Sustainable Development Goals and Land Management Practices

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Major global challenges

Climate change, loss of biodiversity & regulation of natural resources use

CBD - Aichi
Biodiversity targets

Addressed by international agreements

United Nations FORUM ON FORESTS

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UN Agenda 2030 for Sustainable Development

https://www.un.org/sustainabledevelopment/sustainable-development-goals/

SUSTAINABLE DEVELOPMENT GOAL 15

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal:

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

https://sustainabledevelopment.un.org/sdg15

specific targets, indicators and monitoring

The Earth's forest areas continue to shrink, but the rate of forest loss has been cut by 25 % since 2005 (globally).

In Finland, conversion of forests to croplands has resulted **increased GHG emissions** (from 2000 to 2014 + 1Mt CO_2 eq per year).

Linked to

Science based solutions needed. **Examples of the Research topics:**

Development of climate-smart forest management practices, means to avoid nutrient losses and water nutrient loading, circular ecomomy that decrease the pressure for deforestation, etc.

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UN SDG indicators – national reporting designed and Luke is responsible for reporting 18 of them, e.g.

Indicator	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss (Luke 2-5 / Total 10)	TIER	Available
15.1.1	Forest area as a proportion of total land area	II	☺
15.2.1	Progress towards sustainable forest management	II	😐
15.3.1	Proportion of land that is degraded over total land area (UM/Syke)	I	☺
15.4.1	Mountain Green Cover Index (Syke)	I	-
15.6.1	Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits - (Luke or Syke)	II	😐

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Convention of Biological Diversity and IPBES

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The Convention on Biological Diversity (CBD)

Objectives

- The conservation of biological diversity
- The sustainable use of the components of biological diversity
- The fair and equitable sharing of the benefits arising out of the utilization of genetic resources

CBD was launched in the Rio Eath Summit 1992

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

- Assesses the state of biodiversity and of the ecosystem services it provides to society
- Responses to requests from decision makers (e.g. CBD)
- Established in 2012

Better Evidence-based Information Critical to Achieve Global Goals

Recent assessment report by IPBES
Land Degradation and Restoration – Key Messages

- Degradation of the Earth's land surface through human activities is negatively impacting the well-being of at least **3.2 billion people**, pushing the planet towards a **sixth mass species extinction**, and costing more than 10 % of the annual global gross product **Main drivers** are expansion of crop and grazing lands, unsustainable agricultural and forestry practices, and climate change.
- By 2050, land degradation and climate change together **reduce crop yields** by an average of 10 per cent globally
- Land degradation and climate change are likely to force **50 to 700 million people to migrate** by 2050
- **Benefits of restoration** are 10 times higher than the costs, estimated across nine different biomes

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Avoiding, reducing and reversing land degradation is essential for reaching the majority of the SDGs

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Key messages of IPBES Land degradation report

- Species extinction rates are currently hundreds to thousands of times above the long-term rate of species turnover
- Population size of wild terrestrial vertebrate species declined by 38% (1970-2012)
- Over the past two centuries, 8% of soil organic carbon stock has lost globally (176 Gt C); projection to 2050 predicts further losses of 36 Gt C.
- Develop and adopt effective means to avoid and reverse degradation on croplands, grasslands, wetlands, and forests.
- Major changes in consumption patterns, demographic growth, technology and business models are needed.

CBD – Aichi Biodiversity Targets

www.cbd.int/sp/targets

CBD Aichi Biodiversity Targets (all together 20)

Target by 2020 – **actions needed in Finland**

- Incentives, including subsidies, harmful to biodiversity are eliminated – **KEMERA** and **CAP** to be reformed

- Rate of loss of all natural habitats, including forests, is at least halved – In Finland, the loss of forests (19000 ha per yr) to be reduced by better **agricultural policy** and **urban planning**

- Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity – sustainable management practices to be adopted by **land owners**

- Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity – water nutrient loading to be reduced by better **land management practices**

- 17% of terrestrial areas conserved by 2020 – METSO **funding** secured and **peatlands included to METSO** programme

- Ecosystem resilience, biodiversity and C stocks enhanced …. restore at least 15 % of degraded ecosystems – **soil carbon stocks** preserved.

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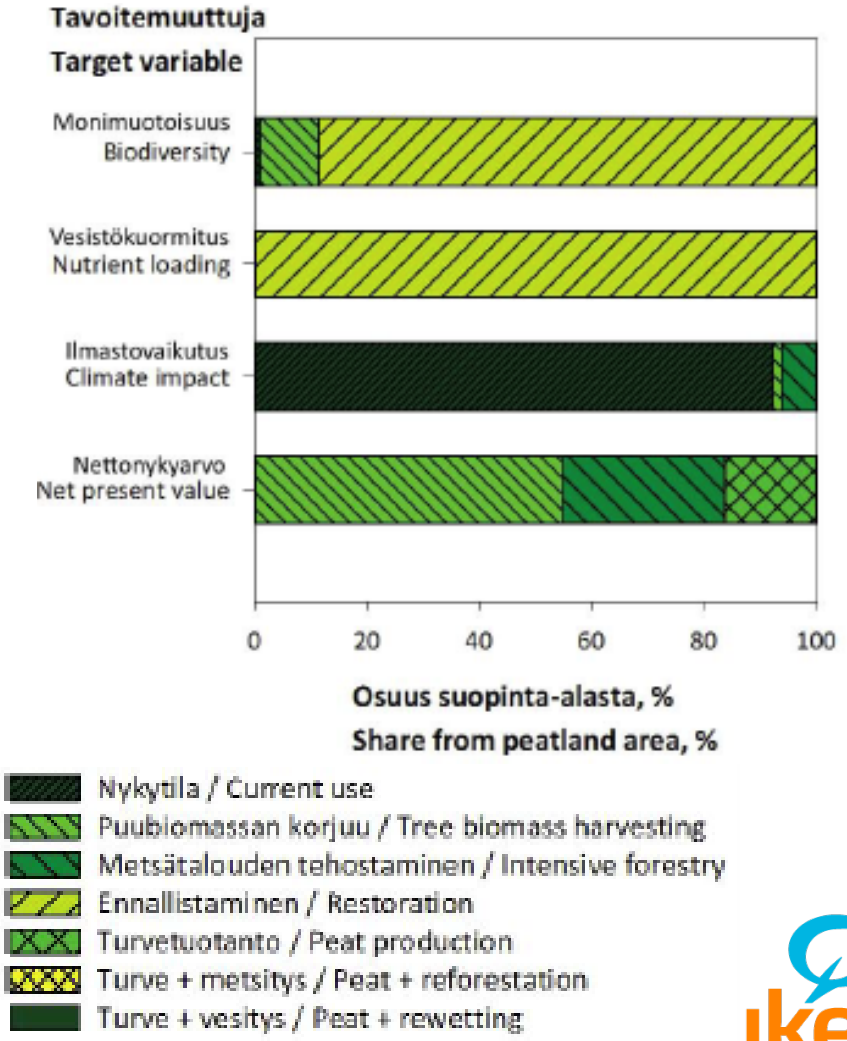
Holistic sustainability and science based solutions

