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# Draft Policy Brief: Restoring the world's drained peatlands is necessary to comply with Sustainable Development Goals and Paris Agreement

# ***Restoring the world's drained peatlands is necessary to comply with Sustainable Development Goals and Paris Agreement***

## Summary

Peatlands cover about 400 million ha (3 percent) of land surface and store more carbon than any other ecosystem, and for longer periods. Since peat is hidden below ground, it is often unrecognised and can be damaged unknowingly. As peat is often hidden by forest cover, new technology is allowing large peatland areas to be discovered including in the tropics. Around 65 million ha of peatlands globally have been drained and transformed to grazing land, forest land and cropland or used for peat extraction or infrastructure. Drained peatlands on ~0.4 percent of the land are responsible for ~4 percent of all anthropogenic greenhouse gas emissions. The global land use sector is foreseen to be a net carbon source in 2100 unless at least 60 percent of the currently drained peatlands are rewetted. This means that rewetting an even larger percentage is necessary for the land sector (incl. peatlands) to provide the carbon sinks necessary to keep climate change below 1.5 – 2.0° C (as decided in the Paris Agreement), to contribute to meeting the Sustainable Development Goals (SDGs) (13 on climate, 15 on biodiversity on land and 17 on partnerships) and to align with the objectives of the UN Decade on Ecosystem Restoration 2021-2030. Parties are therefore encouraged to implement large-scale peatland restoration and to include emissions from organic soils and relevant emission reductions in their Nationally Determined Contributions under the Paris Agreement.

## Policy recommendations

- Protecting existing carbon stocks by stopping new drainage of peatlands will enable continued carbon sequestration and biodiversity conservation. Land use policies, including those for agriculture and forestry, should assure that drainage-based agriculture and forestry do not expand further into peatland areas.
- A minimum of 50 percent of the currently degraded peatlands should be restored by 2030 to comply with the IPCC reduction pathway to enable climate change to remain below 1.5 – 2.0°. The sooner restoration is implemented, the better it is for the climate.
- Parties can effectively reduce $CO_2$ emissions and initiate long-term biodiversity restoration by blocking drainage systems and reintroducing peat-accumulating plant communities when needed.
- Funding mechanisms and Parties are encouraged to provide financial resources for peatland restoration as part of large-scale landscape rehabilitation programs.
- Accounting for peatlands under the Nationally Determined Contributions (NDCs) of the Paris Agreement will provide incentives for their restoration.

## The issue

Peatlands cover about 400 million ha (3 percent) of the Earth's land surface. More than 80 percent of this area is still in a largely natural state, comprising numerous peatland types and large biodiversity values. Around 65 million ha have been drained (Joosten et al., 2016) to allow grazing by domestic animals, cropland use or commercial forestry or to support peat extraction and industrial and urban infrastructures.

Peatlands worldwide store more carbon (~600 Gigatonnes) than any other type of ecosystem and for longer periods. However, drained peatlands, both those still in use and those abandoned, cause a larger loss of ecosystem services and more environmental damage per unit land area than any other terrestrial ecosystem. It is estimated that greenhouse gas emissions (GHG) from drained peatlands and peatland fires are responsible for some 4 percent (~ 2 Gt CO2-eq/year) of global anthropogenic GHG emissions (Joosten et al. 2016, Günther et al. 2020).

Continued emissions from drained peatlands until 2100 may comprise 12 to 41 percent of the remaining GHG emission budget required to keep global warming below +1.5 to +2 °C (Leifeld et al., 2019). Further studies indicate that the land sector will be a net carbon source by 2100, unless the existing intact peatlands remain intact and at the same time at least 60 percent (30 million ha) of currently drained peatlands are rewetted (Humpenöder et al. 2020, Joosten 2021a). This implies that policies and actions should be directed towards restoring virtually all drained peatlands worldwide to allow the land sector (including peatlands, forests and soils) to fulfil its necessary role as a carbon sink.

The challenge ahead is major: Compliance with the Paris Agreement and reaching carbon neutrality (IPCC 2018) means that until 2050 some 50 million ha of drained peatland (half of which is in agricultural use) need to be rewetted and restored, i.e. almost two million hectares per year. This will require an enormous upscaling of restoration practice, innovative approaches, and clear and comprehensive guidance.

To aid in this effort, restoration actions are known and comprehensive guidance from Ramsar and others is in place including experiences from restoration already done (see Joosten 2021a, b).

## Analysis

### ***Peat, water and plants***

Peatlands exist because waterlogging prevents plant decomposition, resulting in peat formation. In peatlands a strong interrelationship exists between plants, water and peat (fig. 1, Joosten 2021a). If one of these components changes, the others will change too, affecting their balance. Peat accumulation occurs within a narrow range of water levels. Peat accumulation is hampered by low water tables (promoting peat oxidation), high water tables (reducing plant productivity) and strongly fluctuating water tables. Wet peat is easily eroded by water, frost and wind action, when exposed and not protected by vegetation. Peatland restoration involves ditch, canal and gully blocking to elevate water levels to around the peat surface and disperse water over a large area (Joosten 2021a). Rewetting is also essential to initiate the re-establishment of peat-accumulating vegetation.

