Toward Continuous Cover Forestry on Boreal Lowlands – Hydrological Responses to Partial Harvesting

Luke
NATURAL RESOURCES INSTITUTE FINLAND

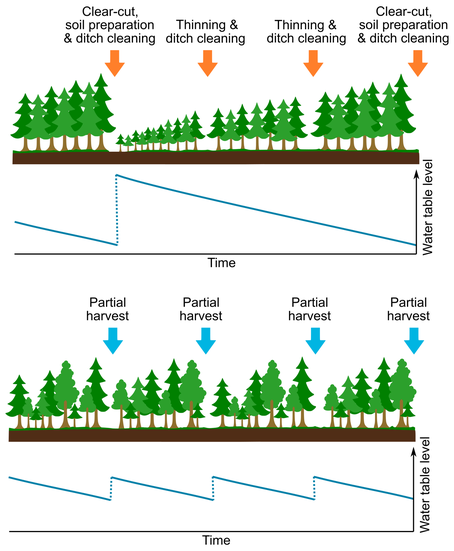
Kersti Haahti[1], Samuli Launiainen[1], Annalea Lohila[2], Mika Korkiakoski[2], Raija Laiho[1], Raisa Mäkipää[1] and Mika Nieminen[1]

kersti.haahti@luke.fi
(tel. +358 29 532 2795)

1 Motivation

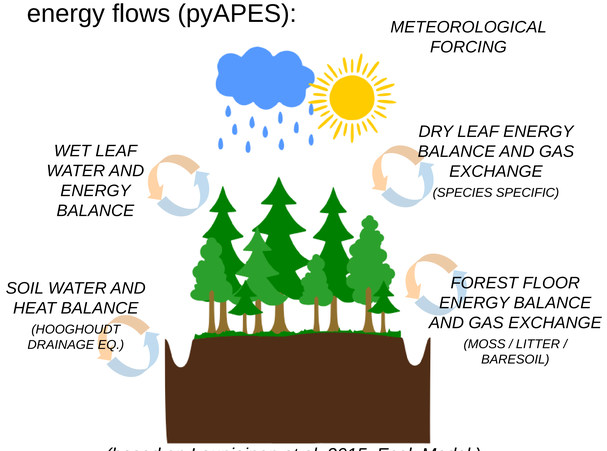
Continuous cover forestry is considered environmentally more favorable than the prevailing **even-aged management**. On lowland soils the feasibility of **continuous cover forestry** depends on whether the tree stand can sustain sufficient drainage after partial harvests.

Combining data analysis and mechanistic modeling we studied the hydrological responses to partial harvesting.



2.2 Model description

A 1D multi-layer multi-species soil-vegetation-atmosphere model describing H_2O, CO_2 and energy flows (pyAPES):

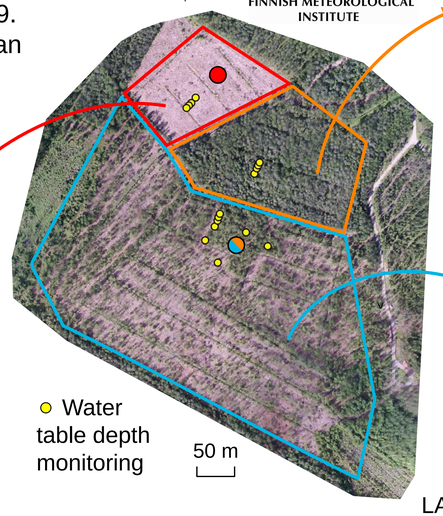


(based on Launiainen et al. 2015, Ecol. Model.)

2.1 Experimental site: Lettosuo

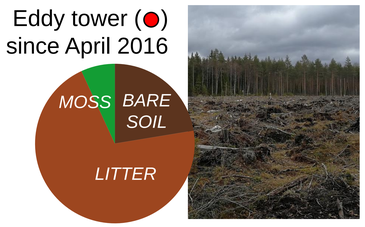
A peatland forest in Southern Finland (60°38'N, 23°57'E) drained in 1969. Monitoring started in 2010, when an Eddy flux tower (●) was installed.

