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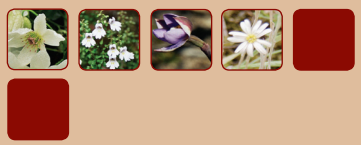

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SOUTH MARLBOROUGH
SIGNIFICANT NATURAL AREAS PROJECT

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

July 2005

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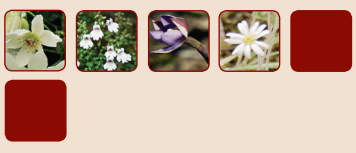

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ACKNOWLEDGEMENTS

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Parts of this report have drawn heavily on the Department of Conservation Wairau Ecological Region Survey Report for the Protected Natural Areas Programme (North 2004).

In addition, Department of Conservation staff members Simon Moore and Jan Clayton-Greene have provided significant input.

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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 South Marlborough. It summarises information published by the Department of Conservation's (DoC) Protected Natural Areas report (North, M. 2004. Wairau Ecological Region – Blenheim, Grassmere, Flaxbourne, Wither Hills and Hillersden Ecological Districts. Survey report for the Protected Natural Areas Programme. Occasional Publication No. 60. Department of Conservation, Nelson.), and ecological information collected by the Marlborough District Council (MDC), in conjunction with landowners in the district, through its work identifying significant natural areas under the Resource Management Act.

The ecology of South Marlborough has previously received little attention. There were few formally protected areas, and there was a perception that little of conservation value remained.

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 approach using maps and aerial photography. It has also provided both landowners and the Council, with opportunities to learn about the existing ecological values and issues that need to be understood, to enable effective protection of the more vulnerable of these areas.

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

Through the combination of these measures, a number of protection projects have been implemented by landowners. The Council intends to continue to promote this protection work in the long term.

THE SURVEY AREA – ECOLOGICAL DISTRICTS

For the purposes of this report, South Marlborough is defined as that part of the MDC territorial area which lies to the south of the Wairau River (apart from the Rarangi area in the north-eastern corner which is north of the Wairau River and is included in the survey area). While ecological survey work is continuing in the northern part of Marlborough (ie, north of the Wairau River and including the Marlborough Sounds), the results of that work are not included in this overview.

The geographical units of Ecological Districts have been used as the basis for this survey (McEwen, 1987). These were developed in the 1980's to provide defined areas within which natural areas of ecological significance could be identified. An Ecological District is defined as a local part of New Zealand where the topographical, geological, climatic, soil and biological features, including 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.

The majority of privately owned land in eight ecological districts in South Marlborough, has been surveyed, subject to landowner permission. These include the Kekerengu (northern portion), Medway, Waihopai, Hillersden, Blenheim, Wither Hills, Grassmere and Flaxbourne Ecological Districts (see Map 2).

For each of the eight ecological districts surveyed the following information is given:

- **OVERVIEW**

  A description of the biogeography and history of the district.

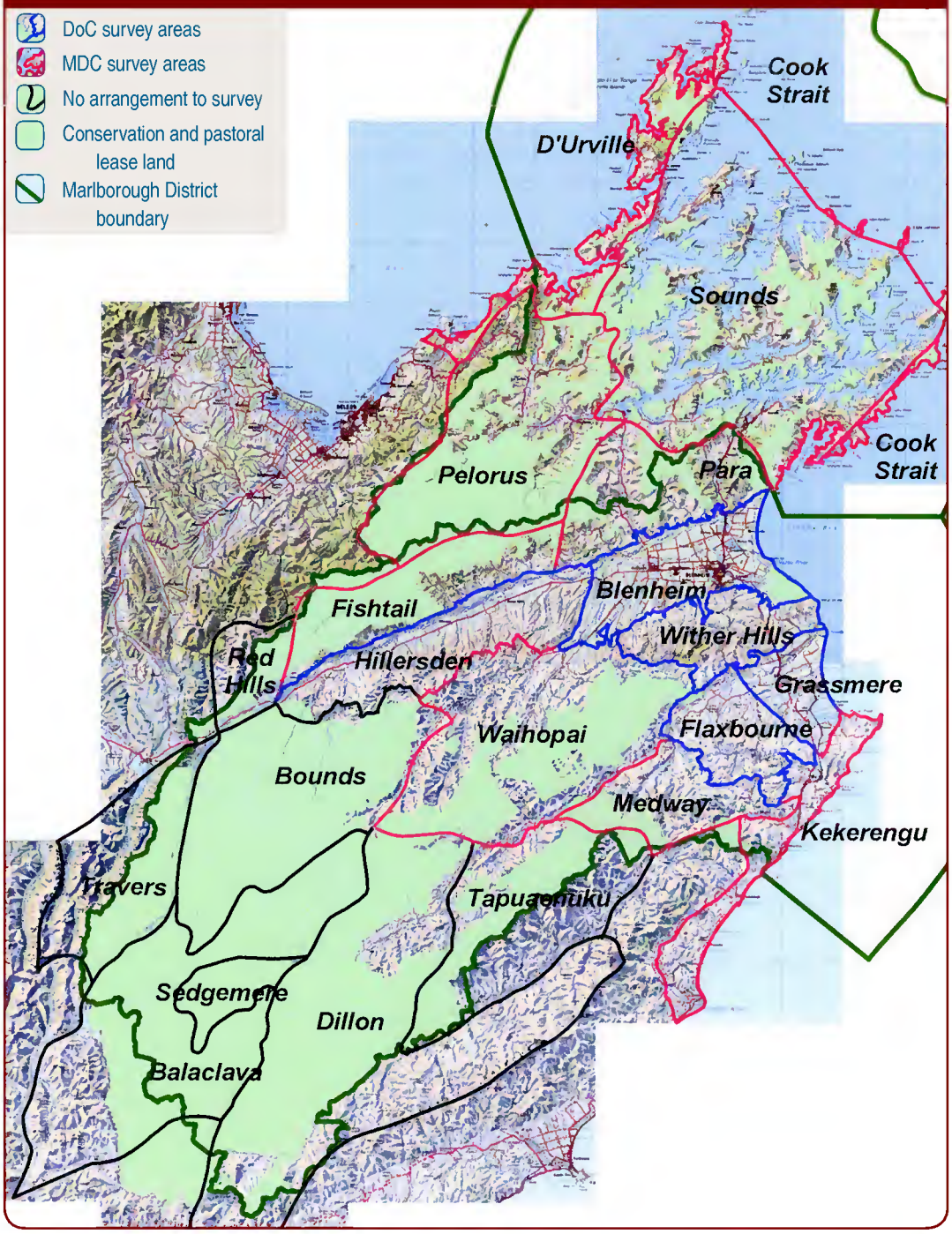
- **SURVEY RESULTS**

  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, anomalies, etc.
- **PHOTO ESSAY**
  A series of photos illustrating typical and distinctive habitats and plants.

Those South Marlborough ecological districts that predominantly include the Molesworth Station, pastoral lease properties and land managed by the Department of Conservation, have not been included in this survey (Tapuaenuku, Dillon, Balaclava, Sedgemere, Bounds and Travers ecological districts – see Map 1).

MAP 1 - THE MARLBOROUGH DISTRICT SHOWING ALL THE ECOLOGICAL DISTRICTS AND CONSERVATION/PASTORAL LEASE LAND



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THE FIELD SURVEY - METHOD

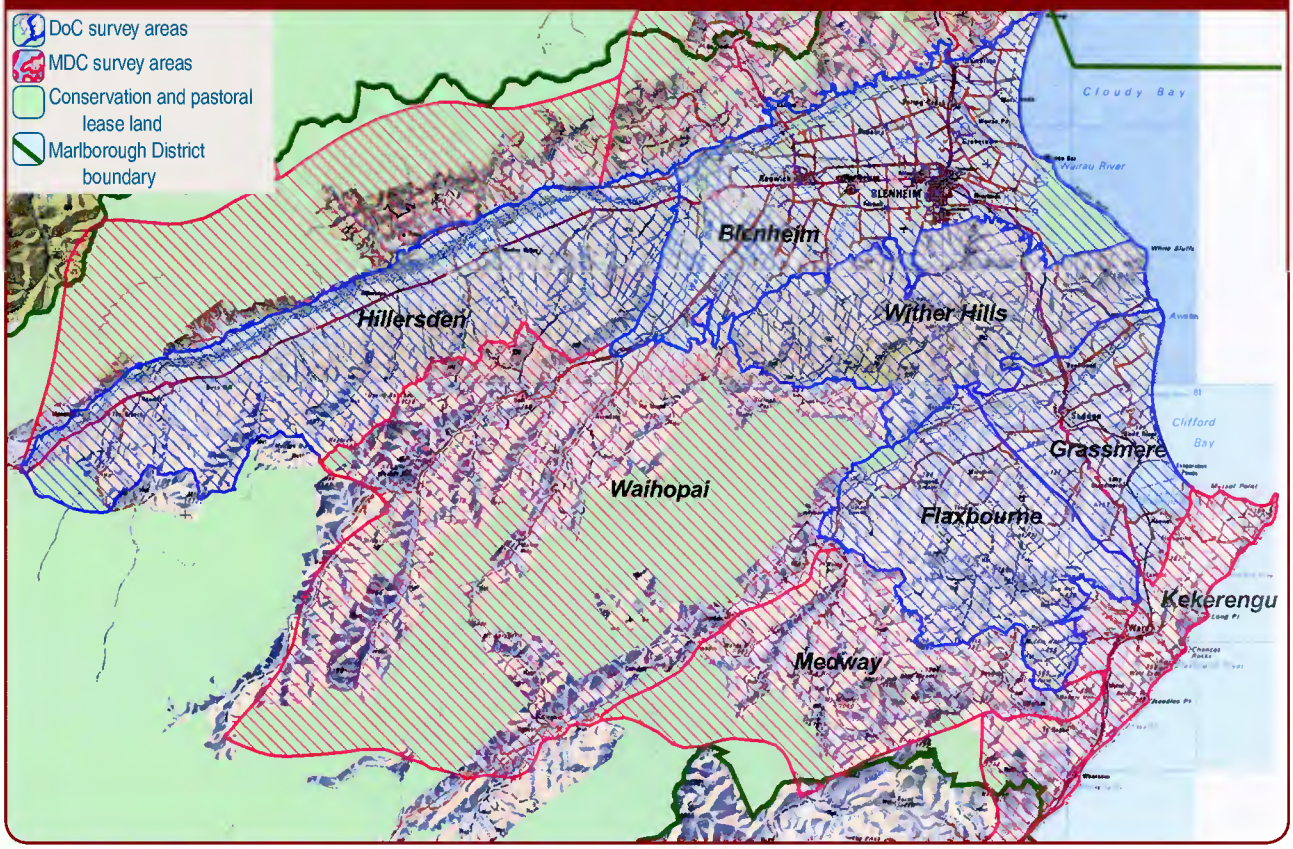
Prior to the field surveys getting underway in 2001, preliminary consultation with landowners and relevant agencies took place. A working group was established by the Council to help manage the project, including landowner representatives, as well as MDC and DoC representatives.

The field survey of South Marlborough took place over a three year period from 2001-2003. It was carried out by both the DoC and the MDC, reported in slightly different but complementary ways.

The DoC undertook a systematic ecological survey of the five dry lowland ecological districts within the Wairau Ecological Region: Blenheim, Wither Hills, Grassmere, Flaxbourne and Hillersden (blue shaded area on Map 2). This was to a formula developed for the Protected Natural Areas Programme, a national survey programme begun in the 1980s. The survey was overseen by Simon Moore (DoC Nelson) and led in the field by Mike North. Individual landowners were approached for access permission, but the survey was not reported on property-by-property. The resulting comprehensive collation of information has been published as a single large stand-alone document (North, M. 2004. Wairau Ecological Region – Blenheim, Grassmere, Flaxbourne, Wither Hills and Hillersden Ecological Districts. Survey report for the Protected Natural Areas Programme. Occasional Publication No. 60. DoC, Nelson).

