EEAC 30th anniversary

PARALLEL SESSION #9
11:30-13:15

FORESTS AND DEFORESTATION - LINKS BETWEEN CLIMATE AND BIODIVERSITY

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#EEAC30
#CriticalDecade

EEAC

KESTÄVYYSPANEELI

SUOMEN LUONTOPANEELI

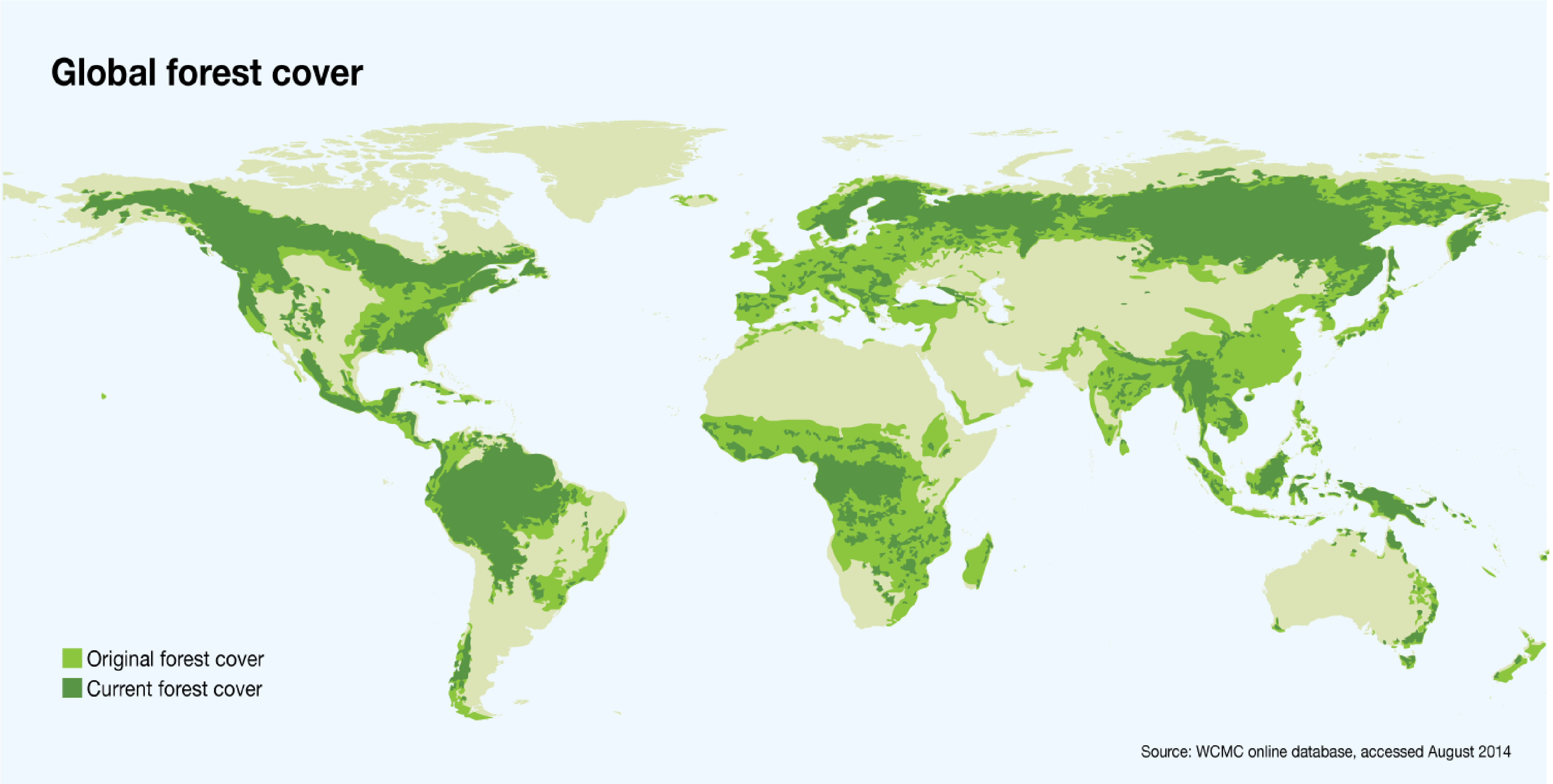
SUOMEN ILMASTOPANEELI
The Finnish Climate Change Panel

EEAC Network's 30th annual conference in Helsinki 14-15 September
Parallel Session 9: Forests and Deforestation - Links Between Climate and Biodiversity

Deforestation and forest degradation: Impacts on Biodiversity and Climate Change

Markku Kanninen
Research director & Professor emeritus
University of Helsinki, Viikki Tropical Resources Institute (VITRI)

Forests – then and now

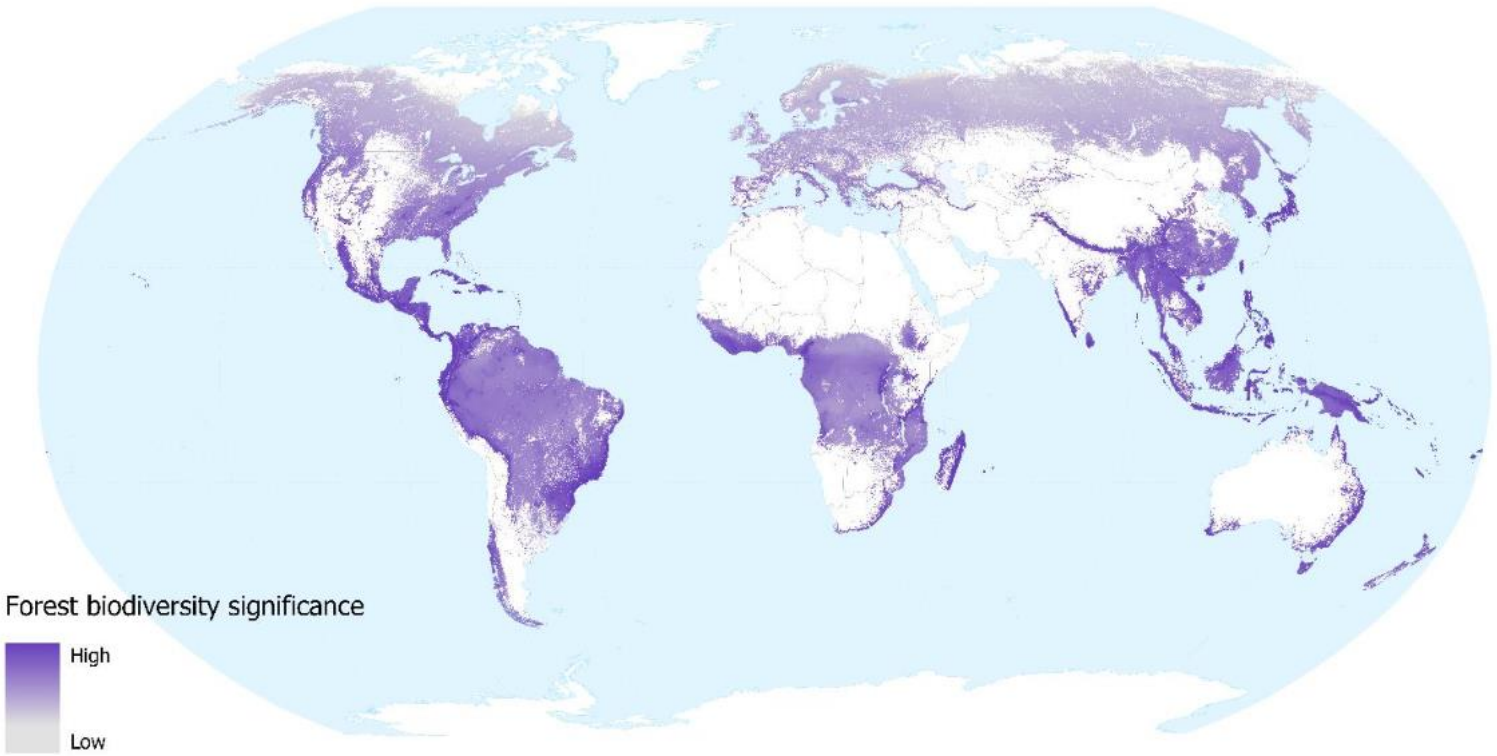


Forests are important for biodiversity

Forests and biodiversity
About 80% of terrestrial species live in forests

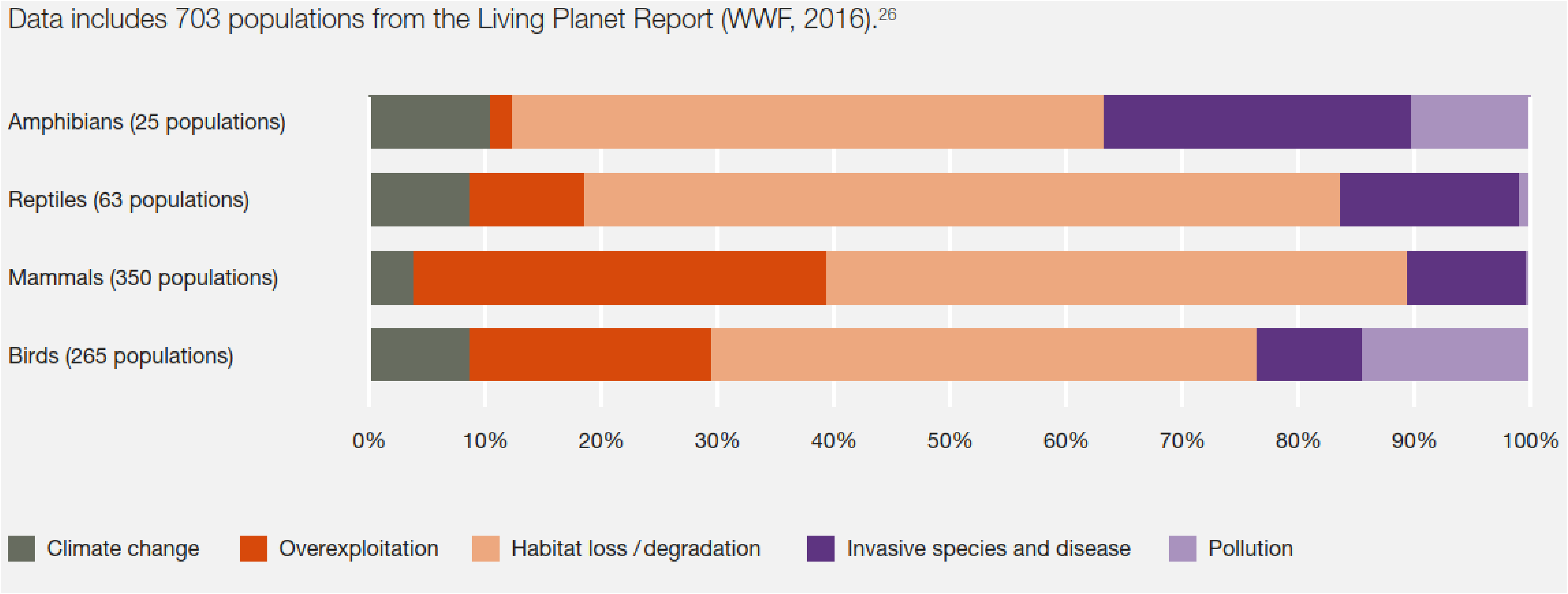
Tree species
- ≈ 80 000 in total
- In the Tropics: about 37 000
- In Amazonia: about 16 000
- In Finland: about 30

Forest biodiversity significance (plants and animas)



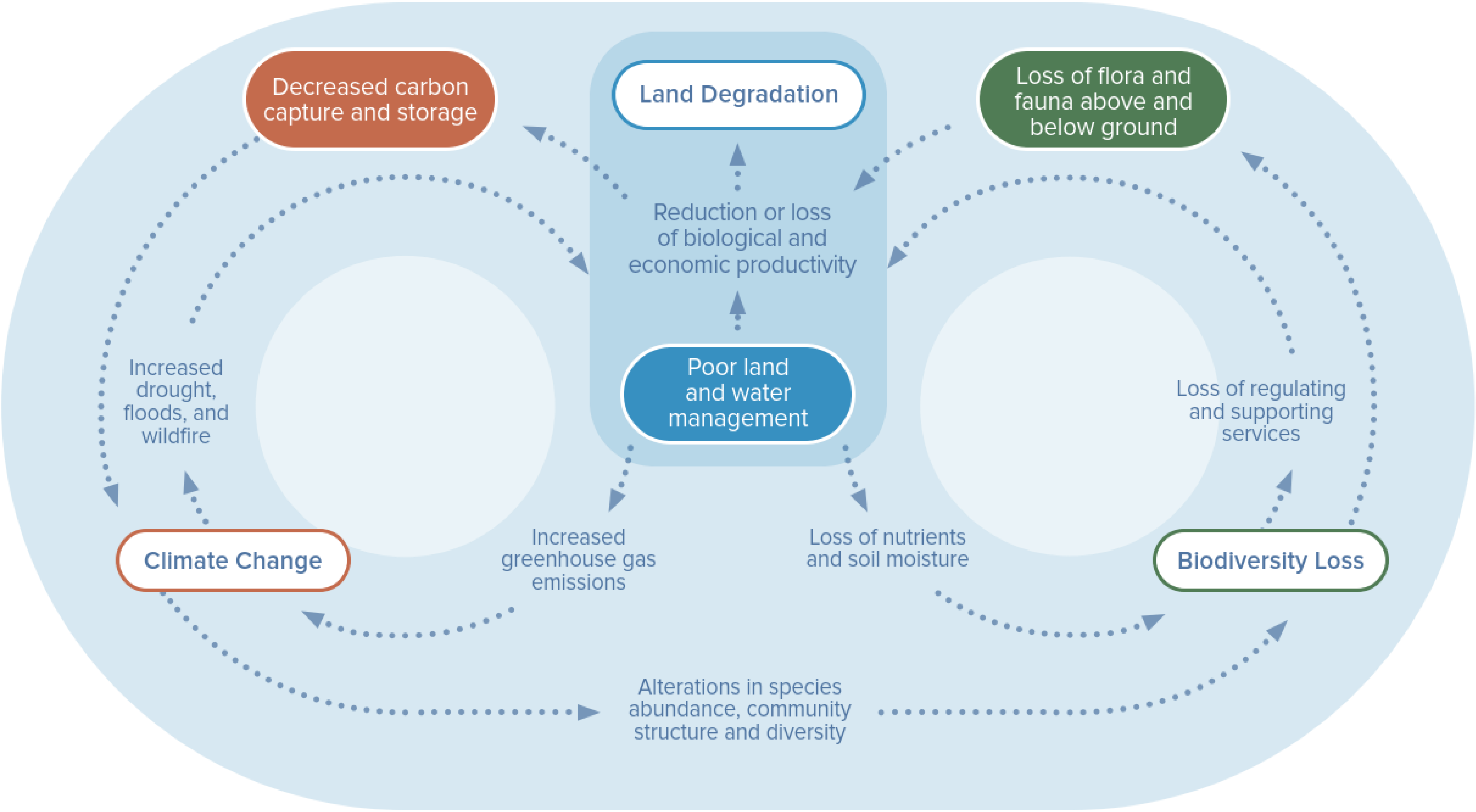
Hill et al. 2019

The most common drivers of biodiversity loss among some animal taxa



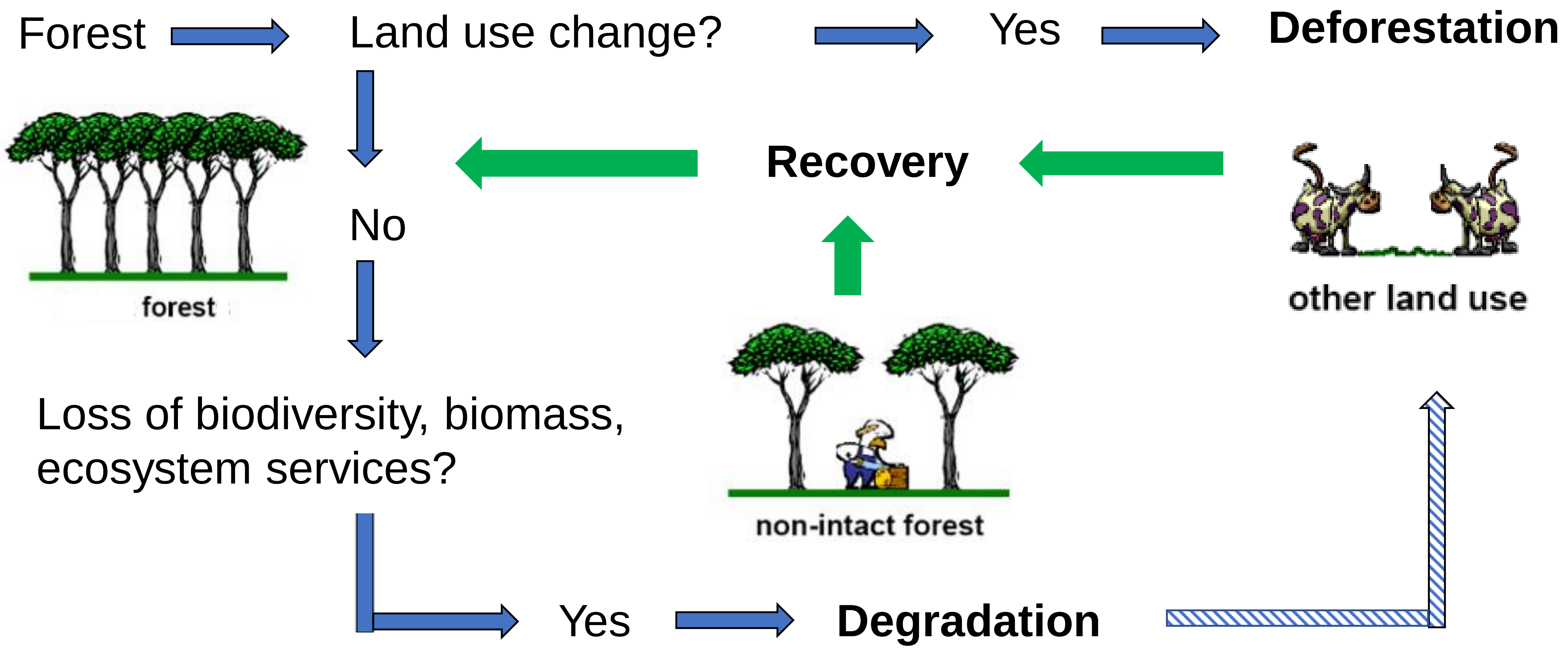
Global Land Outlook 2017

Land degradation, climate change, and biodiversity loss – interlinkages and feedbacks



UNCCD 2022

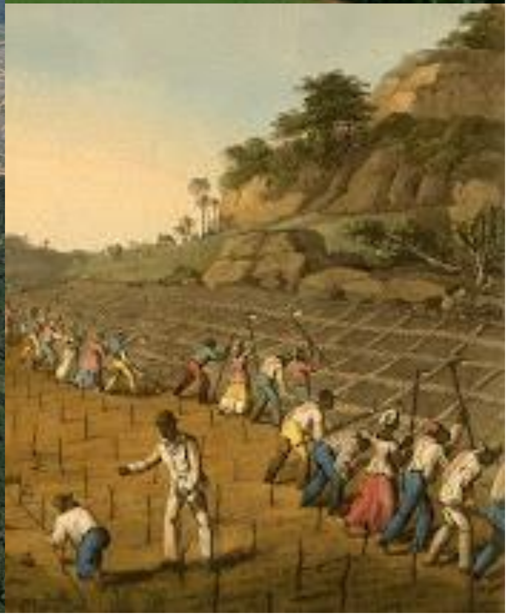
Deforestation, forest degradation, and recovery
(≈ forest transition)



IPCC 2007

Direct drivers of deforestation

- Large-scale, commercial agriculture
- Small-scale agriculture, shifting cultivation
- Mining
- Transport/Infrastructure
- Urbanization



Direct drivers of forest degradation

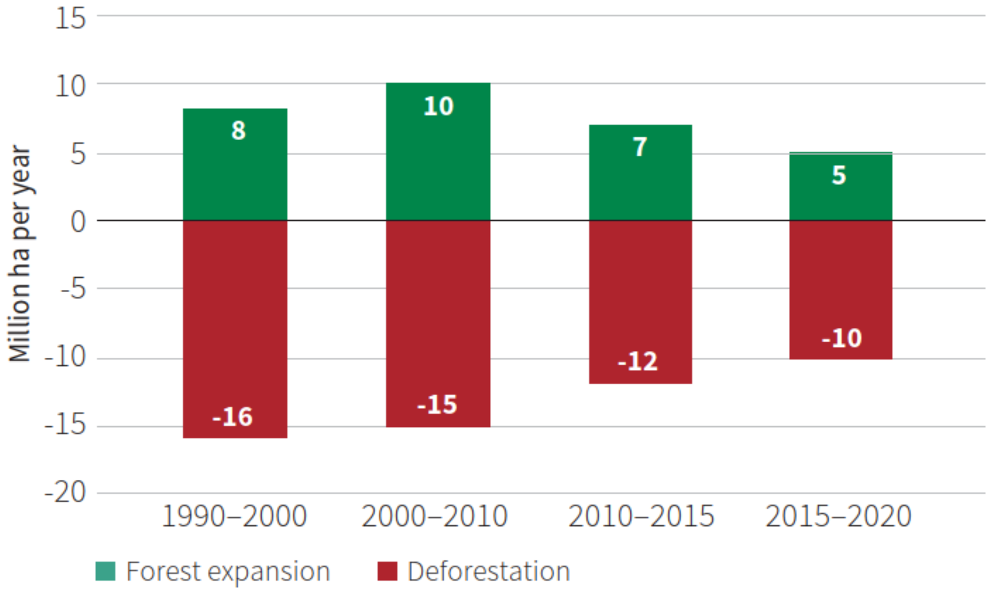
- Unsustainable forest management and logging practices
- Over-exploitation of fuel wood and charcoal
- Large-scale land and forest fires
- Forest grazing, over-exploitation of non-timber forest products etc.

