

Responses of soil, herbaceous vegetation and ants to woody debris additions in restored old fields in a multi-site Before-After-Control-Impact experiment

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Abstract

Ecological restoration of former agricultural land can improve soil condition, recover native vegetation, and provide fauna habitat. However, restoration benefits are often associated with time lags, as many attributes, such as leaf litter and coarse woody debris, need time to accumulate. Here we experimentally tested whether adding fine and coarse woody debris to a decade-old restoration sites can accelerate restoration benefits. We used a Multi-site Before-After / Control-Impact design to test the effects on 30 response variables over a period of two years, including those describing soil physical and biochemical properties, herbaceous vegetation and ant communities. We analysed the data using linear mixed-effect models and perMANOVAs. Of the 30 response variables, a significant effect of mulch or log additions was found for just four variables: volumetric water content, decomposition of tea leaves, native herbaceous species cover and species richness of opportunistic ants. Mulch addition had a positive effect on soil moisture when compared to controls but suppressed growth of native (but not exotic) herbaceous plants. Whilst other soil properties such as organic matter and dissolved organic carbon showed a positive response to mulch addition, the effect was not statistically significant. On plots with log additions, decomposition rates of tea leaves decreased, and species richness of opportunistic ants increased. However, we found no effect on total species richness and abundance of other ant functional groups. The benefit of mulch to soil moisture was offset by its disbenefit to native herbs in our study. Logs increased species richness of opportunistic ants, but given time, may provide habitat for cryptic species. Indeed, benefits to other soil biophysical properties, vegetation and ant fauna may require longer timeframes to be detected. Further research is needed to determine whether the type, quantity and context of mulch and log additions may improve restoration outcomes.

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