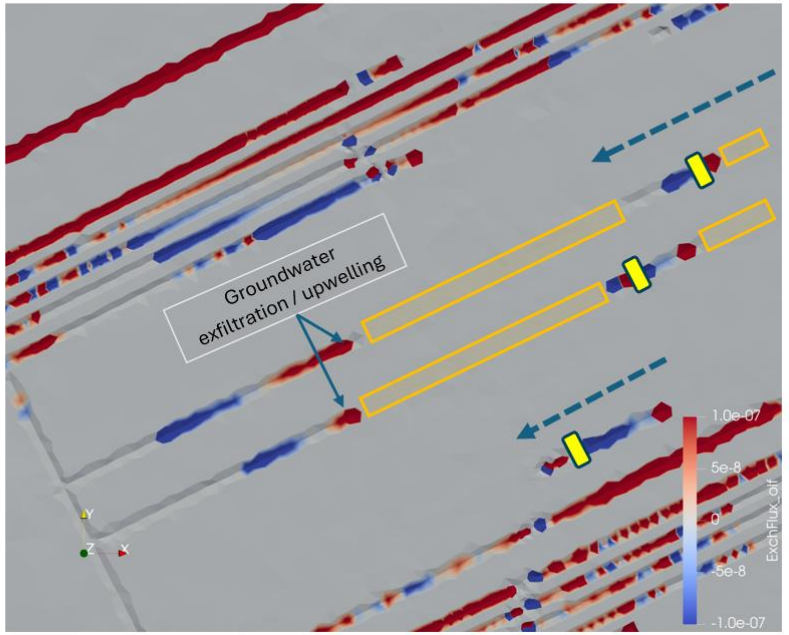
Effect of peat-dams (water retaining/ flooding)





- See presentation by Anna Autio and Omar Nimr/ University of Oulu

Effect of ditch-filling (groundwater diffuses at the tips of unfilled ditches)



- First-simulations testing how restoration activities perform (calibration in progress)
- See presentation by Anna Autio and Omar Nimr/ University of Oulu

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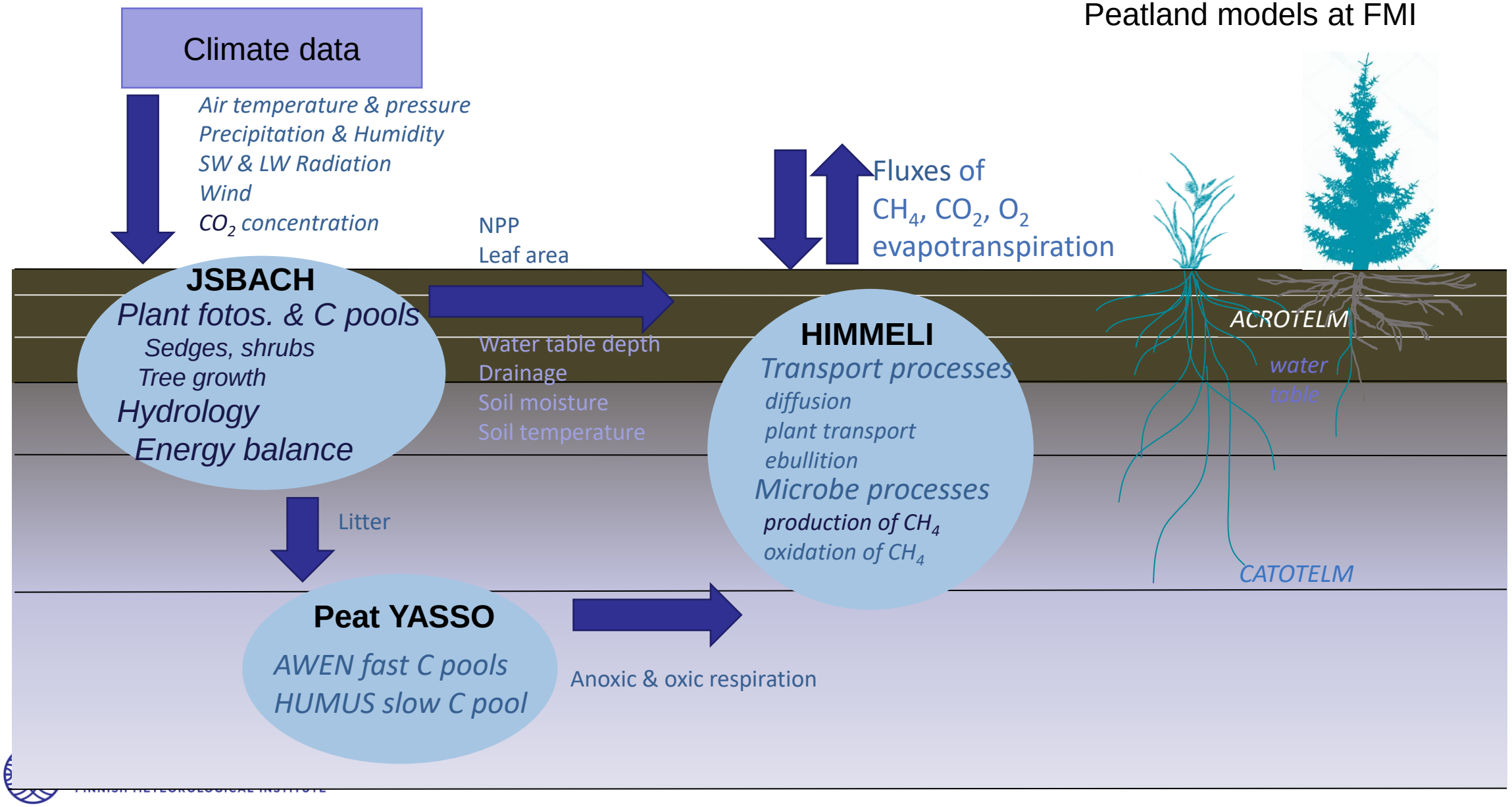
WP3 T8-9 GHG modelling

