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# **Impacts of reduced bird densities on pollination and dispersal mutualisms in New Zealand forests**

**A thesis presented in partial fulfilment of the requirements  
for the degree of Masters of Science in Ecology  
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Kapiti Island viewed from Kapiti Coast

*Photo: Jeremy Rolfe*

“...Plant a new *Truffula*. Treat it with care.  
Give it clean water. And feed it fresh air.  
Grow a forest. Protect it from axes that hack.  
Then the Lorax  
and all of his friends  
may come back.”

*Dr. Seuss 1972*

## ABSTRACT

The arrival of humans in New Zealand has caused a severe decline in the numbers of endemic avian species and their densities. Consequently, there is concern that pollination and dispersal services which birds carry out in New Zealand forests are under threat because of continued bird decline. Studies were conducted to identify whether pollinator and/or dispersal limitation was occurring in New Zealand lowland forests. Mainland sites (located between Wellington and Palmerston North) were compared to Kapiti Island, an island sanctuary. Kapiti Island supports large densities of endemic bird species and is used here as a "benchmark" to measure changes in pollinator and dispersal mutualisms on the mainland.

Exclosure cages were constructed to determine how important birds were as pollinators and whether pollination limitation was occurring in two ornithophilous (bird-pollinated) species (*Metrosideros fulgens*, *Fuchsia excorticata*) and two entomophilous (insect-pollinated) species (*Dysoxylum spectabile*, *Geniostoma ligustrifolium*). Some cages prevented all floral visitors, others excluded birds only, while control branches allowed all bird and insect visitation. Data was collected on bird visitation rates, nectar depletion, number of pollen grains deposited, pollen tube growth and fruit set. Birds and insects were important visitors to *M. fulgens* on Kapiti Island and at Kahuterawa Rd. Birds and insects also pollinated *F. excorticata* but bird pollination was reduced at Gladstone Rd and Akatarawa Rd compared with Kapiti Island. Birds were the main visitors to *D. spectabile* at both Kapiti Island and Wilton Bush. Birds were also important important pollinators of *G. ligustrifolium*, especially so at Lake Papaitonga. Overall, there was strong evidence for pollination limitation of *F. excorticata* on the mainland. Additionally, there was some evidence for pollination limitation of *G. ligustrifolium* as fruit set was low at all sites. Floral morphology was not able to predict whether birds or insects were the most important floral visitors. Birds are therefore, probably involved in the pollination of species which do not display ornithophilous flowers.

The potential effects which pollinator limitation could have on the breeding systems of sexually dimorphic species was investigated. Some secondary sex characteristics (standing crop of nectar, the number of pollen grains on stigmas, pollen tubes in styles, flowering periods and fruit set) differed between the sexes of *F. excorticata* and *G. ligustrifolium*. It is suggested the plasticity of fruit set in male *F. excorticata*, *G. ligustrifolium* and *D. spectabile* would enable them to respond to pollinator limitation. Pollinator limitation has apparently not yet led to sex ratio differences between populations. Most populations demonstrated a male bias which may have resulted from varying environmental conditions.

Possible dispersal limitation of *F. excorticata* was tested at Kapiti Island, Gladstone Rd and Akatarawa Rd using caged branches which prevented bird dispersal and uncaged branches. On Kapiti Island, palms retained proportionally less ripe fruit compared to the mainland study sites and fruits were dispersed at a faster rate. The proportion of dispersed and undispersed *Rhopalostylis sapida* fruit was determined on Kapiti Island, Nikau Reserve and Manawatu Gorge. Again, a greater proportion of fruit was dispersed and at a faster rate on Kapiti Island. The fruit there suffered less pre-dispersal predation from the endemic caterpillar *Doxophytis hydrocosma*. Although *R. sapida* seedling transects showed seedlings were common, there was strong evidence for dispersal limitation of *R. sapida* as well as *F. excorticata* on the mainland. Dispersal limitation could thus, be adversely affecting plant-disperser mutualisms by reducing the ability of species to disperse to new sites and reducing the efficiency of forest regeneration.

The pollination and dispersal services which are carried out by endemic birds suggests their continued decline could be causing pollination and/or dispersal limitation. It is essential to address the problems of declining bird densities to ensure the perpetuation of New Zealand forest ecosystems.

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