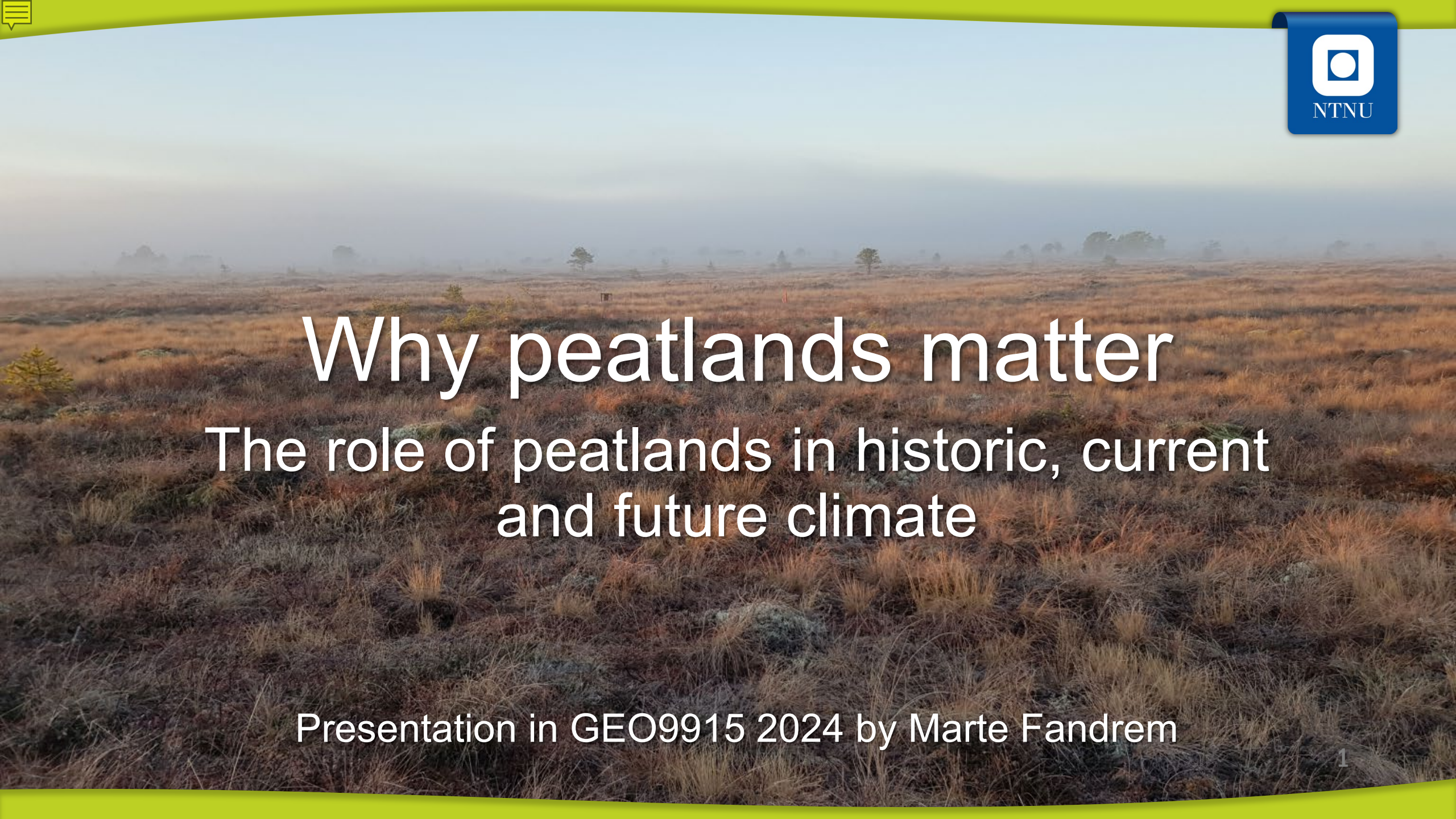


Why peatlands matter

The role of peatlands in historic, current and future climate

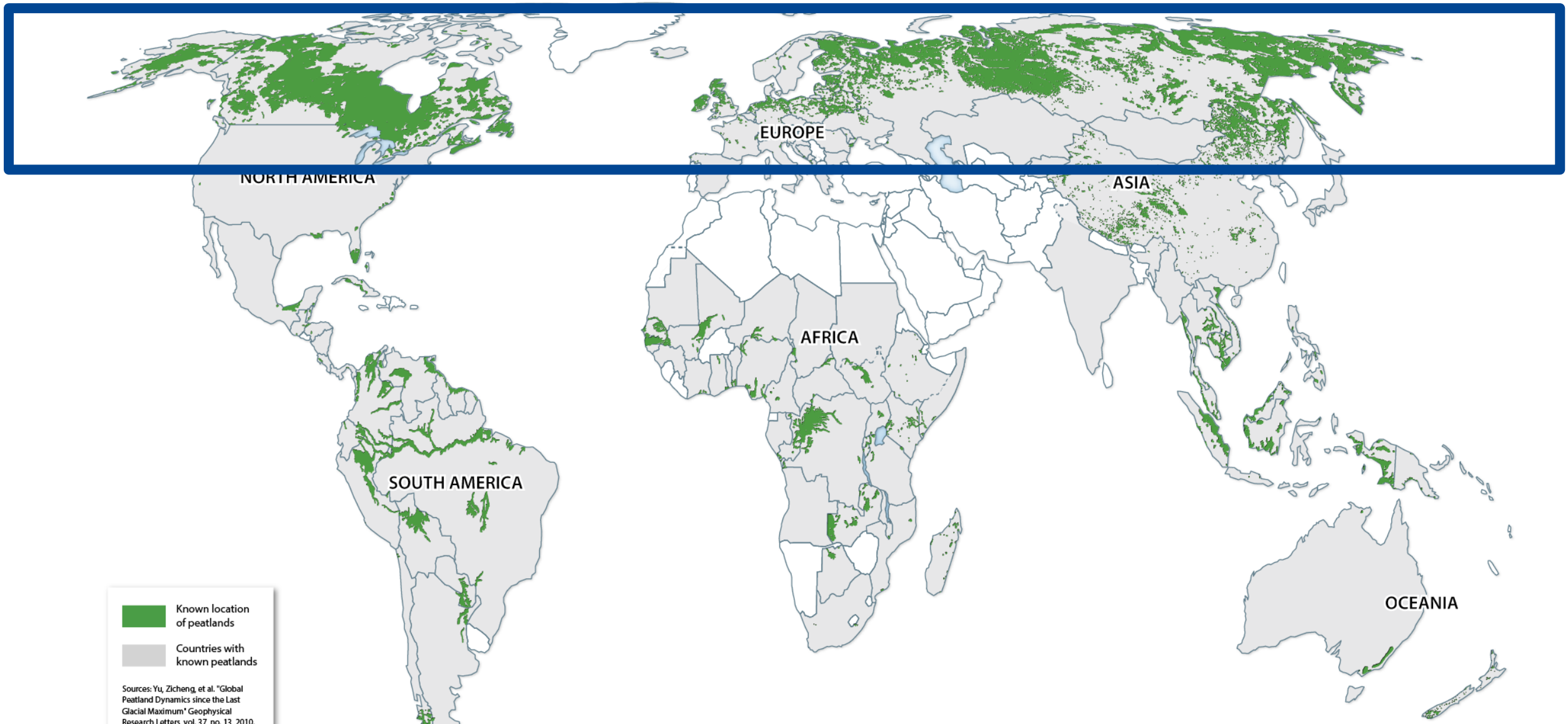
Presentation in GEO9915 2024 by Marte Fandrem


Peatlands store twice as much carbon as all the world's forests
Peatlands are second only to oceans in the amount of carbon they store

