SOMPA WP5

Scientific papers in pipeliene

- Lehtonen et al.: Continuous cover forestry (CCF) for drained peatlands – impacts to emissions and harvesting (Draft, results are ready)

- Eyvindson et al. Quantifying forest management impacts on GHG emissions from drained peatland forests: Balancing production and climate goals (Draft)

- Haakana et al. Carbon stock changes for tree biomass in Finland (Almost ready to be submitted)

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Continuous cover forestry (CCF) for drained peatlands – impacts to emissions and harvesting PRELIMINARY RESULTS

Aleksi Lehtonen, Kari Härkönen, Kyle Eyvindson, Mikko Peltoniemi, Raisa Mäkipää, et al.

Background

- Drained peat exchange GHGs depending
  - Primarily: Site type, ditch spacing, ditch depth, living biomass and weather
- The emissions can be modified through management (changing ditch depth and transpiring biomass)
    - These will change the ground water table – changing the ability of the peat to emit GHGs

Background

- Forest management affects living biomass and ditch depth
  - How can we mitigate GHG emissions from drained peatlands
- If we need to use these sites for production purposes, how should we?
- Forest simulations can inform of the possible trade-offs between production and GHG emissions

How to project forest growth

- Use a forest simulator, here MELA
- Input data:
    - Latest forest inventory data
- Define scenarios and then project future development over time.
- Connect these projections to a modelling framework that estimates GHG emissions

How to model GWT of drained peats

- Link forest modelling data to SpaFHyPeat (Launiainen et al. 2019)
- Input data required (9 elements):
    - **Canopy fraction, Dominant tree Height, LAI of Pine, Spruce and Deciduous trees**, Soil fertility, ditch spacing and depth, and weather data.

Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-45
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Discussion started: 5 February 2019

Hydrology and Earth System Sciences
Open Access
Discussions

Modeling forest evapotranspiration and water balance at stand and catchment scales: a spatial approach

Samuli Launiainen[1], Mingfu Guan[2,1], Aura Salmivaara[1], and Antti-Jussi Kieloaho[1]

[1]Nature Resources Institute Finland, Latokartanonkaari 9, 00790 Helsinki, Finland
[2]Department of Civil Engineering, The University of Hong Kong, HKSAR, China

Correspondence: Samuli Launiainen (samuli.launiainen@luke.fi)

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Academic curiosity and process models for sustainable use of boreal ecosystems

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Modelling ditch depth

- Inclusion of variable ditch depth – (Hökkä et al. 2020)
    - Quality of ditch changes over time
- Model is based on:
    - Ditch age
    - Ditch construction
    - Peat thickness
    - Peat slope

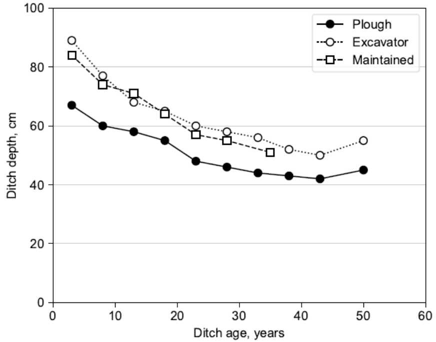


Figure 1. Average depth of original ditches made by plough or excavator, and maintained ditches made by excavator as a function of ditch age

- Some variables are known, others can be estimated

Soil emission estimation

- Understory LAI: 0.5 when basal area (G) less than 0.5 m^2, 1.5 when G > 0.5 & < 5, thereafter decreasing trend until G = 30 (treated as deciduous)
- N_2O & CO_2 after clear felling (Korkiakoski + Mäkiranta):
  - > *Vaccinimiun*: 4 to 1 g N_2O per m^2 linear decrease, first 10 years
  - < *Myrtillus*: 1 to 0.2 g N_2O per m^2 linear decrease, first 5 years
  - > *Vaccinimiun*: from 2700 g CO_2 per m^2 linear decrease, first 9 years
  - < *Myrtillus*: 2000 g CO_2 per m^2 linear decrease, first 9 years
  - Thereafter according to Minkkinen et al. 2020 & Ojanen et al. 2019
- Ditch CH_4 (kg /ha) as function of depth (cm) e <- d/(3.319830 + 0.009518 * d)
- Distance between ditches based segmented forest and ditch network analysis

Soil emission estimation II

Drained peatlands: natural mortality and harvest residues based on Yasso07 simulations

Upland soils: all litterfall based on Yasso07 simulations

Modelling GHG emissions

- Emissions from drained peat linked to ground water table & fertility:
- N_2O – Minkkinen et al. (2020).

$$N_2O\ \text{emission} = (a + b \times WT^2) \times e^{-c \times \text{CN ratio}} + d$$

