# Potential of continuous cover forestry on drained peatlands to increase the carbon sink in Finland

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# Potential of continuous cover forestry on drained peatlands to increase the carbon sink in Finland

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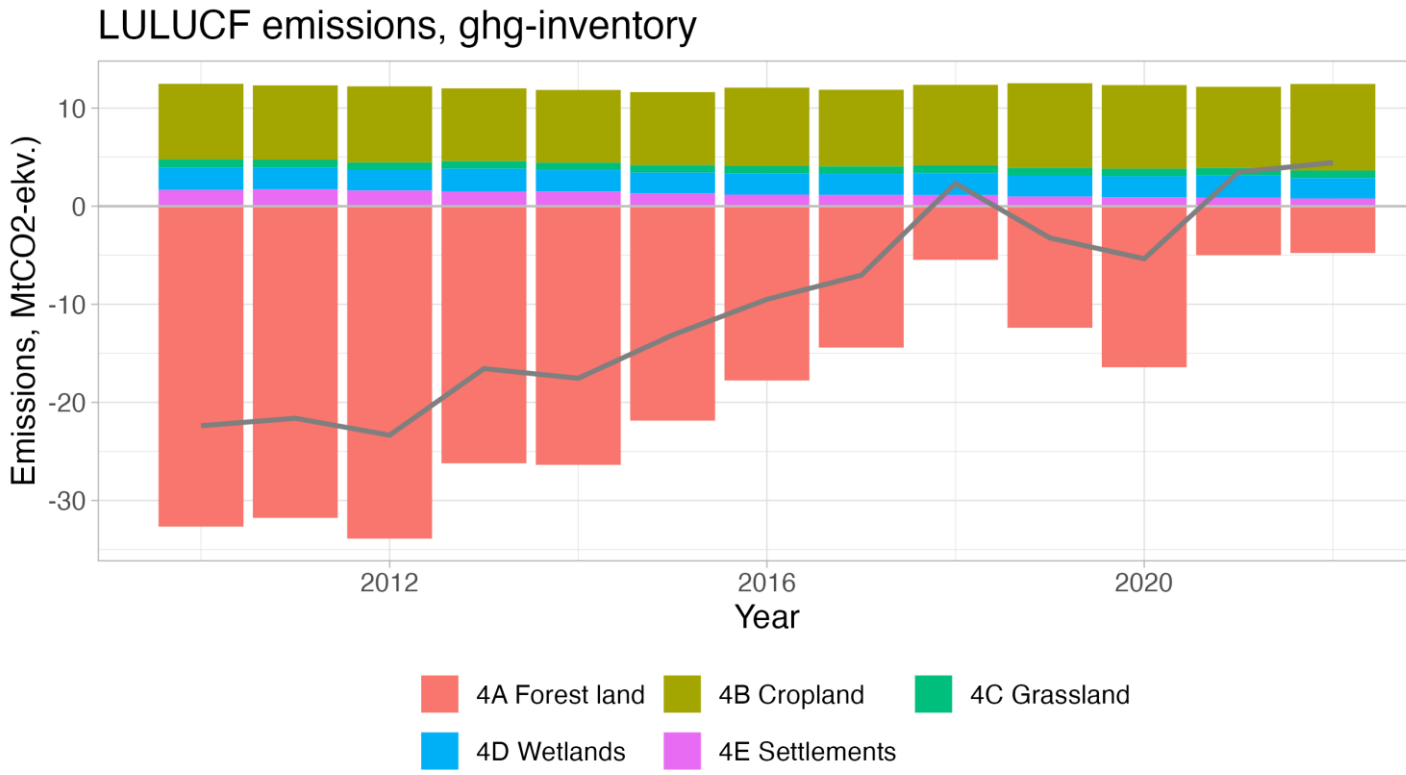
# Background