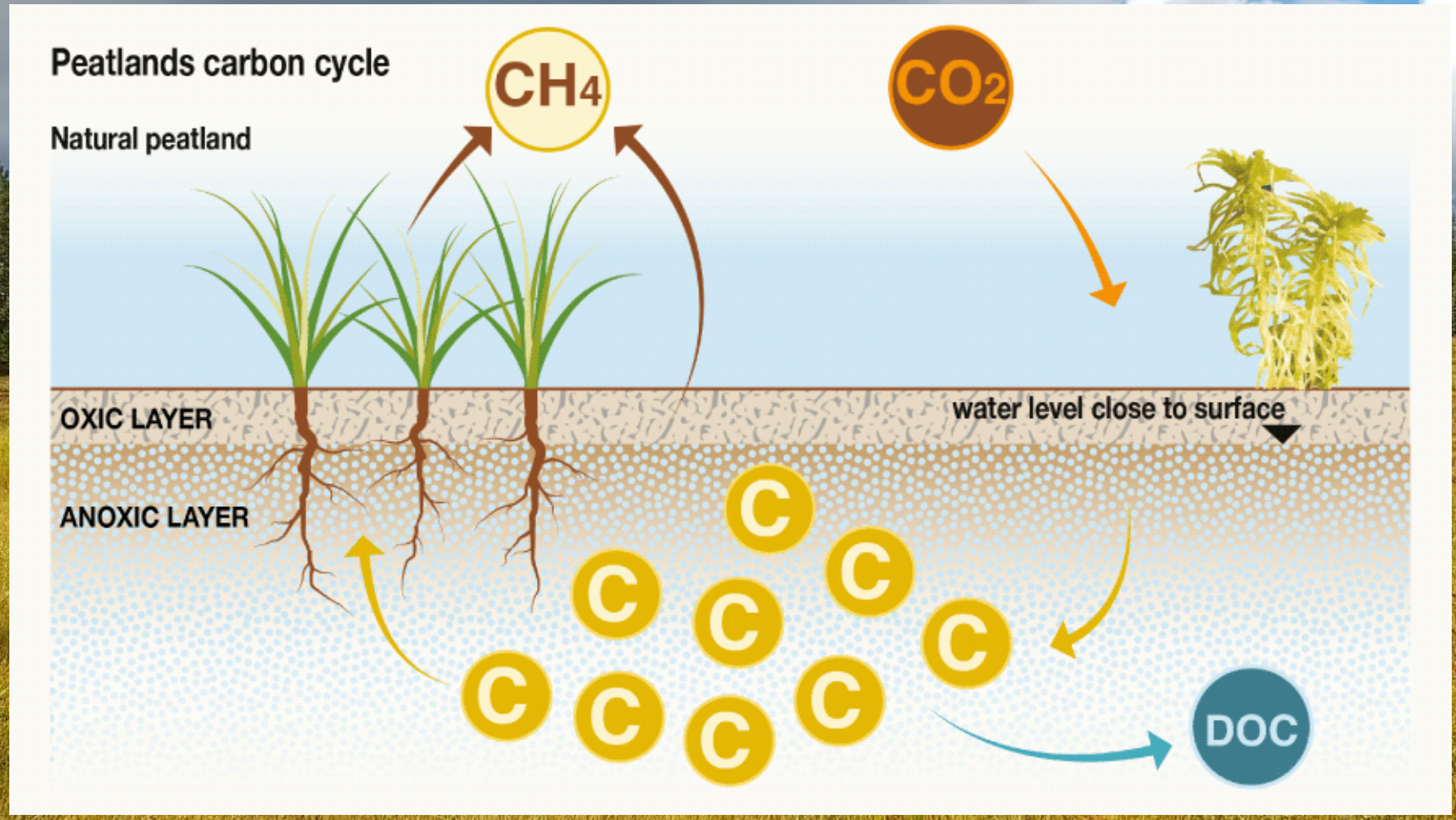
Maludam NP, Sarawak, Borneo


Peatland
Mire
Bog

Global distribution of peatlands

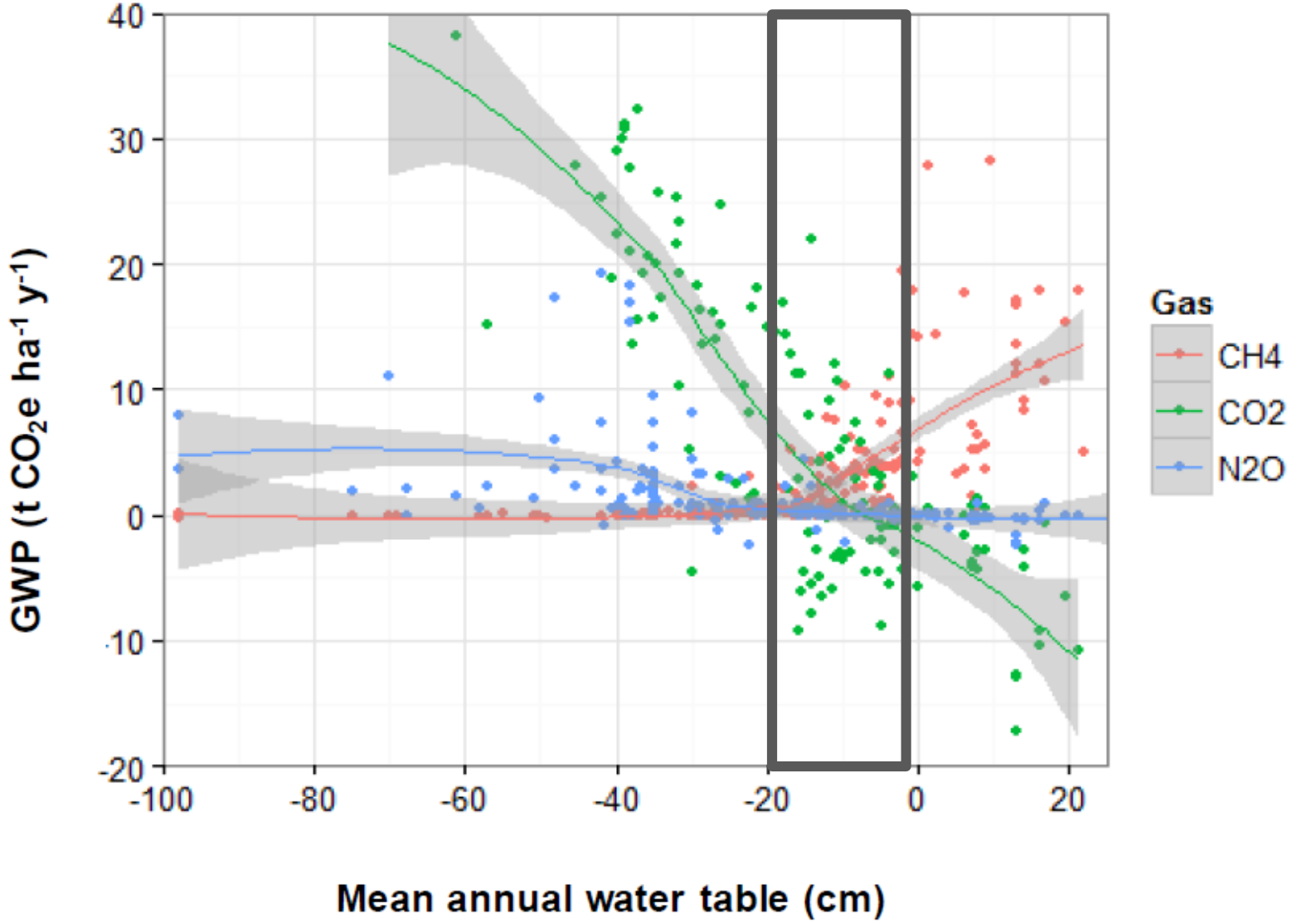



500
Gt
3%
30%
2x rainforest
biomass



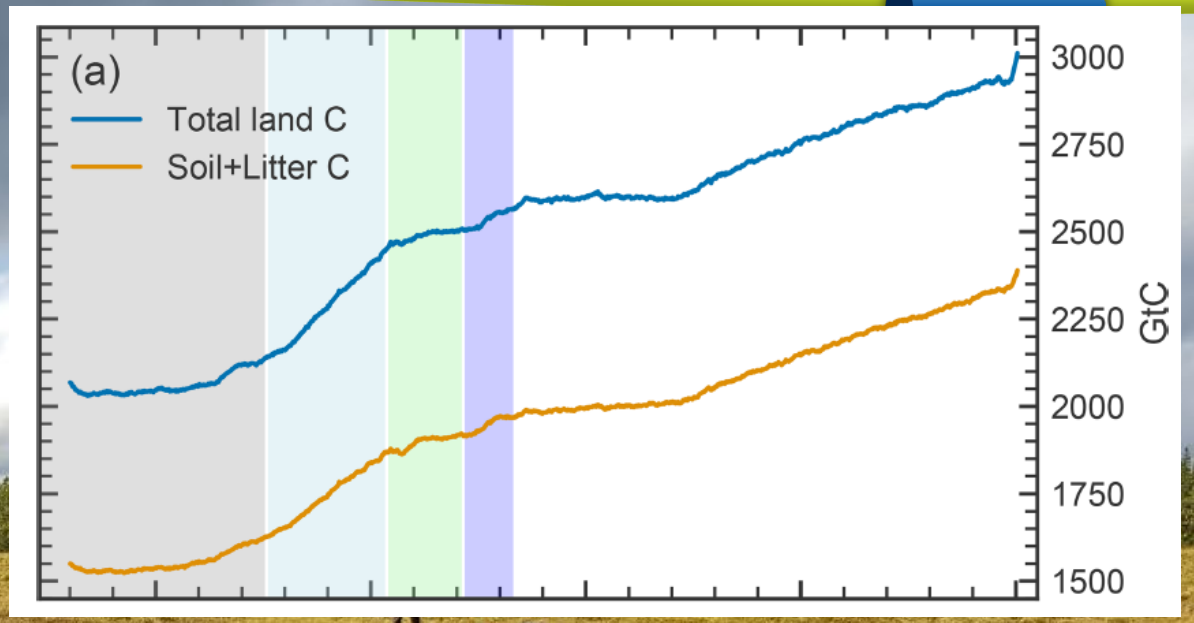
Source: Lopez Izquierdo, 2017. Smoke on Water