Three examples

Cost-effective re-use options for low productive peatlands – to restore or not to restore

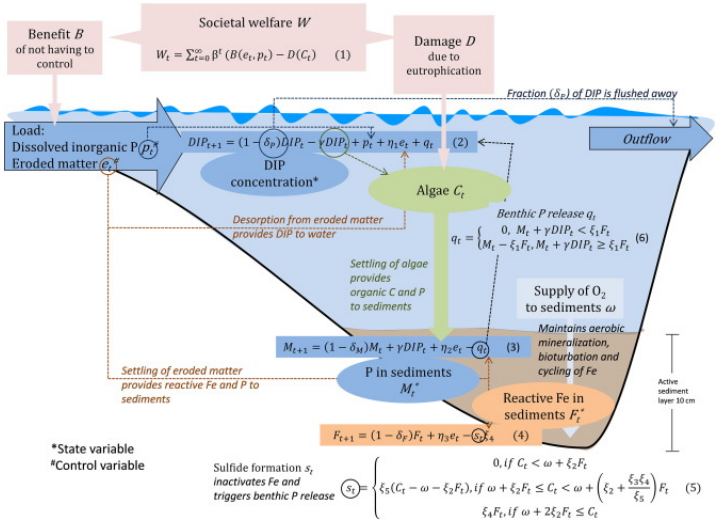


Source: Tolvanen et al 2018. Layman's report of LifePeatlandUse project

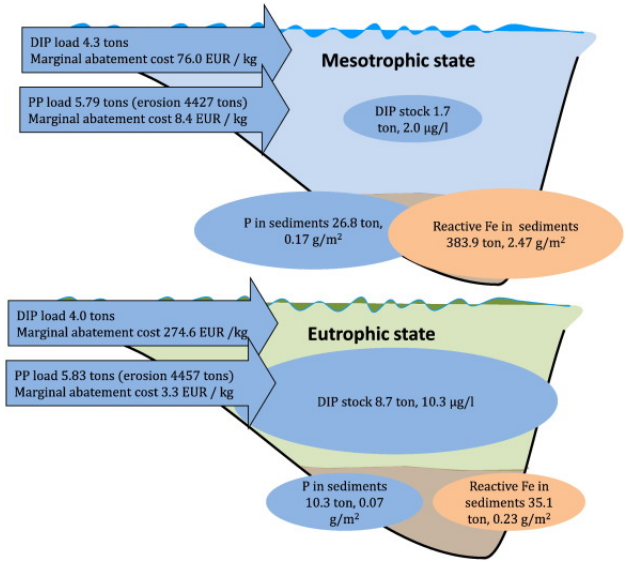
Do we know what are best policies to reduce water pollution and nutrient loading?

Coupled phosphorus cycle & economic analyses. Iho et al (2017) model dynamically optimal eutrophication management in a P-limited and SO_4-containing water body by taking into account the O_2 available and the coupling between the C, Fe, S and P cycles.

Method



Result



Policy recommendation

- Mitigation of P-driven eutrophication should focus more on dissolved P than erosion control.
- Current erosion control by vegetative covers, no-till technologies or buffer zones generate benefits other than reduction of dissolved inorcanic P loading.

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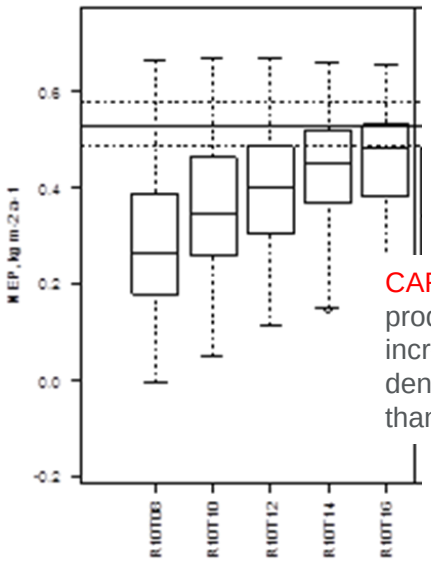
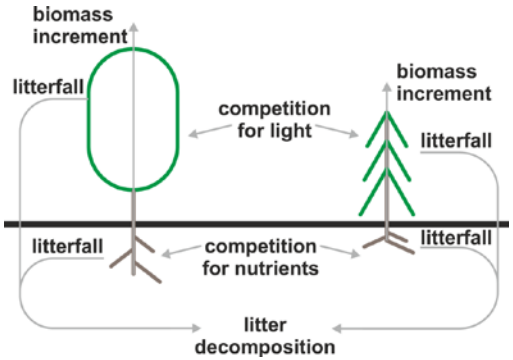
Forest management: highest profitability is reached by management that provide low yield and C sink.

