Community-level Convergence and Community Structure of temperate *Nothofagus* forests

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Abstract

Assembly rules represent the integrated action of species interactions leading to non-random patterns in the distributions of species niches in the combined niche space for a community or guild, i.e. to community structure. The most likely effect of assembly rules would be to limit the degree of overlap between niches that is possible.

In the present study, assembly rules were sought by looking for two types of non-random pattern that might be expected: convergence between disjunct communities in similar environments, and character overdispersion among the species within a community or guild. Convergence was sought both in species richness and in texture – assemblage-wide spectra of species functional characters. These pattems were sought within tall, evergreen temperate rainforest dominated by *Nothofagus* species.

Species occurrence, abundance and texture data were obtained for vascular plant species occurring at 17 environmentally-matched study sites in Tasmania (3 sites), mainland Australia (2 sites), New Zealand (8 sites) and South America (Chile and Argentina, 4 sites). Texture was evaluated in terms of 13 species characters, primarily conceming the structure and function of photosynthetic units (PSUs, i.e. leaves or their functional equivalents in certain species). All questions were addressed at local, regional and landmass scales. Texture convergence and character overdispersion were sought both within whole communities and within guilds, each comprising the species present within a vertical stratum.

Evidence for possible species richness convergence was sought using a bootstrap-based method to test the null hypothesis that communities were no more dissimilar in species richness than expected on a random basis. There were cases at all scales where the null hypothesis could not be rejected, providing preliminary evidence for assembly rules.

Evidence for texture convergence was sought by comparing the observed variation in texture between communities to the variation expected under a null model in which species characters could assort randomly among communities. In separate tests, texture was expressed as the community mean, distribution or mean-adjusted distribution (in which texture distributions from different communities were adjusted arlthmetically to a common overall mean). Little convergence of texture means or distributions was detected. However, when the effects of environmental differences between sites were minimised by comparing mean-adjusted distributions, convergence was detected at all spatial scales, both within and among landmasses. This provides strong evidence for similar assembly rules in the convergent communities.

Character overdispersion was sought by comparing the variance of the spacing of species values along character axes to the variance expected under a null model drawing characters at random from a kernel density distribution. Significantly low observed variances, representing

overdispersion, were detected for a number of texture variates at all scales. There were also trends, non-significant in individual tests, but significant among communities according to binomial tests, in several variates. This provides strong evidence for the operation of assembly rules.

Both convergence and overdispersion were most pronounced in the characters PSU area, succulence, specific weight, phosphorus content, total chlorophyll content and chlorophyll *a/b* ratio. Each of these characters would be expected to be associated with the light regime. This suggests that an important mechanism underlying the assembly rules observed may be competitive niche differentiation leading to partitioning of the vertical light gradient among species.

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