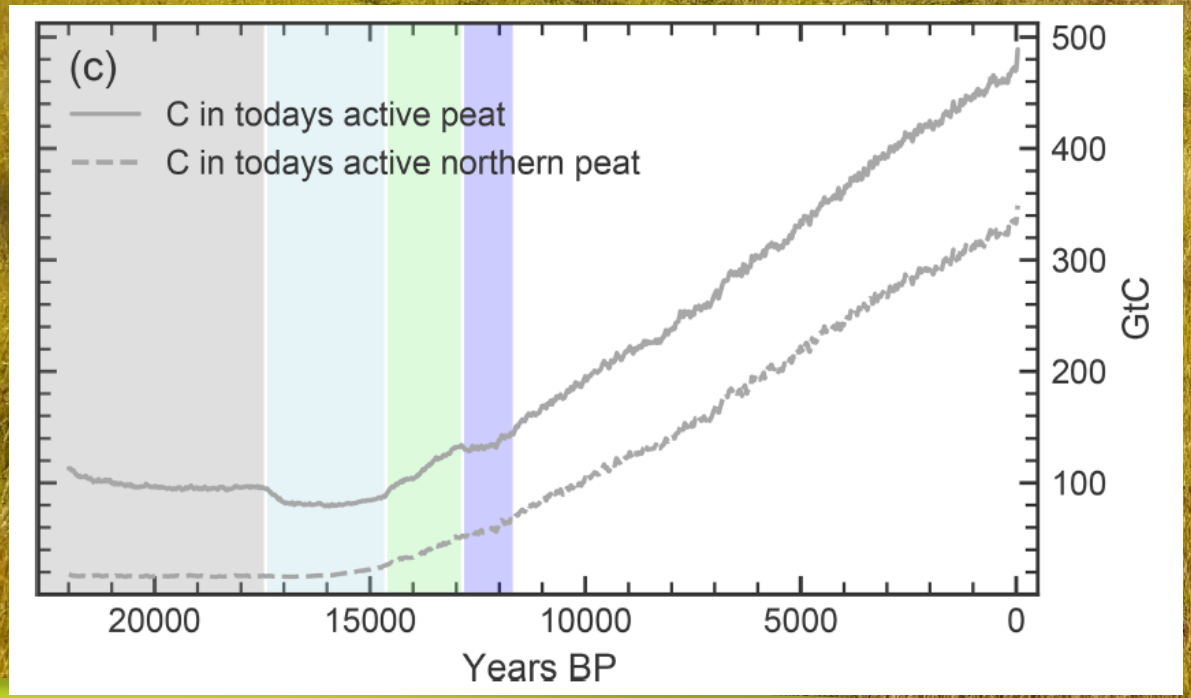

Peatland’s impact on climate

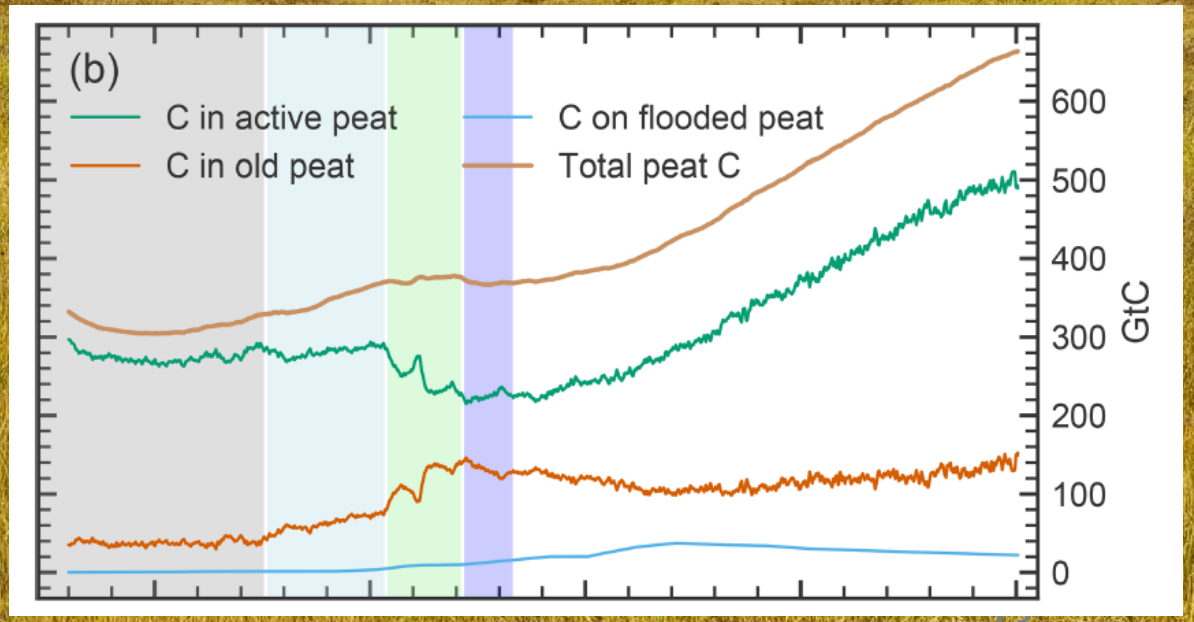


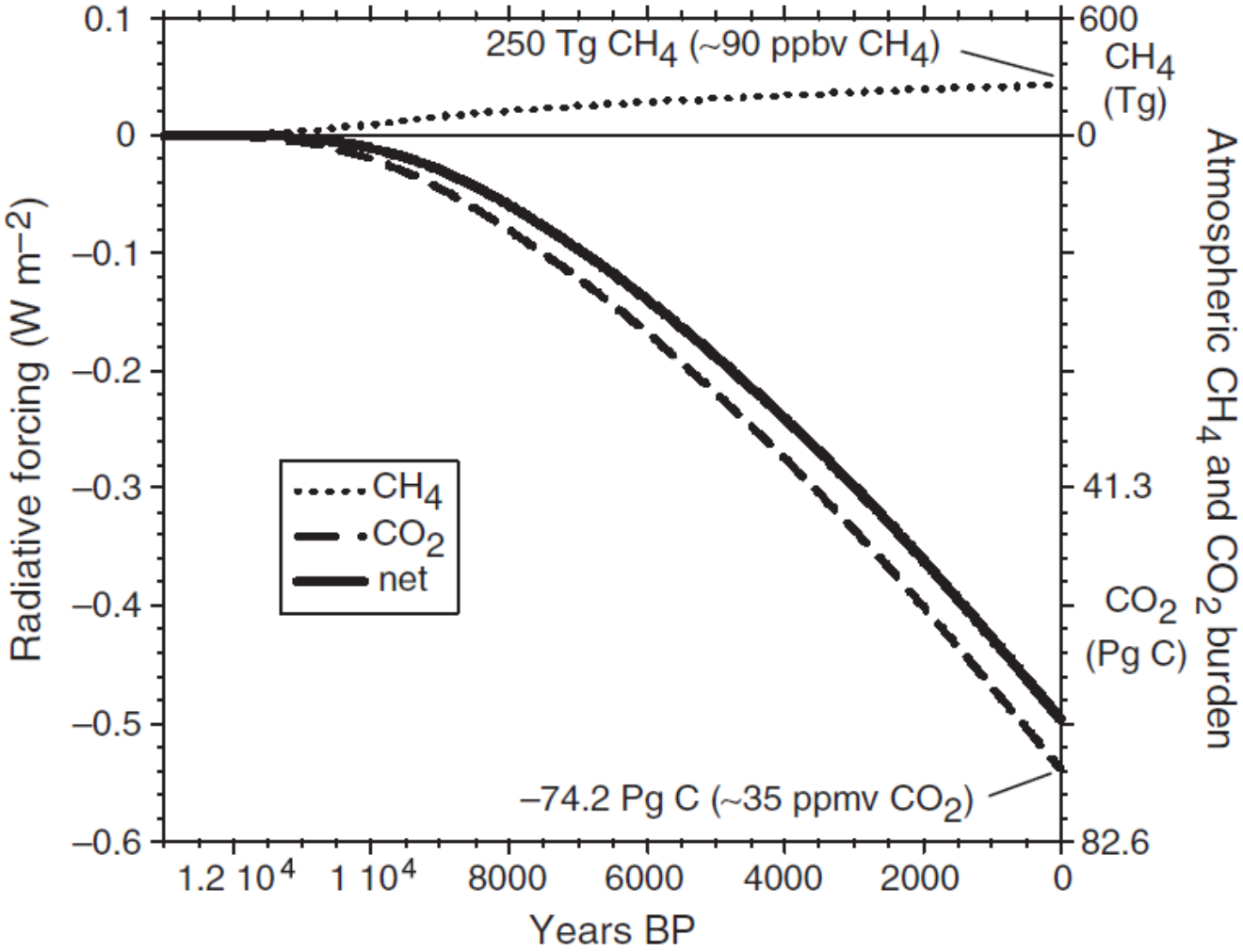
Jurasinski et al. 2015

Müller & Joos 2020. Biogeosciences





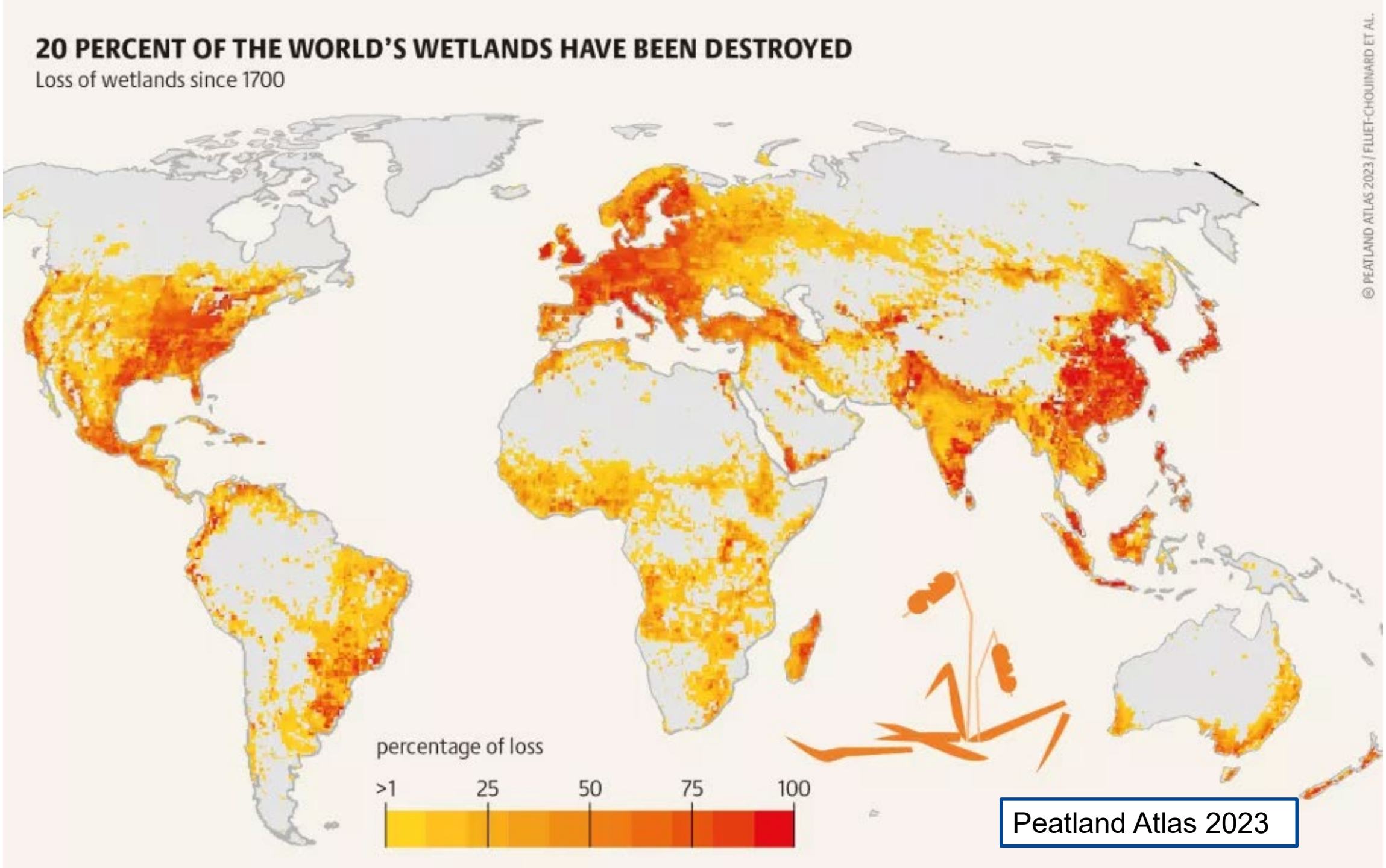




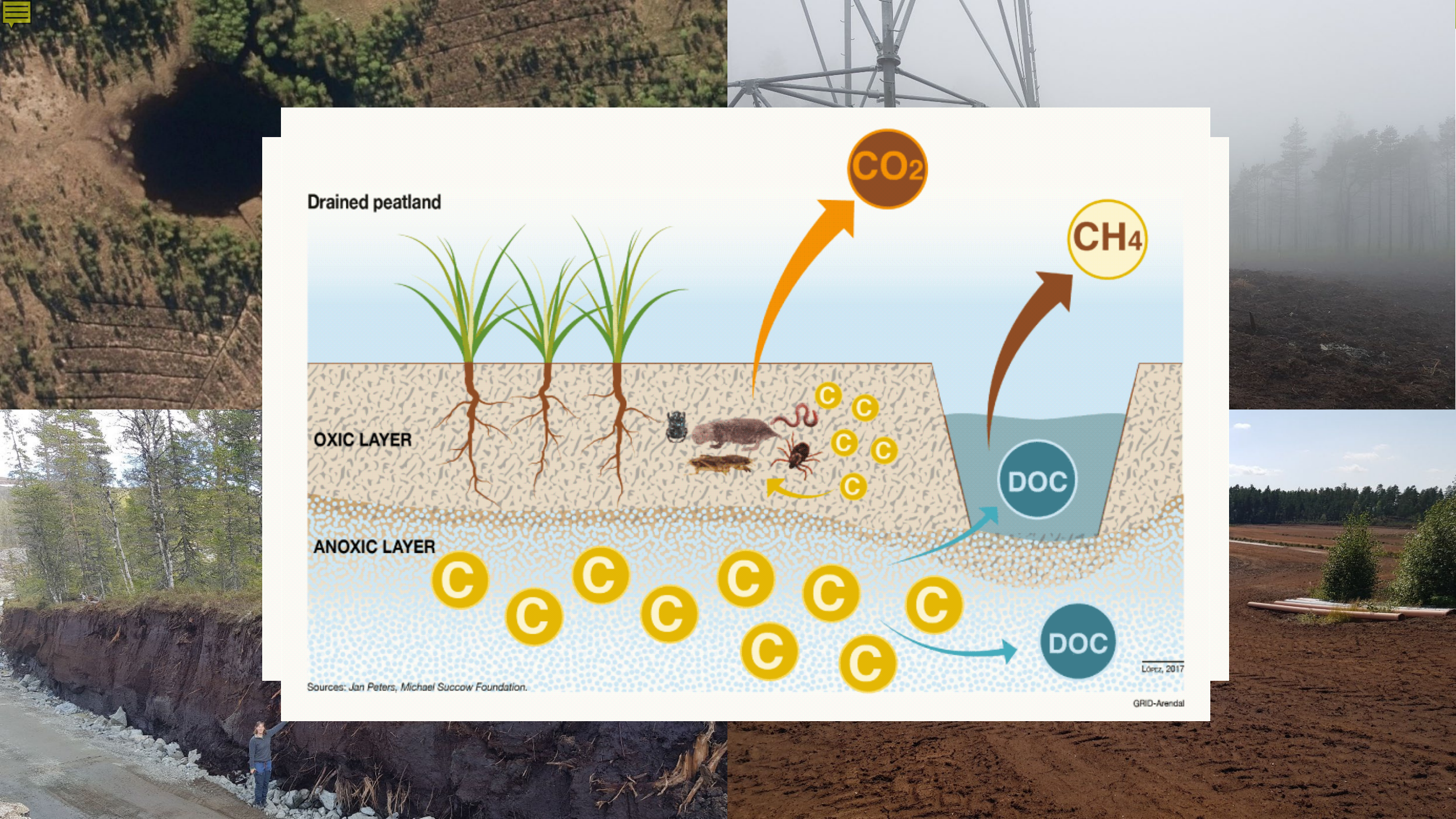
Frolking & Roulet. 2007. Global Change Ecology

