

Plant root material makes a substantial contribution to the soil organic carbon (C) pool, but this contribution is disproportionate below 20 cm, where 30% of root mass and 50% of soil organic C is found. Root carbon inputs changed drastically when native perennial plant systems were shifted to cultivated annual plant systems. We used the reconstruction of a native prairie and a continuous maize field to examine both the relationship between root carbon and soil carbon and the fundamental rooting system differences between the vegetation under which the soils developed versus the vegetation under which the soils continue to change. In all treatments we found that root C:N ratios increased with depth and this plays a role in why an unexpectedly large proportion of soil organic C is found below 20 cm. Measured root C:N ratios and turnover times along with modelled root turnover dynamics showed that in the historical shift from prairie to maize, a large, structural-tissue dominated root C pool with slow turnover, concentrated at shallow depths was replaced by a small, non-structural-tissue dominated root C pool with fast turnover evenly distributed in the soil profile. These differences in rooting systems suggest that while prairie roots contribute more C to the soil than maize at shallow depths, maize may contribute more C to soil C stocks than prairies at deeper depths.