JSBACH/YASSO/HIMMELI
Peatland models at FMI



Plant functional types

- In JSBACH model the diversity of vegetation is represented with Plant Functional Types (PFTs)
- Created a new set of PFTs to the model, based on the vegetation analysis at project sites in northern Finland (Matorovansuo and Välisuo)

Plant Functional Types for Wetlands

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

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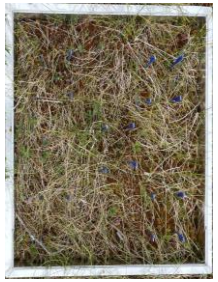
Habitats

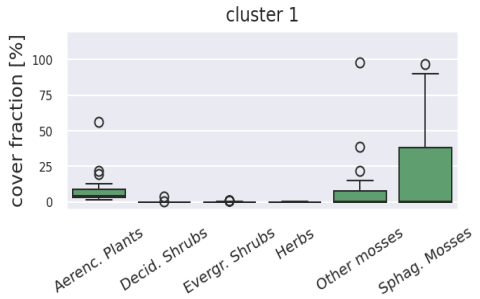
- Six habitats for the sites using cluster analysis (of 153 plots).
- PFTs are assigned to each habitat with varying contributions.

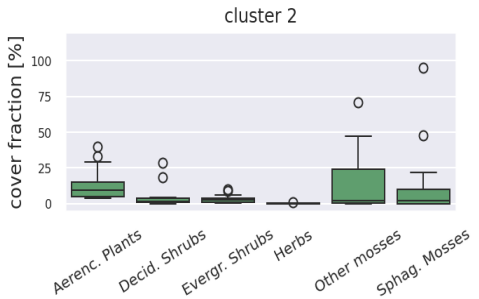
Habitat 1: Flark

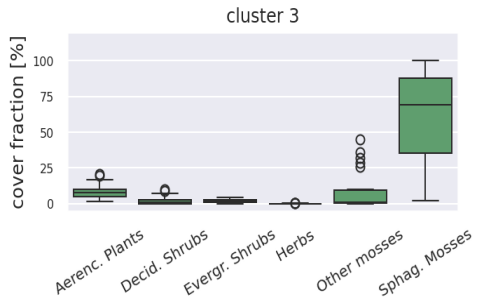
Habitat 2: Trichophorum lawn



Habitat 3: Rich carex lawn







Habitat 4: Pleurozium hummock

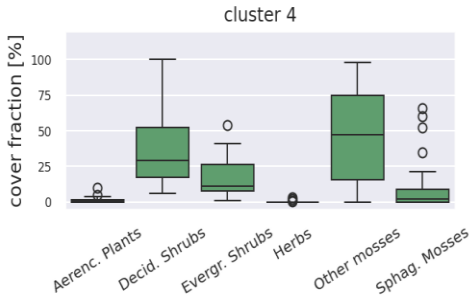
+ tree cover

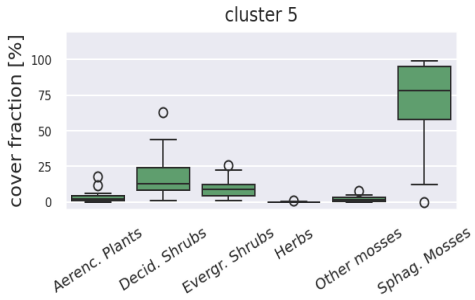
Habitat 5: S. fuscum hummock

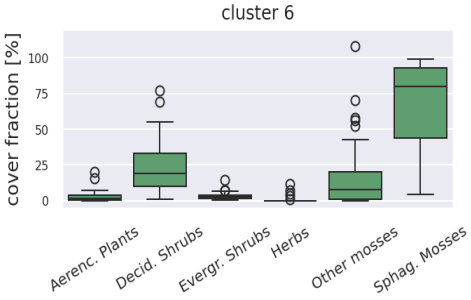
+ tree cover

Habitat 6: Wet forest

+ tree cover







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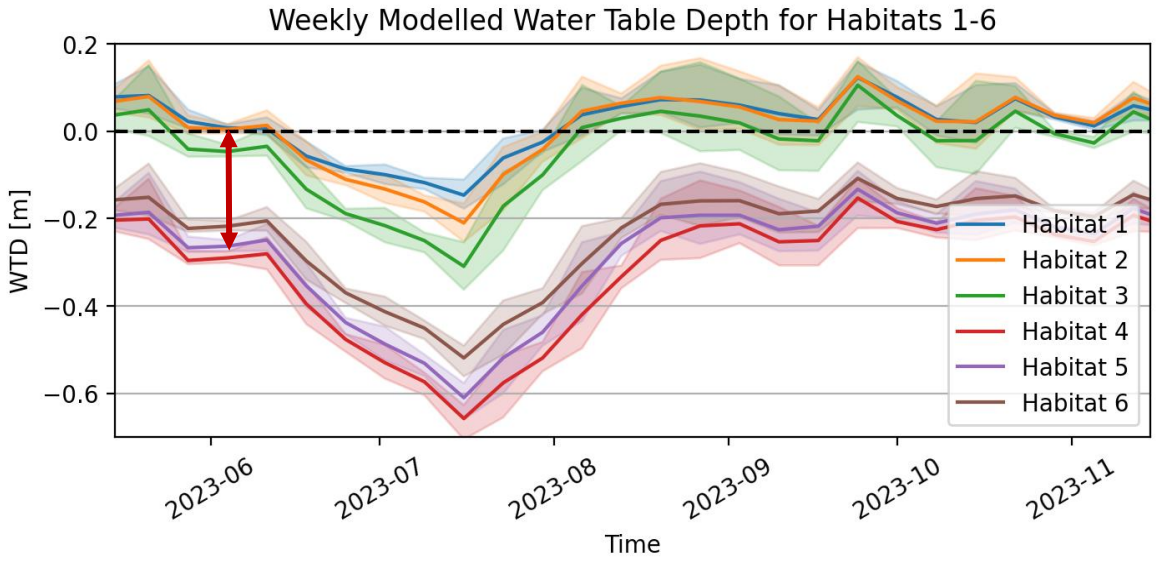
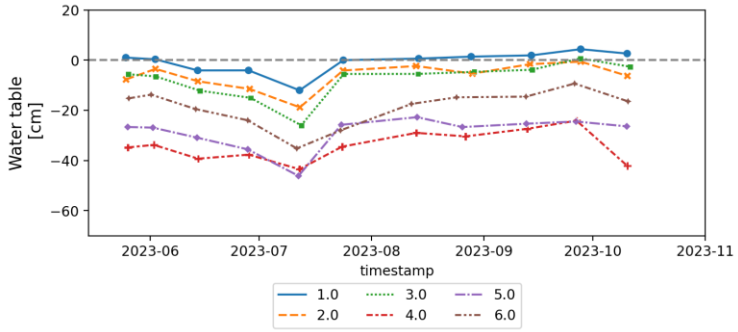
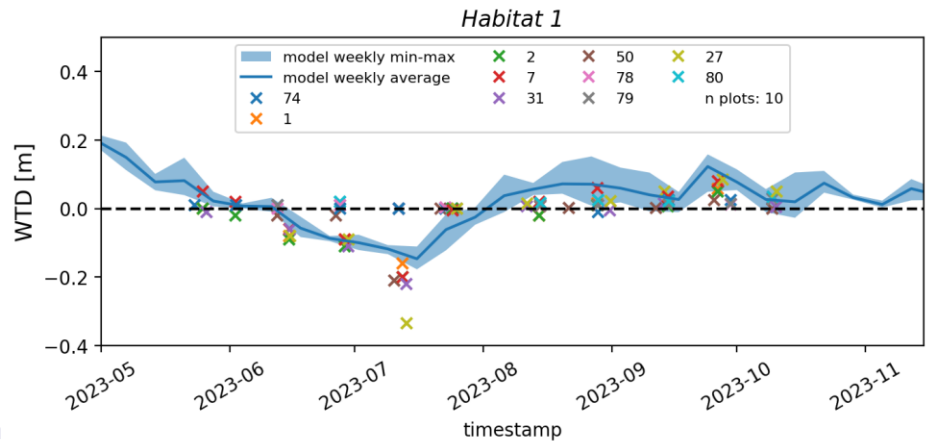
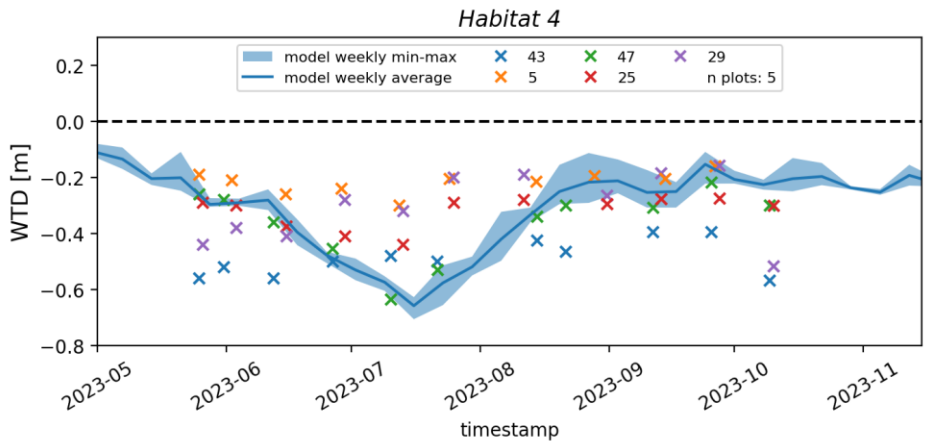
Habitat simulations – Water table

