THE REGENERATION OF COMMERCIAL EUCALYPT FORESTS ON SURREY HILLS, N.W. TASMANIA.

By

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Submitted in fulfilment of the requirements for the Degree of -

M A S T E R O F S C I E N C E

University of Tasmania,

HOBART.

September, 1971.

I, undersigned, Robert Keith Orme, state herewith that

(1) except as stated therein, this thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and that

(2) to the best of my knowledge and belief, this thesis contains no copy or paraphrase of material previously published or written by another person, except when due reference is made in the text of the thesis.

Keith Orme

7/10/71

PREFACE

The contents of this thesis are placed in two volumes to facilitate reading and to enable easy binding.

Volume 1 consists of the main text, some small tables, references, and the index to both volumes.

Volume 2 consists of the majority of tables, figures and the appendices.

The pagination of the thesis is continuous; the relevant tables and figures may be easily located in Vol. 2 near the page number of the relevant section of text. This enables the reader to view diagrams while reading the text.

The main table of results has been repeated on pages 58 and 225.

Detail irrelevant to the development of ideas in the text has been included in appendices.

ACKNOWLEDGEMENTS

The work reported in this thesis was carried out as a joint project between Associated Pulp and Paper Mills Ltd. and my employer, the Forestry Commission of Tasmania.

The immediate work under this project was supervised by Dr. T.M. Cunningham of the Forestry Commission. I owe much to his constructive criticism and advice.

Many thanks are due to forestry staff members of Associated Forest Holdings Pty. Ltd. for their considerable assistance and advice. I have appreciated the services of the company library in Burnie.

Finally, I would Like to thank my supervisor, Professor W.D. Jackson, for his continued guidance and assistance.

CONTENTS

SECTION 2

Campbells, an Experiment of Reafforestation Techniques on Grassland.

List of Appendices

The Regeneration of Commercial Eucalypt Forests on Surrey Hills, N.W. Tasmania.

SUMMARY

The quantity and quality of eucalypt regeneration in all the important forest types on Surrey Hills and adjacent areas has been evaluated in the period between October 1969 and August 1971. The rate of stocking was determined by estimating numbers and distribution of seedlings. Growth was estimated by determining height increment with age. Both stocking and growth were related to a) the site quality evaluated from past forest growth, and b) by the logging and regeneration practice used on the area. The survey was conducted by sampling on a grid pattern using milacre plots at a spacing of 4 x 1 chains as described by Mount (1961). A total of 1,800 plots were sampled.

The results of sampling the distribution of seedlings in space show generally much greater over-dispersion on Surrey Hills as compared with seedling distribution in similar forest types in Tasmania.

The region consists of a complex mosaic of vegetation types ranging from pure Rainforest through Eucalypt-Rainforest, Mixed Forest ecotones, pure Wet Eucalypt Forest,

Grass Savannah to Open Grassland or Sedgeland communities. This mosaic is a result of past climatic changes and anthropogenic influences. Within those areas where sufficient eucalypt has been present to justify exploitation, a local mosaic of eucalypt regeneration exists. Within blocks of one forest type sub-areas without any eucalypt regeneration exist. This is due mainly to the past distribution of seed trees, although management practice contributes. On the sub-areas where some level of stocking exists, the variance in stocking per milacre is very large and is greatly in excess of the average variance for milacre plots in other regions of Tasmania. This disproportionate increase in the over-dispersion of seedling distribution is a product of the regeneration practice rather than any intrinsic function of site quality or forest type. In areas of regeneration resulting from burning practices the minimum figure for successful regeneration has been estimated at 30% milacres occupied by one or more seedlings (Mount 1961). This minimum probably must be raised considerably to forecast successful regeneration in this area because of the higher over-dispersion in seedling distribution. The analysis of a large number of samples from various forest types shows that when 30% of the milacre plots in an area have one or more seedlings, then 50% of the area is unstocked.

Thus, the acceptance of 30% of stocked milacres as a minimum acceptable stocking rate assumes a large potential of unproductive area.

The present logging-regeneration practice does not result in high production in the regeneration crop. Not only is stocking highly variable and in general inadequate, but the growth rate of the regeneration is also lower with this practice than the rate obtained following seed-bed preparation by firing. In this present survey, the growth rates of regeneration on various sites treated by logging and disturbance have been compared with those on areas subjected to wild-fire or coupe-burning techniques in adjacent areas. While these sites are not always strictly comparable due to differences in soil type, the basis of comparison is valid. A series of trials on various soil and forest types to compare regeneration growth following seed-bed preparation by disturbance alone and by slash-burning is required.

Regeneration growth has been estimated by the calculation of the regressions of height on age of the potential commercial crop. This has been sampled by determining the mean height-age relationships for the two tallest seedlingson each 4 milacre plot at a spacing of 4 x 1 chains. Between 90 and 140 samples were.taken from

each area. Regression coefficients of height increment vary considerably within and between forest types under present management practice. Increments over ages of 2 - 10 years range from 8 inches/year on Eucalypt-Grass Savannah to 27 inches/year on Eucalypt-Rainforest types. By comparison, an increment of 57 inches/year on Eucalypt-Rainforest is found on burnt seed-beds of similar site quality in adjacent areas. The mean height of the tallest trees on sampled plots at 4 years on logged Eucalypt-Sclerophyll Scrub-Forest types was found to be 61 inches. The comparable figure for burnt Eucalypt-Sclerophyll Forest was found to be 162 inches; a factor of 2.5!

The wide variation in height increment for the various forest types when the seed-beds are prepared without fire would seem to result from differences in the amount of soil disturbance which can be effected. On sites which were previously open and carried grass or tussock (Diplarrhena), or in those sites where rhizomatous ferns were previously established, growth is poor due to the rapid re-establishment of competition.

A compounded index has been calculated which expresses the productivity of regeneration as the product of area stocked, by stocking rate, by height growth at a fixed age. This index allows the comparison of various

regeneration treatments on each of the various forest types. In addition, the efficiency of each treatment on a particular forest type may be found for that site assuming full stocking. The productivity index indicates that the present practices are very inefficient compared with slash-burning techniques. Regeneration efficiency values, calculated as actual productivity as a percentage of ideal productivitv for the treatments in use, range from 1/5th to 1/2 th of similar values for slash-burning treatments.

These estimates make no allowance for potential loss of productivity due to Dieback disease. This disease will further widen the disparity in relative efficiency between present practices and slash-burning as a regeneration technique. It is likely that loss of productivity due to Dieback disease will be very high with present treatments due to the growth of the rain-forest understoreys.

It is recommended that the present methods of seed-bed preparation be discontinued and that control coupe burning be adopted as a general management technique. The comparatively large areas without sufficient seed will require aerial sowing, hand sowing or planting

depending on site requirements. These practices will ensure at least minimum stocking of all areas, a lower dispersion in stocking rates and higher and more uniform growth rates. The net results in productivity per acre are conservatively estimated at three times the present yield.

The risk associated with the use of fire is quite real, but because of the mildness of the climate and nature of the topography at Surrey Hills, it is considerably less than in areas of Tasmania where coupe-burning for regeneration has been practiced successfully for many years. Pure rainforest can be converted into the more productive eucalypt forest types using the same regeneration techniques. Additional slash-felling is usually required in this case to obtain the same quality of burn.

Table 0.1 is a summary of stocking estimates for the various forest types and treatments; the locations of the areas sampled are shown in figure 4.9.