

Emissions from peat soils

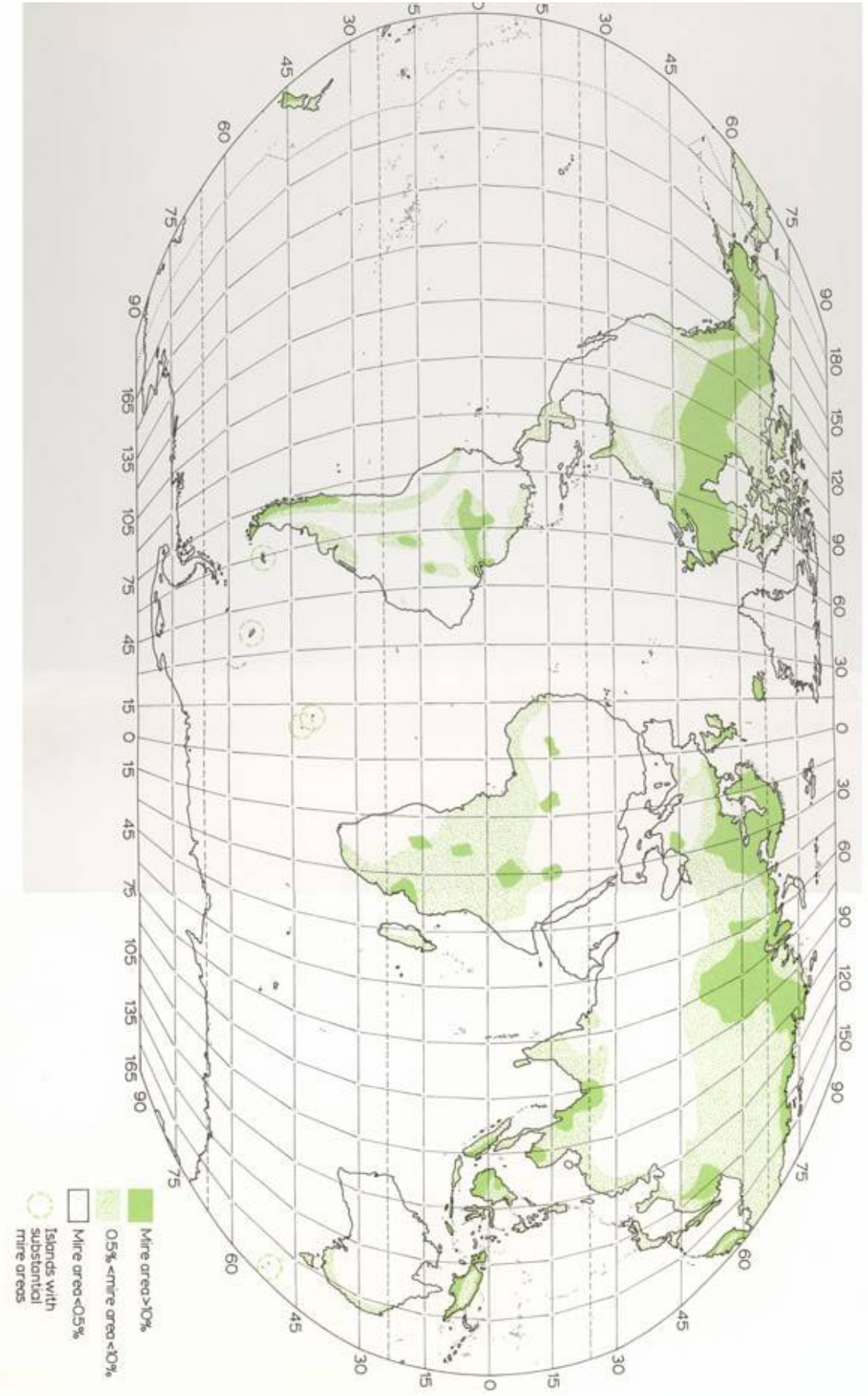
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Outline

