Terrestrial wetlands in Europe: importance for greenhouse gases and mitigation; methodologies for monitoring

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GHG EUROPE

Greenhouse gas management in European land use systems

Rationale

- **Lessons learnt during IPCC Wetlands Supplement:**
  - C pool concept is very useful, but many studies do not distinguish all relevant pools
  - Careful assessment and clear methodologies for monitoring the high carbon soil pool!

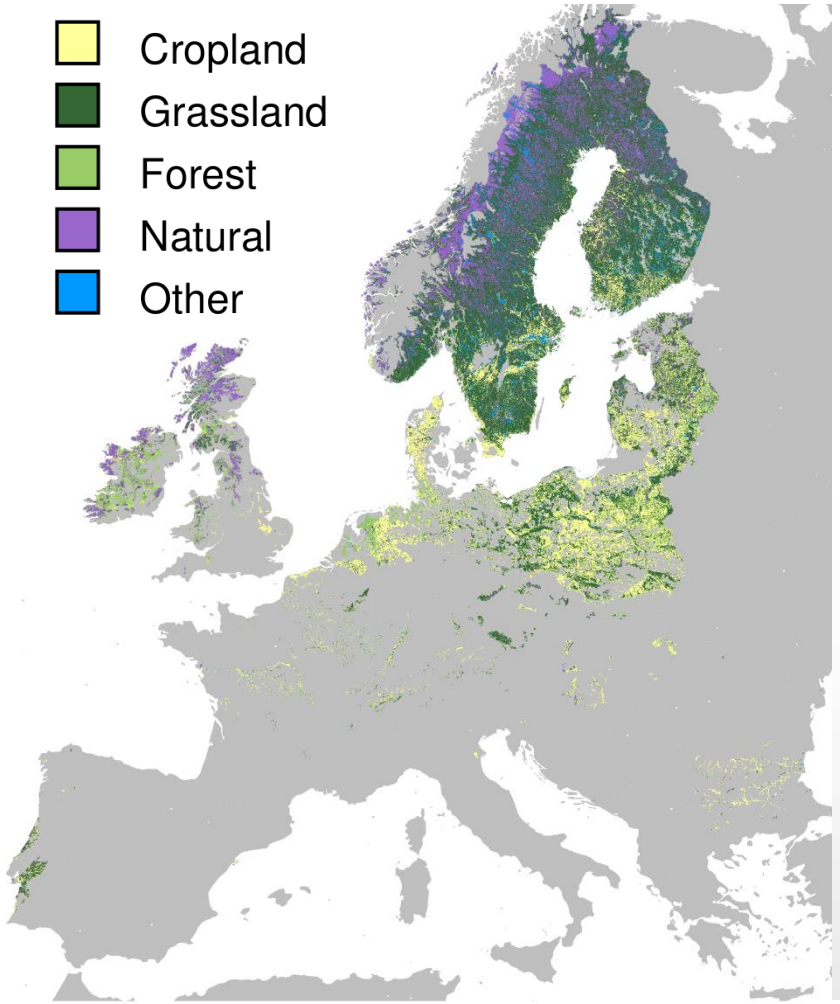
- **Mitigation: MRV is key!**
  - Area
  - Drivers of GHG emissions and mitigation pathways
  - Emissions and removals

Terrestrial wetlands in Europe (EU-27); here: peat soils under all kinds of land-uses and natural

Organic soils from European Soil Database (Montanarella et al. 2006):
303.166 km²

- EU-27:
  7% of area
  of which 60% drained
  (mainly for forest)

- Most of temperate organic soils drained and used for agriculture
- >half of boreal organic soils drained and used for forestry