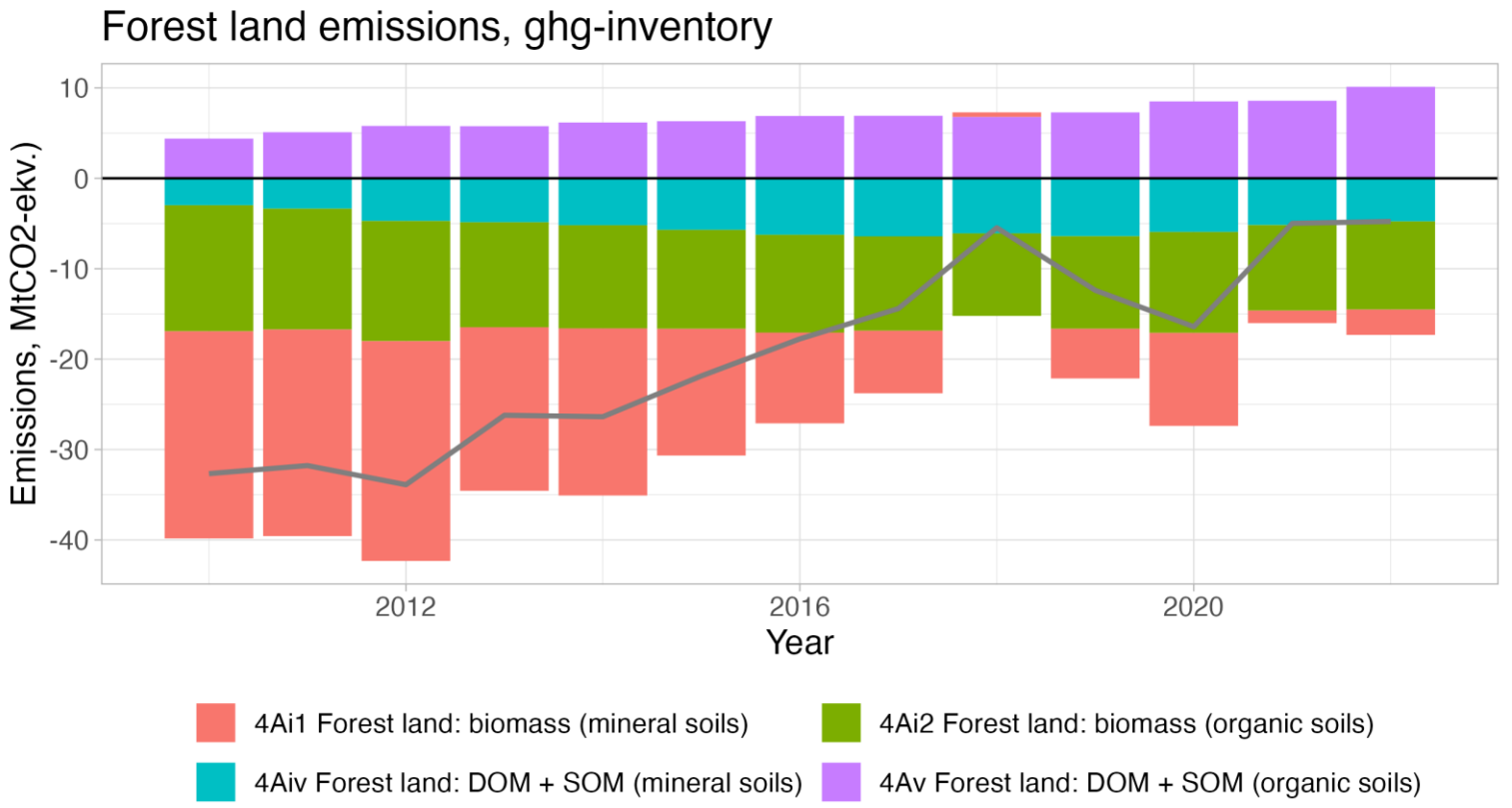
- In recent past, Finnish forests were considered to absorb large fraction of emissions from other sectors
- Forest growth is saturating, cuttings have increased, drought-related (?) decline in growth




Data: Statistics Finland, green-house gas inventory
https://pxdata.stat.fi/PxWeb/pxweb/en/StatFin/

# Background: the peatland soil challenge

- Drained peatlands a significant problem
- Most of the emissions come from nutrient–rich forestry-drained peatland soils (390 000 ha).
- Can continuous-cover forestry in drained peatlands reduce Finland's emissions?




