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# Soil erosion and watershed carbon budget: the need for a multifaceted approach

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There are diverging views as to whether soil erosion (displacement and sedimentation of soil organic C) represents a net C source or sink. There are several fates for eroded C including mineralization during transport, entrapment in upland deposits (grass filters and riparian buffers) and burial in lakes and fluvial reservoirs. The environmental factors controlling these fates must be identified and quantified in order to reduce uncertainties and properly account for the net impact of soil erosion on watershed C budget. In this presentation, data will be presented to question both sides (source/sink) of the argument.

1. Mineralization of eroded C during transport and its retention in upland deposits were investigated at the North Appalachian Experimental watershed (Ohio, USA). Results showed that between 20 and 35% of C mobilized by water erosion could be mineralized depending on rainfall energy (less degradable material mobilized during heavy storms). Additional studies, involving $^{13}C$ distribution in eroding and depositional landscapes, have also documented the retention of up to 55% of eroded C in non-cultivated swales and grass buffers downslope of cultivated watersheds. It was also observed that these depositional zones contain more C than could be accounted for by direct burial of eroded C suggesting possible intersections between nutrient retention (N, P) and enhanced primary productivity in these settings.

2. Between 2005 and 2008, measurements of greenhouse gases (GHG) fluxes were made at a fluvial reservoir in central Indiana (USA). During the study period, $CO_2$, $CH_4$ and $N_2O$ fluxes averaged 1960, 10.1 and 3.2 mg $m^{-2}$ $d^{-1}$, respectively. During the 2006 growing season, 36 of the $CH_4$ and 65 % of the $N_2O$ effluxes occurred after a single major discharge event that was preceded by a long period of low flow (dry summer). These results suggest that if such hydrological events were to become more frequent in a changing climate, they could easily tip C budget of a fluvial reservoir from a net sink to a net source. Therefore, coupling with the hydrologic cycle must be considered when assessing the net contribution of eroded C sedimentation to the global/regional C budget.

These results will be discussed with emphasis on the multifaceted approach that is needed to advance this area of research.