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Restoration and management effects on litter decomposition and microbial functioning in the Chicago Wilderness

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Ecological restoration seeks to restore the entire ecosystem, including not only native organisms, but also ecological processes, to support long-term sustainability. The decomposition of leaf litter is recognized as an important component of ecological process in terrestrial ecosystems, and provides the most important source of nutrients and organic matter to plant roots and soil organisms. However, the impact of restoration and land management on these process is poorly documented. We investigated the impacts of aboveground restoration practices on leaf litter decomposition and functional microbial diversity. Mesh litterbags containing Andropogon gerardii, Rudbeckia subtomentosa or Baptisia australis, (representing a grass, forb and legume species, respectively) were installed in 24 study sites that comprise a subset of the Chicago Wilderness Land Management Research Program (100 Sites for 100 Years). These sites include remnant prairies and former row-crop prairie restorations that are replicated along a restoration chronosequence. Across these sites, increasing time under management is associated with decreasing soil fertility and plant community composition that is more similar to high quality reference prairies. We measured decomposition as mass loss in the field, and evaluated functional microbial diversity as the activity of extracellular enzymes that catalyze the degradation of leaf litter. The largest differences in decomposition occurred between litter types rather than between sites of differing management histories, and there was no direct relationship between mass loss and enzyme activity. However, enzyme activity was highly variable among litter types and sites. Such variations in enzyme activity among litter types suggest that the strong differences in litter chemical and physical properties may have overwhelmed any direct relationship between enzyme activity and mass loss. These results suggest that land use history and management practices may influence plant community development, and but have less influence on decomposition through mass loss or enzyme activity.