Wetlands and Methane:
Key Messages

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Wetlands and Methane: key messages

Methane is a powerful greenhouse gas, which is produced by organic matter decomposition in the absence of oxygen. Methane is the second most important contributor to atmospheric warming, being responsible for around 0.5 °C of warming in comparison to around 0.76 °C warming from carbon dioxide (CO_2). As the global community has committed to limiting temperature increase to 1.5 degrees Celsius (°C) above pre-industrial levels, as set out in the Paris Agreement, efforts should also address human-induced methane emissions. The main sources of anthropogenic methane emissions include fossil fuel production, agriculture (e.g. ruminant livestock), waste and, to some extent, burning of biomass and biofuel under low oxygen conditions.

Emitting methane is an inherent feature of wetlands. Wetlands are the largest natural source of methane emissions to the atmosphere[1]. Emissions from wetlands in their natural state have formed part of a broadly stable global carbon cycle and climate system – and the same is true of natural wetland carbon sequestration. Wetlands are strong sinks of CO_2.

Apart from mitigating climate change, conservation and restoration of wetlands bring multiple co-benefits, from flood mitigation and erosion prevention, to salinity control, water quality improvement, livelihood support, biodiversity conservation and more. Wetland ecosystems increase the adaptive capacity and resilience of communities to the impacts of climate change.

There are, however, misunderstandings on wetlands' contributions to the global greenhouse gas budget. This is why, a few key facts need to be understood on wetlands and methane:

1. Wetlands are key allies in the fight against climate change:

- Methane emissions from natural wetlands are inherent to wetlands' anoxic soil conditions, which enable the wetland to **continue sequestering and storing carbon in the soil.**
- Natural wetlands **cool the global climate** and their methane emissions do not contribute to anthropogenic climate change.

[1] In general, GHG emissions are categorized into anthropogenic (man-made) and natural. If, for instance, a wetland is restored, related emissions are labelled as anthropogenic because restoration implies human intervention (even if it would be merely reversing an earlier human intervention). If a wetland has never been managed, emissions are considered natural. However, there can be some overlap or grey areas between natural and anthropogenic emissions, for instance, when wastewater pollution impacts wetland methane emissions.

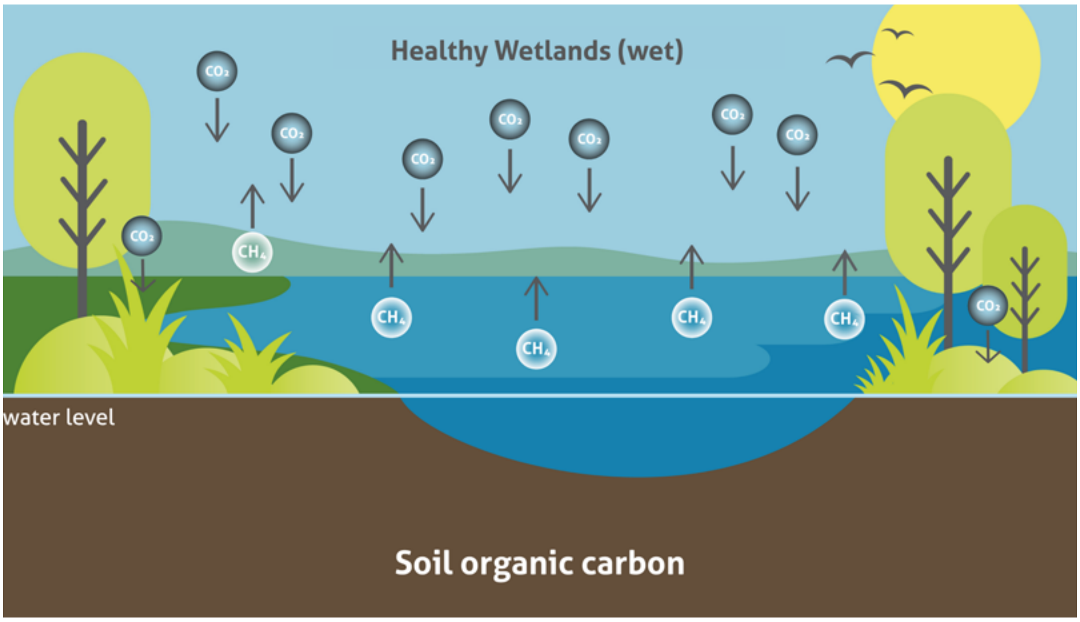

Figure 1: *Healthy wetlands[2] (wet).*

2. Degradation of wetlands is a significant contributor to anthropogenic greenhouse gas emissions:

- Large-scale loss and degradation of wetlands caused by people, especially through drainage and other conversion, has had wide-ranging negative environmental consequences, including the continuing release of vast quantities of greenhouse gases to the atmosphere, i.e. carbon dioxide (CO_2) and nitrous oxide (N_2O) from oxidizing soil organic matter, and methane (CH_4) from drainage ditches.

