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C3 Implementation of climate change mitigation measures in selected demo sites in Finland

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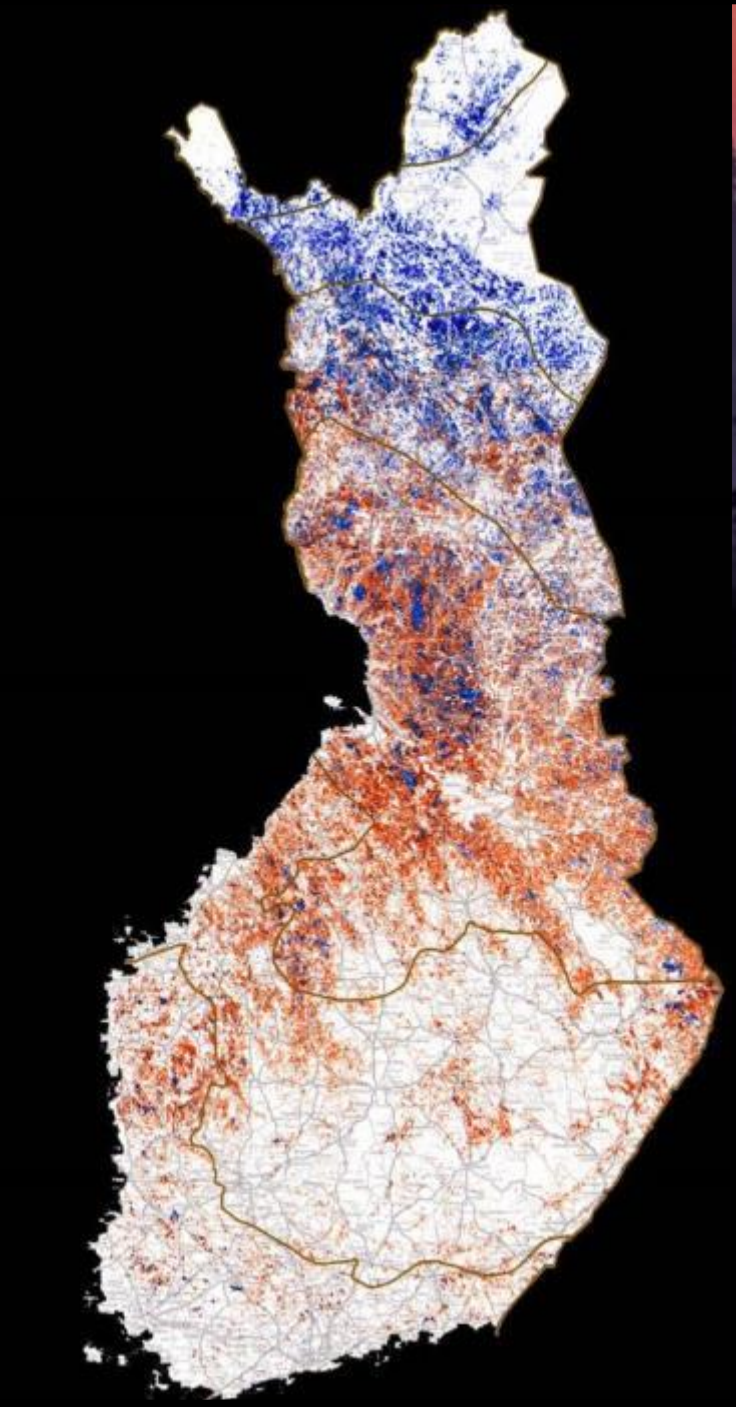
LIFE OrgBalt, LIFE18 CCM/LV/001158

EU LIFE Programme project
"Demonstration of climate change mitigation potential of nutrients rich organic soils in Baltic States and Finland"



Peatlands in Finland

*** About 30% of land area, ~9 M ha**
*** Forestry the most important land use**

- >50% (~4.6 M ha) drained for forestry
- Drained mainly in 1960's and 1970's
- ~¼ of forest area, annual forest growth and total stock volume