In March 2016, two harvesting experiments were carried out, creating tree parallel sites:



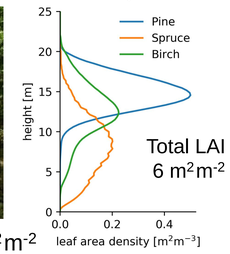
CLEAR-CUT

Eddy tower (●) since April 2016



$LAI_{understory}$ = 0.1…0.8 m^2m^{-2}

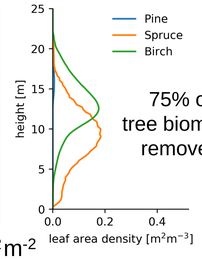
CONTROL (no treatment)



Total LAI 6 m^2m^{-2}

$LAI_{understory}$ = 0.65 m^2m^{-2}

PARTIAL HARVEST

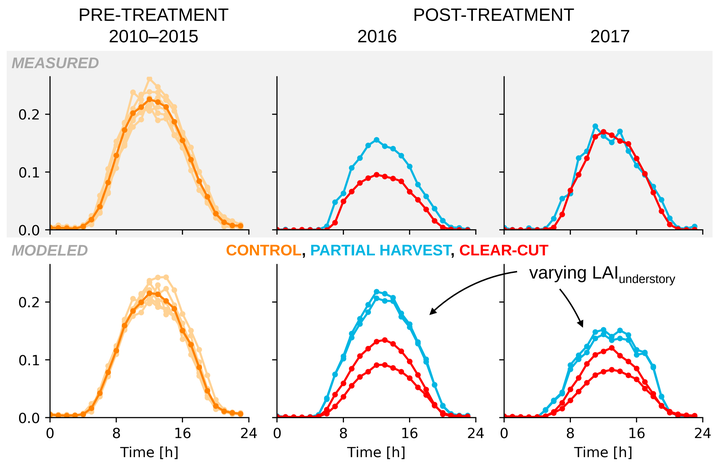


75% of tree biomass removed

$LAI_{understory}$ = 0.4…0.8 m^2m^{-2}

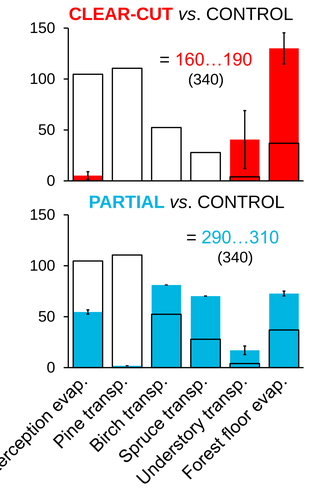
3.1 Results on evapotranspiration (ET)

Diurnal evapotranspiration (mm/h)*

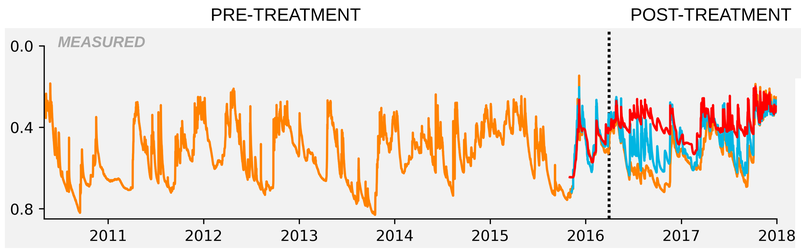


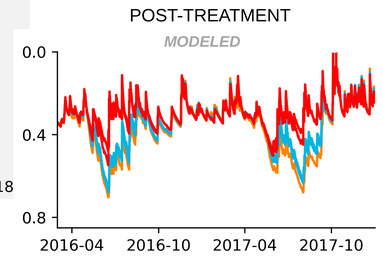
* Includes data from times with no precipitation in May-September (not gap-filled)

Evapotranspiration components (mm/y)



3.2 Results on water table depth (WTD)





4 Conclusions

- At clear-cut site, **changes in vegetation** explained the significantly increased ET during 2nd year
- Differences between modeled and observed ET and WTD during first post-treatment year at partial harvest site indicate **trees were under stress**
- At partial harvest, transpiration of the harvested pine was **almost fully compensated for** by the remaining stand and understory, whereas interception evaporation was clearly reduced
- High ET capacity at partial harvest supports the **feasibility of continuous cover forestry**

[1] Natural Resources Institute Finland, Helsinki, Finland; [2] Finnish Meteorological Institute, Helsinki, Finland