1. Importance of peatlands from the climate perspective
2. Carbon cycling in peatlands
3. Greenhouse gas emissions from peatlands
4. Climate change effects on peatlands
5. Conclusions



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Importance of peatlands from the climate perspective

■ Carbon stock

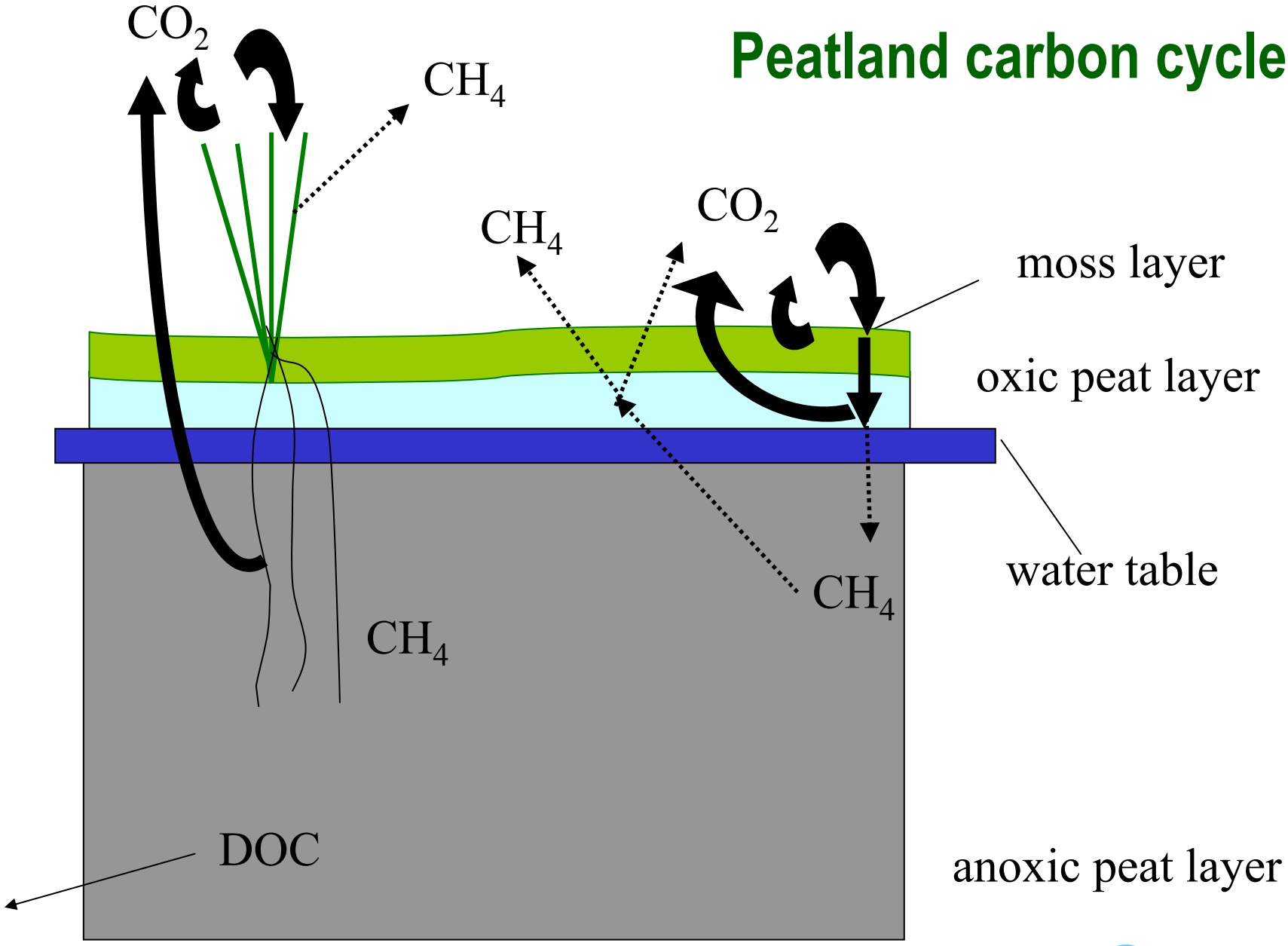
- 15 to 30 % of all soil carbon (250 to 460 vs. 2300 Pg)
- 30 to 60 % compared to the present atmosphere (760 Pg)