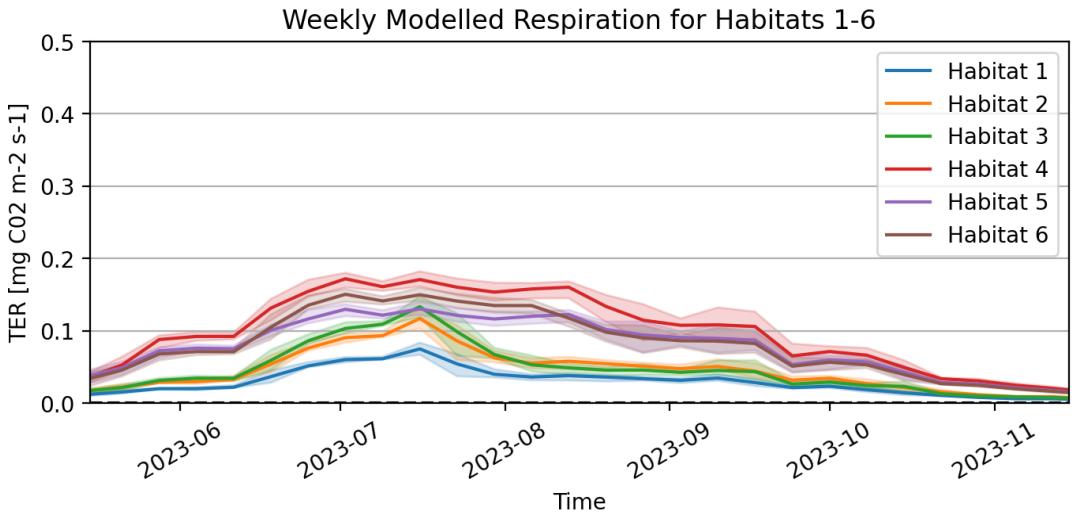


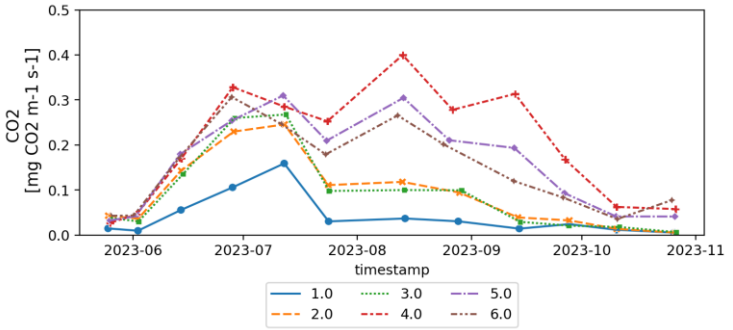




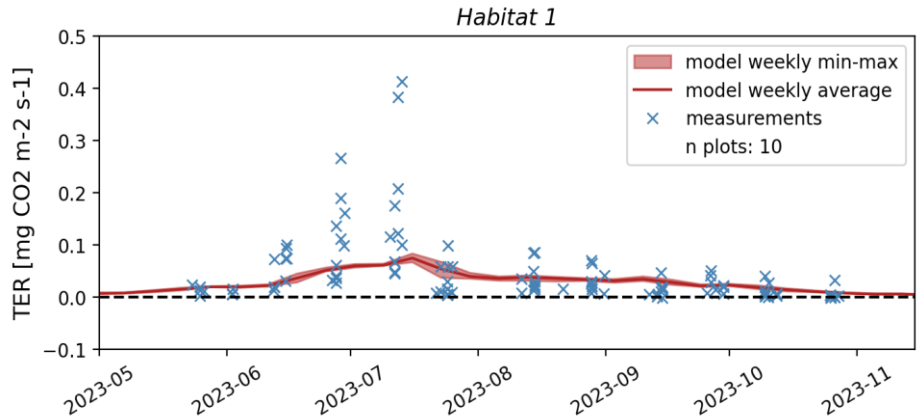


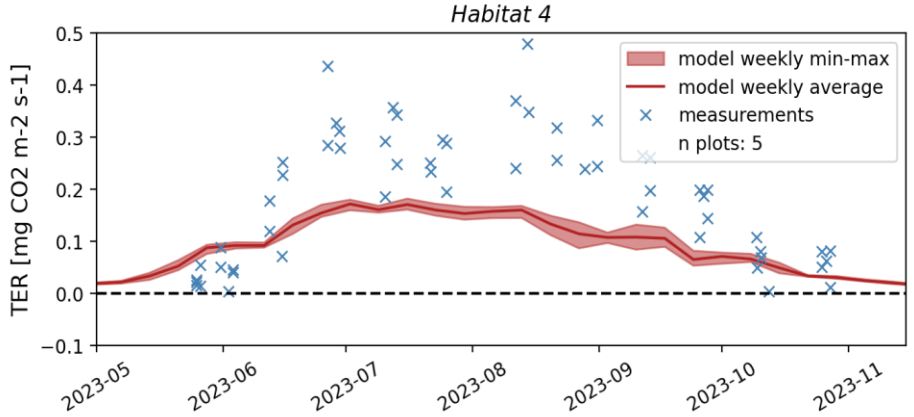
