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

Kathryn Janet Whaley

March 1996

A thesis presented in partial fulfilment of the requirements for the degree of Master of Science at
Massey University, Palmerston North.

“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.

Acknowledgements

Many people have supported, encouraged, and assisted me during the writing of this thesis all of whom I would like to thank. It has been a rather drawn out and sporadic affair with many activities (*e.g.*, tutoring, PNA surveying and report writing and a year at Landcare Research) both enhancing and postponing its conclusion, and all of them have in their various ways kept me enthusiastic and motivated.

I would like to thank my supervisors, Heather Outred and David Fountain who have provided me with valuable help right from this study's conception. They have continued to provided support from afar for which I am very grateful.

I am also eternally grateful to Bruce Clarkson, Mark Smale, John Leathwick, John Innes, Bruce Burns, Bev Clarkson and Geoff Rogers who have all provided me with resources, encouragement, and constructive criticism since my move to Landcare Research, Hamilton.

Also thanks to Alistair Robertson who provided constructive criticism on earlier drafts, and was always willing to share and discuss information.

During my time at Massey I was lucky to be part of a dynamic and exciting group of post-graduate students and staff, many of whom have now gone on to good jobs or further study. They made my time at Massey very special and I would like to thank them all for their support and friendship; Isabel Castro, Cathy Lake, Trish Murray, Dale Towers, Jackie Townsend, Vanessa Munro, Murray Potter, Jill Rapson, Vaughan Keesing, Phil Battley, Alison Franklin and Ian Millner. Thank you too to Jonathan and his parents who gave me much love and support during my years of study.

Others who have also provided time, equipment, expertise and assistance include Jens Jorgenson, Linda Dixon, Steve Pilkington, Proseed Rotorua, who generously donated seeds to my reference collection, and Michael Greenwood, who devotes many hours to the maintenace of Keeble's Bush and the Links area. Pauline Hunt and Peter Neville drafted the location maps, and quadrat figures.

To Nathan, my love and thanks for all his support and understanding during the final months of this thesis.

And finally, to my family an extra special thank you. All of them have, at one time or other, spent days with me in the field, doing predominantly tedious tasks with few complaints!! To Mum and Dad a huge thank you for their love and encouragement, and generous financial support of my academic pursuits.

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/m²/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 than 10 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/m², 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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