Over the same period of time, the MDC employed a contract team of three to survey three further ecological districts - Kekerengu, Medway and the Waihopai, (red shaded area on Map 2) - under the supervision of land resources manager Nicky Eade. Following an introductory letter from MDC, local environmental consultant Paul Millen made phone contact with individual landowners and then set up the programme for the field survey. Ecologists Philip Simpson and Geoff Walls carried out the surveys, property-by-property. Each landowner received an individual report for their property.

MAP 2 - SOUTH MARLBOROUGH ECOLOGICAL DISTRICTS INCLUDED IN THIS REPORT SHOWING MARLBOROUGH DISTRICT COUNCIL AND DEPARTMENT OF CONSERVATION SURVEY AREAS



The criteria used to identify and assess sites of ecological significance by the DoC and the MDC are similar, although there are some slight differences. Both sets of criteria are set out in Appendix One.

Landowners involved with both the MDC and DoC surveys have been subsequently contacted to see whether they could be interested in following up any management suggestions made in the reports. A steady stream of protection initiatives is now underway, 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 their whole properties to merge production with the conservation of natural features, and management guidelines have been developed for this purpose.

Table 1 summarises overall results of the combined ecological survey work in South Marlborough. A total of 186 landowners were approached to participate in the survey, of which 135 chose to be involved, while 51 declined. A total of 265 sites were identified through the survey work, covering a combined area of 21, 420 hectares, and making up an average of 6.6% of the total land area. More detailed analysis under each separate ecological district provides information about the main ecosystem types identified.

TABLE 1 - OVERALL RESULTS OF MARLBOROUGH DISTRICT COUNCIL AND DEPARTMENT OF CONSERVATION ECOLOGICAL SURVEYS IN SOUTH MARLBOROUGH

Ecological Districts	No Properties Surveyed	No Properties Declined	No of Sites	Combined Area (ha)	% of total land area
Kekerengu	18	3	55	1340	4.3 %
Medway	13	3	70	4656	14.6 %
Waihopai	18	15	55	5274	5%
Blenheim	11	1	9	269	<1%
Wither Hills	18	7	13	4905	16 %
Grassmere	9	4	10	152	<1%
Flaxbourne	21	14	24	1165	4.1%
Hillersden	27	4	28	3660	7.5%
Totals	**135**	**51**	**265**	**21420 ha**	**6.6% (average)**

THE ECOLOGY OF SOUTH MARLBOROUGH

South Marlborough is a dramatic landscape. Major faultlines have split and tilted blocks of hard rock to create mountains. The land has been elevated to expose the skirt of younger, softer rocks now eroding into gentle coastal hills. Rivers have created broad plains of alluvial gravels. Earthquakes, rivers and the sea have together created bluffs, cliffs and gorges, which are a feature of the landscape. The climate is just as varied and extreme. Mountains and hills form rain shadows so that the north-east is dry and sunny. The mountains are summer-hot and winter-cold. Cook Strait adds another dimension – wind.

Together, the climate and geology have created a wide diversity of habitats, and this diversity is reflected in the character of the native vegetation. While South Marlborough includes many of the species that make up the mixed forests (beeches, podocarps and broadleaved trees), shrublands (including "grey scrub") and grasslands (silver tussock and snow tussock) widespread throughout New Zealand, it also has special features.

By virtue of its central location in terms of latitude, the area has species near the southern limits of their range (particularly lowland forest species like rangiora) and some near the northern limits. The extreme dryness means that plants adapted to those conditions are prevalent. Interwoven into this

is the unique endemic element, including species that have evolved in the specific dry rocky local habitats and occur nowhere else, such as the pink brooms, NZ lilac and Marlborough rock daisy. The native fauna follows this pattern too, and the combination of these factors makes South Marlborough one of the genetic diversity centres of New Zealand.

Despite the original diversity and uniqueness however, human impact on the sensitive landscape and tough climate has been particularly severe. Fire over the last 500 years has destroyed most of the forest, firstly with Maori induced fires converting it to silver tussock lands and later, with the arrival of Europeans, to pasture. Wetland areas were highly valued by Maori as rich sources of food. They remained relatively unmodified until the arrival of Europeans, when the vast majority were drained and converted to pasture (notably on the Wairau Plain).

Favourable climate, terrain and land-use, have together attracted and encouraged high populations of wild animals (such as goats and pigs) and many introduced plants which have added further pressure on the natural habitats. As a result of both habitat loss, and competition and predation from introduced animals, the primeval fauna (which would have included moa, kiwi, kakapo, bats, giant geckos and native frogs), has also largely disappeared.

However, the indigenous ecosystems and fauna that remain provide opportunities for protection and enhancement. Many landowners, perhaps because of the special characteristics of the area, including the local plants and extreme factors such as drought, often have a particularly strong bond with the land and are keen to learn more about the plants and animals and to protect them if at all possible.

ECOSYSTEMS OF SOUTH MARLBOROUGH

The main ecosystem types found through the ecological survey work are described. These form the basis for the survey results in Tables 2 - 9 and 11 of this report. While the focus is on ecosystems on private land, the coastal and riverbed/riparian sites generally include both public and private land, due to the existance of various types of public land strips alongside these areas (commonly known as the "Queens Chain").

Coastal sand dune and flat communities

Most dunes and flats are now dominated by exotic marram grass, but there are small remnant areas containing native sandbinders: spinifex, pingao, sand tussock and sand coprosma. The best examples occur at Marfells Beach, Mussel Point and Canterbury Gully mouth. Also present in the Cape Campbell vicinity are small populations of coastal mat daisy (*Raoulia* aff. *hookeri*), a nationally rare community.

Coastal rock and stonefield communities

Hard rock outcrops on the South Marlborough coast are uncommon. The two that stand out are at Chancet Rocks and Needles Point, where there are dramatic limestone spines on which Marlborough rock daisy and small coastal plants grow. There are several examples of stonefields at the rear of pebbly and sandy shores. These are also rare habitats, sites that have probably been exposed to the coastal elements for centuries, if not millennia, resulting in ventifacts (wind-sculpted stones). Most of the stonefields have become colonised by marram grass, with exotic iceplant also a problem in some instances, but one or two retain prostrate native plants (the daphne *Pimelea urvilleana* and mat daisies).

Rarangi beach ridge system

There is an impressive system of parallel coastal ridges and hollows behind the beach between Rarangi and Wairau Bar. These represent former positions of the coastline, left high and dry by successive earthquake uplift, and are listed as a geopreservation site. On the ridges are remnant shrublands of *Coprosma crassifolia* and porcupine shrub (*Melicytus* aff. *alpinus* "Waipapa"), and the hollows contain fragments of raupo, manuka and cabbage tree communities. Four native lizard species and a rich native invertebrate fauna have been reported as present.

Coastal wetlands

Two large coastal wetlands are key features of South Marlborough: Wairau Lagoons, famous for their history, archaeology, saltmarsh communities, wetland birds and fish, and Lake Grassmere, highly modified for commercial salt production and with only some saltmarsh habitat remaining.

Other coastal wetlands were never large or common in these dry ecological districts, and most have disappeared or been greatly modified since human arrival. A few remain though: ponds and swamps containing raupo, rushes and sedges; shore wetlands with saltmarsh ribbonwood and ephemeral ponds that have turf plants tolerant of wet and dry conditions. They are often key habitats for water birds and offer opportunities for restoration (fencing, planting, regeneration).

Inland wetlands

Natural inland wetlands were also rare in the past (apart from the large wetland area of the Wairau Plain), and are now even more so due to modification. The few remaining contain vegetation such as raupo, rushes and sedges and are drawcards for water birds. Some small wetlands associated with faults are present. In places there are native shrubs, small trees and other plants that indicate the original condition of fringing bush, shrubland, cabbage trees and harakeke (lowland flax). Several wetlands have permanently open water due to spring-fed upwellings. Very few are formally protected, but several are managed for conservation purposes and all offer opportunities for restoration. Lake Elterwater is an anomaly, being distinctive in having no substantial inlet or outlet streams, a feature that makes it highly vulnerable to completely drying out periodically.

Riverbed/Riparian communities

The Wairau and Awatere are the two great South Marlborough rivers, flowing along massive geological fault lines. Each has numerous tributaries. They, and the smaller Waima (Ure) and Waihopai Rivers, contribute distinctive braided riverbed habitats, made up of gravel with little vegetation. This is a key habitat for several native birds (terns, gulls, pipits, pied stilts and dotterels), several of which are nationally threatened. Threats include water and gravel extraction, woody weeds, predators and vehicles. Other riparian communities include trees, shrubs, harakeke, ferns and grasses on hard rock river and stream banks, flats and terraces. Distinctive plants such as pink brooms and fierce lancewood occur in several sites, some of which are now being managed for conservation.

Rock outcrop, scarp and cliff communities

There are rock outcrops, rocky scarps and cliffs throughout South Marlborough. These occur on hillsides, in gullies and streams and at the coast. They are habitats for distinctive vegetation and plants such as whaririki (coastal flax), "hot rock ferns" (*Cheilanthes distans* and *Pellaea calidirupium*) and various Marlborough endemics: Marlborough rock daisies (*Pachystegia* spp.), NZ lilac (*Heliohebe hulkeana*), pink brooms (*Carmichaelia* spp.), the shrub daisies *Olearia coriacea* and *Brachyglottis monroi* and local forms of the mountain daisy *Celmisia monroi*. At higher altitudes they are habitats for upland plants including small-leaved shrub daisies (*Helichrysum* spp.), "vegetable sheep" (*Raoulia* spp.) and alpine herbs. The highest Marlborough rock daisy plant yet recorded was found at 1350m on Mt Malvern. High-altitude screes host especially adapted plants such as penwiper (*Notothlaspi rosulatum*). The best examples are inaccessible to stock and require little special management.

Limestone communities

The limestone masses at Chalk Range, Isolated Hill, Weld Cone, Needles Point and Woodside Creek have special communities of shrubs, grasses and herbs that include plants found only on limestone (calcicols), for example the gentian *Gentianella* "Ward", the harebell *Wahlenbergia matthewsii* and the woollyhead *Craspedia* "Marfells". Also present are pink brooms, Marlborough rock daisy (*Pachystegia insignis*), NZ lilac and speargrasses (*Aciphylla* spp.). The distinctiveness of these areas is appreciated locally and regionally, and formal protection is being explored for some sites outside the already protected network.

Silver tussock grasslands

Silver tussock is widespread in some hill country areas. It has undoubtedly increased substantially since human arrival and in many places it is dominant enough to form tussock grasslands. Usually there are associated native shrubs (tauhinu, matagouri, small-leaved coprosmas and the coastal shrub daisy *Olearia solandri*). At higher altitudes (above about 700m), upland plants such as speargrasses, mountain daisies and cushion plants grow amongst the tussocks. Sheep farming is the predominant use and is compatible with long-term maintenance of these grasslands, with the tussocks providing stock shelter and conditions which favour pasture grasses in drought conditions.

Dry shrublands ("grey scrub")

Dry shrublands (also known as "grey scrub") are widespread on some country, usually accompanied by silver tussock, and have increased in area following human arrival. The dominant shrubs are tauhinu, matagouri, small-leaved coprosmas (*Coprosma propinqua* and *C. crassifolia*), pohuehue (*Muehlenbeckia complexa*) and coastal shrub daisy (*Olearia solandri*). Porcupine shrub (*Melicytus crassifolius, M. alpinus* and *M.* aff. *alpinus* "Waipapa"), manuka, kanuka and native broom (*Carmichaelia australis*) occur less often. In places there are distinctive clumps of prostrate kowhai (*Sophora prostrata*). The rare shrub *Muehlenbeckia astonii*, leafless clematis (*Clematis afoliata*) and the mistletoe *Ileostylus micranthus* occur in dry shrublands habitat. Bracken is often present and can be locally dominant. These shrublands, especially where more mature, provide favourable habitat for native lizards (skinks and geckos), invertebrates (insects, spiders, etc) and small birds such as grey warbler, fantail and silvereye. They can be compatible with pastoral farming of sheep and cattle, so long as the farming is not too intense. However, the value and uniqueness of this vegetation is not always understood. The concept of deliberate maintenance of dry shrublands, for the benefit of both indigenous biodiversity and farm production, is currently being worked towards on several properties.

