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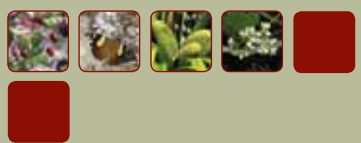

MARLBOROUGH DISTRICT COUNCIL

NORTH MARLBOROUGH
SIGNIFICANT NATURAL AREAS PROJECT

A Summary of Results from an Ecological Survey of Significant Natural Areas on Private Land in Marlborough, North of the Wairau River

June 2009

MARLBOROUGH
DISTRICT COUNCIL

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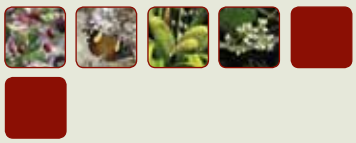

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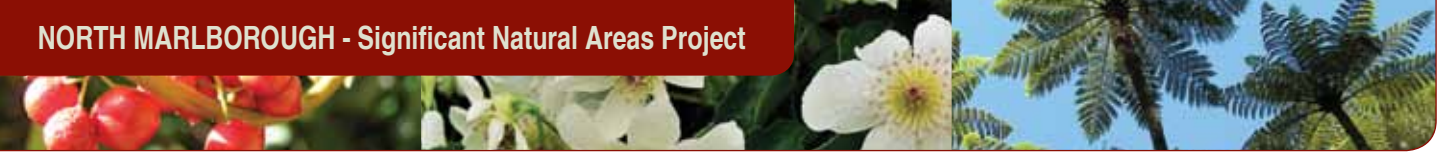

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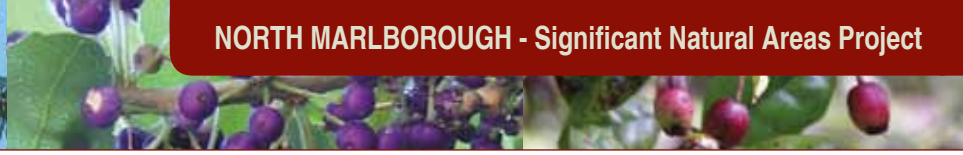

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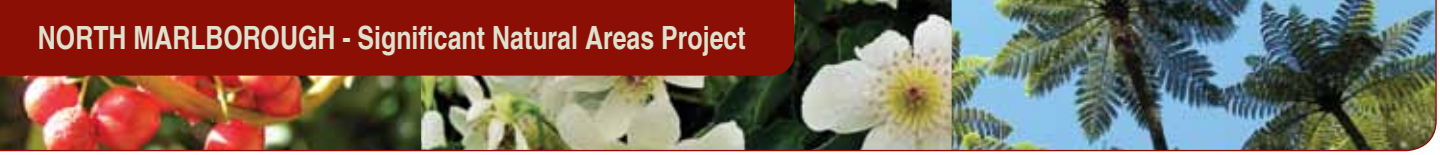

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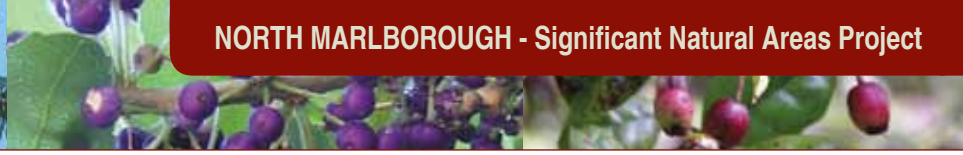


INTRODUCTION

This report provides an overview of the ecological survey recently carried out to identify and encourage opportunities for the conservation of natural features on private land in North Marlborough, complementing a similar overview produced for South Marlborough (Marlborough District Council, 2005). It summarises information collected by the Marlborough District Council (MDC), in conjunction with landowners in the district, through its work of identifying significant natural areas under the Resource Management Act.

North Marlborough has an extensive network of formally protected areas (Mt Richmond Forest Park, numerous reserves and other tracts of conservation land). Therefore, little previous attention had been given to ecological attributes on privately owned land, and a perception had grown that not much more of special value remained. This report indicates that not only do many ecological gems remain on private land, but there are many practical opportunities for conservation and an energy and desire for ecological restoration.

The MDC has worked on the principle of a partnership approach with landowners to achieve improvements in the protection of remaining significant natural areas in the region. This approach has allowed for meaningful and detailed field-based surveys to be carried out in cooperation with landowners, rather than a desk-top type of approach using maps and aerial photography. It has also provided both landowners and MDC with opportunities to learn about existing ecological values and issues that need to be understood, to enable effective protection and enhancement of the more vulnerable of these areas.

A programme providing advice and financial assistance to landowners has been established by the MDC. Support from central government through the "Biodiversity Fund" has boosted the MDC initiative, as has the building of a strong relationship with the QEII National Trust, which assists landowners to protect areas of private land through covenanting.

Through a combination of these measures, landowners have already implemented a number of ecological protection and restoration projects in North Marlborough. The MDC intends to continue to promote this protection/restoration work in the long term.

THE SURVEY AREA – ECOLOGICAL DISTRICTS

For the purposes of this report, North Marlborough is defined as that part of the Marlborough District (MDC territorial area) that lies to the north of the Wairau River (apart from the Tuamarina-Rarangi locality in the south-east, which is included within the South Marlborough survey area).

Ecological Districts (McEwen, 1987) are the geographical units used as the basis for this survey. These were developed for New Zealand in the 1980s to provide a context within which the ecological significance of natural features could be identified. An Ecological District is defined as a local part of the country where the topographical, geological, climatic, soil and biological features, combined with the broad cultural pattern, produce a characteristic landscape and range of biological communities. The MDC territorial boundary, and all of the ecological districts within it, are shown on Map 1.

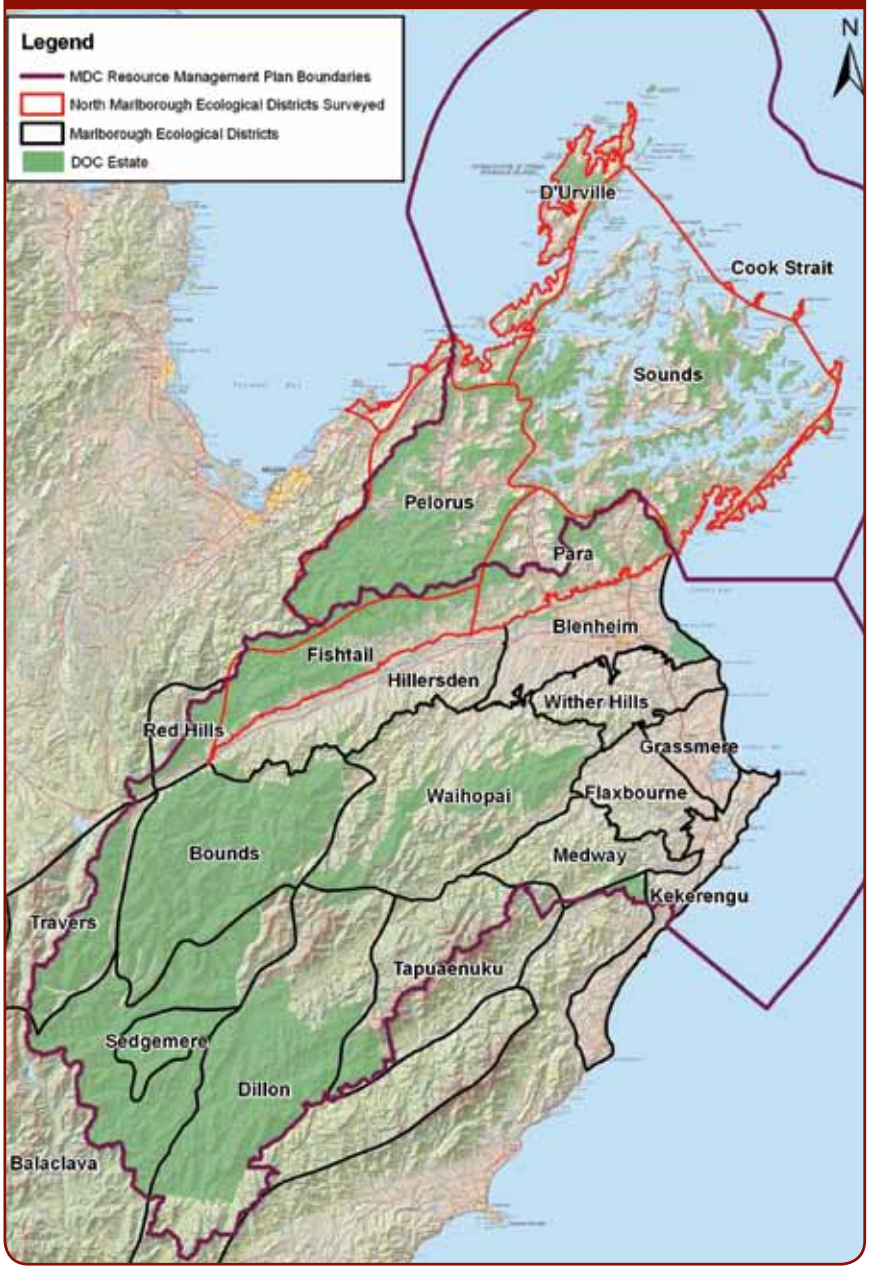
North Marlborough is covered by eight ecological districts: D'Urville, Cook Strait, Sounds, Pelorus, Para, Fishtail, Bryant and Red Hills. Of these, surveys were carried out in the first six. Surveys were not done in Bryant or Red Hills as the portions of these ecological districts within the MDC territorial area are relatively small and include little private land.

Each of the six ecological districts surveyed in North Marlborough, (shown in red outline on Map 1), are described in this report. For each, the following information is given:

- **OVERVIEW**

  A description of the biogeography and history of the district.

MAP 1: THE MARLBOROUGH DISTRICT SHOWING ALL THE ECOLOGICAL DISTRICTS AND CONSERVATION LAND



- **SURVEY RESULTS**

  A table showing the number of sites identified and total area of sites by ecosystem type. The data presented in tabulated form is a simplification, as sites frequently have more than one ecosystem type present.

- **ECOSYSTEMS FOUND**

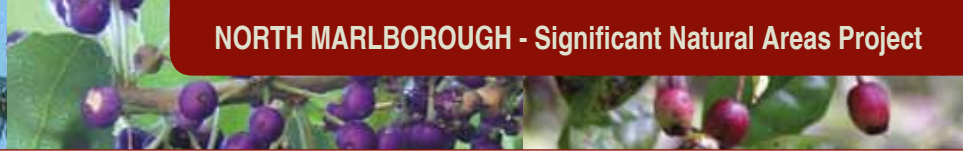
  Description of the main indigenous ecosystem types present.

- **SPECIAL FEATURES**

  Rare and threatened flora and fauna, distribution limits, archaeologically significant plants, anomalies, etc.

- **PHOTO ESSAY**

  A series of photos illustrating typical and distinctive habitats, flora and fauna.



THE FIELD SURVEY - METHOD

The North Marlborough ecological surveys followed on from and overlapped with those done in South Marlborough. Prior to the fieldwork getting underway (in early 2001 for South Marlborough, and in late 2002 for North Marlborough), preliminary consultation with landowners and relevant agencies took place. A working group was established by the MDC to help manage the project, and included landowner representatives as well as representatives from the MDC and the Department of Conservation (DOC). The working group designed the protocols to be followed by consensus and regularly reviewed the survey process. The key principle was that landowners were offered an obligation-free ecological survey, that their participation was voluntary and that surveys were only done with their consent.

The MDC employed a contract team of three for the surveys, under the supervision of Nicky Eade from the Environmental Science and Monitoring group. Following an introductory letter from the MDC, local environmental consultant Paul Millen made phone contact with individual landowners and then set up the programme for field survey. Freelance ecologists Geoff Walls and Philip Simpson carried out the surveys property-by-property, with Geoff Walls doing the majority. Most fieldwork was done on foot, with access aided by all terrain and four wheel drive vehicles. Some was done by boat, and water transport was needed to reach the main islands (D'Urville and Arapawa) and several remote Sounds properties. Landowners were given verbal feedback, and each received an individual written and illustrated report for their property.

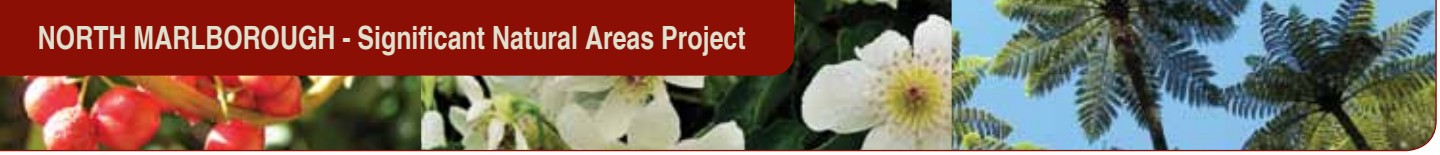
The criteria used to identify and assess sites of ecological significance are closely based on those initially developed for the New Zealand Protected Natural Areas Programme and subsequently widely used for ecological assessment. They are set out in Appendix One.

Landowners involved have been subsequently contacted to find out whether or not they would be interested in following up any management suggestions made in the reports. A steady stream of protection initiatives is now underway as a result, including fencing, pest control, restoration planting, management partnerships and formal covenanting through the QEII National Trust. In addition, some landowners have requested assistance with ecological management of whole properties to merge production with the conservation of natural features, and guidelines have been developed for this purpose.

Table 1 summarises overall results of the ecological survey work done in North Marlborough so far. A total of 169 landowners were offered ecological surveys, of which 125 chose to participate, and 44 declined. A total of 365 sites were identified as ecologically significant through the survey work, having a combined area of 21,549 hectares and making up an average of 7.4% of the total land area. The more detailed analysis provided under each separate ecological district gives information about the main ecosystem types identified.

TABLE 1 - OVERALL RESULTS OF MARLBOROUGH DISTRICT COUNCIL ECOLOGICAL SURVEYS IN NORTH MARLBOROUGH

Ecological Districts	No of Properties Surveyed	No of Properties Declined	No of Sites	Combined Area (ha)	SNA sites as a % of total private land area in ED	SNA sites as a % of total area of ED (DoC and private)	% of DoC land
D'Urville	20	9	46	3,582.0	16.5%	12.0%	27%
Cook Strait	2	0	6	695.0	16.8%	12.5%	24%
Sounds	61	16	182	11,479.0	16.0%	9.5%	39%
Pelorus	18	10	43	1,467.5	3.8%	1.4%	63%
Para	18	7	55	2,975.0	8.7%	6.2%	24%
Fishtail	6	2	33	1,350.5	9.0%	3.0%	55%
Totals	**125 (73%)**	**44 (27%)**	**365**	**21,549.0**	**(Av = 12%)**	**(Av = 7.4%)**	**(Av = 38.5%)**



THE ECOLOGY OF NORTH MARLBOROUGH

North Marlborough is distinctive, diverse and spectacular. It includes the rugged uplifted mass of the Richmond Range, its foothills, the boisterous Pelorus River, numerous streams, and the convoluted labyrinth of the Marlborough Sounds. There are mountains, hills, valleys, gullies, alluvial plains, sheltered waterways, wild exposed coasts, bays, islands and headlands. The geology is complex and interesting, featuring numerous faultlines, blocks of rocks that are tilted, crushed, uplifted and sunken, and deep deposits of alluvial and colluvial material. The geological structure follows a SW-NE axis, with parallel faults and blocks. The most distinctive is the band of ultramafic rocks (the Nelson Mineral Belt) that runs from the Red Hills to D'Urville Island. To the east the main sedimentary rocks become more schistose and in places are tilted to form gigantic slabs.

The climate is equally complex, but is predominantly sunny and reliably moist. In the mountains the summers are hot and the winters are sharp, whilst in the Sounds the temperatures are moderated by the sea. Cook Strait adds another dimension – powerful wind.

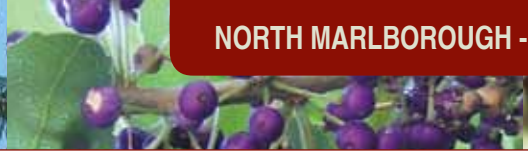
Together, the topography, geology and climate have created a great diversity of habitats, and this is reflected in the character of the native vegetation. The forests are mostly dominated by beeches, but include many podocarps (for instance, rimu, matai, miro, totara and kahikatea) and broadleaved trees. The composition varies widely but has distinct patterns, the most obvious being the abrupt changes in the beech species with altitude. In the outer Sounds a vibrant subtropical forest element is provided by kohekohe, nikau and pukatea. The upland forests feature silver beech, southern rata and Hall's totara and are stunted and festooned with mosses, lichens and orchids. The humid climate allows a proliferation of ferns, from the giant tree ferns of the Sounds to the filmy ferns of the cloud forests.

Other native vegetation types include ultramafic and subalpine shrublands, tussock grasslands and large areas of vegetation regenerating after past forest clearance. The towering forests of the valleys and coastal flats have largely gone, but on most slopes the regeneration process is leading to the eventual return of a forest cover resembling the original.

The native flora is typical of central New Zealand, but there are several species near the southern limits of their range (e.g. kohekohe, tanekaha, rewarewa, taupata, gully fern and swamp maire) and some notable absences (such as northern rata). There are plants endemic to the mineralised ultramafic soils, others endemic to the exposed Cook Strait coast (the most well known being Cook Strait kowhai) and an alpine daisy found only on the summit of Mt Stokes, the highest point of the Sounds at 1203 metres. In addition, there is a wealth of plants listed as nationally threatened.

Matching the flora is a diverse native fauna. Although depleted from its original richness, it includes birds of the bush, mountains, shore and sea, several lizard species (skinks and geckos), both tuatara species, Hamilton's and Maud Island frogs, bats, a range of freshwater fish and numerous invertebrates. Quite a few of these native animals are nationally threatened; several are endemic to North Marlborough (including King shag, the two frogs, Brothers Island tuatara, at least one gecko and three giant land snails). There are safe havens on several of the Sounds islands; otherwise the fauna faces a continual onslaught from exotic predators and competitors. On the predator-free islands, intense seabird activity is a reminder of a more widespread past phenomenon in the Sounds. Weka and kiwi are the last remnants of the former wealth of large ground-dwelling birds, and moa gizzard stones can still be found in many places.

Human impact has affected the North Marlborough ecology from the coast to the mountain tops. Several centuries of Maori settlement would have brought only small-scale localised forest clearance, but the impacts on the native fauna of hunting and the depredations by kiore (rats), and kuri (dogs), would have been widespread. These ecological effects were substantially heightened after European arrival. Much of the forest cover has been destroyed, particularly in the lowlands, although considerable tracts remain and native forest is now regenerating widely. Feral pigs, deer, goats, possums, mustelids, rodents, cats and hedgehogs are throughout, except on some islands. As a result, the native fauna on



most of the mainland is now just a shadow of its pre-human state. Many introduced plants have added further pressure on the natural ecosystems. Some, such as wilding pines and old man's beard, are widespread and highly invasive.

However, much remains to celebrate and nurture. The indigenous (native) ecosystems that remain provide a wealth of opportunities for protection and enhancement. Many landowners have strong bonds with the natural features on their land and a keen awareness of the management issues. There are already some outstanding conservation initiatives on private land in North Marlborough, including bush protection, wetland restoration, the retirement of tracts of land from farming to allow forest regeneration and the establishment of "mainland islands" where intensive pest eradication is done. There are plenty more opportunities.

ECOSYSTEMS OF NORTH MARLBOROUGH

The main ecosystem types recognised through the ecological survey work are described in this section, grouped under headings. They form the basis for the tabulations of ecological district survey results in the report (Tables 2-7 and 9). While the focus is on ecosystems on private land, the coastal and riparian sites generally include both private and public land, due to the existence of public land strips such as esplanade and other reserves. Some ecosystems described here are not listed in the tabulated survey results, either because they occur on public land only (tussock grasslands and other alpine ecosystems), or are areas that provide an important habitat within wider ecosystem types but have not been identified as specific sites through the significant natural area surveys (waterways, inland rock outcrop and cliff communities and swamp forest). In both cases, these ecosystem types are integral parts of the landscape as a whole.

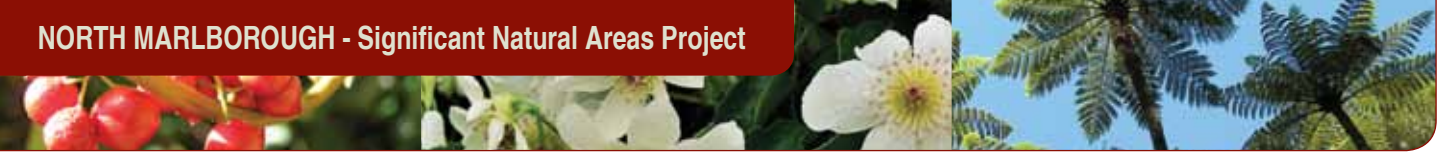
The Significant Natural Areas survey did not cover every property in North Marlborough with natural values, but rather focussed on larger properties, areas of high value native vegetation or areas with special features such as wetlands, coastal habitats and so on. Many smaller properties that have not been individually ecologically surveyed will contain natural values common to large parts of the North Marlborough area. Generally these properties will have regenerating native vegetation present and the descriptions below under the "Lowland shrubland and bracken fernland communities", "Mixed broadleaved-tree fern communities" or "Kanuka forest" headings are likely to be most relevant.

COASTAL ECOSYSTEMS

Coastal dune and beach communities

Dunes and sand beaches are rare in North Marlborough. They occur only on western D'Urville Island and in Port Underwood. The vegetation is mostly highly modified and dominated by marram grass, although there are tiny remnants of spinifex, matai, ngaio, manuka and kanuka to provide reminders of the natural cover. There are also small populations of coastal mat daisy (*Raoulia aff. hookeri*), a nationally rare community. In the past, the foredunes would have supported pingao, shore milkweed and sand tussock (all nationally threatened), and behind would have been tight shrubland rising back into forest. There are usually accumulations of driftwood, valuable habitat for native shore birds (dotterels, oystercatchers and penguins), lizards and invertebrates. Some dunes have deposits of small stones (gravel). This may be there because of tsunamis, but is more likely to have accumulated over millennia through sea lion activity (disgorging material used as ballast). Bones of extinct birds and reptiles have been found in dunes also.

There are many gravel or shingle beaches throughout the Sounds. Mostly the vegetation has been heavily modified, but bush runs right down to the water's edge in places and there are rare examples of fringes of shore milkweed, whaririki (coastal flax), kiekie, cabbage trees and akiraho. Driftwood is usually a feature, as with sand beaches.



Coastal rock and stonefield communities

Rocky shores are peppered with numerous rock outcrops (often forming stacks, or tiny islets). They are routinely used by coastal birds (gulls, terns, herons and shags) for roosting and nesting, and frequently have low-growing native vegetation (such as iceplant, taupata and small herbs and grasses) nurtured by the bird guano and nesting material. Boulderfields and stonefields of rounded water-worn rocks occur on very exposed shores, and form an elongated "boulder bank" at Greville Harbour on D'Urville Island. The vegetation is usually sparse but features taupata, iceplant, shore convolvulus and whaririki. Driftwood is also usually present, forming a distinct habitat.

Coastal rocky scarp and cliff communities

Most North Marlborough coastlines are rocky, steep and erosion-prone, the result of the sinking of the land and the constant gnawing of the sea. Sheltered shores have small scarps, fringed in many places by a distinct vegetation of whaririki, akiraho, taupata, silver tussock and various small-leaved shrubs and small native coastal herbs. Shag colonies occur sporadically, both in trees (pied, little and black shags) and on rock ledges (spotted shags). Little blue penguins nest in holes and under whaririki bushes. Karaka and rengarenga (renga lily) occur in places, as they also do on exposed shores, and owe their presence to former Maori settlement in the vicinity.

Exposed shores have larger scarps, forming towering cliffs where facing the prevailing westerlies or the gales of Cook Strait. Turfs of salt-tolerant plants (iceplant, glasswort, *Selliera radicans* and *Samolus repens*, normally found in estuaries), with silver tussock and small shrubs, grace headlands and faces frequently lashed by salt spray. Rock faces and cliffs are sparsely clad in tough shrubs (including Cook Strait kowhai, Cook Strait porcupine shrub, taupata, akiraho and tauhinu), silver tussock, Cook Strait speargrass and whaririki. Cook Strait kowhai, Cook Strait porcupine shrub and Cook Strait speargrass are, as their names suggest, endemic to the Cook Strait region. The sea cliffs have forest cover in places, even where highly exposed. The forest is dense and low-stature and includes kohekohe, wharangi, akiraho, kanuka, manuka, mapou, mahoe and titoki, with localised occurrences of totara, matai, large-leaved milk tree and fierce lancewood. Large-leaved milk tree and fierce lancewood are rare. Coastal birds use the exposed shores and include King shags (endemic to the Sounds), and the nationally threatened little blue penguins and reef herons. Cliffs and sunny scarps are home to geckos, skinks and native invertebrates such as copper butterflies, weta and large beetles.

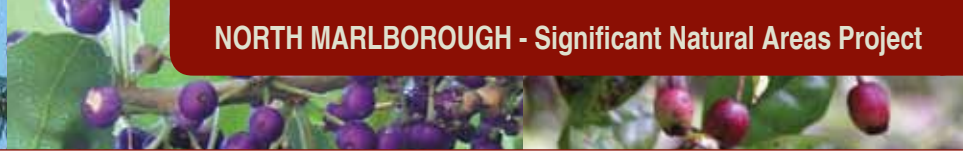
Of particular note are areas on D'Urville Island where cliffs of ultramafic geology occur on the coast.

