VEGETATION AND FLORA OF BLUE DUCK SCIENTIFIC RESERVE, KAIKOURA

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Introduction

Blue Duck Scientific Reserve is a remnant stand of mixed podocarp forest and shrubland and grassland approximately 20 km north of Kaikoura. The reserve is administered by the Department of Conservation and consists of 85 hectares of predominantly mature, high canopy, mixed podocarp forest with tongues of *Nothofagus solandri* present on the lower spurs. Small pockets of *Beilschmiedia tawa* are also present. The reserve has recently been extended above the forest to the ridge line (760 m) to include a large area of shrubland and herbaceous vegetation (c. 150 ha in total). The reserve lies in the Aniseed Ecological District of the Kaikoura Ecological Region (Breese et al. 1986). This paper provides an overview of the vegetation of Blue Duck Scientific Reserve, focusing mainly on the forest communities, and presents a vascular plant species list for the reserve.

Physical and Historical Features of the Seaward Kaikoura Range

The slopes of the Seaward Kaikoura Range are generally steep, especially in the north where the highest peak, Mt Manakau 2569 m, is only 11 km from the coast. The range has been formed by recent and rapid tectonic uplift of the area bounded by the Clarence and Hope Faults. Average slope is in excess of 25° in most areas (Wardle 1971), with relatively few extensive plateau areas north of the Kowhai River.

The main rock types are greywacke and argillite. Greywacke, which represents the younger sediments of the Torlesse group, is of Jurassic and early Cretaceous age. It is much folded and contorted, and many active faults and shatter zones exist (Suggate 1961). However, Oligocene limestone deposits are present on both sides of the range. They are extensive on the western slopes of the Blue Duck Valley. Also, early Tertiary sandstones, mudstones and sandy mudstones, together with surficial deposits of coarse greywacke gravels and angular fragments of limestone, form a shelf which slopes gently towards the east (Wardle 1961). Blue Duck Scientific Reserve perches on this shelf, which otherwise has been cleared to develop pasture.

Soils of the Seaward Kaikoura Range have been mapped by Gibbs & Beggs (1953). The main forest soils are Tekoa stony silt loams, shallow soils formed on steep greywacke land between 450 m and 1050 m occurring mainly on the eastern and southern flanks of the main range; and Hurunui sandy loams, which are present on moderate slopes further south (Wardle, 1971). On limestone substrates are Kaitoa steepland soils and Puhi Puhi hill soils; they are likely to be more fertile than those on other substrates.

Little is recorded of the climate of the Kaikoura ranges. Cockayne (1928) considered the vegetation characteristic of a dry climate and indeed on the western side of the range, around the Clarence Valley, the climate is probably sub-continental in nature with severe frosts and clear days in winter. Even though annual average rainfall is low, rainfall

intensities are some of the heaviest on record in the eastern South Island. For example, 645 mm of rain fell in just 4 days in 1923 (Sherrard 1966). Total precipitation is higher on the eastern side of the range. Kaikoura Peninsula receives about 825 mm per annum, but near the foot of Mt Fyffe annual rainfall rises to 1375 mm per annum (Wardle 1971). The nearest alpine meteorological station is distant to the north-west, on Black Birch Range at 1455 m altitude. Here the average annual rainfall is 1250 mm (Goulter 1967). Combined with higher rainfall in eastern areas is the persistence of coastal fogs at certain times of the year, particularly in spring (September to December). It is likely that these fogs provide a considerable amount of moisture to vegetation in the area (cf. Ingraham & Mark 2000) and account for the lush nature of mixed podocarp 'rain forest' stands in an otherwise relatively dry vegetation zone (Wardle 1961, Zotov 1983).

The history of human occupancy and land modification in the Kaikoura area has been described and documented by Sherrard (1966) and the following information is summarised from this. The Kaikoura coast has been inhabited for some 700 years, firstly by Maori and, in the last 150 years, by Europeans. The Maori population prior to 1824 was probably one of the most concentrated on South Island (Te Wai Pounamu), with an estimated 3000-4000 people. During their long period of occupancy, fires frequently raged uncontrolled into the Seaward Kaikoura Range devastating large areas of forest (see also Wardle 1971). The rate of forest destruction has dramatically increased over the last 150 years with logging and clearing operations for agriculture. The combination of widespread land clearance in a tectonically unstable area with high rainfall intensities has resulted in massive slip and scree formation, especially at higher altitudes. In the forests, large numbers of pigs, goats, deer, rats, and most recently, possums have also had a pronounced impact on the flora and fauna.