Paubrasilia echinata

Anatomy of global forest transition

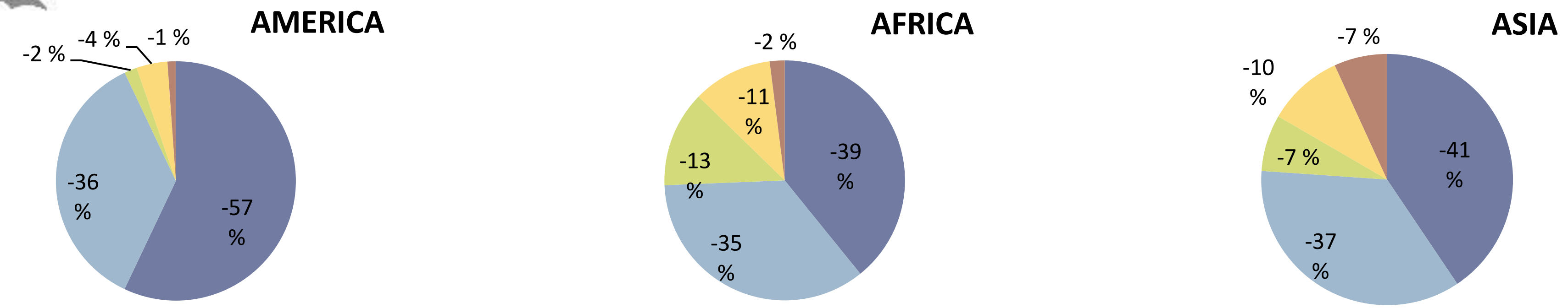
- Deforestation
  = Forest -> Other land use
  - Drivers: agriculture, cattle ranching, mining, urbanization, infrastructure development
- Characteristics of the change
  - Old growth, natural forests disappear
  - Biodiversity loss accelerates
  - Large emissions of GHGs + lost carbon sink
  - Area of young, planted forests increases
  - Recovery of carbon stocks is slow

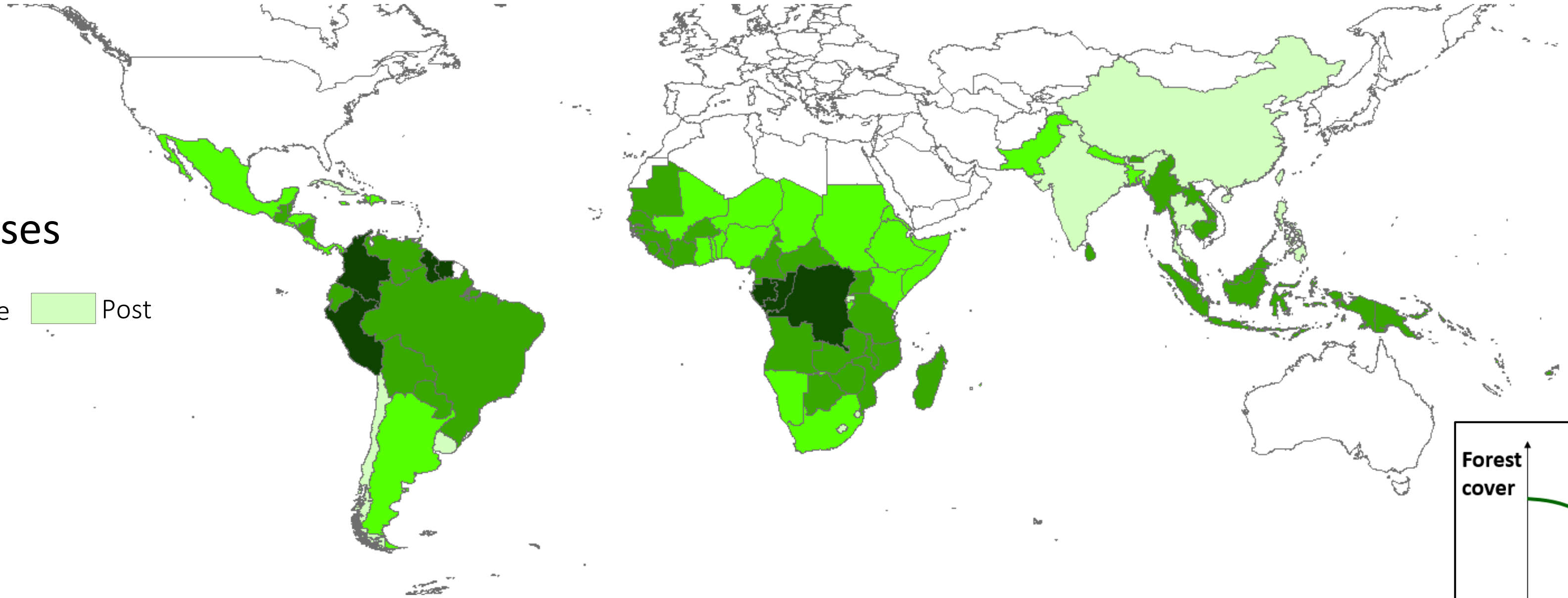
Deforestation and forest expansion (Mill ha/year) 1990-2020



FAO FRA 2020

Drivers of deforestation





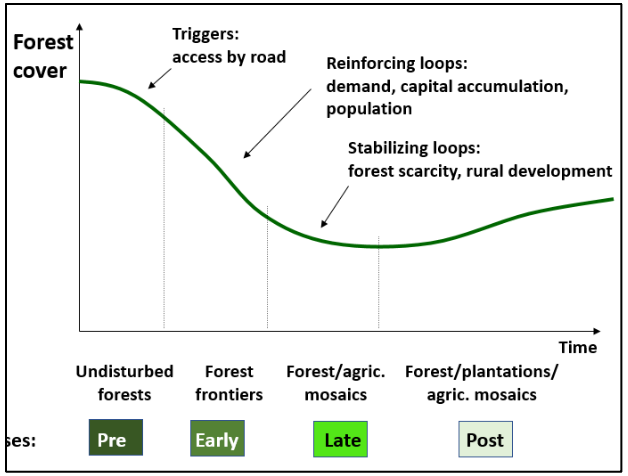
Forest transition phases

Pre Early Late Post

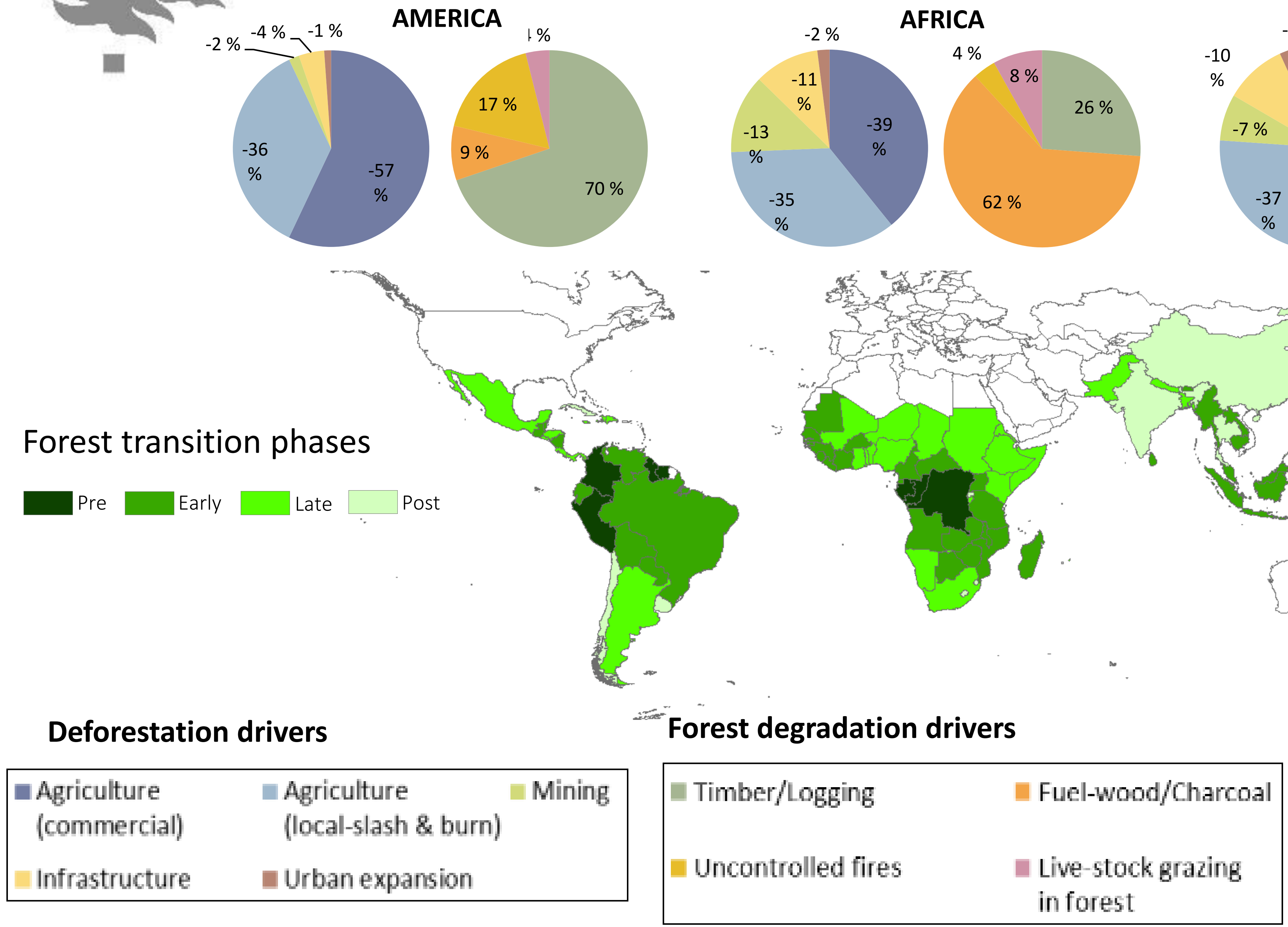
Deforestation drivers

Agriculture (commercial)	Agriculture (local-slash & burn)	Mining
Infrastructure	Urban expansion	

Hosonuma et al. (2012)



Drivers of deforestation and forest degradation



Hosonuma et al. (2012)

Direct divers of deforestation and forest degradation

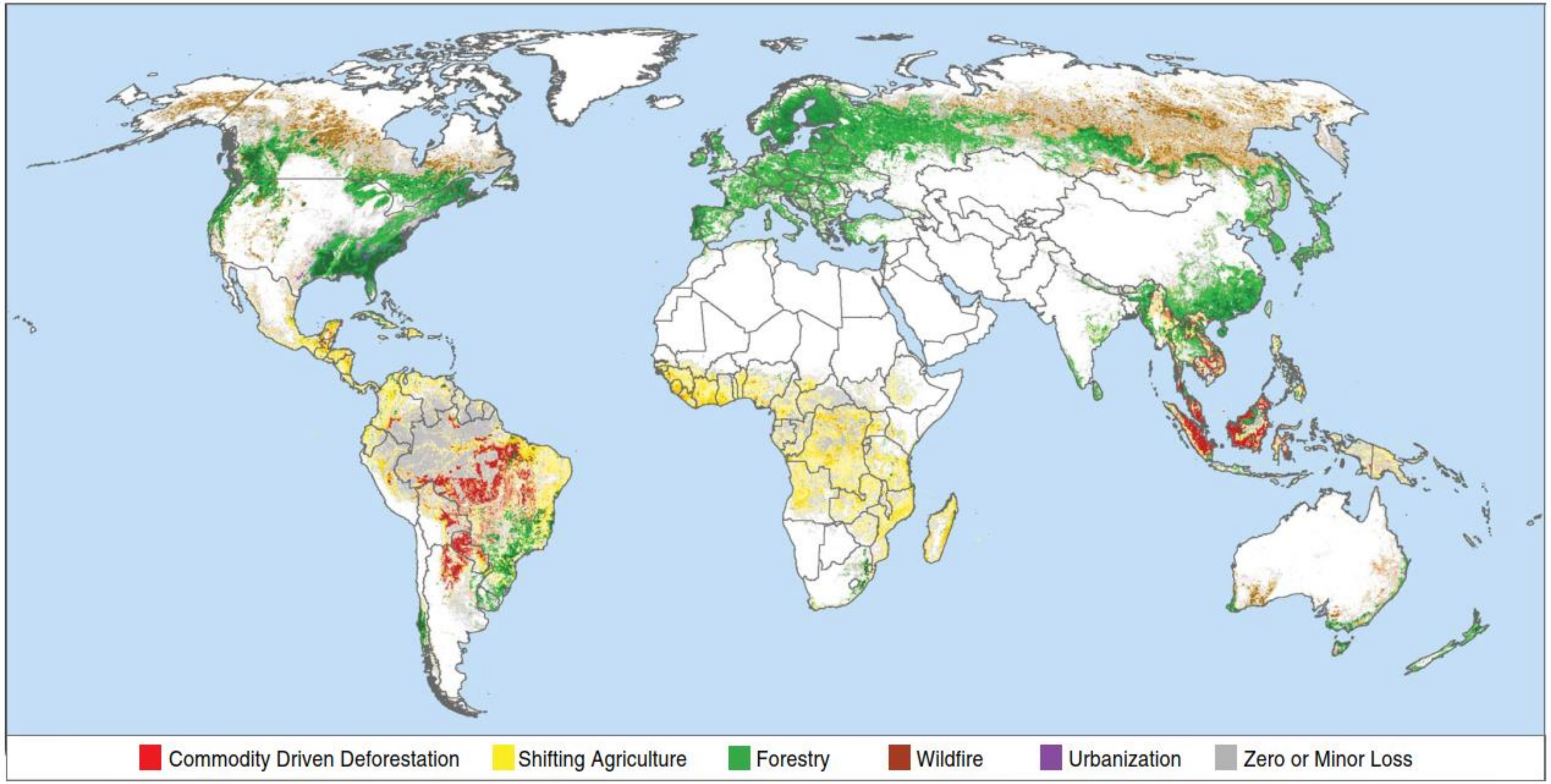
- Major deforestation drivers for all 3 continents are commercial and local/subsistence agriculture (~ 83 %)
- Major degradation drivers for American and Asian continent is timber/logging which account for almost 70% of total, on the other hand fuel-wood/charcoal are the main driver for African continent
- Major underlying drivers: increased human consumption and international trade of raw materials (e.g. minerals), food (e.g. palm oil, soy, beef), and wood (e.g. tropical hardwoods)

Hosonuma et al. (2012)

Primary drivers of forest cover loss 2001 to 2015

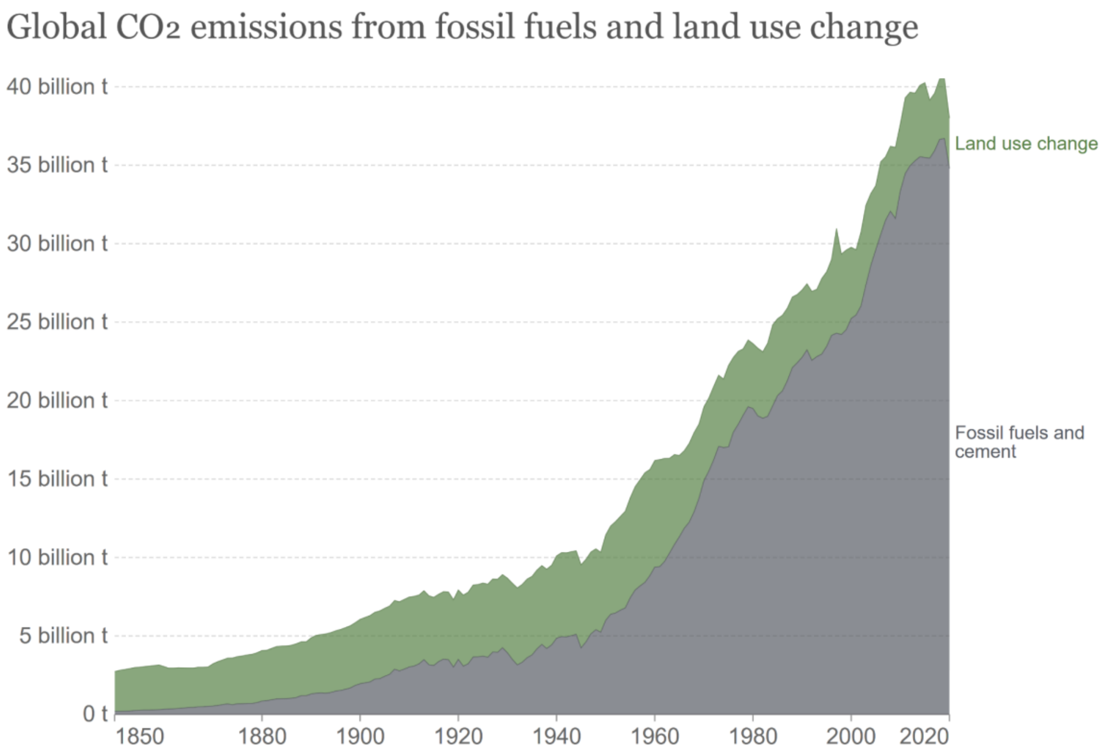
Darker color intensity indicates greater total quantity of forest cover loss

Note:
Forest cover loss
≠ deforestation



Curtis et al. 2018

Contribution of fossil fuel and land-use change to global CO_2 emissions



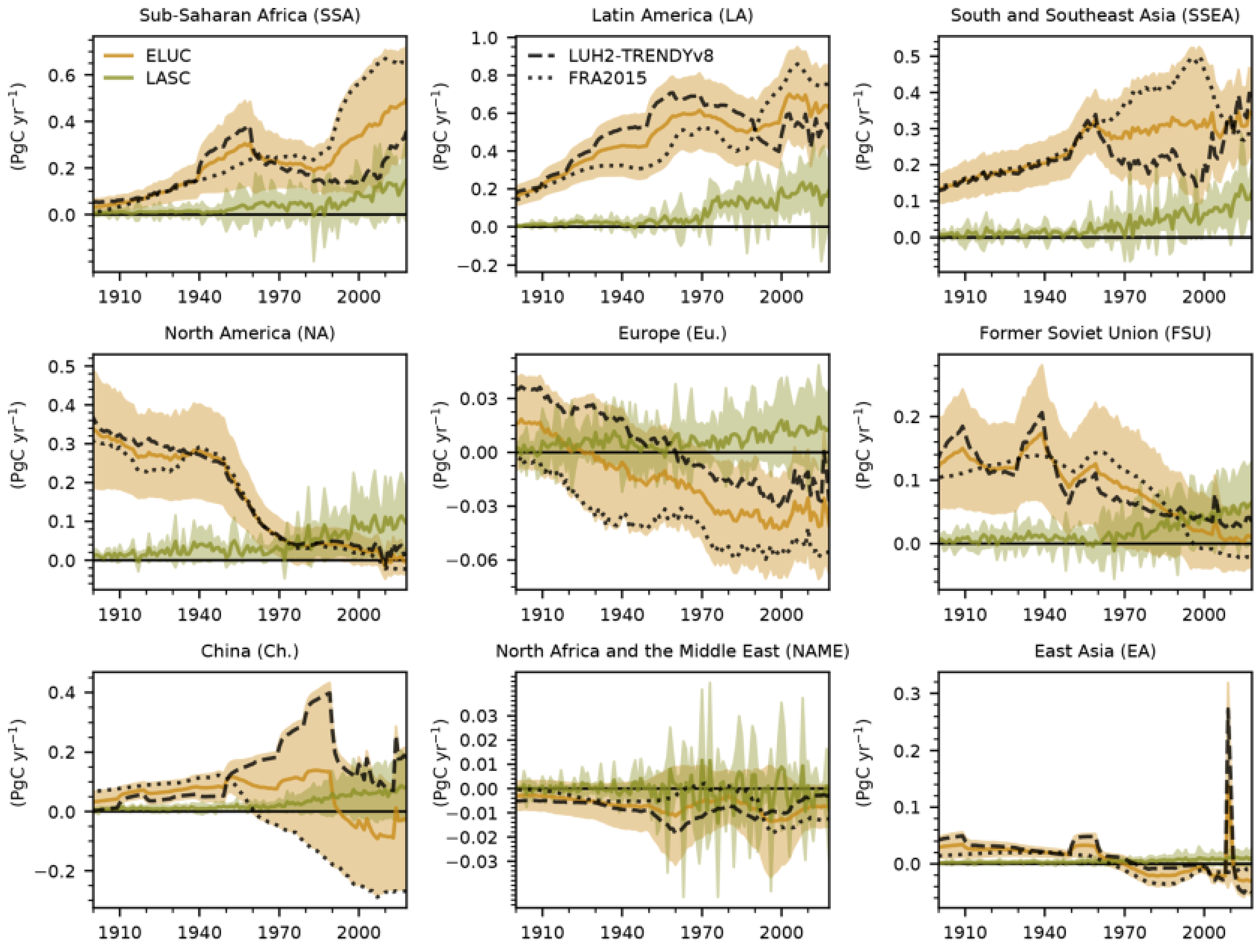
- Land use & food production = about 34% of global GHG emissions
  - Of total emissions of food production, about 60% is from animal-based food
- About 22% of global GHG emissions is coming from AFOLU sector
- About 11% of global GHG emissions is from land use change, mainly deforestation
- Land degradation is a serious problem exceeding planetary boundaries
- Land use & food production emissions are becoming an “emission hot spot”

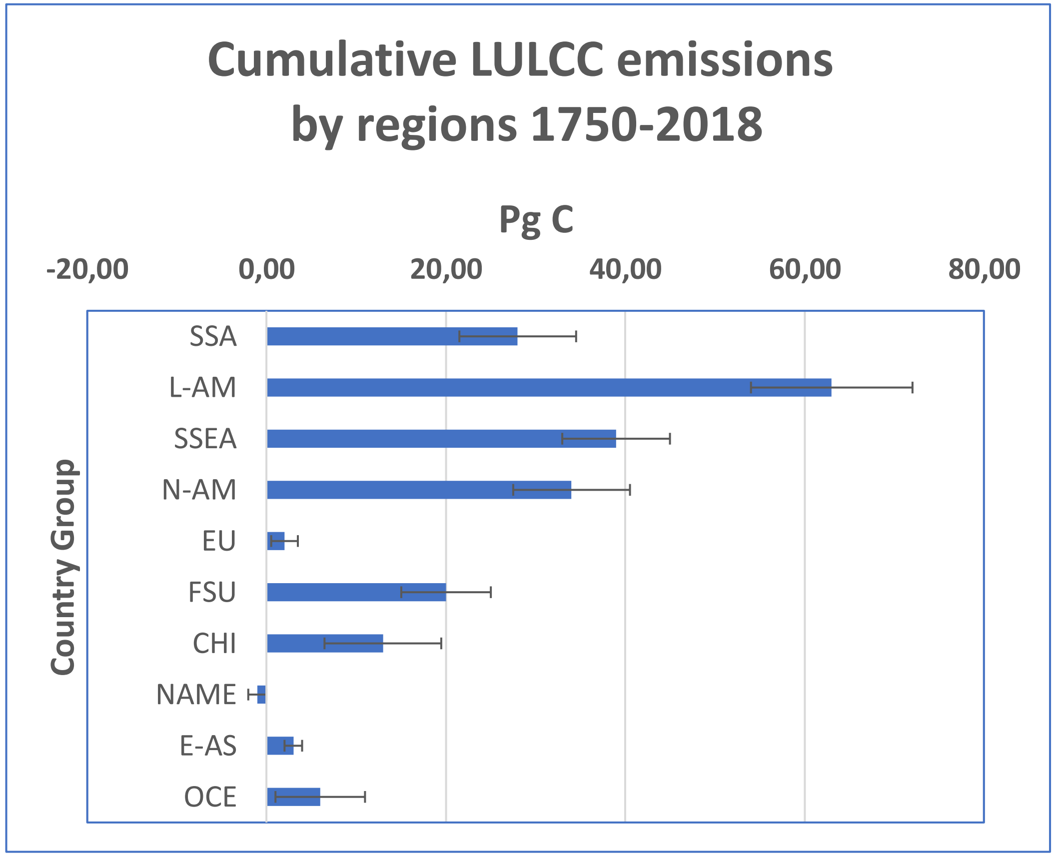
Global Carbon Project (2021)