Habitat simulations – Respiration



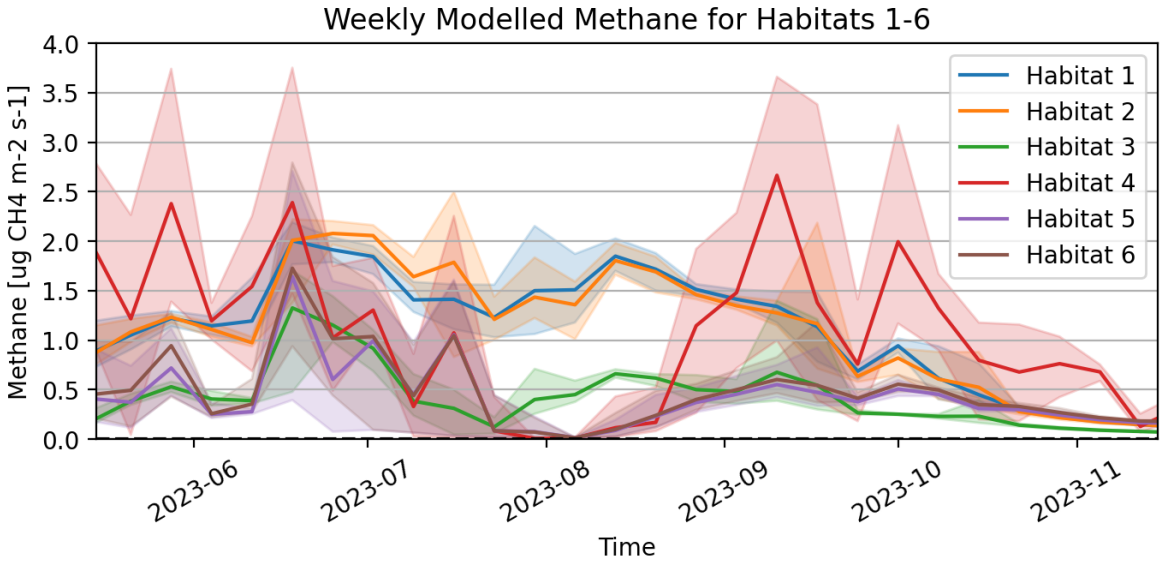


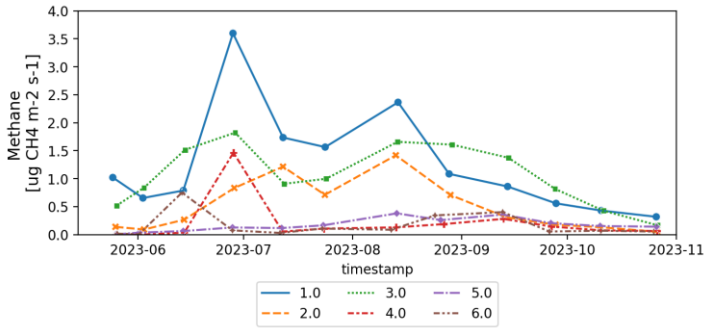
Model is driven with daily forcing → modelled values represent daily averages

