

Wetlands Solutions *for the Future*

Learning from ALFAwetlands and
REWET Projects

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SHORT-TERM IMPACTS OF REWETTING ON NET ECOSYSTEM CO₂ AND CH₄ EXCHANGE IN A PEATLAND FOREST

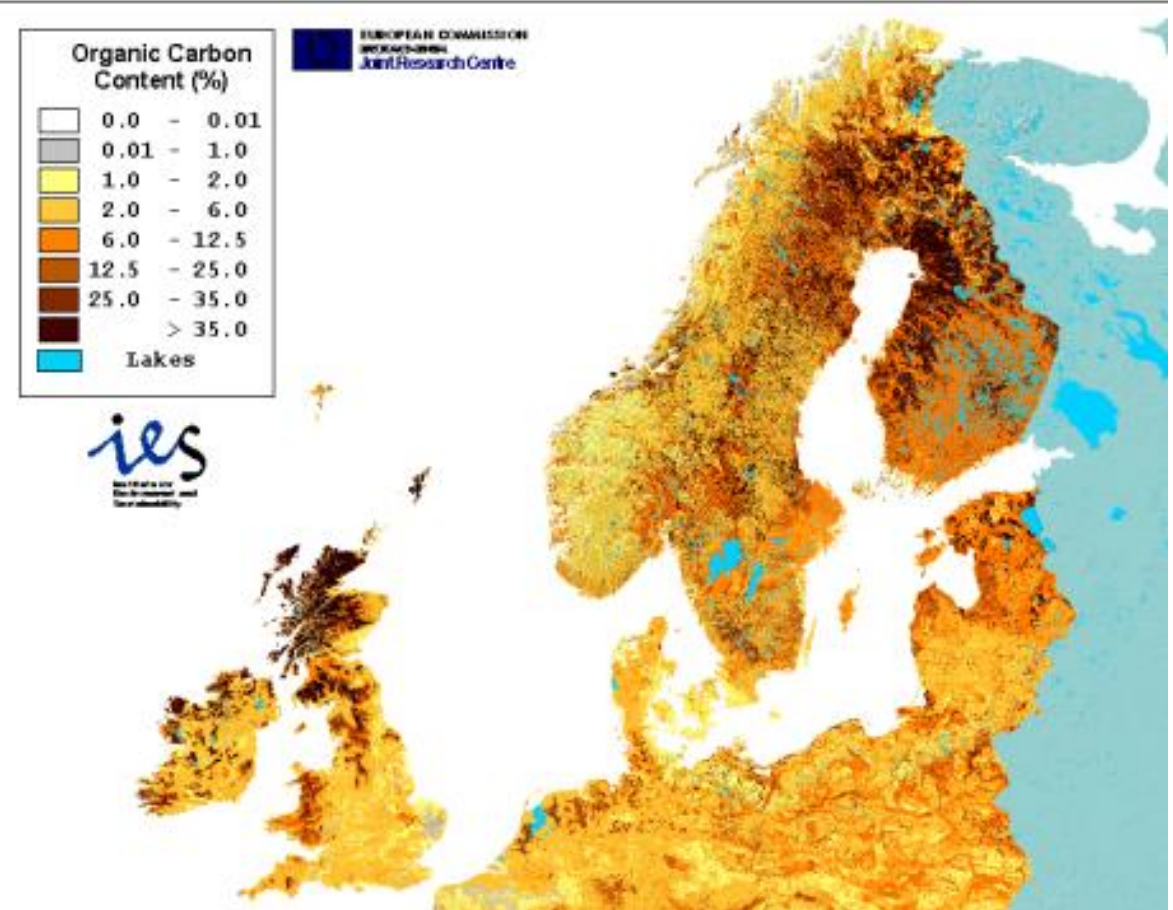
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BACKGROUND