Montane and subalpine shrublands

Near and above the bushline are shrublands containing a diversity of shrubs not found in the lowlands, such as inaka (*Dracophyllum* spp.), shrub daisies (*Olearia* spp. and the upland form of tauhinu), various hebes, small-leaved coprosmas and mountain wineberry (*Aristotelia fruticosa*). Associated with them are tussocks, whararikі, mountain daisies and speargrasses. They are in best condition on shaded faces that have rarely been burnt.

Beech forests

Beech forest occurred in parts of the dry lowlands of South Marlborough but has now gone from there completely and is only found in the more mountainous country. Black beech can tolerate fairly dry, lowland conditions. It occurs in the gullies south-west of a rough line from the north bank of the lower Waima River to Boundary Creek (that flows into the Wairau River at Hillersden), mostly associated with kanuka, kowhai and broad-leaved trees. Red beech occurs further inland, where it is a little cooler and wetter, and is often associated with Halls totara and black beech. Mountain beech occurs above about 600m. Silver beech occurs on inland valley flats subject to the extremes of winter cold. Substantial tracts of beech forest occur in the head of the Avon catchment, in Black Birch Stream on the Blairich Range and on the southern side of Blue Mountain Range. However, most remaining beech forest is fragmented and in total amounts to only a small proportion of what formerly existed in South Marlborough.

Broadleaved forests (coastal gullies)

Most coastal gullies in the dry zone of South Marlborough would have been occupied in the past by broadleaved forests. Only tiny pockets remain. They mostly contain ngaio, akiraho, mahoe, cabbage tree and five-finger, and include tree hebe (*Hebe parviflora*) and various ferns. They are mostly acknowledged as special and are being informally conserved. Fencing and formal protection is proceeding for some of the best remnants. In the less arid zone south of the Waima River, greater plant diversity is present, akin to the inland broadleaved forests described in the next ecosystem type. Nikau occurs in Woodside Creek, the only known plant of this species found between Tuamarina and Rakautara just north of Kaikoura.

Broadleaved forests (inland gullies & faces)

Many inland gullies and shaded faces would also have been occupied in the past by broadleaved forests. They would have been dominated by hinau, broadleaf, lancewood, mahoe, pigeonwood, kaikomako and five-finger, and may also have contained podocarps (matai and totara) and kanuka. They have been a major casualty of the quest for timber and farmland, and now only modified remnants still remain. However, in places there is strong regeneration, especially of lancewood and five-finger. Titoki occurs in some lower-altitude gullies, indicating a linkage with the Marlborough Sounds and the humid Kaikoura coast. For many of the broadleaved forest remnants to survive and regenerate long-term, fencing is necessary.

Lowland podocarp-broadleaved forests

Forests of podocarps (matai and totara, possibly also kahikatea in damp sites) and broadleaved trees would have once grown in inland fertile sheltered alluvial and colluvial sites (flats, fans and basins). They are now functionally extinct apart from one remaining area near the Waima River. The only remaining clues are tiny remnant stands or isolated individual podocarp trees in sheltered warm basins, on steep shaded faces or on alluvial flats, usually with broadleaved forest or kanuka.

Montane and subalpine podocarp-beech forests

Forests of Halls totara and mountain beech, with plants such as broadleaf and mountain lacebark (*Hoheria lyallii*) in the gullies, would have been widespread in the South Marlborough mountains. Now they are reduced to patches, such as those on the southern side of Blue Mountain Range and Isolated Hill. Elsewhere, all that remains is the odd remnant tree and fragments of burnt wood, almost invariably of Halls totara. This species is incredibly tough and has withstood fire, storm, intensive possum and goat browsing and extreme exposure in a number of places. Regeneration is only possible where fires are minimal and stock intensity is low. The comprehensive possum control currently being carried out by the Animal Health Board, is allowing a marked recovery in Halls totara canopies.

Kanuka forests

Kanuka forests were probably widespread in the past, maintained by natural fires, storm events and erosion. Most have disappeared from the lowlands, but there are examples in gullies and a lone remnant on the lower Wairau Plain. The fragility of the lowland kanuka forest is illustrated by the recent total destruction of the Wither Hills remnant by the Boxing Day fires of 2000 and the death of many of the Wairau Plains trees in recent drought, despite the fact that both sites have formal protection. Logging for commercial firewood income occurs and can impact on older remnants. Kanuka is increasingly being recognised for its value in the medicinal honey industry (it is classed as manuka for honey), and fertile young kanuka areas with reliable rainfall hold potential for earning income from carbon credits. Inland, there are reasonably extensive kanuka forests. Mostly fairly simple in composition because of the presence of stock and feral animals, they can however include associated kowhai, lancewood and other broadleaved trees, and sometimes beeches and Halls totara. The kanuka forests are good habitat for native birds, especially bellbird, robin, brown creeper, tomtit, grey warbler and fantail. The rare sedge *Carex inopinata* was found under kanuka in two sites in South Marlborough.

Manuka low forests

Forests of manuka are fairly rare in the region. They were probably never very common, due to the dryness, however, there are some interesting pockets. The northern-most coastal manuka remnant near Cape Campbell is being formally protected and conserved. It contains ground orchids and several ferns, including a single young mamaku. Another area near the lower Waima River, has a lot of emergent kowhai, and is also in the process of being protected.

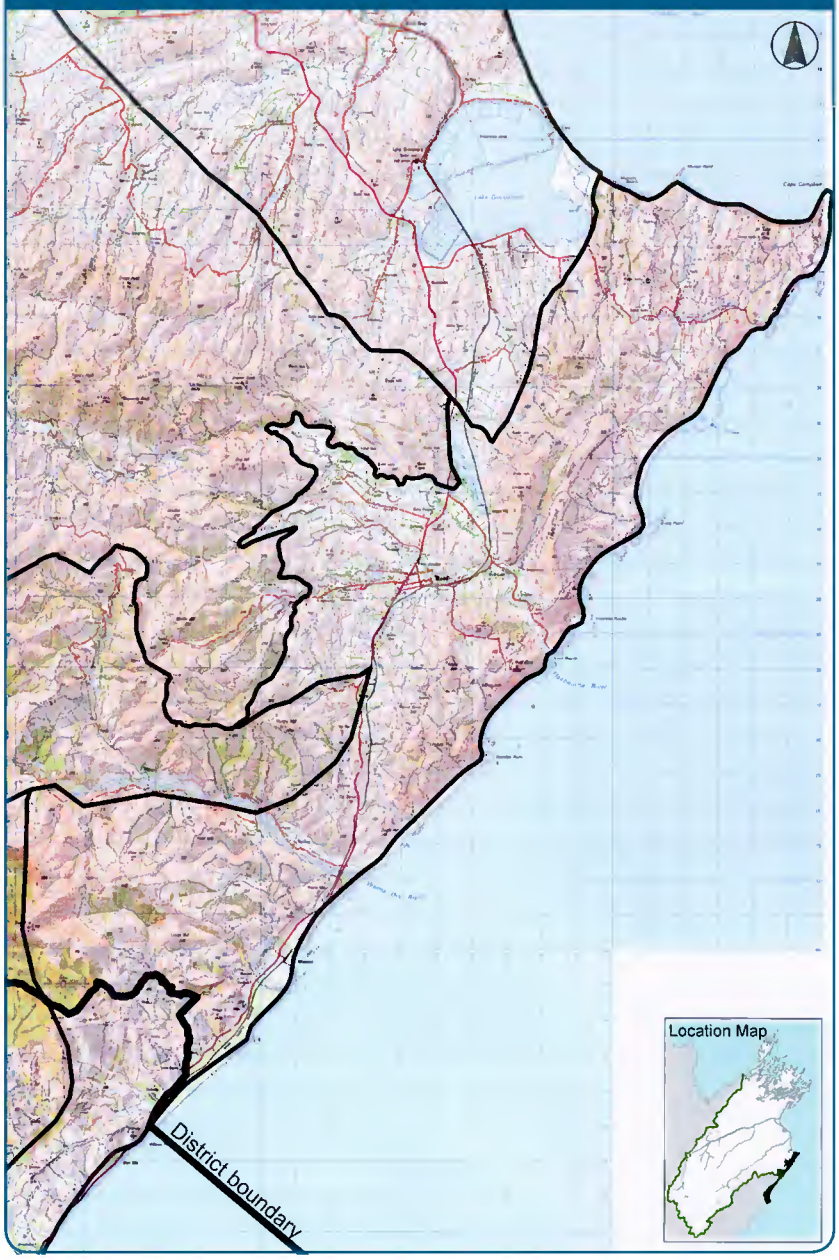
Cabbage tree (ti kouka) and other treelands

Cabbage trees are found throughout South Marlborough, sometimes in stands forming treelands and frequently associated with seepages, swamps and other wetlands or former stream channels. Although iconic in Marlborough, they are taken for granted. They were far more common in the past and are diminishing yearly. Fencing to protect the best examples, especially on valley flats, would ensure their recovery and long-term survival. Good regeneration of cabbage trees is happening in several hillslope sites that have been fenced from stock. There are a few examples of other treelands in South Marlborough, including kowhai treelands in the lower Waima Valley and kanuka treelands, mostly in valley situations.

RESULTS OF ECOLOGICAL DISTRICT SURVEY WORK

KEKERENGU ECOLOGICAL DISTRICT

MAP 3 - KEKERENGU ECOLOGICAL DISTRICT



OVERVIEW

The northern half of the Kekerengu Ecological District lies along the eastern coast of the Marlborough territorial area. It is a zone of low coastal hills of complex geology. It is essentially composed of sedimentary rocks (sandstone, limestone and mudstone), post-glacial loess and recent river and coastal deposits. The dramatic coastline is exposed to south and east, with an abrupt directional change at Cape Campbell. It is a very dry area with hot summers and strong winds channelled by Cook Strait.

The highest points are Weld Cone (368m) in the north, and Laings Nut (548m) and Ben More (1244m) in the south. The Waima and Flaxbourne Rivers cut through the zone, and the hill country is made up of a complex system of ridges, streams and gullies. The dominant geological features are limestone masses at Weld Cone, Needles Point and Woodside Creek. Several fault-lines cross the zone. Wind-blown loess soils form a surface layer in places. The geological complexity underlies landscape and habitat diversity. The landforms are particularly scenic; sometimes spectacular, sometimes forming gentle smooth terrain, sometimes eroding to form a 'badlands' terrain.

The original vegetation was probably predominantly forest but now consists of regenerating forests, shrublands and silver tussock grassland, all within a pastoral land use. A dryland forest of totara (with matai in the sheltered valleys), kanuka and kowhai, with akiraho and broadleaf on the rocky slopes, may have dominated in the past. Shrublands of prostrate kowhai (inland rocks), *Olearia solandri* (coastal areas), matagouri and *Muehlenbeckia astonii* may have occurred, and tussock grassland is likely to have been largely confined to the uplands. Beech and podocarp-broadleaved forests would have grown in the moister parts of the area; there are some small remnants still remaining. The limestone masses are inherently unstable, and have eroded into cliffs, steep outcrops, precipitous gullies and mobile screes. For that reason, they have developed a suite of plants found nowhere else. They include various daisies and small fleshy herbs. Plants normally found in the mountains, such as big speargrasses and mountain daisies, also occur on the limestone, in places very near the coast.

