Rewetting Peatlands: From Emission Source to Carbon Sink

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About Peatlands

- Definition: A wetland, where water saturation of the ground leads to accumulation of **peat** - partly decomposed organic material, mostly from Sphagnum mosses or reeds and sedges
- Peatlands store more carbon than any other ecosystem

Drained Peatlands - A CO_2 source

Draining of Peatlands - Why and how?

- Drainage allows conventional agriculture and livestock grazing.
- Food security and incomes depend on the use of peatlands.
- Deep ditches and below-ground drainage pipes lower the water table typically by 1-2m.

Greenhouse Gas Emissions from Drained Peat Soil

- Oxygen availability facilitates microbial decomposition of peat.
- Carbon is released into atmosphere mainly in the form of CO_2.
- Drained peatlands cause approx. 4% of global anthropogenic emissions.

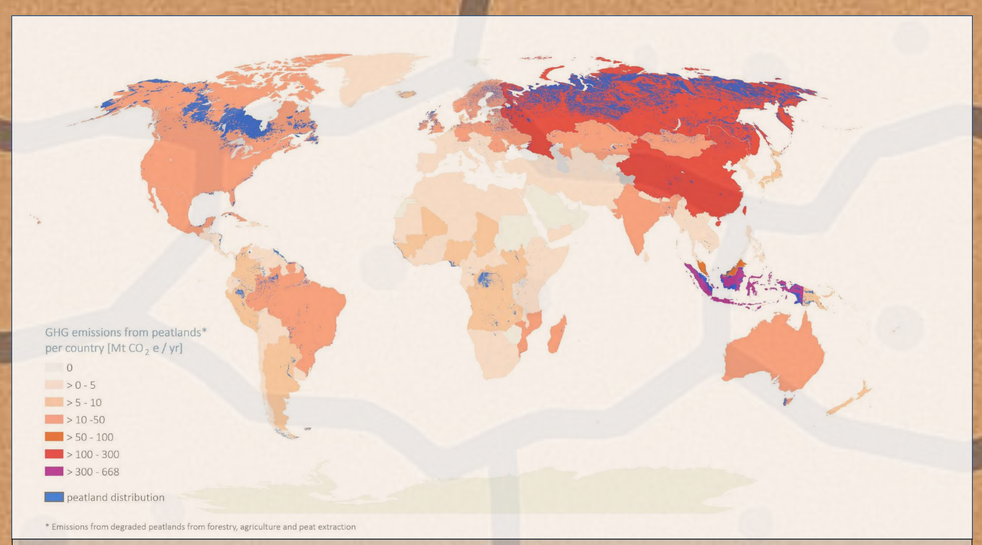

Fig.1 Map of Global Emissions from degraded peatlands from forestry, agriculture and peat extraction
Source: Global Peatlands Assessment data retrieved from the Global Peatland Database compiled by the Greifswald Mire Centre

Effects beyond Climate Change

- Loss of habitats and biodiversity.
- Land subsidence due to peat decomposition.
- Aggravation of drought due to lowered water tables and reduced evapotranspiration.
- Fire risk is increasing.

Wet or Rewetted Peatlands- A CO_2 sink

Sustainable Economic Use of Wet Peatlands

- Secures livelihood for local people and societies after the rewetting of former agricultural land.
- Paludiculture: Growing of suitable crops in wet conditions, e.g. *Phragmites, Typha or Sphagnum.*
- Peatland photovoltaics ? Research ongoing!

Rewetting Reduces Greenhouse Gas Emissions

- Rewetting is usually achieved by the removal of drainage systems and additional dams where needed.
- Water table should ideally be at surface level or just slightly lower (a few cm).
- Anoxic conditions in water-saturated peat prevent microbial activity.
- Carbon remains locked in the peat.
- CH_4 emissions only temporarily increase after rewetting.
- Long-term reduction of CO_2 emissions.
- Formation of new peat is possible under wet conditions.

References

- Evans, C. D., Peacock, M., Baird, A. J., Artz, R. R. E., Burden, A., Callaghan, N. et al. (2021). Overriding water table control on managed peatland greenhouse gas emissions. Nature. DOI:10.1038/s41586-021-03523-1. https://www.nature.com/articles/s41586-021-03523-1
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2018). The IPBES Assessment Report on Land Degradation and Restoration. https://zenodo.org/record/3237393#.Yx7djnaxWUk
- International Panel on Climate Change (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Pean, C., Berger, S. et al. (eds.). Cambridge: Cambridge University Press. https://www.ipcc.ch/report/ar6/wg1/
- International Union for Conservation of Nature (2021). Peatlands and Climate Change. [online]. IUCN Issues Brief (November 2021). https://www.iucn.orgnds - Evidence for Action toward the Conservation, Restoration, and Sustainable Management of Peatlands. https://wedocs.unep.org/20.500.11822/41222
- /sites/default/files/2022-04/iucn_issues_brief_peatlands_and_climate_change_final_nov21.pdf
- Temmink, R. J. M., Lamers, L. P. M., Angelini, C., Bouma, T. J., Fritz, C., van de Koppel, J. et al. (2022). Recovering wetland biogeomorphic feedbacks to restore the world's biotic carbon hotspots. Science 376(6593). https://www.science.org/doi/10.1126/science.abn1479
- United Nations Environment Programme. (2022). Global Peatlands Assessment: The State of the World's Peatla