Tūī to town

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Summary

Project and Client

Information on tūī distribution, biology, and behaviour in relation to the biogeography of Blenheim and the Wairau Plain (Blenheim Ecological District) was collated by Landcare Research for the Marlborough District Council, under an Envirolink small advice grant, in November–December 2007 (Project MLDC22).

Objective

- To collate existing information on tūī distribution, biology, and behaviour, and to relate it to the specific biogeographical situation around the town of Blenheim in order to assist with a project to increase tūī presence in Blenheim and the surrounding Wairau Plain.

Methods

- Information on tūī distribution, biology, and behaviour was collated from a literature review. The biogeographical situation around Blenheim was obtained from a site visit and inspection of maps.

Results

- Tūī occur throughout New Zealand, but are scarce east of the Southern Alps. They are largely absent from the Wairau Plain, but are consistently present and assumed to be breeding in the Richmond Range about 10 km north of Blenheim.
- Tūī feed mainly on nectar, supplemented by fruit and invertebrates. Nectar and fruit are obtained from a large range of native and introduced plants.
- During the breeding season (September to January) tūī normally travel no more than 0.5 km from their nest site daily, but outside the breeding season they may travel up to 30 km to forage.
- Research on tūī in and around towns and cities is currently being undertaken by the Department of Conservation and Landcare Research. Environment Waikato, the Hamilton City Council, and the Banks Peninsula Conservation Trust are currently undertaking tūī restoration programmes.

Conclusions

- Tūī are scarce in and around Blenheim because there are insufficient nectar-bearing plants for feeding and insufficient habitat for nesting. Options for restoring tūī to the Blenheim area include habitat restoration and predator control. Planting food plants in and around Blenheim will attract tūī as winter visitors, and undertaking predator control in the nearest nesting populations will increase the number of tūī available to visit Blenheim. Such restoration efforts will also benefit other bird species such as bellbird and kererū.

Recommendations

The Marlborough District Council (together with private landowners and other agencies such as Department of Conservation, Forest & Bird, and the Landcare Trust) should investigate ways of increasing tūī numbers in and around Blenheim by:

- Establishing a website outlining the project's vision to the public, and providing a web-based data entry form for collecting tūī sightings by the public, to establish a baseline of tūī distribution and abundance before restoration starts, against which to measure the success of restoration efforts
- Organising a public meeting, workshop, and/or other publicity events to engage public and corporate support for the project
- Recording and mapping areas of current plantings on the Wairau Plain that might provide food for tūī, to identify areas where new plantings need to occur
- Undertaking a programme of planting appropriate species in new areas to provide food, especially nectar, for tūī year-round – this could include subsidising tūī-friendly trees for planting in school grounds, golf courses, riparian areas, and private gardens
- Investigating the possibility of undertaking predator control in source breeding areas of tūī in the Richmond Range, to increase the number of tūī that will visit, and eventually breed in Blenheim – source breeding areas to target could be located by catching tūī visiting Blenheim and attaching radio transmitters to them, as was done in Hamilton.

1. Introduction

Information on tūī distribution, biology, and behaviour in relation to the biogeography of Blenheim and the Wairau Plain (Blenheim Ecological District) was collated by Landcare Research for the Marlborough District Council, under an Envirolink small advice grant, in November–December 2007 (Project MLDC22).

2. Background

The tūī (*Prosthemadera novaeseelandiae*) is an iconic New Zealand endemic bird species. It is a key pollinator and an important seed disperser of many native plants (Heather & Robertson 1996; Ladley & Kelly 1996; Ladley et al. 1997). It has been described as one of the seven best songsters in the world (Hartshorne 1973, in Higgins et al. 2001). Surveys of public opinion have shown that people want to see more native birds in our towns and cities (Clout & Craig 1998; http://www.ew.govt.nz/projects/ hamiltonhalo/, accessed 8 November 2007). Many bird species once common in Marlborough, such as the tūī, are now largely absent from some areas such as the Wairau Plain (http://www.marlborough.govt.nz, accessed 8 November 2007). This is because much of the area has been cleared of forest or wetland vegetation to make way for farming.

Under the Resource Management Act 1991, local territorial authorities have a role in maintaining and enhancing indigenous biodiversity in their region. The Marlborough District Council (MDC) has been undertaking some native plantings on public land it administers and also working with private landowners to identify and promote protection of significant natural areas in Marlborough. However, because some lowland areas like the Wairau Plain are so heavily modified, significant natural areas and habitat for indigenous birds and insects are scarce and further restoration effort is required. To promote this within the community the MDC has a vision of increasing tūī presence on the Wairau Plain, especially in the town of Blenheim. The council needs information on tūī distribution, biology, and behaviour in relation to the specific biogeographical situation around Blenheim to assist with this restoration.

3. Objective

- To collate existing information on tūī distribution, biology, and behaviour, and to relate it to the specific biogeographical situation around the town of Blenheim in order to assist with a project to increase tūī presence in Blenheim and the surrounding Wairau Plain.

4. Methods

Information on tūī distribution, biology, and behaviour was collated from a review of the literature, using the author's own literature collection, an online literature citation database (CAB Abstracts®), the search engine Google™, and websites of the Department of Conservation (http://www.doc.govt.nz) and Landcare Research (www.landcareresearch.co.nz). The biogeographical situation around Blenheim was obtained from a site visit and inspection of maps.

5. Results

5.1 Tūī distribution

Tūī are found throughout New Zealand, but are scarce east of the Southern Alps (Heather & Robertson 1996; Robertson et al. 2007). They are predominantly a forest bird, but have adapted well to human changes to the environment (Heather & Robertson 1996; Medway 2006). Thus, tūī may be found in a number of towns and cities throughout New Zealand where there is suitable habitat (e.g. Auckland, Wellington, Nelson, Dunedin, and Invercargill). They are largely absent from the town of Blenheim, the surrounding Wairau Plain, and the hills to the south, but are consistently present and assumed to be breeding in the Richmond Range approximately 10 km to the north (pers. obs.; N. Eade, MDC, pers. comm.). Local knowledge and anecdotal evidence indicate that tūī regularly visit the Wairau Plain when nectar-producing plant food is available (mainly in winter and spring). They are more commonly observed on the northern side of the Wairau Plain within a kilometre or two of the forest reserves on the Richmond Range, but occasionally travel to the urban areas of Renwick and Blenheim (N. Eade, MDC, pers. comm.).