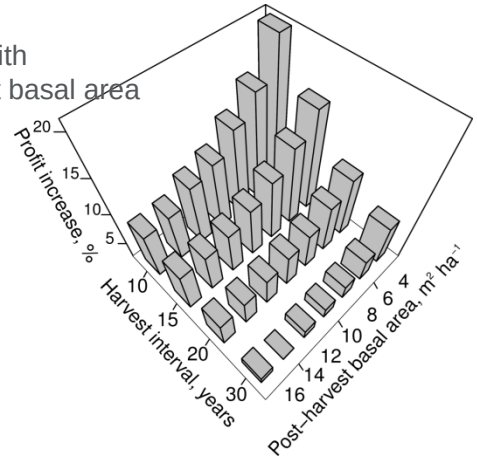


CARBON: Net ecosystem production (NEP, kg C/m2/a) of increased with higher postharvest density, and was generally lower than that at unmanaged

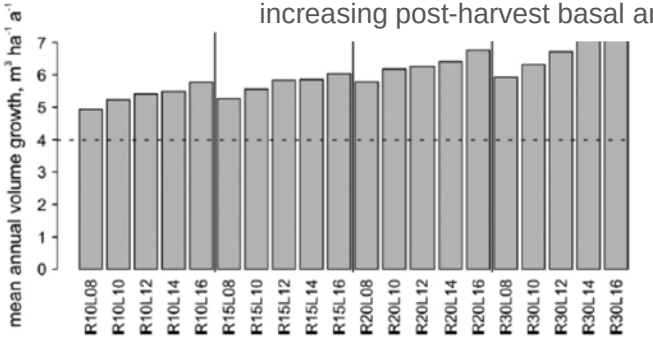


Ecosystem model combined with economic analyses

Profitability increased with decreasing post harvest basal area



Mean annual volume growth of uneven-aged Norway spruce stand increases with increasing post-harvest basal area



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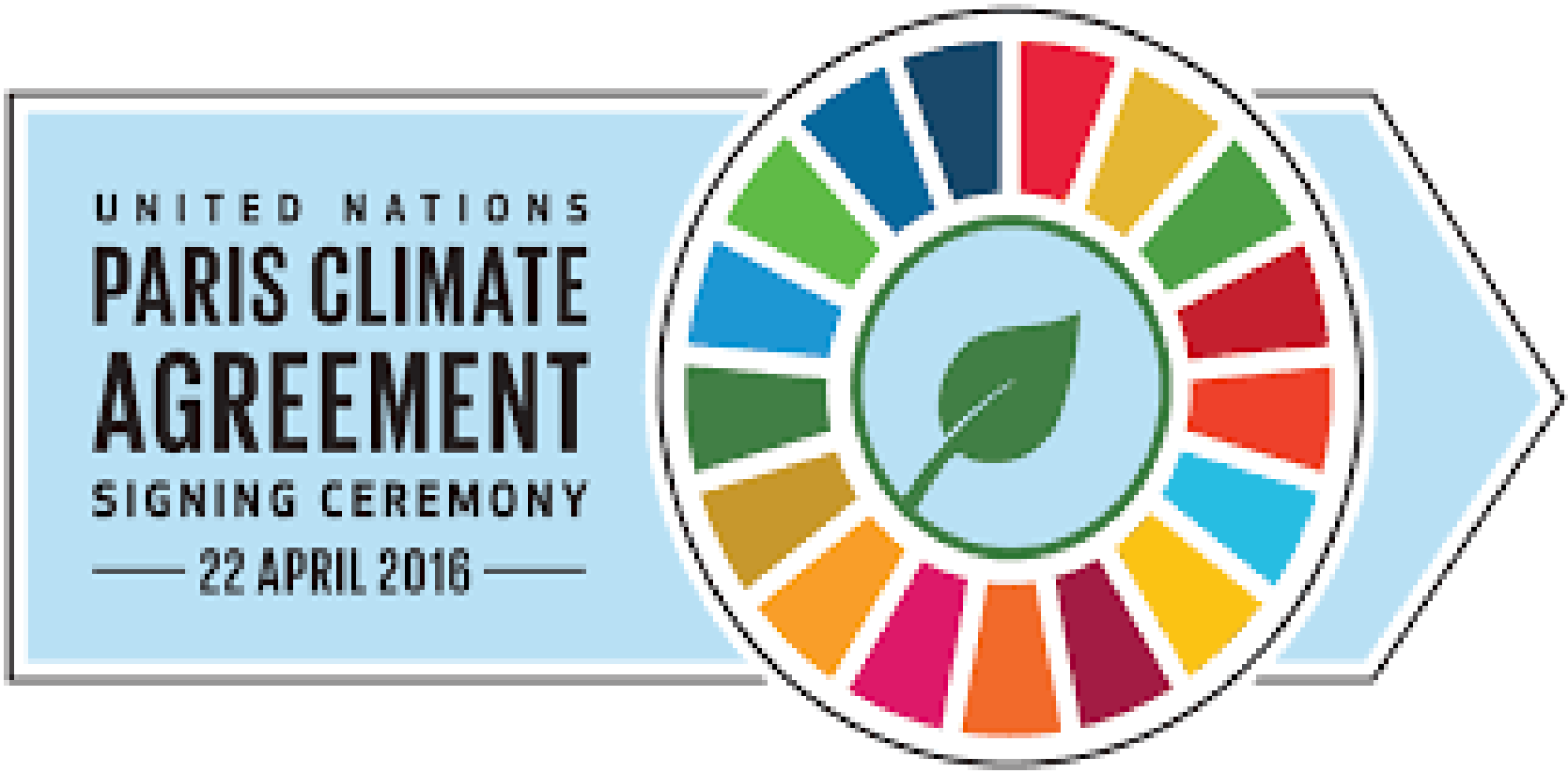
Sources Shanin et al. 2016. For Ecol Management ; Juutinen et al. 2018 Forestry