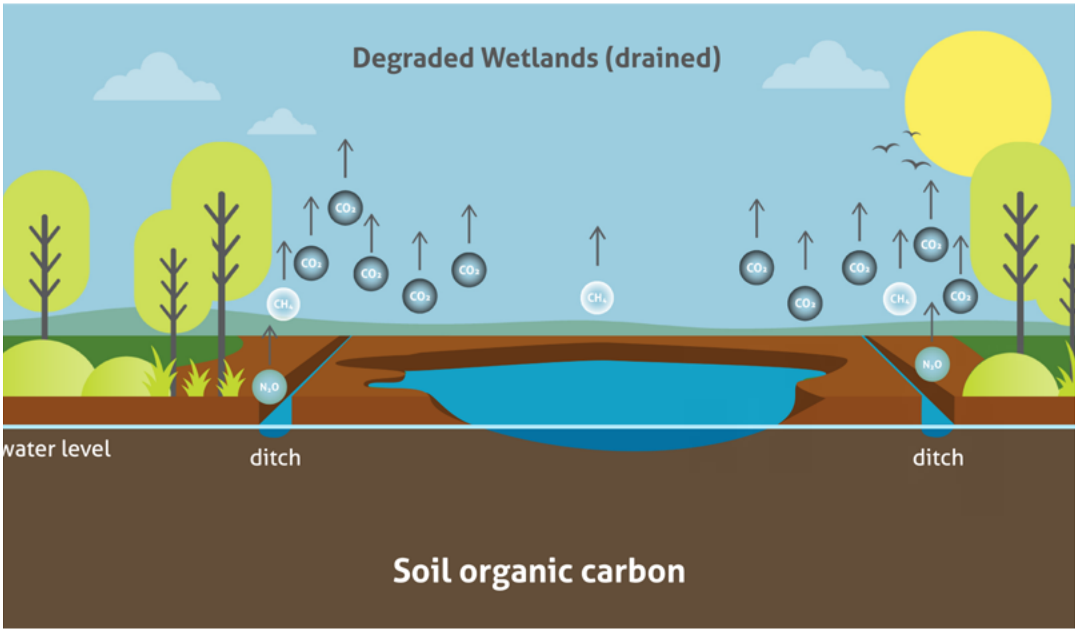

Figure 2: *Degraded wetlands (drained)*

3. The carbon sequestration resulting from wetland conservation and restoration has a lasting cooling effect on the climate and far outweighs their methane emissions:

- Restoring drained wetlands through rewetting will not only halt soil carbon loss, but may also turn the wetland back into a net carbon sink.
- Moreover, restoration helps the recovery of other vital ecosystem services associated with wetlands.
- **Wetland restoration** may result in short-term peak emissions of methane as the ecosystem recovers its natural function and creates the conditions that enable wetlands to continue sequestering and storing soil carbon. Such peak emissions can be mitigated through use of best practice techniques (see subsection 4).
- The longer-term climate benefits of restoration are much higher than maintaining the drained status quo. This is because CO_2, which is continuously emitted by drained wetlands, has a long atmospheric lifetime (centuries), accumulates in the atmosphere and thus causes continuously rising temperatures, whereas CH_4, which is continuously emitted by wet and rewetted sites, has a short lifetime (around 10 years) so that its atmospheric concentrations after some decades reach a steady state. Thus, in contrast to CO_2, do not contribute to an overall rise in global temperatures.

