THE REGENERATION OF *Eucalyptus pauciflora* Sieb. ex Spreng. FROM SEED

by

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DECLARATION

The work presented in this thesis is my own. Specific contributions by others are acknowleged in the text and acknowledgements.

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ABSTRACT

Eucalyptus pauciflora Sieb. ex Spreng. occurs over a wide range of altitudes from sea-level to treeline, but the most common occurrence of the species is in the high altitude environments of the Great Dividing Range in eastern Australia. There are gradual changes in the morphology and physiology of the species with increasing altitude. This study examined variation in the regeneration of Eucalyptus pauciflora from seed in populations from a range of sub-alpine environments between 960 m and 1900 m in the Snowy Mountains of New South Wales. The influence of climatic conditions, particularly temperature, on the seasonal timing of germination was investigated using observations of dormancy, germination and emergence from seed in the field, and laboratory manipulations of dormancy.

The dormancy of E. pauciflora seed varies with the origin and size of the seed. Seed from different altitudes has a similar degree of dormancy (i.e. proportion of dormant seed), with the exception of seed from treeline populations (1900 m) which has a greater degree of dormancy. The strength of dormancy increases with altitude of seed source and decreases with seed size within a population of seed. The increases in the strength of dormancy with altitude are not explained by the reduction in seed size with increasing altitude since the dormancy of seed of the same size also increases in strength with altitude of seed source.

Seasonal conditions during seed shedding are unlikely to have a large influence on the dormancy of the seed. However, exposure of capsules to temperatures of 80°C during seed shedding resulted in marked increases in the strength of dormancy of the seed. This indicates that there is a chance that the dormancy of seed shed following a fire may be greater than that of seed shed under normal conditions.

Moist seed may respond to the temperature environment in three ways; changes in dormancy, germination or death. Dormancy is broken at constant temperatures below 6°C and strengthened at temperatures above 9°C. Temperatures between 6°C and 9°C tend to break the dormancy of a portion of the seed sample and increase the strength of dormancy for the rest. The rate at which dormancy is broken declines rapidly as the availability of water declines from a water potential of -4 bars to -10 bars. The temperature at which the rate of breaking dormancy is highest (5.5°C) is similar in seed from altitudes above 1240 m. However, there is some indication that this temperature may increase in seed from lower altitudes.

As the dormancy of the seed is broken, the range of temperatures which is suitable for the germination of seed increases and the germination capacity at any temperature within the range also increases. The rate of germination shows similar increases to the breaking of dormancy. The differences in the temperature response of seed from different altitudes could be wholly attributed to differences in the strength of dormancy of the seed.

In a field test of laboratory results seed was planted in the field at 1610 m and dormancy and germination were monitored. Moist conditions and high temperatures induced dormancy in the seed in within

a week of planting and prevented the germination of a large proportion (98%) of the seed sample until late winter. Low soil temperatures and moist soil conditions led to a progressive reduction in the strength of dormancy in late autumn. Germination occurred when the soil temperatures were low (mean<5°C) and took 30 days to complete. The first seedlings emerged around 30 days after the first germination in the field.

The relevence of differences in the strength of dormancy of seed from different altitudes was tested in a 'reciprocal' transplant experiment. Seed collected at four altitudes was planted at four altitudes between 960 m and 1740 m in autumn 1983. Very few seedlings emerged in autumn or winter. In spring there was a decrease in the number of seedlings emerging from seed from low altitudes, and an increase in the number of seedlings emerging from seed from high altitudes with increases in altitude.

The increase in the innate strength of dormancy of seed with altitude appears to be associated with a greater capacity of the environment to break dormancy at higher altitudes. Thus the timing of germination and emergence ensures that the seedling is less likely to be exposed to either the snow and needle ice as a result of premature germination during winter or drought and high temperatures associated with delaying germination until late spring or summer.

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Corrigenda

page	line	Change from	to
6	8	suitable place	a suitable place
11	25	flooding, frosting	flooding and frosting
12	7	was influenced	were influenced
34	7	was edited	were edited
37	34	required break	required to break
50	4	data is	data are
97	¶3	lower	intermediate
120	24	iteraction	interaction
172	6	Anlogous	analogous
249	26	later	earlier
261	10	This study	This section
268	26	Seedlings in	Seedlings from