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Insights into the carbon dynamics of a wasted peatland under long term drainage and intensive agriculture.

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Lowland fen peatlands in East Anglia, United Kingdom (UK), have had a long history of drainage and agricultural use, with some having been drained for several centuries. This has led to the loss of up to 4.0 m of the original peat layer through initial consolidation and subsequent decomposition.

Today, the primary land use of these peatlands is intensive arable and horticultural agriculture, resulting in continued loss and degradation of the remaining peat layer. This has led to the classification of a large part of these peatlands as 'wasted' - i.e. the peat-forming vegetation has been lost along with a significant depth of peat and the underlying mineral layer increasingly determining soil properties.

Despite a significant fraction of the UK lowland peatlands being classified as wasted (1922 km^2 or 13.5%), there have been no previous studies of the carbon (C) emissions from these peatlands. Studies on non-wasted 'deep' agricultural peatlands (peat depths > 1m) suggest emission factors of 5.2 to 8.3 t CO_2-C ha^{-1} yr^{-1} indicating the potential for wasted peatlands, despite having a lower soil organic C content, to still generate large emissions representing a significant component of the UK's national greenhouse gas inventory.

Using Eddy Covariance, the CO_2 emissions of two co-located fen peatlands within East Anglia under similar intensive agriculture were quantified throughout 2018-2020. The first site, EN-SP3, is a wasted fen peatland where the surface organic layer has been depleted to <40cm. The second site, EF-DA, is a deep peat with an organic soil layer >1m deep. We present initial analysis of C emissions data from EN-SP3, which represent the first emission estimates from a wasted agricultural fen peatland in the UK, in comparison with data collected from EF-DA, the co-located deep peat agricultural fen peatland, over the last ~6 years.

Preliminary analysis of the first full year of emissions data from the wasted peat site (EN-SP3) indicates an approximate net C balance of 5.4 t C ha^{-1} yr^{-1} (17^{th} May 19 – 17^{th} May 20, Celery crop following a Phacelia & Buckwheat cover crop), whilst there was a higher estimated rate of emission during the previous year under a maize crop (222 days; 4^{th} May 18 – 11^{th} Dec 18) indicating a net C balance of 4.7 t C ha^{-1} over the 222 day period. These data compare with 7.8 - 11.2 t C ha^{-1} yr^{-1} from

between 2012-2019 from the deep peat site (EF-DA). We highlight key differences between sites, enabling us to draw early insights into how C dynamics may differ between shallow and deep lowland agricultural peat soils.