IPCC (2022)

Regional estimates of LULCC emissions 1910-2018

LULCC = Land Use and Land Cover Change

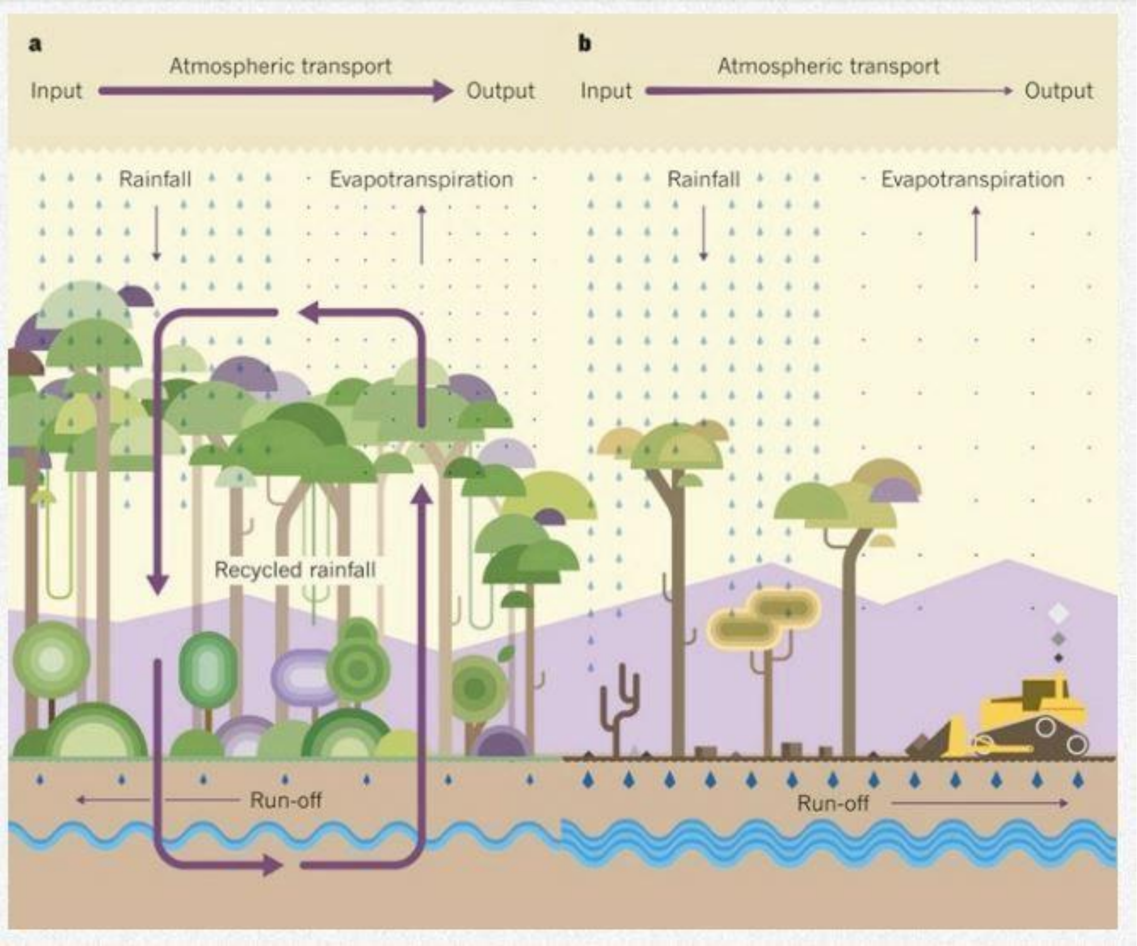




Gasser et al. (2020)

Amazon: the rainforest "water pump"

With trees **Without trees**



Aragao 2012

Amazon “tipping point”

Natural intact rain forest in the Amazon

- Moisture moves with winds from East to West
- 50-75 % of the precipitation is “recycled”
- Water recycling: 5-6 times before hitting the Andes
    -> Rain falls in the Andes, water enters the Amazon river system

Deforestation and fires

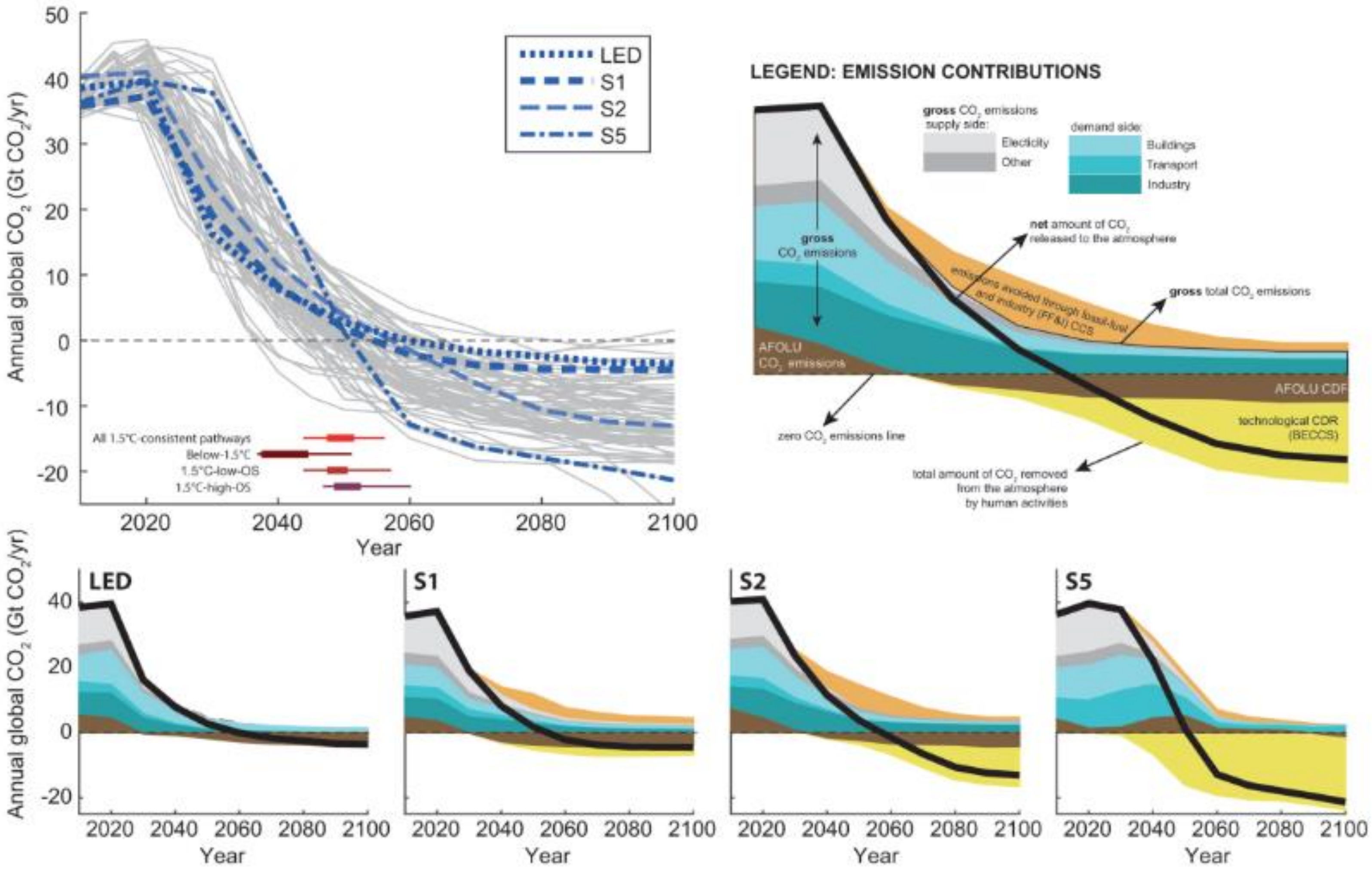
- Current deforestation: 17-20 % of the original rainforest area has been lost
- Forest is getting drier in S and SE parts of the Amazon basin
- No recycling, but the water runs off to rivers
- When the “tipping point” is reached: rain forest -> savanna

Two potential “tipping points” (Nobre et al. 2016):

- Temperature increase of 4 °C, or
- Deforestation exceeding 40% of the forest area

} Which comes first?

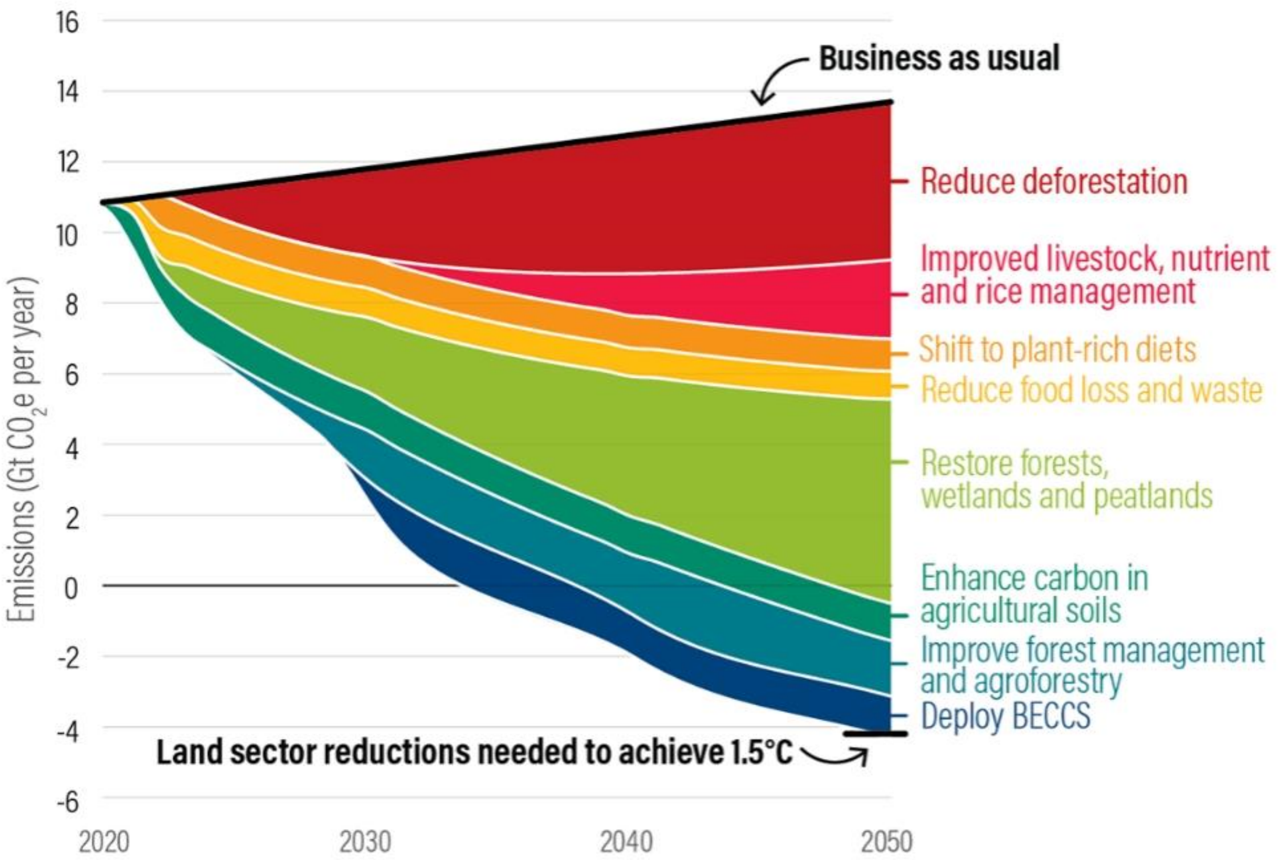
IPCC 1.5 °C Report: Evolution and break down of global anthropogenic CO2 emissions until 2100



IPCC SR 1.5 (2018)

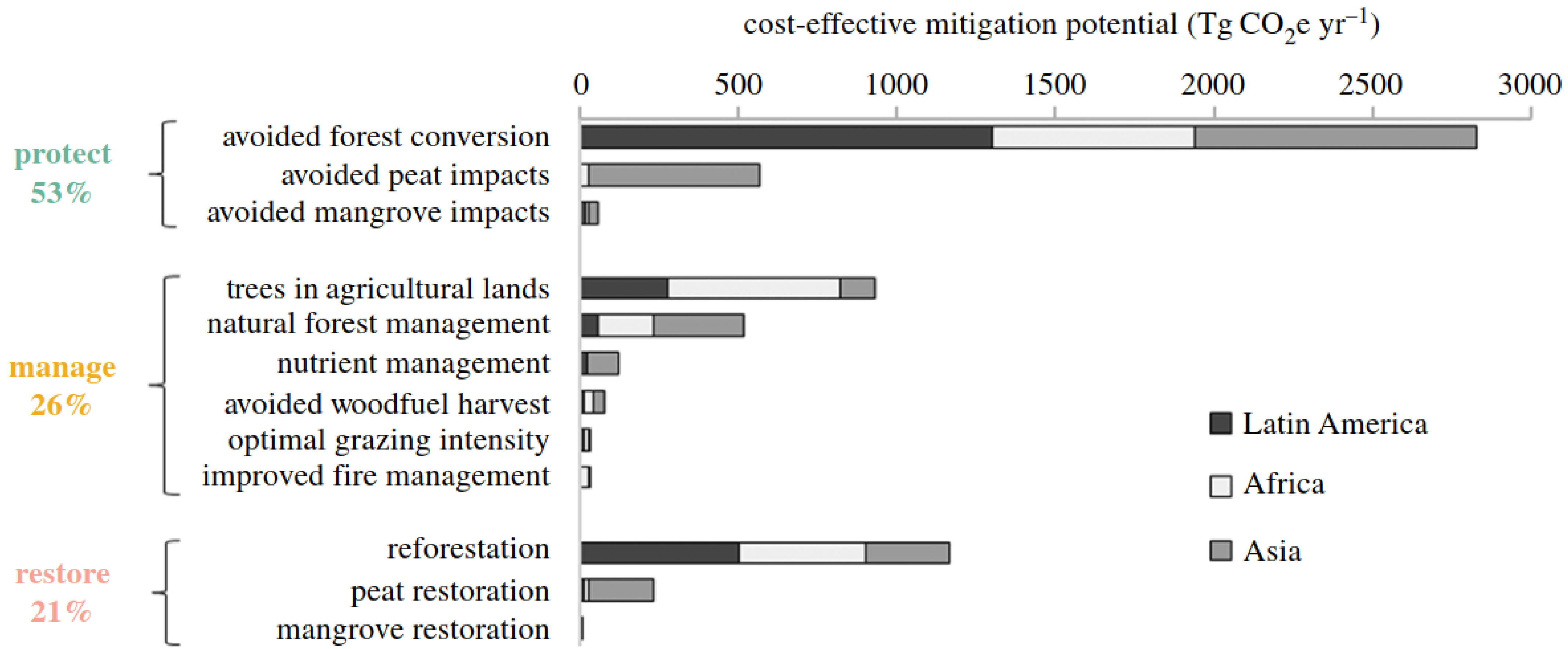
Land-sector roadmap for 2050

1. Reduce emissions from deforestation and degradation
2. Reduce emissions from agriculture
3. Shift to plant-based diets
4. Reduce food loss and waste
5. Restore forests, coastal wetlands and drained peatlands
6. Improve forest management and agroforestry
7. Enhance soil carbon sequestration in agriculture and deploy BECCS



Roe et al. 2019

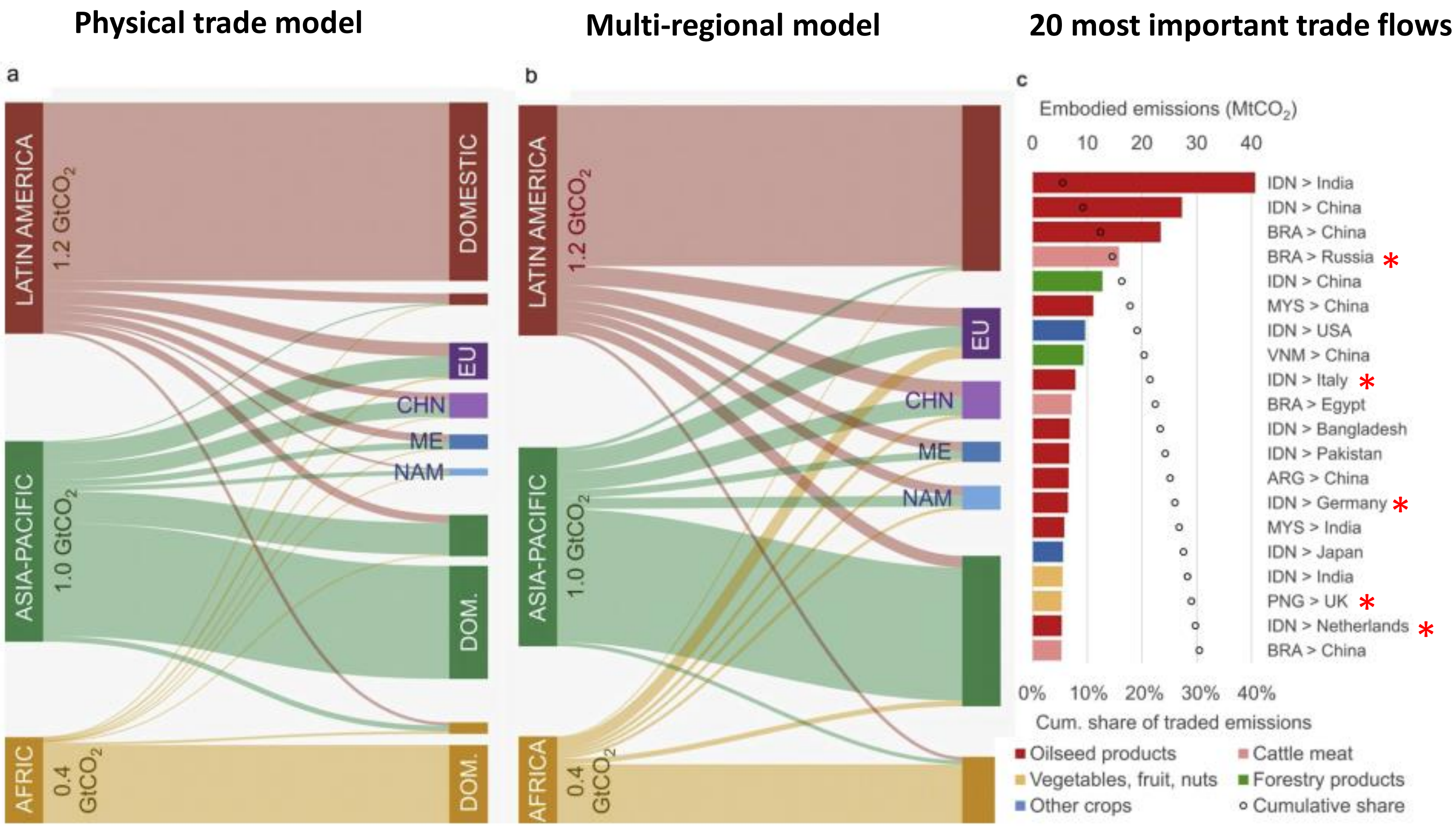
Pantropical climate mitigation potential of three types of NCS pathways (protect, manage, restore)



Griscom et al. 2020

NCS = Natural Climate Solutions

Trade flows of embodied emissions from deforestation 2005-2017



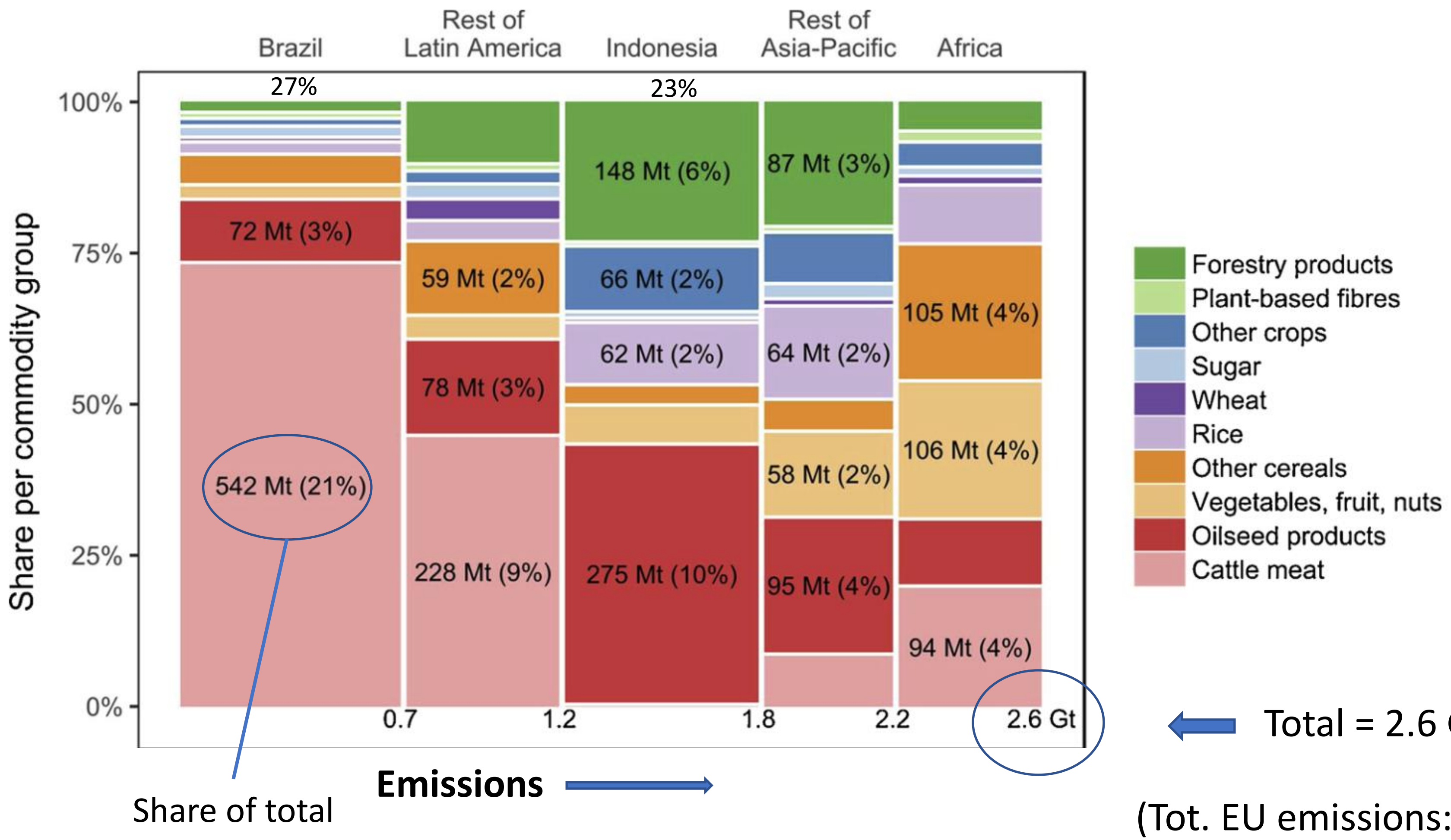
* = in Europe

Pendrill et al. 2019

Emission sources for deforestation-related CO_2 emissions are diverse and vary by region