Data: Statistics Finland, green-house gas inventory
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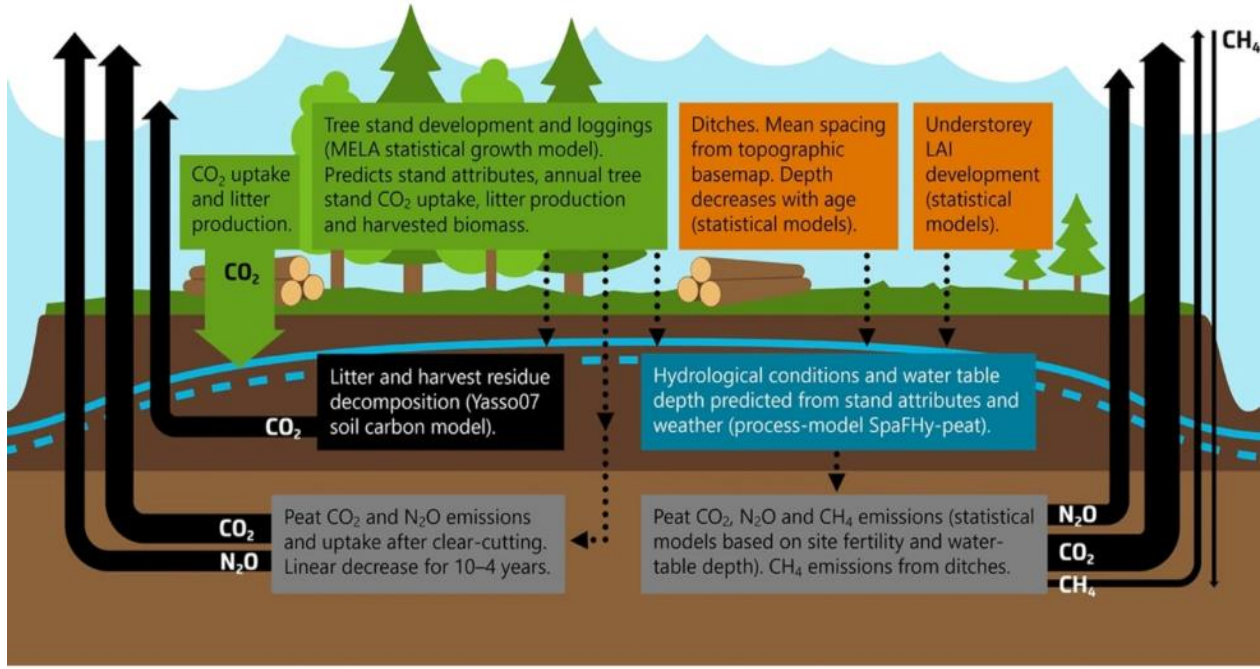
# Peatland GHG emissions and management

- Peat soil GHG exchange depends primarily and directly on:
  - Water level (WL), site fertility, temperature
- WL depends indirectly on:
  - Ditch-network condition and depth
  - Rainfall-evapotranspiration balance
  - Transpiring living biomass






Continuous-cover forestry, idea:

- Control transpiring biomass with regular harvestings to keep WL at a level sustaining stand growth but reducing soil CO2 emissions
- No ditch-network maintenance needed

# Methods & soft-linking models



NFI

Climate data

Mela [1]

Management

Biomass cover (incl. understorey)

Spafhy [2], process-based model:

- Evapotranspiration (ET)
- Peatland water level = f(ET, ditching conditions, climate, peat parameters)

Mineral soil emissions:

Yasso07 [3]

Peatland emissions, empirical:

- CO2, CH4, N2O
- f(WL, T, soil type)
- Impacts of clear-cutting
- Direct CH4 emissions from ditch water surfaces

