Gap regeneration and forest dynamics in a lowland podocarp-broadleaved forest remnant, Keeble's Bush, Manawatu.

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"New Zealand's protected natural areas are more than just museum pieces, a window into the past. They are a source of hope, because within these areas is an abundant source of seeds, the genetic material which could be used to recreate and restore each region's distinctive forest heritage."

The living forests of New Zealand - Cobb *et al.*, 1992.

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Abstract

Gap phase regeneration and forest dynamics were investigated in a lowland podocarp-broadleaved forest remnant, Keeble's Bush, Manawatu, in order to assess its ecological integrity. To this end the seed rain (*i.e.*, viability and diversity of fresh seed input), seedling diversity and survival, and soil seed bank composition were all assessed.

A total of 40 different species were trapped in the seed rain, contributing a total of 2398 seeds/m^2/yr. A high coefficient of variation for seed number and diversity was recorded between traps, illustrating the spatial heterogeneity of the seed rain. Strong seasonal patterns were recorded in the fruiting phenology of the species trapped. A lack of red-arilled viable seeds suggested that 1992 was not a mast year for rimu.

Most of the seeds likely originated from individuals less than 50 m from the seed traps, reflecting the paucity of native frugivores to disperse seeds further, particularly those less than10 mm in size. Virtually all the adventive species trapped were herbaceous with most having wind dispersed seeds. All of them were local in origin; *i.e.*, already present within the gaps at the time of trapping.

The total number of seedlings, and the seedling densities in the two gap sites studied were very similar in both 1992 and 1993. Despite the flux of seedlings into and out of the populations at each site seedling numbers remained stable. Species diversity and number of species/m^2, varied between gaps, with the species population in Gap Two species poor compared with that in Gap One (10 species were shared, with 9 exclusive to Gap One, and 3 present only in Gap Two). Seedling mortality in Gap One fitted the well documented phenomenon of huge mortality during the initial period of establishment and growth. Seedlings in Gap Two, however, showed equal probability of mortality in all height classes. Competition (both above and below ground), browsing by exotic herbivores, drought stress, and litter burial all likely contribute to seedling mortality. The results suggest that the seedling populations in gaps differ between those gaps within the forest interior (Gap One), and those at the forest margin (Gap Two).

Seedlings from 36 species emerged and were identified from the sampled soil seed bank, contributing a total of 821 seedlings. Herbs were the most important life-form in the soil seed bank, making up 77.5% of the total seedlings. Adventive species accounted for 16 of the 36 species, 14 of which were herbaceous. Seedlings of primary forest trees contributed only 1.2% of the seedlings, and emerged from only three of the eight sampling sites. Germination was rapid with the first seedlings emerging from the soil samples within seven days of the start of the experiment; over 86% of the seedlings emerged within the first month. Adventive species dominated the seedlings emerging for the first five weeks.

The number of species and individuals which germinated decreased with soil sample depth. The highest number of seedlings and species occurred in the top 2 cm of soil, with 80% of the seedlings within the top 4 cm. The soil seed banks of the gaps were more diverse, with greater numbers of species and seedlings, compared with sites beneath intact canopy. The results of the longevity experiment suggest tawa and titoki may maintain a short-term transient seed bank, if the seeds are buried rapidly. Kawakawa seeds appear to suffer high predation/decomposition and are likely to last for a shorter period in the soil. Radiata pine does not maintain a seed bank in the soil.

Management implications for Keeble's Bush were discussed, and directions for future research suggested.

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