These events must have considerably modified the original vegetation patterns of the Kaikoura Ranges. Wardle (1971, p 273) considered it doubtful whether it would now be possible "to completely separate seral and induced forest and scrub vegetation from patterns originally resulting from intrinsic physical site conditions such as altitude, slope, physiography and rainfall".

Blue Duck Scientific Reserve

Blue Duck Scientific Reserve is the last significant remnant of true mixed podocarp forest type left in the area (Williams 1982, Breese et al. 1986) and indeed is one of the largest surviving mixed podocarp forests along the entire east coast of South Island. The reserve is exceptional in its diversity of vegetation and structural complexity, and has managed to maintain its integrity as a rain forest ecosystem despite major changes in land use and disturbance around it. Milling of the Blue Duck forests began mid- to late- 19th century and it was quickly realised that the finest stands of timber were to be found on the fertile soils of the western slopes, in particular the upper Irongate and Aniseed (Rakautara) catchments. There, as in the reserved remnant today, podocarp trees in excess of 25 metres tall grew abundantly at upwards of 200-250 trees per hectare.

The outstanding scientific and scenic values of these forests were recognised early and the remaining 85 hectares of forest gazetted as a reserve in 1903. Further south along the Tertiary shelf there appears to be a smaller area of tall podocarps that was not felled, but this has now succumbed to wind and exposure and all that remain are dead stems. At the upper boundary of the reserve, coarse seral scrub grades into low canopy hardwoods where

the podocarps have been selectively cleared. The lower boundary is marked by the Seaward Valley Road which separates the reserve from extensive areas of beech forest on greywacke soils lower in the Aniseed catchment. Climatic effects are apparently severe at the forest boundaries, but aside from the impact of introduced mammals (much of which has been ameliorated by efforts of the Department of Conservation to eradicate and exclude deer, goats, sheep and cattle) the forest structure and diversity of habitat types within the central part of the reserve are largely intact. The Blue Duck Scientific Reserve therefore offers exceptional opportunities for ecological research into the structure and functioning of New Zealand forest ecosystems.

Flora of Blue Duck Scientific Reserve

The total vascular flora of the reserve listed here is 248 species, comprising 207 indigenous species and 41 naturalised species. Cockayne (1928) comments on the large number of locally endemic species in the reserve and describes the forests as semi-North Island in character. This is perhaps the most interesting feature of the vegetation in the region and is probably derived from the compression of forest types approaching from the north and south onto a narrow coastal strip bounded closely by the sea to the east and the Kaikoura Ranges to the west, combined with a relatively mild maritime climate (Holloway 1954).

A number of species with a predominantly northern distribution are present in the Kaikoura area, with several present at Blue Duck. Martin (1932) recorded *Freycinetia banksii, Metrosideros colensoi, Metrosideros perforata* and *Griselinia lucida*, and Smith (1935) recorded *Beilschmiedia tawa* at its then southern-most known limit. *Rhopalostylis sapida* was added to this list by Wardle (1961), and *Collospermum microspermum, Coprosma grandifolia, Cordyline banksii, Cortaderia fulvida* and *Pittosporum cornifolium* have also been recorded from the reserve. Other northern species present in the Kaikoura area but not recorded from Blue Duck so far are *Lophomyrtus bullata* (although this has not been recorded in south Marlborough in recent years), *Melicope ternata, Nestegis cunninghamii* (Martin 1932) and *Nestegis montana* (SPC *pers. obs.*). The record of *Collospermum microspermum* is of particular interest as there are only five other known South Island records for this species (Kelly 1975, SPC *pers. obs.*).

While further *Beilschmiedia tawa* plants have been found closer to Kaikoura since Smith (1935), Blue Duck still retains the most significant southern stands. The origin of *Beilschmiedia tawa* in this area, 100 km south of the nearest neighbouring stands, is not certain. It may represent a surviving remnant of a once more widespread distribution dating from the earlier and warmer part of the present interglacial or alternatively it may represent recent long-distance dispersal from stands further north. Similar explanations may also be invoked to explain the distribution of the two *Nestegis* species in the Kaikoura area. Whatever its origin, the confinement of *Beilschmiedia tawa* to a narrow band along the Tertiary shelf is almost certainly related to the relatively fertile soils (Wardle 1961), possibly coincident with an ancient disturbance event in this zone. *Beilschmiedia tawa* is known to be a competitive invader of tree-fall gaps and disturbed sites (Knowles & Beveridge 1982) and colonisation by bird-dispersed seeds from isolated individual trees in the forest, or from stands further north, may have permitted the successful establishment of a pure stand. Survival and growth in the Kaikoura climate is evidently not limited, for in many areas the forest floor is carpeted with young tawa seedlings 10-15 cm high. *Beilschmiedia tawa* not only forms the canopy of these patches, but also significant portions of the subcanopy and shrub layers.