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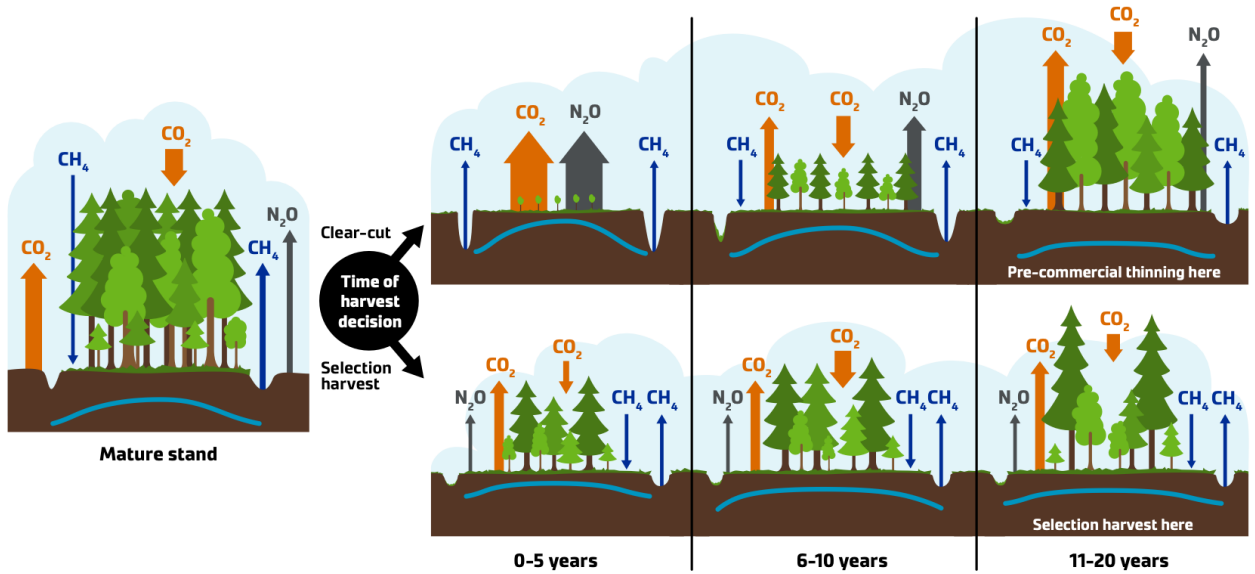
# Scenarios (2022 – 2050) and harvest regimes

BAU-scenario, wood demand 73 Mm3:
- Conventional management of drained peatlands
- Rotation forestry with ditch-network cleaning (Nutrient-rich peatlands)

CCF-scenario, 73 Mm3
- Fertile forestry-drained spruce sites moved to CCF (>Vaccinium type).
- Nutrient poor peatland sites: as in BAU