UN Framework Convention for Climate Change (UNFCCC) and Paris Agreement



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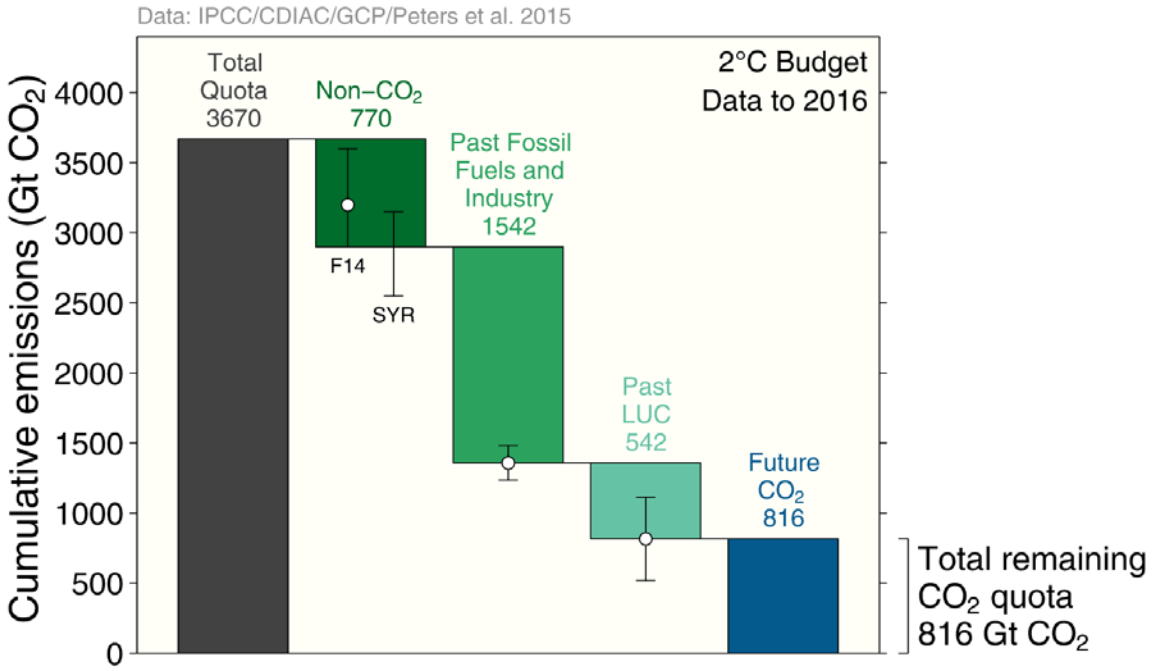
Paris Agreement

- Paris agreement and 2˚C target approved by 184 counties (of 197)



- Global: The total remaining emissions from 2017 to keep global average temperature increase below 2˚ C (800 GtCO2)
- At current emission rates, it will be used in around 20 years.
- By proposed Nationally Determined Contributions (NDCs) for emission reductions Paris target is not reached
- More ambitious commitments needed to keep us on 2˚C pathway… and time is shorter if we aim to reach 1.5˚C target

Compiled by Global carbon project. Grey: Total CO_2-only quota for 2˚ C with 66% chance. Green: Removed from CO_2 only quota. Blue: Remaining CO_2 quota. The remaining quotas are indicative and vary depending on definition and methodology. Source: Peters et al 2015; Global Carbon Budget 2016

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Paris Argeement and EU's LULUCF regulation affects national policies

- EU committed to Paris target and GHG mitigation targets set (-40% by 2030, and negative emissions by the 2nd half of century)
- LULUCF regulation: EU will maintain forest carbon sinks at level, which compensated 7% of the fossil emissions.
- In Finland, non-ET sector will reduce emissions by 39% and LULUCF sector will maintain forest carbon sinks (proposed reference level (28 Mt of CO2 eq.) to be confirmed by 2020)
- Finland is aiming to be carbon neutral by 2045, but such pathway is not designed, yet.
- Tiilikainen (8.2.2019) 'Finnish government proposes that EU emission reduction target upgraded 40% -> 55% by 2030'. The EU will update NDC by 2020.

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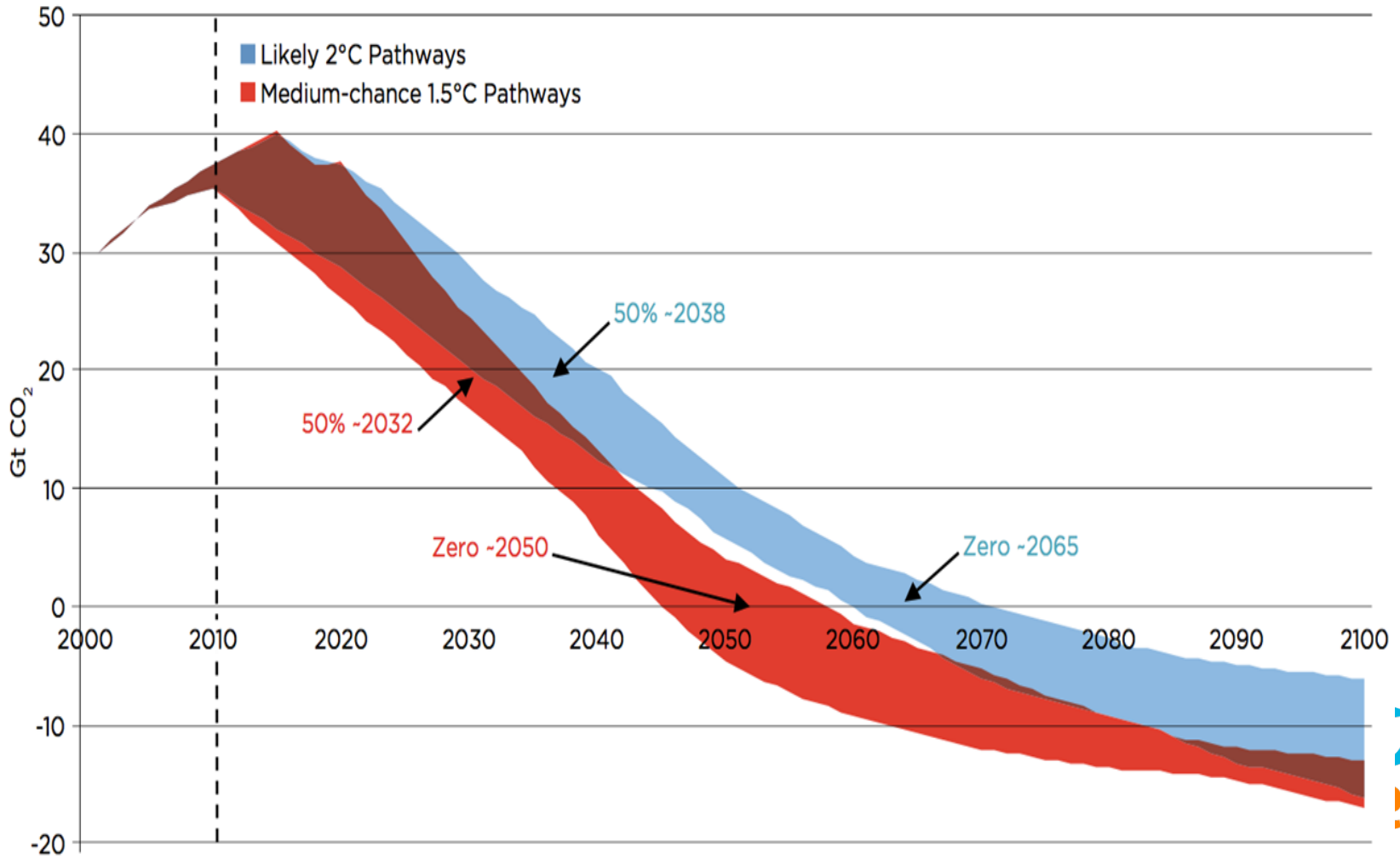
1.5˚C target: carbon neutrality to be reached by 2050 (2˚C; by 2065)