5.2 Tūī breeding

Tūī establish breeding territories in September–October, in dense vegetation, usually native forest or scrub (Heather & Robertson 1996; Higgins et al. 2001), although nests have been found in large introduced trees such as *Pinus radiata* (R. Powlesland, DOC, pers. comm.). The nest is constructed in a fork or the outer branches of trees in the canopy or subcanopy. Eggs (2–4) are laid from September to January, mainly November to December. A replacement clutch may be laid if the first fails. After fledging, both adults and chicks may form loose flocks.

Research in Auckland by Carol Bergquist in the 1980s showed that tūī nested only in native forest patches larger than about 1 ha in area (J. Innes, Landcare Research, pers. comm.; http://www.landcareresearch.co.nz/publications/newsletters/tui/tuinewsletter may04.pdf, accessed 8 November 2007).

Breeding success has seldom been measured. On Tiritiri Matangi, 37.5% of eggs laid fledged chicks (Stewart 1980, in Higgins et al. 2001). On the Chatham Islands, tūī produced 2.25 fledglings per family group (Dilks et al. in Higgins et al. 2001). Current research (see below) is providing evidence that breeding success is greatly affected by predation. Effective predator control in various areas around New Zealand has resulted in a dramatic increase in tūī numbers (http://www.doc.govt.nz/templates/page.aspx?id= 32892, 8 Nov 2007). For example, the tūī population has increased dramatically in the last few years following possum control by Greater Wellington Regional Council in various reserves around Wellington (R. Powlesland, DOC, pers. comm.). Tūī numbers also increased in the Karori Wildlife Sanctuary following erection of the predator-proof fence and exclusion of predators, and have now begun to repopulate Wellington city suburbs (http://www.sanctuary.org.nz/restoration/forest/tui/tui.html, accessed 26 November 2007).

5.3 Tūī feeding

Tūī feed mainly on nectar, supplemented by fruit and invertebrates (Heather & Robertson 1996; Medway 2006). They are more nectarivorous than bellbirds (*Anthornis melanura*) (Merton 1966; Gravatt 1969, 1970, 1971; Craig et al. 1981; O'Donnell & Dilks 1986, 1994). The proportions of nectar, fruit, and invertebrates in the diet vary between the sexes, seasons, and localities (Gravatt 1969, 1970, 1971; Craig et al. 1981; Bergquist 1985a; Craig 1985; Stewart & Craig 1985; Rasch & Craig 1988; Williams & Karl 1996). For example, males dominate females (which have a smaller body size) at preferred food sources, forcing females to feed on more dispersed and less rewarding items. The proportion of nectar decreases and the proportion of fruit and invertebrates increases through autumn and winter. However, nectar is still a preferred food even in winter. Nectar sources used are mainly those with high nectar volumes (more than 10 µl) and sugar concentrations greater than 7% (Bergquist 1987; Rasch & Craig 1988).

Tūī feed on a large range of native and introduced plants (Appendix 1). Some sought-after native nectar sources are flax, fuchsia, kohekohe, kōwhai, pōhutukawa, pūriri, rātā, and rewarewa (see Appendix 1 for scientific names). Sought-after introduced nectar sources include banksia, bottlebrush, camellia, eucalypt, cherry, and rhododendron species.

On Hen Island, tūī spent 97% of their feeding time collecting nectar, mainly from pūriri and kohekeohe, even in May (Merton 1966). On Little Barrier Island, nectar feeding comprised 81% of all tūī feeding observations (Gravatt 1969, 1971). Fruit and invertebrates were important sources of food in autumn and winter. Major nectar sources included flax, haekaro, pōhutukawa, pūriri, rātā, rātā vine, and rewarewa (Gravatt 1970). On Tiritiri Matangi Island, nectar dominated the diet in spring and fruit in autumn (Stewart & Craig 1985). The main nectar sources were flax, kohekohe, pōhutukawa, and rewarewa. Kōwhai and pūriri did not occur on the island. The main fruit sources were *Coprosma* spp. and kohekohe.

In an Auckland study, nectar was the main component of tūī diet in most seasons (Bergquist 1985a, 1987). The main nectar sources were banksia, bottlebrush, Indian coral tree, eucalypts, flax, flowering cherry, kōwhai, pūriri, rata, rātā vine, rewarewa, and tawari (Bergquist 1985a, 1987). The main fruit sources were *Coprosma robusta*, kahikatea, maire, privet, and tōtara.

In South Westland, tūī ate mostly nectar (65% of known foods), fruit (22%), invertebrates (8%), and honeydew (5%) annually (O'Donnell & Dilks 1994). Major nectar sources were southern rātā and fuchsia. Other nectar sources included kāmahi, tutu, and *Pseudopanax* spp.

Rimu was the most important fruit source. Other fruit sources included *Coprosma* spp., kahikatea, *Pseudopanax* spp., and putaputawētā.

In Dunedin, tūī were observed feeding mainly on nectar from kōwhai, five-finger, fuchsia, and flax (Baker 1992, 1999).

In a study of fruit-feeding in Nelson, 67% of tūī faeces contained fruit at Eves and 100% contained fruit at Marsden (Williams & Karl 1996). The main fruit at Eves was Hall's tōtara, and at Marsden it was māhoe, wineberry, and mataī.

