How important are microhabitats, litter traits and decomposer communities for stream and soil litter decomposition in a tropical rainforest

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Abstract

Plant leaf-litter decomposition is a major determinant of energy and nutrient sources in forested terrestrial and aquatic ecosystems. Despite known similarities of biochemical processes (C and nutrient cycling), both ecosystems exhibit functional singularities and only few studies compare decomposition across both ecosystems. Also, decomposition is driven by a vast diversity of organisms among which invertebrates communities are supposed to play a key role. However, in the tropical rainforests, their influence in the decomposition process and the ecosystem functioning remains poorly understood and it is even truer across both ecosystems. In order to understand of how invertebrate communities of both microhabitats control leaf-litter decomposition we first described particularities of terrestrial (soil) and aquatic (streams) communities associated to leaf-litter and then we conducted a 100 days decomposition aquatic and terrestrial field study with 17 leaf-litter tree species in a tropical forest of Yasuní National Park, Ecuador. Invertebrate communities showed deep spatial and structural differences across both ecosystems. Soil communities were 5 times richer in morphospecies and were more heterogeneously distributed in space than aquatic ones. In contrast, biovolume and abundance between morphospecies were largely more heterogeneous in streams. Our experiment revealed global equal leaf-litter decay rates in soil and streams, but with significant differences between species. Results also underlined the consistent importance of litter traits for decomposition processes across ecosystems. Among these traits, micronutrients concentrations (mainly Mn and Cu) appeared to significantly control litter decay. We also identified high variability of decomposition in both ecosystems with a larger one in streams. In the soil, variability was mainly related to site location, i.e. to local-scale microhabitat particularities such as the associated decomposer community. In streams, variability was more stochastic and related to large key species presence (*Machrobrachium sp.*) in litter bags consuming at "micro-scale" a great quantity of litter.

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