Figure 1: Range of Global Emissions Pathways in Scenarios Consistent with Likely Chance of 2°C or Medium Chance of 1.5°C[18]



Sources: Joeri Rogelj et al

Global emissions and climate change mitigation by carbon sinks

34.1 $GtCO_2/yr$

91%

9%

3.5 $GtCO_2/yr$

(2006-2015)

Sources = Sinks

16.4 $GtCO_2/yr$

44%

31%

11.6 $GtCO_2/yr$

26%

9.7 $GtCO_2/yr$

Source: CDIAC; NOAA-ESRL; Houghton et al 2012; Giglio et al 2013; Le Quéré et al 2016; compiled by Global Carbon Project

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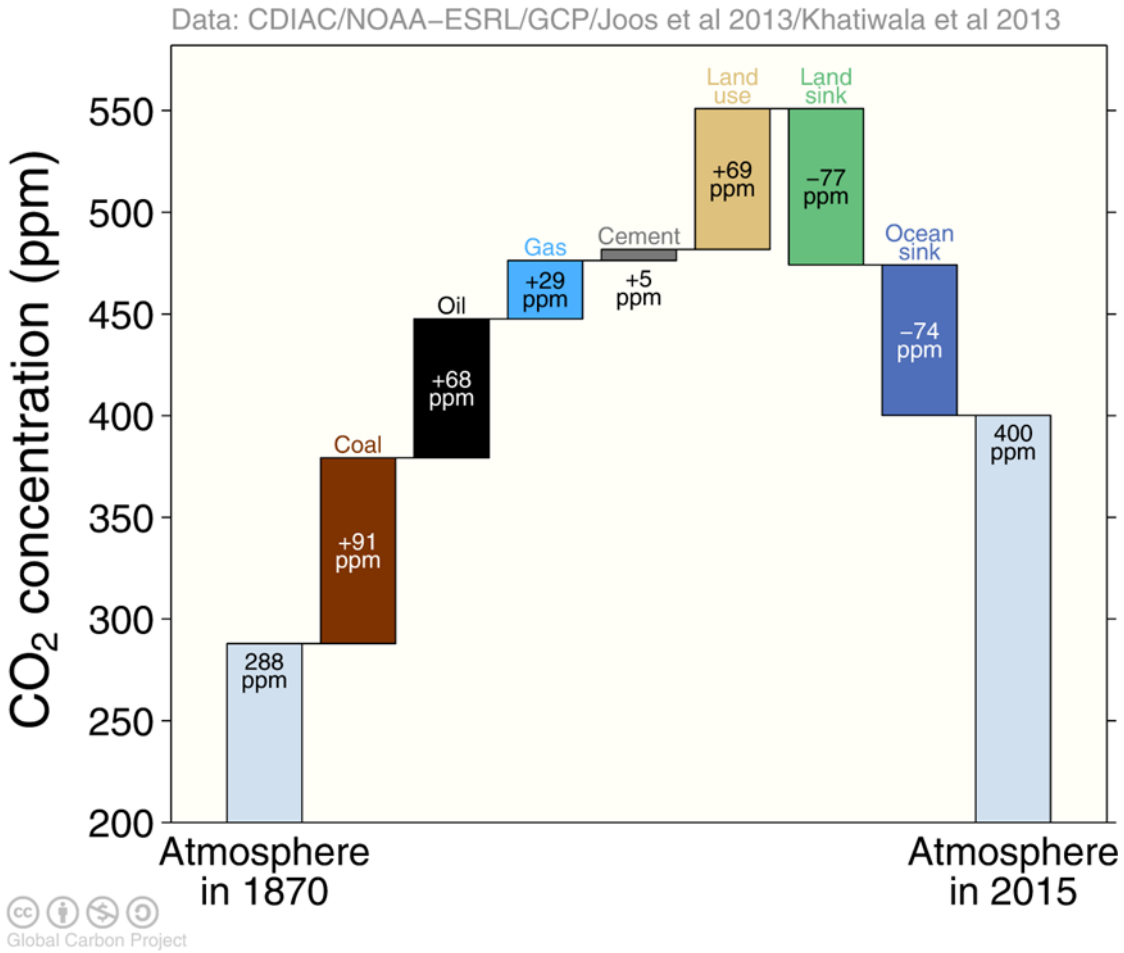
Carbon sinks have major role in global C balance



Cumulative GHG emissions and C sinks since 1870.

Figure compiled by Global Carbon Project, concept from Shrink That Footprint

Source: CDIAC; NOAA-ESRL; Houghton et al 2012; Giglio et al 2013; Joos et al 2013; Khatiwala et al 2013; Le Quéré et al 2016; Global Carbon Budget 2016