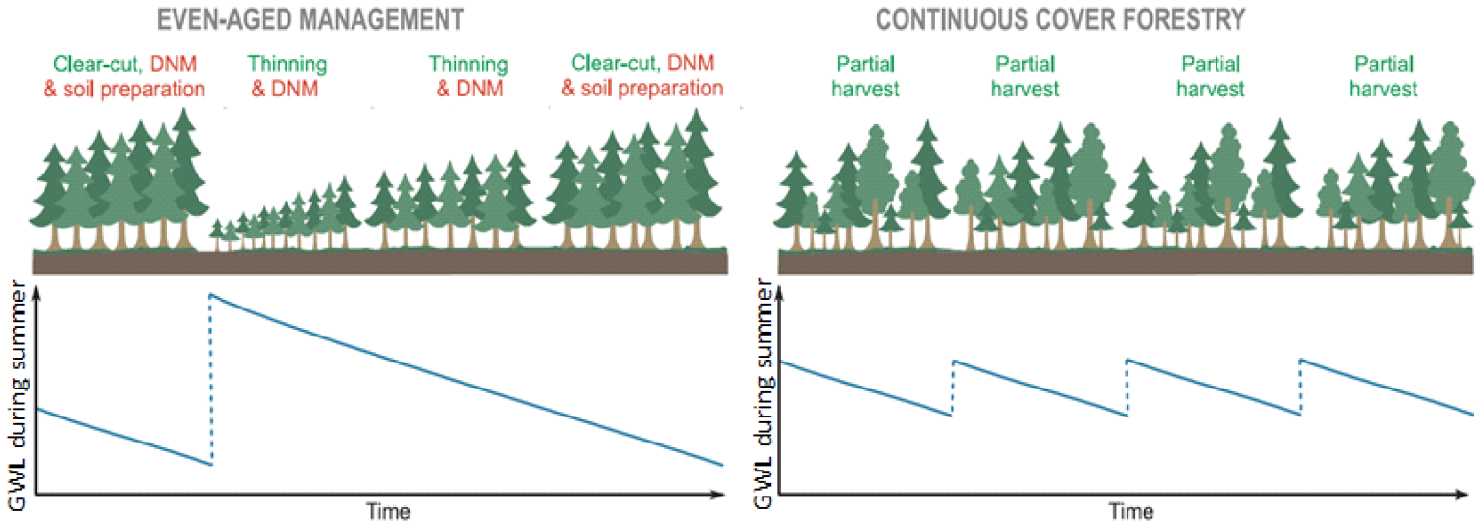
Three drained peatland forest areas chosen in Finland

- Existing research sites providing longer-term data than what can be collected within this project
- Different versions of continuous-cover forestry (CCF)
- Cutting treatments applied in 2016-2018
- Strong stakeholder interest aided in establishing the sites
- CCF in peatlands has a slightly different angle from CCF in mineral-soil forests[1]

[1] Nieminen, M., Hökkä, H., Laiho, R., et al. 2018. Could continuous cover forestry be an economically and environmentally feasible management option on drained boreal peatlands? Forest Ecology and Management 424: 78–84.

Continuous-cover forestry (CCF)

- The CCF in broad sense can be defined to include all management options which do not aim at even-aged stand structure and avoid clearcuts, i.e., retain a significant proportion of the tree stand after each harvesting
- In peatland forests, one aim is to control the water-table level (WL) by CCF



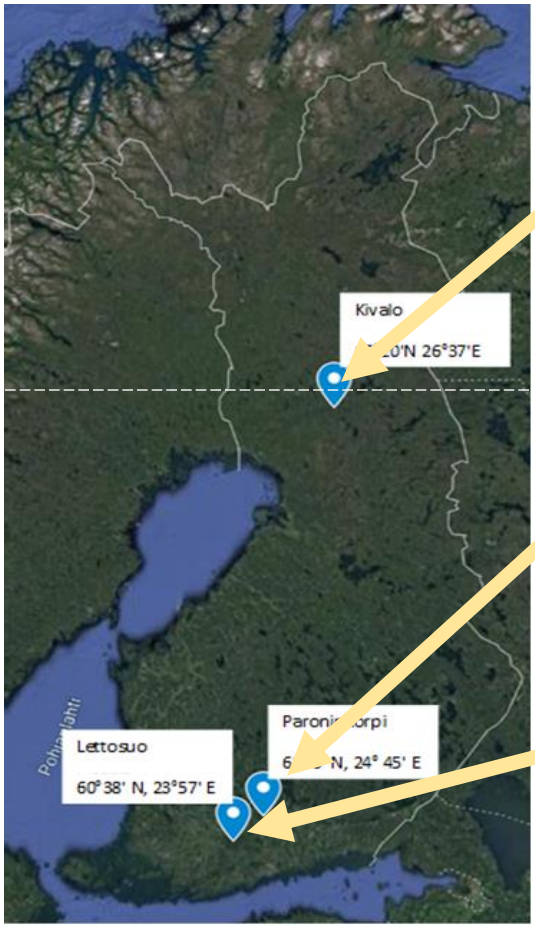
Schematic presentation of tree stand development and growing season WL depth in even-aged management and CCF in drained peat soils in Nordic conditions (modified from Nieminen et al., 2018).

