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Carbon concentrations and transformations in peatland pools

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Peatland pools may act as important features for aquatic and gaseous carbon production, transformation and release. Peatland restoration often results in new pools being created. Here we compare aquatic carbon concentrations in nearby natural and artificial pool systems monitored at three sites in northern Scotland over a three-year period. We found significant differences in pool water carbon concentrations between pool types with larger dissolved organic carbon (DOC) and dissolved carbon dioxide (CO_2) in artificial pools. The differences were strong for all sites and occurred in all seasons. Importantly, the DOC outflows from natural pools were markedly lower than the DOC flowing into natural pools showing that processes in these pools were transforming and removing the DOC. These effects were not found in the artificial pools. Data on the composition of the DOC (absorbance ratios, specific ultraviolet absorbance) suggested that natural pools tended to have DOC that had been processed, and was older (radiocarbon dating) while the DOC in artificial pools was young and had not undergone much biochemical processing. Slope position was an important factor influencing pool DOC with those pools with a longer upslope contributing area and collecting water with a longer hillslope residence time having larger DOC concentrations. Dissolved methane (CH_4) concentrations were not significantly different between pool types but the concentrations were always above atmospheric levels with values $\sim$ 200 times atmospheric concentrations not uncommon. Dissolved CO_2 concentrations in the artificial pools were extremely large; typically $\sim$20 times atmospheric levels while those in natural pools were typically only just above atmospheric levels. The pools were strong sources of CH_4 and CO_2 evasion from the peat system. The smaller size of the artificial pools means that more of their CO_2 is stored in the water until it reaches the stream system, while the larger natural pools have sufficient wind and wave action to facilitate on site release of CO_2 from the pools.