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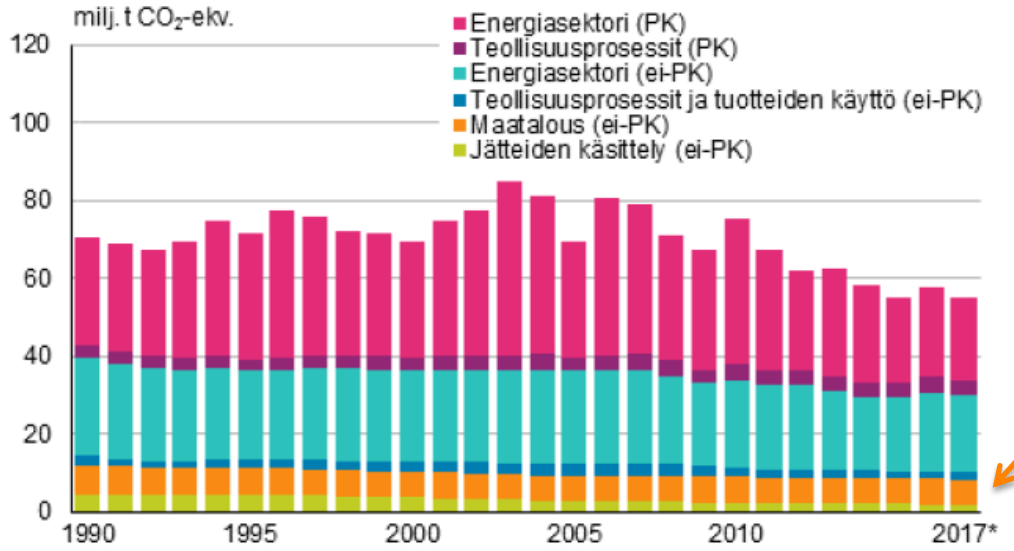
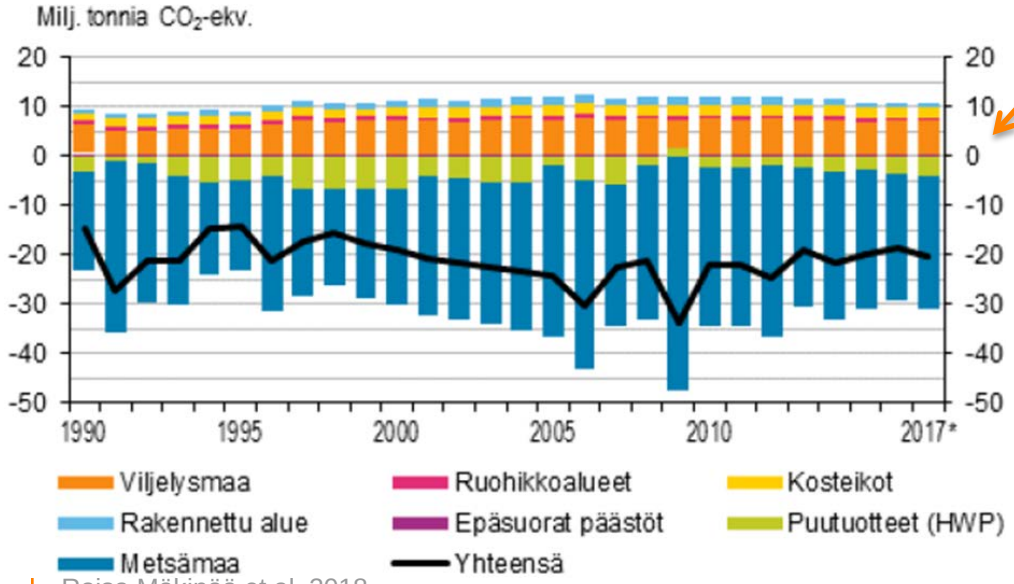
GHG emissions and removals in Finland





Raisa Mäkipää et al. 2018

- Emissions from agriculture (6.5 Mt CO_2eq./yr) contribute over 10% of the total emissions.
- Emissions of croplands and grasslands on peat soil (0.25 million ha). 8,7 Mt CO_2 eq. /yr.

http://www.stat.fi/til/khki/2017/

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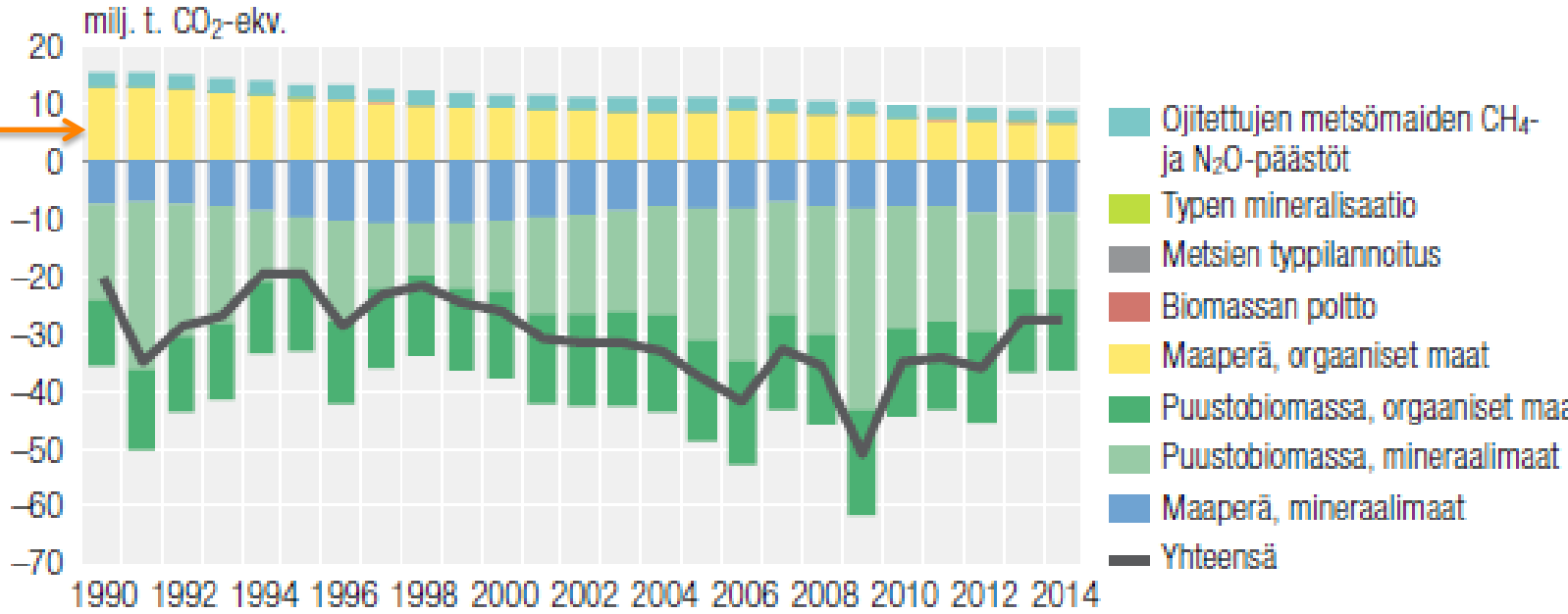
Soil of drained peatland forests is emission source

Peatland soils

Kasvihuonekaasupäästöt (+) ja -poistumat (–) metsämaalla vuosina 1990–2014 (milj. tonnia CO_2-ekv.).