Coastal wetlands

Coastal wetlands are still quite prevalent in North Marlborough, though they are mostly small and heavily modified. They include estuaries, lagoons, ponds and swamps. Largest by far of the estuaries is the extensive system at the mouth of the Pelorus River, a beautiful expanse of jointed rush with a fringe of shrubs, cabbage trees and harakeke (lowland flax). Otherwise there are small estuarine systems in the sheltered waterways of the Sounds, usually at the mouths of streams and containing sea rush, jointed rush, saltmarsh ribbonwood, harakeke, manuka, sedges and cabbage trees. Very rarely, swamp forest of kahikatea and pukatea backs the estuarine vegetation, forming an intact sequence.

The only coastal lagoons are in the west: Croisilles Harbour and D'Urville Island. This is probably because the prevailing westerlies there help create large barrier beach systems behind which water can pond. Each of the lagoons features beds of aquatic plants and is prime habitat for freshwater fish and waterfowl. Shags roost in remnant native trees by the lagoons. Elsewhere near the shore are smaller ponds, fed by small streams.

Coastal swamps are relatively common, and occur in association with lagoons and ponds or in seepage zones in lower valleys or on coastal flats. Where they retain native vegetation it usually features sedges, toetoe, harakeke and/or cabbage trees. Some swamps have shrubland of manuka or coastal shrub daisy (*Olearia solandri*), and a very few have swamp forest (kahikatea and pukatea; very rarely swamp maire).



OTHER WETLANDS AND FRESHWATER HABITATS

Inland wetlands

Intact natural inland wetlands are quite rare. Those on alluvial valley floors have invariably been logged and drained, so that all that remains are damp zones and occasional ponds with some rushes and perhaps the odd remnant kahikatea tree. Very few examples of the original towering kahikatea forests now exist. Otherwise there are various small swamps and seepages in valleys and gullies, some also on hillsides where there are natural springs. They usually contain sedges and rushes but little else.

Riparian communities

Riparian communities include trees, shrubs, harakeke, ferns and grasses on river and stream banks, flats and terraces. Native trees in inland sites typically include totara, matai, rimu, kahikatea, black beech, silver beech, red beech, kamahi, kowhai, lowland ribbonwood, narrow-leaved lacebark and lancewood. In the Sounds they also include pukatea, tawa, nikau and tree ferns. Distinctive plants such as climbing fuchsia (*Fuchsia perscandens*), rohutu (*Lophomyrtus obcordata*, often host to the dwarf mistletoe *Korthalsella lindsayi*), native verbena (*Teucridium parvifolium*), pygmy button daisy (*Leptinella nana*), *Hebe rigidula* and forest forget-me-not (*Myosotis spathulata*) occur in places. The nationally threatened deciduous tree daisy *Olearia hectorii* used to occur in the Pelorus Valley and tributaries but has gone from there: it could be re-introduced.

Braided riverbed habitats of gravel and boulders are rare in North Marlborough, although there are some small examples in rivers and streams on the Northbank of the Wairau. They have little native vegetation except small shrubs, cushion plants, herbs, mosses and lichens, but are important for several native birds (kingfishers, terns, gulls, pipits and dotterels).

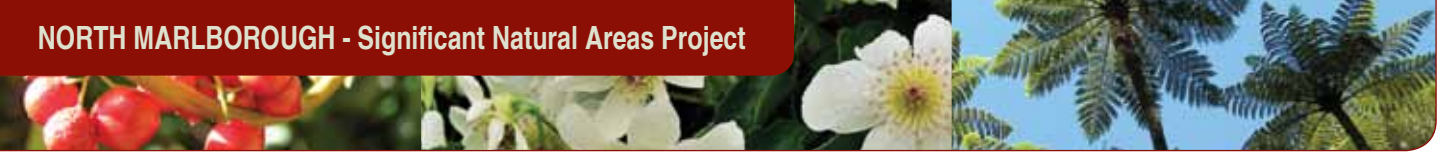
Waterways

The varied topography of North Marlborough is reflected by an equally diverse number of types of waterways. The waterways vary in size from the large flows of the Pelorus River to small Sounds streams that are never more than a trickle. This diversity of type and structure of streams also provides a wide range of habitats for many native fish species. The short steep catchments of the Marlborough Sounds are more typical of high country streams in structure and yet they join directly to the sea. The close proximity to the sea allows species of fish that are usually found in inland waterways to be found very close to sea level. The absence of the introduced predatory species such as trout and salmon in many of the waterways, has resulted in many of the larger streams in Northern Marlborough being home to the rare shortjaw kokopu (*Galaxias postvectis*). Banded kokopu (*Galaxias fasciatus*), redfin bully (*Gobiomorphus huttoni*) and bluegill bully (*Gobiomorphus hubbsi*) are common in the small Sounds streams. Dwarf galaxias (*Galaxias divergens*) upland bully, (*Gobiomorphus breviceps*) and common bully (*Gobiomorphus cotidianus*) are common in the more inland waterways of North Marlborough. The regionally rare giant kokopu (*Galaxias argenteus*) and giant bully (*Gobiomorphus gobiodes*) are also occasionally found in wetlands and upper estuaries of the larger waterways.

GEOLOGICAL ECOSYSTEMS

Inland rock outcrop and cliff communities

Rock outcrops, rocky scarps and cliffs occur throughout North Marlborough. They are on ridges, on hillsides, in gullies and on riverbanks. The rocks provide special micro-environments. They are habitats for distinctive vegetation and plants such as whahariki, “hot rock ferns” (*Cheilanthes* spp. and *Pellaea calidirupium*), threatened native daphnes (*Pimelea gnidia*, which is uncommon and *P. tomentosa*, which is rare), southern rata and various orchids (*Earina autumnalis, E. mucronata, Winika cunninghamii* and the tiny *Ichthyostomum pygmaeum*). Above the bushline (see Alpine Ecosystems



below) they are habitats for numerous upland plants including daisies such as *Celmisia macmahonii var. macmahonii* (found only on Mt Stokes) and *Celmisia macmahonii var. hadfieldii* and *C. rutlandii* (both endemic to the Richmond Range).

Ultramafic communities

The ultramafic zone, an irregular strip in the west from D'Urville Island to the Red Hills, has distinctive vegetation because of the peculiar mineral composition of its soils. In addition, a hard pan generally forms in the soil profile, resulting in poor drainage so that wetland plants can be found growing on ridges and gentle slopes. The primeval cover would have been stunted forest and shrubland, but has been much disrupted by burning since human arrival. Remnants of forest still exist and feature hard beech, southern rata, lancewood, broadleaf, rimu and manuka, with various small-leaved shrubs (including *Coprosma foetidissima, Pittosporum rigidum, Pseudopanax anomalus, Myrsine divaricata* and *Neomyrtus pedunculatus*), ferns (especially small kiokio, *Blechnum procerum*) and sedges (including giant cutty-grasses, *Gahnia* spp.).

Extensive shrubland grows where the original forest has been cleared, also in association with rock outcrops and screes. It is generally dominated by manuka, but also contains inaka (*Dracophyllum filifolium*), kanuka, kamahi, tauhinu, southern rata, five-finger, porcupine shrub and native daphnes (several species). Square sedge (*Lepidosperma australe*) is abundant and is dominant in places. Also present are whaririki, cutty grass (*Gahnia pauciflora*), sun orchids (*Thelymitra* spp.) and small herbs such as spoon-leaved sundew (*Drosera peltata*), the eyebright *Euphrasia cuneata* and the daisies *Celmisia gracilenta* and *Brachyglottis lagopus*. Several plants are endemic to the ultramafic zone. They include *Hebe urvilleana*, *Olearia serpentina*, an unnamed woollyhead (*Craspedia* "serpentine") and a recently named gentian (*Gentianella stellata*). The localised presence of pygmy pine (*Lepidothamnus laxifolius*) is interesting. Its hybrid with yellow silver pine (which is found in similarly poorly drained, infertile places in North Westland) is also present and may represent the beginning of a new species. Wilding pines and gorse are present and pose the greatest threat to this interesting vegetation.

SHRUBLANDS AND EARLY SERAL VEGETATION

Lowland shrublands and bracken fernlands

Native shrublands are common in North Marlborough. They are the early stages of bush regeneration and occur wherever the forest blanket has been cleared in the past and pastoral farming has ceased. Manuka, kanuka and tauhinu (one or other, or in combinations) are invariably dominant, especially at first, and grow to form dense scrub and low forest. These early regenerating manuka, kanuka and tauhinu shrublands are home to many ground orchids and are excellent habitats for small native birds (fantails, grey warbler, tomtits, robins, brown creepers, silvereyes and bellbirds), and also lizards and invertebrates.

Within and beneath these enthusiastic pioneer plants, forest species invariably get established and become ever more dominant with time, so long as fire is prevented, and stock, feral animals and weeds such as wilding pines are not prevalent. First to establish are small trees such as mahoe (whiteywood), five-finger, kaikomako, karamu, lancewood, rangiora, mingimingi and koromiko, usually accompanied by tree ferns (especially mamaku). At the same time, ground ferns, small-leaved shrubs and various climbers also appear.

Within a few decades, much of the manuka and tauhinu becomes replaced by the regenerating forest plants (although kanuka grows taller and lives longer). In the longer term they in turn become overtopped by larger longer-living trees such as kamahi, hinau, kohekohe, rewarewa, beeches and podocarps.

Sometimes bracken is the pioneer plant first on the scene following forest clearance and the cessation of pastoral farming. It can form a dense blanket, but it too does not last. It provides a nursery for tree ferns, trees, shrubs and vines, which quite quickly take over the site. Native broadleaved forest

is usually the eventual result, bypassing the shrubland phase but frequently containing kanuka. Sometimes tree ferns become dominant, and dense thickets of mamaku are a familiar sight in the Sounds. Mixtures of early seral shrubs and bracken are also quite common.

Regenerating shrublands with tauhinu and bracken fern on the slopes and fingers of broadleaved species showing in the gullies.

Regenerating low forest and shrubland on a narrow peninsula in the outer Sounds.

Upland and subalpine shrublands

Upland shrublands have two different types of origin. The first, like the shrublands of the lowlands, have resulted from regeneration following forest clearance. The second, subalpine shrublands, naturally occur above the bushline.

Where forest has been cleared is usually a vibrant mix of trees, shrubs and ferns. Manuka and kanuka are often first to establish, along with bracken. However, trees and other shrubs are usually quickly on the scene, and include kamahi, putaputaweta, heketara, lancewood, horopito, soft mingimingi, five-finger, broadleaf, tree fuchsia, various coprosmas, hebes and bush cabbage tree (*Cordyline banksii*). Numerous ground ferns and vines like bush lawyers establish rapidly too. Beeches and podocarps take longer to establish but eventually take over, in tandem with kamahi. These diverse and ever-changing shrublands are good habitats for native fauna, but can be disturbed and impeded by concentrations of feral pigs and goats.

Subalpine shrublands occur throughout the Richmond Range. They feature a diversity of shrubs and small trees, including inaka or turpentine scrub (*Dracophyllum* spp.), small-leaved coprosmas, several hebes, mountain wineberry, mountain toatoa, snow totara, Hall's totara, porcupine shrub, shrub daisies (*Brachyglottis, Olearia* and *Ozothamnus* spp.), *Pittosporum rigidum* and weeping matipo. Usually also present are whaririki (mountain flax), tall tussocks (*Chionochloa* spp.) and speargrasses (*Aciphylla* spp.). Near Lake Chalice, the rare species *Pittosporum patulum* occurs in the subalpine shrubland. On the Red Hills the subalpine shrubland is sparser and features very tough low-stature shrubs, a reflection of the ultramafic soils and rockiness. Mt Stokes is the only part of the Sounds to have subalpine vegetation and has a distinctive shrubland zone of the aptly named stoppy-stop (*Olearia colensoi*, known elsewhere as leatherwood or tupare), with weeping matipo, small-leaved coprosmas and stunted silver beech.

Mixed broadleaved-tree fern communities

Communities composed of young broadleaved trees and tree ferns are common. They occur more frequently in gullies and on shaded faces, but can also be on sunny slopes. They are the result of vigorous regeneration of native vegetation, the broadleaved trees and tree ferns growing through and replacing the initial post-pasture cover (usually of bracken, gorse, tauhinu or manuka). The most common tree species are five-finger (a powerhouse in the forest regeneration process, providing nectar and fruit for native birds, lizards and insects), mahoe, kaikomako, putaputaweta, cabbage tree, karamu, rangiora and heketara. Mamaku or black tree fern (*Cyathea medullaris*) is the most abundant tree fern, especially in the Sounds, and can be totally dominant in places. These mixed broadleaved-tree fern communities are a mid-seral stage in regeneration, gradually becoming naturally replaced by taller more complex-structured forests with canopies of longer-lived trees.

Regenerating broadleaved forest around the coastal margins with black beech and wilding pines present within it.

Tree ferns and broadleaved species on a shady face.

Other broadleaved trees and tree ferns can be locally dominant. In some places, kamahi forms forests where beech species would be expected, probably reflecting a disturbance event such as a storm wind-throw, fire or landslide, followed by regeneration in which kamahi was the first to arrive. In many gullies, on some slopes and in mid-altitude cloud forests, tawa is dominant. In other places, mostly where there is advanced regeneration or in ridge-crest cloud forests, there may be a mix of broadleaved trees including kamahi, tawa, mahoe, heketara, hinau, tarata (lemonwood), tree fuchsia, putaputaweta and broadleaf. Tree ferns form quite tall and enduring forests in places of reliable moisture and humidity. They represent regeneration following forest disturbance. Mamaku (*Cyathea medullaris*) is usually dominant, but ponga (silver fern, *C. dealbata*), soft tree fern (*C. smithii*), wheki (*Dicksonia squarrosa*) or wheki-ponga (*D. fibrosa*) can be locally abundant.

FORESTS AND TREELANDS

Swamp forests

Most of the natural swamp forest ecosystems have been logged of their great trees and drained. However, small remnants exist to give a guide to what used to be there. They occur in valley bottoms and on wet flats, both inland and coastal. Throughout the Sounds, the swamp forests are mainly pukatea and kahikatea, mostly the result of regeneration following logging and generally accompanied

by nikau, mamaku and other tree ferns, kiekie and supplejack. There are some rare occurrences of swamp maire (*Syzygium maire*). Inland, the swamp forests are of kahikatea, with undergrowth of small-leaved shrubs, ferns and sedges.

Alluvial valley and coastal flats forests

In the past, alluvial valleys would have been filled with towering forests of giant podocarps and beeches, with a complement of broadleaved trees, tree ferns, understorey shrubs, climbers and epiphytes. Because of the excellent timber and fertile soils, these desirable sites have been largely cleared, leaving only scattered trees and tiny forest remnants. The remnants contain trees such as kahikatea, matai, rimu, totara, black beech, silver beech, red beech, tawa, pokaka and hinau. Some have well-developed undergrowth of smaller native trees, shrubs, ferns and grasses. They are precious reminders of the primeval forests.

Coastal flats forests are just as rare nowadays, for the same reasons. Most remnants occur on conservation land in the Sounds, but there are a few on private land. They typically include tawa, pukatea, puka (*Griselinia lucida*), kohekohe, hinau and nikau, and may also have matai, kahikatea, cabbage tree or black beech. There is generally a profusion of ferns, climbers (rata vines, kiekie and supplejack) and epiphytes.

Kohekohe forests

The outer Sounds are characterised by the brilliant green of kohekohe forests that occupy coastal gullies and faces. They provide a lush subtropical element, often complemented by nikau, pukatea and puka. Kohekohe trees are very susceptible to possum browsing, and where possums are common their canopies become ravaged and their flower buds (produced on branches and trunks) are destroyed before fruits and seeds can develop. Therefore, kohekohe forests on the mainland are threatened ecosystems; on possum-free islands such as Arapawa and D'Urville they are fairly safe. Kohekohe naturally occurs throughout the coastal North Island; in the South Island it is only in the Sounds, except for a pocket at the base of Farewell Spit.

Beech forests

Beech species are universal throughout North Marlborough and form the most extensive natural forest cover. They have distinct patterns relating to landforms, soil conditions and altitude. Few examples of inland valley-floor beech forests remain, but those that do feature silver beech, red beech and/or black beech. Otherwise, black beech forms localised forests on lower slopes, dry spurs and headlands. Hard beech is dominant on lowland slopes, forming forests up to about 500m above sea level. Red beech consistently takes over above this altitude, but gives way at about 700m to silver beech. Mountain beech occurs in two places in the Sounds (the tops of Editor Hill and Mt Stokes), but inland is the main high-altitude tree, forming the bushline throughout the Richmond Range. Beech forests are susceptible to storm damage and it is common to encounter areas where young beeches have grown up in a canopy gap. All of the beech forests have shrubs and ferns beneath the canopy and the upland forests, especially those regularly bathed in mist, feature festoons of mosses, lichens, filmy ferns and perching orchids.

Podocarp-broadleaved-beech forests (lowland and upland)

Forests that contain a mixture of podocarp, broadleaved and beech species occur in many places. They reflect a blending of the predominant forest types, and their composition and structure vary according to local conditions and the ecological history. In the lowlands the podocarps are matai, rimu and kahikatea, the broadleaved species include hinau, tawa, kamahi, mahoe, kohekohe, pigeonwood, wineberry, lancewood, five-finger and putaputaweta, and the beeches are black and hard. In the uplands the forests are simpler, the podocarps being miro and Hall's totara (also pahautea or mountain

cedar in places in the Richmond Range), the broadleaved species being mainly southern rata, kamahi and broadleaf, and the beeches being silver and mountain.

Sometimes the beech or broadleaved components are absent or minor, in which case the forests can be described as “lowland-podocarp-beech”, “lowland-podocarp-broadleaved” or “upland-podocarp-beech” forests.

Manuka forests

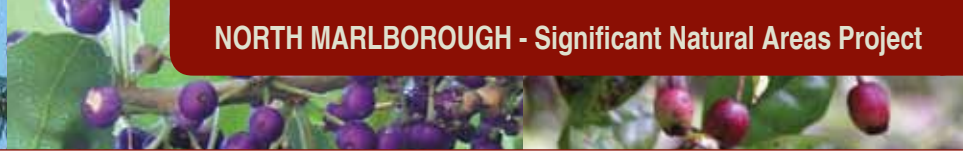
Manuka forests are quite rare. Manuka is generally abundant in the early stages of forest regeneration, but is usually overcome by taller longer-lived trees, especially kanuka. However, manuka has a competitive advantage in poorly drained sites such as wetland margins and can tolerate relatively low soil fertility and the peculiar soils of the ultramafic zone. Therefore in such places it sometimes lives long enough to form low forests.

Kanuka forests

Although a plant of disturbed and regenerating sites, and generally regarded along with manuka as fit only for firewood or stakes for the garden, kanuka often grows to become a substantial elegant tree in North Marlborough and forms extensive forests. Prior to human settlement, kanuka was probably mainly confined to erosion sites, wind-throw areas, flood zones and places of natural fires. It proliferated once the forests began to be cleared, getting established in the early stages of regeneration and becoming dominant as it over-topped smaller pioneers such as manuka, tauhinu and bracken. As kanuka can live for at least 100 years, it will continue to dominate much of the land throughout the Sounds and far inland for considerable time to come. If domestic stock and feral animals are not too numerous, kanuka provides a welcoming canopy for a rich diversity of secondary forest plants, including many native trees, shrubs, ferns and native orchids. These form tiers and some trees, such as beeches, podocarps, kamahi, lancewood, hinau and rewarewa, eventually out-grow the kanuka and form a mature forest canopy. Meanwhile, the kanuka forests are home to bush birds, lizards and invertebrates, providing shelter, nest sites and nectar.

Typical regeneration pattern in North Marlborough: manuka and kanuka on spurs, ridges and faces with broadleaved species and tree ferns in gullies and seepages. Given time, this will lead to more diverse native bush.

Kanuka forest showing emergent ferns and broadleaved species in the understorey.



Treelands

Treelands occur where the forest cover has been reduced to a scattering of trees, or where trees have grown up following clearance but have yet to form a closed canopy. They occur throughout North Marlborough, mostly in valley or coastal flats situations but sometimes on slopes. Individual trees, perhaps hundreds of years old, are important as landmarks, bird roosting and nesting sites, seed sources for propagation and hosts for plants like mistletoes. The best examples of treelands made up of remnant trees are at Koromiko, in the Kaituna Valley and in the Pelorus River catchment. They include totara, kahikatea, matai, black beech, silver beech, lowland ribbonwood, kowhai and cabbage trees. At Koromiko a protection and planting programme is ensuring that not only will the remnant trees survive but forest will be restored. Other examples are being fenced and planted. In the Sounds there are many stands of cabbage trees, often associated with swamps but also on flats and hillsides.

ALPINE ECOSYSTEMS

In the mountains, above the bush and beyond the subalpine shrublands, are alpine ecosystems. They contain plants specialised for the extremes of exposure and climatic variation, notably regular strong winds, summer heat, dense clinging mist, snow and frost. The native fauna is also adapted to these extreme habitats and includes birds such as kea, upland lizards and insects dependent on particular plants. These ecosystems have natural patterns but are somewhat degraded because of feral deer, chamois, possums and hares. In North Marlborough, the alpine ecosystems are entirely on public conservation land: mostly in the Richmond Range but also a limited area on the summit of Mt Stokes in the Sounds.

Tussock grasslands

Grasslands of carpet grass (*Chionochloa australis*) and tall tussocks (other *Chionochloa* spp.) occupy much of the alpine zone where the terrain and conditions allow. Among the grasses grow small native shrubs, alpine daisies (*Celmisia* spp.), buttercups, gentians, eyebrights, speargrasses and numerous other herbaceous plants.

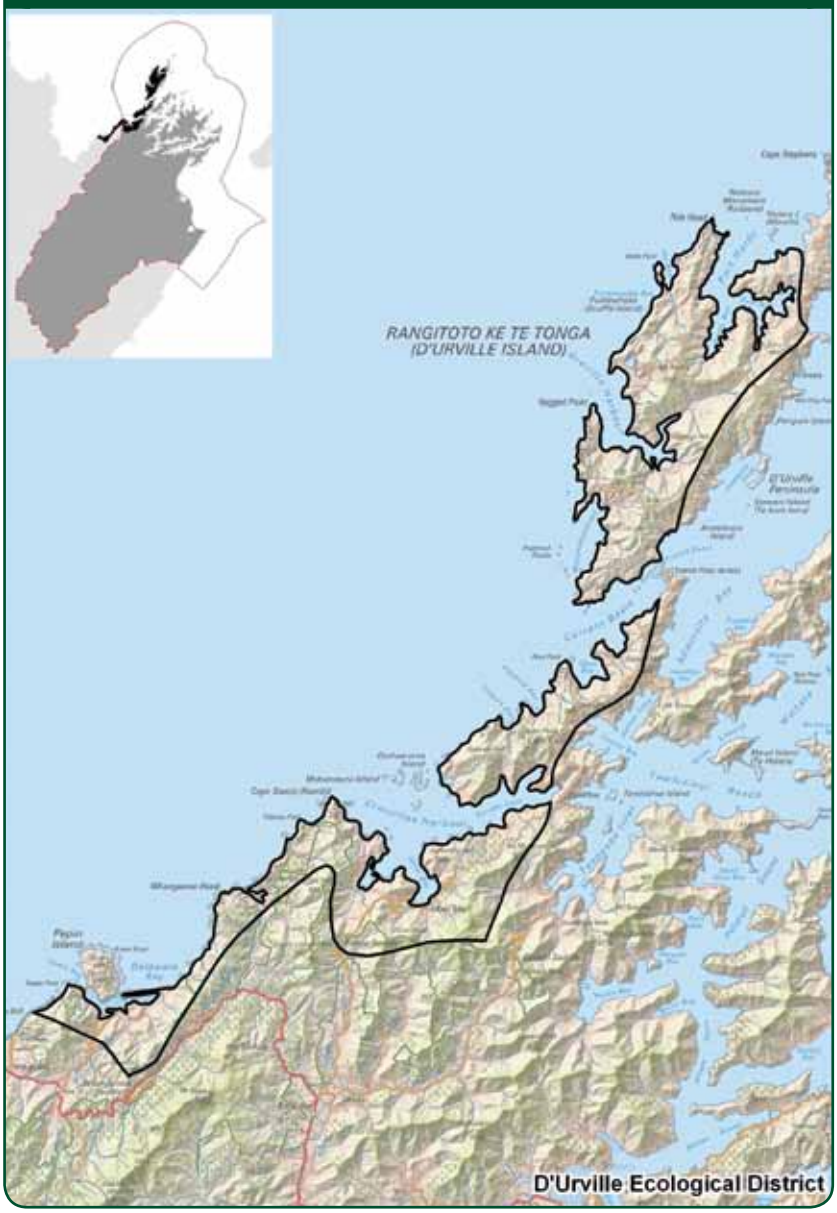
Other alpine ecosystems

Other alpine ecosystems include those of rock outcrops, screes, gully heads, and damp places (bogs and tarns). The rock outcrops and screes feature plants adapted to extreme exposure, weather and limited soil, such as cushion daisies (*Raoulia* spp.), tough mountain daisies (including the endemic *Celmisia macmahonii* and *C. rutlandii*), snowberries (*Gaultheria* spp.), coral daisies (*Helichrysum* spp.), edelweiss (*Leucogenes leontopodium*) and penwiper (*Notothlaspi rosulatum*). Damp sites have cushion plants such as *Donatia novae-zelandiae* and comb sedge (*Oreobolus pectinatus*), as well as mosses and creeping herbs.