In the Auckland study above, fruit larger than 10-mm diameter, such as karaka, miro, tītoki, and tawa (*Beilschmiedia tawa*) were not eaten (Bergquist 1985a). Tūī have a gape size of 9 mm (Clout & Hay 1989). However, tītoki fruit was eaten in Nelson (Williams & Karl 1996), and miro fruit in South Westland (O'Donnell & Dilks 1994).

In the garden around the homestead on Little Barrier Island, tūī investigated just about every type of flower (Gravatt 1970). They also ate fruit from fruit trees, with figs, grapes, guavas, and grapefruit being favourites (Gravatt 1970). Large fruits are eaten by pecking holes in them and extracting juice and flesh. In Pukeiti, New Plymouth, tūī ate nectar and fruit from a wide variety of native and introduced plants (Medway 2006).

5.4 Tūī movements

During the breeding season tūī remained within a radius of about 0.5 km, at least in one study (Bergquist 1985b). However, outside the breeding season they may travel up to 30 km to forage on prime food sources such as flax, fuchsia, or kōwhai nectar (Craig et al. 1981; Bergquist 1985b; Stewart & Craig 1985; Heather & Robertson 1996). They may forage a regular route, taking newly independent young with them (Bergquist 1985b).

5.5 Current tūī research

Department of Conservation

Ralph Powlesland is leading a project to determine the seasonal habitat, food, and nesting requirements of tūī (and kererū) in the urban and rural landscapes around both New Plymouth and Invercargill (http://www.doc.govt.nz/upload/documents/science-and-technical/ kereru1.pdf; http://www.doc.govt.nz/upload/documents/science-and-technical/ kereru2.pdf, both accessed 8 November 2007). It is hoped that the information obtained will help DOC, councils, iwi, landcare groups, and private individuals ensure the long-term presence of tūī in urban and rural environments in New Zealand, and assist with the establishment or re-establishment of tūī in areas where they are presently absent.

Initial results from tūī with colour bands and radio transmitters showed that they tend to stay within 2 km of where they were caught (http://www.biodiversity.govt.nz/news/ media/current/20aug04.html, accessed 21 November 2007). However, they may make more distant flights to seasonal nectar sources such as flowering gums, particularly in autumn and winter. The longest distance tūī have moved to date is 20 km, in 2 months.

Tūī have occasionally been found nesting in towns, and even in introduced trees (e.g. *Pinus radiata*) (R Powlesland, DOC, pers. comm.).

The top 10 tūī foods in New Plymouth were:
Banksia nectar (autumn–winter)
Camellia nectar (winter–spring)
Kahikatea fruit (autumn)
Kohekohe nectar (winter)
Kōwhai nectar (winter–spring)
NZ flax nectar (spring–summer)
Prunus spp. nectar (winter–spring)
Pūriri nectar (autumn–winter)
Rewarewa nectar (spring)
Tōtara fruit (summer–autumn)

The top 10 tūī foods in Invercargill were:
Bottlebrush nectar (summer)
Cider gum nectar (spring–summer)
Fuchsia nectar (spring–summer)
Heart-leaved silver gum nectar (winter)
Kahikatea fruit (autumn)
Kōwhai nectar (spring)
Muehlenbeckia fruit (summer–autumn)
Flax nectar (summer)
Prunus spp. nectar (spring)
Sugar-water (mainly autumn–winter)
(R. Powlesland, pers. comm.).

Landcare Research

John Innes and co-workers are conducting a study (Tui in my Backyard) to learn more about the abundance, movements, and diet of tūī in and around Hamilton and Cambridge in the central Waikato (http://www.landcareresearch.co.nz/research/biocons/tui/, 8 November 2007). The researchers hope this study will result in planting and pest management strategies that increase the presence of tūī in Hamilton, Cambridge, and other towns, and in the surrounding countryside. Public reports indicated that tūī visit farm gardens and urban areas from about May onwards, and continue visiting until the end of September (http://www.landcareresearch.co.nz/publications/newsletters/tui/ tuinewslettermay04.pdf, accessed 8 November 2007). The use of colour-bands and radio transmitters on tūī later revealed that nearly all tūī visiting urban areas in winter fly up to 20 km back to native forest areas to nest from about September onwards (http://www.landcareresearch.co.nz/publications/newsletters/tui/tui_newsletter_mar2005.pdf, accessed 8 November 2007). A few pairs nest in mature planted areas away from native forest. However, in November 2007 a tūī was discovered nesting in Hamilton Gardens (J. Innes, Landcare Research, pers. comm.). The nesting failed at the chick stage, perhaps due to an avian predator, but the pair re-nested and at 20 December 2007 they were still feeding chicks. This is the first known nest in Hamilton city.

Tūī nesting success in native forest has been very low, with only about a quarter (of a small sample) of monitored nests fledging young (http://www.ew.govt.nz/projects/ hamiltonhalo). Most nesting attempts failed, mainly due to predation by ship rats, possums, and harriers. It is thought that tūī numbers in Hamilton, Cambridge, and other urban areas could be greatly increased by controlling key predators (ship rats and possums) in tūī nesting areas in the nearest native forests when they are nesting (http://

www.landcareresearch.co.nz/publications/newsletters/tui/tuinewslettermay04.pdf, accessed 8 November 2007). This is currently being trialled by Environment Waikato (see below).

Tūī visiting Hamilton in winter and spring obtain food from a large range of plants, including nectar from banksia, kōwhai, flowering cherry, camelia, eucalypts, flax, and bottlebrush, and fruit from strawberry tree, dogwood, kahikatea, and privet (http://www.landcareresearch.co.nz/publications/newsletters/tui/tuinewslettermay04.pdf, accessed 8 November 2007). Many of these plants are introduced species. It is likely that nectar is in short supply in native forests at these times.

