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Nutrient scarcity strengthens soil fauna control over leaf litter decomposition in tropical rainforests

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Soil fauna is a key control of the decomposition rate of leaf litter, yet its interactions with litter quality and the soil environment remain elusive. We conducted a litter decomposition experiment across different topographic levels within the landscape replicated in two rainforest sites providing natural gradients in soil fertility to test the hypothesis that low nutrient availability in litter and soil increases the strength of fauna control over litter decomposition. We crossed these data with a large dataset of 44 variables characterizing the biotic and abiotic microenvironment of each sampling point and found that microbe-driven Carbon (C) and Nitrogen (N) losses from leaf litter were 10.1 and 17.9 % lower, respectively, in the nutrient-poorest site but this among-site difference was equalized when meso- and macrofauna had access to the litterbags. Further, on average soil fauna enhanced the rate of litter decomposition by 22.6%, and this contribution consistently increased as nutrient availability in the microenvironment declined. Our results indicate that nutrient scarcity increases the importance of soil fauna on C and N cycling in tropical rainforests. Further, soil fauna is able to equalize differences in microbial decomposition potential thus buffering to a remarkable extent nutrient shortages at an ecosystem level.