Peatland's changing impact on climate

Frolking et al. 2011. Environmental Reviews



Peatland Atlas 2023


Drained peatland
CO_2
CH_4
OXIC LAYER
ANOXIC LAYER
C
DOC
DOC
López, 2017
Sources: Jan Peters, Michael Succow Foundation.
GRID-Arendal

Consequences of degrading peatlands

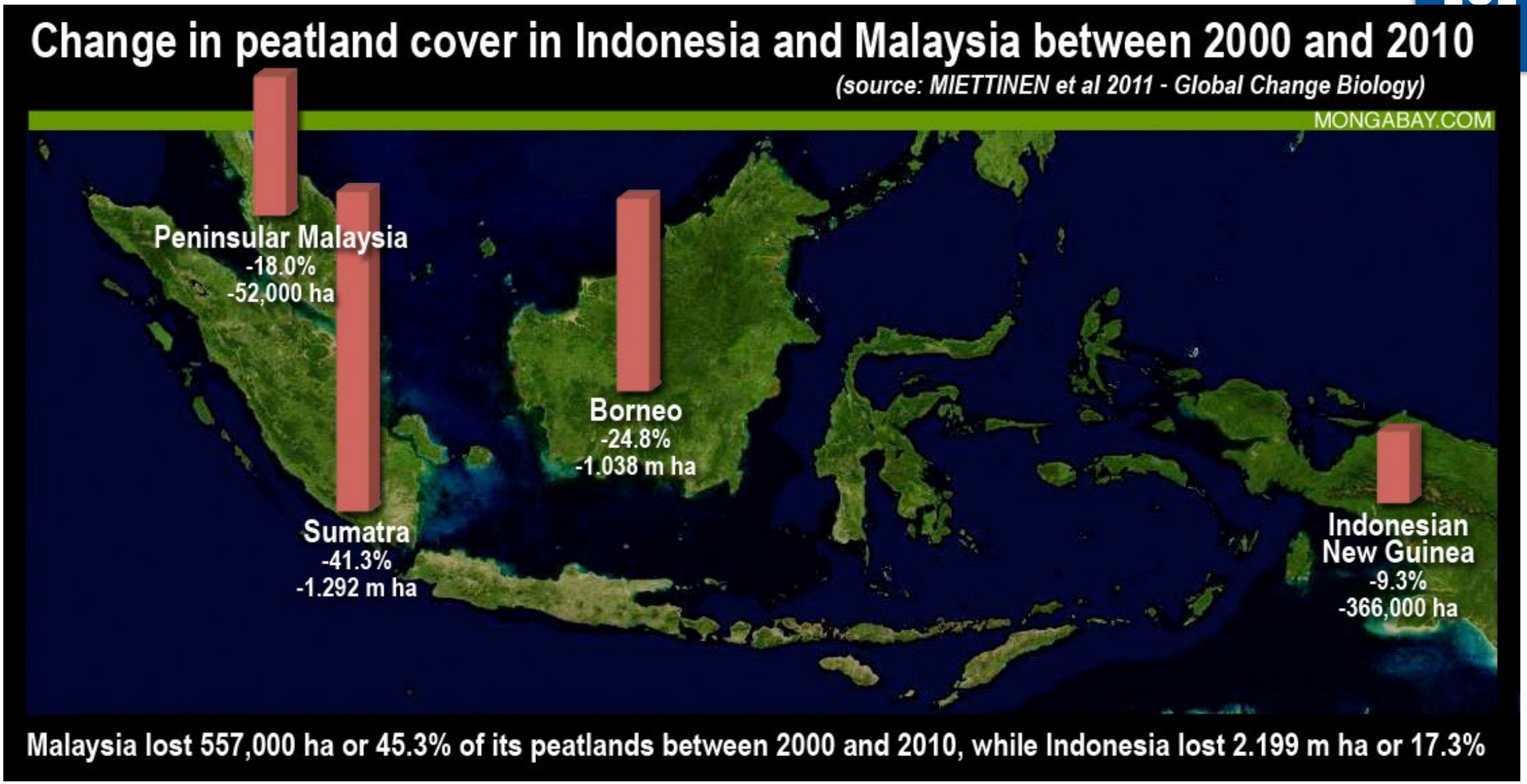
- ~15% of world's peatlands drained
- Emissions of approx. 2 Gt CO_2 annually
  - ~6% of anthropogenic emissions
  - All global air traffic ~2%
- 27 countries, incl. 12 European is responsible for 95% of all global emissions from peatlands
- In Norway: 10-15% of national emissions

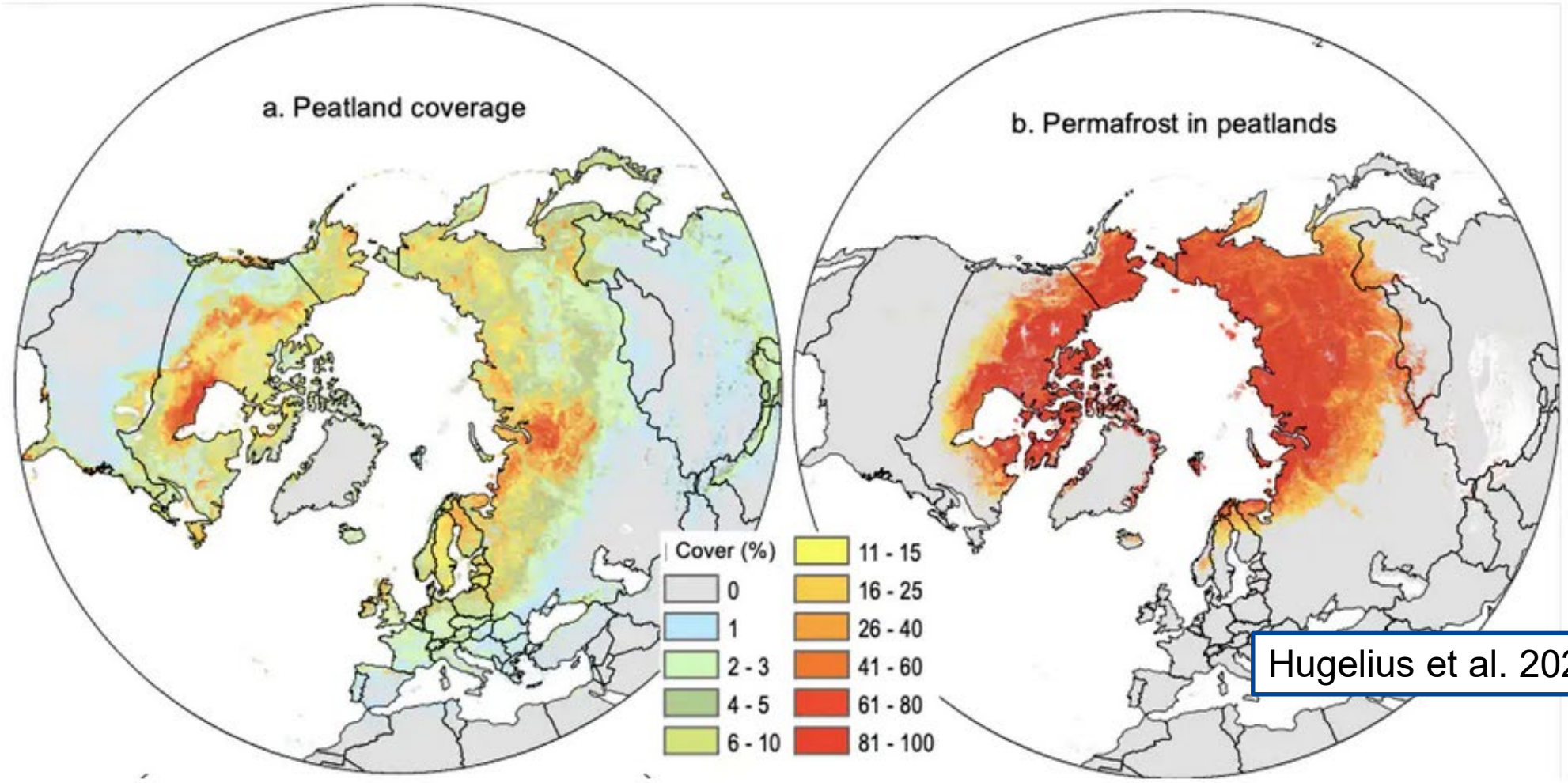
The global CO_2 emissions from drained peatland have strongly increased since 1990

Forest and peatland fire in Alaska, kilde: Alamy

Forest and peatland fire in Indonesia, kilde: Alamy

Datta & Krishnamoorti. 2022. Frontiers in Climate


Change in peatland cover in Indonesia and Malaysia between 2000 and 2010
(source: MIETTINEN et al 2011 - Global Change Biology)
MONGABAY.COM
Peninsular Malaysia
-18.0%
-52,000 ha
Sumatra
-41.3%
-1.292 m ha
Borneo
-24.8%
-1.038 m ha
Indonesian New Guinea
-9.3%
-366,000 ha
Malaysia lost 557,000 ha or 45.3% of its peatlands between 2000 and 2010, while Indonesia lost 2.199 m ha or 17.3%



Peatland covers much of the far north – and often overlaps with permafrost. Hugelius et al / PNAS, Author provided

Hugelius et al. 2020. PNAS

The Arctic's Slumbering Carbon Giant Could Awaken And Unleash It's Fury

Permafrost peatlands

- Increased temperatures and wildfire frequencies leads to permafrost thaw
- Results in eroding coastlines, ground subsidence, landslides +++

Permafrost peatlands

- Increased temperatures and wildfire frequencies will lead to permafrost thaw (already occuring)
- Area of permafrost shrink with 45%
- The relic (frozen) peat will thaw and release GHGs and heavy metals
- Thermokarst bogs will develop

Hugelius et al. 2020. PNAS

Present permafrost (percentage of the surface)

- Continuous (Between 90 and 100%)
- Discontinuous (Between 50% and 90%)
- Sporadic (Between 10% and 50%)
- Isolated patches (Between 1% and 10%)
- Area where subsea permafrost is known or likely to occur
- Thermokarst

Projected permafrost extent in 2100 according to Representative Concentration Pathway (RCP) scenarios from the IPCC Fifth Assessment Report

- RCP 4.5
- RCP 8.5
- Greenland ice sheet and glaciers
- Main population centres


No Paris without peat

“Natural Climate Solutions” (NCSs)