RESULTS OF ECOLOGICAL DISTRICT SURVEY WORK

D'URVILLE ECOLOGICAL DISTRICT

MAP 2 - D'URVILLE ECOLOGICAL DISTRICT



OVERVIEW

The D'Urville Ecological District is one of four forming the Sounds-Wellington Ecological Region. The others are Sounds, Cook Strait and Wellington. D'Urville forms the north-western district, and includes the steeplands of the eastern Tasman Bay coast from Cable Bay to the north tip of D'Urville Island. It is spectacular country exposed to the prevailing westerly weather. The topography includes wild cliff systems, headlands, steep hills, strong ridges, gullies and confined flats and inlets. There are several coastal lagoons and a series of islets and rock stacks.

The geology is complex and consists of Permian argillite, igneous conglomerate, extensive areas of ultramafic "Mineral Belt" rocks and various volcanics. These are arranged in belts or strips along a NE-SW axis. D'Urville Island has only been separated from the mainland since the last glacial period.

The climate is a maritime one, with frequent gales, reliable rainfall, warm summers and mild winters. Soils are steepland soils formed from the parent rocks and include fragmented solifluction debris. They are mostly relatively fertile but in the higher rainfall areas they are leached and have infertile podzols. In the ultramafic areas the unusual concentrations of metallic minerals create soils that inhibit plants such as broadleaved trees and pasture grasses. Some of the soils on the Permian argillite are also difficult to grow pasture on.

The pre-human vegetation cover would have been almost entirely forest, except for eroding cliffs, beaches and water bodies. Much of the forest has been cleared for farming or timber. Hard beech is dominant in most remaining forest areas up to about 500m, with black beech on spurs, kamahi common and some rimu. In the gullies and fertile lower slopes is lush broadleaved forest containing kohekohe, pukatea, tawa and nikau. Above 500m the forest is dominated by red and silver beech. Ultramafic areas retain a little of the former forest cover of hard beech, kamahi and southern rata, but most has been burnt and now supports tight scrub of manuka, inaka (*Dracophyllum filifolium*), tauhinu and other shrubs. Areas of former forest not now in pasture or exotic pines are clad in scrub or regenerating low forest. Kanuka, manuka, tauhinu, gorse and Spanish heath are abundant in such

vegetation at an early stage in regeneration, in drier sites or where there is continued grazing. Later in the regeneration process and in gullies, the dominant plants are kanuka and/or numerous broadleaved trees such as five-finger, mahoe, karamu, heketara and putaputaweta, usually with an abundance of tree ferns. Wilding pines are the main weed threat to these areas.

The flora has features of significance such as species confined to the ultramafics and others that are only on the big sea cliffs. D'Urville Island is rather special; because it is possum-free it still has an abundance of mistletoes and also perching flora in the tall trees of the forest areas. It also supports many threatened plant species including shore milkweed (*Euphorbia glauca*), large-leaved milk tree (*Streblus banksii*) and wind grass (*Anemanthele lessoniana*).

The fauna includes most of the coastal, wetland and bush birds of the region. Threatened species include NZ falcon, marsh crake, reef heron, kereru and South Island kaka. Sadly, little spotted kiwi have disappeared in recent decades but weka are still common. Lizards (skinks and geckos) are fairly common still, and the giant land snail *Powelliphanta hochstetteri obscura* is still present. Native fish, including eels, galaxiids and bullies, occur in most streams and water bodies.

People have lived in this area for many centuries. Evidence of former Maori settlement - middens, terraces, pits and worked stone material - occur in many places. This ecological district contains the best sources of stone material for tool-making in New Zealand; there are extensive prehistoric quarries, particularly on D'Urville Island, from which material and artefacts were moved throughout the country. Some of the forest cover was burnt during the pre-European period of settlement, but most of the clearance happened since European arrival. The patterns of farming, established during the latter 19th century and early 20th century, still remain. However, they are becoming increasingly replaced by exotic forestry and coastal settlement. In a remarkable reversal of the former trend of destruction and alienation of the indigenous ecosystems, some modern landowners are returning their land to native forest and are tackling pests so that the native fauna and flora can flourish.

Weeds that pose serious ecological threats are wilding conifers (mostly pines) and old man's beard. Animal pests are feral pigs, deer, and smaller predators such as rodents, mustelids and hedgehogs, and on the mainland goats and possums as well. Wasps are also an ecological problem. Techniques for dealing with all these pests are available and with regular control it is possible to keep the threats to a minimum.

The Department of Conservation manages a network of reserves in the ecological district and there are areas of private land with protection as QEII National Trust Open Space Covenants.

SURVEY RESULTS

Of the 29 properties where the owners were approached, 20 were surveyed. A total of 46 significant sites were identified. These have a combined area of 3582 ha and make up approximately 12% of the total land area of the ecological district. They are classified into 12 basic categories or ecosystem types (see Table 2). They are mostly native forests, the most extensive being beech forests, but there are also coastal sites (including large wetlands), ultramafic communities and shrublands. Most sites have high value for ecological significance, reflecting how distinctive and special D'Urville Island and the coastal land to the south are.

ECOSYSTEMS FOUND

The original vegetation cover of the D'Urville Ecological District has been disturbed, modified and cleared since human arrival. However, much remains more or less intact and prolific natural regeneration has restored many areas, providing opportunities for protection and enhancement. Some landowners have formally protected the natural areas on their land, and are tackling weeds and animal pests. The MDC and DOC are coordinating protection work on a larger scale, such as eradication of wilding pines that occur on several properties including conservation land. The main ecosystems found were:

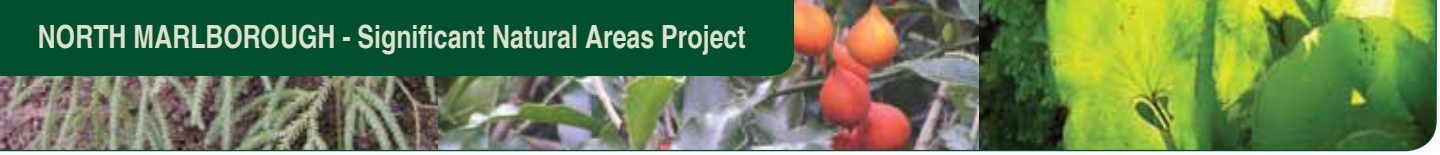


TABLE 2 - SITES IDENTIFIED IN THE D'URVILLE ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% private land area of Ecological District	% total area of Ecological District (DoC and private)
Coastal dune and beach communities	1	7.0		
Coastal rocky scarp and cliff communities	2	141.0		
Coastal wetlands	3	88.5		
Ultramafic communities	2	421.0		
Lowland shrublands	1	58.5		
Upland shrublands	2	12.5		
Alluvial valley and coastal flats forests	1	3.0		
Kohekohe forests	12	71.5		
Other broadleaved and tree fern forests	9	386.5		
Beech forests	6	1,449.0		
Podocarp-broadleaved-beech forests	2	223.0		
Kanuka forests	5	720.5		
Total	**46**	**3,582.0**	**16.5%**	**12%**

COASTAL DUNE AND BEACH COMMUNITIES

One site only; dunes are very rare in North Marlborough.

COASTAL ROCKY SCARP AND CLIFF COMMUNITIES

Two quite large west-facing sites, homes for plant species adapted to handle extremes of exposure to sun, wind and salt.

COASTAL WETLANDS

Two coastal lagoons and a swamp. Rare ecosystems, important for native freshwater fish, invertebrates, plants and wetland birds.

ULTRAMAFIC COMMUNITIES

Highly distinctive vegetation because of the unusual chemical makeup of the parent rock.

LOWLAND SHRUBLANDS

Widespread early seral vegetation in the ecological district, the result of regeneration following forest clearance and farming.

UPLAND SHRUBLANDS

Higher altitude sites containing vegetation that has regenerated following forest clearance and farming.

ALLUVIAL VALLEY AND COASTAL FLATS FORESTS

Very rare in North Marlborough. A single small example.

KOHEKOHE FORESTS

In the South Island, only found in northern North Marlborough and at the base of Farewell Spit. Several sites in the ecological district, mostly small. Especially valuable on D'Urville Island because there are no possums.

OTHER BROADLEAVED AND TREE FERN FORESTS

Occupying lowland and coastal gullies and shaded faces. Both natural and the result of regeneration following logging. Main tree species are tawa, pukatea, mahoe and mamaku.

BEECH FORESTS

Widespread and extensive, from the coast to the tops. Four species of beech, each adapted to different conditions. Podocarps usually present.

PODOCARP-BROADLEAVED-BEECH FORESTS

Mixed forests where conditions suit a variety of tree species.

KANUKA FORESTS

Widespread in the North Marlborough lowlands, the result of prolonged regeneration following forest clearance and farming. If not unduly disturbed, provide good habitat for the regeneration of ferns and tree species that will eventually take over. Manuka is usually present and in a few places is dominant. Good for native ground orchids.

SPECIAL FEATURES

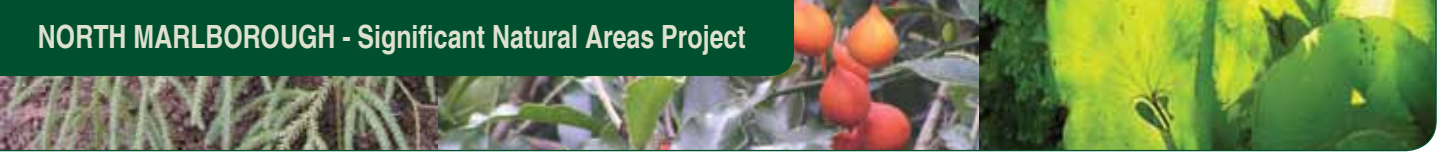
The ecological district is founded on D'Urville Island, one of the largest islands in New Zealand outside the main three, and biologically special because of its freedom from possums and feral goats. Practically the entire ecological district faces the prevailing westerly weather, so its natural ecosystems and biota are adapted to strong wind, pounding seas, salt air and rainfall deluges. There are coastal lagoons (found nowhere else in North Marlborough) and several sand beaches with dunes, homes to particular plants and animals. The most striking feature though is the ultramafic zone, with its unique influence on soil fertility, vegetation and flora.

NATIVE FLORA

- Several plants are endemic to the ultramafic zone. They include *Hebe urvilleana, Olearia serpentina*, an unnamed woollyhead (*Craspedia "serpentine"*) and a recently named gentian (*Gentianella stellata*). The suite of plant species in the native vegetation of the ultramafics is unusual and distinctive.
- D'Urville Island has an abundance of mistletoes: *Alepis flavida, Peraxilla tetrapetala, Tupeia antarctica, Ileostylus micranthus* and *Korthalsella salicornioides*. It also has threatened and regionally rare plants such as shore milkweed (*Euphorbia glauca*), large-leaved milk tree (*Streblus banksii*), fierce lancewood (*Pseudopanax ferox*), Cook Strait porcupine shrub (*Melicytus crassifolius*), *Melicytus* aff. *obovatus* and wind grass (*Anemanthele lessoniana*).
- The localised presence of swamp maire (*Syzygium maire*), pygmy pine (*Lepidothamnus laxifolius*), rewarewa (*Knightia excelsa*) and tanekaha (*Phyllocladus trichomanoides*) is interesting. They are at distribution limits and/or are anomalous.
- Kohekohe (*Dysoxylum spectabile*) dominates coastal forest in many places, imparting a subtropical ecological dimension. It is frequently accompanied by wharangi (*Melicope ternata*) and puka (*Griselinia lucida*).
- Karaka (*Corynocarpus laevigatus*), rengarenga (*Arthropodium cirratum*), harakeke (*Phormium tenax*) and whau (*Entelea arborescens*) occur in localised pockets. They are associated with past Maori settlement, particularly former garden sites. Stands of cabbage trees and occasional kowhai (*Sophora microphylla*) might also indicate former settlement sites.

NATIVE FAUNA

- Bush birds are still quite prevalent, due to the extent of bush cover and diversity of other native vegetation. The forests and shrublands support strong populations of tui, kereru, weka, bellbird, tomtit, brown creeper, silvereye, fantail and grey warbler (riroriro). Of note are the local occurrences of New Zealand robin, rifleman, kaka, kakariki and New Zealand falcon (karearea or sparrowhawk). New Zealand pipit is common in open places.



- Wetland birds have a range of remaining habitats available to them. Ducks, paradise shelduck and pukeko are quite common. Of note are local records of fernbird, marsh crake and Australasian bittern. Banded rail might still be present too.
- Coastal birds are common and include gulls, terns, shags, herons, oystercatchers, gannet and various transient waders. Of note are little blue penguin, king shag, pied shag, black shag, Caspian tern and reef heron: all are listed as nationally threatened. A recent sighting of a brown booby at D'Urville Island is of interest: this is a species of the tropics.
- Burrowing seabirds have remnant breeding colonies on the islands in Croisilles Harbour and on some western D'Urville Island islets.
- Moa bones and gizzard stones have been found in the ecological district. Remains of other extinct birds and tuatara have been found in the D'Urville Island dunes.
- Lizards (skinks and geckos) are quite common, especially in rock outcrops, screes, forest and shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders. The giant land snail *Powelliphanta hochstetteri obscura* is still present in local populations, although severely threatened by feral pigs. Velvet worm (*Peripatus*) occurs in places.
- At least nine species of native freshwater fish have been recorded from the rivers and streams of the ecological district. Of particular note are longfin eel, giant kokopu and shortjaw kokopu.
- New Zealand fur seals are making a comeback and are frequent around the coast. Deposits of rounded pebbles in several places may indicate past populations of New Zealand sea lions; they use pebbles as ballast.

D'URVILLE ECOLOGICAL DISTRICT – PHOTO ESSAY

ULTRAMAFIC "MINERAL BELT" LANDSCAPE

Ultramafic landscape on D'Urville Island with remnant forest in the gully centre and typical low-stature regenerating vegetation foreground and background. This pattern is the result of clearance of the forest in the past using fire. Ultramafic soils have an unusual chemistry and are home to plant species that can tolerate this.

ULTRAMAFIC ROCK OUTCROPS

Rock outcrops like this occur throughout the ultramafic zone. They are often refuges for orchids, ferns, shrubs and trees that have survived burning and the depredations of feral animals. They are also attractive to New Zealand falcons as nest sites and lookouts.

MOUNTAIN CABBAGE TREE

Toii or mountain cabbage tree (*Cordyline indivisa*) is a striking feature of the upland forests. It only occurs sporadically, in sites that are reliably cool and moist due to frequent mists.

MOSAIC FOREST PATTERNS

The D'Urville ecological district has quite a few sequences of native forest from the coast to the tops. As in this Okiwi Bay sequence, the lowland forest cover has generally been cleared in the past but has been restored quite quickly by vigorous regeneration. This often results in mosaics of mature forest and youthful forests in various stages of regeneration.

INSTREAM HABITAT

D'Urville Ecological District is quite rugged and rocky and has reliable rainfall, so the many streams descend steeply and feature falls, cascades and pools. Those protected by native forest are in the best condition and provide the best quality habitat for native fish.

MARLBOROUGH PLANTS

Kiekie (*Freycinetia banksii*), a native New Zealand member of the largely tropical screwpine family that includes *Pandanus*. It climbs and scrambles up trees and around the coastal gullies and slopes of North Marlborough, often forming dense impenetrable masses. The flower bracts and fruit are edible and the leaves are prized by traditional weavers.

MARLBOROUGH PLANTS

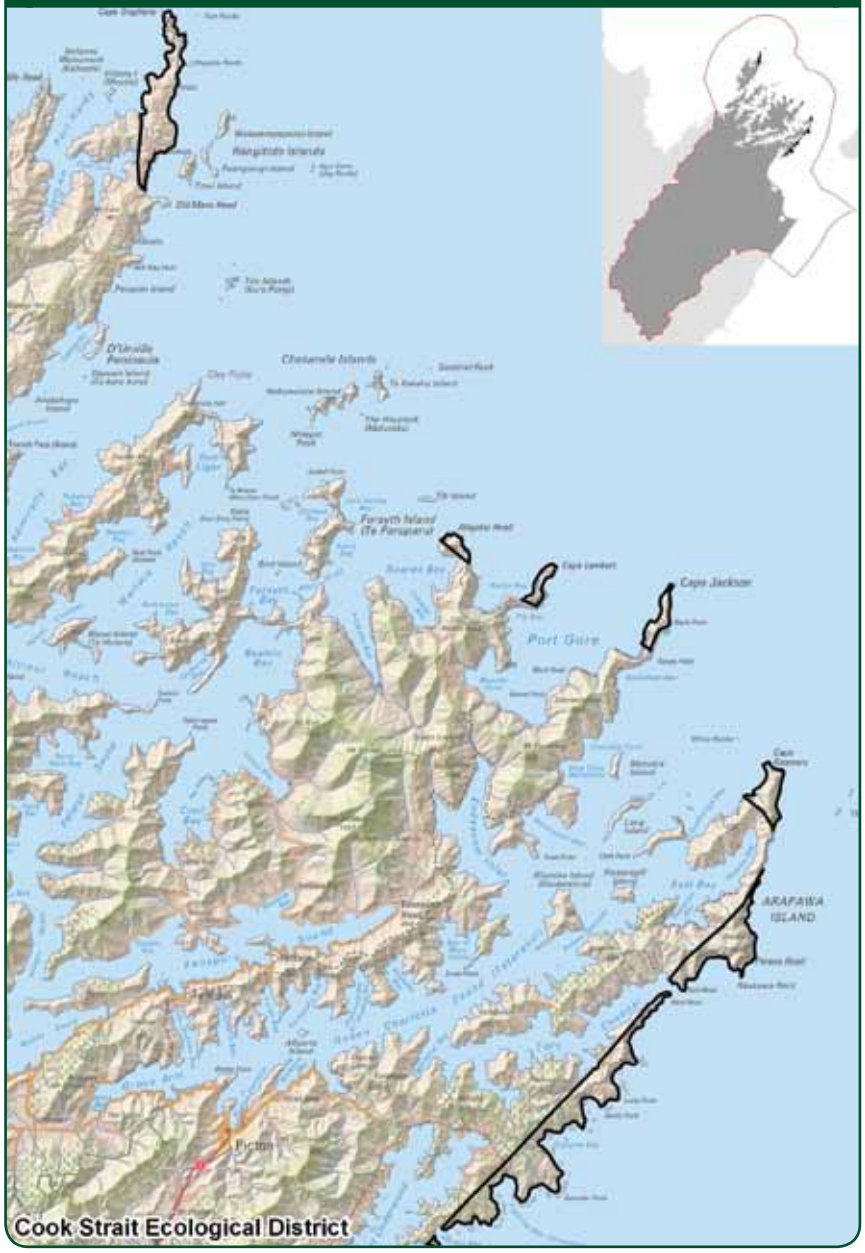
Shore milkweed (*Euphorbia glauca*), a plant of the shore that is now nationally rare and endangered. In North Marlborough it is only found in a few sites on western D'Urville Island.

MARLBOROUGH PLANTS

Kohekohe flower in early winter, the flower spikes emerging from trunks and branches (a feature of tropical plants, giving a clue about the origins of this native species). On possum free islands (such as Awapawa, D'Urville and several other smaller islands) kohekohe canopies are healthy and profuse flowering occurs unhindered. Where possums are present, kohekohe canopies are ragged and flowers are rarely seen.

COOK STRAIT ECOLOGICAL DISTRICT

MAP 3 - COOK STRAIT ECOLOGICAL DISTRICT

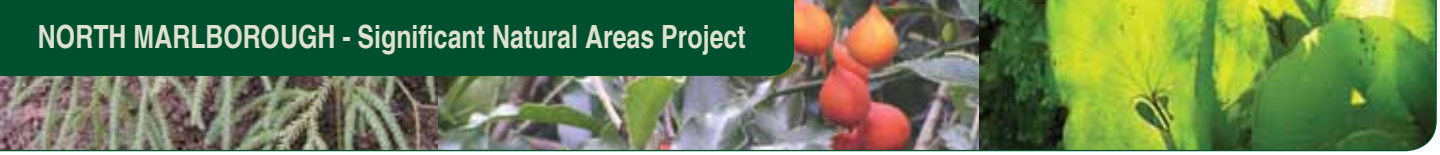


OVERVIEW

The Cook Strait Ecological District contains the exposed coastal cliffs, terraces, headlands and islands on either side of Cook Strait. On the western side (North Marlborough) it includes the outer tips of Cape Stephens, Cape Lambert, Cape Jackson and Cape Koamaru, the scarps of Arapawa Island, the coast between Tory Channel and Port Underwood, and Stephens Island (Takapourewa), the Rangitoto Islands, The Trios, the Chetwode Islands, Titi Island and The Brothers. On the eastern side it includes Kapiti Island, Mana Island and the coastal scarp between Paekakariki and Island Bay, Wellington.

The geology is complex and consists of Permian argillite, greywacke, igneous conglomerate, areas of ultramafic "Mineral Belt" rocks and various volcanics. The climate is an intensely maritime one, characterised by a high wind-run, frequent gales, reliable rainfall, warm summers and mild winters. Soils are mostly shallow and stony steepland soils, with areas of bare rock and scree.

The pre-human vegetation cover would have been almost entirely forest, except for on eroding cliffs and beaches. Most of the forest has been cleared for farming. Kohekohe would have been dominant in most of the forests, even on exposed cliffs. In the gullies there would also have been pukatea, tawa, titoki, wharangi, kiekie and nikau. At higher levels where there is a regular cloud cap the forest would have contained a range of broadleaved species including tawa, heketara and toro, various podocarps including matai, miro and Hall's totara, southern rata (west of Cook Strait), northern rata (east of Cook Strait) and red and black beech. On the cliffs and islands were low forests and shrublands combed flat by wind and exposed to salt spray. The main plants would have been akiraho, ngaio, Cook Strait kowhai (*Sophora molloyi*), kohuhu, mapou, mingimingi (*Leptecophylla juniperina* and *Coprosma propinqua*), tauhinu, coastal shrub daisy (*Olearia solandri*) and pohuehue (*Muehlenbeckia complexa*). Even more exposed and eroding sites would have had a sparse vegetation of whaariki (coastal flax), iceplant, silver tussock, speargrass (*Aciphylla squarrosa*) and salt turf plants. Remnants of all these vegetation types still exist, particularly on the islands. Domestic stock, possums and wilding pines are the main threats to these areas on the mainland.



The flora has features of significance including species more or less confined to the Cook Strait vicinity such as Cook Strait kowhai, the porcupine shrub *Melicytus crassifolius*, the annual seabird colony groundsel *Senecio sterquilinus* and particular forms of *Melicytus* aff. *obovatus*, kohuhu, *Coprosma propinqua* and Cook Strait speargrass. Other notable plants are large-leaved milk tree (*Streblus banksii*), fierce lancewood (*Pseudopanax ferox*), raukawa (*Raukaua edgerleyi*), *Pittosporum cornifolium*, rengarenga (*Arthropodium cirratum*), sea holly (*Eryngium vesiculosum*), *Hebe elliptica*, coastal mat daisy (*Raoulia* aff. *hookeri*) and the mistletoes *Ileostylus micranthus* and *Tupeia antarctica*.

The fauna contains highly significant and distinctive elements. It includes most of the coastal and bush birds of the region. Threatened species include king shag, pied shag, reef heron, New Zealand falcon, marsh crake, kereru, kiwi and kaka. The islands are refuges for these species and others. They are also home to colonies of burrowing seabirds (petrels, prions, shearwaters and penguins), two species of tuatara, several species of lizards (skinks and geckos), Hamilton's frog, the giant land snail *Powelliphanta hochstetteri bicolor*, giant ground weta and an array of other important endemic or native invertebrates.

Evidence of former Maori settlement - middens, terraces, pits, garden areas and worked stone material - occurs in many places. From the extensive prehistoric quarries on D'Urville Island, material and artefacts were moved throughout the district and further afield. Some of the forest cover was burnt during the pre-European period of settlement, but most of the clearance happened since European arrival. The patterns of farming, established during the latter 19th century and early 20th century, still remain. However, in a reversal of the former trend of destruction and alienation of the indigenous ecosystems, some modern landowners are returning land to native forest and are tackling pests so that the native fauna and flora can flourish. Retirement of land from pastoral farming is also opening up the option of deriving meaningful income from carbon credits.

Weeds that pose significant ecological threats are wilding conifers (mostly pines) and old man's beard. Animal pests are feral pigs, deer, goats and possums, and smaller predators such as rodents, mustelids and hedgehogs. Wasps are also an ecological problem. The Department of Conservation manages a series of reserves in the ecological district, including most of the islands that are refuges for a range of threatened species.

SURVEY RESULTS

Because Cook Strait Ecological District is one of extremes and occupies a very small part of Marlborough, there are few private land holders. Both of the two properties where the owners were approached were surveyed. A total of six significant sites were identified, with a combined area of 695 ha, making up approximately 12.5% of the total land area of the ecological district. They are classified into five basic categories or ecosystem types (see Table 3). The largest area contains regenerating native shrublands, but there are also coastal cliffs, a dune system, salt turfs, one wetland and small remnants of kohekohe forest. Most sites have high value for ecological significance, reflecting the extreme conditions of Cook Strait.