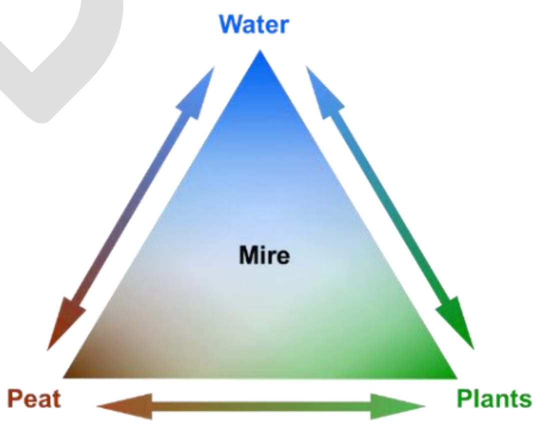

**Fig. 1.** Peatlands comprise three essential components: water, plants and peat. If one of these components changes, the others will change too, affecting the peatland and its functions (Joosten 2021a).

***Greenhouse gasses: their fluxes and balances***

One of the most important reasons for peatland rewetting and restoration is climate change mitigation (Griscom et al. 2017). The significant GHG emissions from drained peatlands can be reduced by raising the long-term average water table to around (i.e. at or above) the peat surface. The exact level depends on the peatland type.

Whereas natural peatlands have been cooling the global climate for many thousands of years (Frolking & Roulet 2007), drained and degraded peatlands are significant sources of CO2 (carbon-dioxide), sometimes of N2O (nitrous-oxide) in association with nutrient rich organic soil and reduced CH4 emissions. These greenhouse gases result from microbial oxidation of organic matter when air penetrates the formerly water-saturated peat (Joosten et al. 2016).

When the water level is below the surface, the relationship between the mean annual water table and greenhouse gas emissions is largely linear: the lower the water table, the higher the emissions. This means that for example half of the emissions from a drained peatland can be reduced by raising the water table to half of its former depth below the surface. Zero CO2 emissions occur when the annual average water level is at the peat surface (‘0 = 0’).

The drier conditions following drainage also increase the risk of peat fires (Kettridge et al. 2015, Sirin et al. 2020). Except for GHG emissions, smouldering peat fires cause widespread haze with deleterious effects to human health (Marlier et al. 2019, Graham et. 2020).

With a stable and high water table – as in the natural state – the (slow) accumulation of organic material over time (‘peat accumulation’) implies a net sequestration of CO2 (carbon sink) Such situation may be restored by damming and blocking drainage systems. See the comprehensive Ramsar guidance on restoration [link].

In an intact or rewetted peatland, a small part of the accumulated plant material is decomposed anaerobically (without oxygen) resulting in the emission of $CH_4$ (methane), a greenhouse gas 28 times stronger than $CO_2$, but with a much shorter residence time in the atmosphere. Usually, rewetting drained peatlands instantly leads to climate benefits: The overall climate effect (expressed as the combined fluxes of carbon dioxide, methane, nitrous oxide and dissolved organic carbon DOC) is (strongly) reduced compared to the former drained situation, and the carbon sink function is starting to be restored (Nugent et al. 2018, Günther et al. 2020).

In some cases, a large initial $CH_4$ peak may occur after rewetting. Still the longer-term climate effect of rewetting is better than maintaining the drained status quo, because $CH_4$ has a shorter atmospheric lifetime compared to $CO_2$ and $N_2O$, which actually accumulate in the atmosphere, whereas the atmospheric concentrations of $CH_4$ quickly reach a steady state (Günther et al. 2020, Fig. 2). Large $CO_2$ (and $N_2O$) emissions will continue if drained peatlands are not rewetted. Only when rewetting takes place, these emissions will drop, hence timing is important to prevent further accumulation of these gases in the atmosphere. A possible initial burst of $CH_4$ emissions (Fig. 2 right) will over time be counterbalanced by the stopping of $CO_2$ and $N_2O$ emissions. Furthermore, management techniques are available to prevent or reduce possible methane emissions (link to Technical Report).