■ Greenhouse gas emissions

- Methane emissions of all wetlands 20 to 40 % of the global total, 70 to 90 % of the natural emissions
- Carbon dioxide sink 1 % compared to the present annual fossil carbon emissions (0.07 vs. 8.2 Pg)
 - A hypothetical 1 % loss of peat carbon reserves would be equal to 30 to 60 % of the annual fossil carbon emissions
- Nitrous oxide exchange usually limited

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Peatland carbon cycle



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Natural peatlands

- Sinks of carbon dioxide
- Sources of methane
- Exchange of nitrous oxide limited, except for nutrient-rich fens

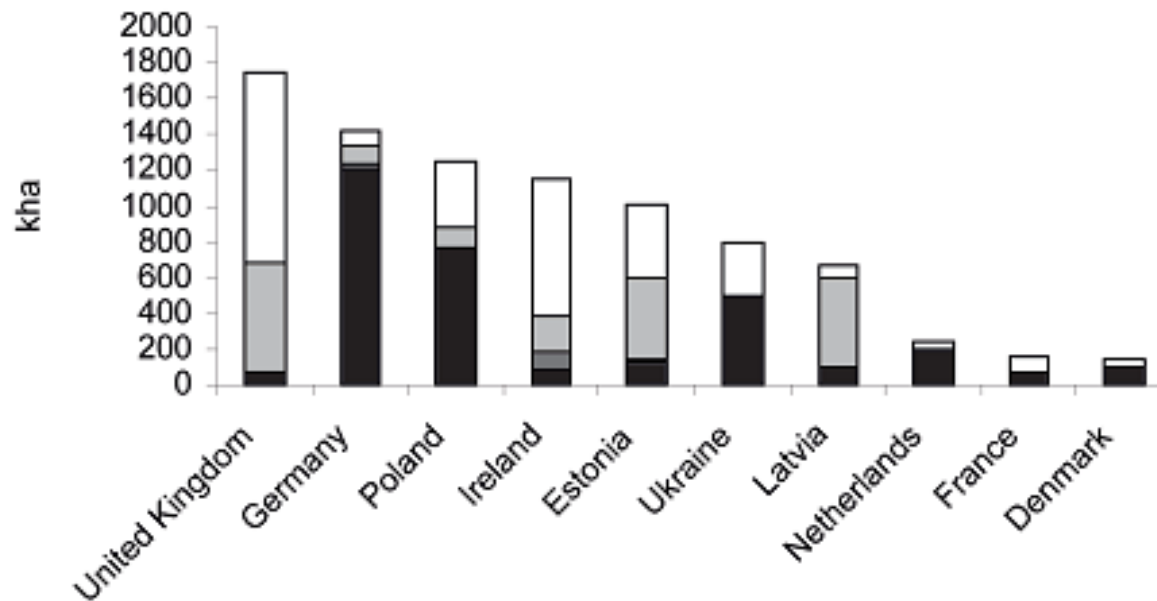
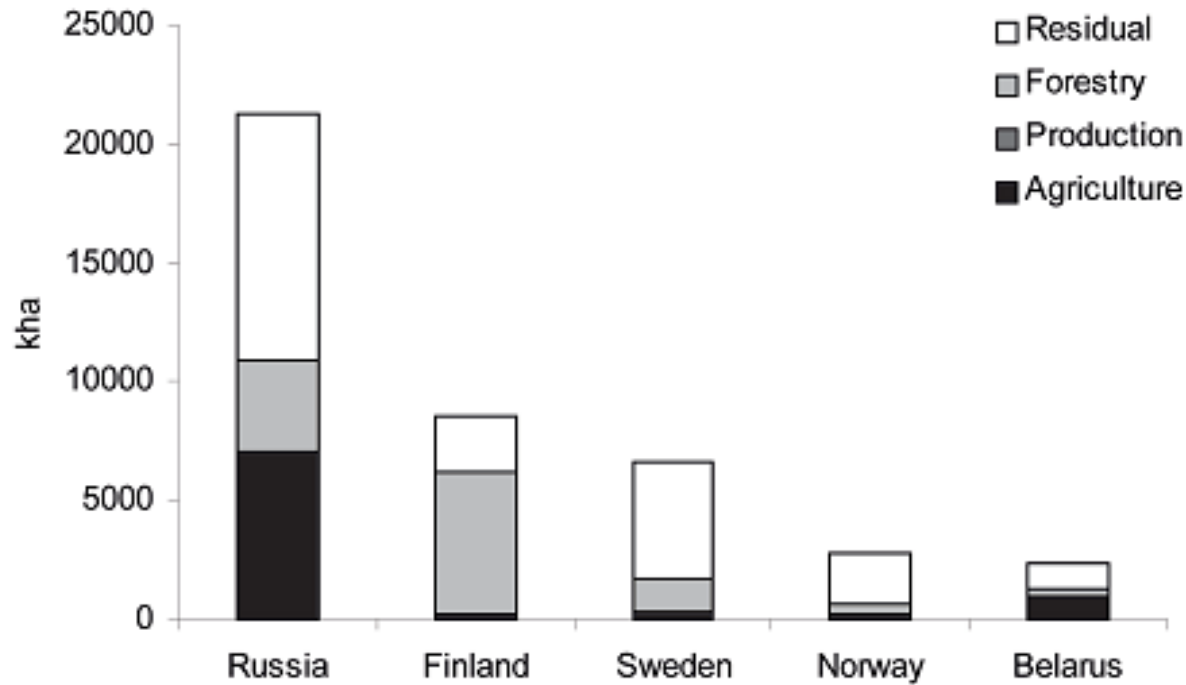
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European peatlands