SURVEY RESULTS

Of the 21 properties where the owners were approached, 18 were surveyed. A total of 55 significant sites were identified. These have a combined area of 1340 ha and make up approximately 4.3% of the total land area of the ecological district. They are classified into 15 basic categories or ecosystem types, (see Table 2). The majority of sites are situated in gullies, reflecting the value of these havens of natural biodiversity in an arid landscape. An appreciable number are rugged and rocky and several are coastal or wetland. Most sites fall into the category of high value for significance, indicating how distinctive and special they are.

TABLE 2 - SITES IDENTIFIED IN THE KEKERENGU ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% area of Ecological District
Coastal sand dune and flat communities	2	53	
Coastal rock and stonefield communities	1	20	
Coastal wetlands	5	21	
Inland wetlands	2	2	
Riparian communities	2	63	
Rock outcrop, scarp and cliff communities	8	99	
Limestone communities	3	133	
Silver tussock grasslands	2	51	
Dry shrublands ("grey scrub")	11	354	
Manuka low forests	1	2	
Broadleaved forests (coastal gullies)	11	266	
Broadleaved forests (inland gullies/faces)	1	60	
Podocarp-broadleaved forests	1	145	
Kanuka forests	3	66	
Cabbage Tree treelands	2	5	
Total	**55**	**1340**	**4.3%**

ECOSYSTEMS FOUND

The original vegetation cover of the Kekerengu Ecological District has been thoroughly disturbed and modified since human arrival. However, there are several indigenous ecosystems that remain, providing opportunities for protection and enhancement. Most are now mere remnants of their original extent, so every one is valuable. To date, there are virtually no areas of public land protected for conservation purposes (the tiny Chancet Rocks Scientific Reserve is one), but a number of landowners are in the process of protecting natural areas on their land as a direct result of this survey. The main ecosystems found were:

COASTAL SAND DUNE AND FLAT COMMUNITIES

Mainly dominated by marram grass, but small remnants of native sandbinders and other special coastal plants including mat daisies.

COASTAL ROCK AND STONEFIELD COMMUNITIES

Rare, very old ecosystems, threatened by exotic plants.

COASTAL WETLANDS

A few small examples left, some ephemerally wet.

INLAND WETLANDS

A few small examples left, some with spring-fed upwellings.

RIPARIAN COMMUNITIES

Two remaining examples of significant riparian plant communities.

ROCK OUTCROP, SCARP AND CLIFF COMMUNITIES

Widespread and containing Marlborough endemic plants (rock daisies, pink broom and NZ lilac).

LIMESTONE COMMUNITIES

Localised and containing plants distinct to the limestone.

SILVER TUSSOCK GRASSLANDS

Fairly widespread. Recognised as having value to pastoral production (stock shelter, pasture growth) so generally conserved by farm practice.

DRY SHRUBLANDS ("GREY SCRUB")

Widespread in the hill country. Habitat for native shrubs, climbers, small birds, lizards and invertebrates. Recognised as having value to pastoral production (stock shelter, pasture growth) so generally conserved by farm practice.

MANUKA LOW FORESTS

Never very common, now rare.

BROADLEAVED FORESTS (COASTAL GULLIES)

A number of small remnants remain.

BROADLEAVED FORESTS (INLAND GULLIES AND FACES)

Only a few small modified pockets remain.

PODOCARP-BROADLEAVED FORESTS

Functionally extinct in most of the Ecological District although a substantial remnant remains in the southern area.

KANUKA FORESTS

Formerly widespread, now only remnants in gullies south west of Ward.

CABBAGE TREE (TI KOUKA) TREELANDS

Several good examples left, although formerly far more common.

SPECIAL FEATURES

There are many special biological features in the Kekerengu Ecological District. That is because of its complex geology, extreme climate, elongated shape and diversity of topography. Its history of human settlement and land-use, extensive more than intensive and with a sense of stewardship, has ensured that these special features remain. They fall into several categories of flora and fauna.

NATIVE FLORA

- Marlborough endemics (plants found only in Marlborough) are quite common, particularly in steep rocky places. They include Marlborough rock daisy (*Pachystegia insignis*), NZ lilac (*Heliohebe hulkeana* subsp. *hulkeana*), pink broom (*Carmichaelia glabrescens*), the shrub daisies *Olearia coriacea* and *Brachyglottis monroi* and local forms of the alpine daisy *Celmisia monroi*.

- Localised endemics (plants found only in local areas) are also present. They include *Heliohebe hulkeana* subsp. *evestita*, which is more or less confined to the Waima Valley, the coastal groundsel *Senecio hauwai*, and several plants confined to limestone: the gentian *Gentianella* "Ward", Ward daisy (*Brachyscome* "Ward"), the harebell *Wahlenbergia matthewsii*, the small grass *Poa acicularifolia*, the willowherb *Epilobium wilsonii* and the woollyhead *Craspedia* "Marfells".

- Nationally threatened plants found during the survey include shrubby tororaro (*Muehlenbeckia astonii*), *Muehlenbeckia ephedroides*, sand tussock (*Austrofestuca littoralis*), pingao (*Desmoschoenus spiralis*), coastal mat daisy (*Raoulia* aff. *hookeri*), *Convolvulus verecundus*, the mistletoe *Tupeia antarctica*, limestone plume grass *Dichelachne lautumia* and fierce lancewood (*Pseudopanax ferox*).
- Geographical distribution limits and isolated populations have been discovered for several plants, due largely to the strong climatic drought gradient. Tree hebe (*Hebe parviflora*) is confined to the north and the northern coastal limit of Marlborough rock daisy (*Pachystegia insignis*) occurs near Long Point. Black beech, hinau, titoki, rangiora, matai, totara, kahikatea, kanono, climbing rata and narrow-leaved lacebark only occur south west of Ward. The only occurrence of nikau between Rarangi and Rakautara is at Woodside Creek. An isolated population of sand coprosma occurs at Canterbury Gully mouth. Isolated pockets of kawakawa, tree fuchsia, ngaio and mamaku occur in microsites in the extreme dry zone of the Cape Campbell hinterland.
- Plants typical of the alpine or subalpine zone occur in the lowlands, even at the coast. They include the daisy *Celmisia monroi* and the speargrasses *Aciphylla aurea* and *A. glaucescens*.

NATIVE FAUNA

- NZ fur seals haul out and breed in various places along the coast. Numbers were severely reduced by human hunting but are making a dramatic comeback.
- Waterfowl that breed on small wetlands include NZ scaup (black teal).
- Bush birds are not prevalent due to lack of habitats, but the forest remnants contain strong populations of bellbird, fantail and grey warbler. Of note are the local occurrence of NZ robin and NZ falcon (karearea or sparrowhawk).
- Lizards (skinks and geckos) are common, especially in rock screes, mature shrubland and coastal driftwood. These habitats are also good for native invertebrates such as weta, giant earwig, black cockroach, ground beetles, moths and spiders.
- The Cape Campbell area is significant for *Metorana* and *Notoreus* moths and the weta *Hemiandrus* "Cape Campbell".
- Although eight species of native freshwater fish have been recorded in the district, fish are not common because of minimal available habitat. Where there is sufficient flow, such as the Flaxbourne River, a diverse native fish fauna exists. Long fin eel are listed as nationally threatened. Upland bullies are non-migratory and may be genetically isolated in their catchment.

KEKERENGU ECOLOGICAL DISTRICT – PHOTO ESSAY

WETLANDS IN A DRY LANDSCAPE -

Wetlands are rare in South Marlborough. This one is even more unusual in being a spring-fed pond high on a hillside. Silver tussock is common in the dry hill country, imparting an indigenous element and serving a useful purpose for pastoral farming.

COASTAL VEGETATION -

Exotic marram grass has invaded most of the sand dunes in the ecological district at the expense of the specialist native sand plants. However, there are still some of the native plants in places and techniques for restoration and marram control are available. On the slopes behind is typical coastal shrubland, also worth retaining and restoring.

LIMESTONE HABITATS -

Limestone scree, a distinctive feature in parts of South Marlborough. It provides habitat for lizards (skinks and geckos), native invertebrates and native plants, some of which are confined only to limestone.

DRY CLIMATE VEGETATION PATTERNS -

The great importance of aspect in a low rainfall area is demonstrated in this photograph. On the north-facing slope to the right of the photo, silver tussock and prostrate kowhai are dominant, being exposed to prolonged sunshine and drying winds. On the south-facing slope to the left of the photo, dense tauhinu is being colonised by broad-leaved tree species, especially five-finger.

NATIVE VEGETATION REGENERATION -

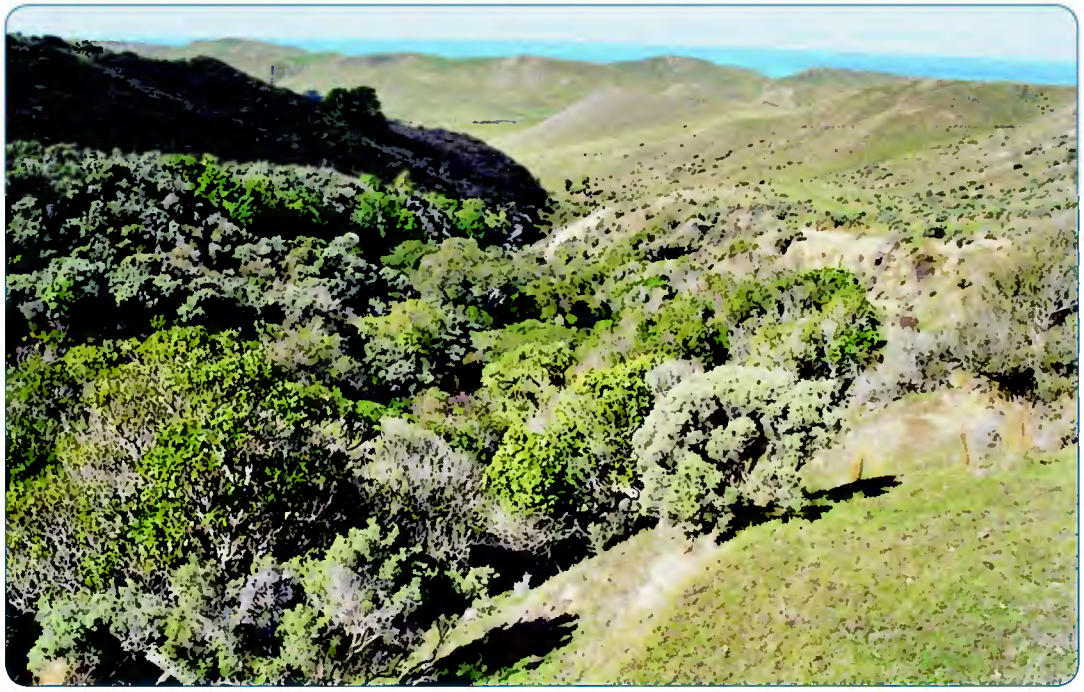
This photo shows a mosaic of shrubby vegetation representing basic stages in natural succession following clearance of the former forest cover for farming. If permitted or encouraged, the initial silver tussock-pasture stage will give way to tauhinu shrubland that in turn will be replaced by kanuka forest.

ROCK REFUGES -

Rock outcrops such as these contain much of the distinctive indigenous biodiversity of South Marlborough. They are refuges for special plants such as rock daisies, pink brooms and NZ lilac. They also provide habitat for small fauna such as lizards and invertebrates.

FOREST REMNANTS -

A rare sight in the really dry country of the north Kekerengu coast: a remnant of manuka low forest and a gully with broadleaved trees (mostly big old ngaio). Most such vegetation has been cleared long ago. This site is now being formally protected and fenced to exclude stock. Sites like this can provide a useful source of seed for planting projects in the area.



REMNANTS OF SPECIAL COASTAL VEGETATION -

Cushions of coastal mat daisy (*Raoulia* aff. *hookeri*) in sand dunes near the coast. This is a nationally rare community.

