Spatial distance, not environmental heterogeneity, explains fine-scale patterns of ß-diversity in multiple life stages of logged tropical forest trees

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Abstract

Selective logging of tropical forests substantially alters the composition and spatial arrangement of plant communities. Previous studies examining logged-forest tree assemblages have focused primarily on adult communities, leaving major knowledge gaps regarding the diversity patterns of earlier life stages. A key question is to elucidate the temporal dynamics of community assembly in human-modified forests. Sampling 8,664 sapling, juvenile, and adult trees from a heavily logged forest in Sabah, Malaysian Borneo, we tested whether compositional variation and the relative importance of different environmental and spatial factors explaining patterns of ß-diversity differed between life stages, and whether dissimilarity was driven by species turnover or nestedness. We found positive ß-deviations in all communities, consistent with a strong influence of assembly processes that result in aggregated spatial distributions of individual species. Across life stages, ß-diversity was largely explained by spatial distance, rather than measures of environmental heterogeneity. Dissimilarity was driven by species turnover not nestedness, with compositional variation in early life stages strongly correlated with turnover in adult communities. Collectively, our findings indicate that despite increased spatial heterogeneity in forest structure, liana infestation, and canopy openness post-logging, these factors do not sufficiently explain fine-scale patterns of tree composition. Alternatively, diversity patterns of earlier life stages more closely reflect potential assembly processes related to aggregated adult distributions and associated dispersal limitations resulting from spatial variation in logging activity.

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