5.6 Tūī restoration projects in other areas

Hamilton

Hamilton City Council and community groups such as Tūī 2000 have been restoring and reconstructing indigenous ecosystems in the city for a number of years in an attempt to bring back tūī (Clarkson & McQueen 2004). Tūī are highly valued by residents of the city (http://www.ew.govt.nz/projects/hamiltonhalo/, accessed 8 November 2007). It has been estimated that it may be necessary to have almost 100 ha of quality habitat within the city or 1000 ha within 10 km of the city to support resident tūī (Clarkson & McQueen 2004). Consequently, community groups have supported planting programmes to restore areas such as Waiwhakareke (Horseshoe Lake) and Barrett Bush.

Environment Waikato has recently initiated the Hamilton Halo project to help bring tūī (and some other native birds) back into Hamilton. The council is working with landowners to control ship rats and possums at selected sites where tūī breed, within a 20-km radius (halo) around the city, in an attempt to improve tūī nesting success in the area and so increase the number of tūī available for visiting the city. Sites selected were those where tūī caught and radio-tracked by Landcare Research in Hamilton city went to nest in the summer. Environment Waikato is also working with the Hamilton City Council and landowners to plant tūī-friendly plants and undertake pest control at key sites within the city, to provide safe habitat for tūī to breed when they come to the city.

Banks Peninsula

The Banks Peninsula Conservation Trust (http://www.bpct.org.nz) has established a tūī restoration group, with the objective of re-establishing tūī on Banks Peninsula. Tūī were once common on the Peninsula but largely disappeared about 15 years ago (i.e. about 1990), and since then there have been only occasional sightings (http://www.inet.net.nz, accessed 31 October 2007). The restoration group plans translocating birds from Maud Island in the Marlborough Sounds. In preparation for this, the Trust has been planting appropriate native plants on the peninsula for some years. Natural re-establishment of tūī is considered unlikely because the closest remaining tūī population is 100–140 km away. No previous tūī translocation attempts have been recorded (Armstrong 2007), so this could be a first.

5.7 Biogeographical situation around Blenheim

Blenheim is surrounded by the Wairau Plain, which is covered with extensive areas of productive farmland, especially vineyards (Fig. 1). The closest blocks of native forest where tūī are likely to be breeding are on the Richmond Range, approximately 10 km to the north. Between the Richmond Range and Blenheim the landscape has been highly modified since European settlement in the late 1800s, with only tiny pockets of native vegetation remaining.

The area to the south of Blenheim is predominantly dry pastoral grassland with some extensive areas of kānuka forest and a few patches of both indigenous and exotic forest. Tūī have not been recorded in this area.

Until about 1995, the predominant land use on the Wairau Plain was mixed horticulture, seed production, and pastoral farming, with extensive shelterbelts of mainly exotic trees. Since 1995, there has been a rapid conversion to vineyards, and a significant number of shelterbelts have been removed (N. Eade, MDC, pers. comm.). However, several new plantings and restoration projects, on both public and private land, have also been established over the last decade or so (Fig. 2). Most of these areas are very small but collectively they have provided a modest increase in indigenous biodiversity on the Wairau Plain. However, there is potential for a more substantial increase in indigenous biodiversity.

5.8 Issues for tūī restoration in and around Blenheim

Source population of tūī

The potential source population of tūī in the Richmond Range is only 10 km from Blenheim, which is within tūī flying distance (see movements above). However, the source population is in only one direction, to the north of Blenheim. This limits the chances of attracting tūī to the town.

Habitat

The habitat between the source population in the Richmond Range and the town of Blenheim, and also within Blenheim itself, is currently relatively unattractive for tūī. Two aspects of habitat need to be considered, the habitat for feeding and the habitat for breeding. The first is important for attracting tūī to the town, the second for keeping them there. There is a potential conflict between improving the habitat for tūī (and other birds) and not increasing bird damage to grapes that will need to be managed.

Predators

Will cats (and rats) prevent establishment of tūī in Blenheim, even if tūī get there? Would control of predators (especially possums, stoats, rats, and cats) in the source population area (Richmond Range) increase the tūī population there and so increase the chances of tūī dispersing into Blenheim?