- 48 % natural peatlands
- 52 % converted over the last century
 - 50 % to agriculture
 - 30 % to forestry
 - 10 % to peat extraction
 - Rest to urbanization etc.

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Peatland area

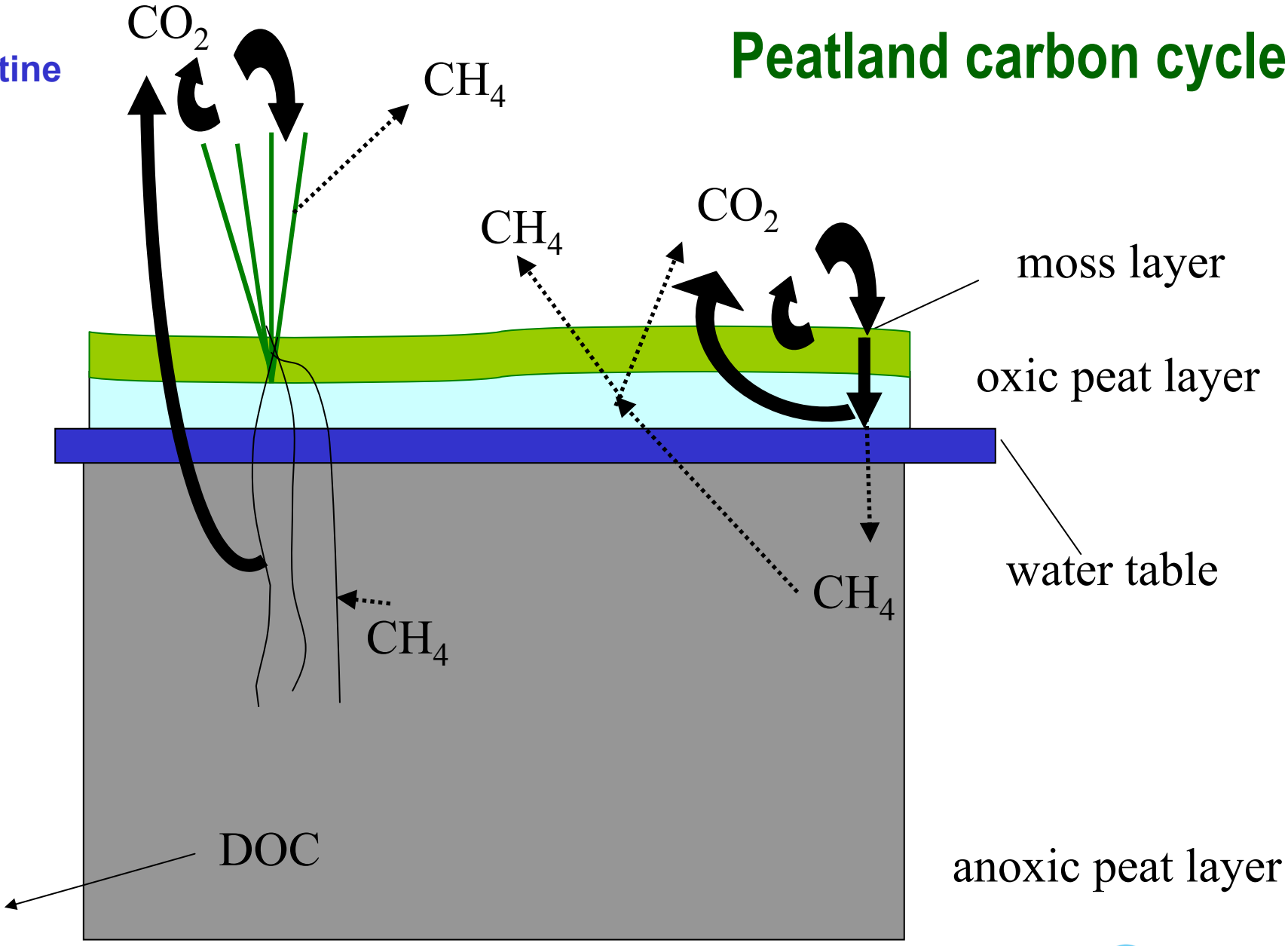


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Byrne et al. 2004

Peatland carbon cycle

