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CO_2 and CH4 exchange from ditch networks in two floodplain fens.

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Historically, many peatlands were drained using ditches. These ditches are now often used to control water levels in sites under conservation management, though they can be a significant atmospheric source of both CO_2 and CH4. Studies have already been undertaken on ditches in ombrotrophic peatlands (bogs), but little work has been done on C exchanges in drainage ditches in floodplain fens. This study quantified C exchange in drainage ditches at two floodplain fens, Sutton Fen (52°45'N 001°30'E) and Strumpshaw Fen (52°36'N 001°27'E), in The Norfolk Broadlands of England.

C exchange was quantified between 19th June 2012 and 2nd September 2013 using floating static chambers. Ecosystem respiration (Reco), net ecosystem exchange (NEE) and CH4 fluxes were measured and a seasonal pattern was observed in all three, with the highest fluxes in late summer. Both sites were sources of CO_2 and CH4. The few previous studies of C fluxes from ditches in floodplain fens have suggested flux ranges of 69.6 to 199 mg CO_2 m2 h-1 for both Reco and NEE, and 1.2 to 366 mg CH4 m2 h-1 (positive means a flux to the atmosphere). For Reco, NEE and CH4, our values were generally at the higher end of the reported values. Reco ranged from 3.66 to 420.18 mg CO_2 m-2 h-1 and 28.35 to 257.07 mg CO_2 m-2 h-1 for Sutton and Strumpshaw, respectively. The highest flux was observed in September 2013 at Strumpshaw (506.03 mg CO_2 m-2 h-1). NEE ranged from -80.64 to 786.2 mg CO_2 m-2 h-1 and -70.72 to 229.75 mg CO_2 m-2 h-1 for Sutton and Strumpshaw, respectively. The majority of NEE fluxes were positive (a source), apart from April, June and July 2013, where a small uptake occurred. Sutton had significantly greater CH4 emissions than Strumpshaw, with values ranging from 0.46 to 733.72 and 0.05 to 89.11 mg CH4 m-2 h-1, respectively. This difference may have been related to ditch water SO42- concentrations, which were higher at Strumpshaw (23.11 $\pm$ 1.26 mg L-1) than at Sutton (17.78 $\pm$ 1.68 mg L-1), Increased sulphate concentrations can suppress methanogenesis by favouring sulphate-reducing bacteria, which out compete methanogens for labile C. This research shows the importance of surface water bodies in floodplain fens as a significant source of C and further research is needed into these environments.