TABLE 3 - SITES IDENTIFIED IN THE COOK STRAIT ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% private land area of Ecological District	% total area of Ecological District (DoC and private)
Coastal dune and beach communities	1	12		
Coastal rocky scarp and cliff communities	2	17		
Coastal wetlands	1	10		
Kohekohe forest	1	13		
Lowland shrublands	1	643		
Total	**6**	**695**	**16.8%**	**12.5%**

ECOSYSTEMS FOUND

Although the original forest cover has largely gone, the elements that influence the native vegetation and fauna remain. The main ecosystems found were:

COASTAL DUNE AND BEACH COMMUNITIES

Features a remarkable dune system with wind-blown sand extending well inland.

COASTAL ROCKY SCARP AND CLIFF COMMUNITIES

Typical of the ecological district, home to distinctive flora and fauna.

COASTAL WETLANDS

One large swamp behind a small sand-gravel beach, much modified for farming.

KOHEKOHE FORESTS

Pockets in gullies and on hillsides, mostly unprotected from farm animals.

LOWLAND SHRUBLANDS

Early successional vegetation of tauhinu, manuka, kanuka and mingimingi, the first stage of coastal forest regeneration.

SPECIAL FEATURES

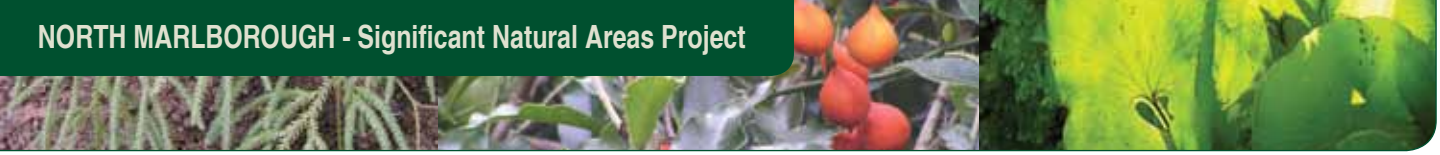
The ecological district is one of extremes: the tips of land bearing the full brunt of the wildness of Cook Strait. It includes portions of D'Urville and Arapawa Islands, among the largest islands in New Zealand outside the main three, and biologically special because of their freedom from possums. The natural ecosystems and biota are adapted to very rugged topography, violent seas and weather extremes, especially salt-laden gales. The islands are sanctuaries for very special plants and animals and provide a suite of unique opportunities for their long-term conservation.

NATIVE FLORA

- There are several threatened and regionally rare plants such as shore milkweed, large-leaved milk tree (*Streblus banksii*), fierce lancewood (*Pseudopanax ferox*), Cook's scurvy grass (*Lepidium oleraceum*), the native groundsel *Senecio sterquilinus* (associated with seabird activity), Cook Strait kowhai (*Sophora molloyi*), Cook Strait porcupine shrub (*Melicytus crassifolius*), *Melicytus* aff. *obovatus* and the rosette plants *Kirkianella "glauca"* and *Sonchus kirkii*. Some occur on the mainland, but they are mostly on islands.
- Other noteworthy plants that are present include tree hebe (*Hebe parviflora*), the small native daphne *Pimelea urvilleana*, climbing aniseed (*Scandia geniculata*), Cook Strait speargrass (a local form of *Aciphylla squarrosa*) and a local low-growing form of matagouri (*Discaria toumatou*).
- Kohekohe (*Dysoxylum spectabile*) dominates the coastal forest in most places, imparting a subtropical ecological dimension. It is frequently accompanied by wharangi (*Melicope ternata*) and puka (*Griselinia lucida*).
- Karaka (*Corynocarpus laevigatus*) and rengarenga (*Arthropodium cirratum*) and harakeke (*Phormium tenax*) occur in localised pockets. They are associated with past Maori settlement, particularly former garden sites. Stands of cabbage trees might also indicate former settlement sites.

NATIVE FAUNA

- Bush birds are still quite prevalent on the bush-clad islands and mainland. There are strong populations of tui, kereru, weka, bellbird, tomtit, brown creeper, silvereye, fantail and grey warbler (riroriro). Of note are island populations of New Zealand robin, rifleman, kaka and kakariki. New Zealand falcon (karearea or sparrowhawk) occurs in low numbers and New Zealand pipit is common in open places.



- Coastal birds are common and include gulls, terns, shags, herons, oystercatchers, gannet and various transient waders. Of note are little blue penguin, king shag, pied shag, black shag, Caspian tern and reef heron: all are listed as nationally threatened.
- Seabirds are abundant around Cook Strait, and several burrowing species have breeding colonies on the predator-free islands. They include sooty shearwater, flesh-footed shearwater, fluttering shearwater, diving petrel and fairy prion. Guano deposits indicate former long-established gannet colonies.
- Moa bones and gizzard stones have been found in the ecological district.
- The ecological district is the stronghold for both tuatara species. Stephens Island has the largest population of Cook Strait tuatara (*Sphenodon punctatus*), whilst the only remaining natural population of Brothers Island tuatara (*S. guntheri*) is on North Brother Island.
- The only wild population of the endemic Hamilton's frog (*Leiopelma hamiltoni*) is on Stephens Island.
- Lizards (skinks and geckos) are very common on the predator-free islands and also occur on the mainland. They include several gecko species, including the threatened striped and Duvaucel's geckos and yellow forms of Marlborough green gecko, and several skink species.
- The ecological district has remaining populations of special native invertebrates. The giant land snail *Powelliphanta hochstetteri bicolor* is still present on Arapawa Island, although severely threatened by feral pigs. On predator-free islands are threatened species of giant weta, click beetles, weevils and ground beetles.
- New Zealand fur seals are making a comeback and are frequent around the coast. They breed on Stephens Island. Deposits of rounded pebbles in several places may indicate past populations of New Zealand sea lions. Cook Strait is renowned for whales and dolphins.

COOK STRAIT ECOLOGICAL DISTRICT – PHOTO ESSAY

COASTAL DUNE SYSTEM

This is one of very few dune systems in North Marlborough, and is peculiar in having an elongated slope of sand blown way inland and to an altitude of over 100m. Behind is a mass of volcanic rock, in the crevices of which grow salt turf plants including uncommon species.

REGENERATING COASTAL VEGETATION

Cape Jackson is a peninsula stretching out into Cook Strait. Pastoral farming has ceased and there is now an interesting mosaic of remnant forest, regenerating low forest and scrub (the precursor for regenerating forest). The owners derive income from ecotourism and carbon sequestration as the woody vegetation regenerates.

SPECIAL COASTAL PLANTS

At the tip of Cape Jackson, exposure to strong winds and salt spray is extreme. Nevertheless, plants such as Cook Strait speargrass (foreground and lower right), Cook Strait porcupine shrub, tauhinu and the endemic coastal form of silver tussock, all thrive.

SEABIRDS

Red-billed gull with two chicks. Despite occurring all around the North Marlborough coast, the red-billed gull numbers appear to be dwindling. Cook Strait islands are a main breeding grounds for this species, along with burrowing seabirds like petrels, shearwaters and penguins.

STEEP COASTAL SCARPS

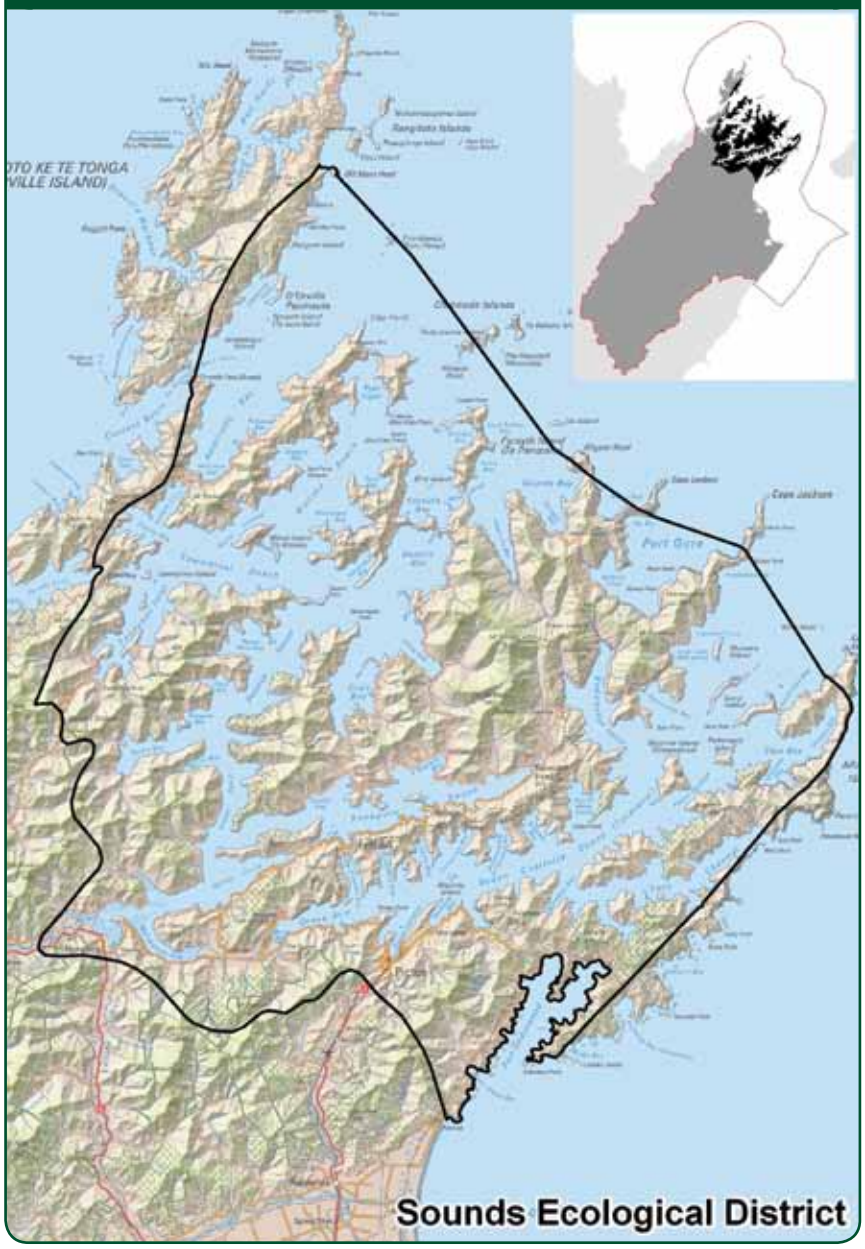
Coastal scarps characterise the Cook Strait ecological district. While in some places still grazed by farm stock, in general they are too steep and have never been cleared or are regenerating in tough shrubs (including endemic species such as Cook Strait kowhai) and flaxes. Even on such precarious and exposed sites as this northwest-facing coastal scarp, native forest exists. Prior to the arrival of exotic predators such as rats, stoats and cats, such sites would have been alive with colonies of burrowing petrels, penguins and other seabirds. Tuatara and several species of skinks and geckos would also have been present.

DRIFTWOOD HABITAT

Driftwood provides an important habitat for various native coastal plants and animals, including shore convolvulus (*Calystegia soldanella*), several insects, katipo spiders, skinks and shore-nesting birds such as banded dotterel and oystercatchers.

SOUNDS ECOLOGICAL DISTRICT

MAP 4 - SOUNDS ECOLOGICAL DISTRICT



OVERVIEW

The Sounds Ecological District is one of four forming the Sounds-Wellington Ecological Region. It forms the largest and central district, and includes the entire Marlborough Sounds except the very outer reaches, Croisilles Harbour and western D'Urville Island. It is a wonderfully complex labyrinth of convoluted land and waterways ("drowned valleys"), with a robust but rather benign climate. The topography includes peninsulas, headlands, steep hills, strong ridges, gullies and confined flats and inlets. There are several substantial islands within each of the two main sounds, Pelorus and Queen Charlotte, and some smaller islets. The highest point is Mt Stokes (1203m), high enough to have an alpine character.

The geology is complex. In the west is Permian argillite and igneous conglomerate, with some areas of ultramafic "Mineral Belt" rocks and volcanics. In the centre is Carboniferous greywacke and argillite, and in the east is Carboniferous Marlborough schist. These are arranged in belts or strips along a NE-SW axis. D'Urville Island has only been separated from the mainland since the last glacial period.

The climate has prevailing west to north-west winds with fairly frequent gales, reliable rainfall, warm summers and mild winters. Soils are steepland soils formed from the parent rocks and include fragmented solifluction debris. They are moderately fertile as a rule, but in the higher rainfall areas are leached and have infertile podzols. In the ultramafic areas, the unusual concentrations of metallic minerals creates soils that inhibit plants such as broadleaved trees and pasture grasses.

The pre-human vegetation cover would have been almost entirely forest, except for eroding scarps, beaches, water bodies and at the summit of Mt Stokes. Much of the forest has been cleared for farming or timber. Hard beech is dominant in most remaining forest areas up to about 500m, with black beech on spurs, kamahi common and some rimu. In the gullies and fertile lower slopes is lush broadleaved forest containing kohekohe, pukatea, tawa and nikau, sometimes with large rimu, matai and kahikatea. There is usually a profusion of ferns, climbers and epiphytes in these forests. Between 500 and 700m in altitude the forest is generally dominated by red beech, with kamahi and silver beech. Southern rata and Hall's totara often occur on ridge crests. Above 700m, the forest is dominated by silver beech, with mountain beech on some western peaks. On the summit of Mt Stokes, above 1100m, is alpine vegetation of snowgrass, alpine daisies and cushion plants, with a fringe of "stoppy-

stop" (leatherwood or tupare, *Olearia colensoi*) scrub. Ultramafic areas retain a little of the former forest cover of hard beech, kamahi and southern rata, but most has been burnt and now supports tight scrub of manuka, inaka (*Dracophyllum filifolium*), tauhinu and other shrubs. Areas of former forest not now in pasture or exotic pines are clad in scrub or regenerating low forest. Kanuka, manuka, tauhinu, gorse and Spanish heath are abundant in such vegetation at an early stage in regeneration, in drier sites or where there is continued grazing. Later in the regeneration process and in gullies, the dominant plants are kanuka and/or numerous broadleaved trees such as five-finger, mahoe, karamu, heketara and putaputaweta, usually with an abundance of tree ferns. Wilding pines are the main weed threat to these areas.

The flora has features of significance such as plants peculiar to the summit of Mt Stokes. These include the distinctive daisy *Celmisia macmahonii* var. *macmahonii* and species confined to the ultramafics. Cook's scurvy grass, once abundant around the coast, has virtually disappeared but still occurs on some islands. D'Urville Island is rather special; because it is possum-free it still has an abundance of mistletoes. It also has threatened plants such as shore milkweed (*Euphorbia glauca*), neinei (*Dracophyllum urvilleanum*) and wind grass (*Anemanthele lessoniana*).

The fauna includes most of the coastal, wetland and bush birds of the region. Threatened species include New Zealand falcon, marsh crake, kereru and South Island kaka. Sadly, little spotted kiwi have disappeared in recent decades from their former range, but have been rescued on some predator-free islands. Weka are still common. There is a nationally endangered endemic frog, Maud Island frog (*Leiopelma pakeka*), found only on the island that gives it its name. Lizards (skinks and geckos) are fairly common still, and the giant landsnails *Powelliphanta hochstetteri obscura* and *Powelliphanta hochstetteri bicolor* are still present. Native fish, including eels, galaxiids and bullies, occur in most streams and wetlands.

People have lived in this area for many centuries. Evidence of former Maori settlement - middens, terraces, pits and worked stone material - occur in many places. There are extensive prehistoric quarries, particularly on D'Urville Island, from which material and artefacts were moved throughout the country. Some of the forest cover was burnt during the pre-European period of settlement, but most of the clearance happened since European arrival. Ship Cove is famous for being used by Captain Cook during his explorations in the late 18th century. He liberated pigs and goats for the first time in New Zealand there. The patterns of farming, established during the latter 19th century and early 20th century, still remain. However, they are becoming increasingly replaced by exotic forestry and coastal settlement. In a remarkable reversal of the former trend of destruction and alienation of the indigenous ecosystems, some modern landowners are returning their land to native forest and are tackling pests so that the native fauna and flora can flourish.

Weeds that pose serious ecological threats are wilding conifers (mostly pines) and several vines of which old man's beard is worst. Animal pests are feral pigs, deer, goats and possums, and smaller predators such as rodents, mustelids and hedgehogs. Wasps are also an ecological problem. Techniques for dealing with all these pests are available and with regular control it is possible to keep the threats to a minimum.

The Department of Conservation manages an extensive network of reserves throughout the ecological district. There are areas of private land with protection as QEII National Trust Open Space Covenants. Threatened plant and animal species are being managed on several of the islands, notably Maud Island in Pelorus Sound and Motuara Island in Queen Charlotte Sound.

SURVEY RESULTS

Of the 77 properties where the owners were approached, 61 were surveyed. A total of 182 significant sites were identified. These have a combined area of 11,479 ha and make up approximately 9.5% of the total land area of the ecological district. They are classified into 20 basic categories or ecosystem types (see Table 4). They are mostly native forests, the most extensive being kanuka and beech forests, but there are also several other forest types, coastal sites (including wetlands and a stonefield), inland sites, upland sites and shrublands. Most sites have high ecological values, reflecting the high topographic and biological diversity of the Marlborough Sounds and its hinterland.

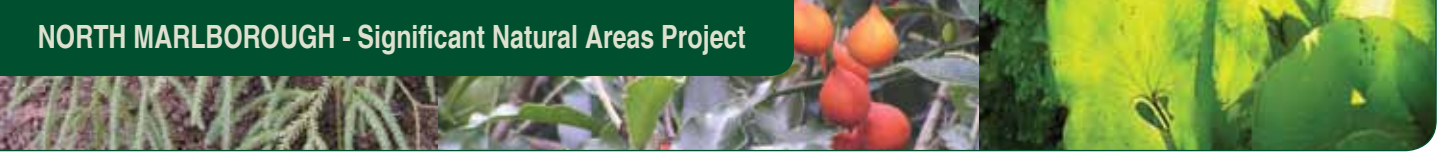


TABLE 4 - SITES IDENTIFIED IN THE SOUNDS ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% private land area of Ecological District	% total area of Ecological District (DoC and private)
Coastal dune and beach communities	4	22		
Coastal rocky scarp and cliff communities	12	175		
Coastal rock and stonefield communities	1	2		
Coastal wetlands	6	28		
Estuarine vegetation	1	2		
Inland wetlands	2	8		
Riparian communities	2	9		
Lowland shrublands	10	487		
Mixed broadleaved–treefern communities	9	126		
Alluvial valley and coastal flats forests	5	38		
Kohekohe forests	20	115		
Broadleaved forests (coastal gullies)	23	542		
Broadleaved forests (inland gullies and faces)	12	209		
Beech forests	17	1,333		
Lowland podocarp-beech forests	2	341		
Lowland podocarp-broadleaved forests	11	561		
Podocarp-broadleaved-beech forests	8	498		
Upland podocarp-beech forests	1	760		
Kanuka forests	34	5,988		
Manuka forests	3	235		
Total	**182**	**11,479**	**16%**	**9.5%**

ECOSYSTEMS FOUND

The original vegetation cover of the Sounds Ecological District has been disturbed, modified and cleared since human arrival. However, much remains more or less intact and prolific natural regeneration has restored many areas, providing opportunities for protection and enhancement. Some landowners have formally protected natural areas on their land, and are tackling weeds and animal pests. The local community (through the Marlborough Sounds Restoration Trust), MDC and DOC are coordinating protection work on a larger scale, such as eradication of wilding pines that occur on many private properties and conservation land. The main ecosystems found were:

COASTAL DUNE AND BEACH COMMUNITIES

Dunes are very rare in the ecological district, confined to a few beaches in Port Underwood.

COASTAL ROCKY SCARP AND CLIFF COMMUNITIES

The coast is largely rocky, with steep scarps gnawed at by the sea. They are the habitat of a suite of specialist shore plants and birds such as shags, gulls, terns and little blue penguin.

COASTAL ROCK AND STONEFIELD COMMUNITIES

One site found only.

COASTAL WETLANDS

Coastal wetlands occur in several places; usually quite modified but readily recoverable with stock exclusion.

ESTUARINE VEGETATION

Mostly confined to small sheltered sites, but on a larger scale at places such as Nydia Bay.

INLAND WETLANDS

Rare in the ecological district; two sites found during the survey.

RIPARIAN COMMUNITIES

Mostly highly modified or absent; two interesting sites found during the survey.

LOWLAND SHRUBLANDS

Abundant and widespread, usually on abandoned former farmland. Not identified as ecologically significant except where intermingled with older vegetation or providing habitat for threatened fauna such as giant land snails and lizards.

MIXED BROADLEAVED–TREE FERN COMMUNITIES

Quite common and widespread, usually the result of rapid regeneration following cessation of pastoral farming in gullies and on shaded faces.

ALLUVIAL VALLEY AND COASTAL FLATS FORESTS

Once occupied by towering native forests, but almost completely logged out and converted to pasture. There are a few precious remnants.

KOHEKOHE FORESTS

Only in the outer Sounds, in coastal gullies and on sunny faces. Formerly fairly extensive, but now mostly reduced to small vulnerable remnants. For them to flourish, stock exclusion is necessary. Possum-free sites, such as on D'Urville and Arapawa islands, are nationally important.

BROADLEAVED FORESTS (COASTAL GULLIES)

Occupying coastal gullies and shaded faces. Both natural and the result of regeneration following logging. Main tree species are tawa, pukatea, mahoe, nikau, ngaio and mamaku.

BROADLEAVED FORESTS (INLAND GULLIES AND FACES)

Occupying inland gullies and shaded faces. Main tree species are tawa, mahoe, kamahi, hinau, five-finger, tree fuchsia and putaputaweta.

BEECH FORESTS

Widespread and in many places dominant. They include black and hard beeches in the lowlands and red and silver beeches in the uplands. Podocarps (rimu, matai and miro) are often present.

LOWLAND PODOCARP-BEECH FORESTS

Uncommon, because the podocarps are mostly logged out.

LOWLAND PODOCARP-BROADLEAVED FORESTS

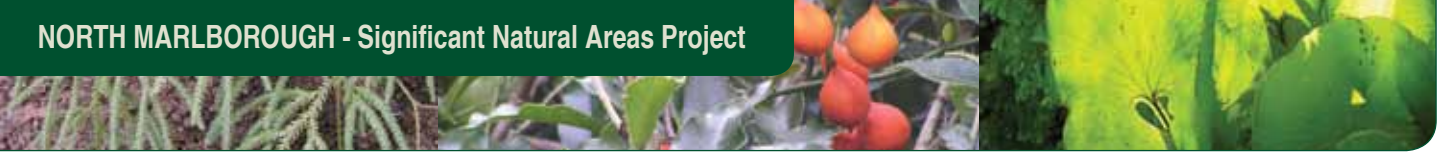
In places where the soil is relatively fertile. The podocarps (especially kahikatea and matai) are often young, having grown up since the old adults were logged.

PODOCARP-BROADLEAVED-BEECH FORESTS

Occurring where a wide range of tree species intermingle, although often the beeches are on dry spurs, the broadleaved trees are in the gullies and the podocarps are in a variety of microsites.

UPLAND PODOCARP-BEECH FORESTS

Above about 500m altitude in the cloud forest zone. The podocarps are Hall's totara and miro.



KANUKA FORESTS

Widespread in the North Marlborough lowlands, the result of prolonged regeneration following forest clearance and farming. If not unduly disturbed, provide good habitat for the regeneration of ferns and tree species that will eventually take over. Manuka is usually present and in a few places is dominant. Good for native ground orchids.

MANUKA FORESTS

Low regenerating forests in which the manuka remains dominant, not yet outgrown by kanuka, broadleaved species, podocarps or tree ferns.

SPECIAL FEATURES

The ecological district has a complex interplay of land and water, extending from the sheltered inner Sounds to the outer Sounds that are exposed to the turbulence of Cook Strait. Therefore there is a broad spectrum of biological features, with much local variation according to aspect, topography, geology and climate. The ecological district includes portions of D'Urville and Arapawa Islands (both large and possum-free), as well as numerous smaller islands, most of which play strong roles in the conservation of special native flora and fauna.