Gt CO_2 yr^{-1}

Data:
2010-2014



Total = 2.6 Gt CO_2 yr^{-1}

(Tot. EU emissions: 4.3 Gt CO2 yr^{-1})

Pendrill et al. 2019

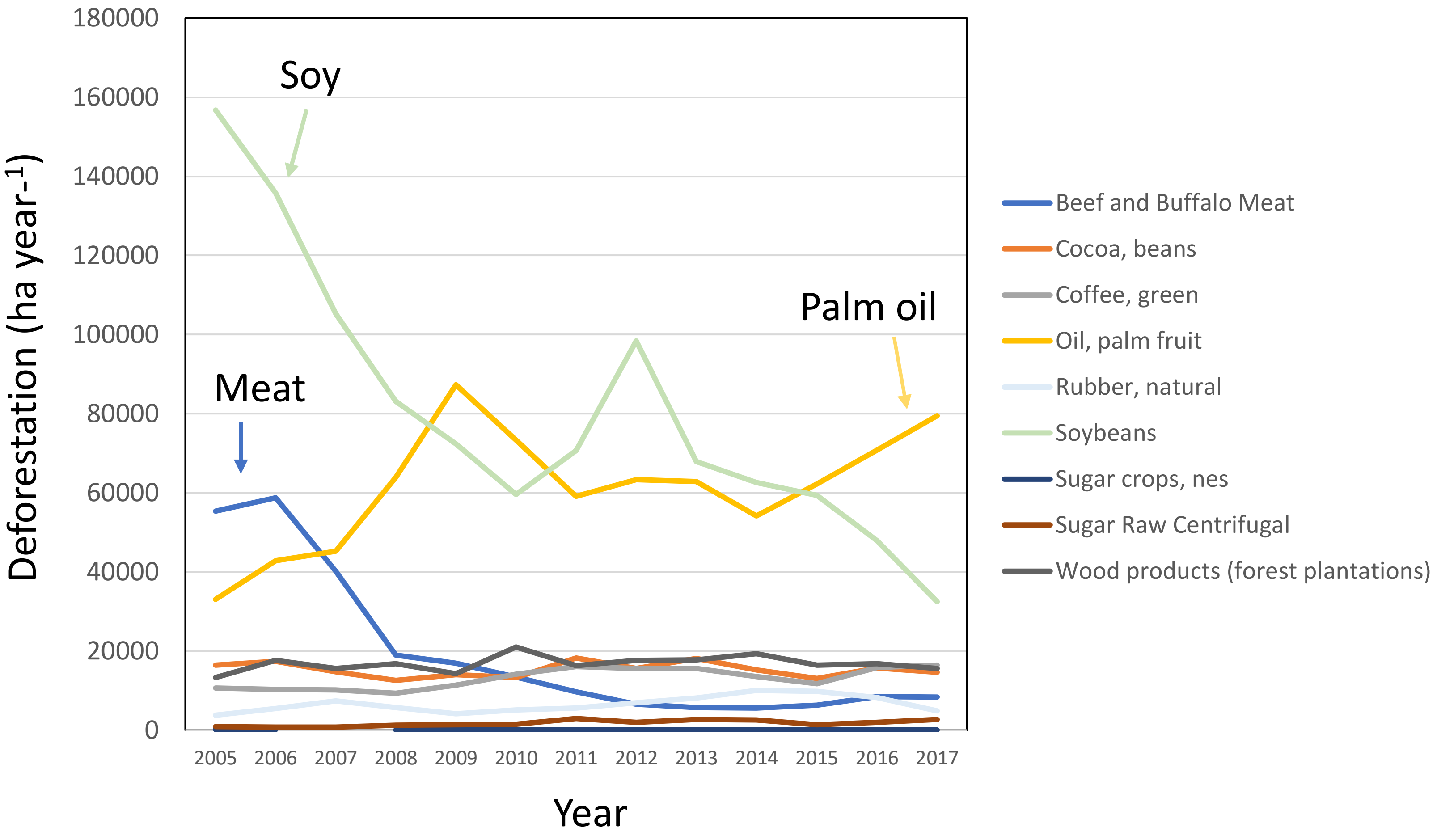
Deforestation embodied in the EU 27 consumption of agricultural and forestry commodities 2005-2017

EU consumption causes tropical deforestation of

- About 10-15% of all tropical deforestation
- About 190 000 ha year^{-1}

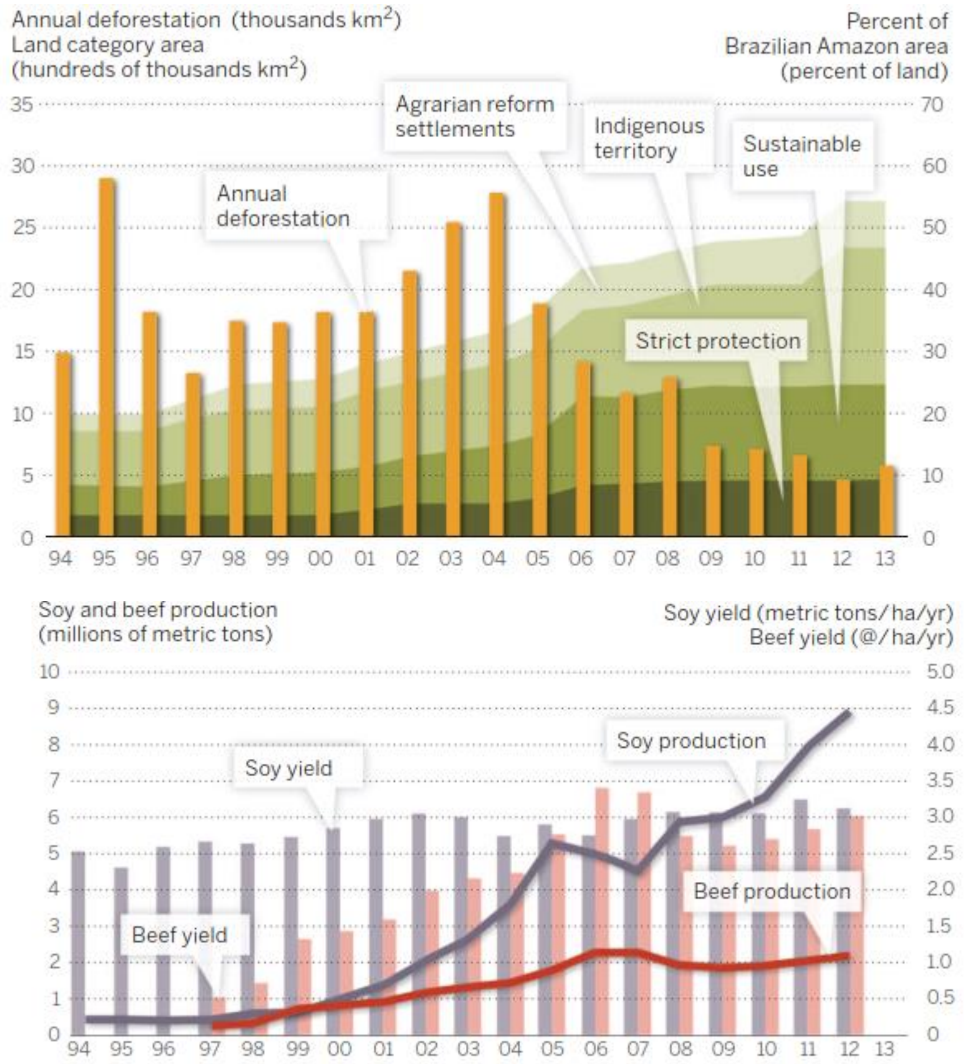
This causes annual GHG emissions of

- About 100 Mt CO_2 year^{-1}
- ≈ 2x emissions of Finland



Pendrill et al. 2020

Deforestation in Brazilian Amazon 1994-2013



Nepstad et al. 2014

Slowing Amazon deforestation through public policy and interventions

- Deforestation rate decreased by 70% from 2004 to 2014

Drivers of change:

Increased productivity

- Decoupling agricultural production and deforestation

Enhanced government action

- Increased tenure security
- Monitoring & law enforcement

Value-chain action

- Commodity certification

Slash and burn agriculture in the Amazonia (1990’s)

Slash and burn agriculture in Finland (1890's)

Eero Järnefelt: Under the Yoke (Burning the Brushwood), 1893

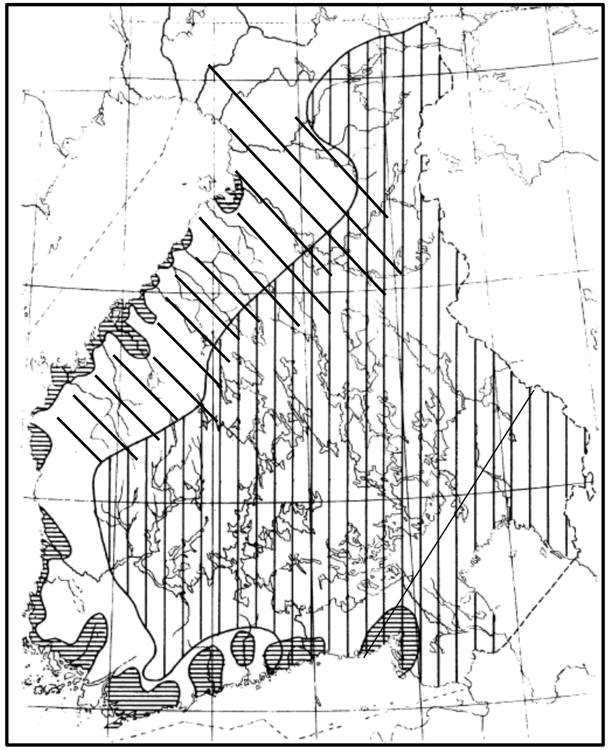
Deforestation and forest degradation in Finland

Areas of logging, tar burning, and slash-and-burn agriculture in 1750

Extraction of large timber for shipbuilding and sawmilling

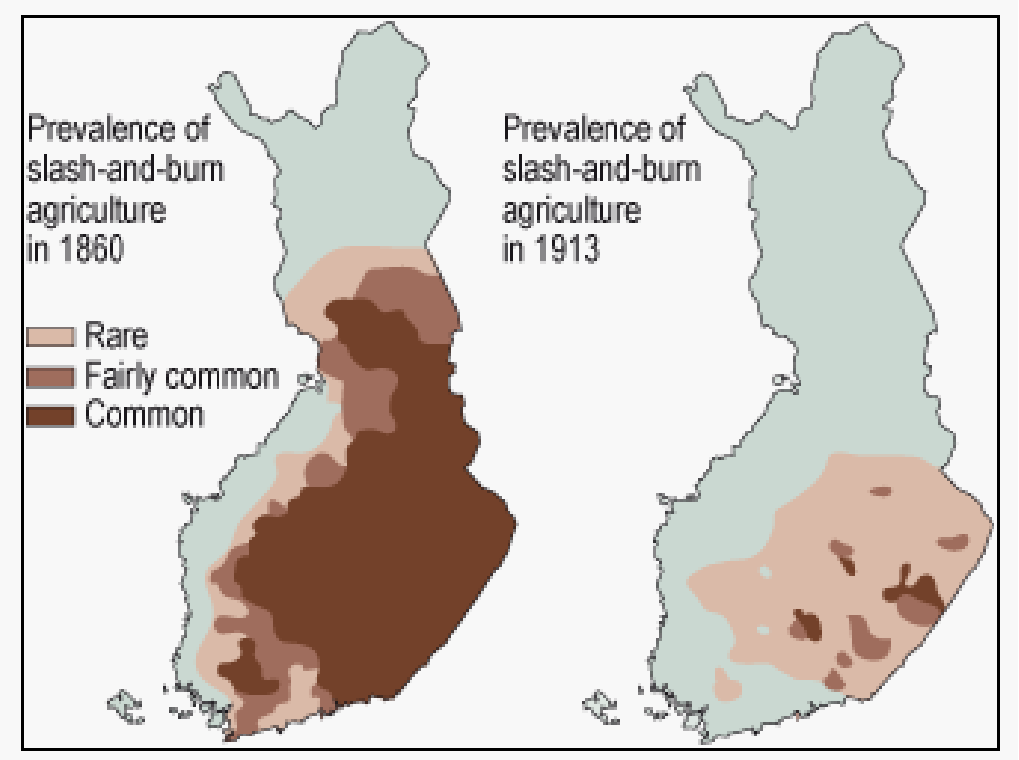
Tar burning

Slash and burn agriculture



Modified from Kaila, 1932

Areas of slash-and-burn agriculture in 1860 and in 1913



After Heikinheimo, 1915

Main points

- Deforestation and forest degradation has its roots in agricultural expansion, unsustainable extraction of natural resources, and trade
- Land degradation and forest loss are accelerating biodiversity crisis
- Currently, about 30-40% of tropical deforestation is driven by international trade
- About 11% of global GHG emissions is from land use change, mainly deforestation
- The 1.5 and 2.0 ^{o}C climate targets require establishment of considerable negative emissions (carbon sinks) by 2040-2070
- Examples from Brazil and other countries show that effective policies and measures can considerably slow down deforestation and forest degradation
- EU consumption causes about 10-15% of all tropical deforestation
- EU is formulating policies to reduce its deforestation footprint of imported goods

Thank you

Rio Tambobata – Peruvian Amazon

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NATURAL RESOURCES
INSTITUTE FINLAND

Mitigation of climate change and linkages to biodiversity targets

Raisa Mäkipää, Natural Resources Institute Finland (Luke)

EEAC conference, 14.-15.9.2022 Helsinki, Finland

SESSION 9: FORESTS AND DEFORESTATION - LINKS BETWEEN CLIMATE AND BIODIVERSITY

Major global challenges: Loss of biodiversity, land degradation and climate change

Solutions

- Global targets
- International agreements

- Fair support for transition
- Good land management practices adopted by local land owners

Luke NATURAL RESOURCES INSTITUTE FINLAND

Forest-based climate change mitigation in the EU

Forests and wood products in the EU remove approximately 380 MtCO2eq/year (compensating about 10% of total annual EU greenhouse gas emissions).

EU's policy target for the Land Use, Land-Use Change, and Forestry (LULUCF) sector is to remove additional 50 MtCO_2eq/year by 2030, 100 MtCO_2eq/year by 2035, and 170 MtCO_2eq/year by 2050.

In the LULUCF sector croplands are emission source and under the current (till 2027) Common Agricultural Policy (CAP) major new instruments that enhance emission reductions are not seen and emissions may even increase (as has been the case in Finland).

Thus, target of LULUCF sector should be reached by forest carbon sinks. However, there are no direct incentives to increase forest carbon sequestration or to reduce emissions of peatland soils.

Furthermore, analyses on the emission reduction costs are not comprehensive and it's not seen which measures are cost efficient. Further analyses and cross-sectoral comparisons are needed.

Coming soon (Sept 20)... report by EFI, Verkerk et al. 2022


EUROPEAN FOREST INSTITUTE

From Science to Policy 14

Forest-based climate change mitigation and adaptation in Europe

Pieter Johannes Verkerk, Philippe Delacote, Elias Hurmekoski, Janni Kunttu, Robert Matthews, Raisa Mäkipää, Fredric Mosley, Lucia Perugini, Christopher P.O. Reyer, Stephanie Roe, Erik Trømborg

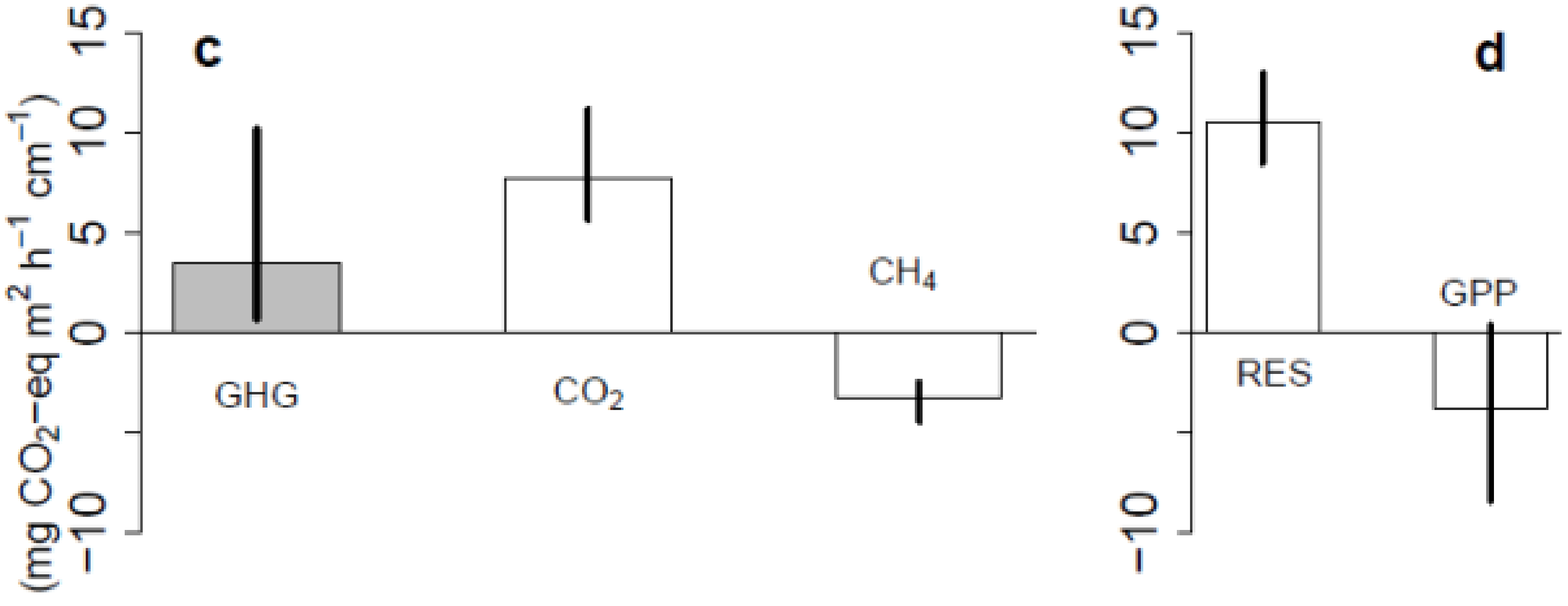
Report incl. Chapter on **Synergies between climate change mitigation and biodiversity**

Linkages between biodiversity and climate change mitigation

- Bi-directional synergies between measures that mitigate climate change and maintain biodiversity, i.e. win-win.
- In general, actions to halt biodiversity loss generally benefit the climate (Shin et al. 2022).
- Climate change mitigation measures that have positive effects on biodiversity, e.g.
  - Protecting carbon rich forest ecosystems from deforestation and from soil degradation
  - Forest conservation that increase average carbon stock of forest.
- Forest-based climate change mitigation measures that focus on active management are often in direct or partial conflict with biodiversity goals, but positive synergies do exist (e.g., Giuntoli et al. 2022)
  - Less frequent harvesting and greater retention of forests' structural elements
  - Selection and retention systems have a less severe impact on species richness than rotation forestry that employs clearcutting (Chaudhary et al. 2016, Paillet et al. 2010)
  - Forest stand thinning may increase diversity of plant species.
  - Lengthened rotation times will increase the availability of older trees and dead trees, both of which promote biodiversity (Ranius et al. 2003; Weslien et al. 2009; Felton et al. 2016).
  - Restoration of peatland hydrology decrease GHG emissions and enhance survival of peatland vegetation.