REMNANTS OF SPECIAL COASTAL VEGETATION -

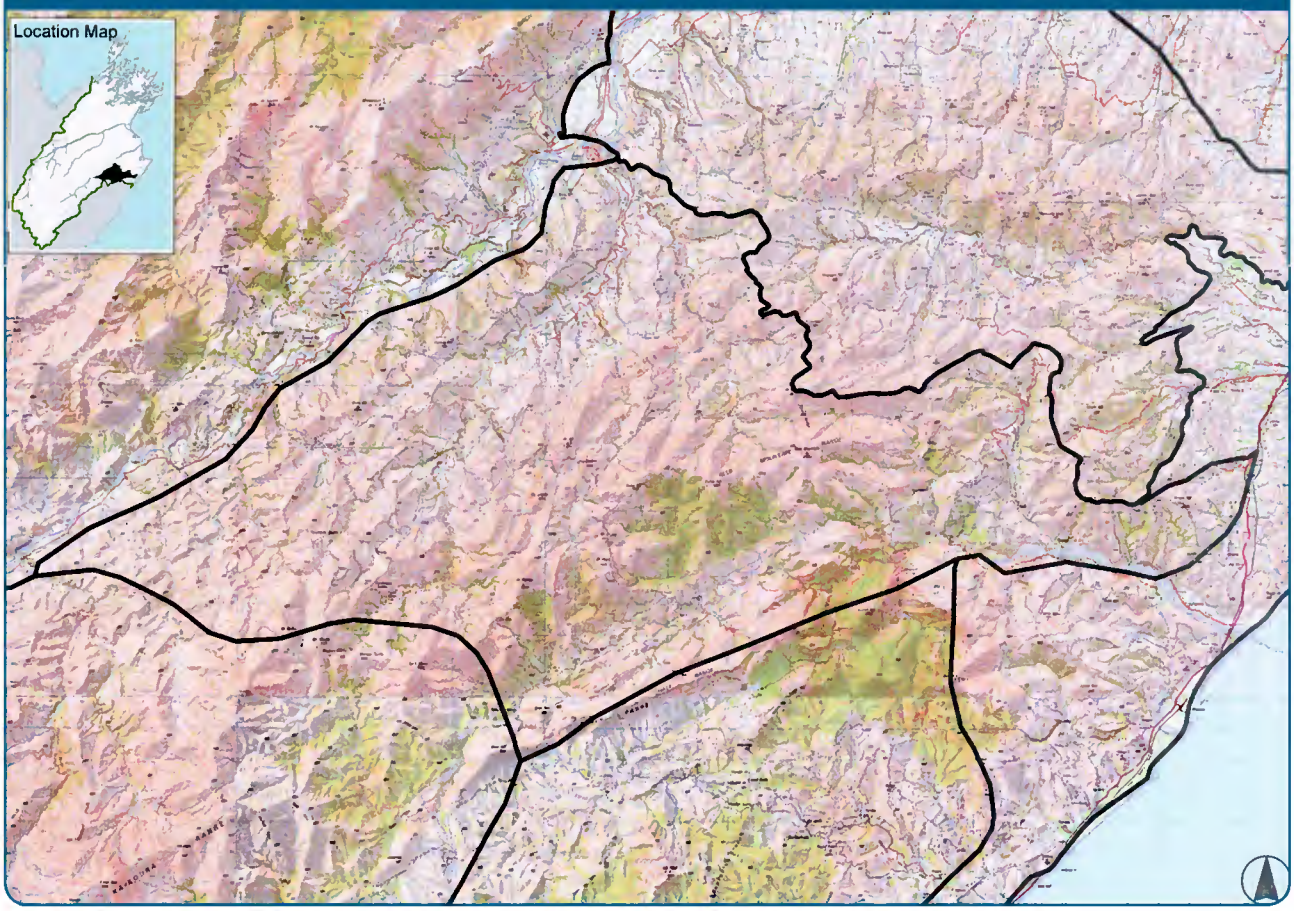
Another important dune area on the coast. Native sand plants still persist here: sand tussock (*Austrofestuca littoralis*), pingao (*Desmoschoenus spiralis*) and sand coprosma (*Coprosma acerosa*). Although marram grass is in the vicinity it has not yet overcome the native sand vegetation.

THREATENED PLANTS IN SOUTH MARLBOROUGH -

In the foreground are plants of shrubby tororaro (*Muehlenbeckia astonii*), a plant classified as nationally threatened. Fencing to exclude stock and allow regeneration is being done on this site, which now has formal protection.

MEDWAY ECOLOGICAL DISTRICT

MAP 4 - MEDWAY ECOLOGICAL DISTRICT



OVERVIEW

The Medway Ecological District is centred on the Medway and Waima catchments that drain the flanks of the northern extremity of the Inland Kaikoura Range, whilst the Awatere River forms the western boundary. There are three main geological components. The core is typical greywacke and argillite, and forms the dominant peaks and ridges, including the Blue Mountain Range in the east, Little Cregan (1080m) and Big Cregan (1015m) centrally, and Mt Malvern (1426m) through to Mt McRae (1438m) in the south. To the south-east there is a large area of younger limestone - the Chalk Range and associated hills - cut through by the Waima River to form spectacular gorges. The north-west part of the ecological district is composed of even younger marine deposits of poorly consolidated conglomerate (known as the 'Great Marlborough Conglomerate') underlain by mudstone (papa). These deposits are readily eroded and the western rivers and streams typically form deep gullies. Associated with these three geological elements are outwash deposits from various glacial events, as well as more recent alluvial terraces and flood plains.

High ranges around much of the district result in a relatively dry climate and the predominantly north-westerly aspect results in hot summers. Snow is occasional but not long lasting, but winters are cold.

Originally nearly the whole of the ecological district would have been forested, with bushline reaching almost to the tops of the highest peaks except on exposed ridges, bluffs and screes. Black, mountain and red beeches would have predominated with broadleaved species (such as hinau) and podocarps (such as totara and matai) entering the forests on limestone in the south-east. Most of the forest was probably burnt in pre-European times. However, the extremely rugged limestone country with large areas of exposed rock has protected large patches of forest in the south-east. Elsewhere, a few

small gully forests of beech remain. Silver tussock is the dominant ground cover over large areas, but where this has been disturbed by fire and grazing, extensive scrub and secondary forest have developed. The secondary forest is typically kanuka, with manuka on the wetter soils formed on papa, and there is also a range of broadleaved species such as five-finger, lancewood, mahoe and kohuhu. The scrub is typical Marlborough "grey scrub" dominated by matagouri, porcupine shrub and *Coprosma propinqua*. The bluffs and escarpments support a range of Marlborough endemic plants such as Marlborough rock daisy (*Pachystegia insignis*), NZ lilac (*Heliohebe hulkeana*) and pink broom (*Carmichaelia glabrescens*). The Jordan catchment at the south-west edge of the district, supports some of the spectacular weeping tree broom, *Carmichaelia stevensonii*, which also occurs in neighbouring Ecological Districts.

Few obvious signs of the first human inhabitants are visible now, although the extensive tussock grasslands probably owe their origin to the clearance of forest cover by centuries of Maori fires. Today, sheep grazing is the dominant land use, with cattle on the lower country. The district is relatively weed free except for local concentrations of old man's beard. Feral goats and pigs are common.

SURVEY RESULTS

Of the 16 properties where the owners were approached, 13 were surveyed. A total of 70 significant sites were identified. These have a combined site area of 4656 ha and make up approximately 14.6 % of the total land area of the ecological district. They are classified into 11 basic ecosystem types (see Table 3). The majority of sites are found within gullies, probably reflecting the value of these pockets of natural biodiversity as fire sanctuaries. An appreciable number are rugged and rocky. Most sites fall into the category of medium and high value for significance, indicating how distinctive and special they are.

TABLE 3 - SITES IDENTIFIED IN THE MEDWAY ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% area of Ecological District
Riparian communities	23	746	
Rock outcrop, scarp and cliff communities	13	203	
Limestone communities	1	613	
Silver tussock grasslands	1	260	
Dry shrublands ("grey scrub")	5	125	
Beech forests	5	1432	
Broadleaved forests (inland gullies/faces)	2	45	
Kanuka forests	16	1090	
Manuka forests	2	17	
Montane and subalpine shrublands	1	123	
Cabbage tree treelands	1	2	
Total	**70**	**4656**	**14.6%**

ECOSYSTEMS FOUND

The original vegetation cover of the Medway Ecological District has been thoroughly disturbed and modified since human arrival. However, there are several indigenous ecosystems that remain, providing opportunities for protection and enhancement. Most are now mere remnants of their original extent, so every one is valuable. There is only one substantial area of public land protected for conservation purposes: Isolated Hill Scenic Reserve at the south end of the ecological district. Prior to this survey, three landowners already had existing protected areas. Several others are now in the process of protecting natural areas on their land as a direct outcome of the survey. The main ecosystems found were:

INLAND WETLANDS

A few small examples left (swamps and ponds), none of sufficient quality to define as significant but with restoration potential.

RIPARIAN COMMUNITIES

A number of riparian communities are present in naturally protected gorges and along streams and gullies.

ROCK OUTCROP, SCARP AND CLIFF COMMUNITIES

Widespread and containing Marlborough endemic plants (rock daisies, pink broom and NZ lilac). In higher altitude communities there are interesting assemblages of native shrubs, speargrasses, cushion plants and herbaceous plants, including local endemics.

LIMESTONE COMMUNITIES

Localised and containing plants distinct to the limestone.

SILVER TUSSOCK GRASSLANDS

Fairly widespread although only one area is identified as significant. Recognised as having value to pastoral production (stock shelter, pasture growth) so generally conserved by farm practice.

DRY SHRUBLANDS ("GREY SCRUB")

Widespread in the hill country. Habitat for native shrubs, climbers, small birds, lizards and invertebrates. Recognised as having value to pastoral production (stock shelter, pasture growth) so generally conserved by farm practice.

BEECH FORESTS

Extensive mountain beech forests in the south, with some Halls totara present. Small remnants of black beech in gullies in the Waima catchment, and a few remnant trees in the lower Medway in the proposed Broom Reserve. A small remnant of red beech in a gully in the Blue Mountain Range.

BROADLEAVED FORESTS (GULLIES/ FACES)

Several small modified pockets remain.

PODOCARP-BROADLEAVED FORESTS

Functionally extinct in the lowlands, though a few podocarp trees remain, such as the isolated old totara in the Awatere. In the uplands are remnants of Halls totara, with broadleaf, lancewood, mountain lacebark and other associated trees.

KANUKA FORESTS

Formerly widespread, now mainly occurring as remnants (some quite large) in gullies.

MANUKA FORESTS

Never very common, now rather rare and confined to poorly drained mudstone.

MONTANE AND SUBALPINE SHRUBLANDS

One area of high altitude shrubland survives.

KOWHAI TREELANDS

A good example remains in the lower Waima Valley.

SPECIAL FEATURES

There are many special biological features in the Medway Ecological District. That is because of its complex geology, varied climate and diversity of topography. Its history of human settlement and land-use, extensive more than intensive and with a sense of stewardship, has ensured that these special features remain. They fall into several categories of flora and fauna.