NATIVE FLORA

- There is distinct altitudinal zoning of the forest species, with consistent changes at about 500m and 700m asl. Many of the high ridges have a capping of cloud forest, festooned with mosses, lichens, filmy ferns and perching orchids.
- Estuarine communities are quite rare and fragmentary in the ecological district, although there is a major system at the mouth of the Pelorus River. They contain distinctive plants such as oioi (jointed rush, *Apodasmia similis*), salt marsh ribbonwood (*Plagianthus divaricatus*) and salt-tolerant turf species. The saline herbs also occur on headlands exposed to regular salt spray.
- There are small areas of the ultramafic zone on eastern D'Urville Island. They include the ultramafic endemics *Hebe urvilleana*, *Olearia serpentina*, an unnamed woollyhead (C*raspedia "serpentine"*) and a newly named gentian (*Gentianella stellata*). The suite of plant species in the native vegetation of the ultramafics is unusual and distinctive.
- D'Urville Island and Arapawa Island have many mistletoes because they are free of possums.
- The small alpine zone on the summit of Mt Stokes is highly distinctive. It includes the endemic mountain daisy *Celmisia macmahonii* var. *macmahonii*, a cushion bog and a fringe of "stoppy-stop" (*Olearia colensoi*).
- Other threatened and regionally rare plants that occur in the ecological district include large-leaved milk tree (*Streblus banksii*), fierce lancewood (*Pseudopanax ferox*), raukawa (*Raukaua edgerleyi*), the rosette daisy *Kirkianella "glauca"*, Cook Strait porcupine shrub (*Melicytus crassifolius*), *Melicytus* aff. *obovatus* and Cook Strait kowhai (*Sophora molloyi*).
- The localised presence of swamp maire (*Syzygium maire*), white maire (*Nestegis lanceolata*), black maire (*N. cunninghamii*) and rewarewa (*Knightia excelsa*) is interesting. They are at distribution limits and/or are anomalous.
- Kohekohe (*Dysoxylum spectabile*) dominates coastal forest in many places in the outer Sounds, imparting a subtropical ecological dimension. It is frequently accompanied by titoki, tawa, wharangi (*Melicope ternata*) and puka (*Griselinia lucida*).
- Karaka (*Corynocarpus laevigatus*), rengarenga (*Arthropodium cirratum*) and harakeke (*Phormium tenax*) occur in localised pockets. They are associated with past Maori settlement, particularly former garden sites. Stands of cabbage trees and occasional kowhai (*Sophora microphylla*) might also indicate former settlement sites.

NATIVE FAUNA

- Bush birds are still quite prevalent, due to the extent of bush cover and diversity of other native vegetation. The forests and shrublands support strong populations of tui, kereru, weka, bellbird, tomtit, brown creeper, silvereye, fantail and grey warbler (riroriro). Of note are the local occurrences of New Zealand robin, rifleman, kaka, kakariki and New Zealand falcon (karearea or sparrowhawk). New Zealand pipit is common in open places.
- Wetland birds have remaining habitats available to them. Ducks, paradise shelduck and pukeko are quite common in places. Of note are local records of banded rail, marsh crake and Australasian bittern.
- Coastal birds are common and include gulls, terns, shags, herons, oystercatchers, gannet and various transient waders. Of note are little blue penguin, king shag, pied shag, black shag, Caspian tern and reef heron: all are listed as nationally threatened. The recently established gannet colony at Waimaru Bay has dramatically expanded. Fluttering shearwater is frequently within the waterways of the Sounds, although it breeds on the Cook Strait islands. A recent sighting of a brown booby at D'Urville Island is of interest: this is a species of the tropics.
- Moa bones and gizzard stones have been found in the ecological district.
- The nationally endangered endemic Maud Island frog (*Leiopelma pakeka*) is found only on the island that gives it its name.
- Lizards (skinks and geckos) are quite common, especially in rock outcrops, screes, forest and shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders. The giant land snails *Powelliphanta hochstetteri obscura* and *Powelliphanta hochstetteri bicolor* are still present in local populations, although severely threatened by feral pigs. Velvet worm (*Peripatus*) occurs in places.
- At least 14 species of native freshwater fish have been recorded from the rivers and streams of the ecological district. Of particular note are longfin eel, lamprey, giant kokopu and shortjaw kokopu.
- New Zealand fur seals are making a comeback and are frequent around the outer coasts. Dolphins regularly come into the Sounds.

SOUNDS ECOLOGICAL DISTRICT – PHOTO ESSAY

SOUNDS VEGETATION PATTERNS

A typical pattern of vegetation in the Sounds, with mature native forest on the upper slopes and lower slopes regenerating native vegetation invaded by wilding exotic pines, on the lower slopes which were logged and cleared for farming in the past.

KARAKA TREE

A karaka tree by the shore in a small bay. Its presence indicates former Maori settlement, as it was deliberately planted for food, although the fruit can be poisonous if not properly prepared.

MOA GIZZARD STONES

Rounded quartz moa gizzard stones like these can be found in places far from water - a link with the primeval ecosystem when birds were the dominant animals.

ARGILLITE ROCK FLAKES

Flakes of metasomatised argillite can be found on many beaches in the Marlborough Sounds, remnants of a former Maori culture with sophisticated stone-working skills. The argillite naturally occurs only in ultramafic areas, where it was quarried then distributed throughout New Zealand.

COASTAL WETLANDS

Coastal wetlands like this are rare in the Sounds, most having been cleared and drained for farming and settlement. If not disturbed, these sites can regain a natural appearance as plants like cabbage trees and harakeke (lowland flax) regenerate or grow from restoration plantings.

MARLBOROUGH GREEN GECKO

Prior to human arrival, lizards would have been abundant throughout the region. They now have to run the gauntlet of introduced predators and loss of suitable habitat. This gecko on Arapawa Island, is a rare yellow form of manuka gecko (*Naultinus manukanus*), also known as the Marlborough green gecko. This species is endemic to North Marlborough and is on the list of nationally threatened fauna.

GIANT FOREST TREES

Lowland forests throughout the Sounds have mostly been logged of their big old podocarp trees. Reminders of the former forest giants, such as these emergent rimu, remain in places.

KOHEKOHE FOREST REMNANTS

A kohekohe forest remnant on a pastoral farm distinguished by its bright green colour. These remnants provide shelter for stock but the understorey is almost completely lacking in these circumstances. Partial fencing, or fencing of some pockets so that there was still some stock shelter, would allow regeneration to occur and ensure a future for such sites.

SALT TURF AREAS

Salt turfs develop in exposed coastal places that are frequently lashed by wind-driven salt spray. They contain typical estuarine turf-forming native plants such as glasswort, iceplant, *Selliera radicans* and *Samolus repens*. Plants listed as at risk, such as the uncommon native sow thistle *Sonchus kirkii* and sea holly (*Eryngium vesiculosum*),are found at some sites.

COASTAL FOREST

Where lush forest comes down to the shore, it is possible to visualise the primeval forests that occupied most of the lowlands of the Sounds.

INSECTS

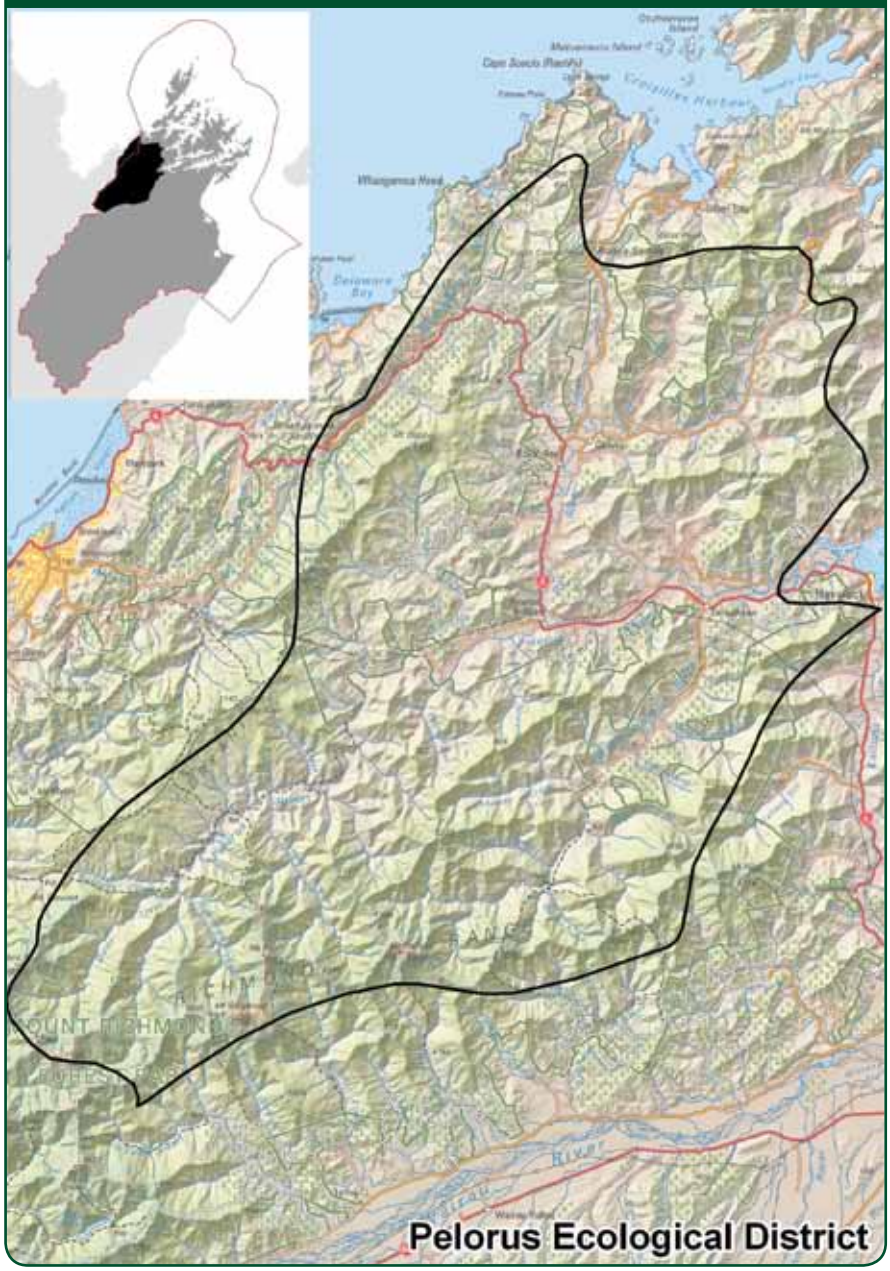
Large stick insects and a cicada on the trunk of a rohutu (*Lophomyrtus obcordata*) in riparian forest. They indicate the value of such forests to invertebrates, which in turn provide food for various native birds.

LOWLAND TOTARA

Lowland totara, once common in the Sounds, has been logged so systematically that few signs of its existence remain. This tongue of forest – mostly totara – on the valley floor of Manaroa is very special.

PELORUS ECOLOGICAL DISTRICT

MAP 5 -PELORUS ECOLOGICAL DISTRICT



OVERVIEW

The Pelorus Ecological District is one of three forming the Richmond Ecological Region; the others are Para and Fishtail. The Region is named for the Richmond Range that rises between the Alpine Fault at Top House Saddle and the inland-most extension of the Marlborough Sounds. Pelorus forms the northern district, Para the eastern and Fishtail the southern.

Pelorus Ecological District is based on the inland hill country and mountains of the Pelorus River catchment. It includes the tributaries of the Wakamarina, Ronga, Opouri, Rai and Tinline rivers, all of which drain into Pelorus Sound at Havelock. It also contains most of the catchment of the Whangamoa River, excluding only the coastal portion. The valley floors are mostly gentle, with fertile terraces and flats. The flanks are generally steep and rise to strong ridges, hills and peaks. In the SW, Mt Richmond (1758m) and Mt Fishtail (1641m) rise like islands surrounded by continuous forest and support several endemic species as a result of this sub-alpine isolation. Other prominent peaks are Mt Baldy, Mt Sunday, Dun Mountain, Mt Duppa, Castor Peak, Editor Hill, Opouri Peak, Mt Rutland and Benbown. Many of the rivers and streams have deep pools of clear water, and the upper parts are often a series of cascading falls and pools. In the lower valleys narrow, swampy flood plains would have once been typical, but most have been drained for farming.

The ecological district is geologically complex and interesting. The Richmond Range is composed of Palaeozoic rocks forming a NW-SE sequence. This is a sequence of increasing metamorphism; in the NW the rocks retain their sedimentary character of greywacke and argillite, to the SE they are metamorphosed to a low-grade schist. In the vicinity of Dun Mountain and along the Bryant Range are the distinctive ultramafic rocks and soils of the Nelson Mineral Belt. Associated with the Mineral Belt are outcrops of metasomatised argillite, highly sought after for stone tool manufacture by Maori and traded throughout the country in the past. Mineral deposits associated with both the Mineral Belt and the schist, notably gold and copper, have been the subject of much Pakeha mining activity.

The climate of Pelorus Ecological District is one of contrasts. The lowland valleys are locally wet and cool, with the strong influence of a diurnal ponding of cold air, creating valley fogs and frosts. The hill

country, with the exception of the mountains, has a milder climate. Summers are warm and rainfall (quite high at 1600-2000mm annually) is reliable. Winds from the W-NW quarter prevail, and storms occasionally create localised damage.

Owing to the location, physical character and climate the natural vegetation exhibits several gradients: coastal to inland, lowland to alpine, and somewhat dry to wet. This results in fairly complex forest patterns. In the lower valleys and slopes podocarps are common, including kahikatea, matai, rimu and miro, with occasional lowland totara and Hall's totara. These are associated with beech forest; black and silver beech on valley floors, hard beech on lower more coastal slopes, red beech further inland and higher, and mountain beech and silver beech at higher elevations still. Frequently several beech species occur together, a rather uncommon feature in New Zealand.

The coastal to inland gradient also influences the composition of the broad-leaved vegetation usually occupying the gullies. A number of lowland species occur in the north-east but don't go far inland (nikau, tawa and New Zealand passion vine, for instance). Others such as mahoe, supplejack, rangiora, pigeonwood, lemonwood, mamaku and bush cabbage tree extend further inland. Montane species such as pokaka, horopito, silver beech and *Alseuosmia pusilla* occur at low altitudes where cold air ponds. In montane forests are localised occurrences of southern rata, pahautea (mountain cedar) and mountain toatoa. Above the bushline are subalpine shrublands, alpine grasslands, herbfields, scree communities and cushion bogs. Several threatened and notable plants have been found in fertile valley sites. Some species are endemic to the high peaks, as mentioned, and others are confined to the ultramafic areas. Together all these patterns combine to create a vegetation and flora of considerable interest.

The natural patterns of vegetation and fauna have been greatly changed in the valley floors and lower slopes by human activity. This was begun by Maori inhabitants, associated with hunting, travelling, camping and exploration. Subsequent Pakeha gold and copper mining led to vegetation clearance (especially of podocarps) and inadvertent fire to high elevations. Clearance for farming has been very widespread. Valleys and slopes have been logged and valley floors have been drained. Small remnants of the great forests of the valleys remains in some of the reserves, notably Pelorus Bridge Scenic Reserve, otherwise the only evidence is a scattering of old trees in the farmland.

On the ultramafic areas, even at high altitudes, the vegetation has been modified by burning. The earliest deliberate fires probably date back centuries, to when Maori exploration for stone materials began. Moa gizzard stones, the only remaining signs of a rich previous fauna of large flightless birds, can still be found in places.

Natural infertility coupled with moist soils has favoured scrub regeneration on marginal farmland, especially bracken, manuka and kanuka. Introduced weeds are widespread including gorse, broom, barberry, hawthorn, Spanish heath and blackberry. Feral pigs, deer, possums, goats and predators such as rodents and mustelids have become well established. As a result of the difficulty of farming, soil depletion and erosion, exotic production forestry has been established on much of the lower hill country.

There are likely to be long-term problems with weeds and feral animal pests in places, but with good stewardship the opportunity exists to protect and enhance remaining native vegetation and freshwater habitats, along with their populations of native plants, birds, lizards, invertebrates and fish.

SURVEY RESULTS

Of the 28 properties where the owners were approached, 18 were surveyed. A total of 43 significant sites were identified. These have a combined area of 1467.5 ha and make up approximately 1.5% of the total land area of the ecological district. They are classified into 12 basic categories or ecosystem types (see Table 5). They are mostly native forests, the most extensive being beech forests, but there are also several other forest types and some shrublands and wetlands. The sites that have high value for ecological significance are those that occur on valley floors or have intact valley-to-skyline ridge forest sequences.

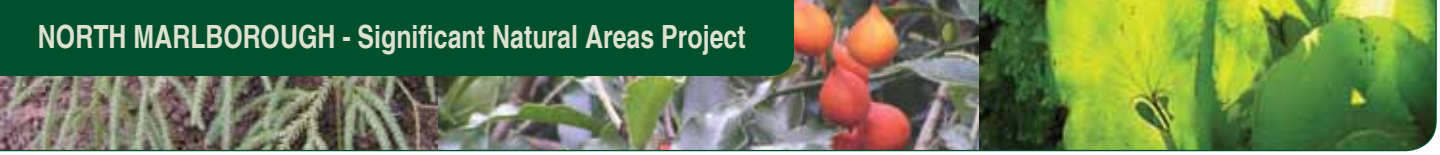


TABLE 5 - SITES IDENTIFIED IN THE PELORUS ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% private land area of Ecological District	% total area of Ecological District (DoC and private)
Inland wetlands	4	13.5		
Riparian communities	5	35.0		
Lowland shrublands	3	32.0		
Alluvial valley flats forests	3	12.0		
Beech forests	10	1,031.0		
Broadleaved forests	2	42.0		
Lowland podocarp-beech forests	4	122.0		
Lowland podocarp-broadleaved forests	3	42.0		
Podocarp-broadleaved-beech forests	3	112.0		
Kanuka forests	2	18.0		
Treelands	4	8.0		
Totals	**43**	**1,467.5**	**3.8%**	**1.5%**

ECOSYSTEMS FOUND

Much of the original vegetation cover of the Pelorus Ecological District has been disturbed, modified and cleared since human arrival, especially in the valleys. However, much remains more or less intact and prolific natural regeneration has restored many areas, providing opportunities for protection and enhancement. The main ecosystems found were:

INLAND WETLANDS

Most of the former valley floor wetlands have been drained, but a few examples still exist.

RIPARIAN COMMUNITIES

Many of the river banks have riparian strips of native trees and shrubs, some containing rare plants.

LOWLAND SHRUBLANDS

Included in sites if serving as nurseries for regenerating native forest.

BRACKEN FERNLANDS

Also included in sites if serving as nurseries for regenerating native forest.

ALLUVIAL VALLEY FLATS FORESTS

Very rare, but a few small remnants exist.

BEECH FORESTS

Widespread and predominant. Black beech and silver beech occur on valley floors and in riparian zones, hard beech occurs on lower more coastal slopes, red beech occurs further inland and higher, and mountain beech and silver beech are dominant at still higher elevations. Podocarps are usually present.

BROADLEAVED FORESTS

In gullies and shaded faces, where the podocarps have been logged out and conditions are not favourable for beeches. Main tree species are kamahi, tawa, mahoe, wineberry and putaputaweta.

LOWLAND PODOCARP-BEECH FORESTS

Not very common due to past logging and forest clearance.

LOWLAND PODOCARP-BROADLEAVED FORESTS

Not very common due to past logging and forest clearance.

PODOCARP-BROADLEAVED-BEECH FORESTS

In places where a range of tree species can coexist.

KANUKA FORESTS

Surprisingly uncommon, especially compared with its abundance in the Sounds.

TREELANDS

Several examples on valley floors. Include big old podocarps (kahikatea and matai) and beeches (black and silver), also some secondary totara. Important living reminders of the towering lowland forests of the past.

SPECIAL FEATURES

The ecological district is one of valleys, hills and mountains and has a largely intact hinterland. It comes near the coast in places but does not feature coastal habitats. Instead, it has a broad array of native vegetation types, flora and fauna, spanning the range from those of the lowlands to those of the alpine tops. One of the most striking features though is the ultramafic zone, with its unique influence on soil fertility, vegetation and flora.

NATIVE FLORA

- There is distinct altitudinal zoning of the forest species, with consistent changes at about 600m, 800m and 1000m asl. Many of the high ridges have a capping of cloud forest, festooned with mosses, lichens, filmy ferns and perching orchids. The transition from bush cover to open tops occurs at around 1300m asl.
- There are substantial areas of the ultramafic zone. The suite of plant species in the native vegetation is unusual and distinctive and contains species endemic to the ultramafics. The forest is rather stunted and contains southern rata and mountain beech.
- Above the bushline are subalpine shrublands, alpine grasslands, herbfields, scree communities and cushion bogs. Some species are endemic to the high peaks, including the mountain daisies *Celmisia macmahonii* var. *hadfieldii* and *C. rutlandii*. Others are notable, such as pahautea or mountain cedar (*Libocedrus bidwillii*).
- Several threatened and notable plants have been found in fertile valley sites, for example *Teucridium parvifolium*, *Leptinella nana*, *Scutellaria novae-zelandiae*, *Olearia hectorii* (now locally extinct), *Myosotis spathulata* and various mistletoes.
- Other threatened and regionally rare plants that occur in the ecological district include *Pittosporum patulum*, *Hebe rigidula* and the beech mistletoes *Alepis flavida*, *Peraxilla colensoi* and *P. tetrapetala*.
- The localised presence of tanekaha (*Phyllocladus trichomanoides*), pokaka (*Elaeocarpus hookerianus*), lowland ribbonwood (*Plagianthus regius*), climbing fuchsia (*Fuchsia perscandens*) and mountain cabbage tree (*Cordyline indivisa*) is interesting. They are at distribution limits and/or are uncommon. Tawa (*Beilschmiedia tawa*) is near its southern limit.

NATIVE FAUNA

- Bush birds are still quite prevalent, due to the extent of bush cover and diversity of other native vegetation. The forests and shrublands support strong populations of tui, kereru, bellbird, tomtit, brown creeper, silvereye, fantail and grey warbler (riroriro). Of note are the local occurrences of weka, New Zealand robin, rifleman, kaka, kakariki and New Zealand falcon (karearea or sparrowhawk). New Zealand pipit is common in open places.
- Wetland birds have some remaining habitats available to them, mostly in the lowlands. Ducks, paradise shelduck and pukeko are quite common in places.
- Moa gizzard stones have been found in this ecological district.
- Lizards (skinks and geckos) are widely present, especially in rock outcrops, screes, forest and shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders. The giant land snails *Powelliphanta hochstetteri obscura* and *Powelliphanta hochstetteri consobrina* are still present in local populations, although severely threatened by feral pigs, possums, rats and thrushes.
- At least 14 species of native freshwater fish have been recorded from the rivers and streams of the ecological district. Of particular note are longfin eel, lamprey, torrentfish, giant kokopu and shortjaw kokopu.

PELORUS ECOLOGICAL DISTRICT – PHOTO ESSAY

RAIN FOREST AREAS

Lower altitude “rain forest” in this high rainfall area, showing the border of tree fern forest and regenerating rimu and matai along a waterway. The brown shrubs are *Coprosma rotundifolia*, a lowland species that grows in fertile soil. Tawa occurs behind and beech-podocarp forest further up the valley. The stream at this point forms a narrow alluvial flat but gets steeper higher up the catchment. It is likely to provide good habitat for various native fish species and invertebrates.

BEECH FOREST

This higher altitude hard beech forest (4-600m) is in very good condition containing trees of all different ages. The understorey is lush with shrubs, ferns and seedlings of the larger trees. Feral animal numbers (pigs, goats, deer possums) must be reasonably low for the forest understory to be so healthy.

WEKA

New Zealand is internationally famous for its ground dwelling birds like takahe, moa species, kiwi, kakapo and weka. Moa are extinct, kakapo and takahe are close to extinction and are being intensively managed by the Department of Conservation and kiwi are locally extinct in Marlborough although still present in some other parts of the country. While weka are locally extinct in other areas, they are still relatively common in North Marlborough. They are very vulnerable to attack and disturbance by pigs, dogs and cats as well as smaller predators when nesting (stoats and rats). They are classified as a threatened species and are fully protected.

MOSSES AND FERNS

The Pelorus Ecological District has the highest rainfall in Marlborough (up to 2600mm) providing excellent conditions for ferns and mosses. This naturally uncommon moss, *Dawsonia superba*, forms dense patches in the open moist forest. These specimens are about 20cm tall. Pahau-kakapo is the Maori name meaning “the beard of the kakapo”, referring to the whiskers under the beak that project sideways and forwards.

TAWA FOREST

Forest vegetation of mainly tawa forest with a few emergent trees of matai and beech on the upper slopes. Hinau occurs in the gullies, and in the foreground on the lower slopes silver beech is the dominant species along the river edge where cold air drainage is a major factor determining the forest composition.

FOREST BIRDS

Kereru/wood pigeon are still relatively common in forested areas of North Marlborough. They play an important role in spreading seed from fruiting native trees and are the only large flying bird that can consume and spread the large sized tawa seed.