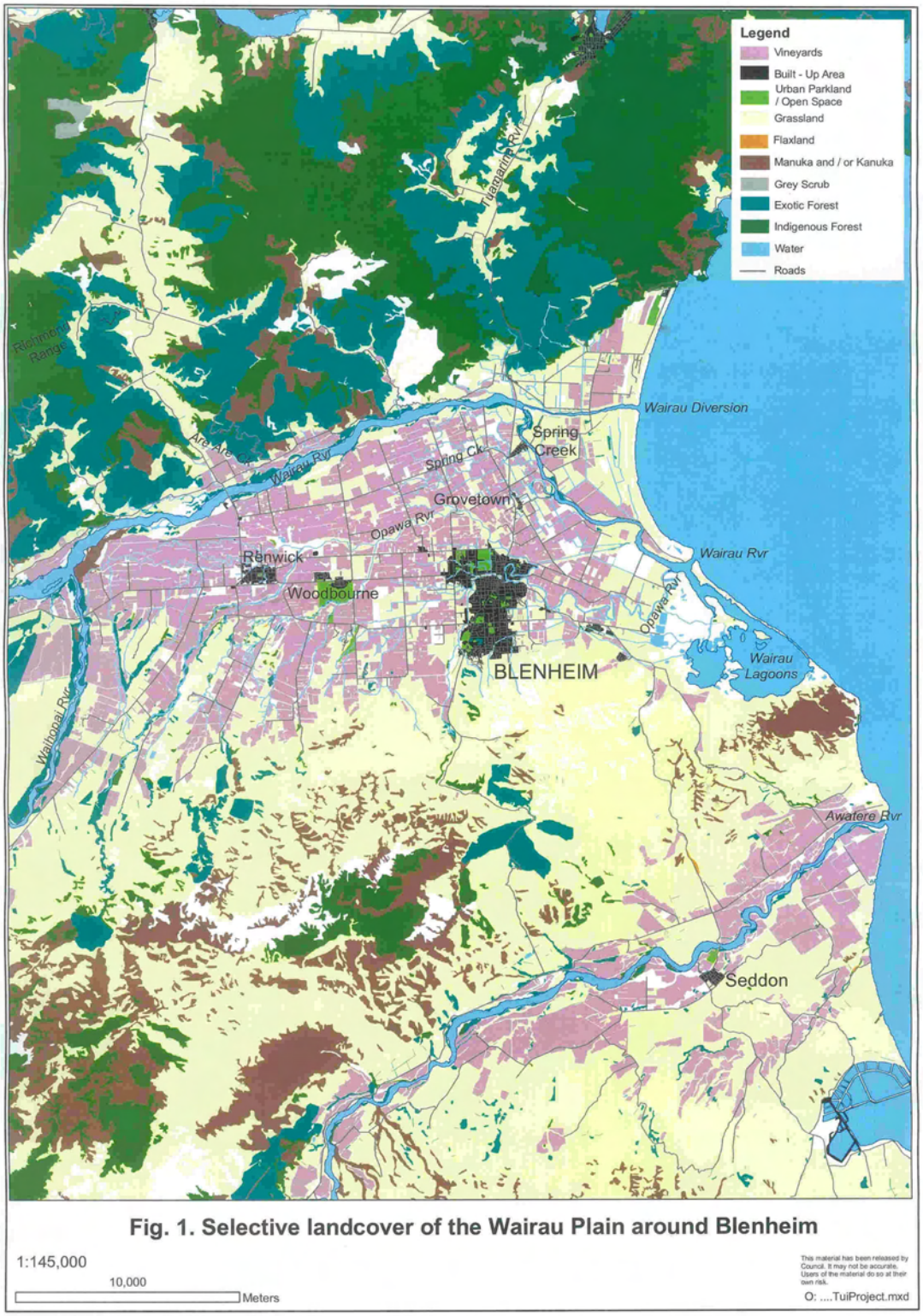

Fig. 1 Selective landcover of the Wairau Plain around Blenheim.

Fig. 2 Known significant natural areas and native plantings on the Wairau Plain.

5.9 Options for tūī restoration in and around Blenheim

Habitat improvement

The habitat for tūī in and around Blenheim could be improved by planting appropriate plants and by providing artificial feeders containing sugar-water (www.doc.govt.nz). There appear to be two potential 'corridors' or rows of 'stepping stones' from the Richmond Range to Blenheim along which tūī might be encouraged to disperse, one from the Kaituna River area of the Richmond Range via Renwick and Woodburn, and the other from the Tuamarina River area via Spring Creek and Grovetown. There are already some plantings along these routes (Fig. 2), and these could be enhanced with additional plantings of appropriate species. There are several council-owned reserves, roadsides, and waterways suitable for planting, and local residents also could be encouraged to undertake planting on private land. This could perhaps be achieved by subsidising tūī-friendly trees for planting in school grounds, golf courses, riparian areas, and private gardens.

There are a number of sources of information on appropriate species to plant for tūī. For example, the Banks Peninsula Tūī Restoration Group has a brochure "Tui tucker, attracting tui to your garden", which lists native and non-native plants for providing nectar and fruit for tūī throughout the year (http://www.inet.net.nz). The Banks Peninsula Conservation Trust website has a botanical assessment of the availability of food for tūī on Banks Peninsula, prepared by Hugh Wilson, manager of Hinewai Reserve (see also Wilson 2007). Native plants that could be planted to benefit tūī on the Peninsula include flax, kōwhai, fuchsia, five-finger, seven-finger, ngaio, karamū, cabbage tree, rōhutu, and tītoki. Introduced plants such

as eucalypts, banksia, and red hot poker may help significantly as a supplement to native plants (Wilson 2007). Some introduced plants favoured by tūī are invasive weeds and should not be planted in particular situations.

The Landcare Research website (http://www.landcareresearch.co.nz/) has two brochures on what to plant in your garden for native birds, particularly bellbirds but applicable to tūī: design for bellbirds, with a list of key native plants providing ripe fruit in winter (http://www.landcareresearch.co.nz/research/biocons/bellbird/documents/GardenDesignforBellbirds.pdf#search="planting for birds") and bellbird food sources, with a list of native and introduced plants and the times of year they produce nectar and fruit (http://www.landcareresearch.co.nz/research/biocons/bellbird/documents/bellbird_brochure_food_sources.pdf#search="bellbird")

The DOC website (www.doc.govt.nz) also has advice on tree planting for native birds: attracting native wildlife to your garden (http://www.doc.govt.nz/upload/documents/conservation/native-animals/birds/tree-planting-for-native-birds.pdf) and a month-by-month calendar of plants for native birds (http://www.doc.govt.nz/upload/documents/conservation/native-animals/birds/plants-for-native-birds-table.pdf).

The website http://www.nzbirds.com/more/plant.html has a list of native and introduced plants that attract tūī.

The Environment Waikato website has a list of recommended food source plants for tūī (http://www.ew.govt.nz/projects/hamiltonhalo/planting.htm). These include flowering and fruiting plants that span the seasons beyond the main winter and spring period when tūī may visit, and when nectar and fruit is in short supply in native forests. Smaller trees and plants such as kōwhai, flax, wineberry and five-finger grow easily and can be planted in urban sections. Larger trees such as kahikatea, rewarewa, kohekohe, and pūriri may be more suitable for larger properties, school grounds, parks, and reserves.

In the context of the Blenheim Ecological District, locally suitable plants that lend themselves to restoration planting include kahikatea, tōtara, kōwhai, putaputawētā, kānuka, flax, cabbage tree, māhoe, wineberry and coprosma species, to name a few. The Council has produced a booklet “Native Vegetation for South Marlborough – A Planting Guide” (http://www.marlborough.govt.nz/enviromonitoring/planting_guide.cfm).

