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Effects of peat inversion on carbon balance and GHG emissions in agricultural peatland

Mounir Takriti[1], Miyuru Gunathilake[1], Synnøve Rivedal[2], Bjørn Kløve[1,3], and Peter Dörsch[4]
[1]Norwegian Institute of Bioeconomy Research, Division of Environment and Natural Resources, Ås, Norway (mounir.takriti@nibio.no)
[2]Norwegian Institute of Bioeconomy Research, Division of Food Production and Society, Fureneset, Norway
[3]University of Oulu, Water, Energy and Environmental Engineering, Oulu, Finland
[4]Norwegian University of Life Sciences, Faculty of Environmental Sciences and Natural Resource Management, Ås, Norway

The need to mitigate climate change has shifted practices and policy towards restoration and sustainable use of agricultural peatlands as a means to protect carbon (C) stores and other ecosystem services. However, a significant percentage of peatlands in Europe are still maintained under drainage and in use as agricultural land, resulting in continuing loss of soil organic C and CO_2 emissions. Mineral soil addition has been used in different regions to improve the agronomic performance of agricultural peatlands, with conflicting effects on GHG emissions reported in the literature. In Norway, “peat inversion” has been employed since the 1970s as an alternative drainage method. Under peat inversion, previously drained peat is covered with a layer of mineral soil excavated from underneath the peat. It has been proposed that peat inversion protects C stores by limiting aerobic decomposition. Data from previous field trials indicate that peat inversion reduces oxygen content in the peat during dry conditions and reduces CH_4 emissions under poor drainage conditions. However, the effect on C-budgets, i.e., the balance of gross primary production and ecosystem respiration, remains unknown. We present results from an ongoing study comparing peat inversion with conventional drainage in a peatland used for grass production in Western Norway. Chamber flux measurements are used in combination with continuous measurements of meteorological and soil conditions, as well as biomass exports, to establish annual C budgets. Preliminary results indicate that peat inversion reduces ecosystem respiration under dry conditions without reducing overall productivity.