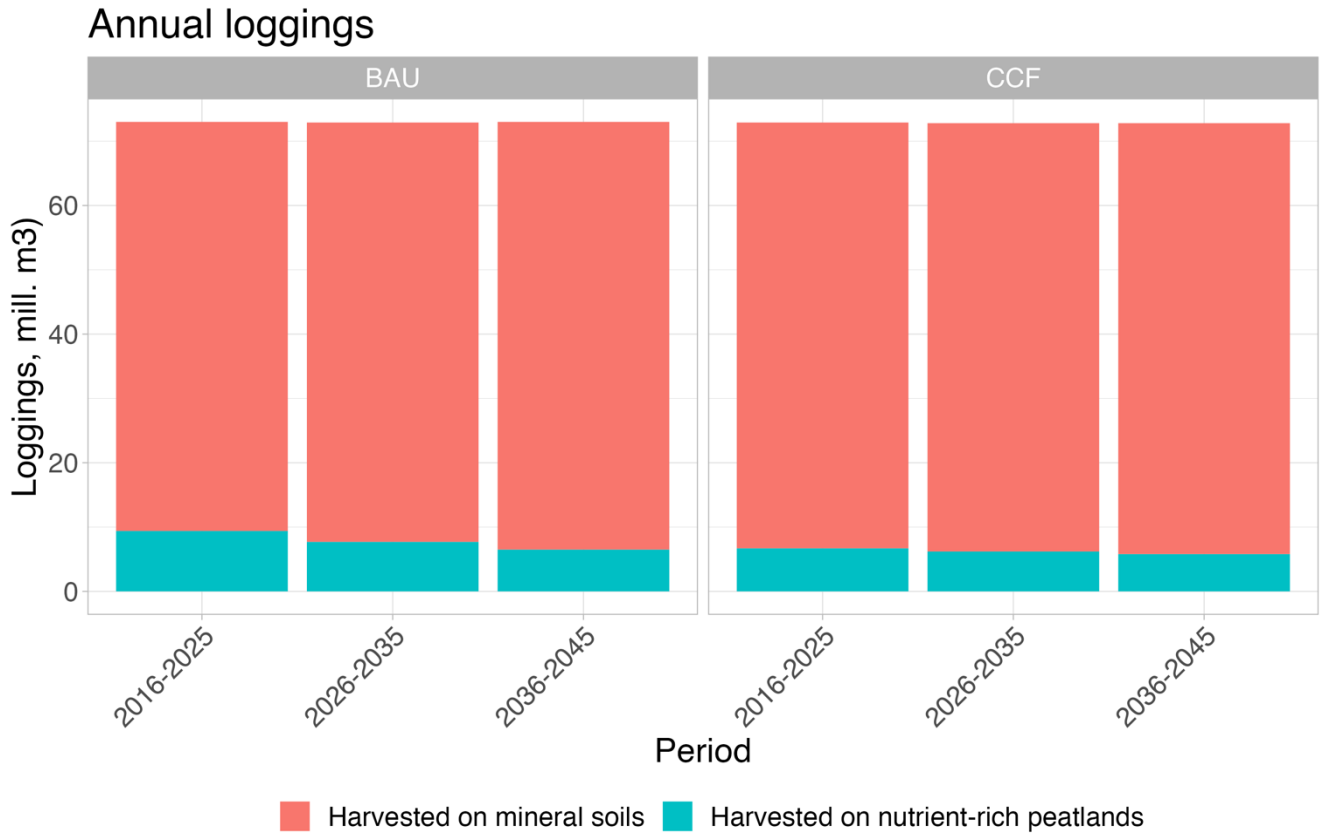
MSY, higher wood demand (not shown)

Continuous-cover harvesting:
- Re-occurring thinnings from above
- Target BA 12-15 m2, requiring > 22 m2 to be harvested
- No re-ditching, existing ditches get shallower with time



# Results: Wood supply from mineral and peatland soils






- CCF is not able to supply as much timber per harvest operation
- Some of the harvests leaked to mineral soils as response to CCF
- Total harvested area increased in CCF scenario by ~ 15 000 ha.

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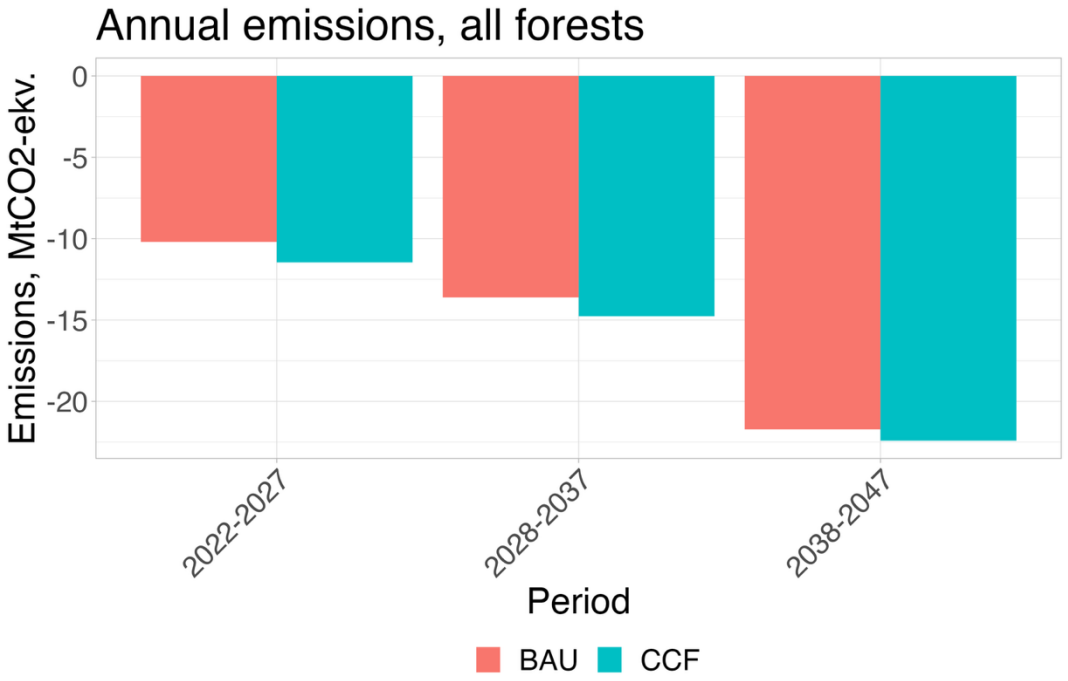
# Results: Forest emissions