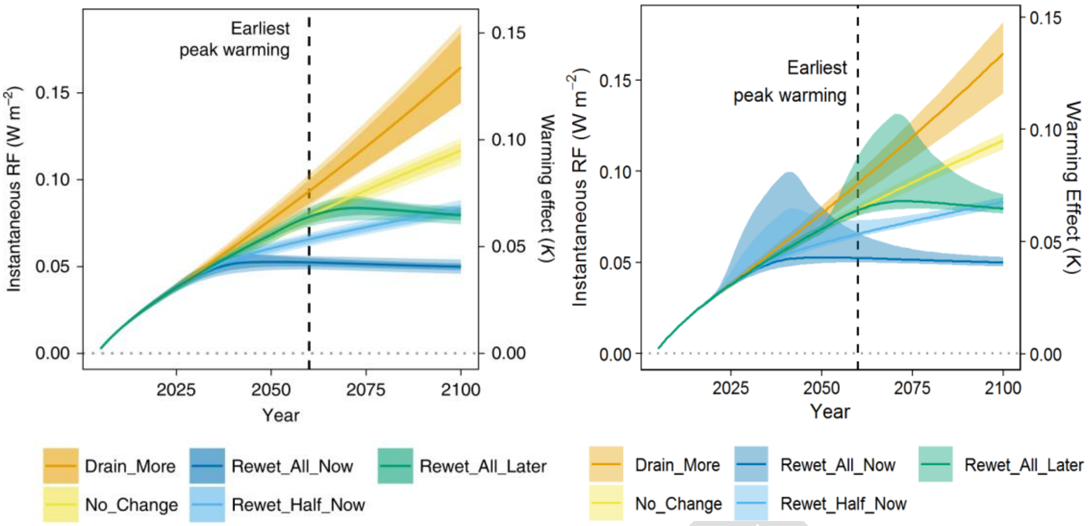


**Fig. 2.** *Radiative forcing (RF) and global climatic warming effects (relative to 2005) of peatland management without (left) and with (right) an initial 10 times larger methane peak for 5 years after rewetting. Drain_More: The area of drained peatland continues to increase from 2020 to 2100 at the same rate as between 1990 and 2017; No_Change: The area of drained peatland remains at the 2018 level; Rewet_All_Now: All drained peatlands are rewetted in the period 2020–2040; Rewet_Half_Now: Half of all drained peatlands are rewetted in the period 2020–2040; Rewet_All_Later: All drained peatlands are rewetted in the period 2050–2070. Source: Günther et al. (2020). Nature Communications 11:1644.*

*Policy perspectives and the role of the Ramsar Convention*

The Ramsar Convention has recently developed a particular focus on peatlands and their contribution to achieving the SDGs and especially SDG 13 on climate action and SDG 15 on conservation of biodiversity on land. Moreover, meeting these SDGs is crucial for meeting several others e.g. SDG 1, 2 and 3 on no poverty, zero hunger, and good health and well-being. In the early years of the Convention focus was on conserving peatlands for their unique biodiversity. More recently their huge role in climate change mitigation and adaptation as well as disaster risk reduction has been recognized. This has resulted in a series of peatland related Resolutions with a strong focus on the restoration of drained peatlands, e.g. Ramsar Resolution *XIII.13 Restoration of degraded peatlands to mitigate and adapt to climate change and enhance biodiversity and disaster risk* reduction [link]. Next to climate and biodiversity, many more ecosystem services and values that deteriorate following drainage, are supported by peatlands, (Bonn et al. 2016a). Restoration of drained and degraded peatlands will initiate a process of returning some of these services important both locally and at a global level. Land use policies should not jeopardize these options.

The necessity to rewet 50 million hectares of degraded peatlands and the worldwide increasing demand for biomass (for enhancing welfare of a growing world population and for replacing all carbon-based fossil resources) imply that these areas cannot all be abandoned after rewetting. When restoration to a (semi-)natural peatland habitat is not feasible and productive use has to continue, existing drainage-based land use has to be replaced by land-use that does not need drainage, i.e. by 'paludiculture' (Wichtmann et al. 2016, Parish et al. 2019).

Other policy frameworks now increasingly promote the restoration of peatlands, including, inter alia, the UN Sustainable Development Goals, the UNEA 2019 resolution on peatlands, the Paris Agreement and its Nationally Determined Contributions (NDCs, UNFCCC), the Aichi targets and the post 2020 Global Diversity Framework (CBD), land degradation neutrality (CCD), the Bonn Challenge, and the UN Decade on Ecosystem Restoration, plus many regional, national and local initiatives.

With the urgent need for peatland restoration financing mechanisms for nature-based solutions (see e.g. the EU Biodiversity Strategy as an example) are crucial for large-scale global peatland restoration implementation.

### Limitation and further research

Many policy frameworks, e.g. at the national level, do not reflect the importance of peatlands, and general policy revisions seem inevitable. Funding is a serious challenge and the allocation of financial resources for nature-based solutions including targeting peatland restoration is urgently needed. Moreover, the identification and mapping of both natural and drained peatlands is necessary first to conserve them and second to restore drained organic soils to meet the climate challengeFurthermore, emission reporting from drained and restored wetlands, including peatlands, often still relies on IPCC default emission factors, which only provide rough figures intended for indicative assessments at the national level. More precise measurement and reporting and more coherent documentation of biodiversity values and climate change impacts, combined with socio-economic knowledge, will substantially improve our understanding and our policy and implementation options.

### Authors

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### Citation

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### Further reading

There are plenty of references documenting the need for peatland restoration. Most notably the Ramsar Technical Report on peatland restoration (Joosten 2021a) and the related Ramsar Briefing Note with practical guidance on restoration (Joosten 2021b) including list of references. As is stated in Page et al. (2008): “Ecological restoration is a complicated, multi-faceted science, in which ecological, social, economic and political factors must all be considered. By simply planting seedlings or stopping fires, we do not address the issues that led to the initial degradation. If we do not seek to understand these ‘barriers’ and develop solutions for them, restoration will be short-lived and superficial.”

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