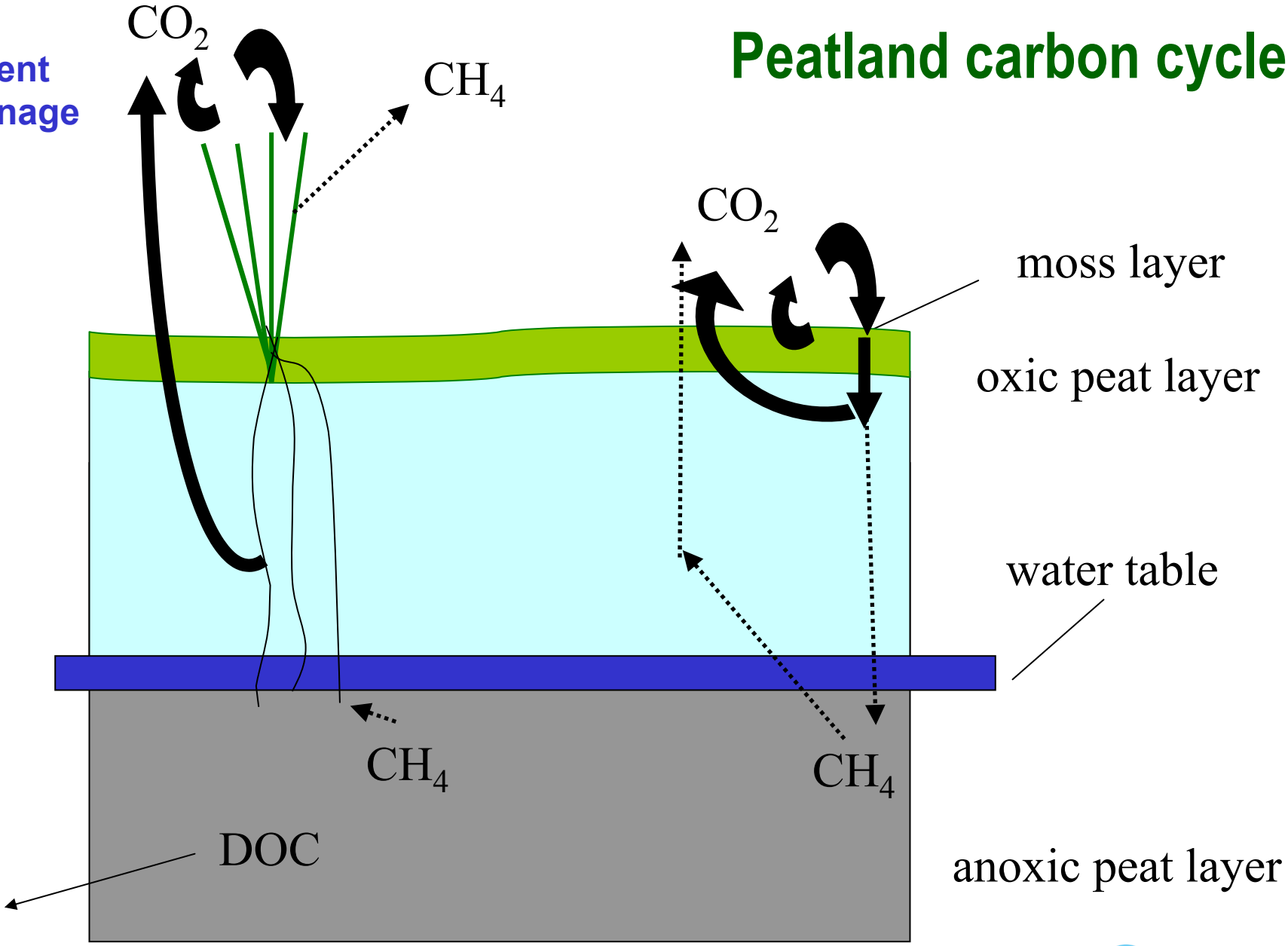
Pristine



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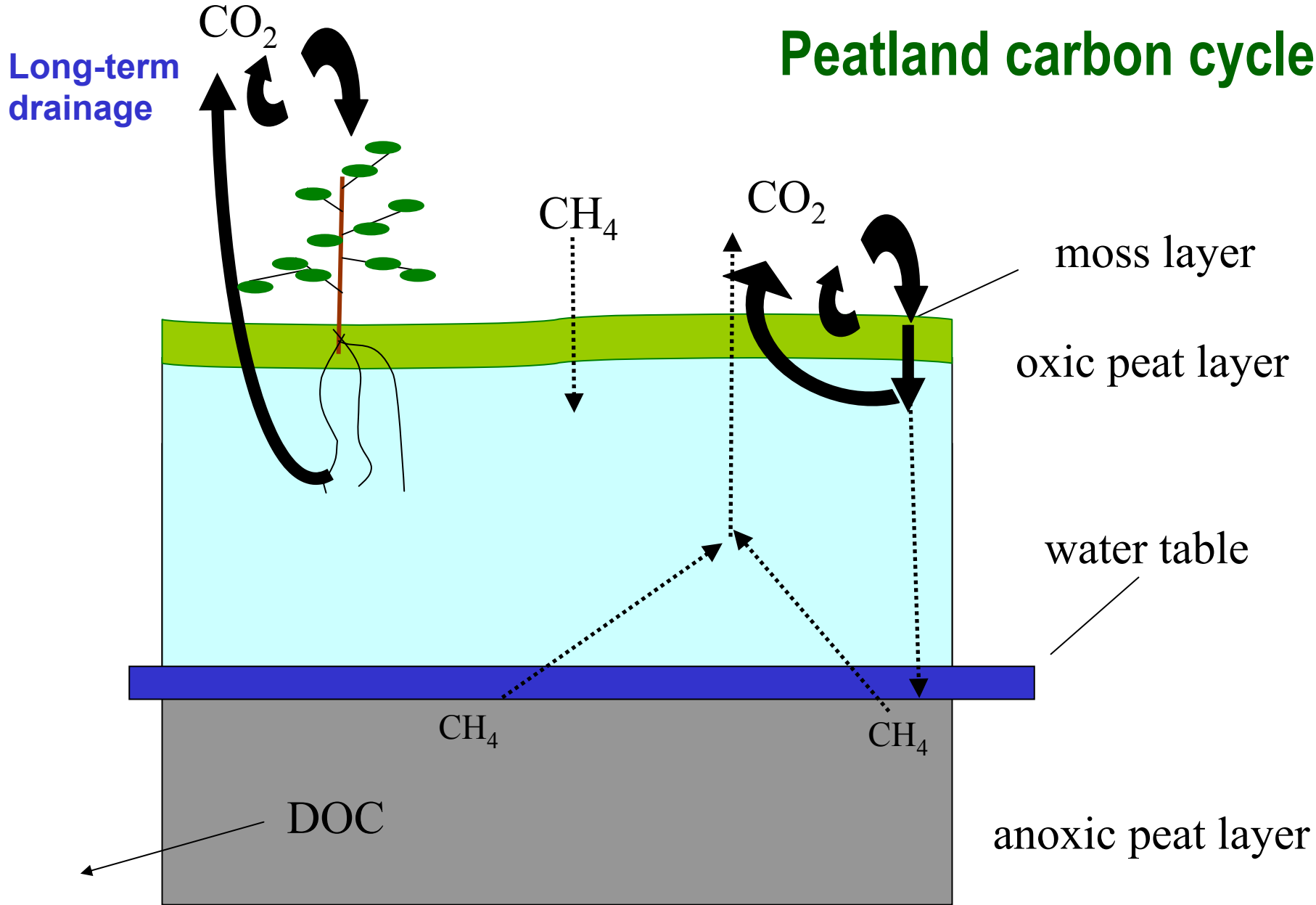
Peatland carbon cycle

