bioclimatic zones, two management regimes and two landforms. Population structures of seven key canopy dominants (kahikatea *Dacrycarpus dacrydioides*, kanuka *Kunzea ericoides*, kohekohe *Dysoxylum spectabile*, matai *Prumnopitys taxifolia*, tawa *Beilschmiedia tawa*, totara *Podocarpus totara* var. *totara* and tree coprosma *Coprosma arborea*) were also assessed.

Forests in the lowland bioclimatic zone were composed of greater numbers of mid-late successional forests than the coastal zone. The coastal zone showed greater densities and basal areas of early successional and warm temperate coastal species than lowland forests. Key canopy dominants characteristic of disturbance (kanuka, totara and tree coprosma) also had higher densities in the coastal zone.

Forests in managed areas exhibited better developed understories with significantly higher densities of saplings and seedlings and significantly higher species richness compared with non-managed areas. However, active management of forest patches in the Raglan Ecological District only began 2-45 years ago and therefore is not yet reflected in stem densities between management regimes. Maximum canopy heights were significantly taller in managed areas. The tallest species recorded, kauri was only found in managed areas.

Forests on slopes exhibited significantly greater species richness than forests on plains. Key canopy dominants kahikatea, matai and totara, which tolerate waterlogging and/or cool climates, had higher densities and basal areas on plains. Frost intolerant key canopy dominants, e.g. kohekohe and tawa, reached their highest densities on slopes. Analysis of small stem class densities showed kahikatea and matai regenerated better on plains while kanuka and tawa regenerated better on slopes. Totara's high sapling densities indicated successful regeneration on both landforms.

Cluster analyses identified five major forest types; tawa, kahikatea, kauri, kanuka, and puriri (*Vitex lucens).* Tawa forest comprised mid-late successional forest, containing the highest densities of shade tolerant species. Kahikatea forest typically occurred on poor draining soils, having the highest densities of species tolerant of waterlogging and/or cool climates. Kauri forest characterised drought prone soils, to which kauri was restricted and also had highest densities of drought tolerant species. Early successional kanuka forest contained highest densities of shade intolerant colonizing species. Finally, the puriri type comprised coastal forest, with highest densities of species typical of warm temperate coastal areas. All forest types identified were similar to forests recorded elsewhere in the North Island by national surveys.

Representativeness analysis shows kauri and conifer forests have been preferentially selected for reserve. In contrast secondary broadleaved and small leaved forests and forests containing taraire (*Beilschmiedia tarairi*) are inadequately represented in the reserve network.

Establishment of a permanent plot monitoring network allows future measurement of changes in composition and structure of forests. This will assist the management, prioritization and decision making for protection and restoration of these forests.

Reference

Cornes, T. 2006. The composition, dynamics and condition of native forest in the Raglan Ecological District. Unpublished MSc thesis, University of Waikato.

Lucy Cranwell Grant Report
Pollination of Invasive Species: Do introduced bees facilitate invasion in two *Lupinus* species?

Alana Jane Lawrence

It has been suggested that pollination does not limit reproduction of most weeds because traits such as vegetative reproduction and self-pollination ensure reproductive success. However this is not always the case, and small sparse weed populations may be less successful at attracting pollinators than larger denser populations, leading to pollen limitation, and an Allee effect. In New Zealand introduced bees are often responsible for pollinating invasive species, and synergistic interactions between plants and pollinators may increase the invasive potential of both parties.

I studied two *Lupinus* species; *L. arboreus* (tree lupin) in the Manawatu-Rangitikei region and *L. polyphyllus* (Russell lupin) in the Mackenzie basin. These species are both serious weeds in New Zealand, and do not self pollinate or reproduce clonally. Lupins also have specialised floral form that can only be pollinated by bees of intermediate to long tongue length. As all New Zealand native bees are short-tongued, these weeds may rely on pollination by longer tongued introduced bees.

I found no evidence of pollen limitation or an Allee effect acting *L. polyphyllus*. In fact there was a significant negative correlation between patch size and fruit and seed set, which suggests plants in large patches may be resource limited. There was no significant difference in seed set of supplementary pollinated and control flowers, which suggests this species is not pollen limited. There was also no evidence of an Allee effect acting on *L. arboreus*.