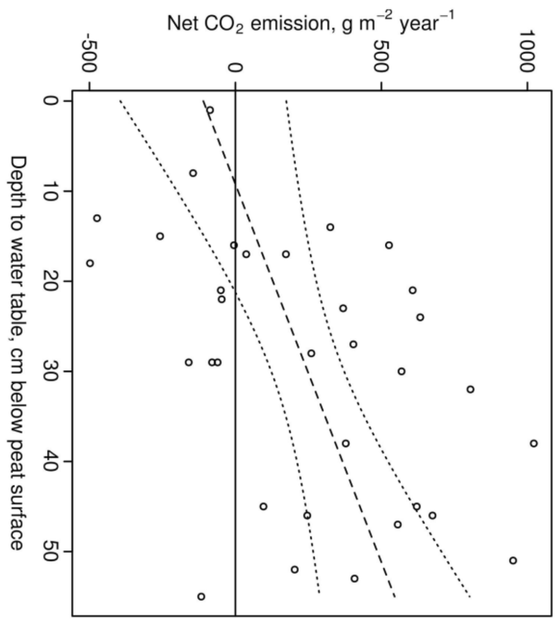
Management of peatlands and climate change mitigation

Soil water level affects peatland GHG emissions



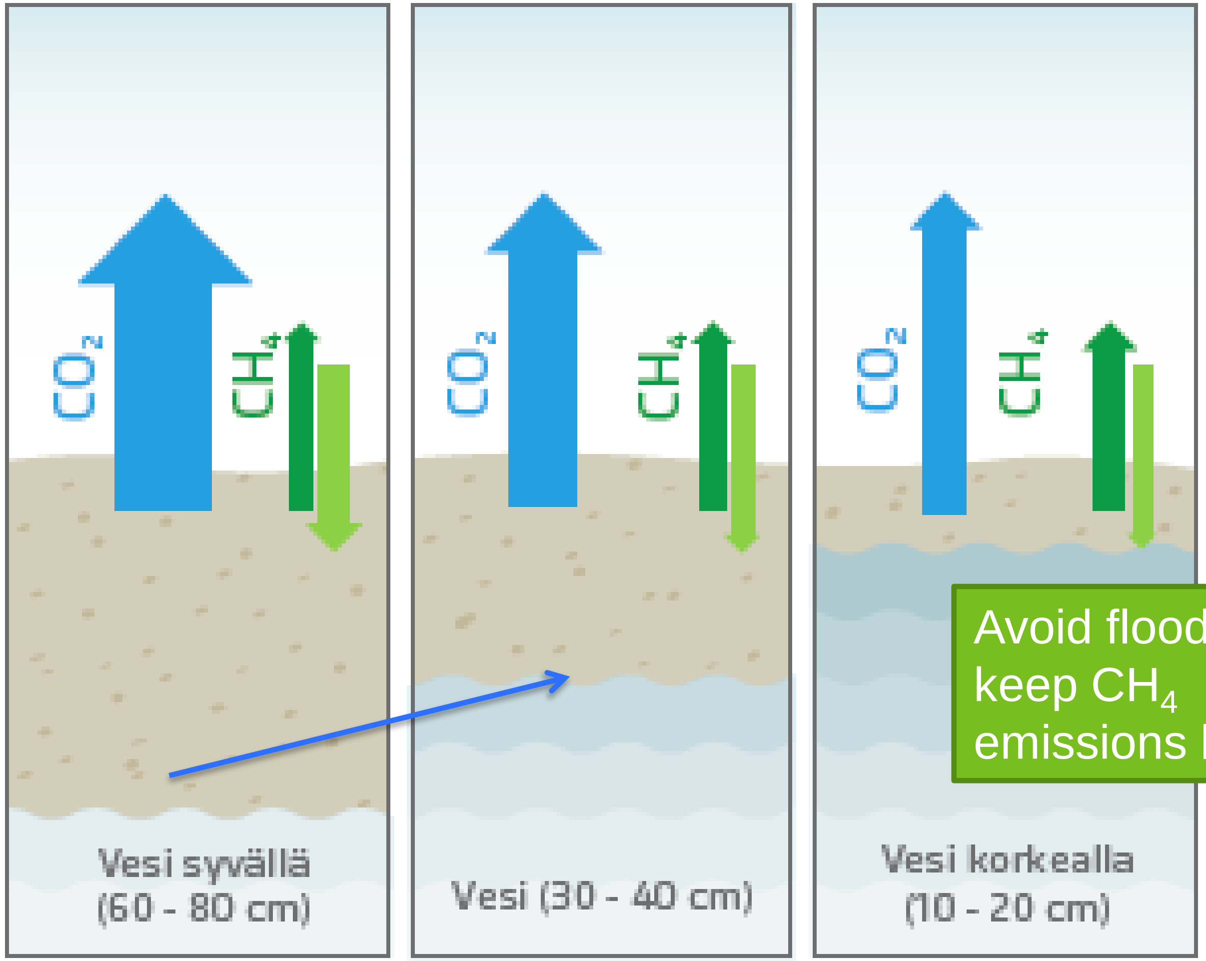
- Average sensitivities of peatland carbon emissions per 1 cm water level drawdown.
- Meta-analyses by *Huang et al. 2021 Nat. Clim. Chang. 11, 618–622* https://doi.org/10.1038/s41558-021-01059-w

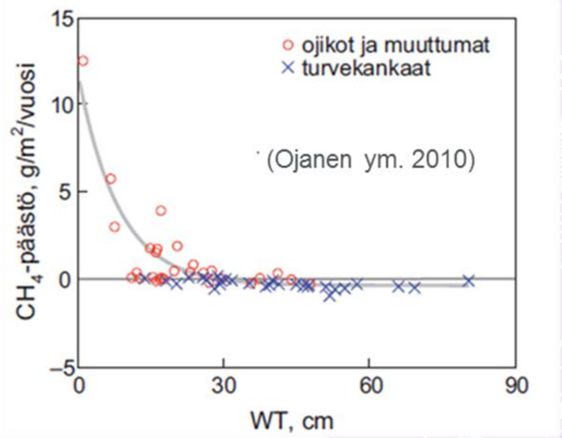
GHG emissions of peat soil are dependent on ground water level



Ojanen et al. 2019

Low water table: peat leyer decomposes and yields high CO_2 emissions

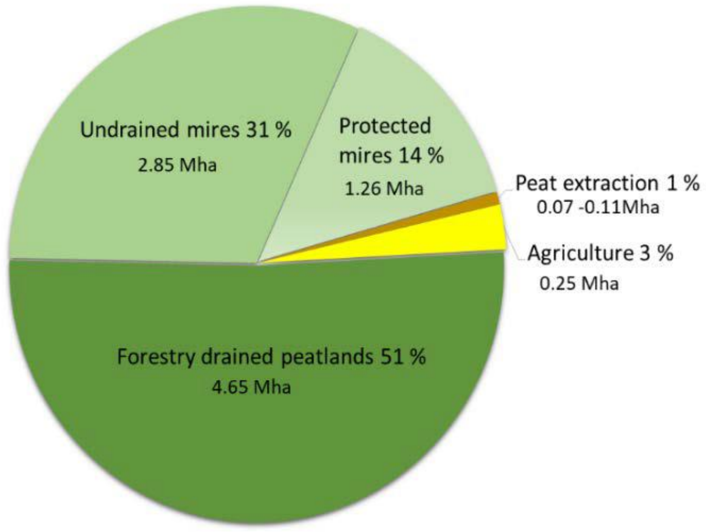


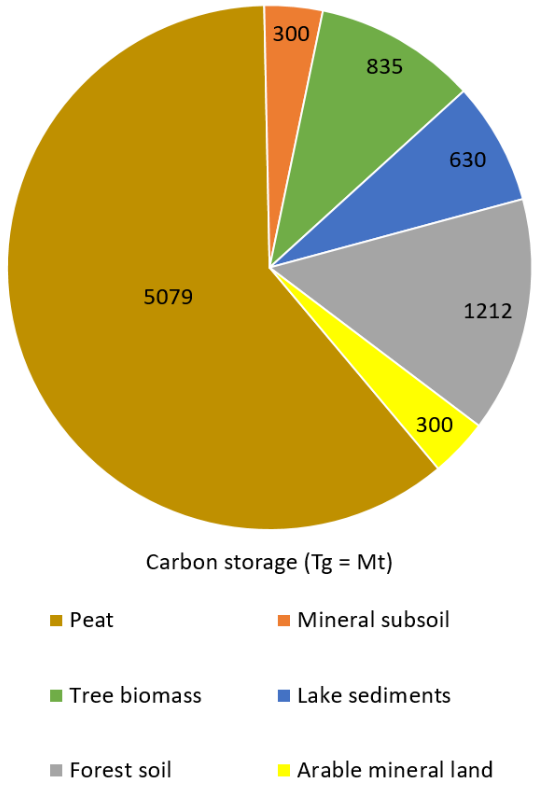


Avoid flooding to keep CH_4 emissions low

Peatland forests – source of timber and greenhouse gas emissions

- In Finland, peatland forest area 9,2 Mha, 30% of land area, 2/3 of ecosystem carbon.
- 23% of forest growth
- 75% of peatlands drained for forestry in S-Finland and 40% in N-Finland
- GHG emissions of peat soils (7 Mt CO_2 eq.) reduced forest carbon sink by one quarter (forest C sink was 22,9 Mt CO_2 eq.) (year 2019)

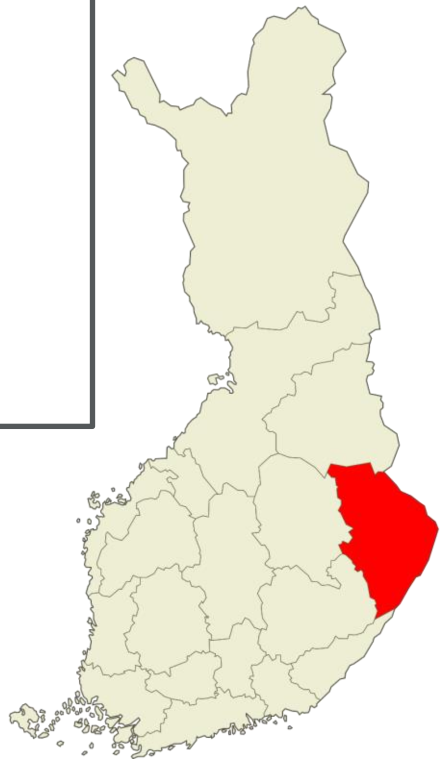


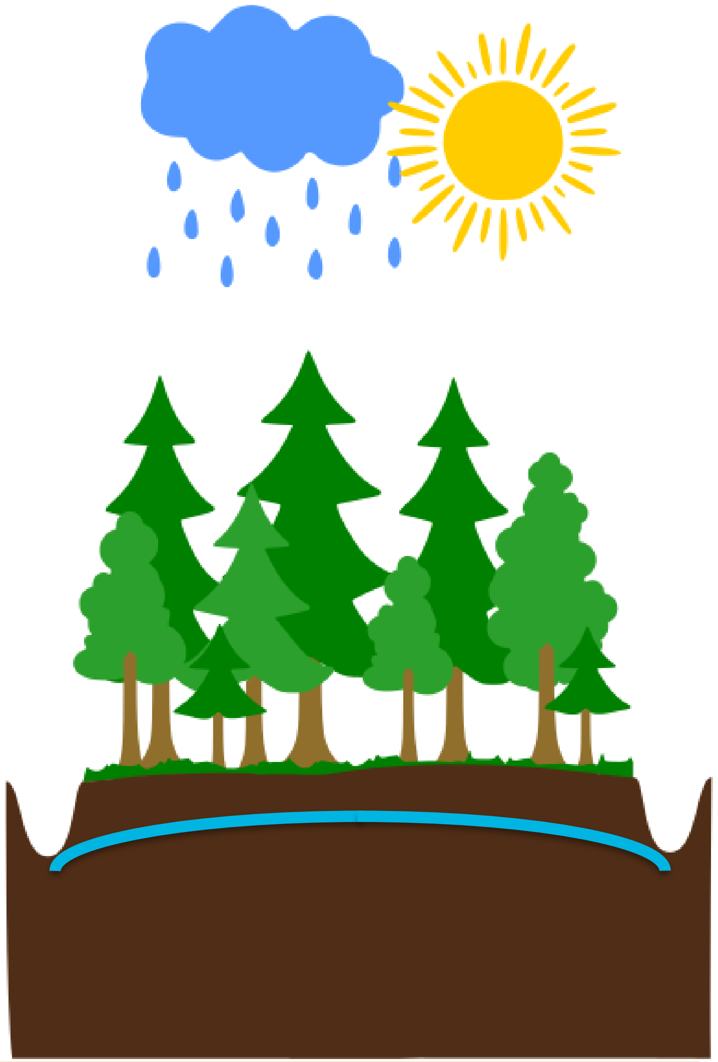


NIR Finland 2021,https://unfccc.int/ghg-inventories-annex-i-parties/2020
https://www.luke.fi/tietoa-luonnonvaroista/metsa/suometsat/
Turunen & Valpola 2020 Mires and Peat 26

Where are peatland's emission hot spots

- Real management units from Metsähallitus
- 120 000 peatland forests
    - Forest cover
    - Drainage age
    - Ditch density
    - Site type



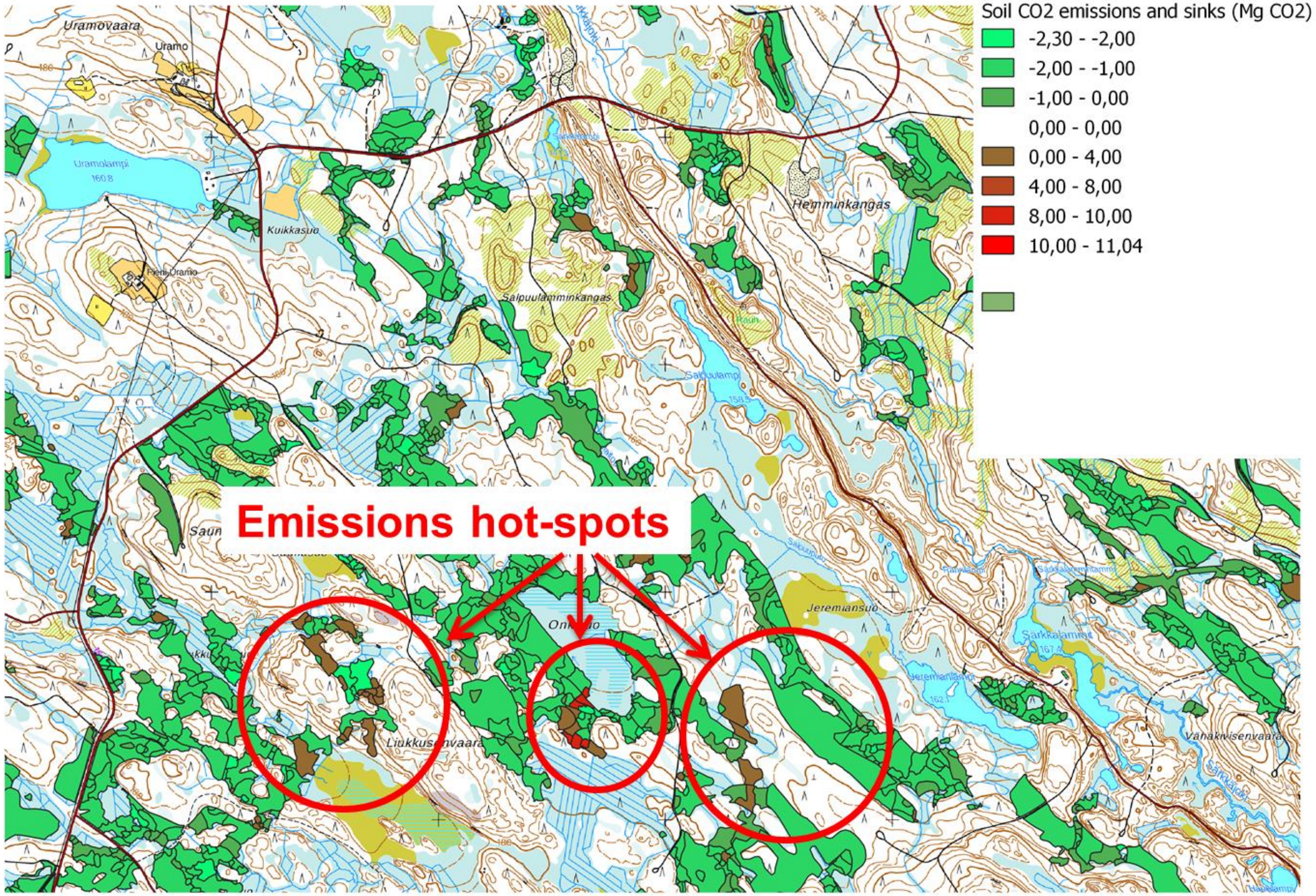


SpaFHy – model for hydrology

- Inputs:
    - Daily weather data
    - Leaf biomass -> LAI
    - Drainage (depth & distance)
    - Soil properties (conductivity & water retention)
- Output:
    - Daily water balance
    - Daily water table depth

Launiainen et al. 2019 [https://doi.org/10.5194/hess-2019-45]

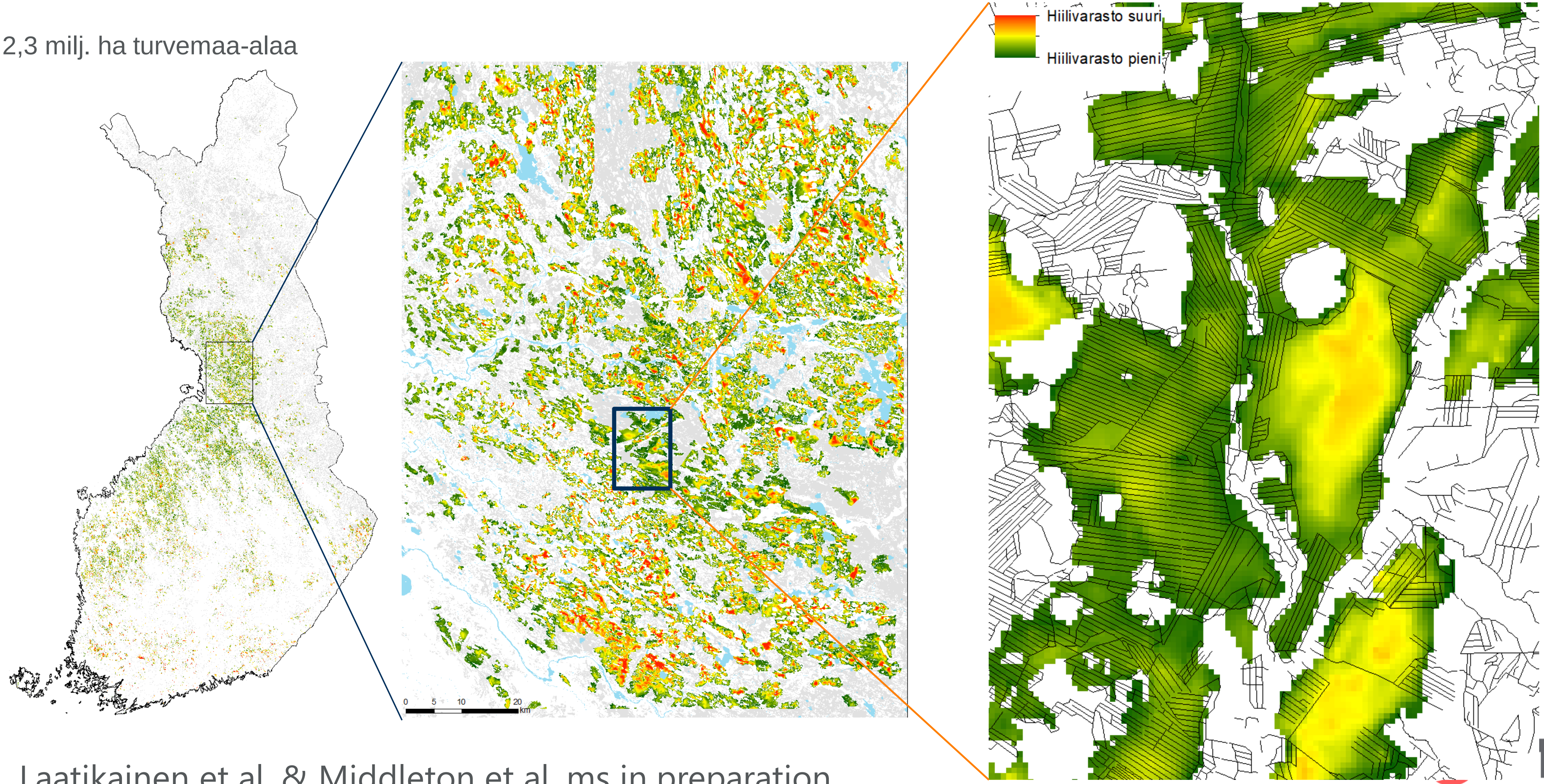
By combining filed data and models emission ’hot spots’ can be located?



Lähde: Lehtonen et al. (in prep.)

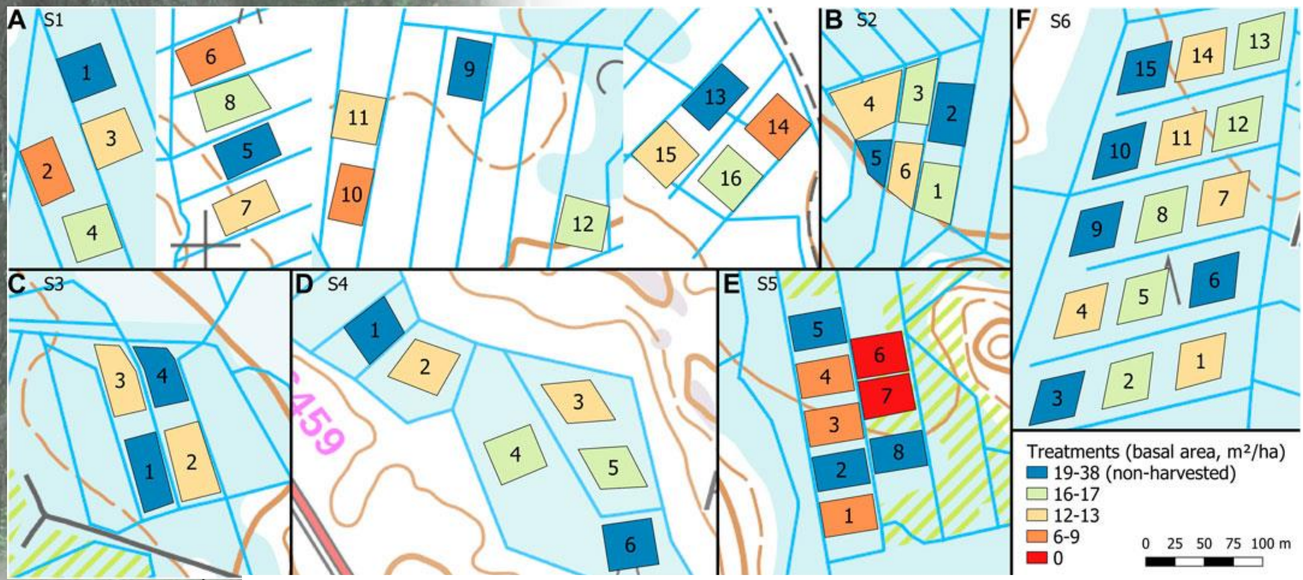
In MaaTi-project detailed soil carbon stock estimates and fertility class estimates for peatland parcels in Finland

- n. 2,3 milj. ha turvemaa-alaa

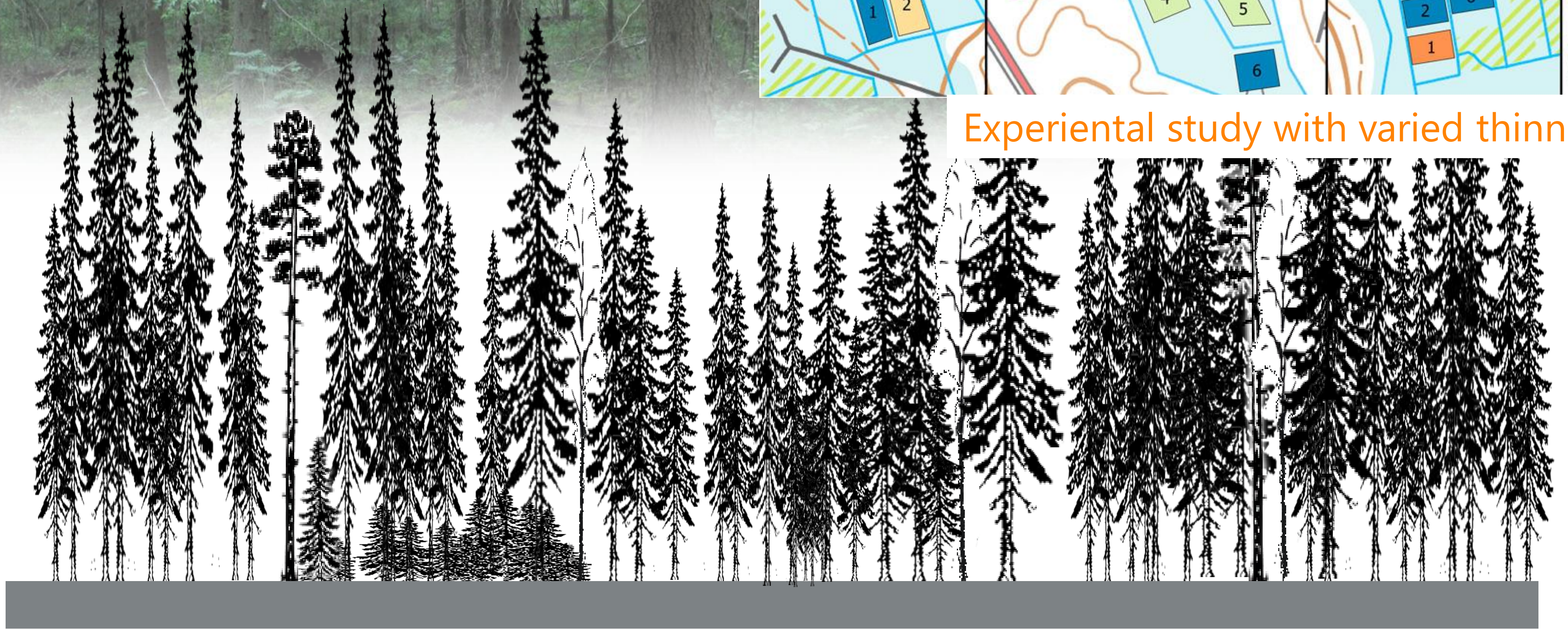


Laatikainen et al. & Middleton et al. ms in preparation.