NATIVE FLORA

- Marlborough endemics (plants found only in Marlborough) are quite common, particularly in steep rocky places. They include Marlborough rock daisy (*Pachystegia insignis*), NZ lilac (*Heliohebe hulkeana* subsp. *hulkeana*), pink broom (*Carmichaelia glabrescens*), the shrub daisies *Olearia coriacea* and *Brachyglottis monroi* and local forms of the alpine daisy *Celmisia monroi*.
- Localised endemics (plants found only in local areas) are also present. They include *Heliohebe hulkeana* subsp. *evestita*, which is more or less confined to the Waima Valley, limestone endemics (such as the harebell *Wahlenbergia matthewsii*, the dwarf broom *Carmichaelia astonii* and the gentian *Gentianella astonii*), coral shrub (*Helichrysum coralloides*) and last but not least weeping broom (*Carmichaelia stevensonii)*, almost confined to the ecological district, and growing in one site with pink broom.
- Nationally threatened plants found in the ecological district during the survey include weeping broom, *Convolvulus verecundus*, the mountain forget-me-not *Myosotis arnoldii*, the mistletoe *Tupeia antarctica* and fierce lancewood (*Pseudopanax ferox*).
- Geographical distribution limits and isolated populations have been discovered for several plants, due largely to the strong climatic drought gradient. Tree hebe (*Hebe parviflora*), titoki, ngaio and red beech reach distribution limits in the south-eastern part of the ecological district. Black beech occurs locally in the Waima and Medway catchments. Lowland totara is almost absent, but there are remnant trees in the lower Awatere Valley and young plants in the lower Waima catchment. Scrambling fuchsia (*Fuchsia perscandens*) and narrow-leaved lacebark are localised in lowland refuges and mountain lacebark (*Hoheria lyallii*) occurs in some upland gullies. Scented daisy (*Olearia odorata*) was found in two isolated localities. Lowland species such as mahoe were found growing at the extreme limits of their tolerance to altitude. The highest Marlborough rock daisy (*Pachystegia insignis*) yet recorded was found at 1350m on Mt Malvern.
- Alpine plants of note include true main range plants such as penwiper (*Notothlaspi rosulatum*), coral shrub, snow tussock (*Chionochloa flavescens*) and narrow-leaved mountain daisy (*Celmisia armstrongii*).
- Plants typical of the alpine or subalpine zone occur in the lowlands. They include the daisy *Celmisia monroi* and the speargrasses *Aciphylla aurea* and *A. glaucescens*.

NATIVE FAUNA

- Bush birds are surprisingly prevalent, despite the lack of general forest cover. The forest remnants and even shrublands support strong populations of bellbird, NZ robin, brown creeper, silvereye, fantail and grey warbler. Of note are the local occurrences of rifleman and NZ falcon (karearea or sparrowhawk). NZ pipit is common in riverbeds and upland open places.
- Lizards (skinks and geckos) are common, especially in rock screes and mature shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders.
- Five species of native freshwater fish have been recorded in the district. Two of which, long fin eel and Dwarf galaxias, are listed as nationally threatened.

MEDWAY ECOLOGICAL DISTRICT – PHOTO ESSAY

SPECIAL SOUTH MARLBOROUGH PLANTS -

Pink broom (*Carmichaelia glabrescens*) on a high rock outcrop (centre of photo). It persists there because it is inaccessible to stock and hard for feral goats to reach.

SPECIAL SOUTH MARLBOROUGH PLANTS -

Coral shrub (*Helichrysum coralloides*), an unusual plant confined to the uplands of South Marlborough. Its form is adapted to cope with extreme elements (cold, heat, drought and wind).

SPECIAL SOUTH MARLBOROUGH PLANTS -

NZ lilac (*Heliohebe hulkeana*), a small plant protected by the rocky nature of the site and exclusion of stock. This species is confined to South Marlborough and North Canterbury.

BACK COUNTRY MEDWAY ECOLOGICAL DISTRICT -

Showing its rugged nature and diversity. Fencing is not a practical option for protection except for special small features. An alternative approach is to tailor the farm practices to allow for conservation of special features alongside productive land-use.

LONE SURVIVOR -

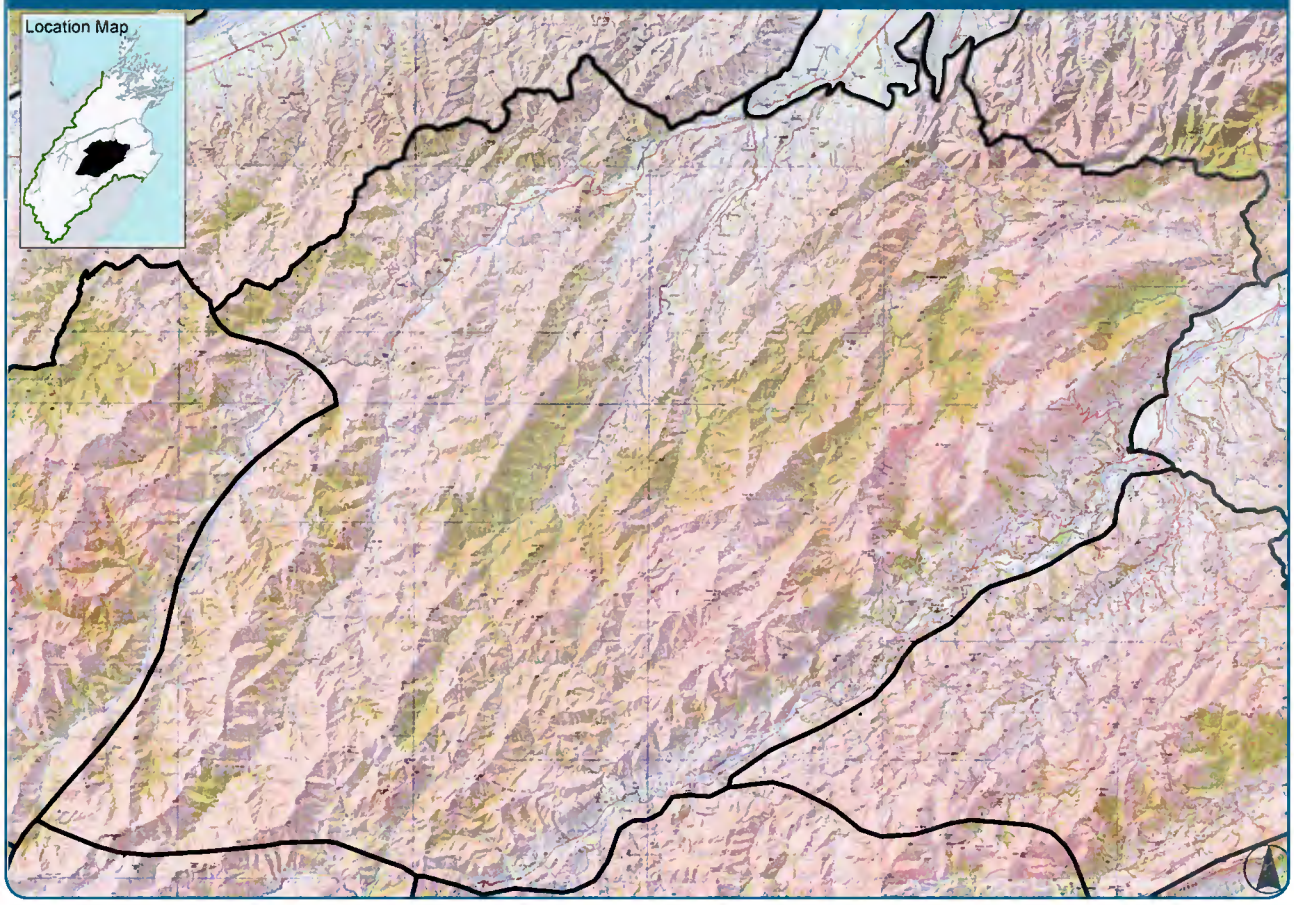
A single lowland totara tree in the Waima Valley. This species would formerly have been widespread in South Marlborough, but now exists only as a few scattered individuals such as this. They may provide material for growing new plants that can be used in restoration planting.

KANUKA FORESTS -

Areas such as this excellent kanuka gully forest are now rare in South Marlborough. They are key sites for birds such as robins and brown creepers, for lizards and a suite of native insects. They also provide sites for native ground orchids.

WAIHOPAI ECOLOGICAL DISTRICT

MAP 5 - WAIHOPAI ECOLOGICAL DISTRICT



Overview

The Waihopai Ecological District is centrally located in South Marlborough. It is essentially a block of greywacke lying between the Awatere and Wairau faults and tilted from the southeast, where there is a series of high points and ridges that represent the north-eastern extension of the main divide. The main tributaries of the Wairau are the Waihopai, Avon and Omaka Rivers. They follow long, well-defined valleys through the foothills with most slopes exposed to hot, dry north-westerly conditions. The streams draining into the Awatere River on the southerly side of the divide are shorter, steeper and more shaded. The peaks between these two systems are often rugged with bluffs, or are more rounded with extensive screes. From south to north the main peaks along the backbone include Blue Mountain (2051m), The Pinnacles (1719m), Barometer (1780m), Altimarloch (1696m) and Blairich (1504m). The Awatere fault has been active in recent times and has created conspicuous features of the topography of the Awatere Valley. The greywacke core of the district is supplemented by younger marine deposits (papa mudstone, sandstone and conglomerate) along the floor of the Awatere Valley. Where streams exit from the hills spectacular bare cliffs can result.

Owing to the dry climate, high sunshine hours and generally sunny aspects, bushline along the main range is among the highest in New Zealand, about 1500m. However, geology and land-use have combined to limit the amount of bush remaining. Much of the area was burnt centuries ago. The original beech forest remains in some of the upper catchments but has largely been replaced by grassland (mainly silver tussock), kanuka forest and scrub (matagouri and coprosma). At higher levels *Dracophyllum* scrub and snow tussock occur. Repeated burning and grazing has resulted in fellfield vegetation in some areas, composed of hard tussock (*Rytidosperma setifolium*) and mountain daisy (*Celmisia spectabilis*).

Little native vegetation remains in most of the low-lying hills. However, in the Avon catchment small areas of lowland bush remain, where species more typical of the Marlborough Sounds survive, for instance kahikatea, NZ passion vine and titoki. The combination of moist lowland valleys (sometimes with a coastal influence), dry hills, mudstone and sandstone cliffs, inland beech forest and alpine ecosystems give the Waihopai Ecological District an important degree of diversity. Marlborough rock daisy (*Pachystegia insignis*) is the most conspicuous of the endemic Marlborough plants in the district and can be found on many bluffs, rock outcrops and steep rocky river banks.

Much of the district has been extensively grazed in the past. Sheep grazing is still the dominant land-use in the district, with cattle on the lower country. There are also increasing amounts of land being planted in exotic production forest. Much of the higher ground is now administered by the DoC. The removal of stock and suppression of fire has resulted in widespread colonisation of the former grassland with native trees and shrubs so that the appearance of this ecological district is rapidly changing. It is relatively weed free except for local concentrations of old mans beard, wilding pines and exotic broom.

Survey results

Of the 33 properties where the owners were approached, 18 were surveyed. A total of 55 significant sites were identified. These have a combined area of 5274 ha and make up approximately 5% of the total land area of the ecological district. They are classified into nine basic ecosystem categories or types (see Table 4). The majority of sites are found in gullies, probably reflecting the value of these pockets of natural biodiversity as fire sanctuaries. Most of the rest are hillslopes, and a few are rocky and precipitous or are wetlands or riverbanks. Most sites fall into the category of high value for significance, indicating how distinctive and special they are.

TABLE 4 - SITES IDENTIFIED IN THE WAIHOPAI ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Total area (ha)	% area of Ecological District
Inland wetlands	5	59	
Riparian communities	15	400	
Rock outcrop, scarp and cliff communities	7	338	
Dry shrublands and silver tussock grasslands	3	1069	
Beech forests	6	1583	
Broadleaved forests (inland gullies/faces)	3	109	
Kanuka forests	13	1370	
Manuka forests	2	21	
Montane and subalpine shrublands	1	325	
Total	**55**	**5274**	**5%**

ECOSYSTEMS FOUND

The original vegetation cover of the Waihopai Ecological District has been considerably modified since human arrival. However, indigenous ecosystems remain, providing good opportunities for protection and enhancement. Substantial areas of the higher land are in public ownership and managed for conservation. Prior to this survey, two landowners already had existing protected areas. Several others are now in the process of protecting natural areas on their land as a direct outcome of the survey. The main ecosystems found were:

INLAND WETLANDS

A few good examples left (swamps and ponds), with restoration potential.