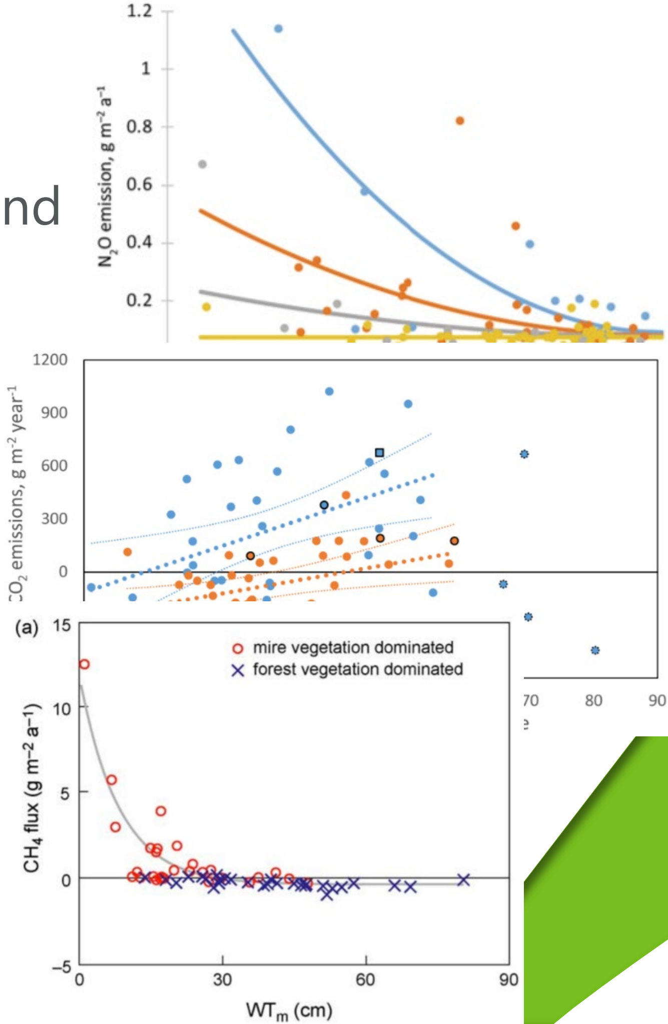
- CO_2 – Ojanen and Minkkinen (2019)

$$\text{nutrient rich: } NE_{CO2soil} = -115 + 12 \times WTD \qquad [3]$$

$$\text{nutrient poor: } NE_{CO2soil} = -259 + 6 \times WTD \qquad [4]$$

- CH_4 – Ojanen et al. (2010)

$$CH_4\ \text{flux} = y_0 + ae^{-bWT_m}$$



Scenarios I

Defining soil management

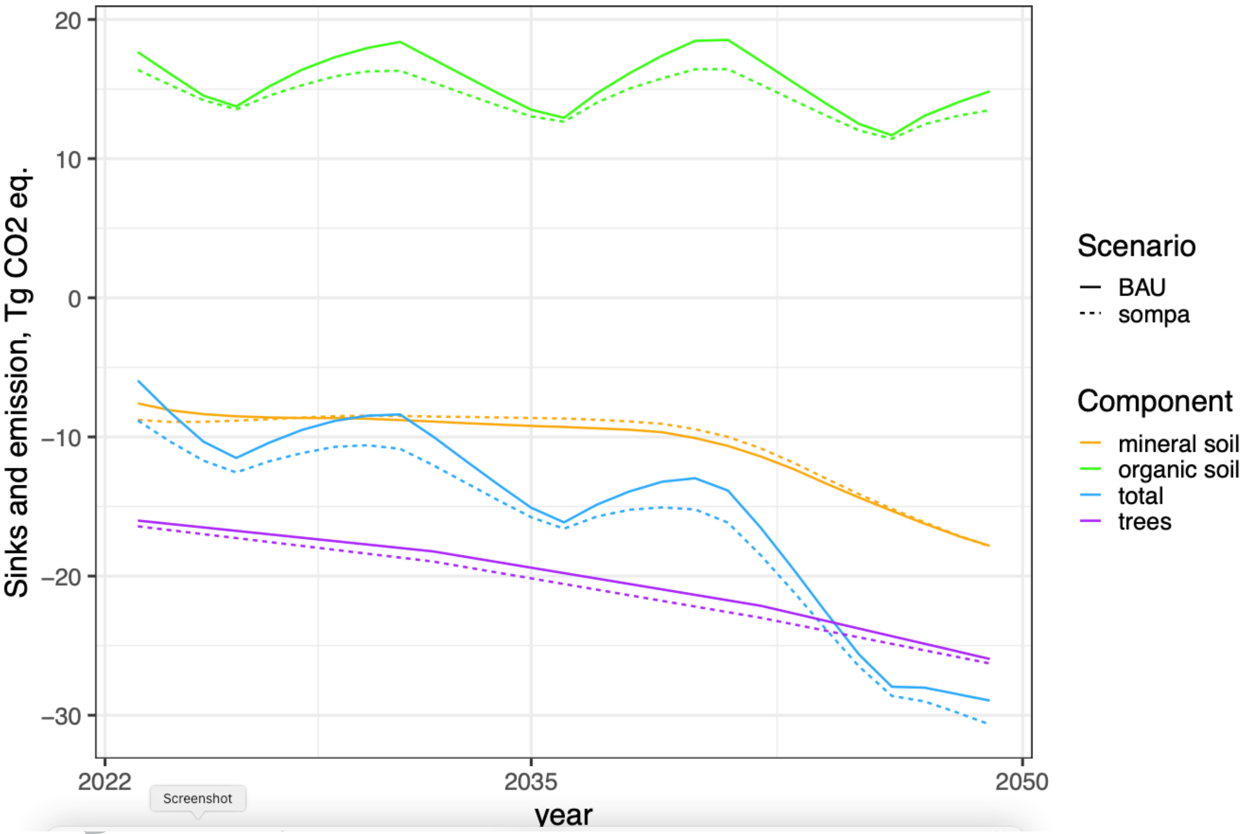
- BAU
  - Management of drained peatlands as it has been, ditching after clearfelling and based on MELA (without subsidies)
- SOMPA
  - Compulsory CCF with spruce dominated stands on fertile soils (>*Vaccinium* type). Nutrient poor sites: ditching as in BAU
- JURO (as a sensitivity analysis)
  - Same as SOMPA, but first 5 years of growth of suppressed trees reduced by 25%

Scenarios II

Defining level of loggings (demand)

- Maximum sustained
    - BAU
    - SOMPA
    - JURO
- Actual fellings (2016-2018)
    - BAU
    - SOMPA
    - JURO

Preliminary results



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