Subsurface soil carbon and nitrogen losses offset surface accumulation in abandoned agricultural fields

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Abstract

Abandoned agricultural fields are thought to accumulate soil organic matter after cultivation cessation. Most research on soil C and N sequestration has focused on the surface and overlooked their dynamics below 30 cm. With 13-year long-term surveys of 21 old field, we found soil C and N accumulated by 30.5 ± 6.5 g C m^{-2} yr^{-1} and 2.41 ± 0.49 g N m^{-2} yr^{-1} in the surface (0-20 cm) yet decreased by 64.6 ± 12.5 g C m^{-2} yr^{-1} and 6.83 ± 1.34 g N m^{-2} yr^{-1} in the subsurface (20-100 cm). Such C and N losses in subsurface soil can be attributed to the shallow root distribution, which is likely caused by the continuing dominance of non-native and shallow rooted C3 grasses and the lack of legumes after abandonment. Thus, vegetation changes are a legacy effect of agriculture that leads to ongoing soil C losses in abandoned agricultural fields.

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