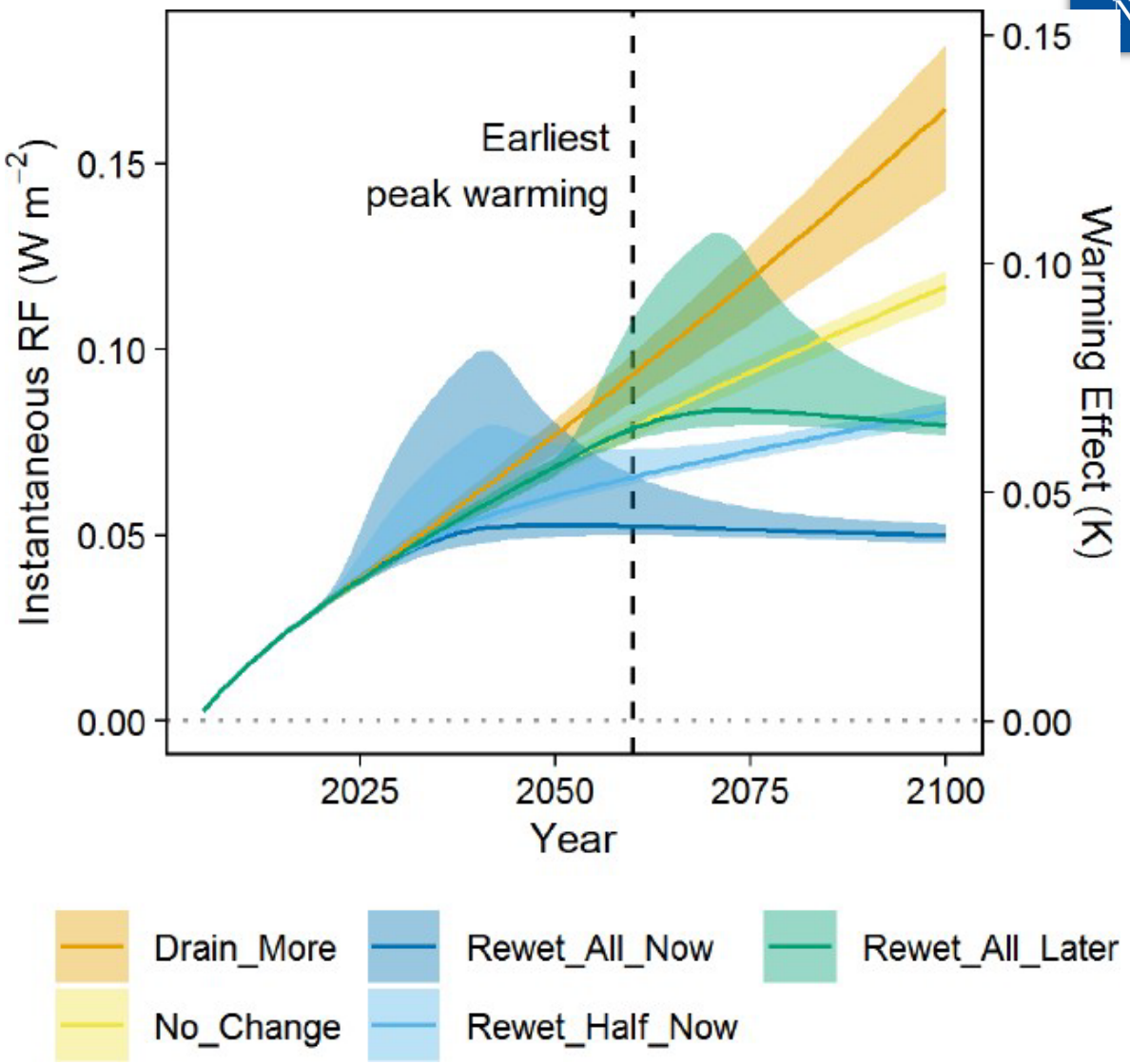
- "Conservation, restoration, and improved area management that increase carbon storage and/or avoids GHG emissions from forest, wetlands, grasslands, and agricultural land in a global context"

- Soil carbon represents 25% of potensial of NCSs
  - Wetlands constitute 72% of soil carbon

Bossio et al. 2020. Nature Sustainability

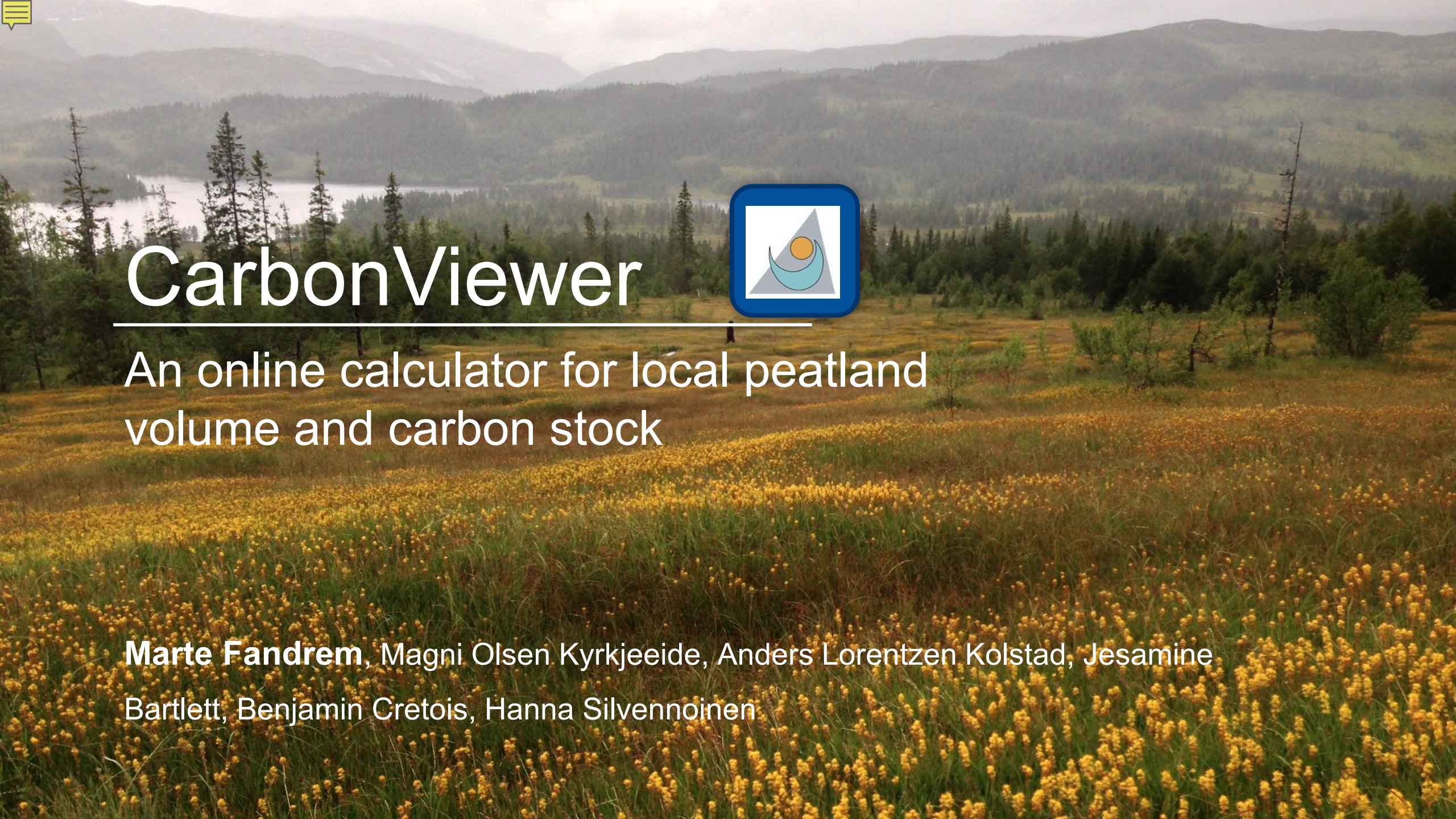
Why restore?

Günther et al. 2020 Nature Communications



Summary

- Peatlands store 30% of soil carbon on 3% land area
- Soil carbon = long-term carbon storage
- The climate forcing of peatlands = the sum of all peatlands and their history
- Human disturbance has altered peatlands from sink to source
- We need to restore/rewet to change the trajectory



CarbonViewer

An online calculator for local peatland volume and carbon stock

Marte Fandrem, Magni Olsen Kyrkjeeide, Anders Lorentzen Kolstad, Jesamine Bartlett, Benjamin Cretois, Hanna Silvennoinen


CAT
Røstad
entreprenør as

How to measure carbon in peatlands

What is the carbon storage of this specific peatland?

What is the global carbon storage of peatlands?

What is the historic accumulation rates?

What is the current accumulation rate of carbon in peatlands?

How to measure carbon in peatlands

What is the carbon storage of this specific peatland?

What is the global carbon storage of peatlands?

What is the historic accumulation rates?

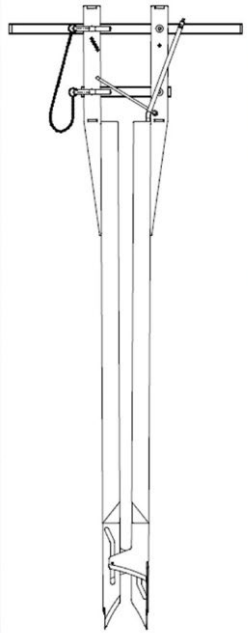
What is the current accumulation rate of carbon in peatlands?

Recipe for success

- Accurate figures for the extent of peatlands
- Accurate figures for the thickness of peatlands
- Accurate figures for the carbon density contained in these peatlands

Total carbon content on a small scale

Based on peat cores from various depths



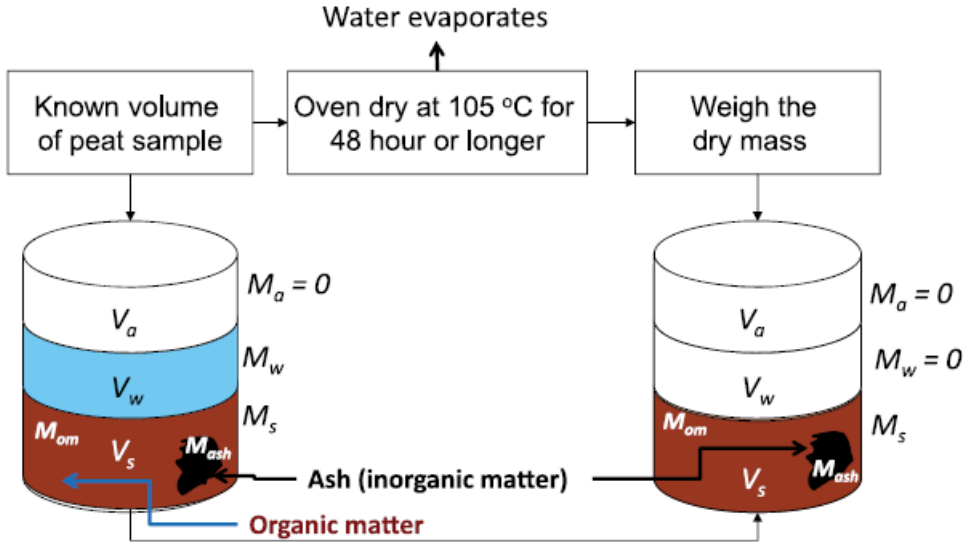
Total carbon content on a small scale

Peat properties:

- Bulk density
- Carbon content

Measuring methods:

- Dry weigh/volume
- Loss-on-ignition (LOI)
- Elemental analyzer (CHNS)