There is little information on the appropriate area of planting or appropriate distance between plantings for attracting tūī. East & Williams (1984) noted that tūī are absent from offshore islands less than about 100 ha. An area sufficient to support at least 7–10 pairs is necessary to ensure at least medium-term viability (Craig 1991). Clarkson & McQueen (2004) noted that it may be necessary to have almost 100 ha of quality habitat in Hamilton city or 1000 ha within 10 km of the city to support resident tūī. Considering that tūī fly long distances to individual flowering and fruiting trees any planting would be better than none, and plantings could be several kilometres apart. Planting appropriate species is probably more important than the area of planting and distance between plantings. However, the area of planting and distance between plantings is likely to be important for enabling tūī to breed. Tūī have not been reported nesting in areas less than about 1 ha, and nesting tūī may be restricted to a feeding range of 0.5 km (Bergquist 1985b). Tūī nesting in or near Hamilton select sites where nectar sources are abundant, such as clusters of at least 10 large flowering flaxes, suggesting that food sources should be planted in clusters (J. Innes, Landcare Research, pers. comm.).

The provision of artificial feeders containing sugar-water is a second option for attracting tūī to Blenheim. It is recommended by DOC, and is already practised in a number of towns and cities in New Zealand (e.g. Auckland and Invercargill). The Banks Peninsula Conservation Trust also proposes encouraging people to provide sugar-water for tūī. The DOC website recommends mixing one tablespoon of sugar in half a litre of water (http://www.doc.govt.nz, accessed 8 November 2007). This equates to about a 3% sugar solution, assuming a tablespoon holds 15 ml (http://en.wikipedia.org/wiki/Tablespoon, accessed 21 November 2007). This is far too weak, and the website needs correcting. Bergquist (1985b) used a 15% sugar-water solution, which is more appropriate. It can be difficult to get tūī started feeding from sugar-water feeders, so people will need to persevere and will need advice on the best location for sugar-water feeders in relation to natural food sources (R. Powlesland, DOC, pers. comm.).

Tūī song playback is a third option for attracting tūī to Blenheim. Such a technique has been used successfully in the USA to attract birds into previously uninhabited vegetation patches, where they remained and bred (Ward & Schlossberg 2004; Ahlering & Faarborg 2006).

Predator control

The breeding success of tūī in the potential source population in the Richmond Range could be improved by undertaking control of predators, especially possums and ship rats, as is being done around Hamilton by Environment Waikato. This would increase the number of tūī available to disperse into Blenheim. However, this would require close cooperation with the Department of Conservation because most of the likely tūī breeding habitat is in Mount Richmond Forest Park. Also, further research would be required to identify more specifically the location of tūī breeding areas before effective predator control could be implemented. This could be achieved by catching tūī visiting Blenheim and attaching radio transmitters to them, as was done in Hamilton.

As in Hamilton, if tūī were to breed on the Wairau Plain or in Blenheim, predator control may eventually have to be expanded to these areas to provide safe habitat for tūī. It is possible that such predator control could be undertaken as a cooperative project between the Marlborough District Council, private landowners, the Department of Conservation, Forest & Bird, Landcare Trust, and other agencies.

A similar approach is being undertaken with bellbirds in Christchurch city. The Christchurch City Council is undertaking control of possums, rats, and stoats on the adjacent Port Hills, where bellbirds breed, in the hope of increasing the number of bellbirds visiting the city.

6. Conclusions

Tūī are scarce in and around Blenheim because there are insufficient nectar-bearing plants for feeding and insufficient habitat for nesting. Options for increasing tūī presence in the Blenheim area include habitat restoration and predator control. Planting food plants in and around Blenheim will attract tūī as winter visitors, and undertaking predator control in the nearest nesting populations will increase the number of tūī available to visit Blenheim.

Predator control will be needed in Blenheim itself later on, if/when tūī attempt to nest there. The costs of tūī restoration (e.g. for revegetation and predator control) can be balanced against the benefits (e.g. pollination, seed dispersal, human satisfaction, and eco-tourism) to justify the restoration efforts. If a cost–benefit analysis was done, the value of all ecosystem services combined would likely exceed the cost of restoration (Clout & Craig 1998).

It is realistic to assume that tūī presence can be increased in and around Blenheim in the short term, by planting suitable native and exotic plants to provide good quality sources of food. However, it is unlikely that tūī will breed there without longer-term, more extensive restoration efforts.

The focus of this report is on tūī, but the principles apply to other native bird species, such as the bellbird (*Anthornis melanura*) and kererū (*Hemiphaga novaeseelandiae*). These species can also adapt to urban environments but like the tūī require adequate suitable habitat for feeding and breeding before they can become resident.

7. Recommendations

The Marlborough District Council (together with private landowners and other agencies such as the Department of Conservation, Forest & Bird, and the Landcare Trust) should investigate ways of increasing tūī numbers in and around Blenheim by:

- Establishing a website outlining the project's vision to the public, and providing a web-based data entry form for collecting tūī sightings by the public, to establish a baseline of tūī distribution and abundance before restoration starts, against which to measure the success of restoration efforts
- Organising a public meeting, workshop, and/or other publicity events to engage public and corporate support for the project
- Recording and mapping areas of current plantings on the Wairau Plain that might provide food for tūī, to identify areas where new plantings need to occur
- Undertaking a programme of planting appropriate species in new areas to provide food, especially nectar, for tūī year-round – this could include subsidising tūī-friendly trees for planting in school grounds, golf courses, riparian areas, and private gardens
- Investigating the possibility of undertaking predator control in source breeding areas of tūī in the Richmond Range, to increase the number of tūī that will visit, and eventually breed in Blenheim – source breeding areas to target could be located by catching tūī visiting Blenheim and attaching radio transmitters to them, as was done in Hamilton.

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9. References

Ahlering MA, Faarborg J 2006. Avian habitat management meets conspecific attraction: if you build it, will they come? Auk 123: 301–312.

Armstrong DP 2007. New Zealand reintroduction projects. http://www.massey.ac.nz/~darmstro/nz_projects.htm (accessed 21 November 2007).