I did find a significant positive correlation between patch size and pollinator visitation rate for *L. polyphyllus*, but there was no evidence of increased fruit and seed set with increasing visitation. These results suggest that restricting the placement of commercial beehives around *Lupinus* patches would not help control their spread.

Despite the wide range of patch sizes and densities sampled, I did not find any evidence of a positive relationship between patch size or density and seed production. Therefore it is unlikely that pollination service will affect the population dynamics of these species.

Acknowledgement
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Reference
Lawrence, A.J. 2006. Pollination of Invasive Species: Do introduced bees facilitate invasion in two *Lupinus* species? Unpublished MSc thesis, Massey University.

Ecological Survey of Motukaraka (Flat Island), Beachlands, Auckland

James C. Russell, Ewen K. Cameron, Jamie W.B. MacKay, Jane L. Dudley & Mick N. Clout

Motukaraka (Flat) Island (5.6656ha; 36.8797° S, 174.9788° E; NZMS 260 R11, 2686800E, 6478500N; Fig. 1, 2) lies just under 500m off the coast of Beachlands, southeast Auckland (not to be confused with Motukaraka Island in the Rangauna, Hokianga or Whangarei Harbours). Dry-access is available approximately 2-3 hours either side of low-tide along a raised shellbank (note – this shellbank appears to have reduced in height over the last 15 years, which coincides with the construction of the nearby marina). Motukaraka was historically a Ngati Paoa pa site and was gazetted on 18 March 1905, becoming the first historic category Scenic Reserve in New Zealand. In 1965 a fire swept across the island for three days removing all vegetation except a few coastal pohutukawa (Anon. 1998), and the resulting bare plateau can clearly be seen in a 1967 aerial photo (Fig. 3; Anon 1980). It is believed that following this fire rabbits, possums and naturalised plants established on the island. Manukau City Council acquired the Beachlands Domain in 1952 and the island has been managed as a crown reserve since that date. Attempts to transfer management to the Hauraki Park Maritime Park in 1983 were rejected following a survey reporting the poor ecological condition of the island.

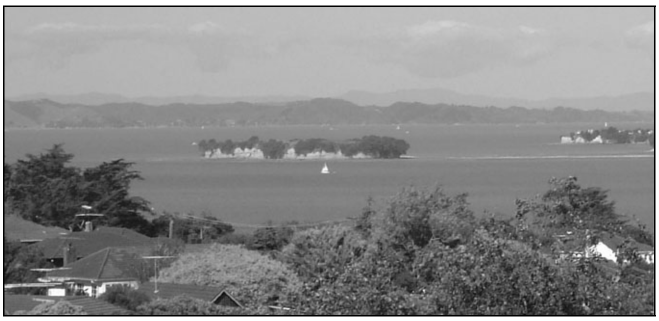

Fig 1. Motukaraka from North Howick. 20 Nov 2005.

Fig. 2. Motukaraka from Beachlands access (staircase). 20 Nov 2005.

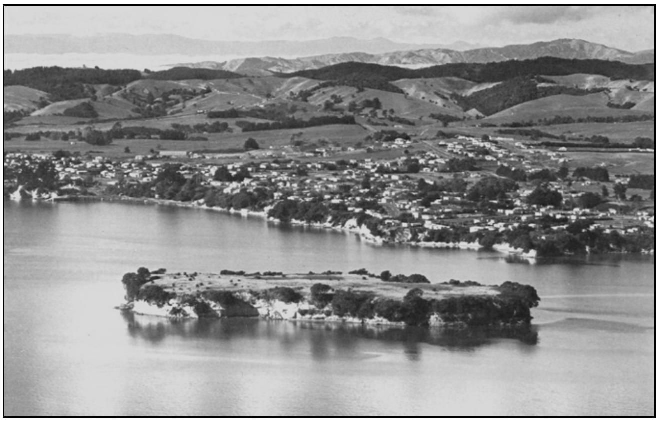

Fig. 3 Motukaraka in 1967 following the 1965 fire.

Following interest in the island around the late 1980s (Cameron and Taylor 1990) the island became a focus for restoration efforts, primarily led by a Forest and Bird South Auckland volunteer group formed in late 1990 and led by Joan Willan and Steve Quinn. Surveys at that time describe the bare vegetation (Fig. 4) as well as the presence of introduced garden snails, possums, rabbits and ship rats (Cameron and Taylor 1990). A follow-up survey also took place in 1991