Recent drainage



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Peatland carbon cycle



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Drainage

- Increases carbon dioxide emissions
 - Faster decomposition, sometimes slower carbon fixation
- Decreases methane emissions
 - Less formation, more oxidation

Greenhouse gas emissions of different peatland uses

■ Bogs (nutrient-poor)

- Forestry < Mire < Restoration < New drainage for forest/peat cut < Peat cut < Abandoned after harvest = Grass < Crop

■ Fens (nutrient-rich)

- (Restoration <) Forestry <= Mire < New drainage for forest < Grass < Crop

Greenhouse gas budget of European peatlands (EU-25)

- Total annual emissions 21 Tg C (CO₂ eq.)
 - Grasslands 11, croplands 7, mires 3, peat cut areas 0.4, residual 0.5, forestry -0.2 Tg C
 - 1 to 2 % compared to the anthropogenic greenhouse gas emissions (about 1400 Tg C)
 - 20 % compared to the carbon sink of tree biomass (110 Tg C)
- Country comparisons
 - Net greenhouse emissions from peatlands in each country
 - Emissions of greenhouse gases depend on peatland types and uses in the countries

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Potential impacts of climate change

Elevated CO₂ concentration → Increase in photosynthesis
Increase in methane emissions

Higher temperatures → Increase in photosynthesis,
increase in respiration,
increase in methane emissions

Prolonged growing season → Increase in photosynthesis

Warmer autumns and
winters → Increase in respiration,
increase in methane emissions

Increased
evapotranspiration,
water level drawdown → Decrease in methane emissions
Increase in respiration,
De-/increase in photosynthesis?

Change in plant
communities



Summary and conclusions

- Peatlands form a large carbon stock
 - Protecting the carbon stock is important to avoid large carbon emissions to the atmosphere
- Greenhouse gas effects of peatlands is a sum of carbon dioxide and methane (and nitrous oxide) emissions
 - Necessary to account for all the gases to correctly estimate the greenhouse gas effect
- Conversion of natural peatlands to some other land uses has long-term impacts
 - Need to acknowledge an appropriate (long) time frame when estimating the consequences
- Net effect of climate change on peatlands still difficult to quantify