Several South Marlborough endemics are present in Blue Duck Scientific Reserve including *Carmichaelia glabrescens*, *Elymus sacandros*, *Wahlenbergia albomarginata* ssp. *flexilis*, *Ozothamnus* "George", *Heliohebe hulkeana* ssp. *hulkeana* and *Epilobium wilsonii*, although the last two extend south of the Waiau River in North Canterbury. While no threatened species have been recorded, four declining or naturally uncommon species are present. The mistletoe *Ileostylus micranthus* and shrub *Teucridium parvifolium* are ranked by de Lange et al. (1999) as 'Declining', while the herbs *Wahlenbergia albomarginata* ssp. *flexilis* and *W. matthewsii* are ranked as 'Sparse' and 'Range Restricted' respectively.

Vegetation of Blue Duck Scientific Reserve

Five distinct forest types are present in the reserve:

(i) Mixed podocarp forest
(ii) *Beilschmiedia tawa* forest
(iii) *Nothofagus solandri* forest
(iv) Gully forest
(v) Higher altitude, low-canopy angiosperm forest

The following vegetation descriptions are based on 15 detailed study plots in the first three forest types (Didham 1992) and general notes on the vegetation in the other two forest types. Additional notes are provided on the shrubland and herbaceous vegetation above the forest.

Mixed podocarp forest

The major portion of the reserve, some 80% (Williams 1982), is dominated by mixed, tall podocarp forest. *Prumnopitys taxifolia, Dacrydium cupressinum* and *Podocarpus totara* are the main canopy dominants, the proportions of which vary considerably throughout the reserve. *Dacrycarpus dacrydioides* and *Prumnopitys ferruginea* are more sparingly present. Below these is a fairly thick angiosperm stratum at about 12-15 m, dominated by *Melicytus ramiflorus*, *Elaeocarpus dentatus*, *Hedycarya arborea* and *Alectryon excelsus*. Other common species include *Myrsine australis*, *Carpodetus serratus*, *Pennantia corymbosa* and *Pseudopanax arboreus*.

The shrub stratum is fairly open in most places except below canopy gaps where vegetation can become dense and tangled. The main shrub species are *Hedycarya arborea*, a large number of *Coprosma* species, *Pseudowintera colorata* and numerous canopy and subcanopy juveniles. In more open sites, *Urtica ferox*, *Kunzea ericoides*, *Leptospermum scoparium* and, on slips, *Phormium tenax* and *Cortaderia richardii* are prevalent. Tree ferns are ubiquitous and abundant in the reserve, forming a very important part of the shrub layer. Four species are present: *Dicksonia squarrosa*, *Cyathea dealbata*, *C. smithii* and *C. medullaris*. *Cyathea dealbata* is by far the most common, but *C. smithii* replaces it on moister sites. *Dicksonia squarrosa* can be locally more abundant than the other three species. There is usually a moderate to dense cover of large ferns on the forest floor (*Asplenium, Blechnum* and *Polystichum* spp.) interspersed with other fern species, *Gahnia* spp., *Uncinia* spp., *Microlaena avenacea*, and *Astelia fragrans*. Many more native and naturalised species occur on open slip faces in the reserve.

Wardle (1971) listed *Metrosideros diffusa*, *Ripogonum scandens* and *Parsonsia heterophylla* as important lianes in mixed podocarp forest. These species are abundant, but the epiphytic and liane flora is far more diverse than suggested by Wardle (1971). Other species present include *Passiflora tetrandra*, *Clematis forsteri* and *C. paniculata*, *Metrosideros colensoi* and *M. perforata*, three species of *Rubus* (*R. cissoides, R. schmidelioides* and *R. squarrosus*), orchids (*Earina autumnalis, E. mucronata* and *Drymoanthus adversus*) and *Collospermum hastatum.* Also abundant throughout the reserve are many species of perching ferns, fern allies, mosses and lichens. Some trees can be entirely coated in a dense profusion of epiphytes.

