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Impact of human-induced soil erosion on the terrestrial carbon cycle: a Holocene perspective

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Recently, the diverging view whether soil erosion is a source or sink of atmospheric CO_2 dominated the discussion of studies on human-induced impacts of soil erosion on the terrestrial carbon budget. These studies typically focused on timescales <100 years, disregarding the long-term agricultural impact starting several thousand years ago. Here I present the first assessment of sediment-bound OC storage in Central Europe from a synthesis of sedimentary archives and highlight the importance of long-term carbon burial on hillslopes and in floodplains.

The results show that hillslopes retain hitherto unrecognized high amounts of eroded soils and exceed floodplain storage in drainage basins < $10^5 km^2$. In terms of carbon burial, OC concentrations in floodplains are much larger than those on hillslopes, and net OC accumulation rates in floodplains (0.7 ± 0.2 g C $m^{-2}a-1$) surpass those on hillslopes (0.4 ± 0.1 g C $m^{-2}a^{-1}$) over the last 7500 years.

To put these estimates into perspective, the estimated hillslope and floodplain-OC storage was compared with C-emissions as a result of anthropogenically induced land cover change. Total Holocene carbon burial in floodplains and on hillslopes in Central Europe is in the same order as carbon emission of human induced deforestation. These results challenge the Ruddiman (2003) hypothesis of the early human impact on the global carbon budget.

Ruddiman, W.F., 2003. The anthropogenic greenhouse era began thousands of years ago. Climatic Change, 61(3): 261-293.