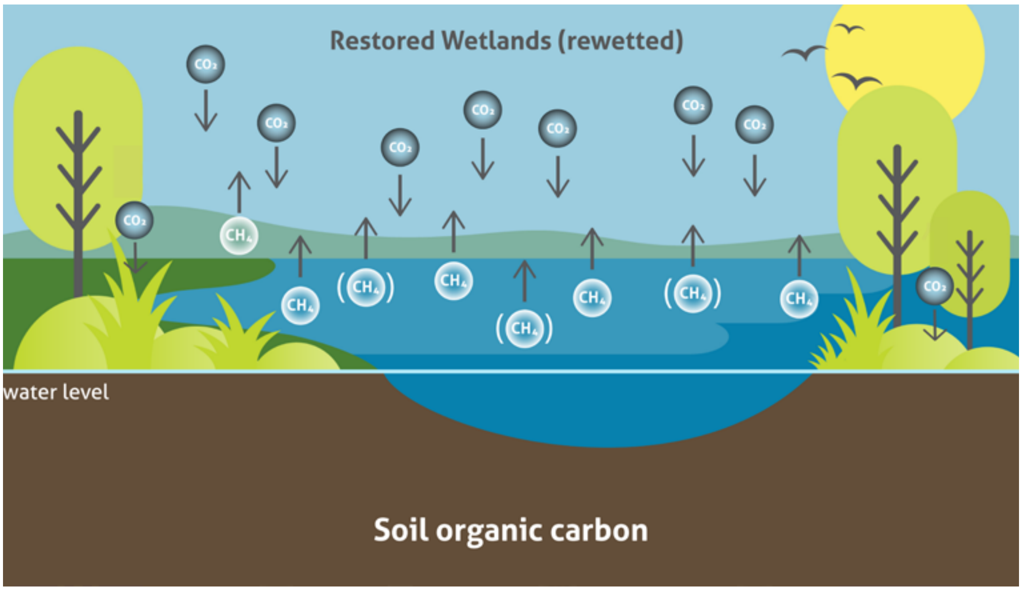

Figure 3: *Restored wetlands (rewetted). CH_4 molecules in brackets represent the possible temporary increase in CH_4 emissions, until the wetland reaches natural emission characteristics again.*

4. Methane emissions associated with rewetting can be managed and reduced[3]

- Possible peaks of methane emissions after rewetting of wetlands can be prevented and minimized with appropriate management techniques (see for instance, **Ramsar Convention on Wetlands 2021 Global guidelines** for peatland rewetting and restoration).
- Human impacts on natural wetlands, such as agricultural and wastewater pollution, as well as the creation of artificial wetlands such as rice paddies, reservoirs and farm ponds, have all contributed to increased methane emissions. These emissions are anthropogenic, and must be mitigated through improved land, water and biota management and pollution control.

Suggested reading:

Convention on Wetlands. (2021). Global guidelines for peatland rewetting and restoration. Ramsar Technical Report No. 11. Gland, Switzerland: Secretariat of the Convention on Wetlands. https://www.ramsar.org/sites/default/files/documents/library/rtr11_peatland_rewetting_restoration_e.pdf

Convention on Wetlands (2021) Restoring drained peatlands: A necessary step to achieve global climate goals. Ramsar Policy Brief No. 5. Gland, Switzerland: Secretariat of the Convention on Wetlands. **https://www.ramsar.org/document/ramsar-policy-brief-5-restoring-drained-peatlands-a-necessary-step-to-achieve-global**

Evans, C. and Gauci, V. (2023). Wetlands and methane Technical Report (Wetlands International). **https://www.wetlands.org/publications/wetlands-and-methane/**

Günther, A., Barthelmes, A., Huth, V. et al. (2020). Prompt rewetting of drained peatlands reduces climate warming despite methane emissions. Nature Communications 11, 1644 **https://doi.org/10.1038/s41467-020-15499-z**

IPCC. (2014). **2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands**. Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. & Troxler, T.G. (eds.). Geneva, Switzerland: IPCC.

Joosten, H., Sirin, A., Couwenberg, J., Laine, J., & Smith, P. (2016). The role of peatlands in climate regulation. In A. Bonn, T. Allott, M. Evans, H. Joosten, & R. Stoneman (Eds.), Peatland Restoration and Ecosystem Services: Science, Policy and Practice (pp. 63-76). Cambridge University Press. **https://doi.org/10.1017/CBO9781139177788.005**

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[2] Figures 1, 2 and 3. do not aim to show the exact relationship between the number of CO_2, CH_4 , and N_2O molecules and their climate impact, but to show the general flux in the different scenarios.

[3] See for more: IPCC, 2014: Wetlands Supplement.

In collaboration with: