Discontinuous distributions of iconic New Zealand plant taxa and their implications for Southern Hemisphere biogeography

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"With regard to general problems of biogeography, the biota of New Zealand has been, perhaps, the most important of any in the world. It has figured prominently in all discussions of austral biogeography, and all notable authorities have felt obliged to explain its history: explain New Zealand and the world falls into place around it." Gareth Nelson (1975)

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Abstract

New Zealand has long been regarded as a key to understanding discontinuous distributions in the Southern Hemisphere. The archipelago is a fragment of the ancient super continent Gondwana. It has been isolated for 80 million years, has an excellent fossil record, and some of its most ancient biota such as the Southern Beeches (*Nothofagus*) and the Araucariaceae show disjunct distribution patterns with relatives on other fragments of Gondwana. Some of the most controversial problems of Southern Hemisphere biogeography with wide ranging implications involve New Zealand taxa. Three of them have been addressed in this thesis.

The transoceanic relationships of the genus *Nothofagus* have long been regarded as an iconic example of a distribution pattern resulting from the break up of Gondwana. Phylogenetic analyses presented here show that, though most of the extant distribution of the genus is indeed shaped by tectonic events, Southern Beeches have crossed the Tasman Sea between Australia and New Zealand at least twice during the Tertiary period. These results, together with findings of studies on other plant and animal taxa, emphasise the importance of dispersal but at the same time raise the question of whether any New Zealand taxa can be considered Gondwanan relicts. There is no geological evidence for the continuous existence of land throughout the Tertiary in the New Zealand area. However, molecular clock analyses presented in this thesis indicate that *Agathis australis* (New Zealand Kauri) diverged from its closest Australian relative prior to the Oligocene, or period of greatest submergence during the Tertiary. Thus these findings reject the hypothesis of the complete drowning of the New Zealand landmass during the Tertiary. They cannot reject the hypothesis of Stöckler *et al.* (2002) that the New Zealand Kauri lineage has persisted on the archipelago since its separation from Gondwana.

Explanations for forest distribution patterns within the New Zealand islands themselves are diverse. New Zealand *Nothofagus* species show distribution gaps that are not explained by recent environmental factors alone. Early Miocene tectonic events and alternatively Pleistocene climates have been proposed as causes for this disjunct distribution pattern. Phylogeographic analyses reported in this thesis suggest that severe Pliocene and Pleistocene climates as well as Pliocene and Pleistocene tectonic events have shaped present day distribution and diversification of *Nothofagus* species in New Zealand.

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List of illustrations

Chapter 2

Tables

Figures

Chapter 3

Tables

Figures

Chapter 4

Tables

Figures

Chapter 5

Tables

Figures

Chapter 6

Figures

Appendix I

Tables

Figures