Continuous cover forestry & no ditching may reduce emissions



Experiental study with varied thinning intensity



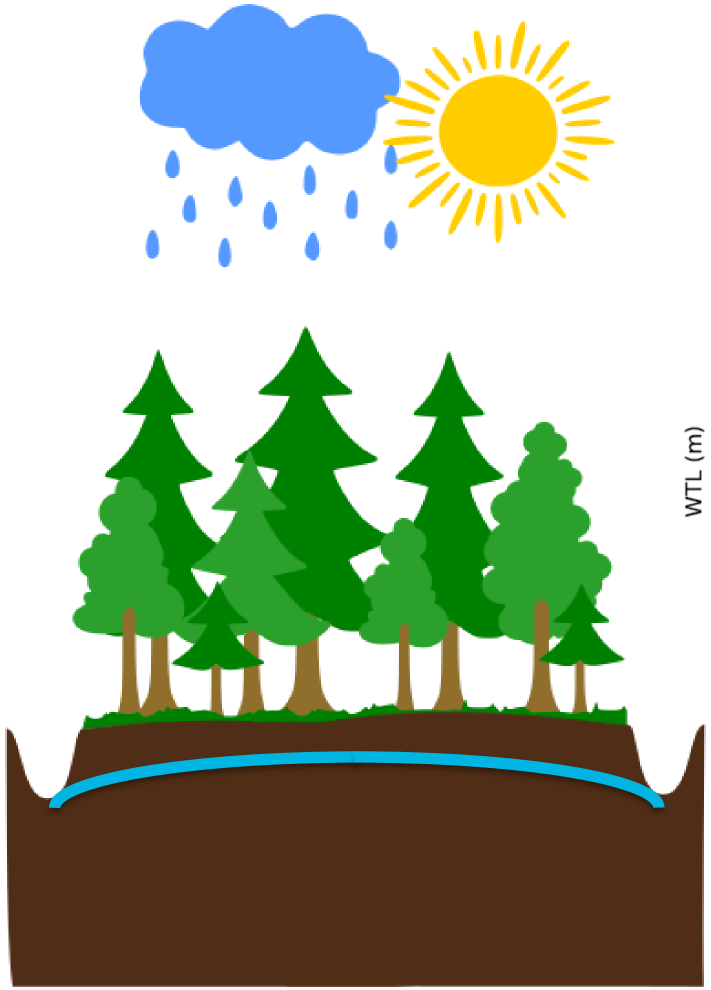
Markku Saarinen

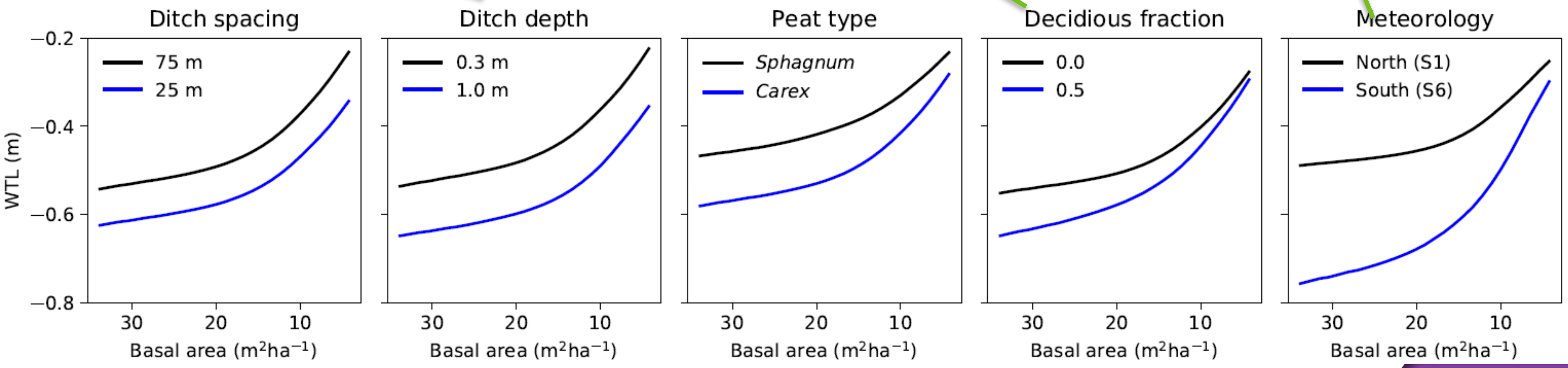
Selection cuttings (CCF) can be used as a tool to control the water level in boreal peatland forests

No need for ditch maintenance if stand is not clear cut

Deciduous fraction can be used to control WTD

Stronger WTD regulation in southern Finland



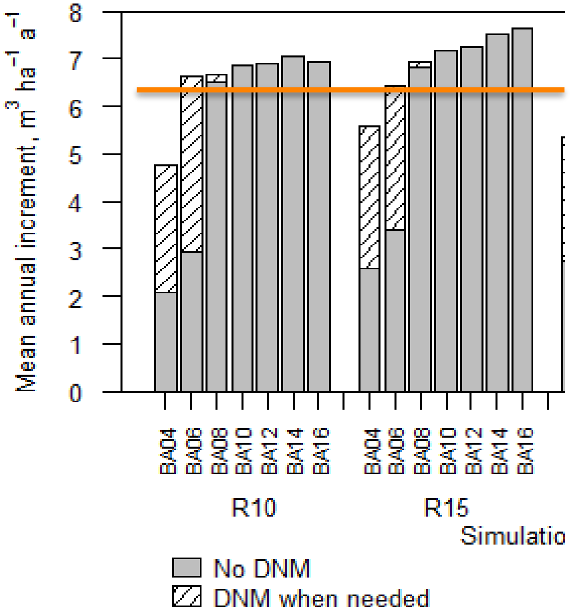


Leppä et al., Selection Cuttings as a Tool to Control Water Table Level in Boreal Drained Peatland Forests (2020) Front. Earth Sci., 09 Oct 2020. https://doi.org/10.3389/feart.2020.576510

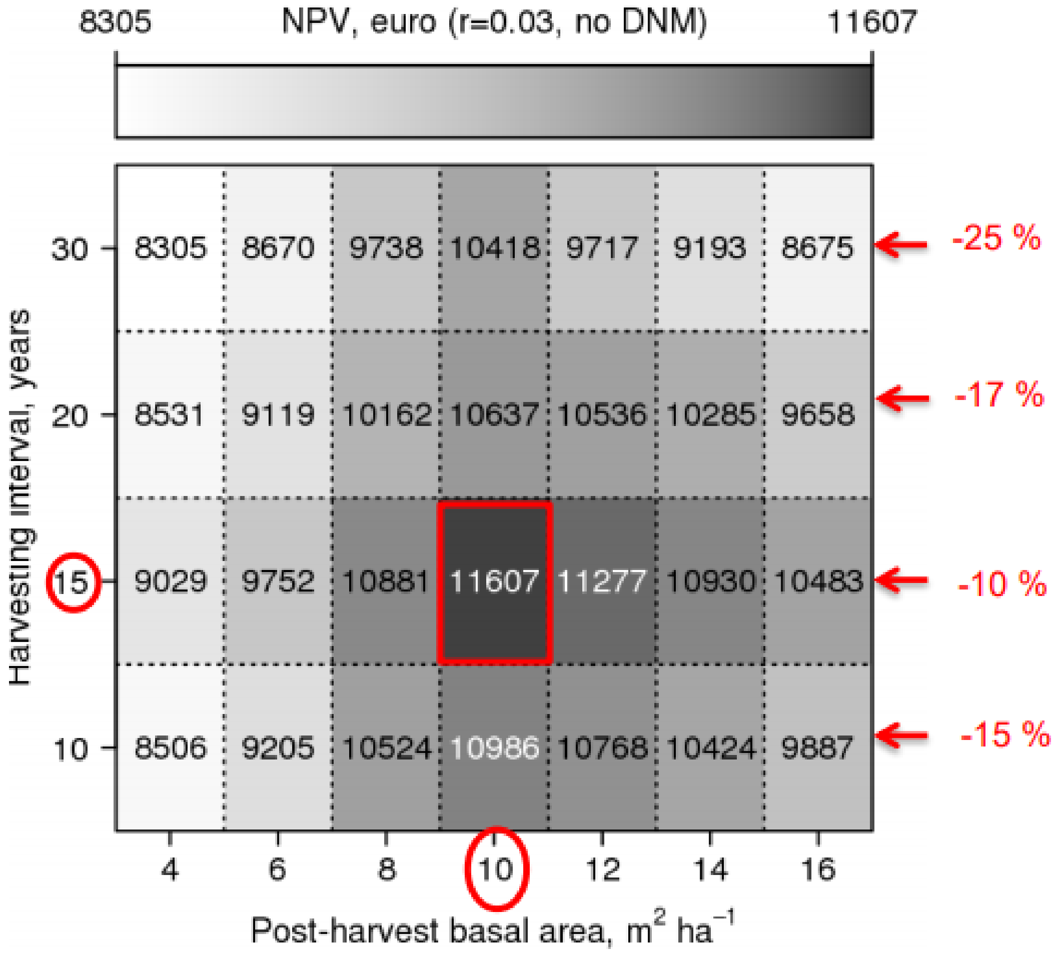
https://github.com/LukeEcomod/SpaFHy-Peat

Profitability of continuous cover forerstry (CCF)

- CCF more profitable than rotation forestry on nutrient-rich peatlands
- Highest NPV:15 year harvest interval & post-harvest BA of 10 m²/ha



Mean annual increment with and without ditch network maintenance (DNM) for the continuous cover forestry scenarios and rotation forestry (RF).

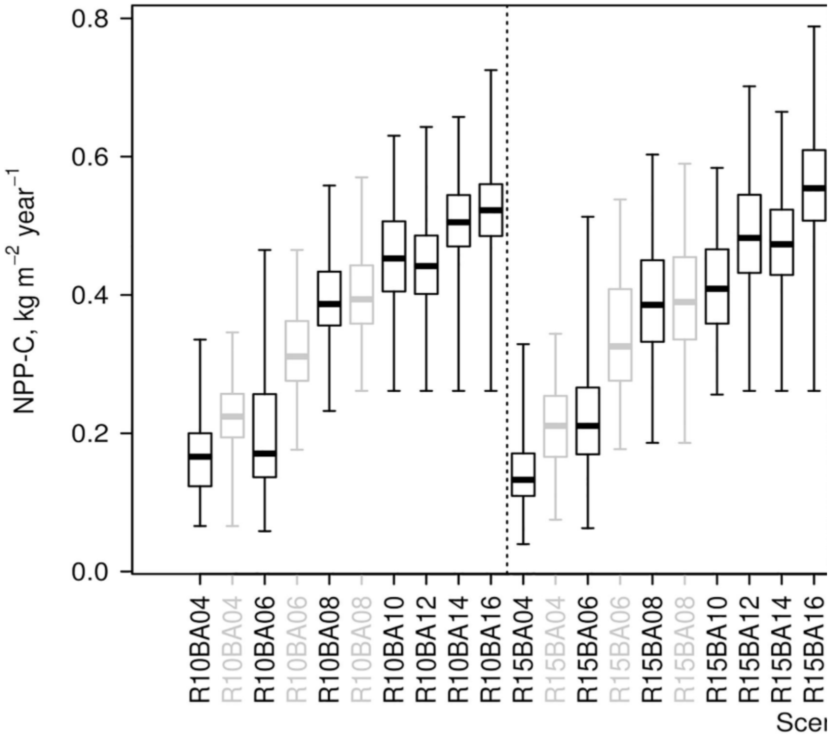


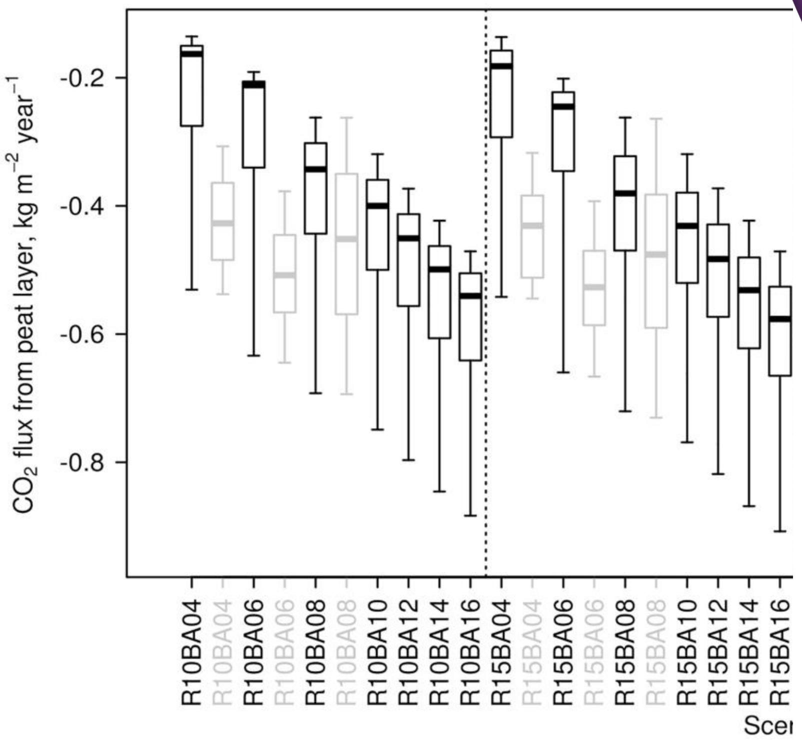
Source: Juutinen et al. 2021 CJFR
https://doi.org/10.1139/cjfr-2020-0305

ND

Harvest interval, post-harvest BA and DNM affect carbon sink of peatland forests

Figure. Net primary production and net annual CO2 fluxes from peat layer



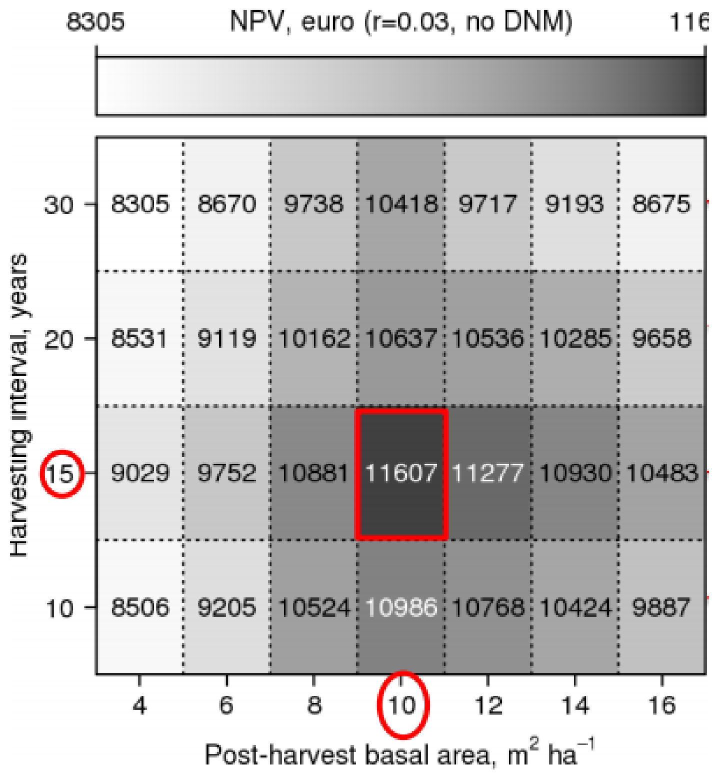


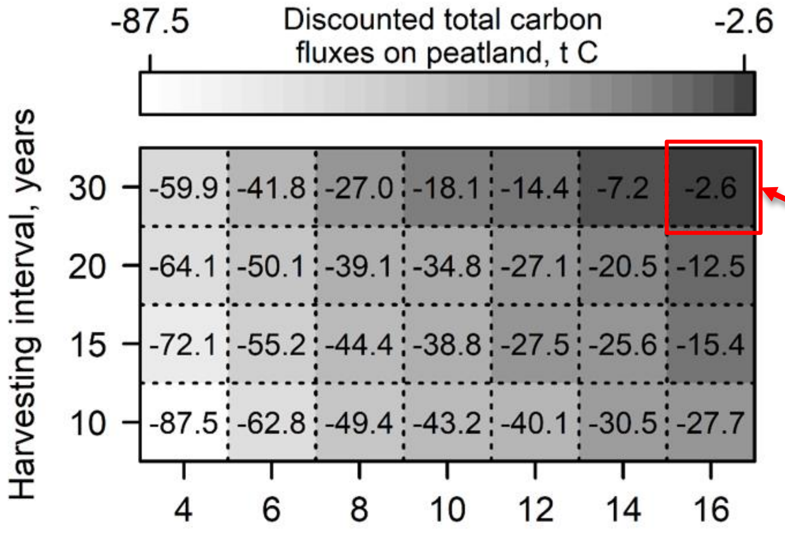
Shanin et al. 2021.
https://doi.org/10.1016/j.foreco.2021.119479

NBP (NEP-harvested C) close to zero in CCF, source of C 0,1 kg/m^2/yr in rotation forestry, and sink of 0,3 kg/m^2/yr in unmanaged.

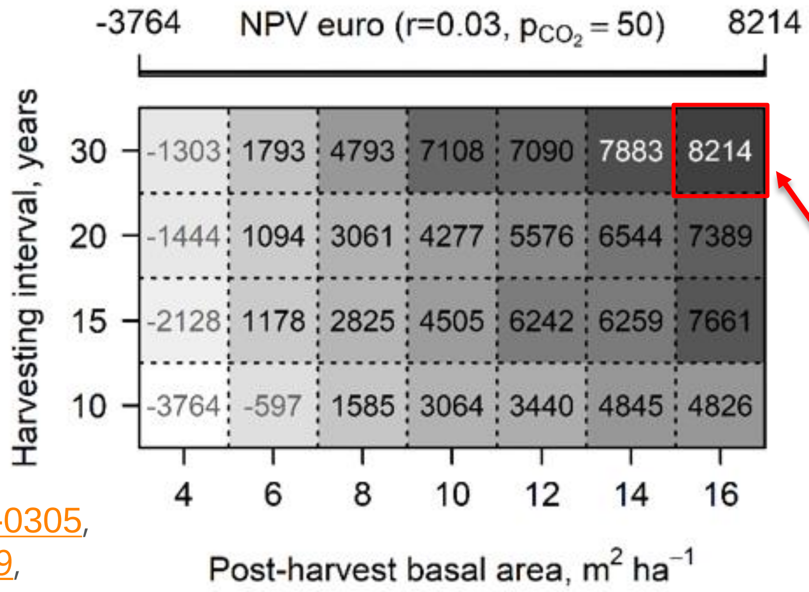
Profitability of continuous cover forestry (CCF) on peatlands

Highest NPV with15 year harvest interval & post-harvest BA of 10 m²/ha





Drained peatlands are emission sources. Lowest the emissions while the harvesting interval and the post-harvest BA are high.

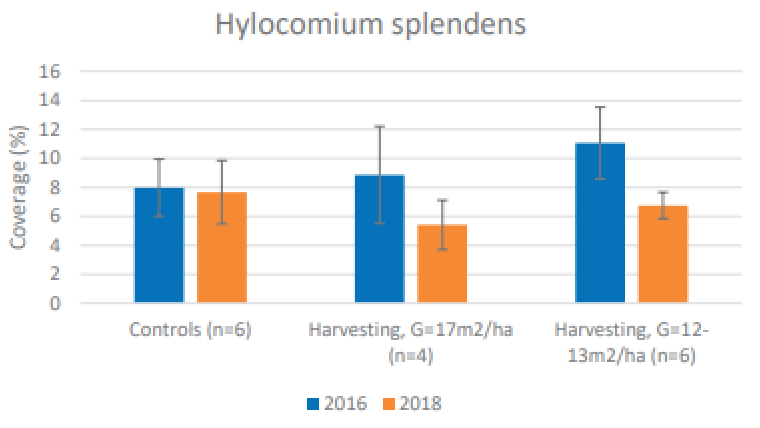


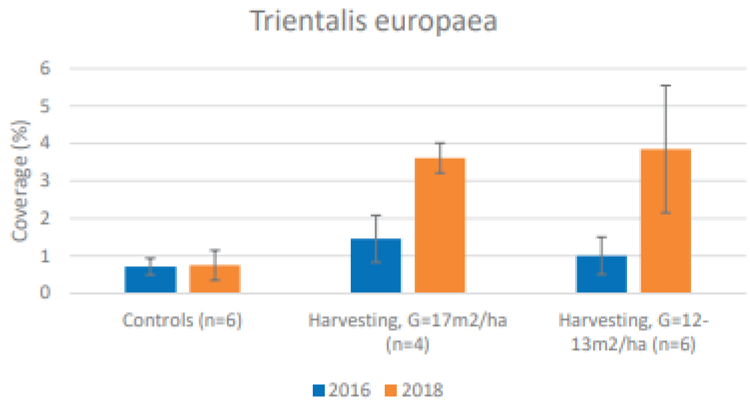
With emission pricing 50€/MgCO_2 and 3% interest rate the highest profitability (NPV) obtained by harvesting interval of 30 yr and post-harvest BA of 16 m2/ha.