RIPARIAN COMMUNITIES

There are a number of rocky riverbanks and stream-sides where distinctive riparian tree-shrublands, Marlborough endemic plants and unusual species such as fierce lancewood and weeping broom occur.

ROCK OUTCROP, SCARP AND CLIFF COMMUNITIES

Widespread and containing Marlborough endemic plants (rock daisies, pink broom and NZ lilac).

SILVER TUSSOCK GRASSLANDS

Fairly widespread. Recognised as having value to pastoral production (stock shelter, pasture growth) so generally conserved by farm practice.

DRY SHRUBLANDS ("GREY SCRUB")

Widespread in the hill country. Recognised as having value to pastoral production (stock shelter, pasture growth) so generally conserved by farm practice.

BEECH FORESTS

Extensive mountain beech forests in the heads of the inland valleys, with red beech and Halls totara. Smaller remnants of red beech with black-mountain beech in gullies in the Avon River and Musgrave Brook catchments, with formal protection over one area.

BROADLEAVED FORESTS (INLAND GULLIES/FACES)

Several substantial secondary areas remain in the lowlands.

PODOCARP-BROADLEAVED/BEECH FORESTS

Functionally extinct in the lowlands, though a few podocarp trees remain, such as the isolated matai and totara in the Omaka catchment. In the uplands are remnants of Halls totara, with broadleaf, lancewood, mountain lacebark, mountain beech and other associated trees.

KANUKA FORESTS

Formerly widespread, now mainly occurring as remnants (some quite large) in gullies and on faces. Some protected in conservation land, and formal protection is being pursued for at least one of the best sites in private ownership.

MANUKA FORESTS

Never common, now confined to several sites only.

MONTANE AND SUBALPINE SHRUBLANDS

One area of high altitude shrubland survives.

UPLAND COMMUNITIES

Interesting assemblages of native tussocks, shrubs, speargrasses, cushion plants and herbaceous plants, including local endemics. Mostly in conservation land.

SPECIAL FEATURES

There are many special biological features in the Waihopai Ecological District. That is because of its complex geology, varied climate and diversity of topography. Its history of human settlement and land-use, extensive more than intensive and with a sense of stewardship, has ensured that these special features remain. They fall into several categories of flora and fauna.

NATIVE FLORA

- Marlborough endemics (plants found only in Marlborough) are quite common, particularly in steep rocky places. They include Marlborough rock daisy (*Pachystegia insignis*), NZ lilac (*Heliohebe hulkeana* subsp. *hulkeana*), pink broom (*Carmichaelia carmichaeliae*) and the shrub daisies *Olearia coriacea* and *Brachyglottis monroi*.

- Localised endemics (plants found only in local areas) are also present. They include the daisy *Celmisia insignis*, virtually confined to this ecological district, and weeping broom (*Carmichaelia stevensonii*, growing in just one tiny site in the Avon Valley, with pink broom nearby).
- Nationally threatened plants found in the ecological district during the survey include weeping broom, *Celmisia insignis*, the mistletoe *Tupeia antarctica*, fierce lancewood (*Pseudopanax ferox*), pink tree broom (*Carmichaelia carmichaeliae*) and *Muehlenbeckia ephedroides* (surprisingly found on a lowland rocky riverbank).
- Geographical distribution limits and isolated populations have been discovered for several plants, due largely to the strong climatic drought and frost gradient. Titoki, ngaio and NZ passion vine reach inland distribution limits in the north of the ecological district. Black beech occurs locally in sheltered valleys, giving way to red beech and mountain beech further inland. Lowland podocarps are almost absent, but there are remnant totara and matai trees in the lower Omaka catchment and kahikatea remained in the Avon until recently. Scrambling fuchsia (*Fuchsia perscandens*), leafless clematis (*Clematis afoliata*) and the shield fern *Polystichum silvaticum* are localised in lowland refuges and mountain lacebark (*Hoheria lyallii*) occurs in some upland gullies. Scented daisy (*Olearia odorata*) was found in two isolated valley localities. The inland limits of Marlborough rock daisy and NZ lilac occur within this ecological district.
- Alpine plants of note include true main range plants such as penwiper (*Notothlaspi rosulatum*), coral shrub, snow tussock (*Chionochloa flavescens*) and narrow-leaved mountain daisy (*Celmisia armstrongii*).

NATIVE FAUNA

- Bush birds are prevalent, probably because of the remaining forest cover. The forest areas and even shrublands support strong populations of bellbird, NZ robin, kereru, tui, brown creeper, silvereye, fantail and grey warbler. Of note are the local occurrences of rifleman and NZ falcon (karearea or sparrowhawk). NZ pipit is common in riverbeds and upland open places.
- Lizards (skinks and geckos) are common, especially in rock screes and mature shrubland. These habitats are also good for native invertebrates such as weta, ground beetles, moths and spiders.
- Six species of native freshwater fish have been recorded in the district. Dwarf galaxias and long fin eel are listed as nationally threatened.

WAIHOPAI ECOLOGICAL DISTRICT - PHOTO ESSAY

QUEEN ELIZABETH II NATIONAL TRUST COVENANTS -

An area of bush in the Waihopai Ecological District formally protected by the private landowners as a QEII National Trust Open Space Covenant. Ownership, control and management still reside with the owners, but the Trust will ensure the bush remains in perpetuity. An increasing number of South Marlborough landowners are choosing to use covenants to provide long term protection of special natural areas on their properties.

SPECIAL SOUTH MARLBOROUGH PLANTS -

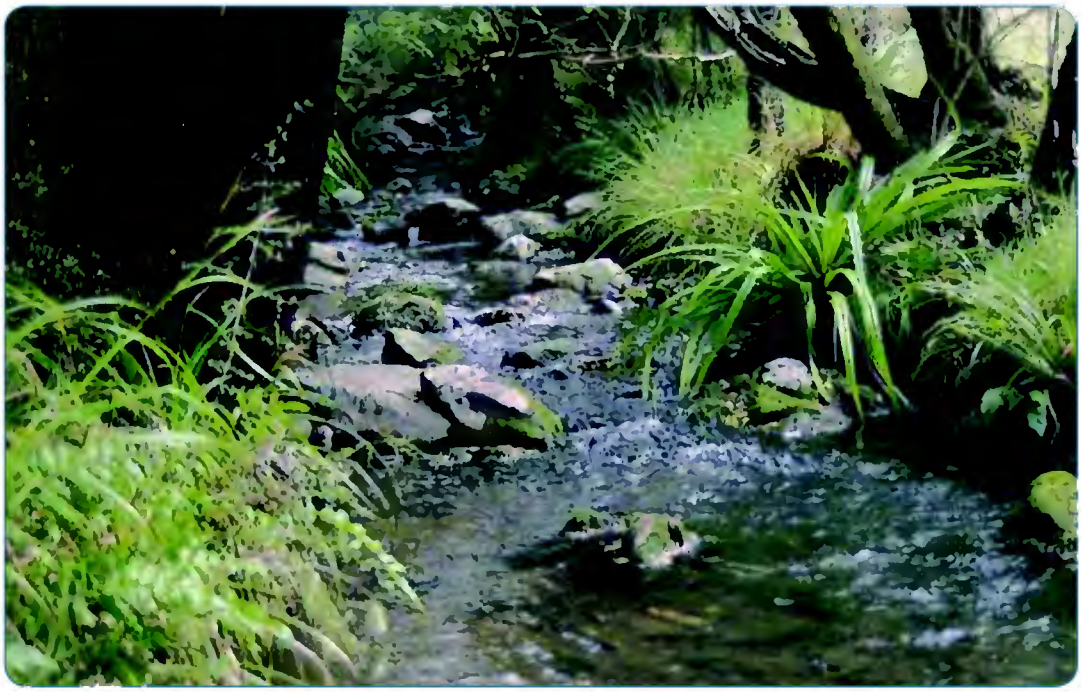
Marlborough rock daisies (*Pachystegia insignis*) on a rocky bluff, safe from stock and feral animals. This sort of endemic plant community is characteristic of the region.

FORESTRY AND PROTECTION OF NATIVE VEGETATION -

A Waihopai bush remnant surrounded by exotic forestry. The remnant is undoubtedly in better ecological health than it would be if stock were still present, but it is at risk during the harvesting and replanting phases. Wilding pines are becoming widespread in the area, especially on rocky sites, and their management is an issue that requires a regional strategy.

RIPARIAN AREAS ALONG WATERWAYS -

Streams are ecologically important and precious. They are places for special riparian vegetation, such as these tree daisies (*Olearia aviceniifolia*). They also provide valuable habitat for native freshwater fish and invertebrates.



RIPARIAN AREAS ALONG WATERWAYS -

A section of stream protected within an Open Space Covenant. Because stock are excluded and the bush retained, the stream is excellent habitat for native fish and riparian plants.

FIERCE LANCEWOOD (*Pseudopanax ferox*) ON THE BANKS OF THE WAIHOPAI RIVER -

This nationally uncommon plant persists in a few such places out of stock reach. This particular population is being protected and enhanced by the landowner.

EXTENSIVE KANUKA FOREST AND SHRUBLANDS OF VARIOUS AGES -

Occur in the upper Waihopai and Spray catchments. These areas are host to a large population of the coral mistletoe *Korthalsella salicornioides*. While some areas are periodically cleared by fire for grazing, other areas, such as riparian forest along the rivers are left to mature. Patches of beech remain on some higher slopes along with extensive areas of secondary native shrubland.

THE HEADWATERS OF THE MAIN WAIHOPAI VALLEY -

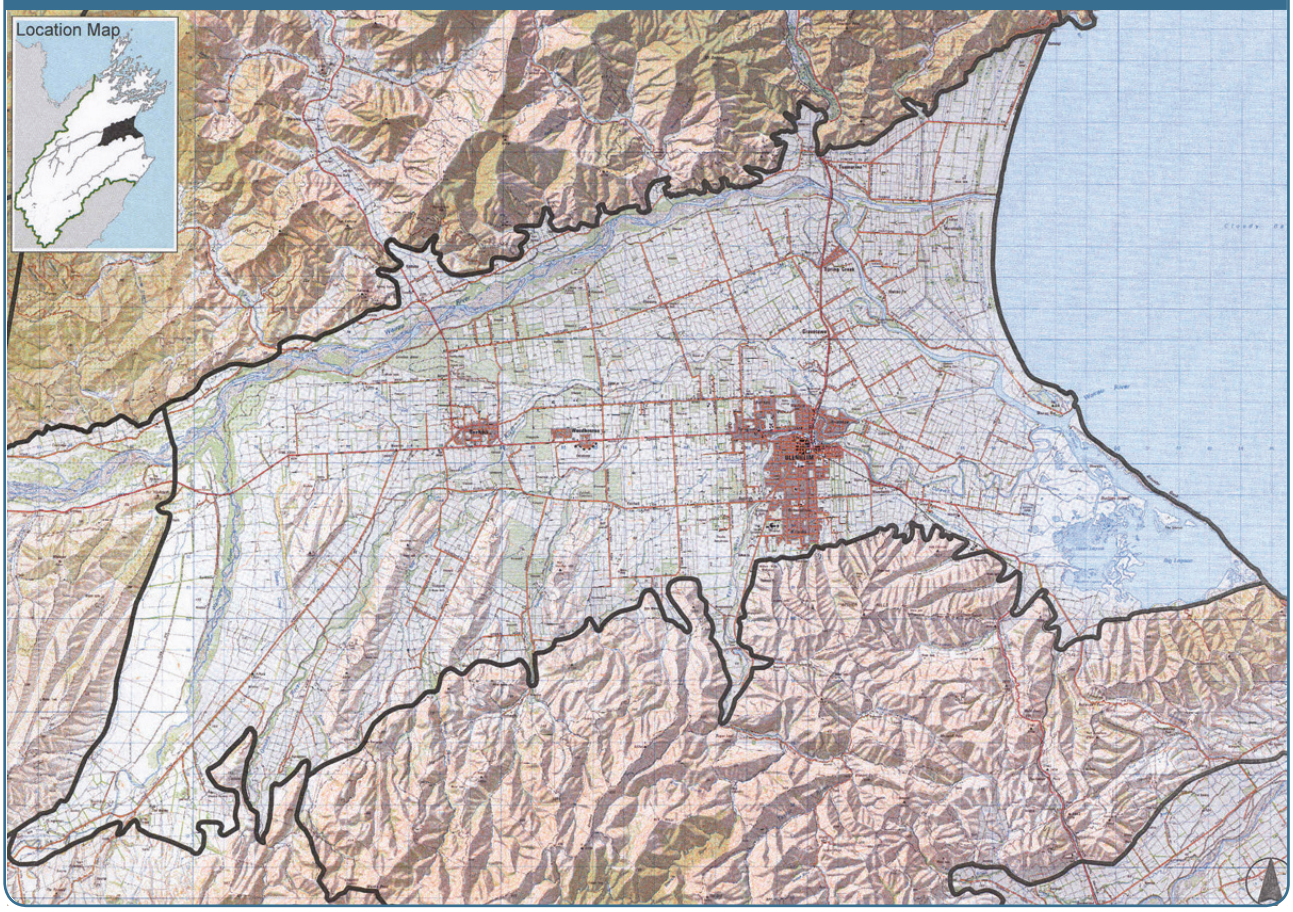
An area of picturesque, formerly glaciated, valleys with scree, bluffs, beech forest and native shrubland and grassland. Flats along the river have many small wetlands and the riverbed itself is a habitat for birds and many native plants.

