

Adult-Recruit Spatial Association of Shorea Species Determined by Topographic Variation in a Mixed-Dipterocarp Tropical Rainforest, Sri Lanka

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The spatial distribution of recruits around conspecific adults of woody species conveys detailed insights on the mechanisms governing species co-existence in tropical rainforests. Hence, we studied adult-recruit association of eight *Shorea* species (*Shorea affinis*, *S. congestiflora*, *S. cordifolia*, *S. disticha*, *S. megistophylla*, *S. trapezifolia*, *S. stipularis*, *S. worthingtonii*) in the Sinahraja Forest Dynamic Plot, using spatial point pattern analysis. The adult-recruit spatial patterns were extracted from four censuses in 1996, 2001, 2006 and 2011 conducted at the plot. We used slope, elevation, aspect, curvature, topographic wetness index and seventeen soil nutrients as habitat variables. To assess the adult-recruit spatial relationship, we used two null models created by the pattern reconstruction method. The null model of independence distributed recruits independently on conspecific adults without considering habitat association, but maintained their observed aggregation. In contrast, the Heterogeneous Poisson Process considered additionally the effect of topographic variations. Departures from the null models were assessed by simulation envelopes and goodness-of-fit tests using the bivariate distribution function of nearest neighbor distances and the bivariate pair correlation function. *S. trapezifolia* and *S. stipularis* indicated independent placement of recruits around adults for all distance intervals of 1-120m while other species showed significant positive association, for all distance intervals of 1-50m. Thus, the majority of recruits of *Shorea* species showed positive associations with conspecifics adults at medium spatial scale which implies high interference of individuals of *Shore* species with conspecifics. Based on the fitted intensity functions of recruits, slope, elevation and soil nutrients were identified as the main environmental factors influencing the bivariate adult-recruit spatial distributions of *Shorea* species. Further, for *S. stipularis*, the fitted Heterogeneous Poisson Process described the observed pattern well (goodness-of-fit test's p-value = 0.15), which suggests that the adult-recruit pattern was mainly driven by habitat heterogeneity. However, departures from the null hypothesis of habitat heterogeneity were shown for all other *Shorea* species (goodness-of-fit tests' p-values < 0.05). We conclude that the heterogeneous environment alone is insufficient to explain the observed patterns of recruits around conspecific adults of *Shorea* species. Consequently, the impact of other mechanisms on conspecific adult-recruit association should also be studied.

Keywords: Adult-recruit association; Intraspecific; Habitat heterogeneity; Heterogeneous Poisson Process; Tropical rainforest