- CCF had 0.7-1.3 Tg $CO_2$ eq. $year^{-1}$ stronger carbon sink compared with BAU
- If growth is reduced in CCF, no benefits gained



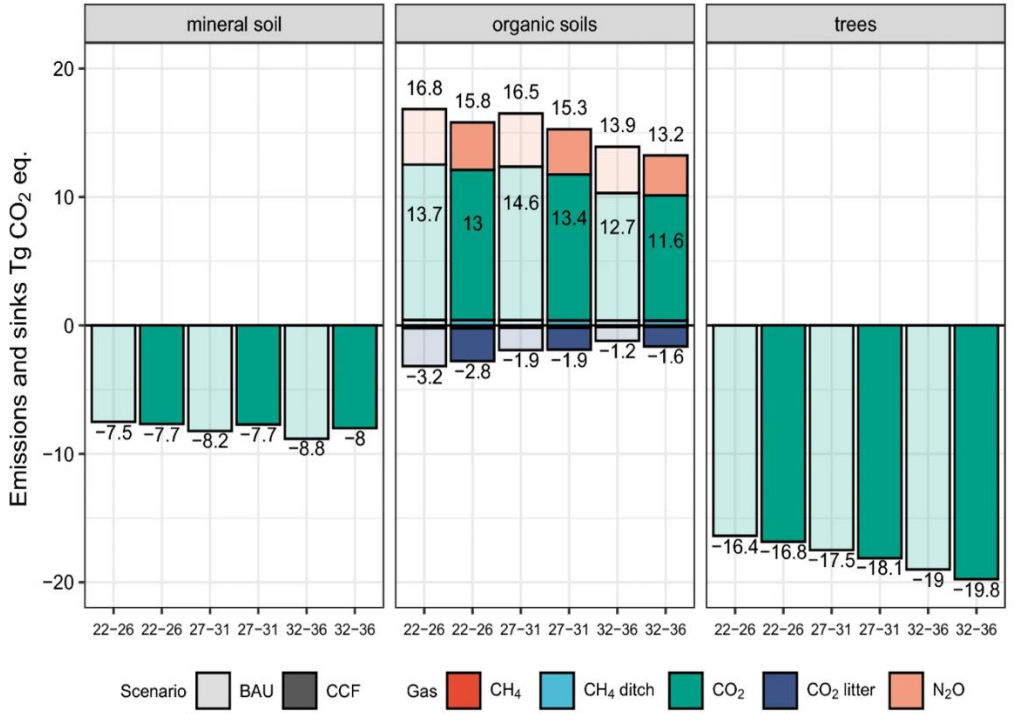




Fig. source: Lehtonen, A (2023).https://doi.org/10.1038/s41598-023-42315-7

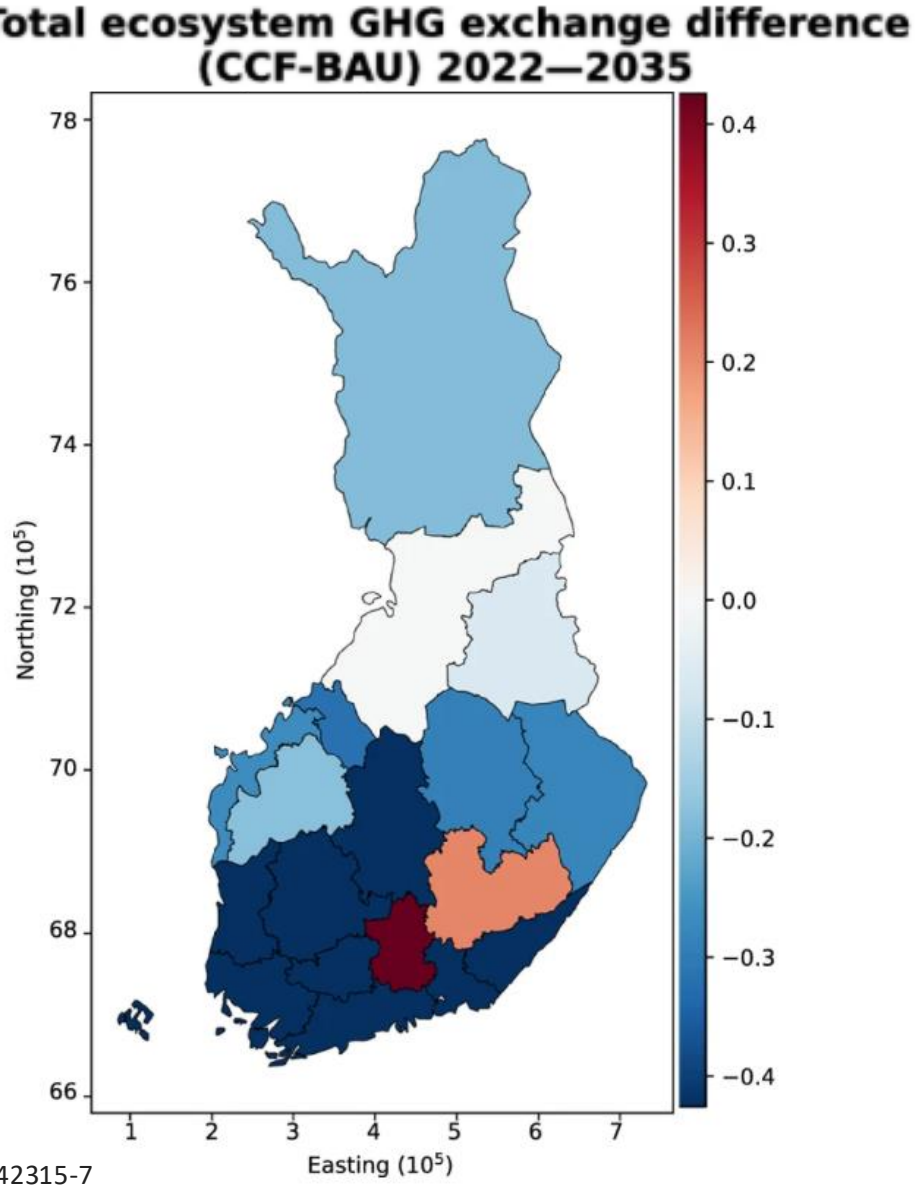
- Extra net sink can be attributed to stronger biomass sink and lower soil emissions in CCF
- Particularly, emissions after cleatcuts in peatlands were large in BAU
- CO2 & N2O important, CH4 played small role

# Climate benefits of CCF vary by region

Variation related to

- Fraction of peatland forests
- Forest types and fertility
- Age-structure
- Climate conditions
- Ditching history and condition

- Possibility for focusing CCF to gain largest climate benefits?

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# Conclusions



Can CCF reduce Finland's GHG emissions ?

- Modestly (here max. 1 Tg $CO_2$ compared to BAU, assuming no CCF-growth reductions)
- Role of water level in controlling emissions was smaller than expected

Is CCF a climate smart solution?

- Not a silver bullet, but it keeps an individual forest an active CO2 sink – and avoids large emissions after clearcut
- Noteworthy: CCF reduces eutrophication, and prevents further degradation of ecosystems and biodiversity

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Thank you
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