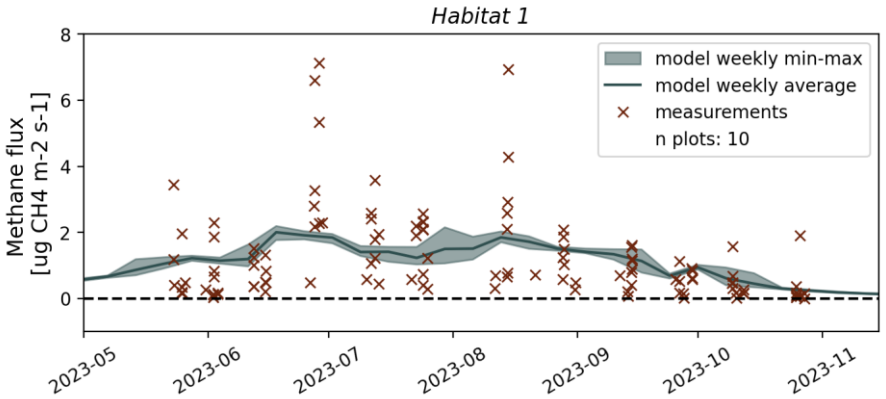


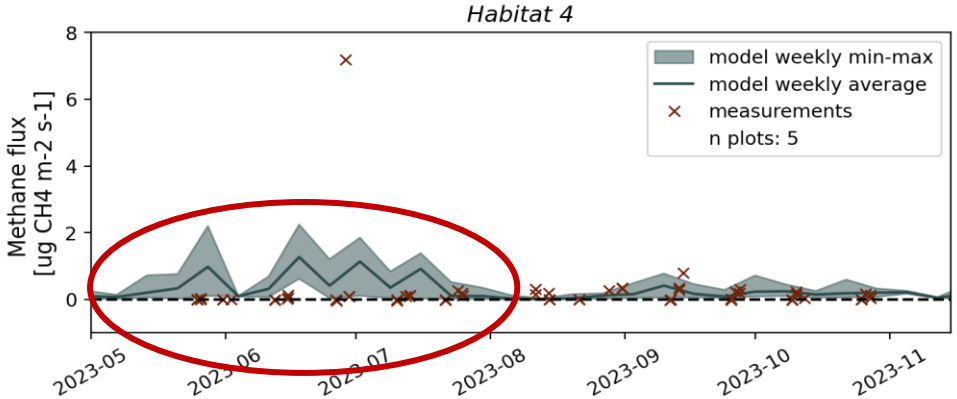


Habitat simulations – Methane









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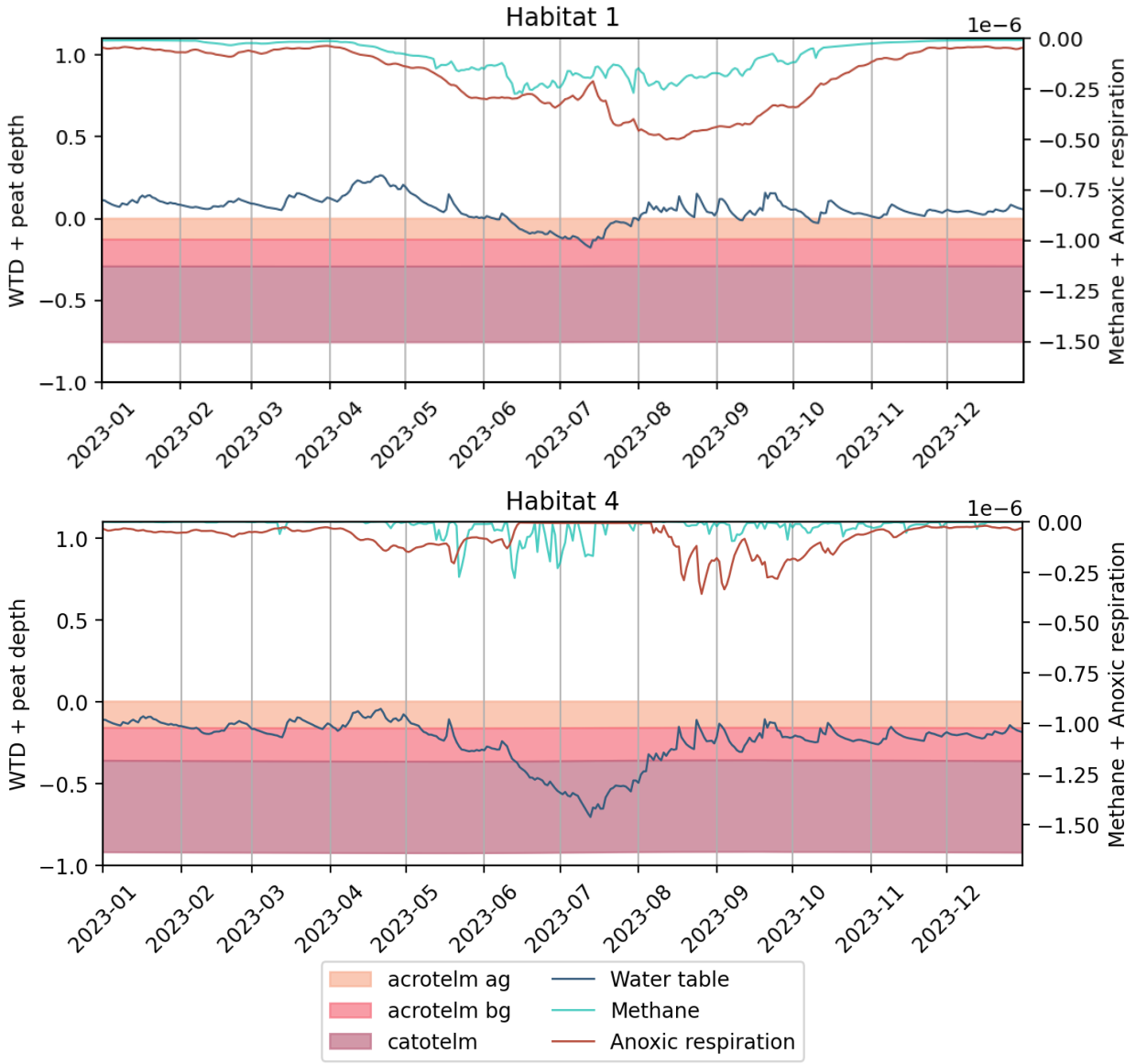
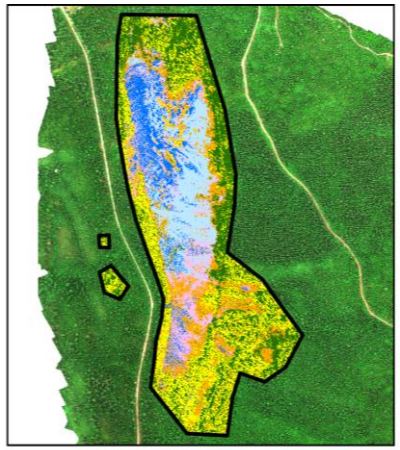
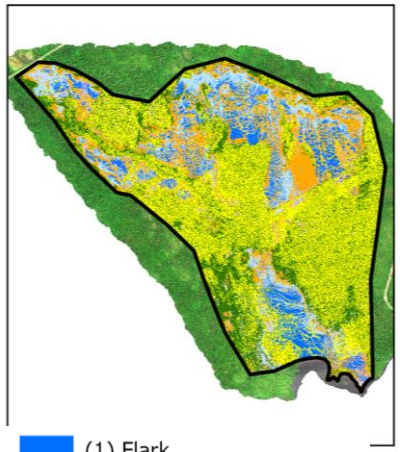
Habitat simulations – Methane

