Effects of Forest Restoration on the Recovery of Dead Wood, Associated Arthropods, and Insect-mediated Wood Decomposition

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Abstract
Dead wood represents 8% of terrestrial carbon stocks and is an important source of habitat and food for decomposer and non-decomposer arthropods. However, anthropogenic disturbance reduces the amount of dead wood, putting at risk the presence of habitat that is essential for arthropods and other organisms that depend on it. Forest restoration aims to assist the recovery of ecosystems that have been damaged or destroyed and could be a means to recover both dead wood and its associated arthropod communities. This doctoral dissertation focuses on answering three overarching questions which have been largely unexplored within the context of tropical forest restoration. (1) What is the effectiveness of forest restoration at recovering dead wood volumes as they are found in reference forests? (2) How do different restoration strategies affect arthropod-mediated dead wood decomposition? and (3) How do different restoration strategies affect arthropod communities in the proximity of dead wood?

My study took place in a premontane tropical rainforest in southern Costa Rica, and in two broadly used restoration strategies, restoration plantations and natural regeneration. We used forests >100 years old as our reference ecosystem. We found that restoration plantations recover 40% of dead wood volumes in only 17 years whereas natural regeneration recovers virtually no dead wood in the same amount of time. We also found that neither restoration treatment nor arthropod colonization affected dead wood decomposition during the first year. Finally, we found that soil and litter-inhabiting arthropod abundances are higher in reference forests, intermediate in plantations, and lowest in natural regeneration. Moreover, proximity to dead logs did not have an effect on arthropod communities with the exception of ants which were richer closer to logs compared to far away from them. Overall, our study shows that forest restoration is effective at recovering dead wood and at hosting arthropod abundances as they are found in reference forests. Further research is required on the effects of insect-mediated dead wood decomposition over a longer timeframe. Finally, to assess the efficiency of restoration at accelerating the recovery of arthropod communities, arthropods should be surveyed in recently abandoned cattle pastures.

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