

EGU24-7398, updated on 20 May 2024

<https://doi.org/10.5194/egusphere-egu24-7398>

EGU General Assembly 2024

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The mitigation of greenhouse gas emissions by manipulating water table level on peat soil growing grass in eastern Finland –mesocosm and field experiments

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Finland commits to carbon neutrality by 2035. Reducing GHG emissions and strengthening carbon sequestration properties from agricultural land is on schedule. Although active agricultural peatlands account for 10% (about 310 000 ha) of total agricultural lands in Finland whereas they contribute to 60% of GHG emissions of agricultural soils. Therefore, large-scale measures are required to Finnish agricultural peatlands. Carbon dioxide (CO₂) and nitrous oxide (N₂O) are the culprit from agricultural peat soils due to increased soil aeration after peatland drainage. Evidently, the most effective way of remedy would be raising ground water close to soil surface. However, total rewetting is not feasible for food production and may result in methane (CH₄) emissions (Regina et al. 2019). There might be a viable water table level reaching the compromise, but effects of underground water elevation in a field scale have not been studied in Finland thus it is not clear about the counterbalance between GHG mitigation and grassland crop yields (under changing water table levels).

This study aimed to tackle the issues being mentioned which incorporate both field and mesocosm experiments. In the field experiment, the underground water levels are manipulated by a drainage well system separating ground water table into high and low levels. Manual chamber and snow gradient methods (Maljanen et al., 2003) were exploited measuring gas fluxes regularly between June 2021 and September 2023 (involving three growing seasons). The mesocosm study was established with the peat soil monoliths taken from the same peat site. Gas fluxes of four water level treatments (below ground -70, -50, -30, -20 cm) were measured with the same methods towards their field counterpart for one year. We will present preliminary results on how water table manipulation will affect gas fluxes and crop yields under Finnish climate.

References

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