Potential of CCF in mitigating climate change and reducing anthropogenic environmental impacts

- Controlled rise in soil water-table level (WL) due to remaining tree stand evapotranspiration[2]; target: not higher than 30 cm during growing season
- Lower impact to environment conditions in the forest stand
- Reduced/no need for ditch network maintenance
- **Reduced soil CO_2 emission from peat due to higher WL**
- **Maintained soil CH_4 sink, or reduced emission, as high WL following clearcut is avoided**
- Reduced water-borne outputs of C and nutrients to surface water bodies

[2] Leppä, K., Korkiakoski, M., Nieminen, M., Laiho, R., et al. 2020. Vegetation controls of water and energy balance of a drained peatland forest: Responses to alternative harvesting practices. Agricultural and Forest Meteorology 295, 108198.

Continuous Cover Forestry (CCF) sites studying forest regeneration and greenhouse gas fluxes

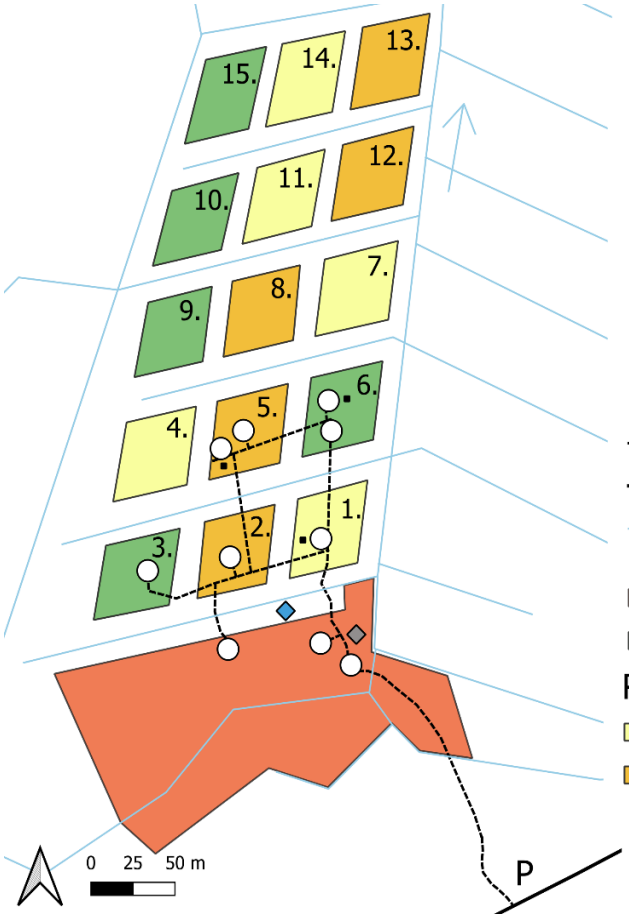


Kivalo (FIC303). Small gap harvesting and natural regeneration in mixed stands. Ditch network maintenance has not been applied in the study area. Land owner: Metsähallitus.

Paroninkorpi (FIC301). Selective harvesting in spruce stands without full ditch maintenance. Conventional clearcut and uncut forest plots are measured as comparison. Land owner: UPM.

Lettosuo (FIC302). Shifting to CCF by overstorey harvesting in originally Scots pine dominated forest. Conventional clearcut + ditch mounding + planting of spruce seedlings, as well as uncut forest, are measured as comparison. Land owner: Metsähallitus.

Continuous forest cover in spruce stands using selective harvesting. Paroninkorpi, Site FIC301.