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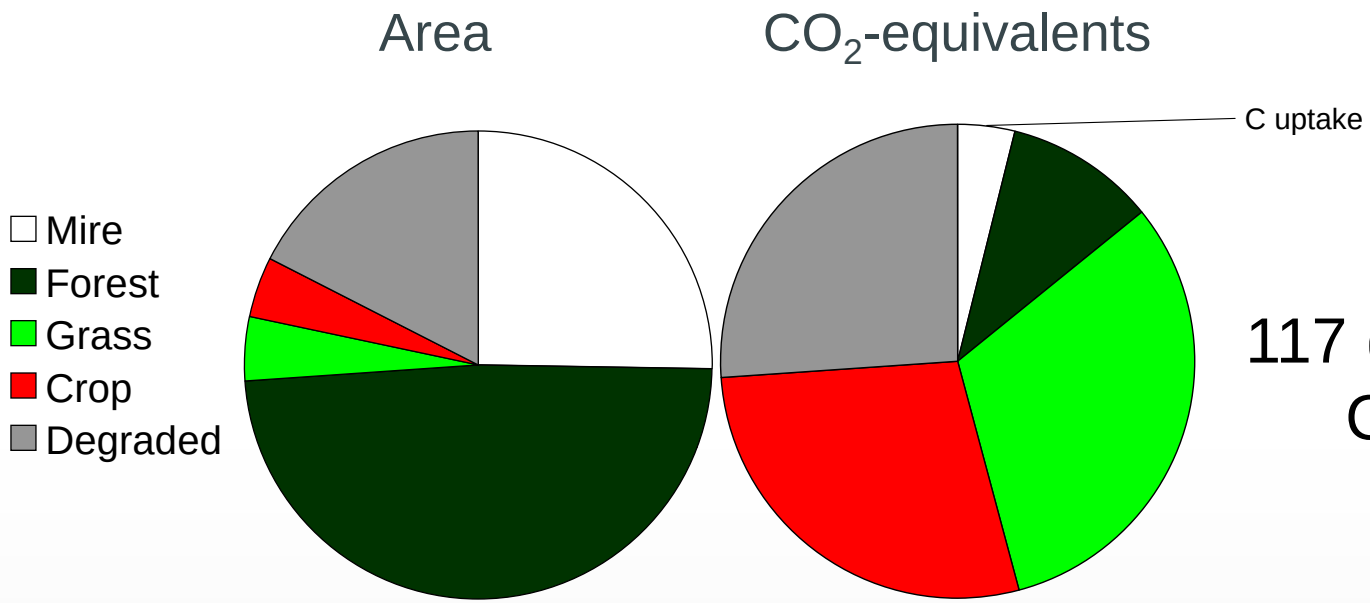


117 (18 – 424) Tg CO_2-eq a^{-1}

Net GHG balance of organic soils (soil C and N pool only) in EU-27 is source:

2.7 (0 -10) % of EU GHG emissions are from organic soils (including the small C sink in natural peatlands)

Main drivers of carbon and GHG fluxes from organic soils

Natural site conditions and land use, management

GPP	Radiation, temperature, vegetation type and vegetation activity
RECO	Temperature, water table, vegetation type and vegetation activity
CO_2 Balance	GPP - RECO, DOC, C-Export, C-Input
CH_4	Temperature, water table (anaerobiosis), labile carbon (vegetation activity), vegetation type (aerenchyma)
N_2O	N-surplus, fluctuating water table

Mitigation potential: theoretically >80% of GHG emissions; practically ???

Rewetting is the key step!

- Full rewetting = land-use conflict
- Full rewetting of former peat cut areas
  = interesting option,
  but who is responsible?
- Full rewetting for paludiculture?
  = Promising but yet to be developed beyond prototype scale
- Partial rewetting: option to reduce GHG emissions with less land-use conflict = done in NL, others yet to follow

Monitoring: „Activity data“

- **Organic soil coverage and soil properties**
  - Soil inventory: updated and in progress in Germany and other EU member states
  - Maps of peat reservoirs, …: often good old high-resolution data available

- **Land-use and land-use change**
  - Very good experiences with aerial photographies analysed with sample grid
  - Space-based remote sensing often highly inaccurate for time series of high resolution