RARE PLANTS

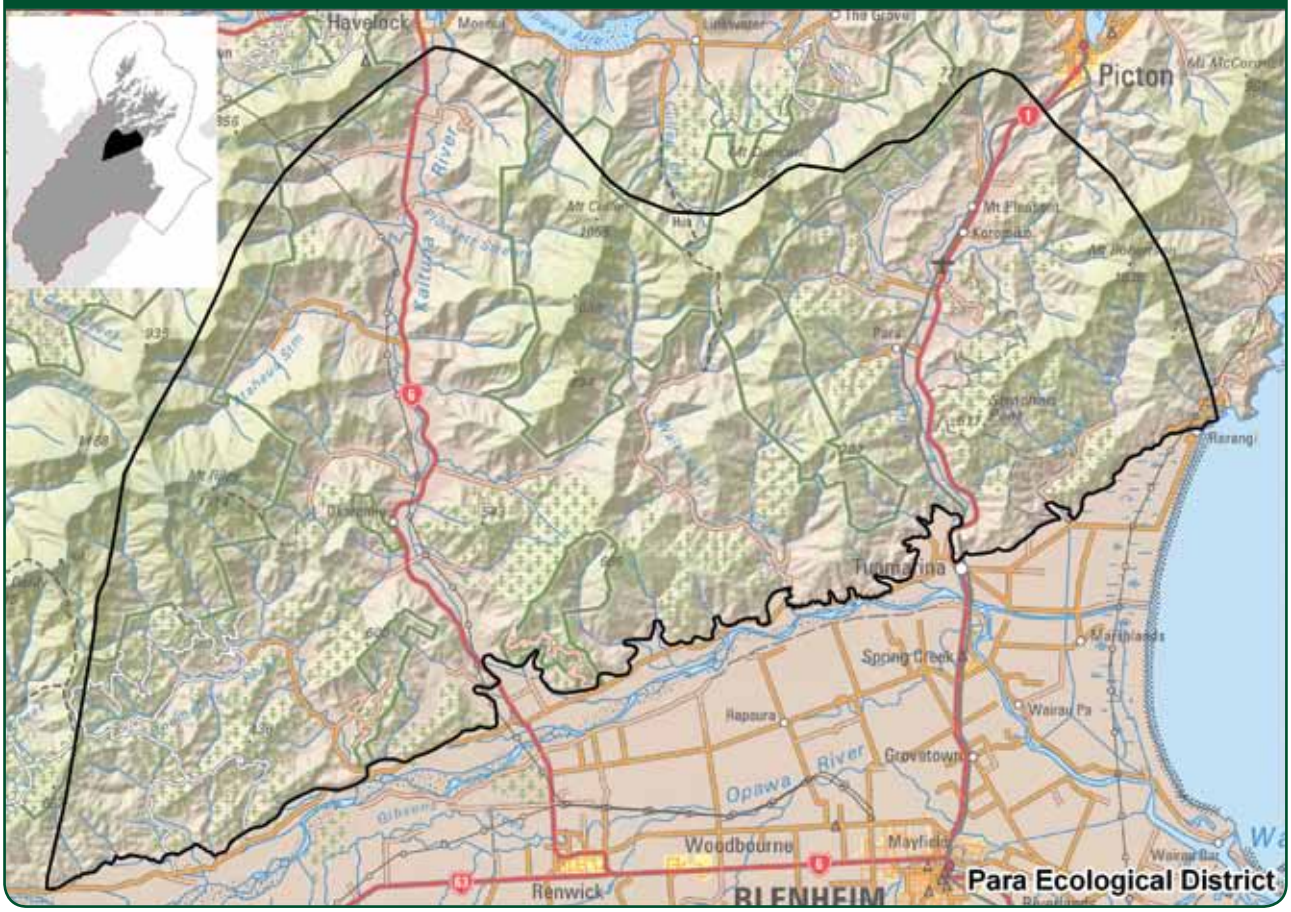
Pygmy button daisy (*Leptinella nana*) occurs sporadically on flood-prone riverbanks in the Pelorus catchment. It is listed as “Threatened, Nationally Endangered”.

UPLAND “CLOUD” FORESTS

The upland forests throughout North Marlborough frequently have cloud cappings. The trees, silver beech in particular, are festooned with mosses, epiphytic orchids and filmy ferns that relish such reliably cool, damp conditions.

PARA ECOLOGICAL DISTRICT

MAP 6 - PARA ECOLOGICAL DISTRICT



OVERVIEW

The Para Ecological District is the eastern district of the three that form the Richmond Ecological Region. It occupies a transition zone between the humid temperate Marlborough Sounds, the mountains of the Richmond Range and dry southern Marlborough. It rises from sea level (at Rarangi) to 1314m (Mt Riley).

The Richmond Range and the southern Marlborough Sounds are composed of Palaeozoic rocks forming a general sequence north-west to south-east. This is a sequence of increasing metamorphism; in the NW the rocks retain their sedimentary character of greywacke and argillite. The central area is metamorphosed to a low grade schist (Chlorite Zone II), while the SE zone is a more completely metamorphosed schist (Chlorite Zone III). In the Para Ecological District the sequence is made complex by a series of fault lines. Most of the district is composed of Chlorite Zone III schist, but there is Chlorite Zone II schist and greywacke-argillite near Havelock and also to the east of Tuamarina and Picton. The main valleys have deposits of alluvium and terrace gravels. There is a unique series of well-preserved old beach ridges composed of gravels at the coast at Rarangi.

During its formation schist forms chemical layers such as mica and quartz, sometimes with gold in the quartz. The layers can separate when weathered (foliation) and hence the schist in the Para District can erode readily with slabs separating by foliation. This process, coupled with geological compression, tilting and uplift, creates rugged hill country with very steep slopes where the vegetation is always in a cycle of renewal. Schist also weathers into clay with low natural nutrient status but high water retention. Greywacke and argillite also weather into steep slopes and clays. This has influenced aspects of land use in the area.

The climate is generally moist, with annual rainfall ranging from 800-1600mm. Valley fogs are common in winter. The hill country of the district is cut by two major valleys, the Kaituna and the Tuamarina. Both are almost flat and probably represent the courses of big rivers that have since been diverted by tilting or uplift of the land. Swampy flood plains would have been typical, but most have been drained for farming; the largest remaining being the Para Wetland (Para Swamp). There are three other significant valleys, the Onamalutu, the Waikakaho and the Pukaka. The rivers and streams in these valleys have deep pools of clear water, and the upper parts and tributaries are often a series of cascades and pools. Native freshwater fish are present.

Great forests of towering podocarps (kahikatea, matai, rimu, totara and miro) would have occupied the valleys in the past, growing on the rich alluvial soils. Those forests (as well as the swamps and hill forests) would have held an abundance of bird life. Now the only example left is an impressive few hectares in Onamalutu Scenic Reserve, whilst elsewhere are scattered trees as reminders. Valley swamps would have contained kahikatea, pukatea and swamp maire, as well as harakeke (lowland flax), tussock sedges and cabbage trees. Broadleaved trees typical of the North Island lowlands come into Para Ecological District. Foremost of these is tawa, which still occupies many gullies, despite much logging and land clearance for farming in the past. By contrast, southern upland trees are also present, for example Hall's totara and southern rata.

On the hills, the former forest cover would have been dominated by beeches (red, black, silver and hard) with kamahi and various podocarps. Much of that cover has been cleared, but there are remnant tracts and pockets, usually with kanuka, secondary broadleaved trees and tree ferns. All beech species are still present, sometimes growing together, which is unusual in New Zealand.

The natural vegetation pattern has been greatly changed by human activity. This may have been started by Maori inhabitants, associated with hunting, travelling, camping and exploration for stone materials. Subsequent European gold mining led to vegetation clearance (especially the valley floors) and inadvertent fire to high elevations. Clearance for farming has been most widespread. The valleys and slopes have been logged, the valley floors have been drained, and the flax swamps have been milled and now virtually eliminated. Natural infertility coupled with moist soils favours scrub regeneration on marginal farmland, especially of manuka, kanuka and bracken.

Introduced weeds are widespread, including gorse, broom, Spanish heath, Himalayan honeysuckle, old man's beard and blackberry. Feral pigs, deer, possums, goats and predators such as rodents and mustelids have become well established. As a result of the difficulty of pastoral farming, soil depletion and erosion, production forestry has been established on much of the hill country in the last half century. The New Zealand Forest Service formerly owned most of these plantings, but today the production forest is largely privately owned. There is likely to be a long-term problem with conifer wildings in places, but with good stewardship the opportunity exists to protect and enhance the remaining native vegetation and freshwater habitat, along with their populations of native birds, lizards, invertebrates and fish.

SURVEY RESULTS

Of the 25 properties where the owners were approached, 18 were surveyed. A total of 55 significant sites were identified. These have a combined area of 2975 ha and make up approximately 6.2% of the total land area of the ecological district. They are classified into nine basic categories or ecosystem types (see Table 6). They are mostly native forests, the most extensive being beech forests, but there are also other forest types and some wetlands. The sites that have high value for ecological significance are those that occur on valley floors or have intact valley-to-skyline ridge forest sequences.

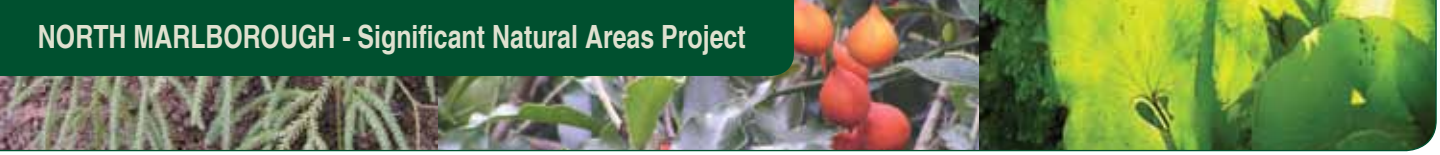


TABLE 6 - SITES IDENTIFIED IN THE PARA ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% private land area of Ecological District	% total area of Ecological District (DoC and private)
Inland wetlands	5	8		
Beech forests	13	1,628		
Broadleaved forests	9	319		
Broadleaved-tree fern forests	1	108		
Lowland podocarp-beech forests	1	2		
Podocarp-broadleaved-beech forests	13	651		
Kanuka forests	10	230		
Manuka forests	1	24		
Treelands	2	5		
Totals	**55**	**2,975**	**8.7%**	**6.2%**

ECOSYSTEMS FOUND

Much of the original vegetation cover of Para Ecological District has been disturbed, modified and cleared since human arrival, especially in the valleys and on lower slopes. However, much remains more or less intact and prolific natural regeneration has restored many areas, providing opportunities for protection and enhancement. The main ecosystems found were:

INLAND WETLANDS

Several small wetlands were surveyed. They are mostly seepage-fed swamps with native vegetation, but most have weed issues.

BEECH FORESTS

Dominant in the hinterland and mostly upland.

BROADLEAVED FORESTS

Mostly tawa forest in gullies and other sheltered places.

BROADLEAVED-TREE FERN FORESTS

Secondary regenerating forest of gullies and shaded faces.

LOWLAND PODOCARP-BEECH FORESTS

A few small remnant pockets.

PODOCARP-BROADLEAVED-BEECH FORESTS

Several substantial sites where conditions favour a range of tree species.

KANUKA FORESTS

Fairly common, the result of decades of regeneration following pastoral farming.

MANUKA FORESTS

Although manuka is a common species, especially in regenerating vegetation, it usually fizzles out when overtopped by other trees. It has a competitive advantage in poorly drained situations.

TREELANDS

Several excellent examples, two on private land in the Kaituna Valley and one on public land at Koromiko administered by the MDC. They are echoes of the original great forests on the valley floors. The MDC is working with the local community to restore the Koromiko site to forest with plants raised from local sources.

SPECIAL FEATURES

The ecological district is one of valleys and hills and has a hinterland with extensive tracts of bush. It comes near the coast in places and features coastal habitats at Rarangi. It has a broad array of native vegetation types, flora and fauna, spanning the range from those of the lowlands to those of the alpine tops. One of the most striking features is the zone of near-vertical schist seams on either side of the Kaituna Valley. Another is the abrupt landform and ecological discontinuity formed by the Wairau (Alpine) Fault and the Wairau Valley. Para Wetland (Swamp) is by far the biggest lowland alluvial freshwater wetland system in Marlborough. There are several significant treelands in the lowland valleys, reminders of the former great podocarp-beech forests. A majestic alluvial podocarp forest remnant exists in Onamalutu Scenic Reserve, and there is a smaller one on private land in the Kaituna Valley.

NATIVE FLORA

- There is distinct altitudinal zoning of the forest species, with consistent changes at about 500m and 700m asl. Many of the high ridges have a capping of cloud forest, festooned with mosses, lichens, filmy ferns and perching orchids.
- There is a small alpine zone on the summit of Mt Riley, containing tussock grasses, shrubs and herbs such as mountain daisies.
- Threatened and regionally rare plants that occur in the ecological district include yellow mistletoe (*Alepis flavida*), red mistletoe (*Peraxilla tetrapetala*), raukawa (*Raukaua edgerleyi*) and neinei (*Dracophyllum urvilleanum*).
- The localised presence of swamp maire (*Syzygium maire*), white maire (*Nestegis lanceolata*), nikau, pukatea, kiekie, gully fern (*Cyathea cunninghamii*, a tall elegant tree fern uncommon in the South Island), akeake (*Dodonaea viscosa*), pokaka, lowland ribbonwood, narrow-leaved lacebark, tawa, ngaio, southern rata, a small uncommon daisy known only as *Celmisia* "Tararua" and the native daphne *Pimelea gnidia* is interesting. They are at distribution limits, are uncommon and/or are anomalous.
- All New Zealand beeches (red, hard, silver, black and mountain) are present. So too are the great podocarps (totara, Hall's totara, rimu, matai, miro and kahikatea) of central New Zealand.

NATIVE FAUNA

- Bush birds are still quite prevalent, due to the extent of bush cover and diversity of other native vegetation. The forests and shrublands support strong populations of tui, kereru, bellbird, tomtit, brown creeper, silvereye, fantail and grey warbler (riroriro). Of note are the local occurrences of weka, New Zealand robin, rifleman, kaka, kakariki and New Zealand falcon (karearea or sparrowhawk). New Zealand pipit is common in open places.
- Wetland birds have remaining habitats available to them, notably Para Wetland. Ducks, paradise shelduck and pukeko are quite common in places. Of note are local records of banded rail, marsh crake and Australasian bittern.
- Moa gizzard stones have been found in the ecological district.
- Lizards (skinks and geckos) are quite common, especially in rock outcrops, screes, forest and shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders. The giant land snails *Powelliphanta hochstetteri consobrina* and *Powelliphanta hochstetteri bicolor* are still present in local populations, although severely threatened by feral pigs, possums, rats and thrushes.
- At least 14 species of native freshwater fish have been recorded from the rivers and streams of the ecological district. Of particular note are longfin eel, lamprey, torrentfish, giant kokopu and shortjaw kokopu.

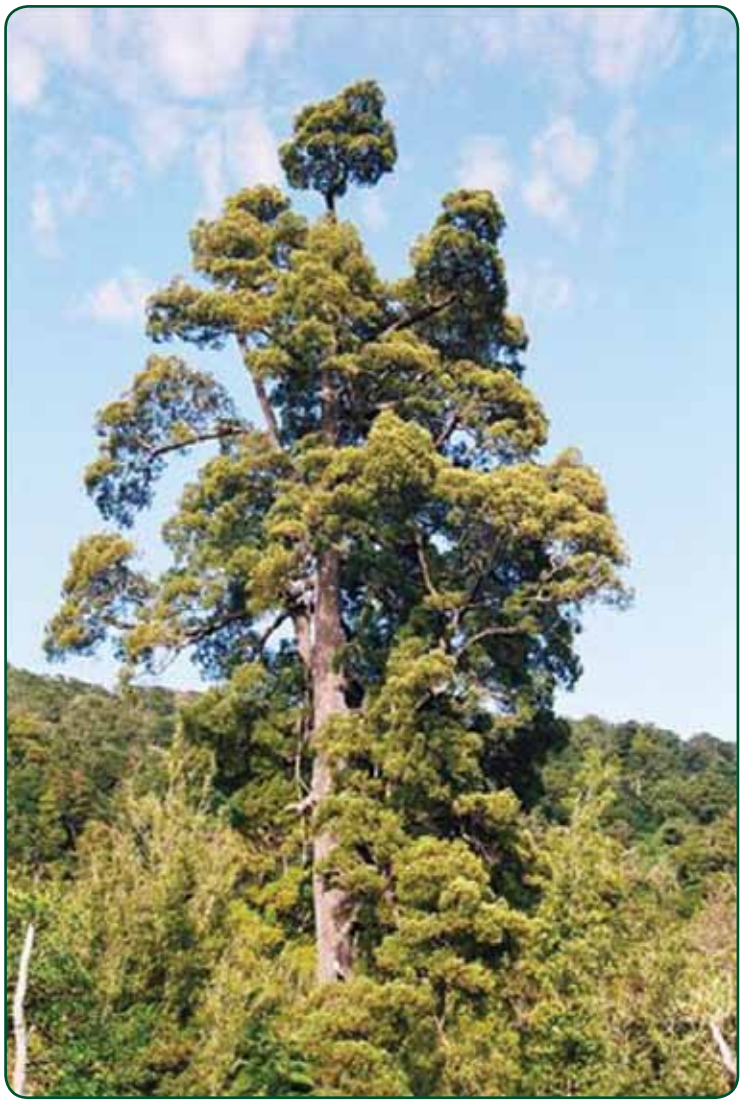
PARA ECOLOGICAL DISTRICT – PHOTO ESSAY

VIEW ACROSS ECOLOGICAL DISTRICT BOUNDARIES

View from the summit of Mt Dobson (702m) in the Para Ecological District of North Marlborough, looking down into the Wairau Valley and Southern Marlborough. The contrast in topography, climatic and resulting land use is obvious. It marks one of the most graphic ecological transitions in New Zealand.

MIXED UPLAND FOREST

Typical upland forest in the Para Ecological District with a rich mix of native plant species present; a good habitat for native bush bird and fish species. The vegetation on most spurs and hill slopes is mixed beech forest in with four of the five beech species represented (red, hard, black and silver beech). Also present are kamahi, kanuka, some southern rata, numerous broadleaved species and abundant tree ferns. Shrubs and ground ferns are common in the understorey. There are also many podocarps (rimu, matai, kahikatea and miro), some of which are enormous and clearly ancient.



GIANT FOREST TREES

A large and ancient kahikatea tree standing out from the surrounding forest, which is a rich mix of beech, broadleaved, podocarp and fern species, regenerating following logging of most of the big podocarp trees.

KANUKA FOREST PATCHES

A triangular patch of kanuka forest (centre) surrounded by exotic forest. There are some large trees present (up to 15m tall) and a diverse understorey of broadleaved species (mainly mahoe, rangiora, putaputaweta and wineberry) and tree ferns (mamaku and ponga) in this area. The site is currently in good condition and is probably in better shape than it was when surrounded by farmland as there are no stock present and the exotic forest provides a sheltered edge prior to harvesting.

LOWLAND WETLANDS

A wetland on alluvial flats within a pastoral farm near Havelock. The few remaining trees around the perimeter (kahikatea, matai, black beech and totara) give a clue as to the original forest that would once have been common in the valleys of the Para Ecological District. Fencing from farm stock and restoration planting of suitable species would soon improve the condition of this relatively weed free wetland.

MARLBOROUGH PLANTS

Neinei (*Dracophyllum urvilleanum*) is a nationally threatened shrub with rust-coloured needle leaves. This plant is found in a few places in the Para Ecological District, and elsewhere in North Marlborough.

FOREST UNDERSTOREY DAMAGE

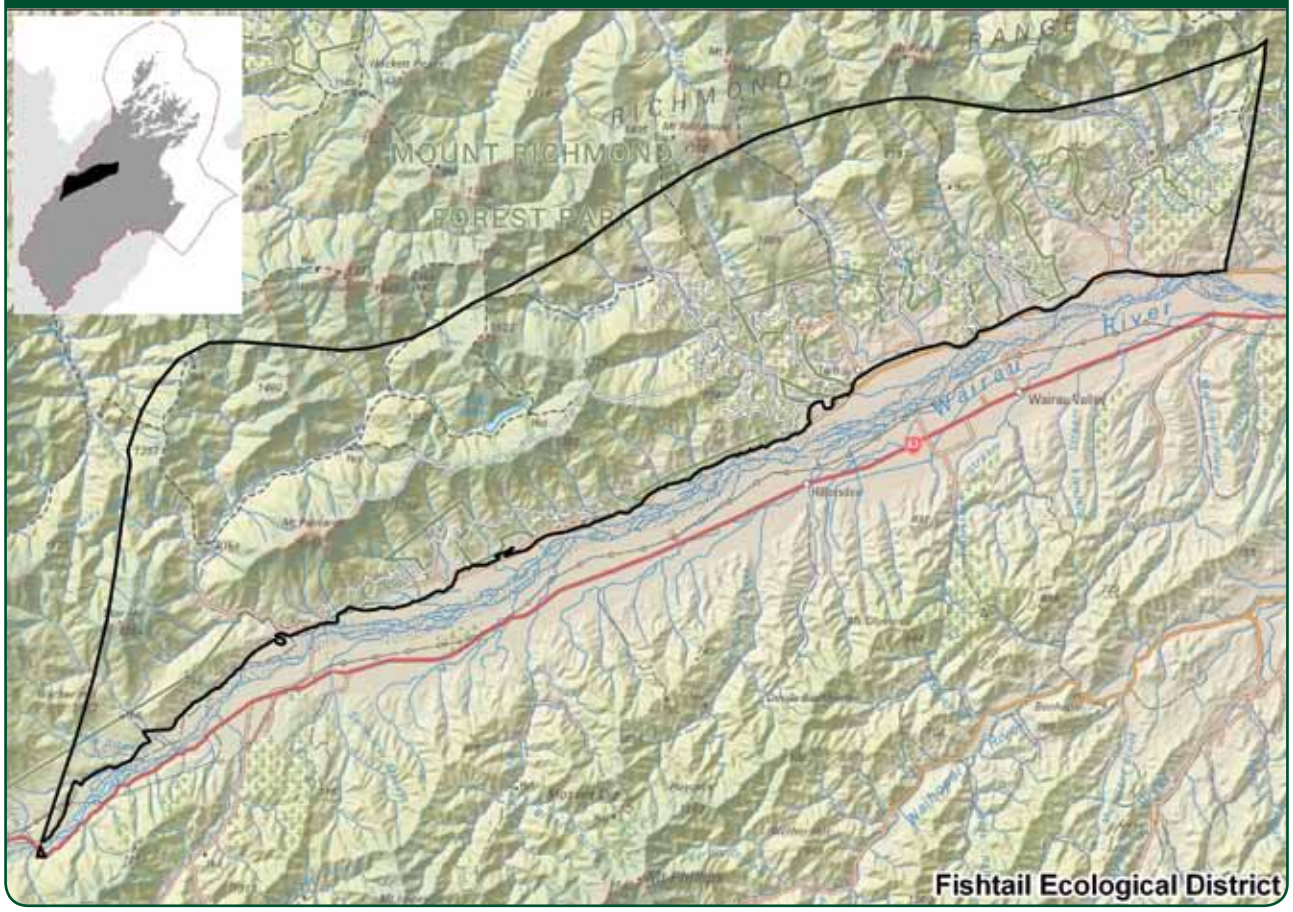
The bare understorey of beech forest showing the effects of heavy feral animal infestation. Very little regeneration is possible in these circumstances.

HEALTHY FOREST UNDERSTOREY

A healthier understorey in beech forest with regeneration evident.

FISHTAIL ECOLOGICAL DISTRICT

MAP 7 - FISHTAIL ECOLOGICAL DISTRICT



OVERVIEW

The Fishtail Ecological District is the southern-most of three forming the Richmond Ecological Region, a geologically complex area founded on the Richmond Range.

The Richmond Range is composed of Paleozoic rocks forming a sequence south-west to north-east. This is a sequence of increasing metamorphism. In the SW the rocks retain their sedimentary character of greywacke and argillite. The central Fishtail area is metamorphosed to a low grade schist (Chlorite Zone II), while the northern and eastern zone is a more completely metamorphosed schist (Chlorite Zone III). During its formation schist forms chemical layers such as mica and quartz, sometimes with gold in the quartz. The layers can separate when weathered (foliation) and hence the schist in the Fishtail District can erode readily with slabs separating by foliation. This process creates very steep slopes and the vegetation is always in a cycle of renewal. Schist also weathers into clay with low natural nutrient status but high water retention. This has influenced aspects of land use.

The Fishtail Ecological District drains the southern flank of the Richmond Range. Numerous streams arise from the main ridge and flow steeply to the Wairau River. A series of very scenic peaks form the upper watersheds: Mts Rintoul (1730m), Old Man (1514m), Richmond (1758m), Fishtail (1641m) and Royal (1365m). These peaks rise like islands surrounded by continuous forest and they support several endemic species as a result of this sub-alpine isolation. Mt Patriarch (1520m) is an extremely steep block of schist isolated from the main range by the catchment of the Goulter River, the largest of the watersheds. Active faulting has been responsible for a landslide that has resulted in Lake Chalice. This lake has been dated at 2000 years old, and is noted as the habitat for a population of larger than normal koaro (*Galaxias brevipinnis*), land-locked when the lake formed. Like many areas throughout

the district, Mt Patriarch bears deep stratified weathered rock (regolith) on its flanks, the result of freeze-thaw cycles during the ice age, and these are unstable and deeply gullied. Many of the streams have deep pools of clear water, and the upper parts are often a series of cascading falls and pools.

In the lower valleys narrow, swampy flood plains would have been typical, but most have been drained for farming.

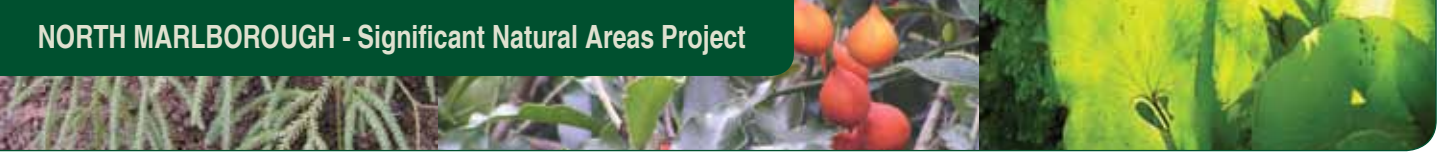
The climate of the Fishtail District is cool and moderately wet, with rainfall varying from 1200mm to 2000mm, depending on altitude. There is a strong rainfall gradient across the Wairau Valley. Lower parts of the district are exposed to periodic drought, exacerbated by strong drying winds, but ameliorated by the water-holding capacity of the clay soils. Snow falls on the higher peaks several times each winter and cold air drainage down the steep valleys has a general cooling effect. The moist forest-covered north bank of the Wairau River contrasts dramatically with the dry grassland-dominated greywacke hills of the south bank.

