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Soil and soil organic carbon redistribution in agricultural ecosystems

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Patterns of soil organic carbon (SOC) vary widely across the landscape leading to large uncertainties in the SOC budget of agricultural systems especially for landscapes where water, tillage, and wind erosion redistributes soil and SOC across the landscape. It is often assumed that soil erosion results in a loss of SOC from the agricultural ecosystem, but recent studies indicate that soil erosion and its subsequent redistribution within fields can stimulate carbon sequestration in agricultural ecosystems. This study investigates the relationship between SOC and soil redistribution patterns on agricultural landscapes. Soil redistribution (erosion and deposition) patterns were estimated in three tilled agricultural fields using the fallout 137Cesium technique. 137Cs and SOC concentrations of upland soils are significantly correlated in our study areas. Soils in upland areas (eroding) have significantly less SOC than soils in deposition areas. SOC decreased as gradient slope increases and soils on concave slopes had higher SOC than soils on convex slopes. These data suggest that soil redistribution patterns and topographic patterns may be used to help understand SOC dynamics on the landscape. Different productivity and oxidation rates of SOC of eroded versus deposited soils also contribute to SOC spatial patterns. However, the strong significant relationships between soil redistribution and SOC concentrations in the upland soil suggest that soil and soil organic matter are transported along similar physical pathways in these systems. Our study also indicates that landscape position is important for understanding soil movement and redistribution patterns within a field or watershed. Such information can help develop or implement management systems to increase SOC in agricultural ecosystems.