EGU24-18878, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-18878
EGU General Assembly 2024

The impacts of peatland restoration on greenhouse gas emissions – importance of holistic carbon and water budget quantification and integration

Shane Regan[1], Mark O'Connor[1], Peter Cox[2], Mohammad Shamsuzzaman[3], Francis Mackin[4], and Owen Naughton[3]

[1]Scientific Advice and Research Directorate, National Parks and Wildlife Service, Dublin, Ireland (Shane.Regan@npws.gov.ie)
[2]Department of Civil, Structural and Environmental Engineerng, Trinity College Dublin, Dublin, Ireland
[3]Department of Civil Engineering, South East Technical University, Carlow, Ireland
[4]RPS Consulting Engineeers, Belfast, Northern Ireland

The restoration of drained peatlands is now considered to be an essential and effective natural solution to curb greenhouse gas (GHG) emissions. This is particularly relevant in Ireland, where a nationwide programme in peatland restoration is underway, backed by significant financial investment and driven by international biodiversity and climate action plans and obligations. To demonstrate the impact of restoration on GHG emissions a representative lowland peatland in the midlands of Ireland was instrumented in 2020 with an eddy covariance tower and hydrometric monitoring network measuring water levels and flow, coupled with fluorescent dissolved organic matter (FDOM) sensors and static flux-chambers. The site, All Saints Bog, was formerly used as a horticultural site, with significant drainage, though over 2m of peat remained in-situ isolating the peatland from underlying groundwater flows. Between 2021 and 2022, large scale engineering restoration management was carried out across the site and consisted mainly of the construction of contoured berms and water level control stations. Prior to the start of the restoration the baseline emission of carbon dioxide (CO_2), was in the order of 10t CO_2 per ha per year. This flux increased to c. 20t CO_2 per ha per year following restoration. It is likely this is a result of CO_2 degassing from substantial areas of open water resulting from the restoration work and the decomposition of peat organic matter from the formerly exposed substrate. Whilst the peatland system is still equilibrating and stabilising after restoration, the loading of dissolved organic carbon (DOC) has decreased significantly, due mainly, to the reduction in runoff on account of an increase in water storage on the site. So whilst the land based CO2 emissions have increased significantly, and also methane (CH_4), DOC has reduced and overall the net increase in C is marginal. The results indicate that until ecology reforms substantially across the site, it will take time for the land-atmosphere C-emission to be significantly reduced from the baseline levels preceding restoration. However, fluvial C losses are reduced due to enhanced water storage, and the overall net C emission has not increased significantly, and will reduce in the long-term. This study demonstrates that long-term, system-based studies are critical when interpreting ecosystem dynamics, carbon budgets and the short to long-term impacts of restoration management.