- Peatland area on forest land 5 million ha, emissions 8.8 million tonnes CO_2 eq. /yr
- Largest emission sources are soils of fertile productive sites

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Managed peatlands are emission hot spots

- **Peat soil** of croplands and forests is currently the **large emission source** in the Finnish LULUCF sector. Emissions from peat soil
  - Annual species on cropland: emissions 35 000 kg CO_2 eq/ha/year (equivalent to 17.5 year emissions of a car (20 000 km *100g CO_2/km))
  - Grasslands: 25 000 kg CO_2 eq/ha/year
  - Wet grassland/Abandoned/Afforested field: 15 000-20 000 kg CO_2 eq/ha/year
  - Drained cropland converted to paludiculture (high water table) -> 0 (?)
  - Drained peatland forest (fertile site): 1800-2400 kg CO_2 eq/ha/year
- With current management practices the emissions are likely to increase, since
  - Large proportion of drained peatland forests are at the phase of final harvest
  - Forested peatlands are converted to grasslands (in 2000-2014 42 700 ha with additonal emissions of 1 Mt CO2-eq./yr).

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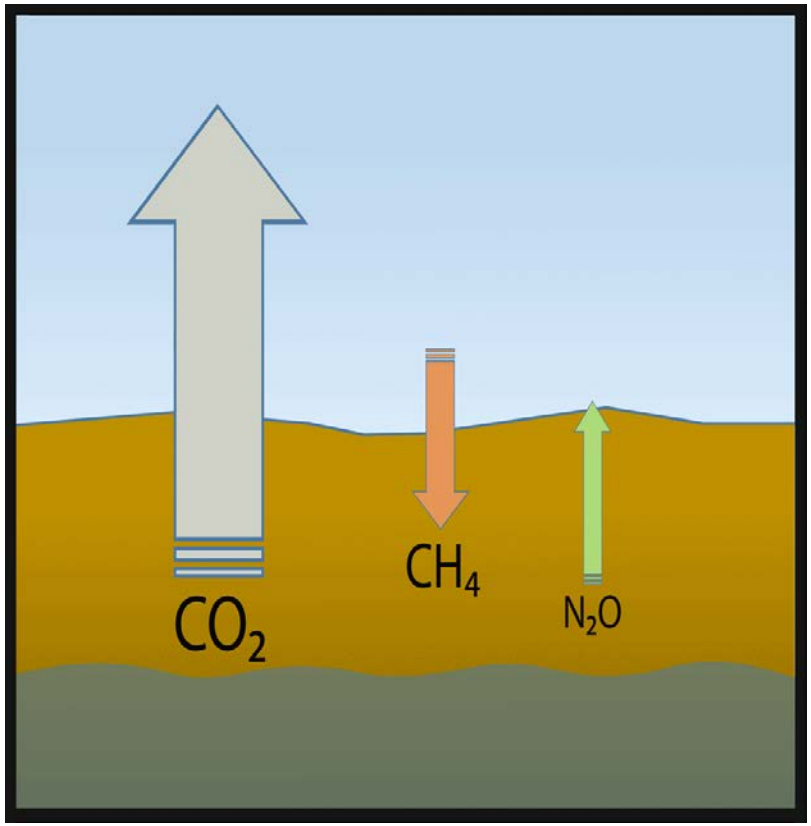
GHG emissions of peat soil can be reduced by improved management practices – in Finland and globally

Peatland management that allows higher water level can decrease the GHG emissions



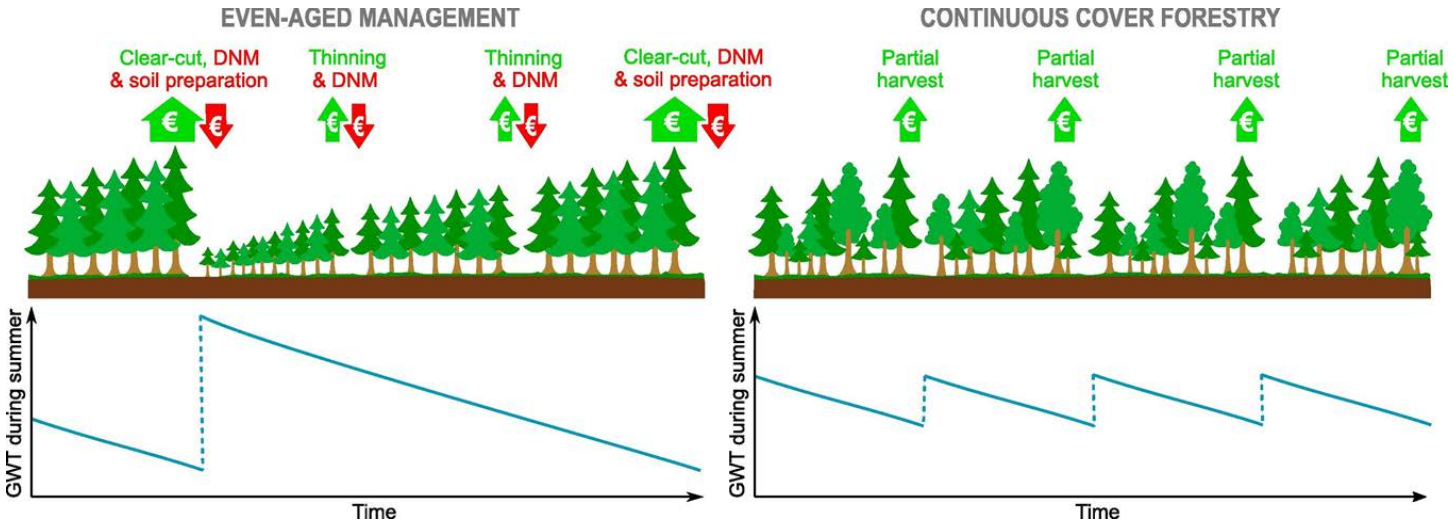
PALUDICULTURE on croplands
and
CONTINUOUS COVER forest mgmt

which will

- Decrease CO_2 emissions
- May slightly reduce CH_4 sink
- May affect N_2O emissions

These fluxed to be quantified and overall climat impact analysed in ongoing projects (e.g. SOMPA www.luke.fi/sompa).