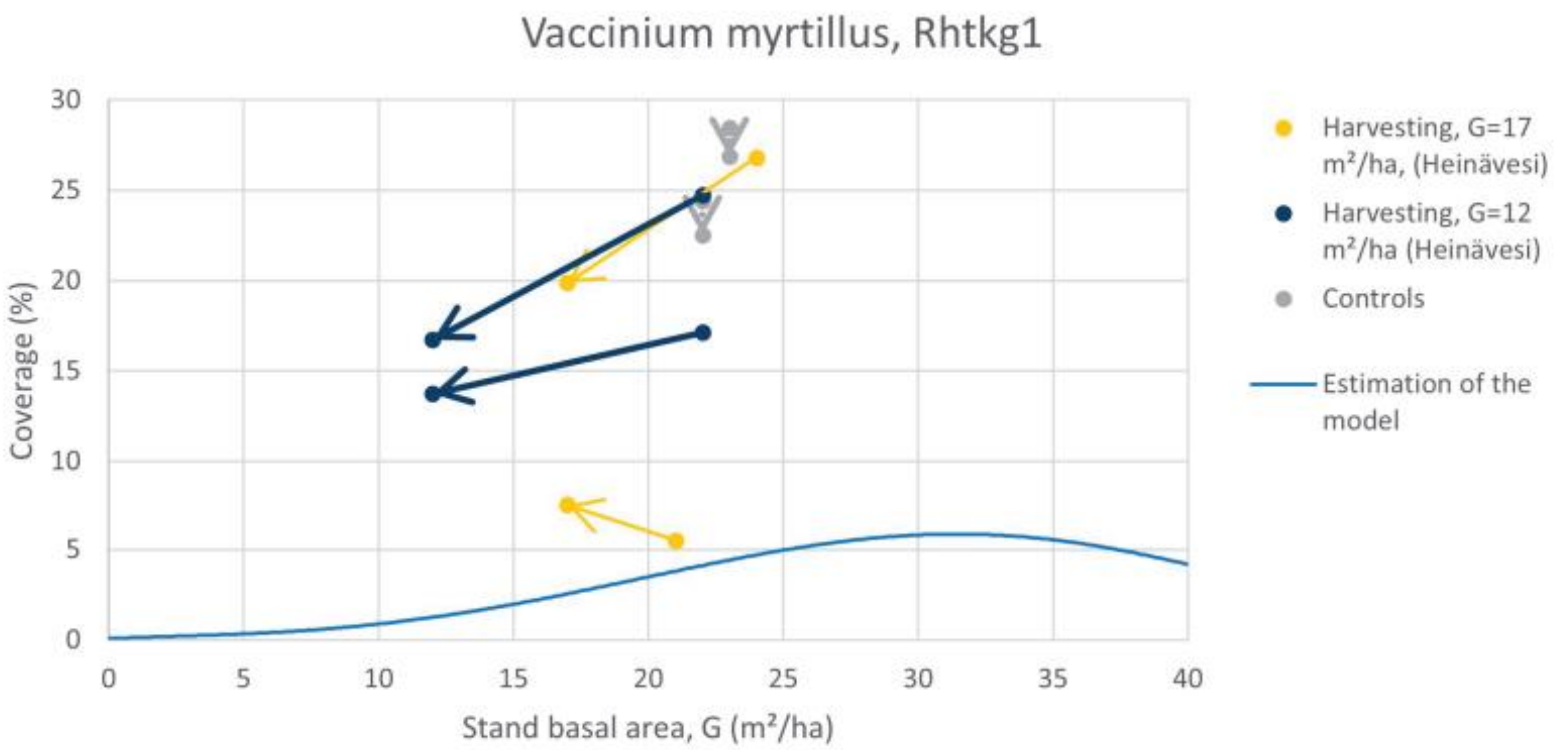
Sources: Juutinen et al. 2021 https://doi.org/10.1139/cjfr-2020-0305, Shanin et al. 2021. https://doi.org/10.1016/j.foreco.2021.119479, Ahtikoski et al. 2022. Frontiers in Env. Sciences, in press.

Management practices affect species diversity. Effects of CCF on spider community studied (Soukainen et al.ms in prep)

Management practices affect abundance of common species. Changes after selection harvesting (CCF)







Source: Haapakoski et al. 2021. http://www.suo.fi/pdf/article10691.pdf

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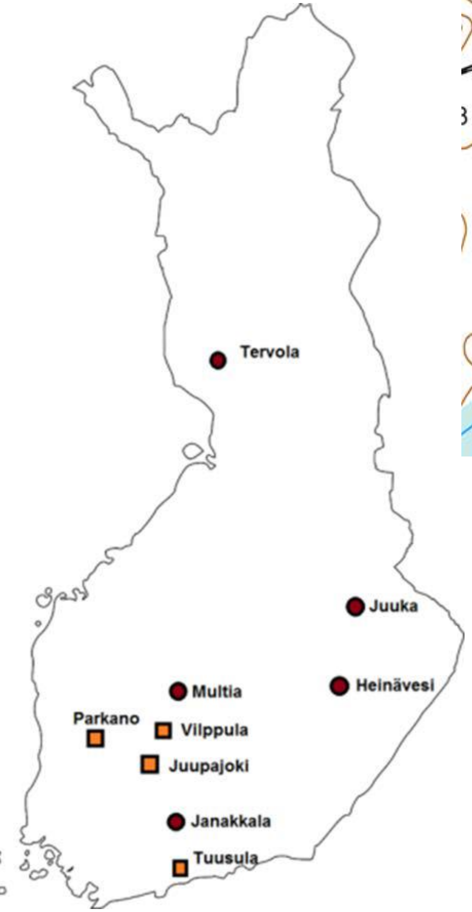
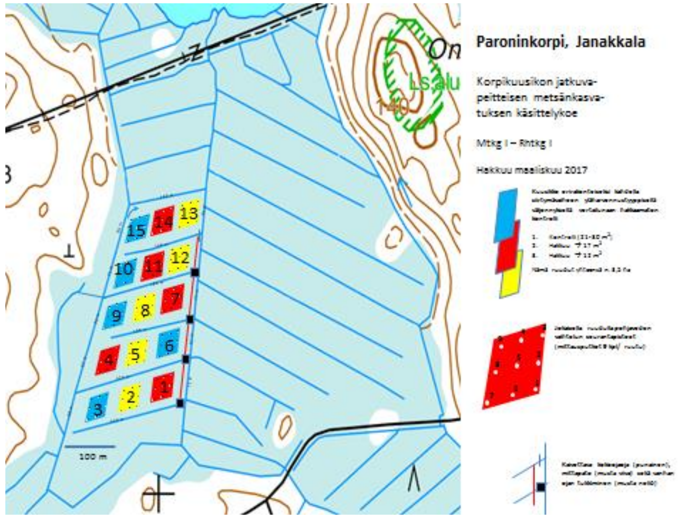
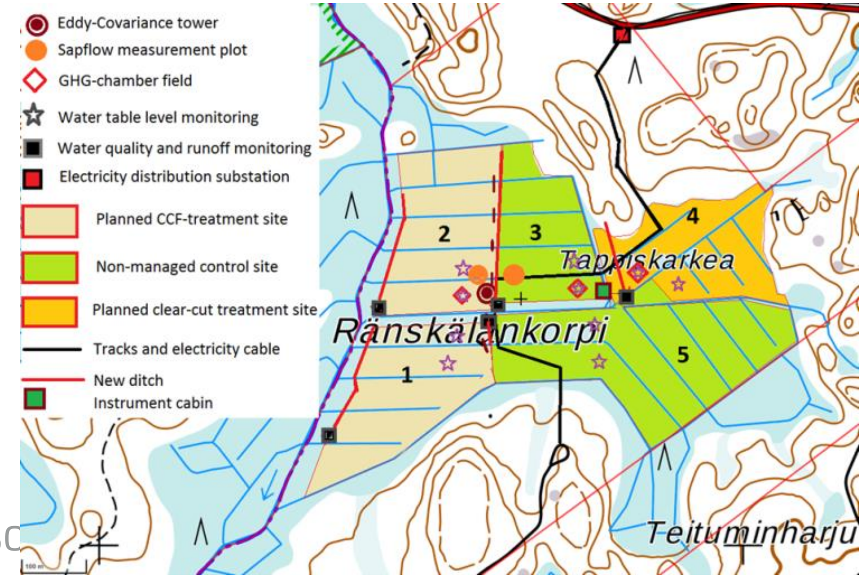
Ongoing experimental studies of CCF on peatland forests – new collaborators warmly welcome

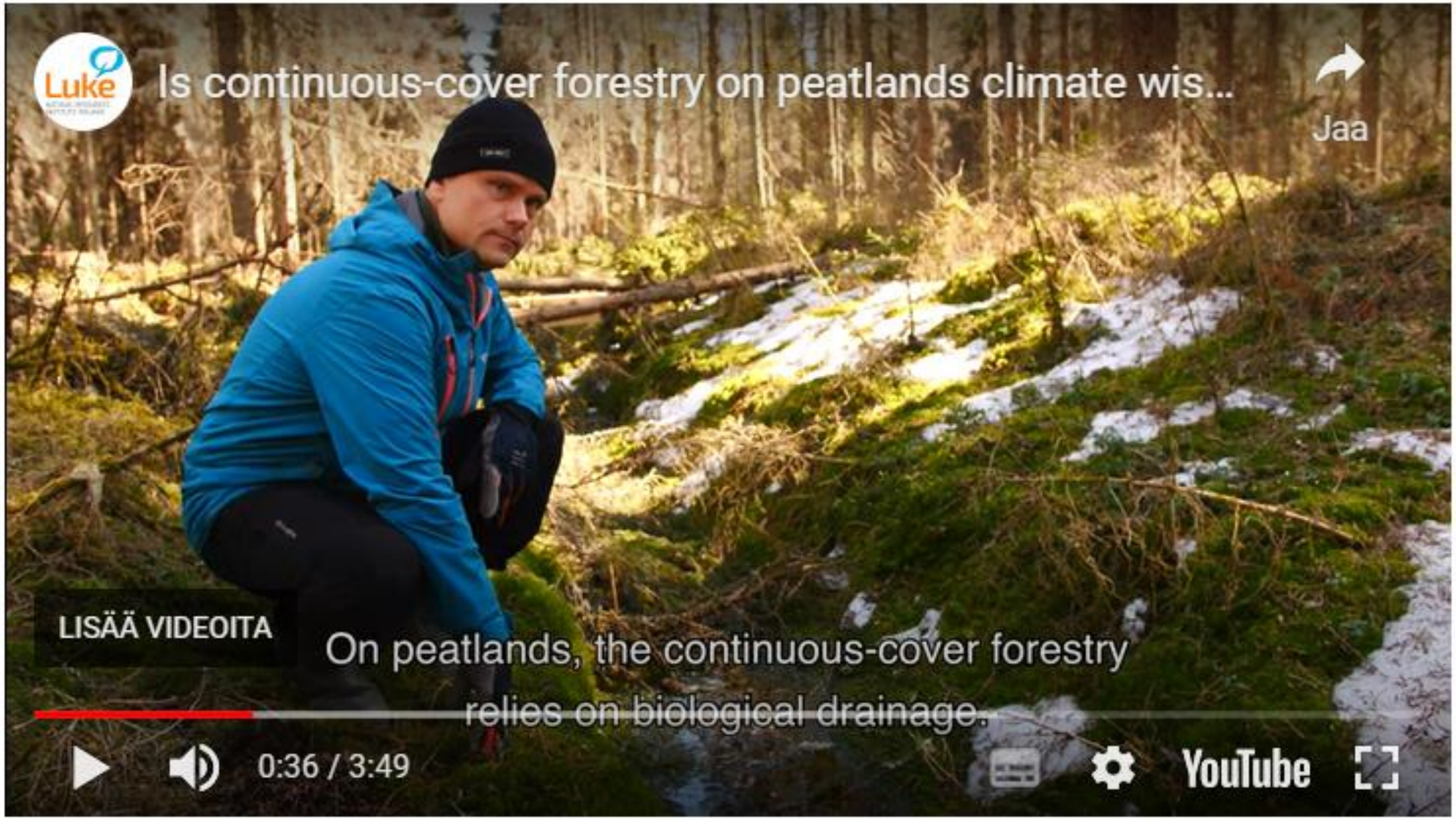






Laurila et al. 2021. Set-up and instrumentation of the greenhouse gas measurements on experimental sites of continuous cover forestry. Natural resources and bioeconomy studies 26/2021. Natural Resources Institute Finland, Helsinki. 51 p. http://urn.fi/URN:ISBN:978-952-380-191-2

We produced videos that guide forest owners



https://projects.luke.fi/sompa/en/2021/12/23/new-videos-on-continuous-cover-forestry/

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Our studies have also be visible in TV

YLE documentary film
SKOGENS RÖST in YLE Svenskan TV on 24.4 reported some of our research findings.
https://areena.yle.fi/1-60929798

YLE documentary film by director Simo Sipola on 'Unknown peatlands' followed our research work for 2 years. Published in
Finnish TV on 17.5.2022, YLE Areena https://areena.yle.fi/1-60960979 and in ARTE on June https://www.youtube.com/watch?v=hDmRKKY-5Tw

Thank you!

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strateginen TUTKIMUS

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FOREST-HUMAN-MACHINE INTERPLAY

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MAANKÄYTTÖSEKTORIN ILMASTORATKAISUT

EEAC
30th
anniversary

PARALLEL SESSION #9
11:30-13:15

FORESTS AND DEFORESTATION - LINKS BETWEEN CLIMATE AND BIODIVERSITY

Prof. Emeritus Markku Kanninen
University of Helsinki

Prof. Raisa Mäkipää
Natural Resources Institute Finland

Dr. Matti Hyyrynen
Natural Resources Institute Finland

Jyri Seppälä
Finnish Climate Change Panel

#EEAC30
#CriticalDecade

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KESTÄ VYYS PANEELI

SUOMEN LUONTO PANEELI

SUOMEN ILMASTOPANEELI
The Finnish Climate Change Panel

European forest sinks and climate targets: past trends, main drivers and future forecasts

Matti Hyyrynen*, Markku Ollikainen**, Jyri Seppälä***

*National Resources Institute Finland (LUKE)

**University of Helsinki (HY)

***Finnish Environment Institute (SYKE)

The Finnish Climate Change Panel

Background

- EU aims to be climate neutral by 2050
- Climate neutrality requires that emissions and sinks (LULUCF sector) cancel each other out
  - LULUCF sector: forests and HWPs, croplands, grasslands, wetlands, build areas
- Efficient LULUCF policy can help to reach the climate neutrality goal in a cost-efficient manner
- With LULUCF policy, EU aims to set an example to the rest of the world
  - Emission trading scheme
- Forest and HWP sink: mitigated at highest 11.3% of the EU's annual GHG emissions
- Net sink of the whole LULUCF sector: mitigated at highest 7.6% of the EU's annual GHG emissions
  - Emissions of the LULUCF sector have been at highest 3.7% of the EU's annual GHG emissions
- We understand rather well the effects of land-cover changes on the C cycle
  - The role of other variables, such as forest management (the macro scale)?
- For the efficient LULUCF policy, it is necessary to understand better
  - the drivers of the sinks
  - the size of the effects of these drivers
  - the associated uncertainty of the effects of these drivers

Research problem and setting

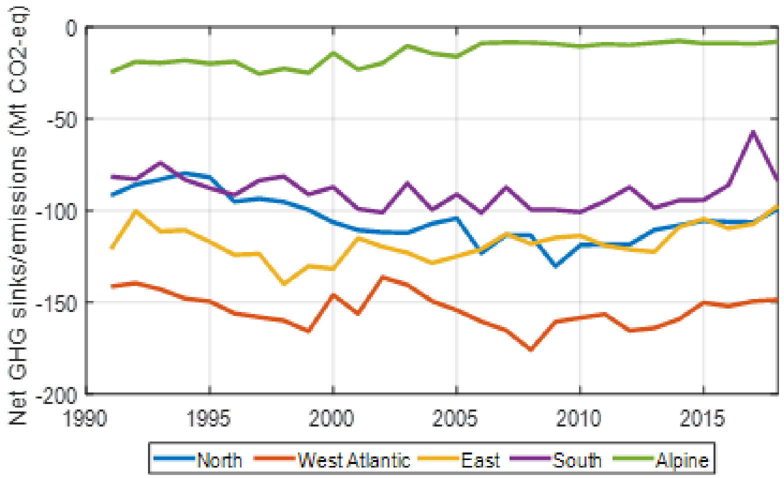
- We separate the policy regimes 2021 – 2025 and 2026 – 2030
  - 2021 – 2025: reference levels for the forest and HWP sinks + sinks of the other land uses
  - 2026 – 2030: EU's common net sink target for the year 2030 (-310 $MtCO_2ekv$), which is divided to member states – linear target trajectory for the net sink
- We study individual member states, regions, and the whole EU
  - Macro level analysis
  - Regions: North, West-Atlantic, East (Baltic countries and other countries), Alpine and South
  - Statistical regression analysis and forecasting (econometric methods)

Contribution and the methods

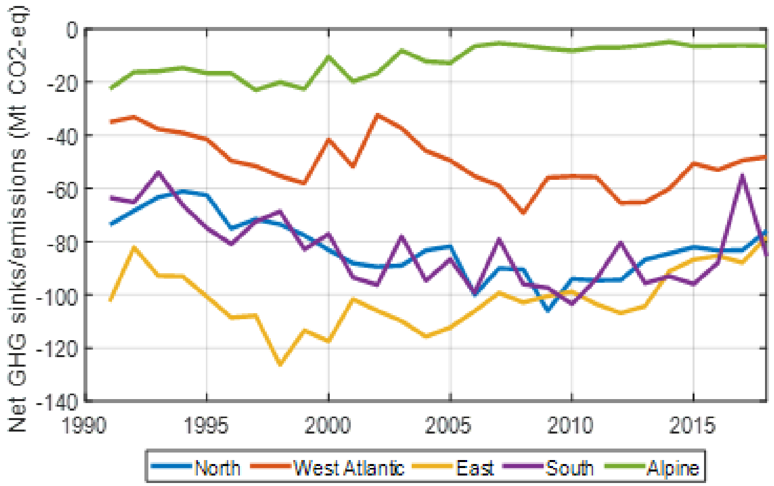
1. We study the historical development of EU forest and LULUCF net sinks in the period 1990-2018
2. We study the driving factors behind the observed annual variation in forest and LULUCF sinks
   - A spatial panel fixed effects lag model with fixed effects for countries and years for the whole EU-level
   - We repeat the analysis for five regions (North, West Atlantic, South, East, Alpine) to study how effect of the harvests changes across the geographical clusters
3. We forecast the development of the forest and HWP sinks and the LULUCF sinks for the period 2021-2030
   - ARIMA models, Regression models, LSTM network models

Results: Past trends

a) Annual forest and HWP sinks/emission



b) Annual LULUCF sinks/emission



Regions: forest and HWP sink
North: great sinks; increased, but decrease after 2008
West-Atlantic: increased, but decrease after 2008; France and Germany
South: quite stable, Spain and Italy
East: decreasing trend, Poland and Romany
Alpine: decreasing trend

EU as a whole: LULUCF net sink follows the variation of forest and HWP sink. Soil emissions more stable, affect the level of the net sink (especially West Atlantic Europe)

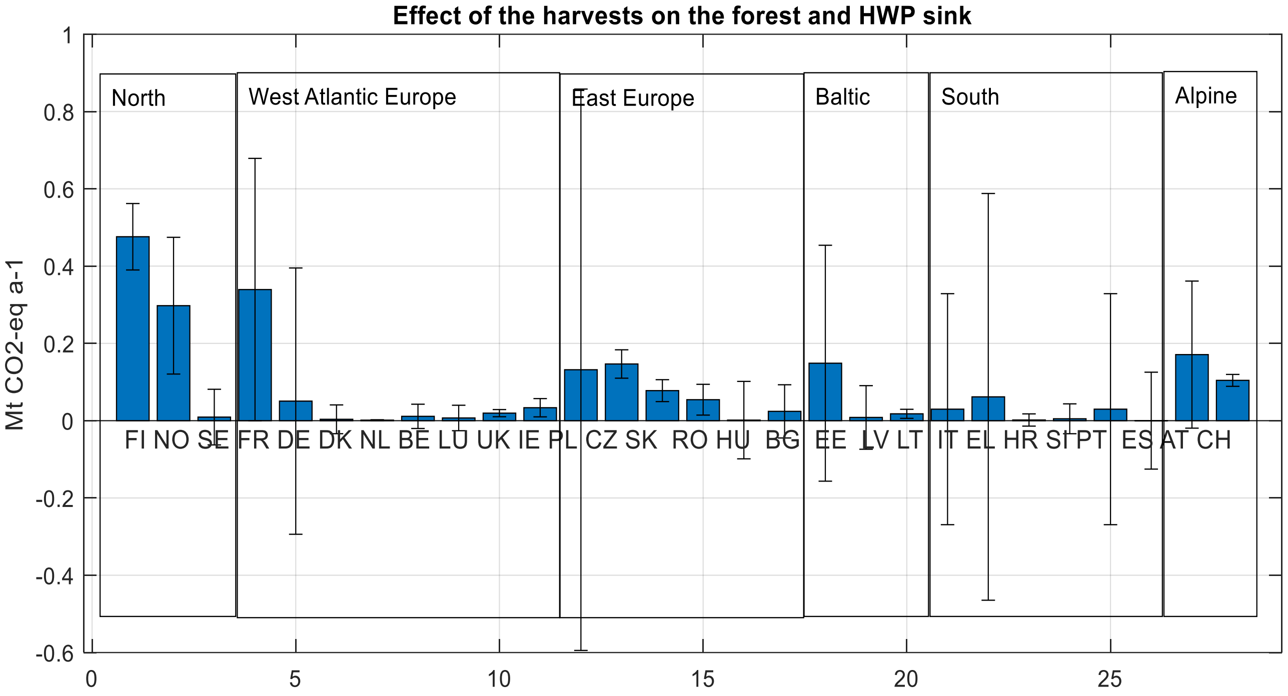
Country comparison (based on historical data)

- Greatest forest sinks (in order):
  - Germany, France, Sweden, Poland, Spain, Finland, Italy, Norway, Romania
- Greatest LULUCF sinks (in order):
  - Sweden, Poland, Spain, France, Italy, Germany, Norway, Finland, Romania
- Greatest forest areas (in order):
  - Sweden (69%), Finland (74%), Spain (37%), France (32%), Norway (33%), Germany (33%), Italy (32%), Poland (31%), Romania (30%)
- LULUCF emission/sinks relative to total GHG emissions (in order):
  - Sweden, Norway, Latvia, Finland, Croatia, Slovenia, Lithuania, Bulgaria, Slovakia, Romania

Driving factors of the forest and LULUCF sinks

- Main drivers: whole EU level
  - Annual harvest – sink decreases
  - Forest fires – sink decreases
  - Planting of the trees – sink increases
  - Age of the forest – sink increases (at first)
  - Exports of the HWPs– sink decreases
    - Imports not significant – carbon leakage problem
  - Agricultural (plant) production – sink decreases (more significant for the LULUCF net sink)
  - Consumption of biofuel – sink decreases
  - Temperature – sink decreases (significant only for the LULUCF net sink)

Effect of the harvests: member states and the harvests



FI=Finland, NO=Norway, SE=Sweden, FR=France, DE=Germany, DK=Denmark, NL=Netherlands, BE=Belgium, LU=Luxembourg, UK=United Kingdom, IE=Ireland, PL=Poland, CZ=Czech Republic, SK=Slovakia, RO=Romania, HU=Hungary, BG=Bulgaria, EE=Estonia, LV=Latvia, LT=Lithuania, IT=Italy, EL=Greece, HR=Croatia, SI=Slovenia, PT=Portugal, ES=Spain, AT=Austria, and CH=Switzerland

The sensitivity of the sinks to harvests varies across the member states

- Finland, Norway, France
- Why greatest in these countries?
  - Forest age structure?
  - Management intensity?
  - The way the forests are treated?