Agus et al. 2011. ICRAF

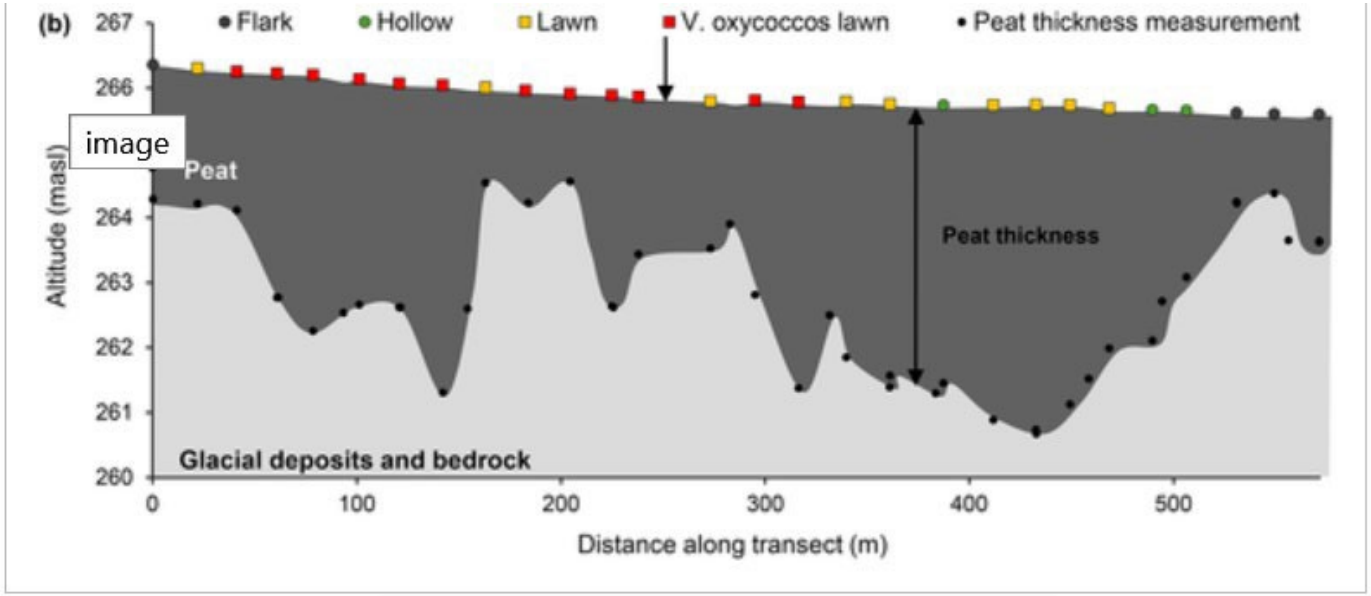
Total carbon content on a small scale

Direct measurements

- Peat characteristics
- Volume

Calculate volume of peat

- Probing
  - Interpolation methods (kriging, IDW etc.)
- Ground penetrating radar (GPR)



Nijp et al. 2019. Ecohydrology

Total carbon content on a small scale

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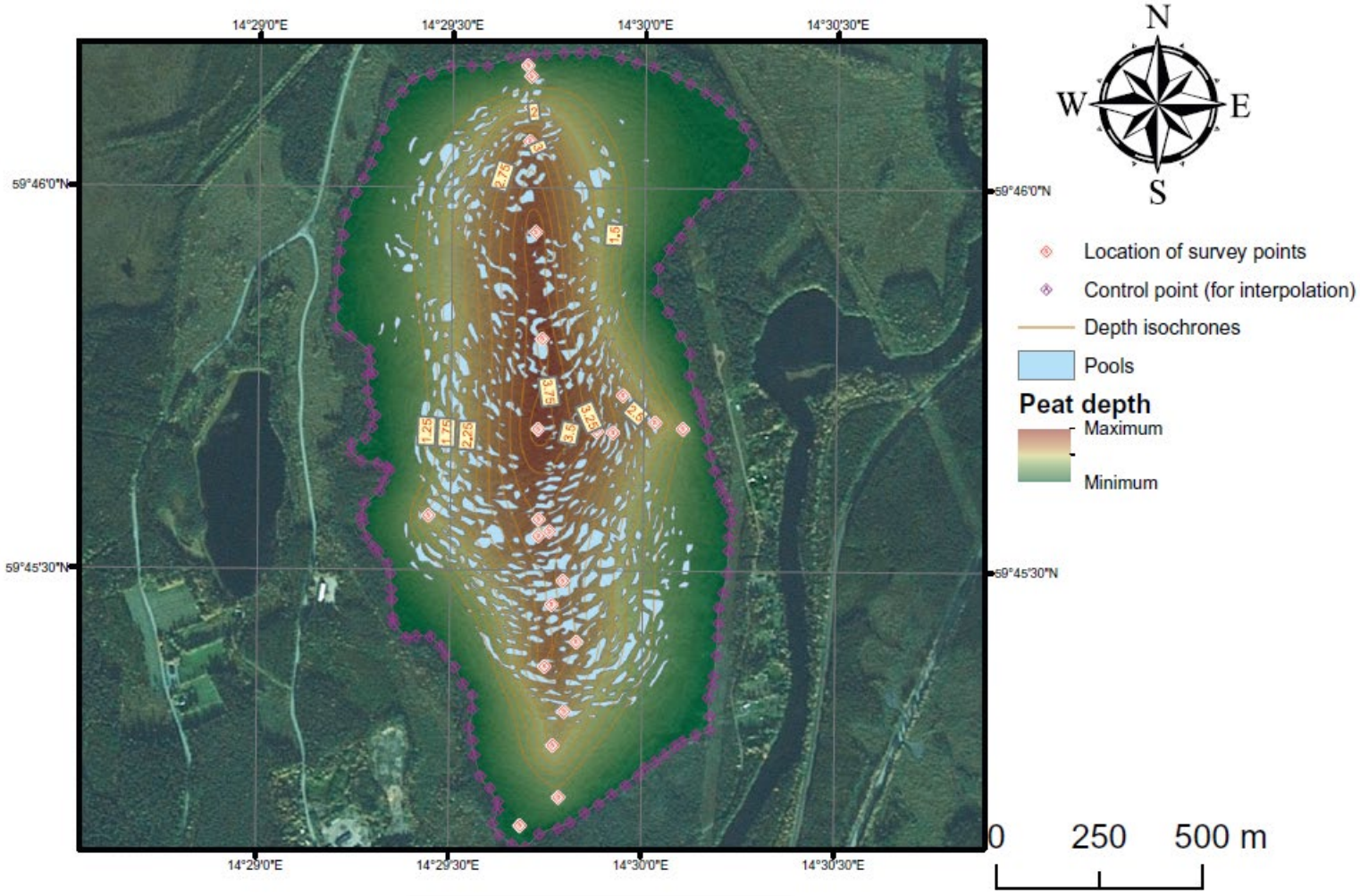
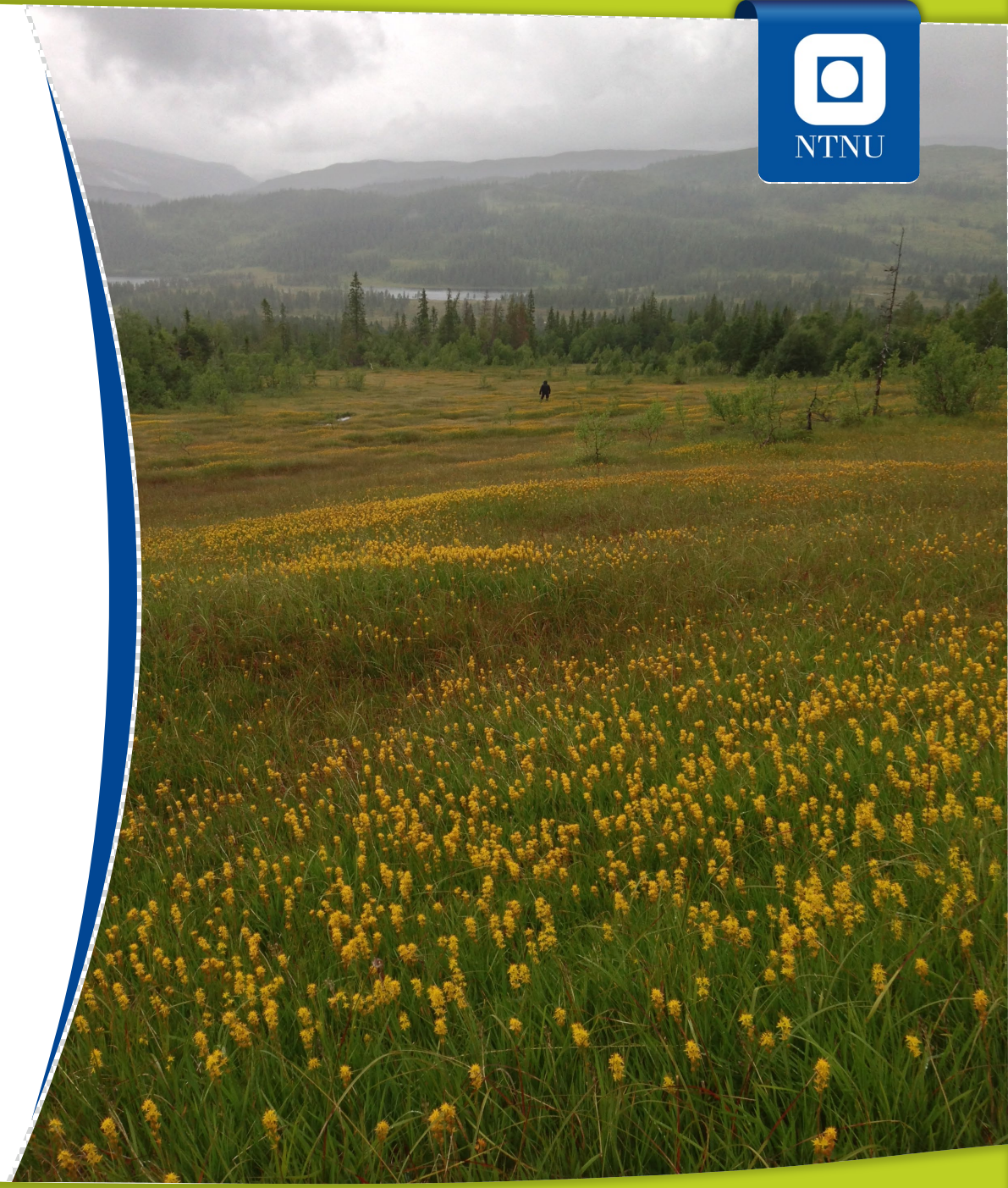


Loisel et al. 2017


https://www.niku.no/2020/06/hvorfor-drar-denne-mannen-rundt-en-pulk-midt-pa-sommeren/