Monitoring: „Activity data“

- **Water table**
  - Dip wells often monitored for other purposes
  - Use only those on organic soils, which monitor the organic soil part (often deeper groundwater is monitored)
  - Water table is key monitoring requirement for rewetting projects
  - High resolution digital elevation map + water table interpolated from dip wells = water table distance to soil surface

Monitoring of the soil C balance: 1. Eddy Covariance method

C balance (soil) = NEE + I_a + I_b + $I_{Understorey}$ + DOC (+ CH_4)

NEE: Eddy covariance as NEE of ecosystem

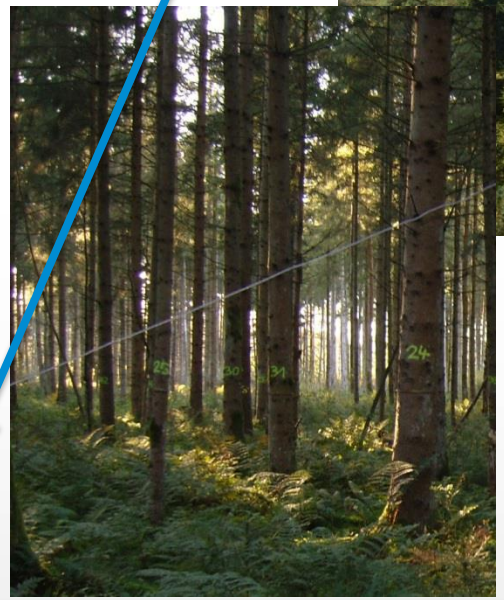
I_a : Above-ground increment of trees

I_b : Below-ground increment of trees

$I_a + I_b$: Forest inventory
Tree cores for increment
Coarse root sampling

$I_{Understorey}$: Measure or estimate

DOC: estimated from DOC concentration and climatic water balance



Monitoring of the soil C balance: 2. Chamber method: high uncertainty!

C balance (soil) = NEE(chamber) – $I_{Understorey}$ (chamber) – $C_{leaf\ litter}$ – $Ra_{fine\ root\ mortality}$ – I_b + DOC (+ CH_4)

NEE from measurement campaigns or automated chambers, modelled

$C_{Blattstreu}$: Forest inventory, tree growth model

$Ra_{fine\ root\ mortality}$ =

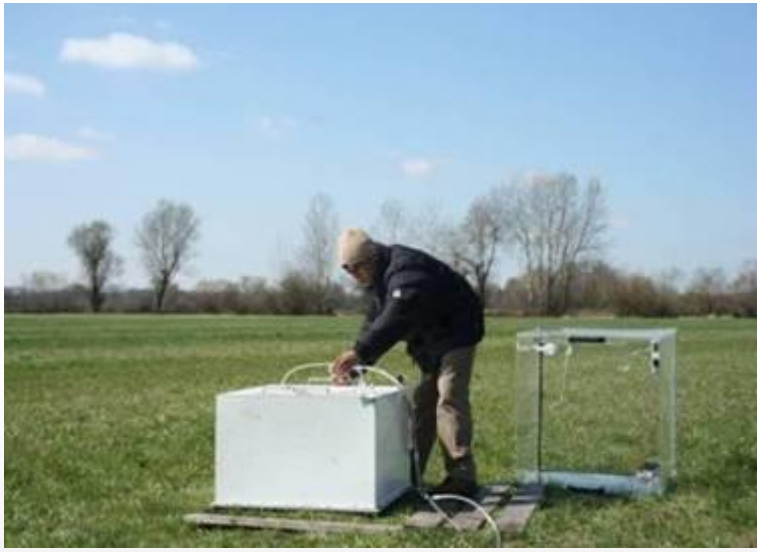
Estimated from leaf biomass and fine root turnover

High uncertainty!!!

Measurements: transparency and quality control! IPCC authors had to consult many paper authors.

Good documentation and quality control of

- Chamber location (e.g. distance from trees…)
- C pools included
- Meeasurement methodology must be state-of-the-art
- Full annual coverage
- Carbon input by fertilizer,
  Carbon export by biomass harvested



Uncertainty can be much reduced by good documentation


Thank you