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Natural and restoration peatland pools contain mainly contemporary carbon

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Peatlands accumulate soil carbon (C) over millennia and are a globally important long-term terrestrial C store. This C store is at risk of destabilisation by climate and human disturbance. Many peatlands have pools or ponds at the surface which often contain very high C concentrations in organic (dissolved and particulate organic C) and gaseous (CO_2 and CH_4) forms. The radiocarbon composition (^{14}C) of this C can tell is where these high C concentrations are primarily generated; i.e., from contemporary primary production or C released from deeper, old peat layers due to destabilisation. We present novel ^{14}C and stable C ($\delta^{13}C$) isotope data from six peatland pool locations in the United Kingdom. Our data are from two distinct pool types: natural peatland pools and those formed by ditch blocking efforts to rewet peatlands (restoration pools). We focus on dissolved and particulate organic C and dissolved CO_2, with additional sediment, CH_4 and ebullition (bubble) observations (total n = 97). The majority of pools contained mainly contemporary C, with the most C (~50-75%) in all forms being younger than 300 years old. Both natural and restoration pools were found to transform and decompose organic C in the water column and emit CO_2 to the atmosphere. Mixing with ambient atmosphere and subsequent greenhouse gas emissions were more evident in the generally larger natural pools. Little evidence of deep, old C was found either in natural or restoration pools, even though there is substantial old C in the surrounding peat matrix. We did observe some potential evidence for old C emission via CH_4 ebullition, however. Our results suggest that some millennial-aged C can be emitted by peatland pools. But the overwhelming age of C in our sampled pools was contemporary. Our results suggest that restoration pools formed by management interventions such as ditch blocking can be effective at preventing the release of old C via the aquatic pathway.