

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

"The Germination, Growth and Survival
of Red Beech (Nothofagus fusca) Seedlings
in relation to Forest Regeneration."

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

Selwyn Robert June.

1974.

<u>CONTENTS</u>		Page
Abstract		1
Chapter I	Introduction	2
Chapter II	The Study Area	4
Chapter III	The Seedling Population	
Section 1.	Introduction	8
" 2.	Seed Production	9
" 3.	Germination: an experimental sowing	10
" 4.	Seedling microsites	13
" 5.	Seedling numbers	18
	(i) Densities	
	(ii) Survivorship	
"	6. Seedling height and diameter	40
"	7. Seedling ages	44
"	8. Effects of light intensity on growth and survival	48
"	9. Allelochemicals and seedling growth; a preliminary study	66
Summary		73
Chapter IV	The Tree Population.	
Section 1.	Phenology	78
" 2.	Size distribution	78
" 3.	Spatial pattern and growing site	85
" 4.	Growth form and canopy cover	91
" 5.	Growth rates and tree ages	93
" 6.	Mortality rates	95
Chapter V	Regeneration	97
Appendix		112
Acknowledgements		116
References		117

ABSTRACT

The population structures of three stands of red beech forest in the N.W.Ruahine Range are described. Seedling establishment, growth and survival is studied by means of tagged seedlings in permanent plots. Three microsite types are identified, the rotting wood microsite being the most favourable for seedling growth and survival. No seedlings survive under the extensive fern layer. Light compensation points for 1st year seedlings are 1.9% and 3.9%. Light intensities in some microsites are below the compensation point. Seedlings have established at least every 2 - 3 years in the past and seedling establishment is not solely dependent on the occasional mast seed years. A model combining estimates of densities, survival rates and mortality rates predicts that the size of the seedling population will be maintained.

Regeneration appears to be effective only in the ridge-top stand. Large canopy gaps containing few saplings and seedlings occur in all stands. Seedling numbers are limited by the availability of suitable microsites and this in turn reduces the rate of regeneration.

CHAPTER I. INTRODUCTION

Nothofagus forest covers much of this country's mountainous land where it has an important protective function in stabilizing the soil and controlling flooding. It also forms part of the unique aesthetic and recreational appeal of the mountains. Deterioration in the condition of Nothofagus forest was noticed soon after the introduction of browsing mammals (Cockayne, 1926) and continues to give concern in many areas (N.Z.Forest Service, 1972). This deterioration is considered to be largely due to the removal of seedlings by browsing so that replacement of canopy gaps and colonization of slip-faces is retarded or prevented. Trampling by animals also damages the forest floor (McKelvey, 1959). An extensive campaign is being conducted to control the introduced animals, of which red deer and opossums are the most important. Studies of forest regeneration are necessary to assess the effects of animal control and other management programmes, and to predict future trends in the condition of the forests.

The aims of this study were (1) to quantitatively describe a red beech (Nothofagus fusca) population and (2) to determine the mechanisms of regeneration in this population. Regeneration refers to the replacement of the canopy trees by younger members of the same population. The state of regeneration is usually assessed by relating the frequency and size range of the immature individuals to the amount of canopy space being created by dying and senescent trees. Assumptions are made about the likelihood of the immature individuals present growing and surviving in sufficient numbers to fill the canopy gaps. Direct assessment of the state of regeneration requires a long period of observation and has seldom been done.

Emphasis was placed on the population dynamics of the seedling part of the red beech population. Seedlings represent the input of individuals necessary to maintain the population structure. Seedling success may be determined by competition with other plant species or with older members of the red beech population.

Of the possible environmental factors involved in this competition, light intensity was studied in detail.

Attention was also given to the possibility of allelopathic interactions involving phenolic compounds.

From a knowledge of seedling dynamics obtained over a short period, and from a description of the present population structure, (including mature trees), it was hoped to obtain an overall view of red beech regeneration.