Great uncertainties:
Poland, Greece, Denmark, Estonia, France, Portugal

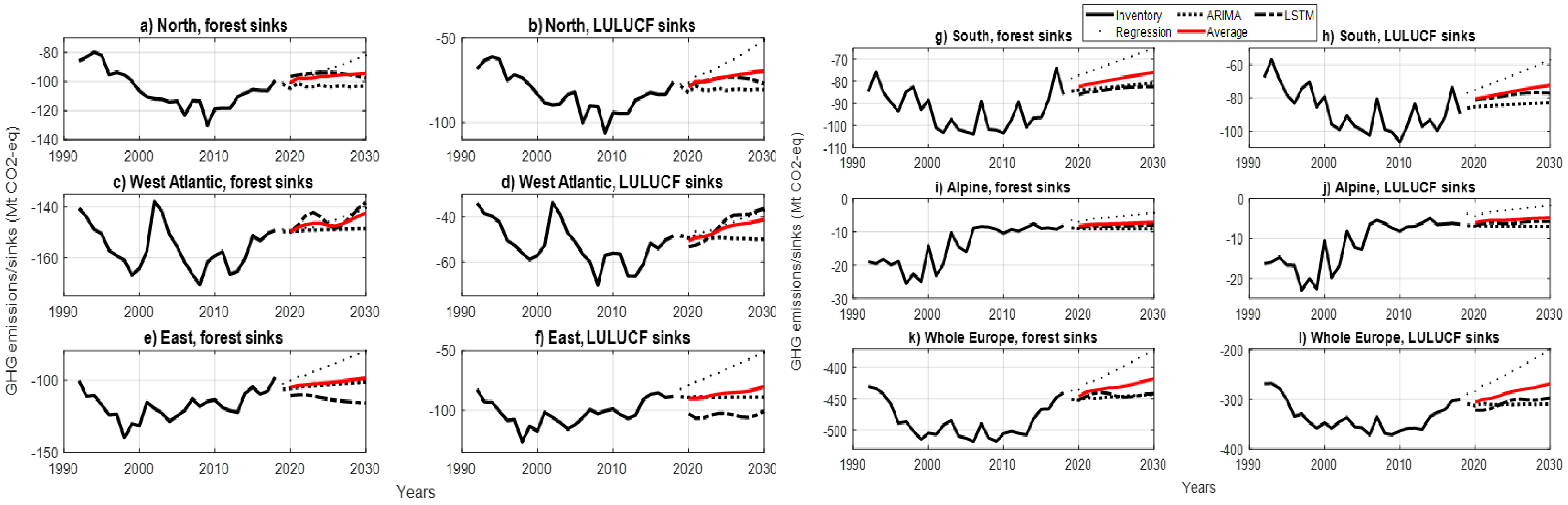
The regional effect of the harvests on the forest sinks

- In Northern Europe
  - the effect of the harvest on the sinks is more than 6.5 times greater than in Europe on average
- In West Atlantic Europe
  - the effect is about the same as the European average
- In Southern Europe
  - the effect of the harvest on the sinks is 74% smaller than the European average (statistically insignificant)
- In Alpine
  - the effect of the harvests on the sinks is 4.2 times greater than the average effect in EU

The regional effect of the harvests on the forest sinks

- In Eastern Europe, the effect of the harvests on the forest sinks in insignificant
  - The effect of the harvests is significant after the 2008 finance crisis
- We also divide this region further to two separate blocks
  1. Estonia, Latvia, and Lithuania
  2. Romania, Bulgaria, Czech, Slovakia, Hungary, and Poland
- In the first block, the result regarding the harvests remains the same: the effect is statistically significant only after 2008 finance crisis
- In the other block, the effect of the harvests on the sinks is 3.4 times greater than the average effect in EU

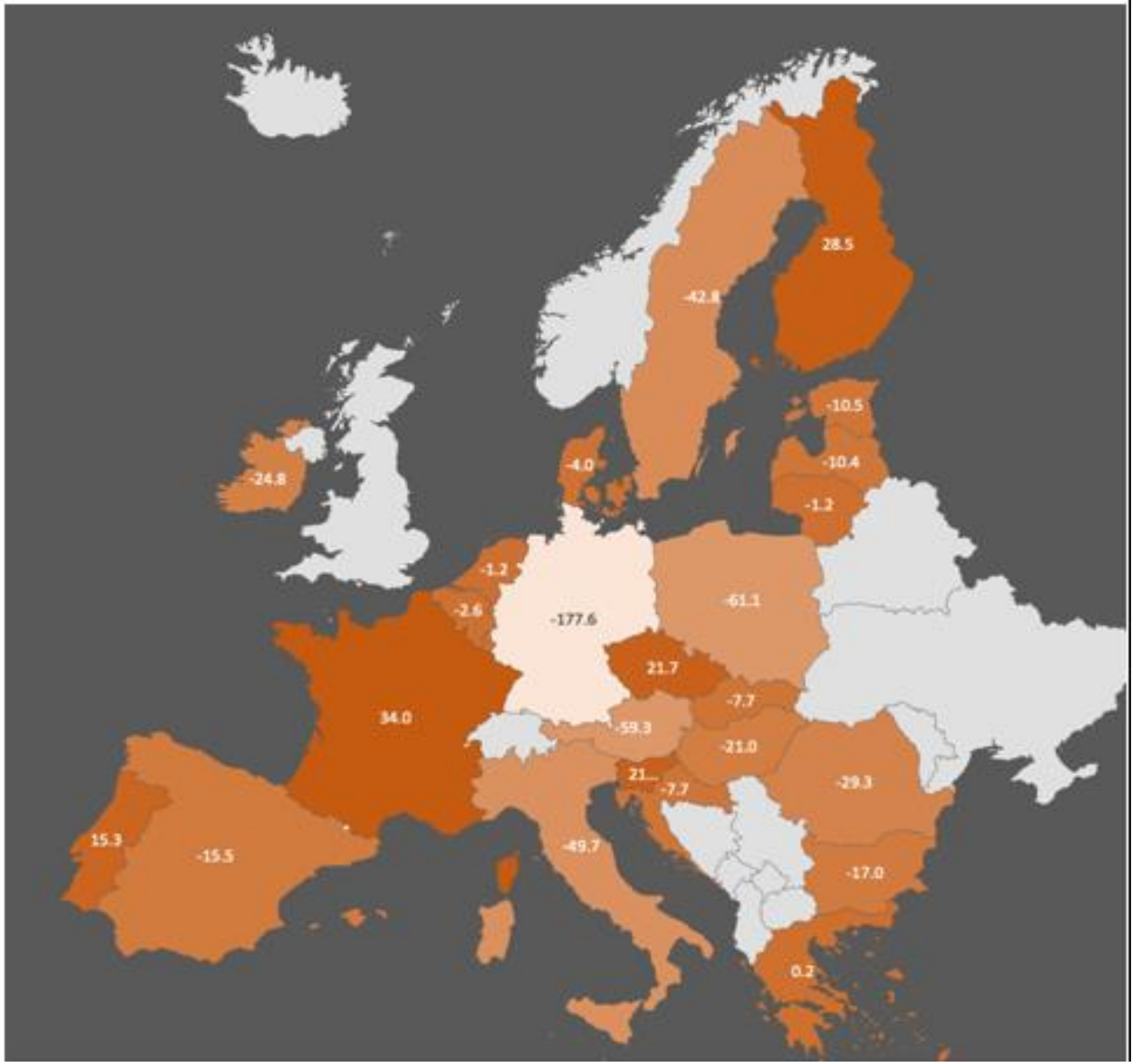
Forecasts: EU-level development until 2030



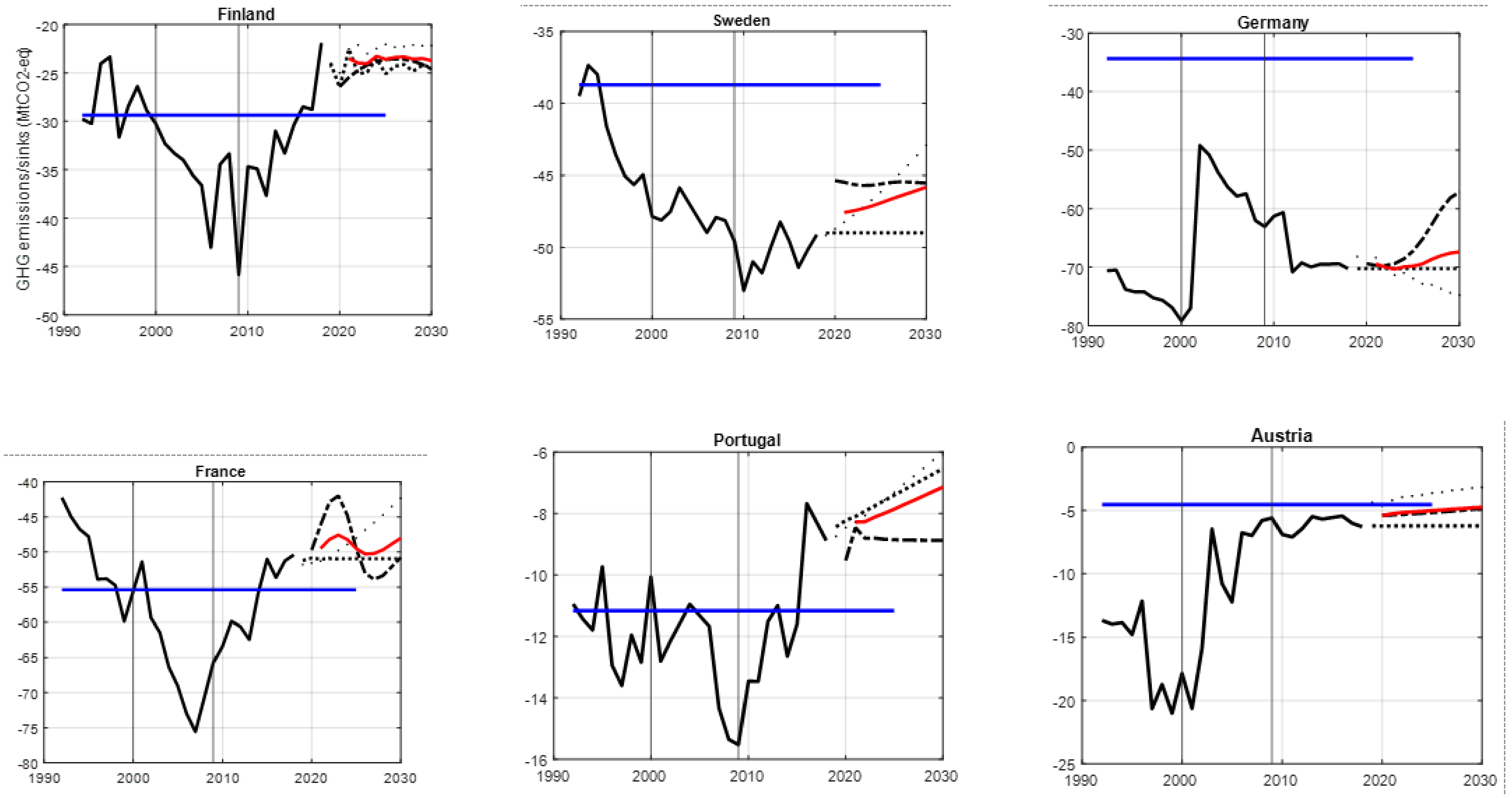
Decreasing trend in all the regions: West Atlantic Europe, strongly decreasing trend

South & Alpine: relatively stable sinks

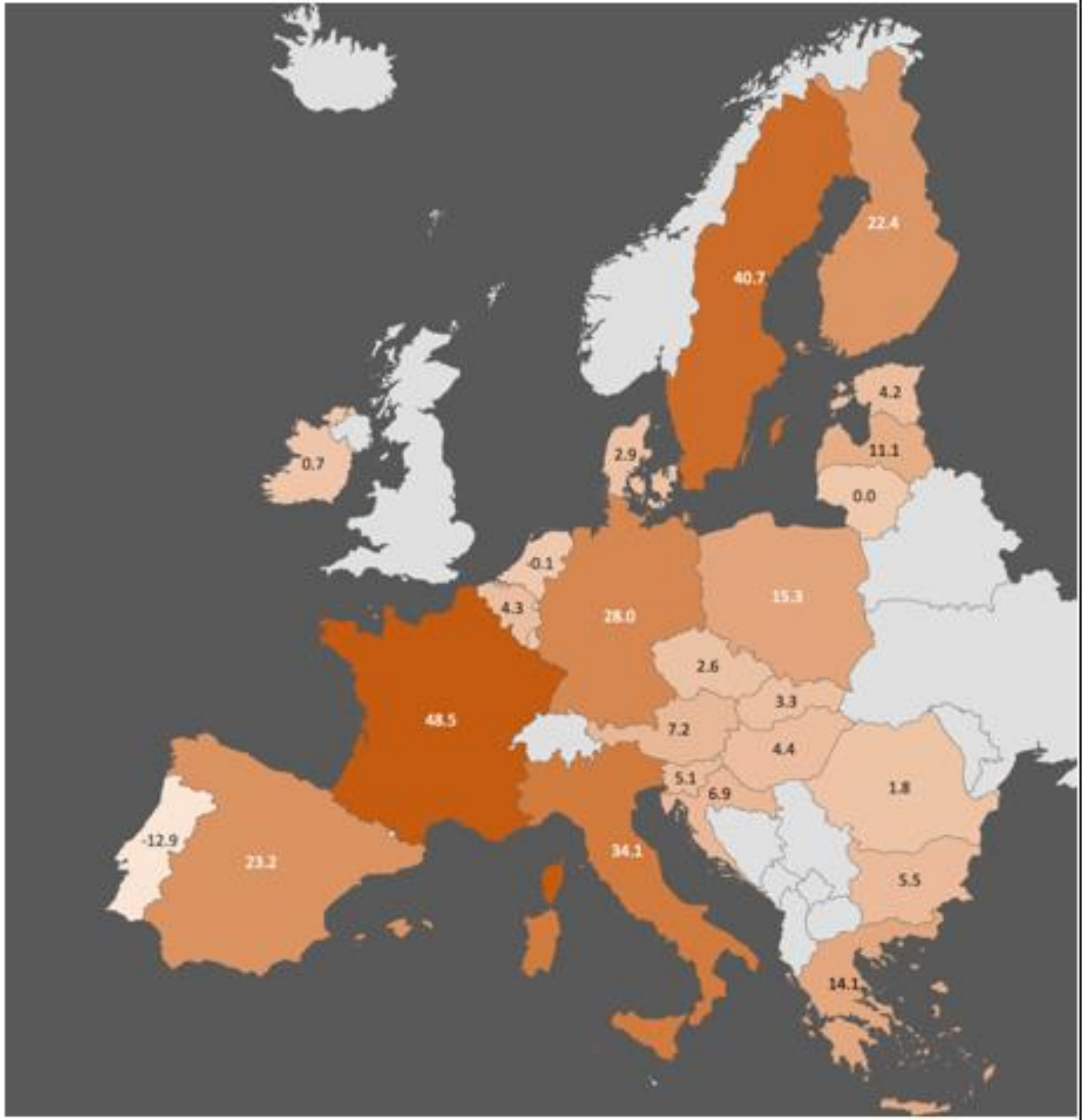
Forest and HWP sinks 2021-2025



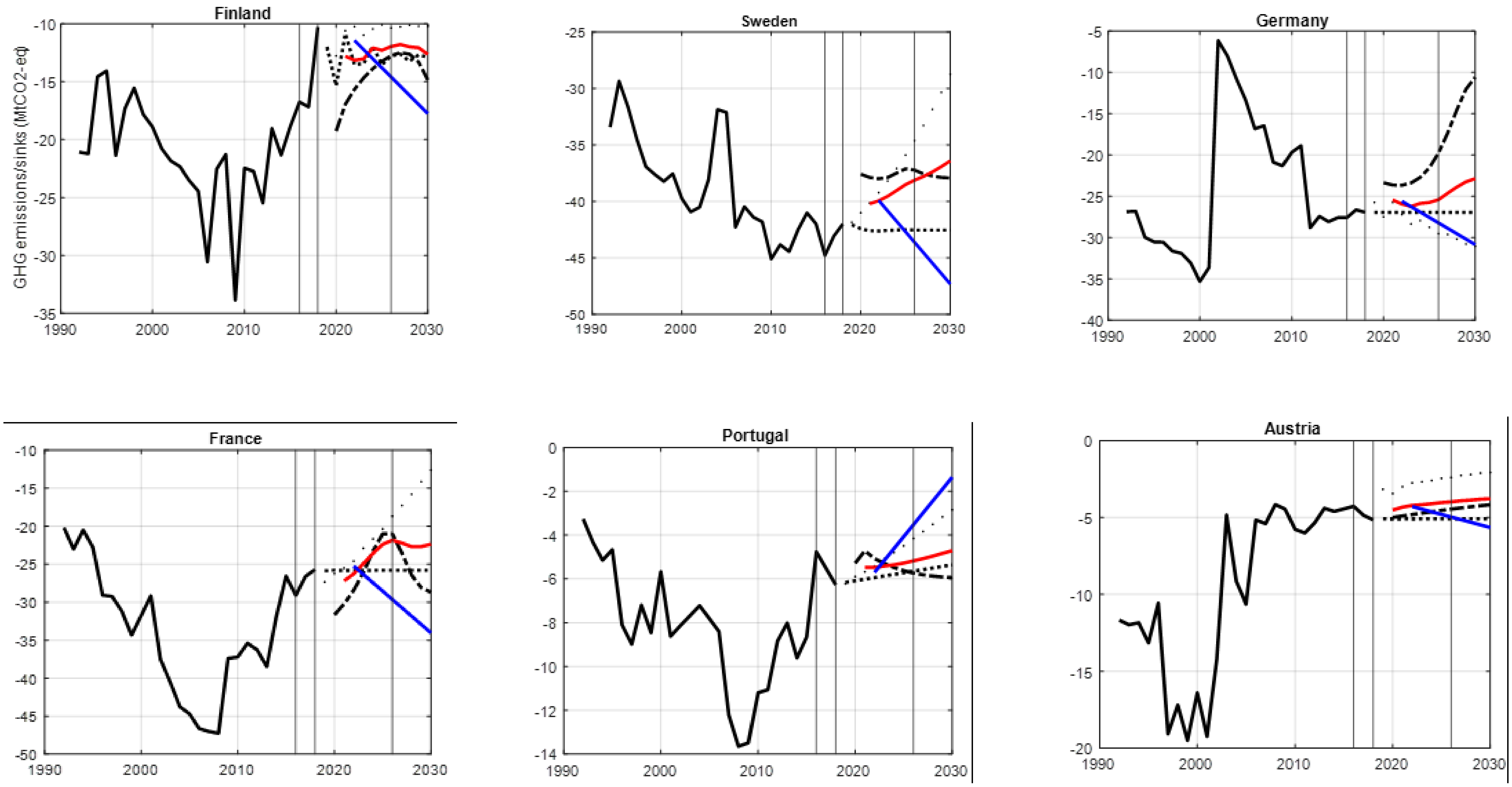
- Forecasted forest sinks exceed FRLs in most countries
- Surplus for the period 2021-2025 is about 422 $MtCO_2eq$
- FRLs are set quite low compared to historical sinks, which is the primary reason for the result
    - Particularly Germany, Poland, Austria, Italy, Sweden, and Romania
- If we compare the forecasts of LULUCF net sinks with the reference levels, the sector's carbon debt would be 113 MtCO2eq (flexibilities considered)
- However, this could be covered by growing forest sinks in countries where they fall below the FRLs, and the no-debit rule would be achieved


Finland
Sweden
Germany
France
Portugal
Austria
GHG emissions/sinks (MtCO2-eq)
1990
2000
2010
2020
2030

LULUCF sinks/emissions 2026-2030



- The EU's predicted LULUCF net sink is -239 MtCO2eq in 2030 – the carbon debt would thus be 71 MtCO2eq
- When comparing the annual forecasts to the linear target projections for the period 2026-2030, in almost all countries the forecasts fall below the target track
  - Especially France, Sweden, Italy, Germany, Spain, Finland, Poland, and Latvia
- The 2030 goals are high for Sweden, Spain, Poland, France, Italy, and Germany, because in these countries the net sink was high in 2016-2018
- The high LULUCF targets for 2030 are the main reason for the result
  - In Finland, the net sink was low in 2016-2018 due to high logging levels
- According to forecasts and calculations, the EU's total carbon debt for the period 2026-2030 is approximately 274 MtCO2eq


Finland
GHG emissions/sinks (MtCO2-eq)
-10
-15
-20
-25
-30
-35
1990
2000
2010
2020
2030
Sweden
-25
-30
-35
-40
-45
-50
1990
2000
2010
2020
2030
Germany
-5
-10
-15
-20
-25
-30
-35
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1990
2000
2010
2020
2030
France
-10
-15
-20
-25
-30
-35
-40
-45
-50
1990
2000
2010
2020
2030
Portugal
0
-2
-4
-6
-8
-10
-12
-14
1990
2000
2010
2020
2030
Austria
0
-5
-10
-15
-20
1990
2000
2010
2020
2030

Conclusions

- At the EU-level, and in each region, LULUCF sink is decreasing
- Period 2021-2025
  - In most countries it is easy to achieve forest sink targets (due to low reference levels
  - Targets are most difficult to reach for France, Finland, Czech, Slovenia, Portugal, Greece, and Luxembourg
- Period 2026-2030
  - Regulation is still a little bit open
  - Challenging for all the countries (except for Portugal and the Netherlands)
  - Targets are most difficult to reach for France, Sweden, Italy, Germany, Spain, Finland, Poland, Latvia
  - The ambition and efficiency of the LULUCF policy needs to be developed
- LULUCF policy
  - If countries start to actively increase forest sinks and reduce emissions from other forms of land use, it is possible that the climate goals of the EU's LULUCF sector will be achieved
  - Economic incentives and effective policies, both at the EU and national level, will be necessary for decreasing emissions and increasing the sinks from land use sector

EEAC 30th anniversary

LUNCH 13:15-14:30

Paasin kellari, floor 0

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