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Distance Correlations Do Not Scale with Size Correlations of Tree Species in a Tropical Rain Forest Stand

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Abstract

Spatial patterns of forest trees have long been recognised as evidences of underlying biological processes within the forests. We used point pattern analysis methods and process-based models to uncover the demography and dynamics of trees in a primary rainforest stand.

A fully mapped 1 ha plot was investigated in the tropical rain forest, Cucphuong National park, Vietnam. Trees were stem-mapped, diameter-measured and classified into four life-history stages: sapling, juvenile, premature and mature based on diameter at breast height. Spatial patterns and tree size correlations of life-history stages, within species and between species were analysed using the pair-correlation and r-mark-correlation functions to reveal scale dependent patterns.

At community level, sapling and juvenile stages were clustered up to large scales, while premature and mature trees were regular and had random distributions. The strong evidence of competitive interaction was showed by distance correlations. However, tree sizes did not correlate significantly to the same tendency with tree-tree distances. In intra-specific interactions, three of four abundant species were significantly clustered while negative correlations in tree size were clearly showed within *Hydnocarpus kurzii* and *Saraca dives*. In addition, marginal repulsions were found in distance correlations approved by size correlations when considering the inter-specific interactions with dominant species.

We suggest that self-thinning was an important driver of the forest community dynamics. Clustered distributions were predominant among conspecific trees. Weak inter-specific interactions between light demanding species (*S. dives*) and other species can be explained by competition for light. High diversity of species could cause the equilibrated competition for limited resources as an overall competitive effect. Here, tree size (diameter at breast height) correlations and inter-tree distance correlations did not scale well, however they also mutual complement indicating for competitive interactions between tree individuals.

Keywords: Pair-correlation function, r-mark-correlation function, spatial point pattern analysis, tropical rain forest, Vietnam