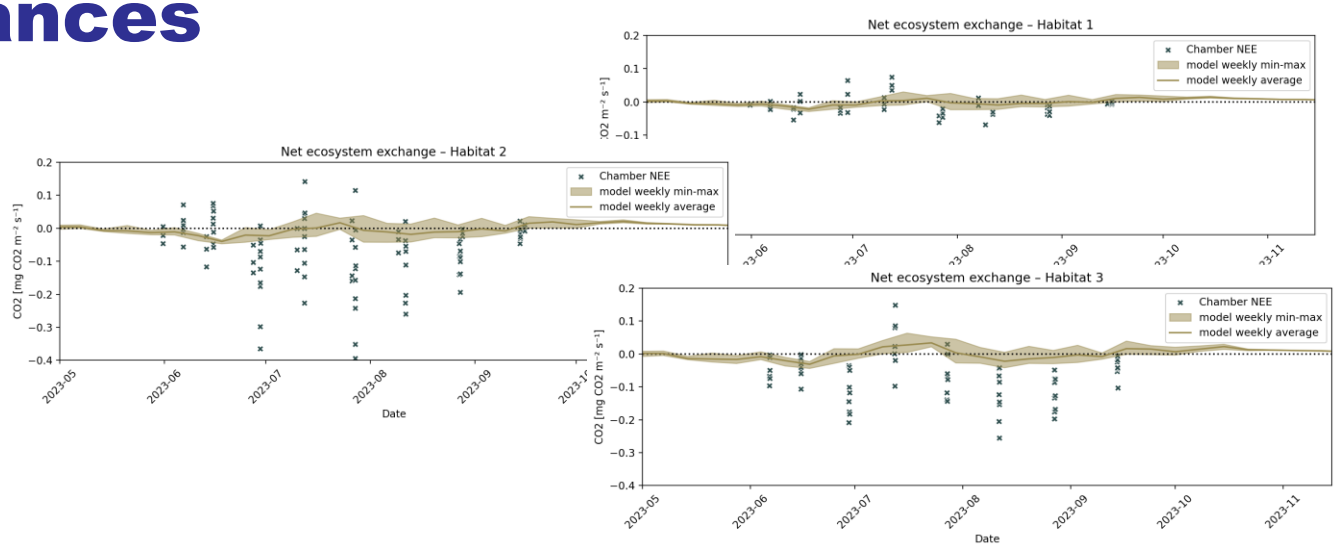


Matorovansuo growing season (June-August) GHG balances



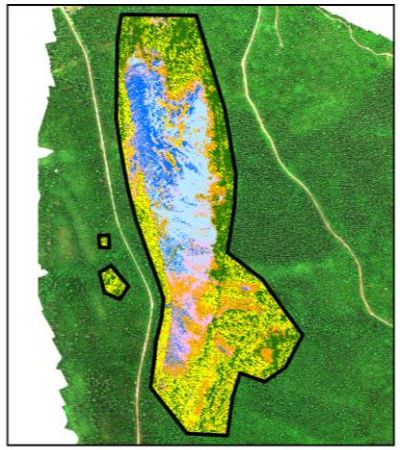


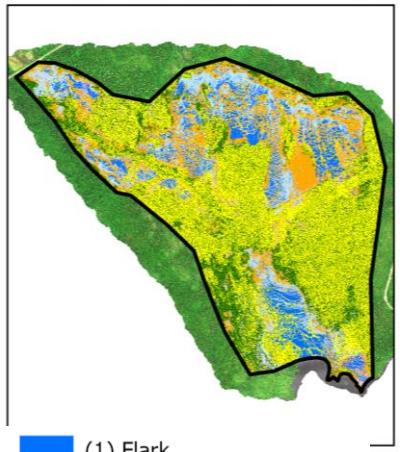
(1) Flark
(2) Trichophorum lawn
(3) Rich carex lawn
(4) Pleurozium hummock
(5) S. fuscum hummock
(6) Wet forest



Habitat	Area [ha]	CH_4 [gC m^{-2}]		CO_2 [gC m^{-2}]	
		Model	Chamber	Model	Chamber
Flark	18.2	9	10	-11	-13
T. lawn	8.3	9	4.9	-27	?
R. carex lawn	19.1	4	7.8	-6.9	-28