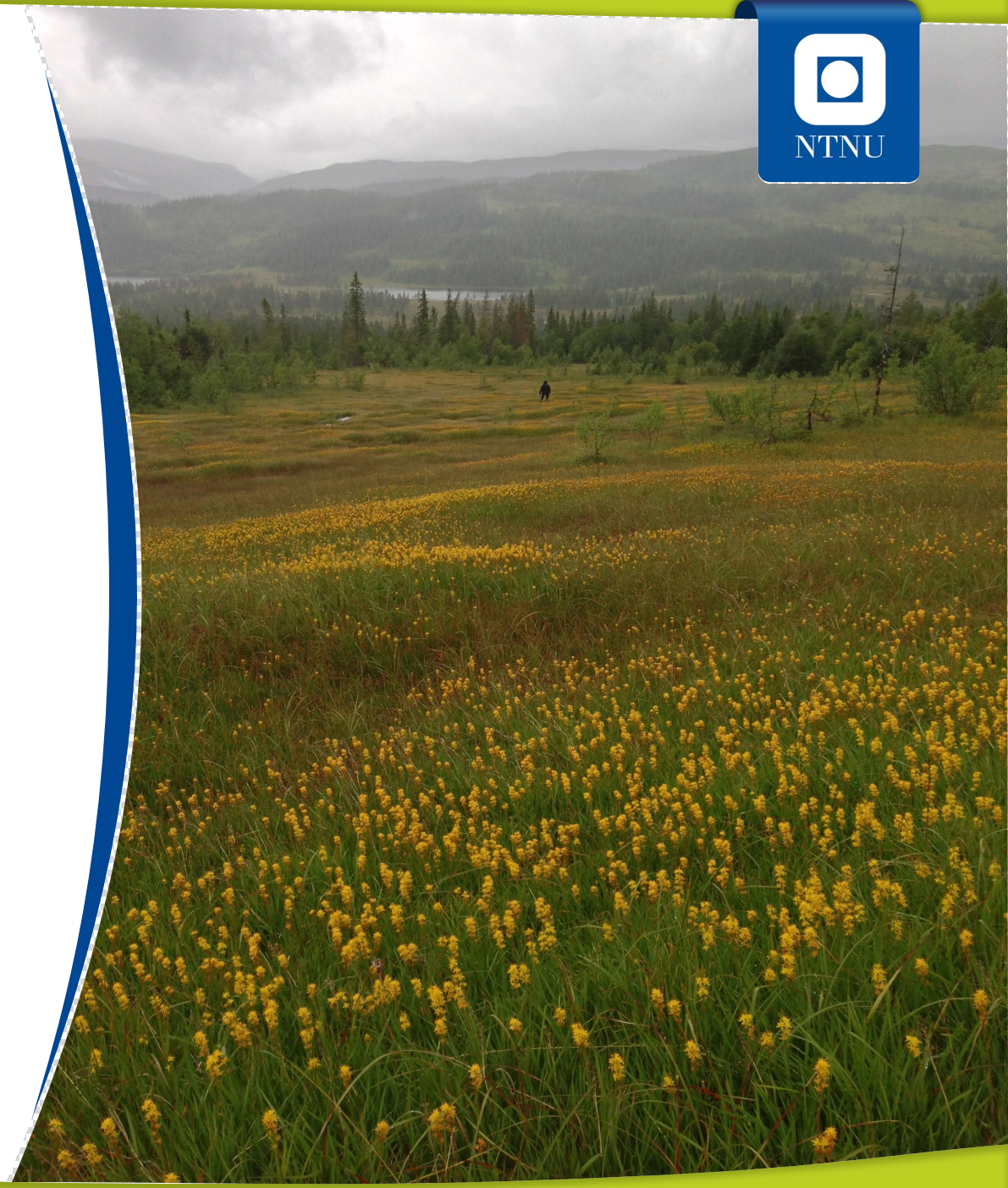
What

- Easy to use tool for calculations
- A Norwegian peat characteristic database



http://carbonviewer.nina.no
https://anders-kolstad.github.io/carbonCalculator/

How it works



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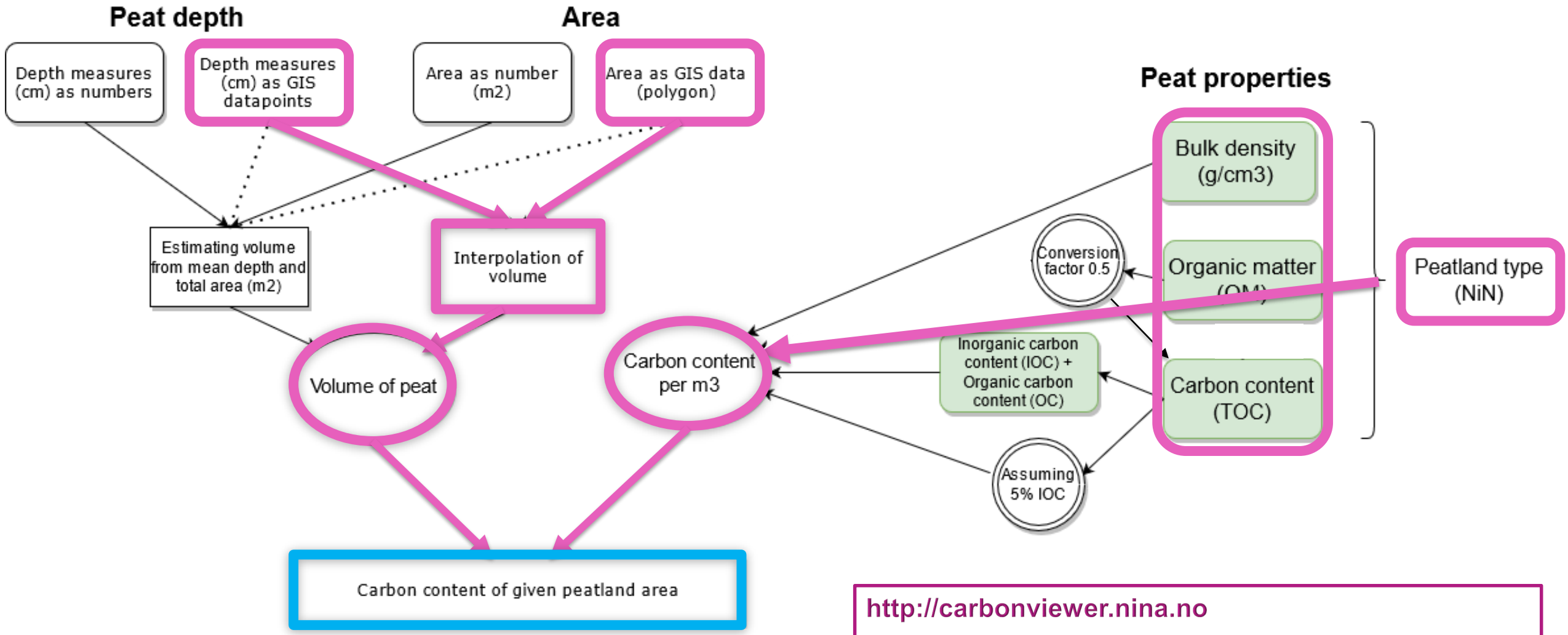


http://carbonviewer.nina.no
https://anders-kolstad.github.io/carbonCalculator/

https://carbonviewer.nina.no

NTNU

Change language

en

Instructions

Volume calculation

Peat properties

Default values

General peatland type

Bog / Nedbørsmyr

Specific peatland type

Raised bog / Høgmyr

Load values

Custom values

Power se

Results

Power value

1 4 6

1 2 3 4 5 6

The power parameter is set at its optimal value ... compu... both the volume of peat and the amount of car... in the a... Nevertheless, it is possible to change it to better fit one's purpose.

AREA
37914.19 m2

VOLUME
77745 m3

CARBON CONTENT
mean: 3382 Tons C
sd: 613 Tons C

Map of the area

http://carbonviewer.nina.no
https://anders-kolstad.github.io/carbonCalculator/

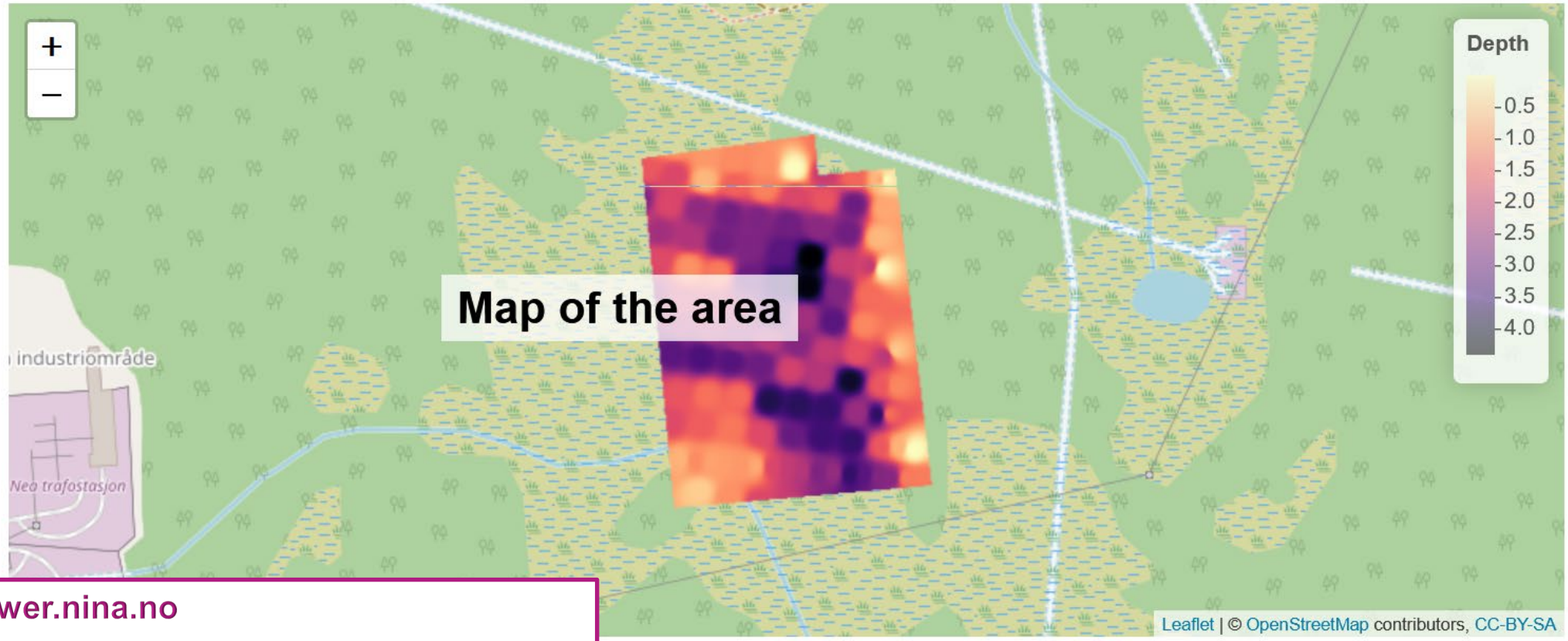
https://carbonviewer.nina.no

Results

Download results

App made with ❤ by the IPN-GRAN team.

