

Microenvironmental filtering, regeneration patterns, and tree species coexistence in a temperate forest

Chris Lusk¹, Daniel Laughlin¹

¹*University Of Waikato*

Forest ecologists researching the functional basis of tree regeneration patterns and species coexistence often attempt to correlate traits with light-gradient partitioning. However, an exclusive focus on light can overlook other important drivers of forest dynamics. We measured light, temperatures, humidity, and sapling densities in each of four phases of a forest dynamic mosaic in New Zealand: shaded understoreys, tree-fall gaps, treefern groves, and margins of clearings. We then measured leaf, wood and seed traits, as potential predictors of species' regeneration patterns. The margins of clearings had the most distinctive microclimates of the four phases, with three times as many air frosts as treefall gaps and somewhat higher summer vapour pressure deficits. Saplings of 18 out of 21 species were significantly associated with one or other of the four phases, and associations were best predicted by a two-trait model (leaf size, wood density) explaining 51% of observed variation. Species associated with treefall gaps had traits favouring light pre-emption (large leaves, low-density wood), whereas those establishing on the margins of clearings mostly had small leaves and dense wood, traits probably conferring resistance to the frosts and summer water deficits that saplings were exposed to there. The dynamics of some forests cannot be explained adequately by light-gradient partitioning through a growth vs. shade tolerance trade-off, underpinned by the leaf economics spectrum. Consideration of multiple environmental filters and multiple traits will enhance understanding of regeneration patterns and species coexistence.