Matorovansuo growing season (June-August) GHG balances





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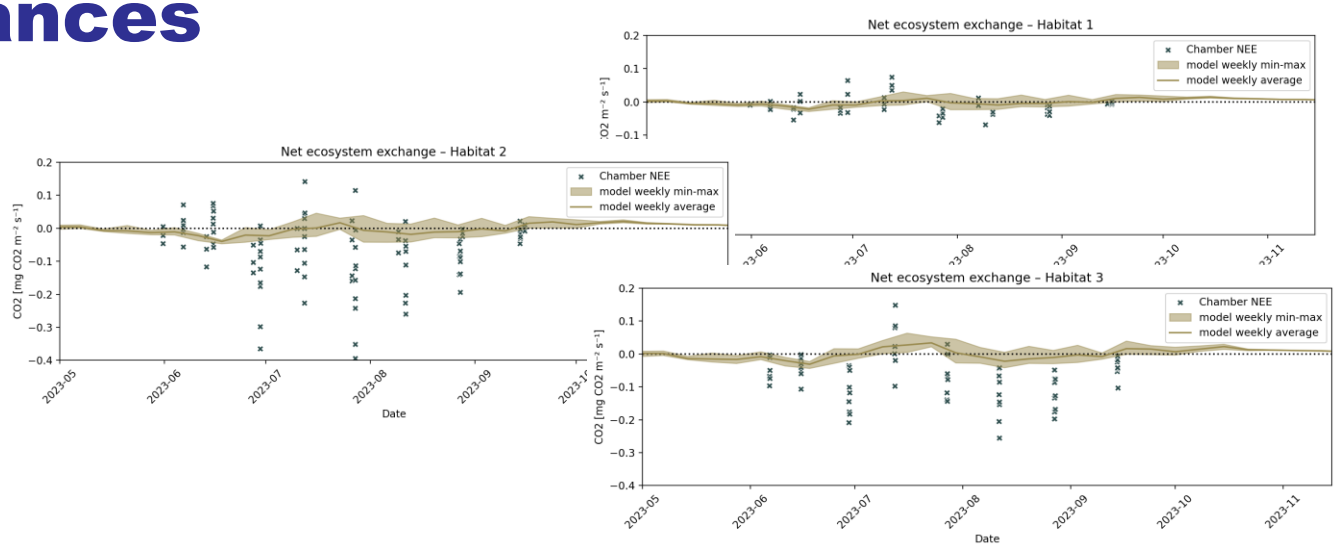

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JSBACH-HIMMELI is able simulate variability of GHG fluxes on peatland habitats

Aggregated balances from JSBACH and GESTs

Välisuo

	Area [ha]	Annual CH4 [t CO2 –eq.]	Annual CO2 [t CO2 – eq.]
JSBACH	28.4	63	-52
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	362	-368
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

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

WP3 T8-9 Next steps

- PFT level optimization of parameters
- Soil decomposition parameters require fixing
- Water table from hydrological model
- Future scenarios with restoration (effect of changing plant composition) and changing climate for Välisuo and Matorovansuo (+sites in Latvia)
- Regional simulations of climate change mitigation potential of peatland restoration in Finland (wider area of Nordics and Baltic countries)

WP5-6 Outreach

- Project meetings
  - Remote meetings related to vegetation analysis, GEST types, remote sensing
- Conferences and meetings
  - Gingko modelling meeting, November, Jena
  - INFRA meeting, April, Sotkamo, Finland
- Communication with policy makers and stakeholders
  - Ministry of Agriculture and Forestry in Finland: discuss and comment the first draft document on EU certification methodology for soil emission reductions through peatland rewetting under the Carbon Removal and Carbon Farming (CRCF) Regulation, entitled 'Draft elements for an EU certification methodology on carbon removals and soil emission reductions through carbon farming under the CRCF Regulation', October
  - Organized the National Hydrological and Climate Modeling Seminar at FMI, >90 participants from Finnish universities and research institutes, November, Helsinki
  - Seminar with national inventory makers, April, Helsinki

WP5-6 Outreach

- Web-stories and news
  - Related to restoration, meetings and visits, world wetland day at LIFE Peat carbon webpage
  - LIFE Finnish pages in FMI, LUKE, UOulu webpages: e.g. https://www.ilmatieteenlaitos.fi/peatcarbon
  - 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
  - Restoration news released at FMI, LUKE and Metsähallitus webpages
  - Local newspaper published news about Pallas restoration
- Video footage of restoration
  - winter (tree logging) and summer (filling ditches) -> three videos prepared
  - videos translated to Finnish, shared with FMI, LUKE, Metsähallitus communications, published them in You Tube, and advertised in Instagram and LinkedIn
    - LIFE PeatCarbon -hankkeessa ennallistetaan ja tutkitaan suota Suomessa ja Latviassa
    - Miten soiden ennallistamisella voidaan vähentää kasvihuonekaasupäästöjä ja sitoa hiiltä?
- Photo exhibition
  - Provided photos from Pallas, translated texts to Finnish, Photo exhibition opening June 10, FMI building, Helsinki

WP5-6 Outreach next steps

- LIFE Project meeting, June 10-12, Helsinki
  - 1,5 days meeting + one day field trip to restoration site near Helsinki
  - Progamme ot the meeting will include the following tasks:
    - Evaluation of ecosystem services
    - Remote sensing, GEST types, vegetation analysis and habitats, microbes
    - Ecosystem and hydrological modeling
    - Upscaling, replication, exploitation of results
    - Communication activities