***Beilschmiedia tawa* forest**

Small clumps of *Beilschmiedia tawa* are scattered among the other angiosperm trees between 340 m and 390 m (corresponding roughly to the 1100 ft to 1400 ft of Wardle 1961; not 700 ft to 800 ft as stated by Smith 1935) and in at least one place Wardle (1961) found *B. tawa* to form a nearly pure second story beneath the podocarps. Wardle's extensive 'second storey' of *B. tawa* was located at an altitude of 380 m, but *B. tawa* is considered to be a canopy dominant. The average height of *B. tawa* is 18 m+ and while this is several metres lower than the podocarp canopies, the *B. tawa* association forms a continuous cover over low angiosperm trees. Sparsely scattered, but very large, podocarps (all in excess of 1 metre dbh) are emergent above this. A second, smaller stand of *B. tawa* is located north-east of the first at an altitude of 350 m, but it is somewhat less distinct. *B. tawa* is scattered through the forest in this part of the reserve, ranging from single trees to small patches of up to 10 trees. Below the dense canopy cover of *B. tawa* and interspersed podocarps (principally *Prumnopitys taxifolia* and *Podocarpus totara*), light levels are lower than other areas of the forest where foliage density is not as great. Consequently the shrub and ground tiers are sparse. *Melicytus ramiflorus* and *Carpodetus serratus* dominate, with *Blechnum* spp. ferns, *Ripogonum scandens* and in places *Urtica ferox*, below.

***Nothofagus solandri* forest**

Nothofagus solandri (mountain beech) is abundant below the lower boundary of the reserve (the Seaward Valley Road), but only extends into the mixed podocarp forest as tongues along spurs and as outlying clumps up to 350 m altitude. This distribution is largely determined by environmental conditions. *N. solandri* appears to grow poorly on the limestone substrates higher in the reserve, probably being a poor competitor in these more fertile situations, and is not found at all on the high ridge above the forest. On greywacke, *N. solandri* is mainly restricted to spurs, in keeping with its relatively light-demanding seedlings and tolerance of dry conditions. It forms the canopy and a large portion of the subcanopy of this association. Podocarps, where present, are sparsely distributed and only of moderate size (50 cm dbh). There is often a fairly dense subcanopy angiosperm tier present, comprising *Pseudopanax arboreus*, *P. crassifolius*, *Carpodetus serratus*, *Melicytus ramiflorus* and *Pittosporum eugenioides*.

The ground and shrub tiers are dense due to the open nature of the *N. solandri* canopy. Various *Coprosma* spp. are common, as well as large ground ferns and *Gahnia* and *Uncinia* spp. Tree ferns are abundant. Epiphytes and vines are not a prevalent feature of *N. solandri* forest, although they may be abundant in the subcanopy. Common species are

perching ferns, *Rubus* spp., *Metrosideros* spp., *Ripogonum scandens* and occasionally *Collospermum hastatum*.

Gully forest

Gully forest has similarities with the angiosperm component of the mixed podocarp forest, but with the addition of several common moist habitat species including *Coriaria arborea*, *Aristotelia serrata* and *Fuchsia excorticata*. A distinctive ground vegetation including *Asplenium bulbiferum*, *Pneumatopteris pennigera* and *Leptopteris hymenophylloides* is present, and tree ferns can be abundant. Lianes are common and can form dense tangled thickets in canopy gaps.

Higher altitude, low-canopy angiosperm forest

At the highest altitudes in the forested part of the reserve occurs a low-canopy angiosperm forest similar to that described by Wardle (1971) as "Mixed Scrub-hardwood Forest", but with the addition of *Elaeocarpus dentatus* as a canopy dominant, along with *Melicytus ramiflorus* and *Carpodetus serratus*. However, this may be an induced rather than intrinsic similarity, as it is likely that the upper zones of the forest were subject to selective logging and/or burning when much of the surrounding forest was cleared.

Other vegetation types

Above the forested part of the reserve is an extensive area of treeland, shrubland and grassland that has experienced varying degrees of disturbance. Fire appears to have occurred here in the past and slumping and rockfalls from the limestone bluffs higher up the slope have also had an influence on the vegetation pattern. More recent grazing by sheep and goats has also limited the expansion of woody vegetation. Today this area is a mosaic of vegetation types with a high proportion of exotic species (especially grasses and forbs). This part of the reserve is where all the South Marlborough endemics and nationally uncommon and declining species occur.

