# GENETIC DIVERSITY AND DIVERGENCE WITHIN AND AMONG NATURAL POPULATIONS OF *ARAUCARIA* IN EASTERN AUSTRALIA.

**Thesis submitted by**

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## ABSTRACT

Historical and contemporary fragmentation of natural populations has resulted in many species being confined to disjunct isolates. An understanding of the underlying distribution of genetic diversity and divergence within species is critical to informed conservation and management practices, yet for many species this information is lacking. While many plant species have been substantially exploited over the past few centuries in Australia, thus potentially exacerbating any genetic effects of historical fragmentation, little is known on the effects of these practices on the genetic diversity and divergence of their extant populations. However, for most plant species, the genetic effects of historical fragmentation prior to exploitation are unknown. Any meaningful interpretation of contemporary genetic impacts must be viewed against an historical background. The genus *Araucaria* (Araucariaceae) has undergone dramatic range reductions and population size fluctuations throughout its history on the Australian continent and is now represented by two extant species: *Araucaria bidwillii* and *Araucaria cunninghamii*. The historical effects of their dynamic histories are examined using two independent neutral molecular markers, RAPDs and ISSRs, and is discussed in terms of extant population size, isolation and historical microfossil records. For both species, these markers proved to be highly congruent in the amounts of diversity they detected and how that diversity was spatially partitioned among populations. High diversity characterised all but one of the populations sampled and was accompanied by high divergence among the populations

sampled. Discrepancies in the amount of variation these markers attributed to regional and populational divergence is discussed and emergent trends noted. The results cast some doubt on some of the earlier, simplistic rainforest refugial hypotheses that have been proposed for eastern Queensland. Furthermore, the results have allowed for a more detailed dissection of the *Araucaria* microfossil record in eastern Australia, which until now could only provide static evidence and indicate the relative regional importance of the genus. When the present results are reviewed in association with the available microfossil evidence, the high diversity and high divergence detected in both species among the populations sampled suggests substantial periods of isolation in the absence of gene flow, yet the maintenance of diversity appears to be the product of the longevity of these species and/or recent population size reductions.

Finally, the implications of these results for both the ongoing conservation and management of extant populations of these economically important and iconic Australian species is discussed with reference to their historical genetic associations. Given the quantification of their historical genetic signals, future research directions are suggested that are imperative for the maintenance of the evolutionary potential of these species.

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