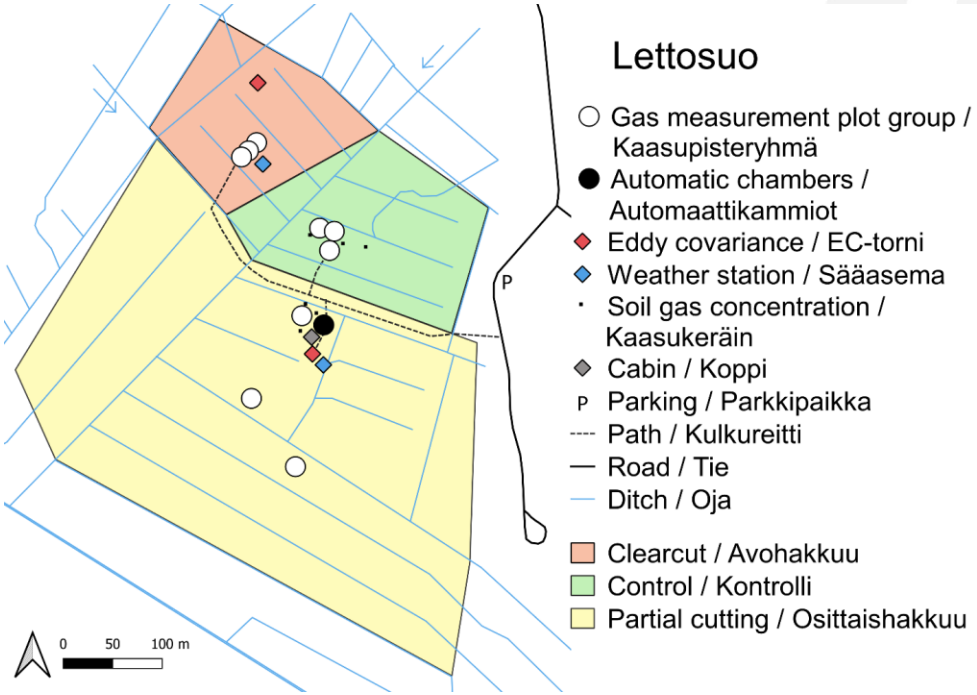
Paroninkorpi

- ○ Gas measurement plot group / Kaasupisteryhmä
- ◆ Weather station / Sääasema
- ▪ Soil gas concentration / Kaasukeräin
- ◆ Cabin / Koppi
- P Parking / Parkkipaikka
- ---- Path / Kulkureitti
- — Road / Tie
- — Ditch / Oja
- Clearcut / Avohakkuu
- Control / Kontrolli

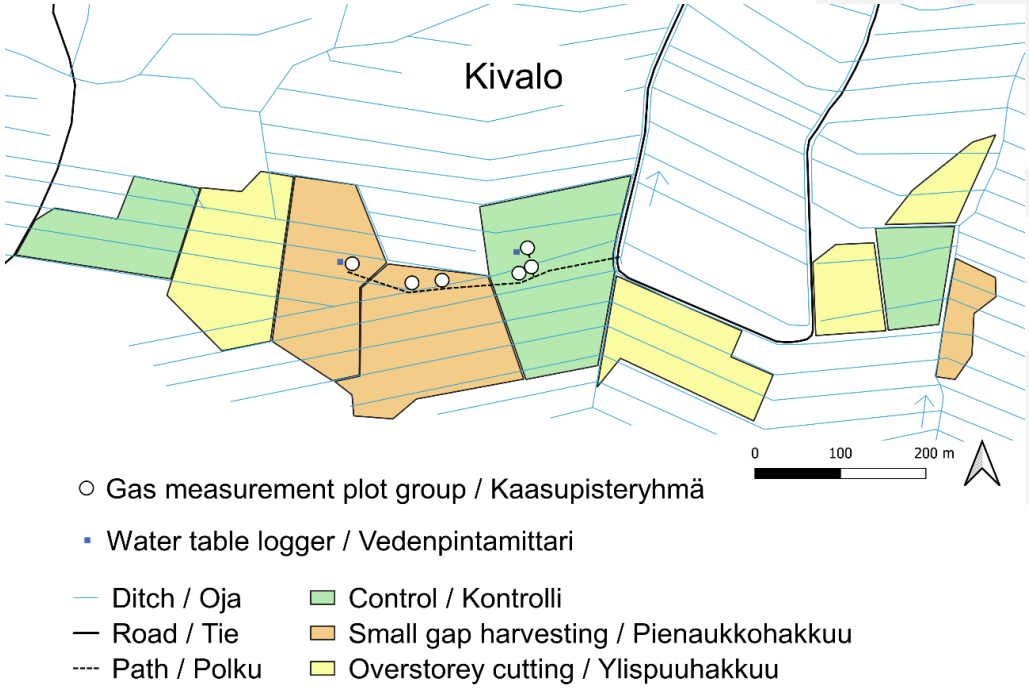
Partial cuttings / Osittaishakkuut:

- 30 %
- 50-60% of total basal area / pohjapinta-alasta

Continuous forest cover in originally mixed forest dominated by Scots pine using overstorey removal and utilization of spruce understorey. Lettosuo, site FIC302.