On more gentle limestone slopes treeland comunities are dominated by varying amounts of *Podocarpus hallii*, *Hoheria angustifolia*, *Plagianthus regius* and *Sophora microphylla* with an understorey of *Urtica ferox*, *Coprosma propinqua*, *Polystichum vestitum*, *Poa cita* and pasture grasses. *Coprosma propinqua* is usually dominant in shrublands. Thickets of *Rubus squarrosus* can also be common. On steeper limestone faces the treeland and shrubland includes *Griselinia littoralis*, *Carpodetus serratus*, *Olearia paniculata*, *Carmichaelia australis*, *Brachyglottis monroi*, *Cordyline australis*, *Melicytus ramiflorus* and *Pseudopanax arboreus*. On the limestone bluffs *Phormium cookianum*, *Hebe hulkeana*, *Epilobium wilsonii* and *Poa colensoi* are often conspicuous, and this is the only habitat of *Poa acicularifolia* and *Carmichaelia glabrescens* in the reserve.

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VASCULAR FLORA OF BLUE DUCK SCIENTIFIC RESERVE

The following list is based on visits by Peter Williams (PW; May 1980), Shannel Courtney (SC; October 1990), and David Norton (DN; October 1990 and May 1994). Supporting herbarium vouchers for several species have been lodged at the University of Canterbury herbarium (CANU), (y), (* naturalised species).

	CANU	PW	SC	DN
Ferns and fern allies				
Adiantum cunninghamii	y	x	x	x
Asplenium appendiculatum ssp. *appendiculatum*	y		x	x
A. bulbiferum		x	x	x
A. flaccidum	y	x	x	x
A. gracillimum	y		x	x
A. hookerianum	y		x	x
A. lyallii	y		x	x
A. oblongifolium		x	x	
A. richardii	y			x
Blechnum chambersii		x	x	x
B. colensoi		x	x	x
B. discolor	y	x	x	x
B. fluviatile			x	x
B. membranaceum			x	
B. nigrum				x
B. procerum			x	x
B. vulcanicum		x		
B. novae-zelandiae		x	x	x
Cyathea dealbata		x	x	x
C. medullaris		x	x	x
C. smithii			x	x
Dicksonia squarrosa		x	x	x
Histiopteris incisa		x	x	x
Huperzia varia (*Lycopodium varium*)			x	x
Hymenophyllum demissum	y	x	x	x
H. flabellatum	y			x
H. sanguinolentum		x		
Hypolepis ambigua	y	x	x	x
H. rufobarbata			x	
Lastreopsis glabella	y		x	x
L. hispida	y		x	x
L. velutina	y	x	x	x
Leptolepia novae-zelandiae		x		x
Leptopteris hymenophylloides			x	x
Lycopodium volubile			x	x
Microsorum pustulatum	y	x	x	x
Paesia scaberula			x	x
Pellaea rotundifolia	y		x	x
Pneumatopteris pennigera		x	x	x
Polystichum richardii		x	x	x
P. vestitum	y	x	x	x
Pteridium esculentum		x	x	x
Pteris tremula	y			x
Pyrrosia eleagnifolia	y	x	x	x
Rumohra adiantiformis	y		x	x
Tmesipteris elongata	y		x	x