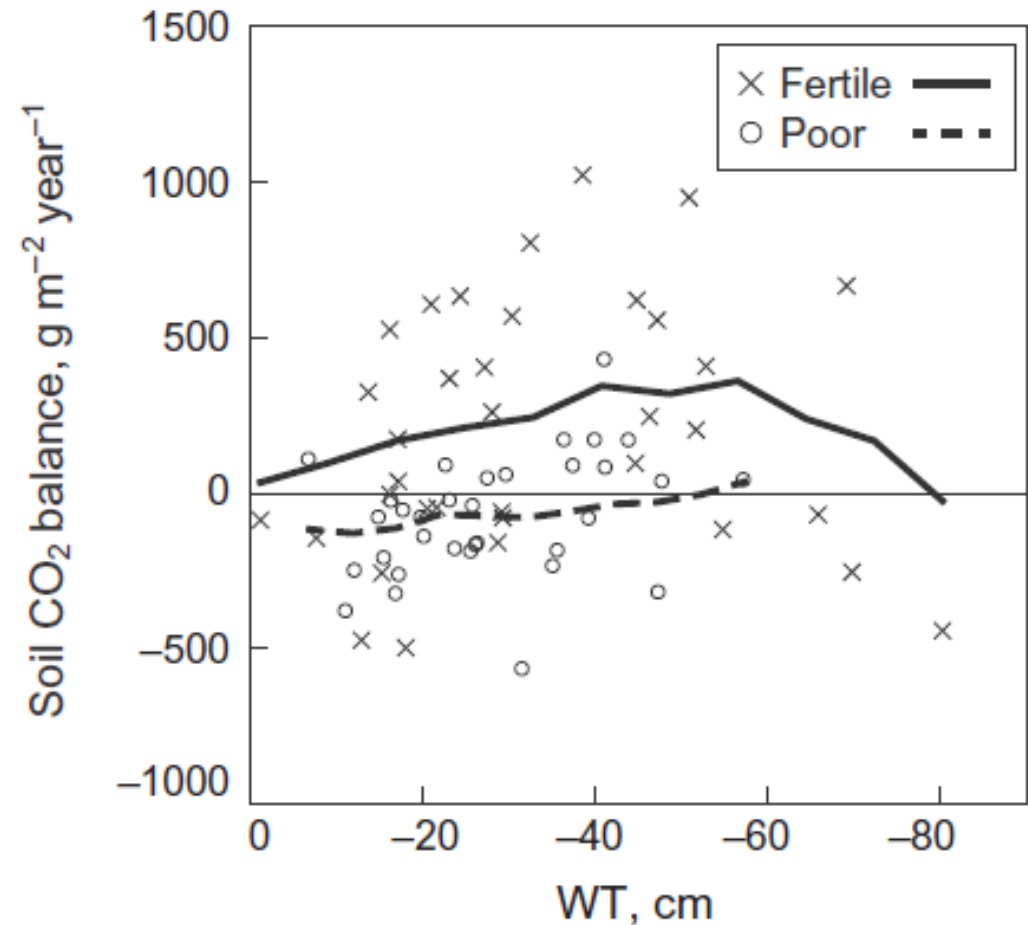
- *Ca.* 30% and 24% of the Europe's peatland area in Finland and Sweden, respectively (Montanarella et al. 2006)
- Finland:
 - Total peatland area *ca.* 9 Mha
 - Drained *ca.* 4.8-5 Mha (~60%)
 - 4.6-4.7 Mha for forestry!



Montanarella et al. 2006 et al. 2006

BACKGROUND

- Soil C balance in forestry drained peatlands?
 - Nutrient poor sites can be considerable C sinks even after drainage
 - Nutrient rich sites act as small sinks or sources
 - Factored by litter quality (recalcitrant in poor sites) and nutrient availability for decomposers?



Ojanen et al. 2013

IS THE GHG EMISSION MITIGATION POTENTIAL LARGEST IN FERTILE SITES?

Nutrient rich

- Earlier research on GHG responses has focused on poor sites mostly
- Nutrient poor sites are more likely to be preferred as rewetting targets due to poor forest growth



Average nutrient status

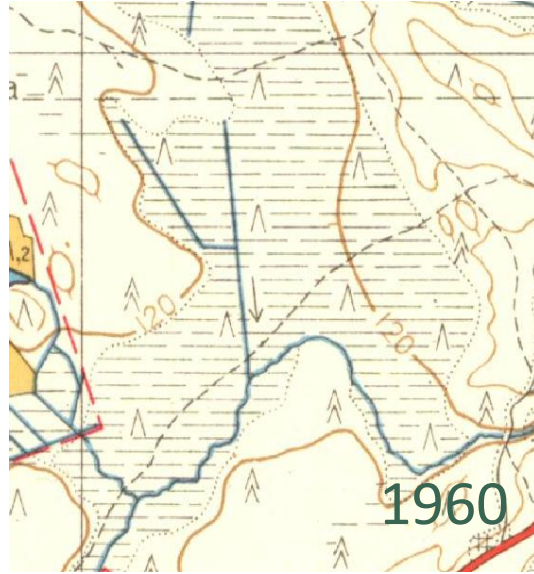


OBJECTIVE

- What are the short-term effects of rewetting on ecosystem CO₂ and CH₄ fluxes in a fertile forestry-drained peatland?
- Rottasniitunsuo peatland as a test case

