Sources of soil organic matter transported by soil erosion in fire-prone upland ecosystems of the Sierra Nevada

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Soil erosion can induce a terrestrial sink for atmospheric carbon dioxide and impose important controls on biogeochemical cycling of carbon (C) and nitrogen (N). A growing number of studies have investigated the role of erosion on biogeochemical cycling of different elements. However, considerable uncertainty still exists on the sources of the eroded C and N that is laterally redistributed to lower-lying depositional landform positions or exported out of the eroding catchments. We used stable isotopes of C and N, and solidstate ^{13}C-NMR to determine the sources of eroded material exported out of headwater catchments in the Kings River Experimental Watersheds project in the southern part of the Sierra Nevada, California, USA. Our findings show that the majority of material exported out of these headwater catchments is derived from the forest floor and stream bank erosion. In these steep landscapes where surface material is preferentially eroded, the laterrally distributed organic matter could be readily decomposed. The fate of this soil organic matter (SOM), however, depends on the availability of physical and chemical stabilization mechanisms in the final depositional settings for the eroded SOM. We also find that eroded sediment rich in particulate organic-matter- forms macroaggregates by association with small and reactive soil minerals that are transported along with the SOM. Our results suggest that macroaggregate formation is an important mechanism for the physical stabilization of the eroded SOM once it arrives at depositional landform positions.