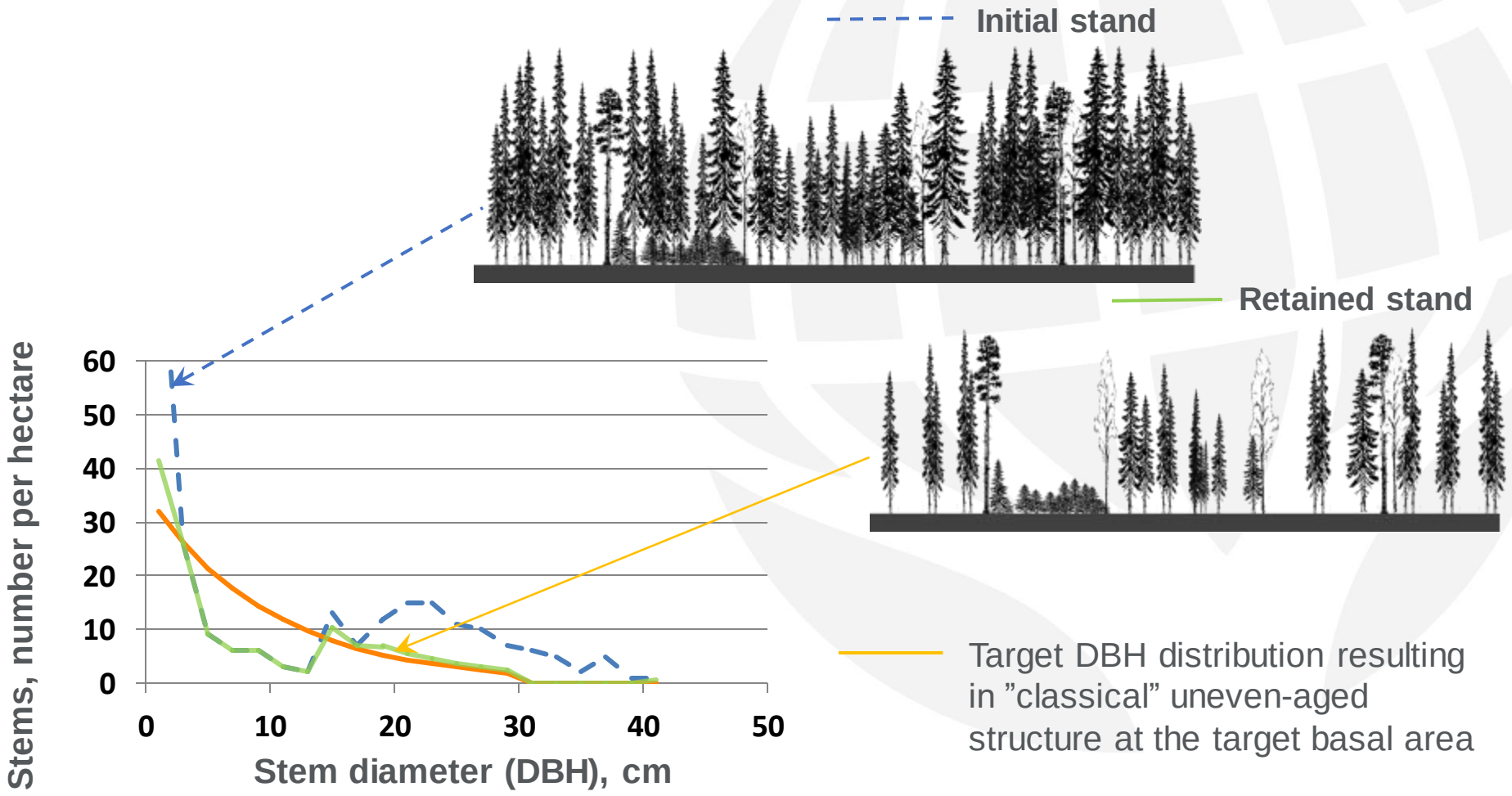


Continuous forest cover in mixed stands using small gaps harvesting. Kivalo, site FIC303.