Trichomanes venosum		x	x	x
(47 indigenous species)				
Gymnosperm trees and shrubs				
Dacrycarpus dacrydioides	y	x	x	x
Dacrydium cupressinum	y	x	x	x
Podocarpus hallii	y			x
P. totara	y	x	x	x
Prumnopitys ferruginea	y	x	x	x
P. taxifolia	y	x	x	x
(6 indigenous species)				
Dicotyledons: trees and shrubs				
Alectryon excelsus	y	x	x	x
Aristotelia serrata		x	x	x
Beilschmiedia tawa	y	x	x	x
Brachyglottis monroi	y		x	x
*Buddleja davidii**	y			x
Carmichaelia australis	y		x	x
C. glabrescens	y		x	x
Carpodetus serratus	y	x	x	x
Coprosma areolata	y	x	x	x
C. crassifolia	y		x	x
C. foetidissima			x	x
C. grandifolia	y	x	x	x
C. linariifolia			x	x
C. lucida	y		x	x
C. propinqua	y	x	x	x
C. rhamnoides	y	x	x	x
C. robusta			x	x
C. rotundifolia	y	x	x	x
C. sp. "t" (*C. parviflora* var. *dumosa*)	y		x	x
Coriaria arborea		x	x	x
Corokia cotoneaster			x	
Corynocarpus laevigatus			x	x
*Cytisus scoparius**				x
Discaria toumatou			x	x
Elaeocarpus dentatus	y	x	x	x
E. hookerianus			x	x
Fuchsia excorticata		x	x	x
Griselinia littoralis	y	x	x	x
G. lucida		x	x	x
Hebe salicifolia			x	x
Helichrysum lanceolatum	y			x
Heliohebe hulkeana ssp. *hulkeana*	y		x	x
Hedycarya arborea	y	x	x	x
Hoheria angustifolia	y		x	x
H. lyallii				x
Ileostylus micranthus	y		x	x
Kunzea ericoides	y		x	x
Leptospermum scoparium			x	x
Leucopogon fasciculatus		x	x	x
Macropiper excelsum	y		x	x
Melicope simplex		x		x
Melicytus alpinus			x	

M. sp. "Brockie"	y			x
M. ramiflorus	y	x	x	x
Myrsine australis	y	x	x	x
M. divaricata				x
Neomyrtus pedunculata	y		x	x
Nothofagus solandri	y	x	x	x
Olearia cymbifolia			x	
O. paniculata			x	x
Ozothamnus leptophyllus	y		x	x
O. sp. "George"	y			x
Pennantia corymbosa	y	x	x	x
Pimelea oreophila	y			x
Pittosporum cornifolium			x	
P. eugenioides		x	x	x
P. tenuifolium			x	x
Plagianthus regius	y		x	x
Pseudopanax arboreus	y	x	x	x
P. crassifolius		x	x	x
Pseudowintera colorata	y	x	x	x
Raukaua edgerleyi	y		x	x
Schefflera digitata			x	x
Solanum laciniatum	y		x	x
Sophora microphylla	y	x	x	x
Streblus heterophyllus		x	x	x
Teucridium parvifolium		x	x	
Urtica ferox			x	x
(66 indigenous species & 2 naturalised species)				
Dicotyledons: lianes				
Calystegia tuguriorum			x	
Clematis foetida	y		x	x
C. forsteri		x		
C. paniculata		x	x	x
Fuchsia perscandens x *excorticata*			x	
Metrosideros colensoi	y		x	x
M. diffusa	y	x	x	x
M. perforata	y	x	x	x
Muehlenbeckia australis		x	x	x
M. complexa		x	x	x
Parsonsia capsularis		x		
P. heterophylla	y	x	x	x
Passiflora tetrandra		x	x	x
Rubus cissoides		x	x	x
R. schmidelioides		x	x	x
R. squarrosus		x	x	x
(15 indigenous species & 1 hybrid)				
Dicotyledons: herbs				
Acaena anserinifolia	y	x	x	x
Anaphalioides bellidioides			x	x
*Bellis perennis**		x		x
Brachyglottis lagopus var.	y		x	x
*Capsella bursa-pastoris**		x		x
Cardamine debilis agg.			x	x
Celmisia monroi	y		x	x

C. spectabilis				x
*Cerastium fontanum**		x		x
*Cirsium arvense**		x		x
*C. vulgare**				x
Crassula sieberiana			x	x
*Crepis capillaris**	y	x		x
Dichondra repens	y		x	x
*Digitalis purpurea**		x		x
Epilobium wilsonii			x	
E. nummulariifolium		x	x	x
E. rotundifolium			x	x
Galium trilobum			x	
*Geranium molle**		x		x
G. sessiliflorum		x		
Gingidia montana	y		x	x
Haloragis erecta	y		x	x
*Hieracium pilosella**				x
*H. praealtum**				x
Hydrocotyle heteromeria			x	x
H. moschata			x	x
H. sp. "montana"			x	x
*Hypochoeris radicata**				x
Leptinella pusilla	y			x
L. pyrethrifolia s.s.	y			x
*Linum catharticum**				x
L. monogynum	y		x	x
*Mycelis muralis**				x
Myosotis sp. "australis yellow"	y			x
*Marrubium vulgare**				x
Nertera depressa		x	x	x
Oxalis exilis			x	x
O. magellanica			x	
*Plantago lanceolata**				x
Pratia angulata				x
*Prunella vulgaris**				x
Pseudognaphalium luteo-album agg.			x	x
Ranunculus reflexus		x	x	
*R. repens**				x
Raoulia australis	y			x
*Rumex acetosella**		x		
*R. brownii**		x		
*Senecio jacobaea**				x
S. minimus				x
S. glaucophyllus ssp. *toa*	y			x
*Solanum nigrum**				x
*Silybum marianum**			x	
*Taraxacum officinale**		x		x
*Trifolium arvense**		x		x
*T. dubium**				x
*T. repens**		x		x
*Verbascum thapsus**				x
*Vicia sativa**				x
Vittadinia australis	y		x	x
Wahlenbergia albomarginata ssp. *flexilis*	y		x	x
W. matthewsii	y		x	x