Baker AR 1992. Food plants of the bellbird, tui, and New Zealand pigeon. Notornis 39: 261–262.

Baker A 1999. Food plants of bellbird (*Anthornis melanura*), tui (*Prosthemadera novaeseelandiae*) and New Zealand pigeon (*Hemiphaga novaeseelandiae*) in Dunedin. Notornis 46: 270–272.

Bergquist CAL 1985a. Differences in the diet of the male and female tui (*Prosthemadera novaeseelandiiae*: Meliphagidae). New Zealand Journal of Zoology 12: 573–576.

Bergquist CAL 1985b. Movements of groups of tui (*Prosthemadera novaeseelandiiae*) in winter and settlement of juvenile tui in summer. New Zealand Journal of Zoology 12: 569–571.

Bergquist CAL 1987. Foraging tactics of tui (Meliphagidae). New Zealand Journal of Zoology 14: 299–303.

Castro I, Robertson AW 1997. Honeyeaters and the New Zealand forest flora: the utilisation and profitability of small flowers. New Zealand Journal of Ecology 21: 169–179.

Clarkson BD, McQueen JC 2004. Ecological restoration in Hamilton City, North Island, New Zealand. 16th International Conference, Society for Ecological Restoration, 24–26August 2004, Victoria, Canada. http://cber.bio.waikato.ac.nz/images/Ecological_restoration_in_Hamilton_City,_New_Zealand.pdf, accessed 27 November 2007.

Clout MN, Craig JL 1998. Ecological restoration for vertebrates: ecosystems will not work without them! In: Restoring the health and wealth of ecosystems, a conference on ecological restoration in New Zealand. Christchurch, New Zealand. (http://www.landcareresearch.co.nz/news/conferences/ecorestoration/Clout.pdf)

Clout MN, Hay JR 1989. The importance of birds as browsers, pollinators and seed dispersers in New Zealand forests. New Zealand Journal of Ecology 12: 27–33.

Craig JL 1985. Status and foraging in New Zealand honeyeaters. New Zealand Journal of Zoology 12: 589–597.

Craig JL 1991. Are small populations viable? Proceedings of the International Ornithological Congress 20: 2546–2552.

Craig JL, Stewart AM, Douglas ME 1981. The foraging of New Zealand honeyeaters. New Zealand Journal of Zoology 8: 87–91.

Crowe A 2004. Which native tree? Auckland, Penguin Books.

East R, Williams GR 1984. Island biogeography and the conservation of New Zealand's indigenous forest-dwelling avifauna. New Zealand Journal of Ecology 7: 27–35.

Gaze PD, Fitzgerald BM 1982. The food of honeyeaters (Meliphagidae) on Little Barrier Island. Notornis 29: 209–213.

Godley EJ 1979. Flower biology in New Zealand. New Zealand Journal of Botany 17: 441–446.
Gravatt DJ 1969. The feeding ecology of honeyeaters (Aves-Meliphagidae) on Little Barrier Island. Unpublished MSc thesis, University of Auckland, Auckland, New Zealand. (Not sighted).
Gravatt DJ 1970. Honeyeater movements and the flowering cycle of vegetation on Little Barrier Island. Notornis 17: 96–101.
Gravatt DJ 1971. Aspects of habitat use by New Zealand honeyeaters, with reference to other forest species. Emu 71: 65–72.
Heather BD, Robertson HA 1996. The field guide to the birds of New Zealand. Auckland, Penguin Books.
Higgins PJ, Peter JM, Steele WK 2001. Handbook of Australian, New Zealand and Antarctic birds. Vol. 5. Tyrant-flycatchers to chats. Melbourne, Oxford University Press.
Ladley JJ, Kelly D 1996. Dispersal, germination, and survival of New Zealand mistletoes (Loranthaceae): dependence on birds. New Zealand Journal of Ecology 20: 69–79.
Ladley JJ, Kelly D, Robertson AW 1997. Explosive flowering, nectar production, breeding systems, and pollinators of New Zealand mistletoes (Loranthaceae). New Zealand Journal of Botany 35: 345–360.
Medway DG 2006. The birds of Pukeiti. New Plymouth, Zenith.
Merton DV 1966. Foods and feeding behaviour of some forest birds on Hen Island in May. Notornis 13: 179–184.
O'Donnell CFJ, Dilks PJ 1986. Forest birds in South Westland: status, distribution and habitat use. Occasional Publication 10. Wellington, New Zealand Wildlife Service.
O'Donnell CFJ, Dilks PJ 1994. Foods and foraging of forest birds in temperate rainforest, South Westland, New Zealand. New Zealand Journal of Ecology 18: 87–107.
Rasch G, Craig JL 1988. Partitioning of nectar resources by New Zealand honeyeaters. New Zealand Journal of Zoology 15:185–190.
Robertson CJR, Hyvönen P, Fraser MJ, Pickard CR 2007. Atlas of bird distribution in New Zealand 1999–2004. Wellington, Ornithological Society of New Zealand.
Stewart AM, Craig JL 1985. Movements, status, access to nectar, and spatial organisation of the tui. New Zealand Journal of Zoology 12: 649–666.
Ward MP, Schlossberg S 2004. Conspecific attraction and the conservation of territorial songbirds. Conservation Biology 18: 519–525.
Wardle JA 1984. The New Zealand beeches: ecology, utilisation and management. Christchurch, New Zealand Forest Service. 447 p.
Williams PA, Karl BJ 1996. Fleshy fruits of indigenous and adventive plants in the diet of birds in forest remnants, Nelson, New Zealand. New Zealand Journal of Ecology 20: 127–145.
Wilson H 2007. Food for tui on Banks Peninsula. A botanical assessment. Christchurch, Department of Conservation.

Appendix 1 Plants providing food for tūī

Plant species known to provide nectar and fruit for tūī (* indicates adventive species). Numbers refer to references at foot of table. Table not complete.