Owing to the location, physical character and climate the natural vegetation exhibits several gradients: coastal to inland, lowland to sub-alpine, and dry to wet. This results in fairly complex forest patterns. In the lower valleys and slopes podocarps are common, including kahikatea, matai, rimu and occasionally miro and Hall's totara. These are associated with beech forest; black beech at low elevations changing to mountain beech at higher elevations, red beech in the moist gullies and silver beech in both cool valleys and higher slopes and ridges. Frequently all three beech species occur together, a rather uncommon feature in New Zealand.

The coastal to inland gradient influences the composition of the broad-leaved gully vegetation usually beneath the beech-podocarp canopy. A number of lowland species drop out in the Para district to the north-east (nikau, tawa and passion vine, for instance), but others extend into Fishtail, such as supplejack, rangiora, pigeonwood, mamaku and bush cabbage tree. Some species present are more typical of the drier country across the Wairau, such as kowhai, akiraho, matagouri and *Coprosma propinqua*. Lowland species such as mahoe and five-finger are eliminated with altitude, but conversely some become more common (eg pokaka). Mountain species extend down into the valleys, such as southern rata, Hall's totara and mountain daisies. While natural shrubland is rare except above the bushline, dry infertile sites have resulted in a type of 'north bank pakihi' involving some distinctive species such as *Pimelea gnidia*, thickets of prickly mingimingi and a ground cover of blueberry (*Dianella nigra*). Elsewhere, subalpine shrubland dominated by *Dracophyllum* and speargrass has extended down-slope on land that was cleared of beech, then grazed and now retired. *Pittosporum patulum* is a regionally rare small tree species that regenerates in this type of montane shrubland. Together all these patterns combine to create a vegetation and flora of considerable interest.

The natural vegetation pattern has been greatly changed in the valley floors and lower slopes by human activity. This may have been started by Maori inhabitants, associated with hunting, travelling, camping and exploration for stone materials. Subsequent European gold and scheelite mining led to vegetation clearance (especially of podocarps) and inadvertent fire to high elevations. Clearance for farming has been very widespread. The valleys and slopes have been logged, the valley floors drained, and the flax swamps milled and now virtually eliminated.

Natural infertility coupled with moist soils favours scrub regeneration on marginal farmland, especially of manuka and kanuka. Introduced weeds including gorse, broom, Spanish heath and blackberry are widespread. As a result of the difficulty of farming, soil depletion and erosion, both conservation forestry (in areas of high country erosion on the Lake Chalice Ridge and Mt Patriarch) and production forestry using exotic species (mainly Northern Hemisphere conifers) have been established over the last half-century. The New Zealand Forest Service formerly owned these plantings, but today the production forest is privately owned and the conservation planting is part of the conservation land of the extensive Mt Richmond Forest Park. There is likely to be a long-term wilding conifer problem, so a buffer zone between production and conservation land is important.



SURVEY RESULTS

Of the eight properties where the owners were approached, six were surveyed. A total of 33 significant sites were identified. These have a combined area of 1350 ha and make up approximately 3% of the total land area of the ecological district. They are classified into six basic categories or ecosystem types (see Table 7). They are mostly native forests, by far the most extensive being beech forests, but there are also other forest types, shrublands, riparian vegetation and wetlands. The sites that have high value for ecological significance are those that are larger, more intact and more diverse.

TABLE 7 - SITES IDENTIFIED IN THE FISHTAIL ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% private land area of Ecological District	% total area of Ecological District (DoC and private)
Inland wetlands	2	8.5		
Riparian communities	1	6.5		
Lowland shrublands	1	2.5		
Beech forests	22	1,135.5		
Kanuka forest	4	153.5		
Manuka forests	3	45.5		
Total	**33**	**1,350.5**	**9%**	**3%**

ECOSYSTEMS FOUND

Much of the original vegetation cover of Fishtail Ecological District has been disturbed, modified and cleared since human arrival, especially in the valleys and lower slopes. However, much remains more or less intact and natural regeneration has restored many areas, providing opportunities for protection and enhancement. The main ecosystems found were:

INLAND WETLANDS

Of the two wetland sites, one is a tarn or small lake on moraine deposits, whilst the other is an elongated valley floor swamp containing harakeke (lowland flax), raupo, manuka and sedges. Other, smaller wetlands occur within several sites that are mostly forest-covered.

RIPARIAN COMMUNITIES

A remnant of riparian black beech forest, with some matai and kanuka, was found.

LOWLAND SHRUBLANDS

Matagouri, porcupine shrub, manuka and other shrubs occur on dry open ground.

BEECH FORESTS

These are by far the most common and extensive of the native vegetation types in the ecological district. Black beech occurs at low elevations, changing to mountain beech at higher elevations, whereas red beech is present in moist gullies and silver beech is in both cool valleys and higher slopes and ridges

KANUKA FORESTS

Kanuka forests are common in the ecological district and achieve considerable stature. They occur where originally there would have been beech forest.

MANUKA FORESTS

Manuka is also common and in places forms low forests.

SPECIAL FEATURES

The ecological district is one of valleys and hills and has a reasonably intact hinterland with extensive tracts of bush and upland habitats. It has a broad array of native vegetation types, flora and fauna, spanning the range from those of the lowlands to those of the alpine tops. The sharp peaks of the Richmond Range soar above the mantle of bush. The abrupt landform and ecological discontinuity formed by the Wairau (Alpine) Fault and the Wairau Valley is just as spectacular. Both have considerable influences on the biodiversity of the ecological district. An added effect is the transition inland, getting well away from the coastal influence.

NATIVE FLORA

- There is distinct altitudinal zoning of the forest species, with consistent changes at about 600m, 800m and 1000m asl. Many of the high ridges have a capping of cloud forest, festooned with mosses, lichens, filmy ferns and perching orchids. The transition from bush cover to open tops occurs at around 1300m asl.
- Above the bushline are subalpine shrublands, alpine grasslands, herbfields, scree communities and cushion bogs. Some species are endemic to the high peaks, including the mountain daisies *Celmisia macmahonii* var. *hadfieldii* and *C. rutlandii*.
- Threatened and regionally rare plants that occur in the ecological district include *Pittosporum patulum*, neinei (*Dracophyllum urvilleanum*), coral mistletoe (*Korthalsella salicornioides*), the sedge *Carex uncifolia*, forest forget-me-not (*Myosotis spathulata*) and dwarf broom (*Carmichaelia corrugata*).
- In addition there are the largest known specimens of the hemi-parasitic *Exocarpus bidwillii*, the only non-ultramafic occurrence of the heath *Epacris alpina* in Marlborough, kowhai treelands, the largest remaining populations of a distinct mid-Wairau race of cabbage trees, remnant pockets of harakeke and a distinctive community of porcupine shrub (*Melicytus alpinus*).
- Other notable plants include the native daphne *Pimelea gnidia*, titoki, supplejack, akeake, mahoe wao (*Melicytus lanceolatus*), matagouri, akiraho (*Olearia paniculata*), parsley fern (*Botrychium biforme*), green mistletoe (*Tupeia antarctica*), the shield fern *Polystichum silvaticum*, southern rata and pokaka. They reach distribution limits and/or are uncommon.

NATIVE FAUNA

- Bush birds are still quite prevalent, due to the extent of bush cover and diversity of other native vegetation. The forests and shrublands support strong populations of tui, kereru, bellbird, tomtit, brown creeper, silvereye, fantail and grey warbler (riroriro). Of note are the local occurrences of weka, New Zealand robin, rifleman, kaka, kakariki and New Zealand falcon (karearea or sparrowhawk). New Zealand pipit is common in open places.
- Wetland birds have few remaining habitats available to them and are therefore not common. However, the occurrence of black-fronted tern (mostly associated with the braided bed of the Wairau River but also visiting side streams and ponds) and fernbird (in shrubland at Manuka Island) is exceptional and of great regional importance.
- Moa gizzard stones have been found in the ecological district.
- Lizards (skinks and geckos) are widely present, especially in rock outcrops, screes, forest and shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders. The giant land snail *Powelliphanta hochstetteri consobrina* is still present in local populations, although severely threatened by feral pigs, possums, rats and thrushes.
- At least 10 species of native freshwater fish have been recorded from the rivers and streams of the ecological district. Of particular note are longfin eel, lamprey, giant kokopu and the anomalous population of koaro at Lake Chalice.

FISHTAIL ECOLOGICAL DISTRICT – PHOTO ESSAY

FISHTAIL ECOLOGICAL DISTRICT LANDSCAPE

A characteristic Fishtail Ecological District landscape showing commercial pine forest on the lower slopes, a diverse beech-podocarp forest on the mid to upper slopes and alpine areas (on conservation land) along the ridgeline.

STEEP WATERWAY

A typical steep waterway with pools and rocky waterfalls. Native fish species can utilise this habitat, climbing upstream through the wet rocky areas such as this.

GIANT FOREST TREES

A large matai tree towering over the forest canopy. The hammered appearance of the bark is an easily recognisable feature of this species.

WETLAND REMNANTS

A small wetland of harakeke (lowland flax) and sedges in a valley surrounded by commercial forestry operations. Though only about 0.5 ha in size, this wetland is valuable both as a natural feature and as a water supply. It will remain in the long term if it is carefully managed. Flax requires good light conditions so replanting pine trees too close would be potentially harmful.

FERNS

Ferns are common within the high rainfall Fishtail Ecological District. Several species of filmy fern are found including *Hymenophyllum dilatatum* seen here.

FOREST BIRDS

South Island robin, a native bird found in the forests throughout North Marlborough. These birds are insectivorous and curious, often feeding in the leaf litter on the ground. They are very vulnerable to predation and habitat loss.

SUMMARY OF ECOLOGICAL SURVEY RESULTS

As outlined above for each ecological district, an impressive range of native ecosystems remain on private land throughout North Marlborough. Despite the high degree of past modification and loss of a lot of the primeval vegetation and much of the fauna, there are still excellent opportunities for ecological protection, restoration and enhancement. North Marlborough's topography and climate favour rapid natural regeneration of native vegetation. Once suitable habitats are restored, recovery of native fauna is possible.

Table 8 shows the number of properties surveyed in each ecological district, along with the number of identified sites and their total area. Overall, nearly three-quarters of the landowners approached voluntarily participated in the ecological surveys (73%). 365 ecologically significant sites were identified, with a combined area of 21,549 hectares, approximately 7.4% of the total land area.

TABLE 8 – SUMMARY OF ECOLOGICAL SURVEY RESULTS

Ecological Districts	No. Properties Surveyed	No. Properties Declined	No. of Sites	Combined Area (ha)	SNA Sites as a % of total land area
D'Urville	20	9	46	3,582.0	12%
Cook Strait	2	0	6	695.0	12.5%
Sounds	61	16	182	11,479.0	9.5%
Pelorus	18	10	43	1,467.5	1.4%
Para	18	7	55	2,975.0	6.2%
Fishtail	6	2	33	1,350.5	3%
Totals	**125**	**44**	**365**	**21,549.0**	**7.4%**
	(73%)	**(27%)**			**(average)**

Table 9, following page, shows the main ecosystem types identified, and their distribution and extent across the six ecological districts. The sites together contain a substantial amount of the remaining habitats for native fauna and flora in the lowlands and mid-altitude lands of North Marlborough. They complement the protected public lands (reserves and conservation areas), providing lowland elements that are somewhat lacking in the public lands.

CHARACTERISTICS OF REMAINING ECOSYSTEMS

The sites identified by the survey extend from the coast to the high ridges and peaks. The ecosystems include shore communities, wetlands, valley floor and riparian communities, rock outcrop, scree and cliff communities, ultramafic communities, forest tracts and remnants, and regenerating native vegetation at various stages of development.

Some ecosystems have been severely depleted, such as towering forests on valley floors and coastal flats, ultramafic forests and wetlands. Others, like kanuka forests, tree fern communities and early successional shrublands, have greatly increased in extent due to clearance of the primeval forest cover and prolific regeneration following the waning of pastoral farming. If not unduly disturbed, the kanuka forests and tree fern communities will in time be overtaken by larger native trees and become diverse forests resembling the primeval forest cover. The same applies to the shrublands too, although they may go through a kanuka stage on the way. These natural successional changes can be disrupted by weed invasion (especially wilding pines) and high levels of feral animals such as deer, goats and pigs.

TABLE 9 – DISTRIBUTION AND EXTENT OF ECOSYSTEM TYPES SURVEYED (PRIVATE LAND ONLY; AREAS IN HECTARES)

Ecosystem Types *(in alphabetical order)*	D'Urville	Cook Strait	Sounds	Pelorus	Para	Fishtail	Totals (ha)
Alluvial valley and coastal flats forest	3.0		37.5	12.0			**52.5**
Beech forests	1,449.0		1,333.0	1,031.0	1,628.0	1,135.5	**6,576.5**
Bracken fernlands				9.0			**9.0**
Broadleaved forests (coastal gullies)	131.5		542.0				**673.5**
Broadleaved forests (inland gullies and faces)	255.0		209.0	42.0	319.0		**825.0**
Broadleaved-tree fern communities			126.0		109.0		**235.0**
Coastal dune and flat communities	7.0	12.0	22.0				**41.0**
Coastal rock and stonefield communities			2.0				**2.0**
Coastal rocky scarp and cliff communities	141.0	17.0	174.5				**332.5**
Coastal wetlands	88.5	10.0	28.5				**127.0**
Dry shrublands						2.5	**2.5**
Estuarine vegetation			2.0				**2.0**
Inland wetlands			8.0	13.5	8.0	8.5	**38.0**
Kanuka forests	638.5		5,988.0	18.0	230.0	153.0	**7,027.0**
Kohekohe forests	71.5	13.0	115.0				**200.0**
Lowland podocarp-beech forests			341.0	122.0	2.0		**465.0**
Lowland podocarp-broadleaved forests			561.0	42.0			**603.5**
Lowland shrublands	58.5	643.0	487.0	23.0			**1,164.5**
Manuka forests	82.0		235.0		24.0	45.0	**386.0**
Montane and subalpine shrublands	4.0						**4.0**
Podocarp-broadleaved-beech forests	223.0		497.5.0	112.0	651.0		**1,483.5**
Riparian communities			9.0	35.0		6.0	**50.0**
Treelands				8.0	5.0		**13.0**
Ultramafic communities	421.0						**421.0**
Upland podocarp-beech forests			760.0				**760.0**
Upland shrublands	8.5						**8.5**
Totals	**3,582.0**	**695.0**	**11,479.0**	**1,467.5**	**2,975.0**	**1,350.5**	**21,549.0**

Sites range in size from less than a hectare to hundreds of hectares. The vegetation is mostly forest, the most extensive types being beech forest and secondary kanuka forest. Also well represented are mixed podocarp-broadleaved-beech forests and lowland shrublands. Of particular note are kohekohe forests, confined to the outer Sounds and mostly reduced to small remnants in gullies. Those on D'Urville Island and Arapawa Island are of national importance because they are possum-free and therefore have healthy canopies.

Ecosystems that are naturally rare in the region are dunes and coastal wetlands (including estuarine vegetation). Ultramafic communities (nationally rare) only occur in D'Urville Ecological District.

CONSERVATION MANAGEMENT ISSUES, OPPORTUNITIES AND RESTORATION GUIDELINES

Despite the high degree of past destruction and modification of the original vegetation cover and native wildlife, there are still excellent opportunities for ecological protection, enhancement and restoration in North Marlborough. Understanding which native habitats and species are still present is the first step in securing their protection and restoration. The second step is to identify what is needed, both in terms of encouraging natural processes such as regeneration and in the removal or mitigation of threats. The third step is to provide the means.

North Marlborough has suffered large-scale land clearance, mainly involving loss of the native forest, but much forest remains and conditions are highly favourable for speedy natural regeneration. The main threats to regeneration are weeds (notably wilding exotic conifers), browsing mammals and feral pigs. The native fauna is threatened by a suite of introduced predators as well as by habitat loss. However, an array of effective techniques to deal with these problems is available.

DOMESTIC STOCK

Domestic stock (sheep, cattle, deer, horses, goats, etc) in general destroy native vegetation and undergrowth - particularly in forest and wetland sites - and prevent regeneration. They also favour certain plant species over others as food and therefore considerably modify the composition of the vegetation. For instance, areas purely of kanuka or manuka are invariably the result of selective browsing of the broadleaved plants and ferns that would otherwise be present in substantial quantities. Fencing to exclude stock is therefore essential within a productive farming landscape if natural remnants or areas for restoration are to remain and flourish. Fencing is proceeding in several key sites and in many instances can provide benefits for both the farming operation and conservation, particularly around the coast, on erosion-prone slopes and in gullies and swamps. However, in situations where severe weeds such as old man's beard and wilding pines are present, continued grazing by stock can prevent their spread so can be beneficial for the time being.

The forest is devoid of any regenerating understorey to eventually replace the older vegetation.

Prolific regeneration can occur if farm stock are fenced out and feral animals are kept at low numbers.

FERAL ANIMALS

Feral pigs, deer, goats, possums and hares are present throughout North Marlborough, and are a general problem. Their populations appear to have built to quite high densities in recent years. All have serious impacts on native flora and fauna, and in combination their effects can be devastating. As a result, much of the bush has a "hollowed out" structure, lacking undergrowth. Pigs are extremely destructive of soil and litter and have nearly eliminated the large land snails. Goats can inflict intensive local damage.

Feral goats and pigs can occur in very high numbers in localities in North Marlborough and can cause significant damage through grazing and ground disturbance.

Possums are general browsers but target species such as kohekohe and southern rata, doing severe damage in places. Deer and hares live throughout but can be locally damaging and significantly affect the high country vegetation. Extensive bark-stripping of trees such as five-finger by deer has recently been observed on D'Urville Island. Chamois are present in the Richmond Range and contribute to degradation of high country vegetation.

Left: Evidence of possum damage on kohekohe trees, favoured food along with other broadleaved species like five finger.

Right: Dieback and complete destruction of areas of kohekohe forest can occur in the worst case scenario.

Mustelids (ferrets, stoats and weasels), rodents (rats and mice), feral cats and hedgehogs are throughout the region. Largely uncontrolled, they are responsible for great damage to the small native fauna (birds, lizards and larger invertebrates). Rabbits are beginning to spread into the Sounds and are already having a negative impact on the native vegetation, even well within bush remnants.

Left: Native land snails are very vulnerable to predation by possums, rodents, mustelids, cats and hedgehogs.

Right: Domestic cats and dogs are an added threat to weka, listed as nationally threatened and the last of our remarkable flightless native birds. North Marlborough is one of the last strongholds for these birds.

Some feral animal control is carried out on most properties, but this is highly variable. The extensive hinterland of public conservation lands and the wide roving habits of several of the pest species (especially if regularly hunted), means that continual re-invasion is an issue. Control may require a collaborative programme in the region. Deliberate introduction is another problem. The pest-free status of many of the islands in the Sounds is vital to their value as sanctuaries for native flora and fauna. The lack of possums on Arapawa Island, and the lack of both possums and goats on D'Urville Island also contributes much to the sanctuary quality of North Marlborough.

Several "mainland island" type sanctuaries are in the process of being established on private land in the Sounds, taking advantage of peninsulas with narrow necks that can be intensively managed or fenced to exclude farm stock and feral animals. Full exclusion could result in areas which offer the opportunity to re-introduce rare land birds, burrowing sea birds, tuatara, skinks, geckos and land snails. Kaipupu Point near Picton, jointly administered by Port Marlborough NZ Ltd and the Department of Conservation, is also being managed as a "mainland island", with Council encouragement and strong community involvement.

FERAL ANIMAL CONTROL

Many landowners are motivated to carry out pest control in an attempt to lessen the impact of feral animals in their surrounding area. While any control effort is useful, to be effective in reducing the impact of feral animals over time, comprehensive pest control programmes are likely to be needed. Because every situation is different, expert advice is probably required to set up these more comprehensive programmes. The information provided here gives a general overview of basic accepted control methods for the various feral animal pest species. Further detailed information is available from organisations such as:-

Landcare Research www.landcareresearch.co.nz

Department of Conservation www.doc.govt.nz

Biosecurity New Zealand www.biosecurity.govt.nz

Pigs, deer and goats

The purpose of controlling these species is to reduce the impacts of grazing, browsing, bark stripping and ground disturbance on forest vegetation and habitat. High to moderate densities of these feral animals can significantly affect the habitat quality available for native animal species and over-time potentially change the entire forest structure. Pigs also prey on ground dwelling organisms (insects, worms etc) and of particular significance, the threatened native land snail species.

Control methods: Control of these three species is best achieved through intensive ground hunting with appropriately trained dogs (ideally trained for the individual pest species). Initially an intensive hunting effort (2-4 hectares per hour) by experienced hunters carried out in a systematic and planned way can effectively reduce populations of these species, although migration of animals from non-hunted neighbouring areas is a factor to be considered. Ongoing follow up control is likely to be required. Experience has shown that for native vegetation to show significant recovery, the animal population needs to be reduced to a level where one experienced hunter and dog will encounter only one animal per hunting day. Control that does not achieve this level will still reduce the pressure on the native habitat but not to the extent that full recovery will be able to occur.

Possums

The purpose of controlling possums is to reduce general browsing pressure on native vegetation as well as targeted browsing pressure on some favoured species such as kohekohe and five finger which can ultimately kill these species. Possums also prey on nesting birds, taking eggs and chicks over the spring and summer months.

Control methods: Possums can be controlled through a variety of both trapping and poisoning methods.

1 Trapping

Kill traps – the animal is killed almost instantly so traps do not have to be checked daily. These traps are generally more expensive but are suitable for small scale use.

Non kill traps (cage traps and leghold traps) - have to be checked daily to meet animal welfare guidelines and require that the animal is then humanely killed. Recent legislation has banned various leghold traps. Information on approved leghold trap types can be found at

www.biosecurity.govt.nz/regs/animal-welfare/stds/traps

For both types of traps if weka are present it is recommended that traps are positioned a minimum of 700mm off the ground. It is an offence to kill weka.

2 Poisoning

Anticoagulant type poisons are most commonly used in small scale possum control around smaller properties and baches. However some are highly lethal to mammals and birds, and extremely lethal to fish. Strict adherence to label recommendations is neccessary, to minimise secondary poisoning and prevent entry to the food chain, especially in scavenging feral pigs. The use of bait stations is a condition of use to prevent access to the toxin by wildlife and livestock. Weka are particularly vulnerable to this. Anticoagulants do not produce signs of poisoning for several days after the toxic dose has been consumed therefore bait stations should be kept baited for 3-4 days and then bait removed for up to 5 days. Then they should be rebaited. This helps to prevent "over ingestion" of bait, beyond that required to kill the possum. Those animals requiring a greater dose will receive it in the second baiting.

Acute poisons such as cyanide in both encapsulated pellet (Feratox) and paste form are commonly used for possum control but require a licensed operator.

A summary of poison types can be viewed at;

www.landcareresearch.co.nz/publications/infosheets/possums/pros_cons_of_poisoning.pdf

Mustelids (ferrets, stoats and weasels) and rats, also cats

The purpose of controlling these species is to provide some relief from predation for breeding birds, as well as insect and lizard populations over the spring/summer months. Stoats and ship rats, in particular, are key pests in forest ecosystems. There can be quite a complex relationship between the various predators with impacts on one affecting another and this needs to be considered when control programmes are planned. Cats for instance, while preying on native species, also prey on both rats and stoats. Cats should be particularly targeted when numbers are known to be generally high or particular species are at risk – eg, penguins at nesting time.

Stoats prey on nesting birds, including larger species like kereru and kaka. They have a large range being able to travel many kilometres per day.

Rats also prey on nesting birds with particular known impacts on robins, tomtits and kereru, but also prey heavily on invertebrates and feed on seeds and fruit, potentially reducing forest regeneration. Rat numbers build up seasonally in response to food availability, numbers can also build when there is effective control of stoats, as rats are preyed on by stoats. Rats have smaller home ranges (100 – 200m) and high productivity when conditions are favourable and therefore control must be periodic to be effective and monitoring is required.

Cats are difficult to target but can be caught in leghold or kill traps. They can also be caught in cage traps and then shot.

Control methods: Mustelids and rats can be controlled through both trapping and poisoning methods.

Stoats - Trapping for stoats includes approved kill traps such as the Fenn or DOC 250s, 200s or 150s set at approximately 200m intervals along tracks ridges and prominent points. For larger operations trap lines should be 1km or less apart. Rats are also likely to be trapped in these also, but not to the extent that the rat population will be significantly reduced.

Rats - The current best practice for controlling rat populations involves installing bait stations on a 100m x 100m grid and using an anticoagulant poison (such as "Talon"). Typical active ingredients are: brodificoum, diphacinone, warfarin, and others. Most of these products include green dyes to deter birds; however, dogs and cats have poor colour vision and to them these pellets may look like pet food.

Anticoagulant rodenticides do not produce signs of poisoning for several days after the toxic dose has been consumed therefore bait stations should be kept baited for 3-4 days and then bait removed for up to 5 days and the stations then rebaited. This helps to prevent "over ingestion" of bait, beyond that required to kill the rat. Those rats requiring a greater dose will receive it in the second baiting.