Selective harvesting in FIC301. Photo: Markku Saarinen

Example of a selective cutting scheme



Paroninkorpi, FIC301, 50-60% of basal area removed

Removal of overstorey pine in FIC302

Emission reduction potential?

Region	Site type	Area 1000 ha	NE_CO_{2soil} kg ha^{-1}	NE_CO_{2soil} Tg (million tonnes)
South	I	403	2398	0.97
	II	653	1779	1.16
	III	686	- 586	-0.40
	IV	468	-1336	-0.63
North	I	229	3046	0.70
	II	536	3007	1.61
	III	1022	677	0.69
	IV	564	- 513	-0.29

Almost 4.5 Tg CO_2 emitted from the soils of nutrient-rich drained peat-land forests; area 1.8 mill. ha

Positive values indicate net source to atmosphere and negative values net sink to soil. Site types from nutrient rich to poor: I – Herb-rich, II – *Vaccinium myrtillus*, III – *V. vitis-idaea*, IV – Dwarf-shrub.

Source: Ojanen et al. 2014. Soil CO_2 balance and its uncertainty in forestry-drained peatlands in Finland. Forest Ecology and Management 325: 60-73.

Thank you!

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Identification (number)	FIC301
Area, ha	Site including partial cut (CCM) and control plots: 3.5 ha; clear-cut reference 0.6 ha. The site involves treatment plots following randomized blocks design, so not one uniform treatment area as in other sites.
Demonstrated CCM measure	Continuous forest cover without full ditch network maintenance in spruce stands on nutrient-rich organic soil using selective felling. Comparison of soil emissions in demo plots with emissions in conventional forestry practice plots. CCM is based on reduced soil emissions due to controlled rise in soil water-table level, which is controlled through retained tree stand evapotranspiration.
Short description of the site	Partial harvesting (2017) of mature spruce stand to a target basal area. Uncut plots as reference, clearcut area as reference. The partial harvest treatments and unharvested controls were established on experimental plots based on a randomized block design. The site was established in a project New options for forestry on peat soils funded by Luke. Soil emission measurements were done in 2018-2019 in a project Uneven-structured management as an alternative to intensive forestry on peatlands funded by Kone Foundation.
Establishement activity	Implementation of the CCM measure, setting up soil greenhouse gas emission measurement subplots, installation of duckboards, piezometers, continuous soil temperature measurements, continuous soil water-table level measurements, litter traps, locations for ground vegetation cover and biomass measurements.

Identification (number)	FIC302
Area, ha	13 ha under CCM plus reference area (2.3 ha and 3.1 ha)
Demonstrated CCM measure	Continuous forest cover (utilization of existing spruce understorey) as a forest regeneration method in originally mixed forest dominated by Scots pine on fertile organic soil to reduce CO_2 emissions from soil. Comparison of emissions in demo plot with emissions in conventional forestry practice plots.
Short description of the site	Partial harvesting (2016) of mature mixed pine-dominated stand, demo site. Uncut plot as reference, clearcut plot as reference. Finnish Meteorological Institute has run micrometeorological measurements (Eddy Covariance) on the site since 1997 (CO_2) and 2010 (CH_4). This is an ICOS network site (https://www.icos-finland.fi/stations), providing valuable background information to support the measurements done in Life OrgBalt project.
Establishement activity	Implementation of the CCM measure, setting up soil greenhouse gas emission measurement subplots, installation of duckboards, piezometers, continuous soil temperature measurements, continuous soil water-table level measurements, litter traps, locations for ground vegetation cover and biomass measurements.

Identification (number)	**FIC303**
Area, ha	2.0 ha under CCM plus reference area (3.1 ha)
Demonstrated CCM measure	Continuous forest cover (small gaps) as a forest regeneration method in mixed stands on fertile organic soil to reduce CO_2 emissions from soil. Comparison of emissions in demo plot with emissions in conventional forestry practice plots.
Short description of the site	Small gaps harvesting (2018) of mixed spruce & birch stand. Uncut areas as reference. This site was established based on the agreement between Luke and Metsähallitus Forestry Ltd in anticipation of the Life OrgBalt project.
Establishement activity	Implementation of the CCM measure, setting up soil greenhouse gas emission measurement subplots, installation of duckboards, piezometers, continuous soil temperature measurements, continuous soil water-table level measurements, litter traps, locations for ground vegetation cover and biomass measurements.