W. violacea			x	
(35 indigenous species & 28 naturalised species)				
Monocotyledons: trees, shrubs and lianes				
Cordyline australis			x	x
C. banksii	y		x	x
Freycinetia banksii	y			x
Rhopalostylis sapida		x	x	x
Ripogonum scandens	y	x	x	x
(5 indigenous species)				
Monocotyledons: grasses				
*Agrostis capillaris**				x
*Anthoxanthum odoratum**				x
Chionochloa flavescens ssp. *brevis*	y		x	x
Cortaderia richardii		x	x	x
C. fulvida				x
*Cynosurus cristatus**				x
*Dactylis glomeratus**				x
Elymus sacandros	y		x	?
Festuca novae-zelandiae			x	
*F. rubra**				x
*Holcus lanatus**				x
*Lolium perenne**				x
Microlaena avenacea		x	x	x
Poa acicularifolia ssp. *acicularifolia*	y			x
P. cita	y		x	x
P. colensoi			x	x
*P. pratensis**		x		
Rytidosperma setifolium			x	x
Schedonorus phoenix (*Festuca arundinacea*)*				x
(10 indigenous species & 9 naturalised species)				
Monocotyledons: rushes and sedges				
Carex breviculmis			x	
C. coriacea				x
C. ?cockayneana			x	
C. ?forsteri			x	
G. pauciflora				x
G. xanthocarpa				x
*Juncus conglomeratus**		x		
*J. effusus**				x
J. gregiflorus			x	x
Uncinia clavata			x	x
U. ferruginea		x		
U. scabra			x	
U. silvestris				x
U. uncinata		x	x	x
(12 indigenous species & 2 naturalised species)				
Other monocotyledonous herbs				
Astelia fragrans	y			x
Collospermum hastatum			x	x
C. microspermum			x	
Dianella nigra			x	x

Drymoanthus adversus			x	x
Earina autumnalis	y		x	x
E. mucronata	y	x	x	x
Libertia grandiflora	y		x	x
Phormium cookianum			x	x
P. tenax				x
Thelymitra sp.				x
(11 indigenous species)				

Total number of indigenous species: 207
Total number of naturalised species: 41
Total vascular flora: 248 species

Doubtful records from Williams (1982)
Cyathea colensoi (probably = *C. smithii*)
Gahnia procera (probably = *G. pauciflora*)
Leptopteris superba (probably = *L. hymenophylloides*)

NOTE: *OENANTHE PIMPINELLOIDES* ON OTAMAHUA/QUAIL ISLAND: A FIRST RECORD FOR THE SOUTH ISLAND?

In May 2000 C.B. found, on Otamahua/Quail Island, one plant of an umbellifer unknown to him. Several of the previous summer's umbels, on stout stalks about 30 cm high, were present, as well as one or more rosettes of glabrous, two-pinnate young leaves, reminiscent of carrot. However the fruit shape indicated that it must belong to another genus. H.W. obliged with an identification – it surprised us both because *Oenanthe pimpinelloides*, parsley dropwort, a serious perennial weed of pastures, originally from Europe and western Asia, hitherto has been recorded in New Zealand only from the Auckland province, with outliers at East Cape and Lower Hutt.

The genera name refers to a supposed wine-like smell of the plant. It reproduces by seeds and, after dying down in winter, sprouts from tuberous underground organs. How could it have got to Otamahua? That is a great mystery. An effort is being made to remove all traces of the plant from the island – it would be an undesirable addition to the weed flora of Canterbury.

Hugh Wilson, Colin Burrows