Towards climate-smart forest management – we are testing continuous cover forestry (CCF) on peatlands



Nieminen et al. 2018

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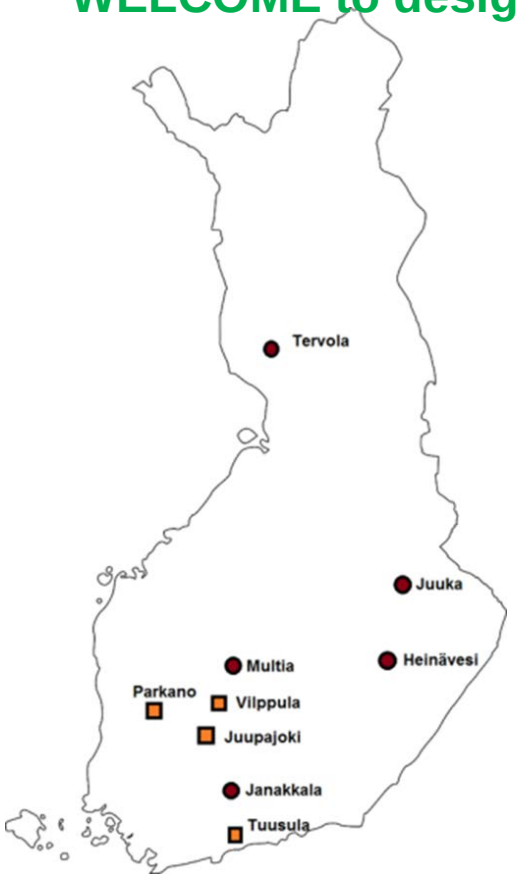
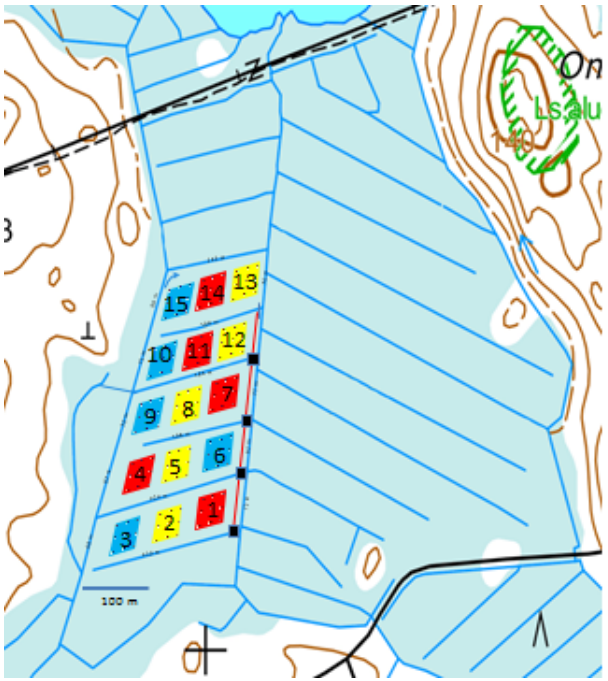
Ongoing measurements on sites where CCF tested

Measurements incl. CO_2, N_2O and CH_4 fluxes (by peat layers), variation of ground water table, peat characteristics, change in understorey vegetation, runoff water quality, tree stand developement (incl. Terrestrial and aerial laser scanning), etc.
WELCOME to design your own measurements on our experimental sites





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Sustainability Research by

Luke's sustainability research Roadmap toward Agenda 2030 SDGs

Luke's well known scientific contribution on SDG

2030

- Mechanism for provision of cost efficient negative emissions
- Climate smart methods for food and biomass production
- LULUCF regulation and sectoral policies
- Environmental performance assessment (footprints, LCA)

2025

- Ecosystem services - multi-use and reconciliation
- Optimization tools for land use planning
- Forest C sink reference level

2019

- Solid science based indicators
- Participation and citizen science facilitated
- Concepts to assess social and cultural sustainability
- Customer tailored tools for decision making
- Solutions for circular economy
- Mechanisms to mitigate biodiversity loss
- Nature based wellbeing – effects and business concepts

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Take home message

- Evidence-based information critical to achieve global goals – e.g. scientific summary reports by IPCC and IPBES have strenghtenes biodiversity (CBD) and climate agreements (UNFCCC & Paris agreement).
- Urgent need for science-based ecosystem management practices – critical to assess holistic sustainability
- Best practices need to be supported by fair incentives and perverse incentives to be replaced.

Thank you!

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Luken vastuulla olevat UN/SDG indikaattorit

Indicator	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture (THL 4; Luke 9 / Total 13)	TIER	Available
2.3.1	Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size	III	😐
2.3.2	Average income of small-scale food producers, by sex and indigenous status	III	☹
2.4.1	Proportion of agricultural area under productive and sustainable agriculture	III	😐
2.5.1	Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities	II	😐
2.5.2	Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction	II	☺
2.a.1	The agriculture orientation index for government expenditures	II	😐
2.a.2	Total official flows (official development assistance plus other official flows) to the agriculture sector	I	☺
2.b.1	Agricultural export subsidies - (NA in Finland)	I	-
2.c.1	Indicator of food price anomalies	II	😐

Luken vastuulla olevat UN/SDG indikaattorit II

Indicator	Goal 5. Achieve gender equality and empower all women and girls (Luke 1 / Total 14)	TIER	Available
5.a.1	a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure'	III	😐
	Goal 12. Ensure sustainable consumption and production patterns (Luke 1 / Total 13)		
12.3.1	Global food loss index	III	☹
	Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development (Luke 2 / Total 10)		
14.4.1	Proportion of fish stocks within biologically sustainable levels	III	😐
14.7.1	Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries	II	😐

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Indicator	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss (Luke 2-5 / Total 10)	TIER	Available
15.1.1	Forest area as a proportion of total land area	II	☺
15.2.1	Progress towards sustainable forest management	II	😐
15.3.1	Proportion of land that is degraded over total land area (UM/Syke)	I	☺
15.4.1	Mountain Green Cover Index (Syke)	I	-
15.6.1	Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits - (Luke or Syke)	II	😐

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