Carbonviewer v. 1.0.0



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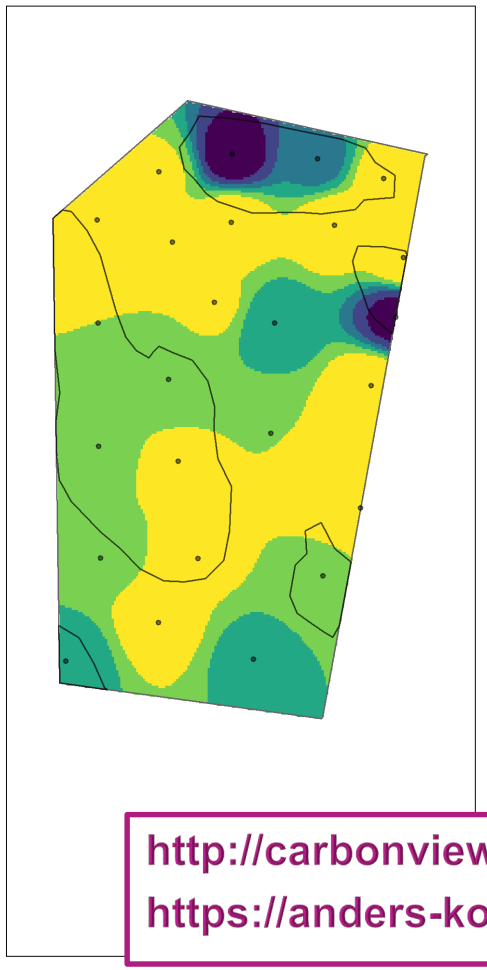

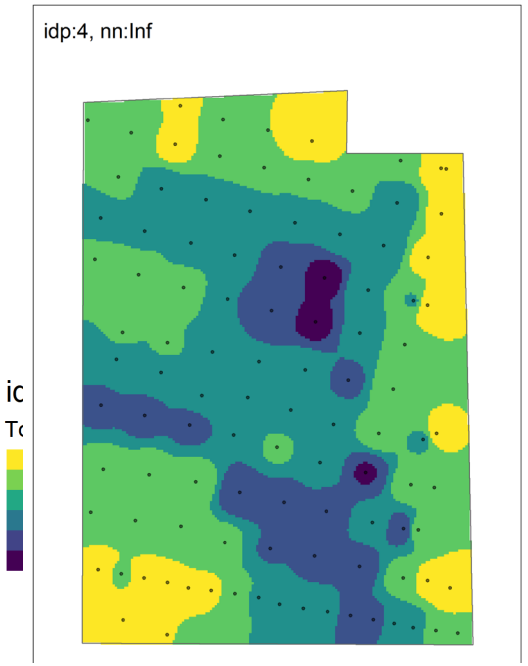

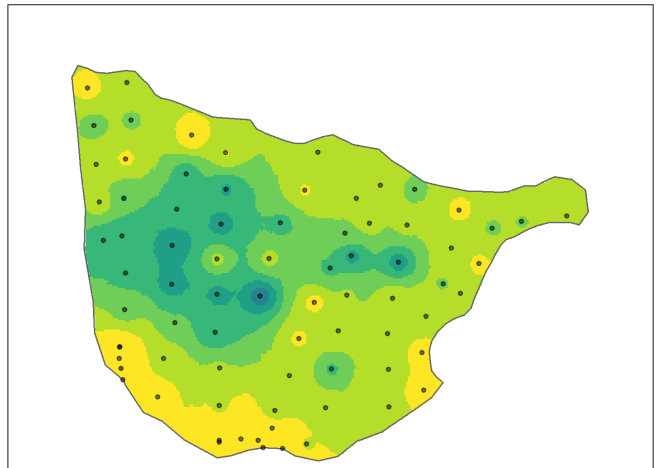

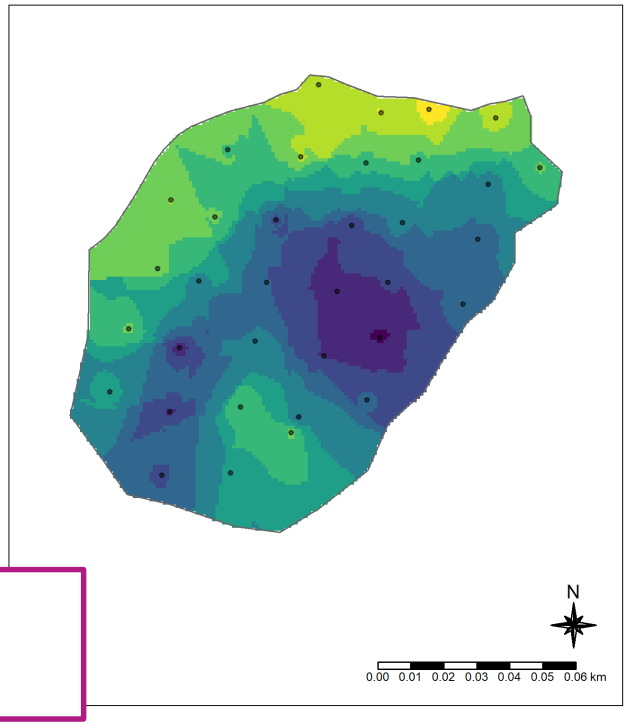

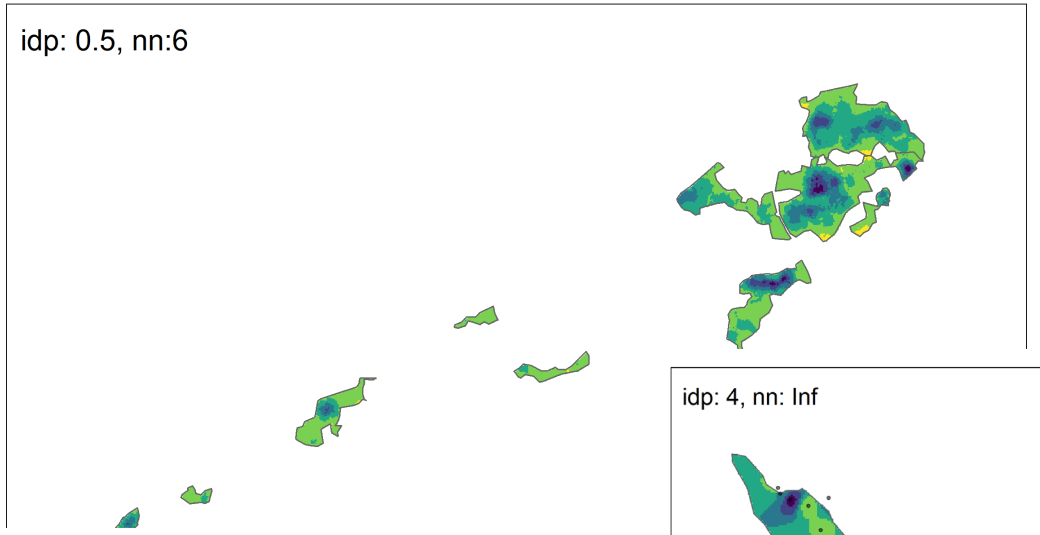

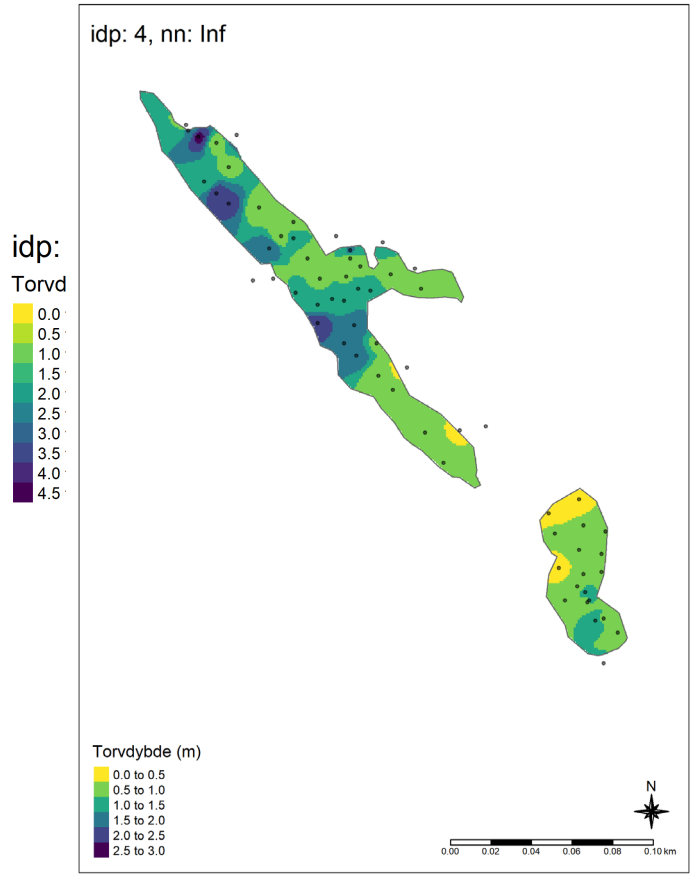

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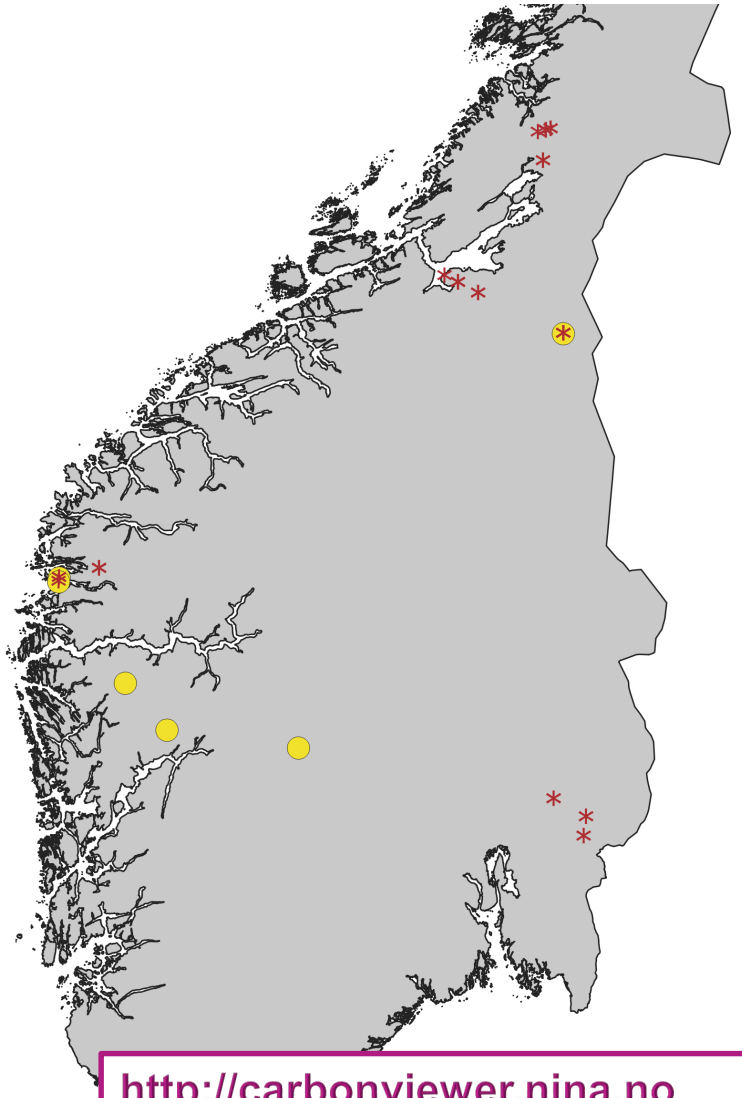

* Peat sampling
● Study sites

http://carbonviewer.nina.no
https://anders-kolstad.github.io/carbonCalculator/

CarbonViewer

An online calculator for local peatland volume and carbon stock

What it does

- Calculates peat volume
- Estimates C content of peat
- Visualizes peat depth variation

What it doesn't

- Estimate C content of vegetation
- Estimate current GHG emissions/uptake
- Estimate GHG emissions from alterations

http://carbonviewer.nina.no
https://anders-kolstad.github.io/carbonCalculator/

For more information, see:

http://carbonviewer.nina.no

https://anders-kolstad.github.io/carbonCalculator/

Thanks!