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The use of δ^{15}N, δ^{13}C, AND C/N to study watershed erosion processes

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Tracers are needed to better understand and model event- or continuous-based watershed erosion. This exploratory research has investigated for the first time the use of δ^{15}N, δ^{13}C, and C/N natural tracers to study event-based erosion within a sub-watershed, Harvard Creek, ID, ($\sim$1km^2) with two distinct land-uses, namely uplands and floodplain. δ^{15}N, δ^{13}C, and C/N tracers of source-soils, collected from the upland hills and floodplain, and eroded-soils trapped at the sub-watershed outlet were sampled for three events to demonstrate the sensitivity of these tracers to identify soils originating from the uplands vs. the floodplain for the three events. The first event was categorized as non-equilibrium erosion process while the second and third events were considered as equilibrium events. As a result coarser particles were entrained during the first event and finer particles for the two subsequent events. Results revealed that δ^{15}N, δ^{13}C, and C/N tracers adequately reflect the particle size distribution of the source eroded-soils for the three events. It was shown that due to known biogeochemical processes the finer particles were enriched in δ^{15}N, δ^{13}C tracers comparatively to the coarser particles allowing the distinction of the storm events triggering the erosion. Furthermore, δ^{15}N and δ^{13}C of eroded-soils reflected the vegetative cover of the upland rills and floodplain headcuts. The ultimate goal of this study was to estimate the percentage of eroded-soil originating from the upland rills and floodplain headcuts. For this purpose, the eroded-soils collected at the outlet of the sub-watershed for the equilibrium events were unmixed to their sources using a Bayesian Markov Chain Monte Carlo unmixing model. The unmixing model provided the percentage of soil that came from the hillslope and the floodplains. The sediment yield predictions obtained by the Water Erosion Prediction Project (WEPP) and a steady-state head-

cut erosion model were compared against those obtained by the Bayesian unimixing model. The comparison substantiated the utility of the tracers to reflect erosion processes and pointed out some of the modeling limitations in coupling upland rill erosion and headcut erosion.