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Anthropogenic and geomorphic controls on peatland dynamics in contrasting floodplain environments during the Holocene and its impact on carbon storage

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Peatlands are an important store of carbon in terrestrial environments, and scientific interest in peatlands has increased strongly in the light of the recent global climatic changes. Much attention has been paid to peatland dynamics in extensive arctic and boreal wetlands or to blanket peat in temperate regions. Nevertheless, long-term dynamics of peat in alluvial wetlands in temperate regions remains largely underresearched. In this study, data from three contrasting environments were used to provide more insights in the anthropogenic and geomorphic controls on peatland dynamics. The results show a high variability in alluvial peatland dynamics between the different study sites. In the central Belgian Loess Belt, alluvial peatlands developed during the early Holocene but gradually disappeared from the Mid-Holocene onwards due to the gradual intensification of agricultural activities in the catchment and consequent higher sedimentation rates in the floodplain system. The end of peat growth is shown to be diachronous at catchment scale, ranging between 6500 and 500 cal a BP. The disappearance of the alluvial peatlands has important implications since it potentially reduces the storage of locally produced C. Nevertheless, it was shown that this reduced production of local C but was outbalanced by the burial of hillslope derived C. Also within the sandy catchments of the Belgian Campine region alluvial peatlands initiated in the early Holocene but, here, they abruptly disappeared in the Mid-Holocene before the onset of intense agricultural activities in the catchment. This suggests that for the sandy regions, anthropogenic impact on peatland dynamics is less important compared to natural factors. For these regions, the disappearance of alluvial peatland formation resulted in a sharp decline in alluvial carbon storage as there is no compensation through hillslope derived C input. For the upper Dee catchment in NE Scotland, Holocene carbon floodplain storage varies strongly along the river gradient as a result of varying geomorphic conditions and changes in hillslope-valley connectivity that control alluvial peatland formation. Overall, alluvial peatland dynamics are shown to be highly variable, in space, timing, rate of changes and controlling factors. This has important implications on C-storage studies and questions the possibilities of extrapolation of single site studies towards larger areas.