However, in North Marlborough there is a problem with weka taking baits and eating poisoned rats. Bait stations are the most prudent way to apply the bait as it gives a measure of protection to birds from eating the bait.

Trapping of rats can be done in smaller areas using 100m x 50m grids or ideally 50m x 50m grids, checked weekly or as frequently as possible. Several kill trap types are available and need to be set up in a weka-proof tunnel.

Rat numbers can rebuild very rapidly, so to maintain them at low levels programmes need to be repeated at least every third year and if possible more frequently. Some mice will also be poisoned/trapped using these methods. Mustelids will also be reduced following a rat poison operation as a proportion of them die by feeding on the poisoned rodents.

Feral Cats – Cats can be trapped in any of the three trap types – kill traps, leghold traps or cage traps. Cage traps are only suitable for control in small areas but are useful in that they avoid pet cats being injured or killed. For more serious control operations, an extensive network of either leghold or kill traps can be used on 100-200 metre lines. Cat control is quite complex and currently there is no effective monitoring technique for feral cat control operations. The Department of Conservation has detailed fact sheets on feral cat control using the three trapping techniques available.

WEEDS

Along with feral animals, introduced plants are placing North Marlborough's natural ecosystems under pressure.

Wilding Conifers

Wilding conifers (mostly *pinus radiata*) have become the greatest weed threat in North Marlborough, proliferating since the wind-down of pastoral farming and the advent of commercial exotic forestry in about the mid 1970s. They are throughout the region and are rapidly invading regenerating vegetation and sensitive places such as coastal scarps and ultramafic areas. Relatively easy to control at the early stages, they have the ability to rapidly proliferate and destroy the integrity of the native vegetation. Control programmes are underway in several places in the Sounds, where individual landowners are carrying out work. The Marlborough Sounds Restoration Trust is an independent organisation established in 2006 to work on a larger scale programme of wilding pine control in the Queen Charlotte Sound with the backing of the Marlborough District Council and the Department of Conservation.

Control methods- the most effective way to control large wilding pines where they are located within regenerating native vegetation and away from areas where people could be endangered by falling branches, is to poison them standing and allow them to die and break down over a period of several years. This method does not create gaps in the vegetation where seeds in the ground can germinate and become an ongoing problem. The method involves drilling from 2-8 holes (depending on the size of the tree), on a downward angle into the growth layer of the tree under the outer bark layer (about 100mm), and filling with a chemical mix of high concentration metsulfuron based herbicide like Meturon, Escort or Matrix (200g per litre of water).

For more detailed information see Factsheet 174 "Poisoning Wilding Radiata Pine - using metsulfuron" from the Department of Conservation or the Marlborough District Council.

Young, smaller pre-coning trees can be felled with a hand or chainsaw.

Left: Scattered wilding pines within regenerating kanuka forest that could be relatively easily controlled by poisoning at this stage.

Right: Example of very good control of wilding pines in the Sounds. The trees have been killed by drilling and poisoning, the most effective technique for mature trees where the risk of falling material is not an issue. The regenerating native vegetation beneath the dead pines continues to grow and the shade provided by these plants prevents any further pines from emerging.

Old man's beard

Old man's beard is also a major and burgeoning problem. It is beyond the capacity of individual landowners to control in several places, even though biological control agents are present. The main control tools are grazing, or cutting stems and painting the cuts with herbicide. Preventing the spread of this weed should be a regional aim.

Control – the most effective control method is to find and cut the vines near the ground and paint the stumps with herbicide, either Vigilant gel, 1 part Glyphosphate to 4 parts water or 1 part Grazon to 20 parts water. Ongoing control will be required for some years to continue removing seedlings. Hand pulling and grubbing is possible with smaller plants. As plants can re-grow from stem fragments ensure these are not left on the ground.

Left: Old man's beard plants showing prolific wind spread seeds after flowering.

Right: Old man's beard smothering native vegetation – the weed can take over areas of native vegetation if left uncontrolled.

Other weed species

Banana passionfruit, Japanese honeysuckle and climbing asparagus are also becoming severe problems, though as yet they are more localised.

Willows threaten natural riparian sites and wetlands. They can be controlled by drilling and poisoning using similar methods outlined for wilding pine trees. Willows spread vegetatively, so if they are going to be mechanically removed they should still be killed by poisoning first, otherwise any pieces left on the ground are likely to re-grow.

Cotoneaster, agapanthus and shrubby stonecrop (*Sedum praealtum*) - all garden escapes - are threats to coastal scarps and should be controlled wherever they become established in the wild.

Banana passionfruit, Japanese honeysuckle and climbing asparagus (left to right), all weeds that could become major problems if allowed to spread.

Gorse and broom are threats to areas where native vegetation regeneration is slow, for instance ultramafic areas and some coastal scarps; otherwise they are benign and are generally quickly outstripped by regenerating native vegetation.

Flowering gorse on Sounds hillsides which will eventually be out-competed by native vegetation although this will take 20-30 years.

Spanish heath, hawthorn, barberry, Himalayan honeysuckle and blackberry are localised but widespread; they are not usually a threat to the native vegetation. For many of these weeds, exclusion of stock and prevention of fire and other disturbance may be sufficient for the regeneration of native vegetation to prevail.

On the few sand dunes, marram grass has invaded and is a severe threat to the natural sand dynamics, as well as to the last remnants of native sandbinding vegetation and mat daisy populations. Control of marram and planting of native sandbinders will be necessary for these special communities to survive long into the future.

"Exotic natives" – New Zealand native plants not naturally occurring in North Marlborough – also pose threats to the natural integrity of the region. They include beloved species such as pohutukawa, kauri, puriri and karo. Pohutukawa and karo have become established in the wild in several places in the Sounds. In terms of ecological integrity it is better not to plant these species but to plant the local equivalents instead: southern rata, totara, kohekohe and kohuhu. Even then, it is preferable to use plants raised from the nearest available source, rather than what can be obtained "off the shelf" from a commercial nursery.

Pohutukawa, although a native species and attractive to native birds is not natural to Marlborough and is spreading in places. From an ecological perspective it is better to plant southern rata, which is natural to the region.

FIRE

Natural fires would have been an infrequent feature of North Marlborough, resulting in fairly small areas of scorched forest, quickly repaired by natural regeneration. Maori probably used burning in the past for localised forest clearance. European settlement was characterised by wholesale felling and burning of the bush to make way for pastoral farming. Fire was then used as a routine tool for clearing regrowth of bracken, manuka, kanuka and tauhinu, and is still used on some farms and forestry blocks. Small-scale judicious use of fire can be a useful alternative to herbicide application, but in North Marlborough fire is generally damaging to soil and regenerating vegetation and creates conditions that favour the proliferation of weeds such as gorse, broom and wilding pines. Avoidence of fire in the early stages of vegetation regeneration (when it is most vulnerable) helps ensure a rapid transition back to native forest.

LAND DEVELOPMENT AND SUBDIVISION

Intensification and changes in land-use and land subdivision may create pressure on natural areas and ecology within the region. Changes in the economics of commercial forestry may encourage more land development in some areas and the abandonment of forestry in other areas of North Marlborough. Weeds can be spread by trucks and roading machinery.

Coastal subdivision has occurred throughout the Sounds to create ribbons and clusters of small holdings by the shore. Most are visited during holidays; few have permanent residents. Almost all have gardens of lovingly tended exotic plants, frequently creating weed problems (see above). Pets (cats and dogs) are often present, and disturbance and deaths of penguins, oystercatchers, herons, shags, gulls, weka and lizards - especially when breeding - is an inevitable and unfortunate result. The proliferation of motorboats and jet skis makes life difficult for coastal birds and seals. Nevertheless, with awareness and sensitivity, native biodiversity and people can co-exist. In places, landowners are collaborating to control weeds and animal pests, supported to varying degrees by the Council, Department of Conservation and/or QEII National Trust.

RIPARIAN MARGINS

The presence of intact native vegetation in riparian margins alongside waterways is particularly important in North Marlborough as many of the native fish species found in the waterways rely on native riparian margins as a source of terrestrial insects as a food supply. Also, the banded kokopu and shortjaw kokopu have adopted the unique behaviour of spawning in the damp leaf litter on the riparian margins during stream freshes. The eggs remain their in the damp leaf litter until the next fresh when they are washed back into the stream. Riparian margins can include native vegetation like flax, tussock sedges, overhanging broadleaved species (five-finger, mahoe etc), but exotic species, even weeds and overhanging pasture grasses along the edges of waterways are better then bare sides with no vegetation of any kind.

A Sounds waterway with overhanging riparian vegetation (above left) providing suitable habitat for a variety of native fish and invertebrate species as seen in the bucket in the photo below.

RESTORATION

There are good opportunities for active ecological restoration throughout the region although in many cases removing impediments may be enough, as natural regeneration can be vigorous. For instance, fencing to remove stock or discourage feral animals where grazing and disturbance is the limiting factor, or weed control where weeds are a serious problem, may be the best course of action.

Active restoration could include:

- re-watering and planting around wetlands (native trees including cabbage tree, lowland ribbonwood and kahikatea, shrubs and harakeke);
- restoration of populations of native coastal plants such as pingao, spinifex, sand tussock, sand coprosma and mat daisy;
- restoration of populations of threatened and local plants such as large-leaved milk tree (*Streblus banksii*), fierce lancewood (*Pseudopanax ferox*), Cook Strait kowhai (*Sophora molloyi*), swamp maire (*Syzygium maire*), white maire (*Nestegis lanceolata*), native verbena (*Teucridium parvifolium*) and mistletoes;
- restoration of shrublands, forests, coastal scarp and ultramafic vegetation through encouragement of regeneration (including exclusion of stock, fire prevention and control of weeds and animal pests);
- planting to enhance and complement bush and shrubland remnants, for instance plants such as totara, rimu, rewarewa and southern rata;
- intensive local control of animal pests to allow the return of native birds and other small fauna to selected locations.

Because of the degree of endemism and highly localised climatic conditions, planting should ideally use only locally sourced plant material. That way the special nature of each ecological district will be celebrated and the plants best suited to the conditions will make the restoration more likely to succeed.

General restoration planting where landowners want to speed up natural regeneration processes will depend to some extent on the specifics of the site. However the following species are local to the North Marlborough area and relatively hardy and easy to grow.

Basic common pioneer species which can be planted first include;-

Common name	Latin name
Akeake	*Dodonaea viscosa*
Akiraho	*Olearia paniculata*
Broadleaf	*Griselinia littoralis*
Cabbage tree	*Cordyline australis*
Five finger	*Pseudopanax arboreus*
Flax species	*Phormium tenax*, *Phormium cookianum*
Fierce lancewood	*Pseudopanax ferox*
Kanuka	*Kunzea ericoides*
Karamu	*Coprosma robusta*
Black matipo/kohuhu	*Pittosporum tenuifolium*
Manuka	*Leptospermum scoparium*
Narrow leaved lacebark	*Hoheria angustifolia*
Ngaio	*Myoporum laetum*
Rewarewa	*Knightia excelsa*
Totara	*Podocarpus totara*
Wineberry	*Aristotelia serrata*

More specialised species that can be added to a planting once the pioneer species above are established include:-

COMMON NAME	LATIN NAME
Black beech	*Nothofagus solandri*
Ferns	*Various species…*
Hinau	*Elaeocarpus dentatus*
Kawakawa	*Macropiper excelsum*
Kahikatea	*Dacrydium dacrydioides*
Kaikomako	*Pennantia corymbosa*
Kohekohe	*Dysoxylum spectabile*
Lemonwood/tarata	*Pittosporum eugenioides*
Mahoe	*Melicytus ramiflorus*
Matai	*Prumnopitys taxifolia*
Miro	*Prumnopitys ferruginea*
Nikau	*Rhopalostylis sapida*
Pigeonwood	*Hedycarya arborea*
Putaputaweta	*Carpodetus serratus*
Red beech	*Nothofagus fusca*
Rimu	*Dacrydium cupressinum*
Southern rata	*Metrosideros umbellata*
Swamp maire	*Syzygium maire*
Tawa	*Beilschmiedia tawa*
Titoki	*Alectryon excelsus*
White maire	*Nestegis lanceolata*

CARBON, BIODIVERSITY AND WATER YIELD "FARMING"

There are developing alternatives to pastoral farming or forestry for deriving an income from the hill country, whilst also nurturing the native flora and fauna. North Marlborough is particularly well placed for these practices, having relatively fertile soils, reliable rainfall and abundant seed sources. They include fostering the regeneration of native forest to capture carbon dioxide from the air and sequester it in growing forests that have long-term security (earning "carbon credits"). That is already well underway on several North Marlborough properties. At the national level, programmes are being developed around the "Emissions Trading Scheme" but international and national approaches to this are still uncertain at the time of writing. The Ministry of Agriculture and Fisheries is the lead government agency involved in developing these programmes.

At the exploration stage are proposals for landowners to gain a financial return for measurably improving indigenous biodiversity and conserving water resources on their land (earning "biodiversity credits" and "water credits"). Meanwhile, commercial return from honey and essential oils is a genuine option for kanuka and manuka vegetation and regenerating native forest. Most ecotourism, holiday and home-stay businesses in the region are founded on the native biodiversity, and anything that protects or enhances the biodiversity will contribute economically.

PROTECTION

Many private landowners in North Marlborough support the concept of protection of natural values on their land. Prior to the initiation of the ecological surveys, some were already protecting special sites. New initiatives underway following the surveys include formal conservation covenants through the QEII National Trust and the Department of Conservation, management agreements, fencing, weed control, animal pest control and restoration planting. They are usually to the benefit of property management and productivity, as well as to ecological conservation.

There are proven methods that can be applied to diminish or remove most of the existing ecological threats to natural sites, as outlined above. Some threats are beyond the resources of private landowners and are a matter of regional concern. These include wilding pines, old man's beard and feral pigs, goats and possums. The Council and the Department of Conservation recognise this and are investigating the control of these pests in some localities.

Practical and financial assistance to protect and enhance areas is available to landowners from the Council through its Landowner Assistance Programme. Assistance for landowners can also be sought from other sources such as central government's Biodiversity Fund and the QEII National Trust, either independently or through a package organised and administered by the Council.

ECOLOGISTS' CONCLUSIONS AND RECOMMENDATIONS

The survey has shown that many private landowners in North Marlborough support the concept of protection of natural values on their land. The voluntary, supportive and non-regulatory partnership approach adopted by the Marlborough District Council has resulted in the collection of a significant amount of ecological information and the promotion of the protection and sustainable management of many of these ecologically special areas. Protection methods include formal covenants, management agreements, fencing, weed control and animal pest control, usually to the benefit of land management and productivity as well as properties' natural values.

It is recommended that the established follow-up process, through the Council's Landowner Assistance Programme, be continued, using the ecological reports as the basis for discussing and designing effective conservation initiatives. There are proven methods for diminishing or removing most existing threats to natural sites and values, given access to advice and resources. Support for private landowners in North Marlborough can be sourced through the Council, although the resources themselves may come from elsewhere. It is recommended that the Council continue to provide a "first port of call" service to private landowners for assistance with protection and conservation management.

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MARLBOROUGH DISTRICT COUNCIL

APPENDIX ONE: CRITERIA FOR ASSESSMENT OF AREAS OF ECOLOGICAL SIGNIFICANCE

The following provides explanations or guidelines for the application of ecological significance criteria in the assessment of sites.

Rankings within each criterion are: **H** = High; **M** = Medium; **L** = Low. They collectively contribute to an overall ranking, indicating the degree of significance. Any site for which all criteria rank **L** is not ecologically significant. However, if any criteria rank **M** or **H**, the site is significant.

Representativeness

The site is significant if it contains a good example of one of the existing or former characteristic ecosystem types in the region or ecological district.

H: The site contains one of the best examples of the characteristic ecosystem types in the ecological district.

M: The site contains one of the better examples, but not the best, of the characteristic ecosystem types in the ecological district.

L: The site contains an example, but not one of the better or best, of the characteristic ecosystem types in the ecological district.

Rarity

The site is significant if it contains flora or fauna listed as nationally threatened; or the site contains flora or fauna of note in the region or ecological district because of scarcity, local endemism, specialised habitats or extreme/anomalous geographic distribution; or the site contains plant or animal communities that are rare nationally, regionally or in the ecological district.

H: The site contains nationally threatened or rare flora, fauna or communities; or the site contains several examples of regionally or locally threatened or rare flora, fauna or communities.

M: The site contains one or a few regionally or locally (but not nationally) threatened, rare or uncommon flora, fauna or communities.

L: The site is not known to contain flora, fauna or communities that are threatened, rare or uncommon in the ecological district, regionally or nationally.

Diversity and pattern

The site is significant if it contains a range of species and ecosystem types that is notable for its complexity (diversity of species and occurrence together of different communities) nationally, in the region or in the ecological district.

H: The site contains a notably high diversity of species and ecosystem types.

M: The site contains a moderate diversity of species and ecosystem types.

L: The site contains a relatively low diversity of species and ecosystem types.

Distinctiveness/special ecological characteristics

The site is significant if it contains ecological features (such as species, habitats, communities, indicators, historical importance) that are outstanding or unique nationally, in the region or in the ecological district.

H: The site contains any ecological feature that is unique nationally, in the region or in the ecological district; or it contains several features that are outstanding regionally or in the ecological district.

M: The site contains ecological features that are notable or unusual but not outstanding or unique nationally, in the region or in the ecological district.

L: The site contains no obvious ecological features that are outstanding or unique nationally, in the region or in the ecological district; i.e. the ecological features are typical rather than distinctive or special.

Size and shape

The site is significant if it is moderate to large in size and is physically compact or cohesive.

H: The site is large in size for the ecological district and is compact in shape.

M: The site is moderate in size for the ecological district and is compact in shape; or the site is relatively large but not very compact or cohesive.

L: The site is small in size for the ecological district, or the site is moderate in size but not at all compact or cohesive.

Connectivity

The site is significant if it is physically connected or close to other natural areas, and/or is part of a larger natural ecosystem or a related sequence of natural ecosystems.

H: The site is close or well connected to a large natural area or several other natural areas.

M: The site is in the vicinity of other natural areas but only partially connected to them or at an appreciable distance.

L: The site is significantly isolated from other natural areas.

Sustainability

The site is significant if it is ecologically resilient, i.e. its natural ecological integrity and processes (functioning) are largely self-sustaining.

H: The site can maintain its ecological integrity and processes with minimal human assistance.

M: The site requires some but not much human assistance to maintain its ecological integrity and processes.

L: The site requires much human assistance to maintain its ecological integrity and processes.

APPENDIX TWO: NOTABLE PLANTS OF NORTH MARLBOROUGH

NOTABLE PLANTS OF NORTH MARLBOROUGH: THREATENED PLANTS, DISTRIBUTION LIMITS AND ANOMALIES

This is a selection of the key plant species that stand out in North Marlborough for their rarity, threatened status, unexpectedness, remnant status or as representing extremes of geographic distribution. It is not intended to include every species listed as threatened or to present a comprehensive distribution map for each species. Rather, the list acknowledges a series of botanical highlights for the region. It is based on:

- Walls GY 1984. Scenic and Allied Reserves of the Marlborough Sounds. Biological Survey of Reserves Series No. 13. Department of Lands and Survey, Wellington.
- Observations from the significant natural area (SNA) surveys.
- Records from Shannel Courtney (Department of Conservation, Nelson).

Threatened status, shown in “inverted commas”, is taken from:

- de Lange PJ, Norton DA, Courtney SP, Heenan PB, Barkla JW, Cameron EK, Hitchmough R, Townsend AJ 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61-96.

Plants are mapped with numerical symbols. Annotations for each species are given:

T = threatened plant

D = distribution limit

A = anomalous/unexpected occurrence

R = remnant

NOTABLE PLANTS OF **NORTH MARLBOROUGH**

	COMMON NAME	BOTANICAL NAME	NOTABLE CATEGORY	COMMENTS
1	Mt Stokes daisy	*Celmisia macmahonii var. macmahonii*	T, D	"At risk, naturally uncommon". Endemic to Mt Stokes.
2	Hadfield's rock daisy	*Celmisia macmahonii var. hadfieldii*	T, D	"At risk, naturally uncommon". Endemic to Richmond Range peaks.
3	Napuka/Titirangi	*Hebe speciosa*	T, A	"Threatened, nationally vulnerable". Of cultural importance.
4	Pitpat	*Pittosporum patulum*	T, R	"Threatened, nationally critical". Mt Richmond Forest Park.
5	Pygmy button daisy	*Leptinella nana*	T	"Threatened, nationally endangered". Inland riverbanks.
6	Neinei	*Dracophyllum urvilleanum*	T	"At risk, naturally uncommon".
7	NZ skullcap	*Scutellaria novae-zelandiae*	T, D, R	"Threatened, nationally critical". Inland valleys.
8	Shore milkweed	*Euphorbia glauca*	T, R	"At risk, declining". D'Urville Island only.
9	Coastal mat daisy	*Raoulia aff. hookeri*	T, R	"At risk, declining".
10	Native verbena	*Teucridium parvifolium*	T	"At risk, declining". Inland valleys, riparian.
11	Pingao	*Desmoschoenus spiralis*	T	"At risk, relict". Sandbinder, extinct in North Marlborough but could be re-introduced.
12	Raukawa	*Raukaua edgerleyi*	T, R	Listed as "Not threatened", but regionally rare and declining.
13	Red mistletoe, Pikirangi	*Peraxilla tetrapetala*	T, R	"At risk, declining". Beech forests; highly vulnerable to possum browse.
14	Scarlet mistletoe, Pirita	*Peraxilla colensoi*	T, R	"At risk, declining". Beech forests; highly vulnerable to possum browse.
15	White mistletoe, Tupia	*Tupeia antarctica*	T	"At risk, declining". Broadleaved forests; highly vulnerable to possum browse.
16	Yellow mistletoe	*Alepis flavida*	T, R	"At risk, declining". Beech forests; highly vulnerable to possum browse.
17	Cook Strait porcupine shrub	*Melicytus crassifolius*	T	"At risk, declining". Outer Sounds, Cook Strait endemic.
18	Coral mistletoe	*Korthalsella salicornioides*	T	"At risk, naturally uncommon". On kanuka and manuka. Localised.
19	Fierce lancewood	*Pseudopanax ferox*	T, R	"At risk, naturally uncommon". Outer Sounds, mostly on cliffs.
20	Gossamer grass, wind grass	*Anemanthele lessoniana*	T, R	"At risk, declining". Very localised; vulnerable to browsing.
21	Large-leaved milk tree	*Streblus banksii*	T, D, R	"At risk, relict". Outer Sounds, rare in the South Island.
22	Cook Strait kowhai	*Sophora molloyi*	T, D, R	"At risk, naturally uncommon". Outer Sounds, mostly on cliffs.
23	Shrub mahoe	*Melicytus aff. obovatus*	T, D, R, A	"At risk, declining". Coastal, very localised; vulnerable to browsing.
24	Cook's scurvy grass	*Lepidium oleraceum*	T, R	"Threatened, nationally vulnerable". Cook Strait islands, very localised.
25	Wire plant	*Muehlenbeckia ephedroides*	T, R	"At risk, declining". Coastal, very localised.
26	Serpentine koromiko	*Hebe urvilleana*	T, D	"At risk, naturally uncommon". Endemic to ultramafic zone.
27	Serpentine gentian	*Gentianella stellata*	T, D	"At risk, naturally uncommon". Endemic to ultramafic zone.
28	Swamp maire	*Syzygium maire*	D, R	Regionally rare, a wetland specialist.
29	Black maire	*Nestegis cunninghamii*	D, A	Common in North Island, very rare in North Marlborough – Linkwater only.
30	White maire	*Nestegis lanceolata*	D, A	Common in North Island, rare in North Marlborough.
31	Pygmy pine	*Lepidothamnus laxifolius*	D, A	Common nationally, very rare in North Marlborough – D'Urville Island only.
32	Rewarewa	*Knightia excelsa*	D, A	Localised but spreading. A North Island plant, recently arrived.
33	Tanekaha	*Phyllocladus trichomanoides*	D	Very localised; nearing southern limit.
34	Kohekohe	*Dysoxylum spectabile*	D	Southern limit is central Sounds.
35	Rengarenga (renga lily)	*Arthropodium cirratum*	A	Associated with former Maori settlements.
36	Whau	*Entelea arborescens*	A	Associated with former Maori settlements. Very localised.
37	Tree hebe	*Hebe parviflora*	D	In North Marlborough only on Arapawa Island and Cape Jackson.
38	Cook Strait speargrass	*Aciphylla squarrosa*	D	A local form of this species.
39	Maidenhair fern	*Adiantum viridescens*	D	This species is rare in the South Island, very localised in North Marlborough.
40	Gully fern	*Cyathea cunninghamii*	D	Common nationally, quite rare in North Marlborough.
41	Toii, mountain cabbage tree	*Cordyline indivisa*	D, R	At southern limits. In a few localities only.
42	Manatu, lowland ribbonwood	*Plagianthus regius*	D, R	Regionally uncommon. Mostly on fertile inland valley floors.
43	Narrow-leaved lacebark	*Hoheria angustifolia*	D	Regionally uncommon. Best valley population at Koromiko.

MARLBOROUGH DISTRICT COUNCIL

MAP 8 - NOTABLE PLANTS