Ecological restoration using litter transplants increases decomposition rates and alters detritivore communities

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Abstract

Habitat degradation and the associated reductions in ecosystem function can be reversed by reintroducing or 'rewilding' keystone species. Rewilding projects have historically targeted restoration of processes such as grazing regimes or top-down predation effects. Few projects have focussed on restoring decomposition efficiency, despite the pivotal role decomposition plays in global carbon sequestration and nutrient cycling. Here, we tested whether rewilding entire communities of detritivorous invertebrates and microbes can improve litter decomposition efficiency and restore detritivore communities during ecological restoration. Rewilding was conducted by transplanting leaf litter and soil, including associated invertebrate and microbial communities from species-rich remnant sites into species-poor, and geographically isolated, revegetated farmland sites. We sampled pre- and post-rewilding communities, comparing remnant, rewilded revegetation, and control revegetation sites for litter decomposition and the abundance and diversity of detritivorous invertebrates and microbes. We also quantified the effect of detritivores on the rate of litter decomposition using piecewise Structural Equation Modelling. Decomposition was significantly faster in rewilding sites than both control and remnant areas and was largely driven by a greater abundance of invertebrate detritivores. Similarly, the abundance of invertebrate detritivores in rewilding revegetation sites exceeded the level of remnant communities, whereas there was little difference between control and remnant sites. In contrast, saprotrophic fungi contributed little to decomposition. Areas selected for agriculture were likely more productive than remnant sites, suggesting that restoration sites have the capacity for higher decomposition rates and more abundant detritivore communities than target remnant sites. Importantly, our findings suggest that the novel and relatively simple act of transplanting leaf litter can increase functional efficiency during restoration and alter community composition. Our methods may prove important across a range of contexts where other restoration methods have failed to restore ecosystem processes to pre-degradation levels.

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