Species	Nectar	Fruit
Alectryon excelsus (tītoki)		10, 14
Alseuosmia macrophylla (karapapa)	20	
Aristotelia fruticosa (mountain wineberry)		14
A. serrata (wineberry)		2, 5, 11, 18, 19, 20
Banksia integrifolia (coast banksia)*	8	
Callistemon speciosus (Albany bottlebrush)*	8	
Camellia spp. (camellia)*	20	
Carpodetus serratus (putaputawētā)		12
Clianthus puniceus (kākā beak)	3	
Coprosma spp.		5, 7, 11
C. areolata		18
C. crassifolia		18
C. grandifolia (raurekau)		14, 20
C. linariifolia		18
C. lucida (karamū)		12, 18
C. propinqua		18
C. robusta (karamū)		8, 14, 18
C. rotundifolia (round-leaved coprosma)		18
Coriaria arborea (tutu)	12	
Corokia spp. (korokia)		11, 18
Corynocarpus laevigatus (karaka)	1	
Dacrycarpus dacrydioides (kahikatea)		6, 8, 12, 14, 19
Dacrydium cupressinum (rimu)		12
Daphne bholua (daphne)*	20	
Dysoxylum spectabile (kohekohe)	1, 2, 7, 16	7
Elaeocarpus dentatus (hīnau)	16, 20	20
Erythrina sykesi (Indian coral tree)*	8	
Eucalyptus spp. (gum)*	8	
Fuchsia excorticata (kōtukutuku, fuchsia)	2, 11, 12, 13, 16, 18, 19, 20	2, 5, 19, 20

Geniostoma rupestre	16	
Griselinia littoralis (broadleaf)	16	18
Hedycarya arborea (pigeonwood)	12	10
Hoheria spp.	18	
Species	Nectar	Fruit
Ileostylus micranthus (mistletoe)		14, 15, 18
Ixerba brexiodes (tawari)	2	
Knightia excelsa (rewarewa)	2, 3, 7, 8, 13, 16, 19	
Kniphofia uvaria (red hot poker)	21	
Kunzea ericoides (kānuka)	11	
Leycesteria formosa (Himalayan honeysuckle)*		14
Ligustrum sinense (privet)*		6
L. lucidum (privet)*		6
Lophomyrtus bullata (ramarama)		11, 18
L. obcordata (rōhutu)		18
Macropiper excelsum (kawakawa)		14
Melicytus spp.		11
M. ramiflorus (māhoe or whitey-wood)		5, 14, 19, 20
Metrosideros spp.	11, 13	
M. excelsa (pōhutukawa)	2, 7, 9, 13, 16, 18, 19	
M. fulgens (rātā vine)	2, 4, 6, 8, 16, 20	
M. robusta (northern rātā)	2, 8, 16, 19	
M. umbellata (southern rātā)	12, 18, 19	
Mitraria coccinea 'Lake Puyehue'*	20	
Muehlenbeckia australis (pōhuehue)		11, 14, 18
Myoporum laetum (ngaio)		11, 18
Myrsine spp.		11
M. australis (māpou or red matipo)		4, 6, 12, 18, 19
M. salicina (toro)		18
Nestegis spp. (maire)		8
N. cunninghamii (black maire)		10
Pennantia corymbosa (kaikōmako)		18
Peraxilla colensoi (red mistletoe)	12, 17	15

P. tetrapetala (red mistletoe)	12, 17	15 (incorrect)
Persoonia toru (*Toronia toru*)	2	
Phormium spp. (flax)	11, 13, 18	
Phormium colensoi (small flax)	2	
Phormium tenax (flax)	2, 3, 7, 8, 16	
Photinia davidiana (photinia)*		20
Pieris japonica (lily-of-the-valley-shrub)*	20	
Pittosporum spp.	11	
Species	Nectar	Fruit
P. crassifolium (karo)	2, 16	
P. eugenioides (lemonwood)	16	
P. tenuifolium (kōhūhū)	16	
P. umbellatum (haekaro)	2, 16, 18	
Podocarpus spp.		11
P. hallii (Hall's tōtara)		14
P. totara (tōtara)		6, 8, 18, 19
Prumnopitys ferruginea (miro)		12
P. taxifolia (mataī)		10, 14
Prunus spp.*	20	
Prunus campanulata (flowering cherry)*	8, 20	
Pseudopanax spp.	11, 18	11, 18
P. arboreus (five-finger)	2, 16, 20	14, 19
P. crassifolius (lancewood)	12	19, 20
P. edgerleyi		12
P. laetus (large-leaved five-finger)	20	
P. lessonii (houpara)		3
Rhabdothamnus solandri	3	
Rhododendron spp.*	19	
Ripogonum scandens (supplejack)	1	10, 12, 14
Schefflera digitata (patē)		12, 19, 20
Sophora spp. (kōwhai)	11, 13, 18	
S. microphylla (SI kōwhai)	3, 19, 20,	
S. tetraptera (NI kōwhai)	6, 8, 20	
Streblus heterophyllus (milk tree)		11, 18

Tropaeolum speciosum (flame flower)*	20	
Tupeia antarctica (mistletoe)		18
Vitex lucens (pūriri)	1, 2, 3, 4, 6, 8, 11, 16, 18, 19	19
Weinmannia racemosa (kāmahi)	12, 16	

References: 1, Merton 1966; 2, Gravatt 1970; 3, Godley 1979; 4, Gaze & Fitzgerald 1982; 5, Wardle 1984; 6, Bergquist 1985a; 7, Stewart & Craig 1985; 8, Bergquist 1987; 9, Rasch & Craig 1988; 10, Clout & Hay 1989; 11, Baker 1992; 12, O'Donnell & Dilks 1994; 13, Heather & Robertson 1996; 14, Williams & Karl 1996; 15, Ladley & Kelly 1996; 16, Castro & Robertson 1997; 17, Ladley et al. 1997; 18, Baker 1999; 19, Crowe 2004; 20, Medway 2006; 21, pers. obs.