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The potential of global peatland rewetting for climate change mitigation

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Vast areas of peatlands have been drained globally for agriculture and forestry causing loss of peat and consequently carbon dioxide and nitrous oxide emissions. Rewetting of these peatlands has been proposed to reduce greenhouse gas emissions for climate change mitigation.

During recent years, evidence has accumulated showing that the carbon dioxide and nitrous oxide emissions from these drained soils vary substantially depending on land-use, soil nutrient status and climate. Rewetting effectively reduces or even completely stops these emissions. On the other hand, rewetting induces methane emissions from soil, their magnitude depending largely on soil nutrient status. The effect of rewetting on climate is further complicated because of the largely different radiative efficacies and atmospheric lifetimes of carbon dioxide, nitrous oxide and methane. Thus, the effect of peatland rewetting on climate also depends strongly on the studied time interval. On peatlands drained for forestry, also carbon sequestration by trees can have a considerable effect on radiative forcing.

We combined area estimates of drained peatlands for different land-uses and climate zones with estimates on greenhouse gas emissions and removals from drained and rewetted peat soils. We then calculated the effect of global peatland rewetting on the emission/removal time series of different gases. Further, radiative forcing scenarios were constructed for each land-use and climate zone. The effect of carbon sequestration by trees was assessed in a sub study on Finnish forestry-drained peatlands. We answer the following questions: How big effect on climate a global rewetting of drained peat soils would have? How much the increased methane emissions offset the benefit of decreased carbon dioxide and nitrous oxide emissions? For which time intervals, land-uses and climate zones rewetting is an effective tool for climate change mitigation?