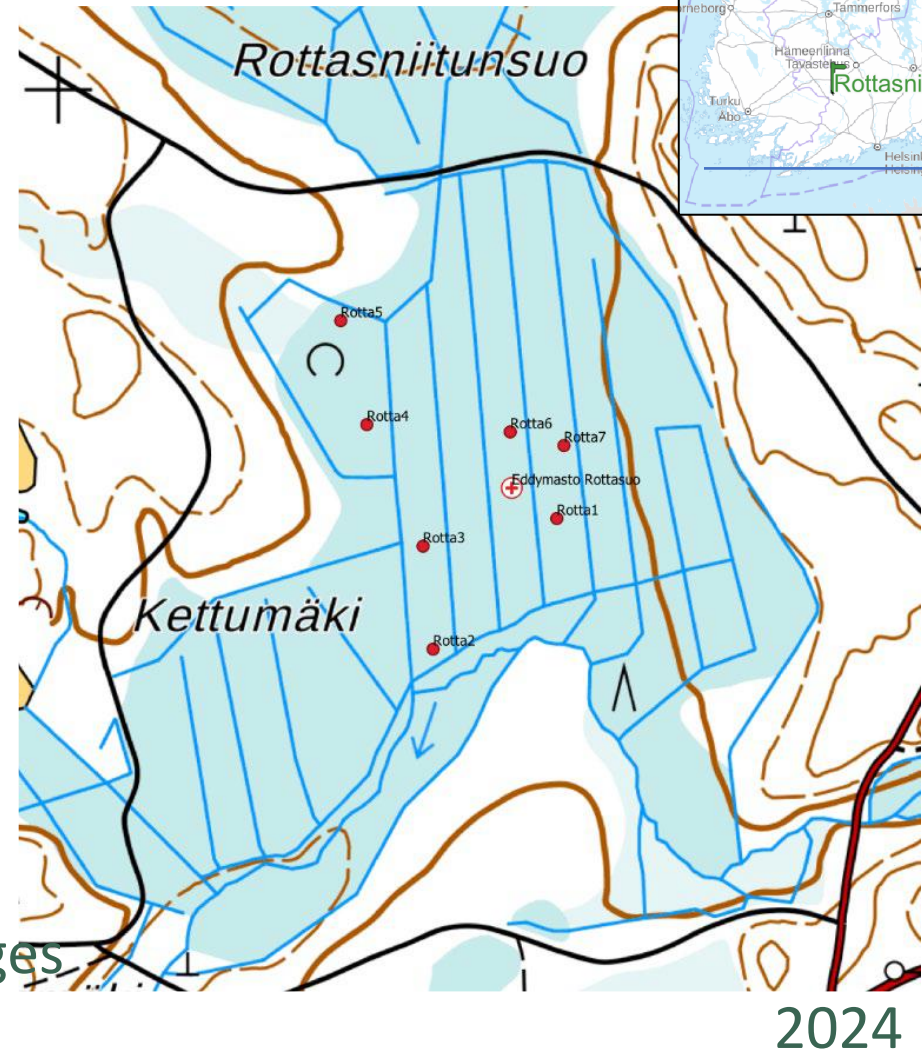


ROTTASNIITUNSUO



National Land Survey of Finland

- 24 ha peatland (44 ha catchment)
- Pre-drainage: open, wet center, treed at edges
- Some old ditches, extensive drainage ~1970
- Scots pine, Norway spruce, downy birch (several nutrient classes)





Prior to thinning 2022-23



Thinning Feb 2024

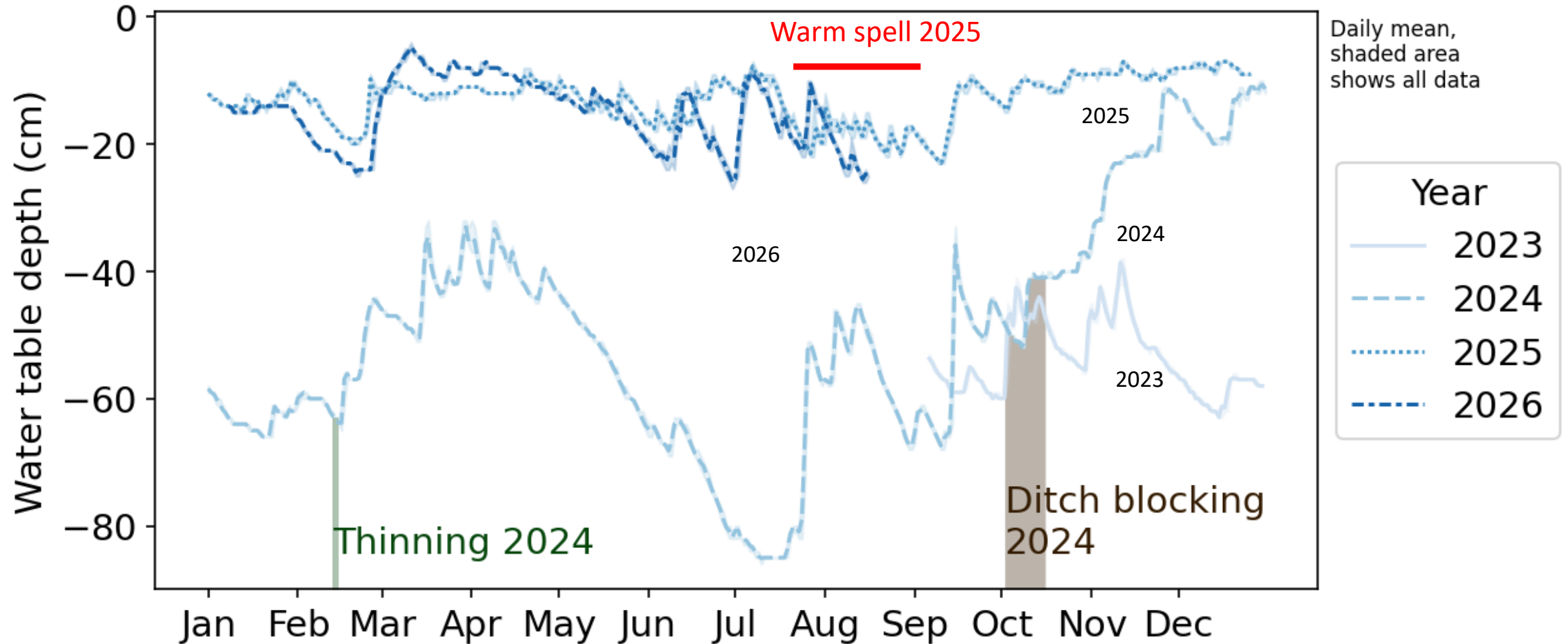


Ditch blocking Oct 2024

Thinning : about 30% of the volume removed

Measurements of CO_2 and CH_4 exchange with eddy covariance at 22 m height

WATER LEVEL RAISED – A SUCCESSFUL REWETTING



ECOSYSTEM CO₂ EXCHANGE

Gross photosynthesis =GPP

Total ecosystem respiration =TER

Net ecosystem CO₂ exchange= NEE

- a clear decrease in summer daily GPP, a slight increase in TER after thinning > lower net CO₂ uptake
- Increased TER 2026 when a dry spell (also GPP)
- Recovery of CO₂ sink in 2026?

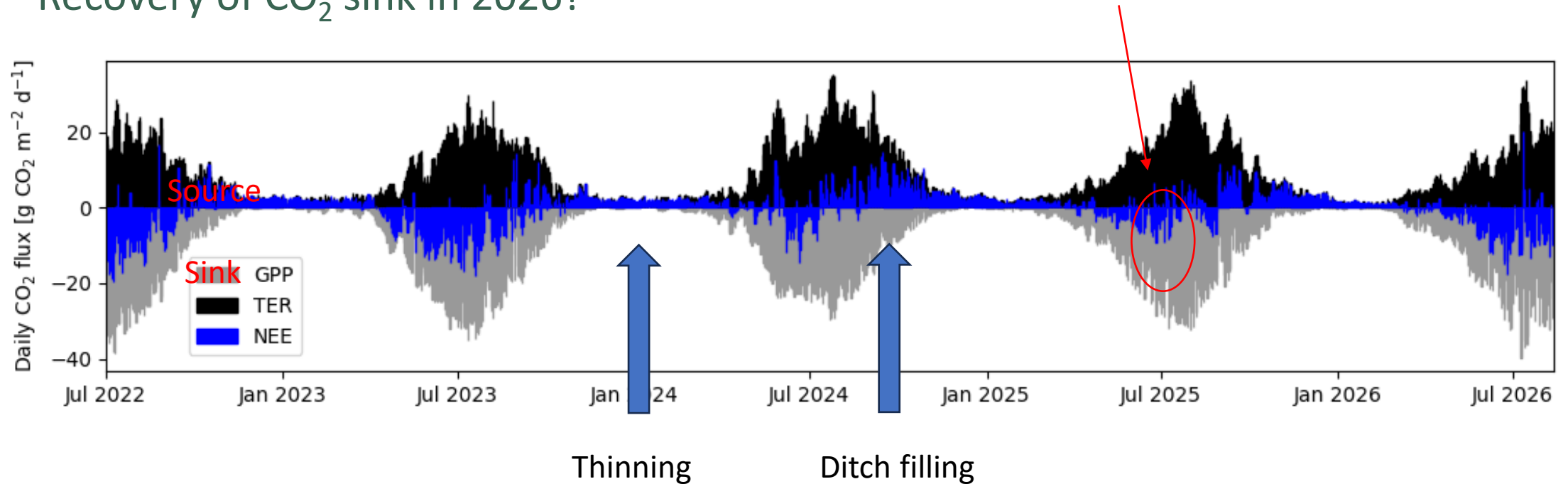
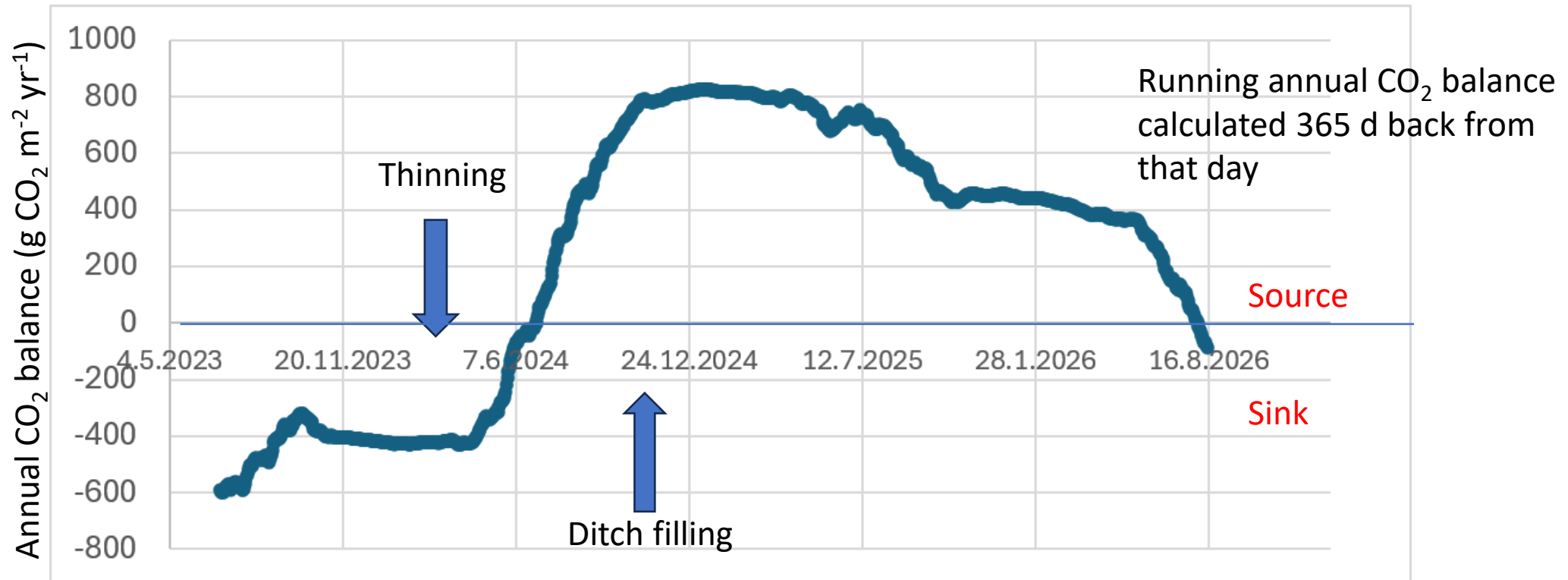


Figure Mika Korkiakoski

RUNNING ANNUAL NET ECOSYSTEM CO₂ EXCHANGE (NEE)

- Before thinning: a net CO₂ sink of about -400 to -600 g m⁻² yr⁻¹
- After thinning: turned to a net source due to lower CO₂ uptake
- Now: turning a sink of CO₂



A SWITCH FROM A CH₄ SINK TO A CH₄ SOURCE

- A small CH₄ sink before rewetting
- A clear increase in CH₄ emissions in August 2025, 10 months after rewetting
- Acted as a sink also during dry periods in 2025 and 2026
- CH₄ emissions still rather small (< 10 mg CH₄ m⁻² d⁻¹; vs pristine mires 50-250 mg CH₄ m⁻² d⁻¹)

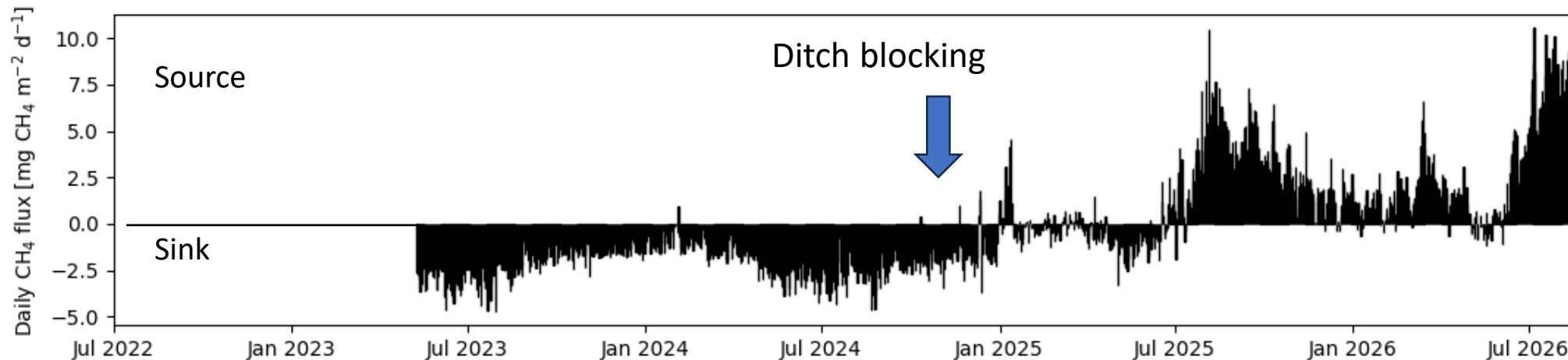
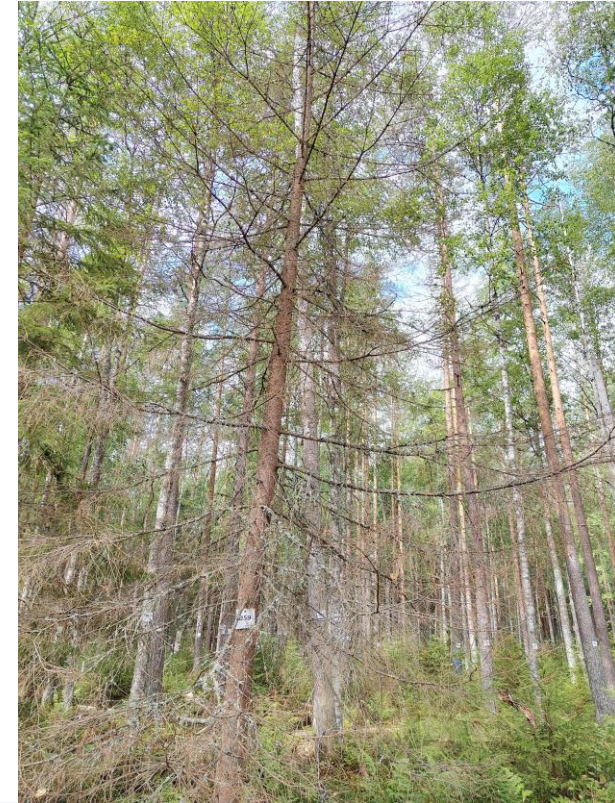


Figure [Mika Korkiakoski](#)

VEGETATION CHANGES

- Cotton grass abundance has increased clearly
- Increased growth of downy birch
- Some spruce trees are dying



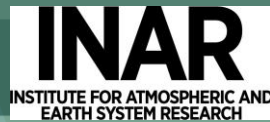
SUMMARY

- Rewetting has been successful in terms of higher water level and increased CH₄ fluxes
- Net CO₂ exchange recovered quickly from thinning of trees (note 30% thinning)
 - Compensation by increased growth of cotton grass & downy birch
 - *What happens as when tree mortality increases?*
 - Soil C balance was not estimated yet

THANK YOU

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