



## **Gully catchment as sediment sinks, not just a source**

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Catchment wide sediment fluxes have been modified throughout the Anthropocene, but its spatial and temporal dimension is still under debate. Here, we present a long-term sediment budget, highlighting the overlooked role of gullies as significant sediment sinks, and challenging the prevalent view of gullies as being exclusively conveyor belts of sediment. This is important, as sediment delivery from hillslopes to trunk streams represents a significant pathway of mass transfer in the landscape, with a large fraction facilitated by gully systems. In this study, we analysed the sediment mass balance and storage dynamics within a headwater gully catchment in central Europe over the last ~12 500 yrs. Human induced erosion resulted in hillslope erosion rates ~2.3 times higher than under naturally de-vegetated conditions during the Younger Dryas. However the total sediment inputs to the gully system (and therefore gully aggradation), were similar. Net gully storage has consistently increased to become the second largest term in the sediment budget after hillslope erosion (storage is ~45% and ~73% of inputs during two separate erosion and aggradation cycles). In terms of the depletion of gully sediment storage, the sediment mass balance shows that export beyond the gully fan was not significant until the last ~500 years, due to reduced gully fan accommodation space. The significance of storage effects on the gully sediment mass balance, particularly the export terms, means that it would be difficult to determine the influences of human impact and / or climatic changes from floodplain or lake sedimentary archives alone and that the sediment budgets of the headwater catchments from which they drain are more likely to provide these mechanistic links.