MATAGOURI IN A FARMED LANDSCAPE -

Gravel fans in the upper part of the Waihopai Valley often carry patches of mature matagouri, adapted to drought and extremes of temperature. The open canopy allows grass to grow beneath and the woodland offers shelter to stock in winter.

BLENHEIM ECOLOGICAL DISTRICT

MAP 6 - BLENHEIM ECOLOGICAL DISTRICT

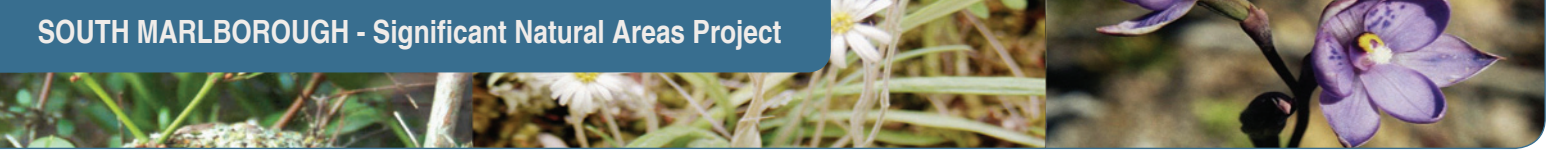


OVERVIEW

The Blenheim Ecological District encompasses the entire lower Wairau River plain, downstream from the Waihopai River. It is bounded to the north by the Richmond Range and to the south by the Wither Hills. Its eastern boundary is the Cloudy Bay coastline. It spans a very small altitudinal gradient, from sea level to 251m, although the river plain only reaches to 75m. A number of small foothills protrude into the ecological district from the Wither Hills to the south. The river plain includes the lower reaches of a number of tributary rivers that flow in from the south: the Waihopai River; and the Omaka, Taylor, and Fairhall Rivers that become the Opawa River. The Tuamarina, Waikakaho and Kaituna Rivers all flow in from the north, but their courses quickly join the Wairau River.

The Wairau plain is composed substantially of post-glacial alluvium, with large areas of Quaternary glacial outwash gravels to the south. The small foothills of the Wither Hills reach into the south of the District. These are of Tertiary mudstones and sandstones grading into basal conglomerates. The Wairau boulder barrier and lagoon is considered to be of national importance as one of the best examples in New Zealand of a river mouth lagoon, bird's foot delta and narrow boulder barrier. A series of post-glacial beach ridges extending inland about 4 km at Rarangi date earthquake uplift events, and the Waihopai River fault terraces are a good example of the results of faulting and deformation occurring on the Wairau Fault.

The area has a warm dry climate with high solar radiation and frequent drought. Frosts occur in winter and the area is moderately windy.



The primeval vegetation cover was probably mainly podocarp forest of matai, totara, kahikatea and rimu, with warm temperate rainforest along the Wairau River corridor and coastal forest and shrubland along the coastal margin. There would have been a vast area of wetland in the lower Wairau River plain, with extensive harakeke, toetoe and raupo and areas of swamp forest of kahikatea, pukatea, cabbage tree and swamp maire. Burning after human arrival resulted in a mix of extensive dryland forest, shrubland and grassland, with kanuka and manuka being predominant. Although they were also burnt, the wetland vegetation types (except the forest) persisted.

Now, almost nothing remains of the former plant and animal life of the Blenheim Ecological District such has been the degree of land development on the lower river-plain. Only tiny remnant terrestrial indigenous ecosystems remain. However, the amount of land currently in protected natural areas is a surprising 6.1% of the ecological district. This is made up mainly of the large estuarine Wairau Lagoons, a nearby lagoon and an extensive sand-gravel beach system, all in public ownership. Otherwise, there are a few freshwater wetlands, mostly in public ownership but also protected private land, a small private cabbage treeland and a remnant of covenanted kanuka forest that was burnt in the Boxing Day fires in 2000.

SURVEY RESULTS

Of the 12 private properties where the owners were approached 11 were surveyed. A total of 9 significant sites were identified on private land. A further 10 sites on public land were identified. The total combined area of the sites on private land is 269 ha which is less than 1% of the total area of the ecological district.

The sites are classified into seven basic ecosystem categories or types (see table below). The majority of sites are wetlands, reflecting the history of almost complete destruction of native vegetation in the landscape. All of the sites are distinctive and special.

TABLE 5 - SITES IDENTIFIED, BLENHEIM ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Public land	Private land	Total area of sites on privately owned land (ha) *	% area of Ecological District in private hands
Inland wetland	9	3	6	65	
Rarangi beach wetland/ridge system	1		1	200	
River bed	2	2		(2100)	
Kanuka forest	3	2	1	(49) 4	
Coastal wetland	1	1		(2309)	
Coastal dunes	2	2		(310)	
Cabbage treeland	1		1	0.2	
Total	**19**	**10**	**9**	**269**	**<1%**

**** Publicly owned sites shown in brackets for information only***

ECOSYSTEMS FOUND

The original vegetation cover of the ecological district has been almost all removed since human arrival. The remnant ecosystems remaining are briefly described below.

INLAND WETLANDS

Freshwater inland wetlands are extremely rare, the largest being an oxbow lake of the Wairau River at Grovetown, and Bankhouse wetland up-river from the Waihopai-Wairau confluence.

RARANGI BEACH RIDGE SYSTEM

The predominantly spring-fed wetlands in the beach ridge hollows include relatively extensive areas of raupo and flax swamp. They are aligned with unique shrublands (small-leaved shrubs including coastal shrub daisy, porcupine shrub, coprosmas and manuka) and stonefields that are remnants of older beaches.

RIVER BED/RIPARIAN COMMUNITIES (PUBLIC)

The Wairau River braids and margins are extremely weedy, but there remain discrete areas where mat-forming herbs still persist on recently semi-stable surfaces. Swamp nettle (*Urtica linearifolia*) has been found in the riparian margins of several waterways. The slower moving smaller rivers of the District are generally choked with exotic water weeds that have largely eliminated the native component. Many of the mid to upper reaches of the streams on the river plain run dry for long periods, and their beds can become thick with annual dryland weeds. The river bed areas provide important habitat to a number of bird species including the nationally threatened black-billed gull and black-fronted tern.

KANUKA FORESTS

Secondary kanuka-mixed broadleaved forest exists only around the north-western boundary at Rarangi, and there is a small pocket (9 ha) of kanuka on the plain near Renwick.

COASTAL WETLAND-ESTUARY AND LAGOONS (PUBLIC)

The brackish Wairau Lagoons support extensive eelgrass beds, with wide margins of glasswort-dominated salt turf, and deep beds of harakeke locally, whilst around the estuary margins are rushlands, shrublands and beds of *Bolboschoenus* sedgeland. The Boulder Bank that encloses it has extensive stonefields with associated coastal herb and shrub vegetation. The foreshore is otherwise dominated by dunes that, despite the abundance of marram, still support areas of native vegetation.

COASTAL DUNES (PUBLIC)

These areas have abundant marram grass but also contain native sandbinders such as spinifex and sand tussock and other prostrate plants such as mat daisies and *Pimelea* species. The dune systems are also habitat to a number of important invertebrates including the endemic mat daisy jumper.

CABBAGE TREE (TI KOUKA) TREELANDS

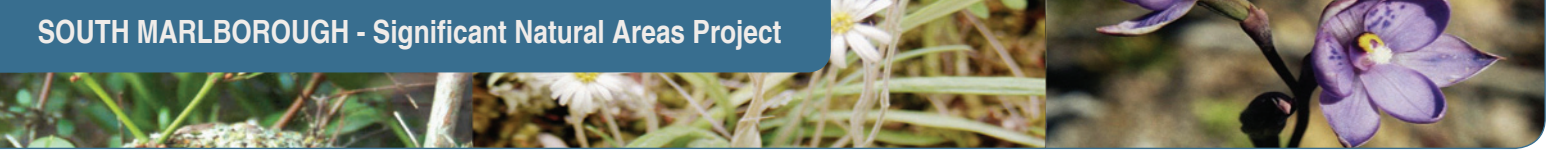
Cabbage trees occur in clumps and scatterings along creek margins.

SPECIAL FEATURES

Despite the history of great modification by people, there are several features to celebrate.

NATIVE FLORA

- Nationally threatened plants found in the ecological district during the survey include sand tussock (*Austrofestuca littoralis*), pingao (*Desmoschoenus spiralis*), sea holly (*Eryngium* aff. *vesiculosum*), coastal mat daisy (*Raoulia* aff. *hookeri*), swamp nettle (*Urtica linearifolia*), native musk (*Mimulus repens*), white fuzzweed (*Vittadinia australis*), *Muehlenbeckia ephedroides*, grassy mat sedge *Carex inopinata* and the herb *Mazus novaezeelandiae* subsp. *impolitus*.
- One plant species, leafless clematis (*Clematis afoliata*) reaches its northern limit in the Blenheim Ecological District. It is possible that Marlborough rock daisy (*Pachystegia insignis*) still reaches its northern limit here also, but permission was not granted to visit the site in question to reconfirm its presence. Swamp maire (*Syzigium maire*) reaches its southern limit.



NATIVE FAUNA

- The Wairau Lagoons and estuary are outstanding wetland bird habitat. The smaller wetlands are also important for birds. Wetland birds listed as nationally threatened that are found in the ecological district are Australasian bittern, grey duck, banded dotterel, white-fronted tern, spotless crake, marsh crake, banded rail, black shag and pied shag. The braided riverbeds are critically important to two other nationally threatened birds: black-billed gull and black-fronted tern.
- Bush birds are uncommon, because there is so little remaining forest cover. Present though are bellbird, kereru, silvereye, fantail and grey warbler. Of note is the occasional sighting of NZ falcon (karearea or sparrowhawk).
- Lizards (geckos and skinks) are present, especially in stonefields and mature shrubland. There are records of four species in the ecological district: common gecko (*Hoplodactylus maculatus*), Marlborough mini gecko (*Hoplodactylus* sp. "Marlborough mini"), spotted skink (*Oligosoma lineoocellatum*) and common skink (*Oligosoma nigriplantare polychroma*).
- Sixteen species of native freshwater fish have been recorded in the District, more than any other in the Ecological Region. Listed as nationally threatened are dwarf galaxias, longfin eel, giant kokopu and lamprey. Banded kokopu and koaro are regionally scarce. Three species - dwarf galaxias, northern galaxias and upland bully - may have locally distinct populations because they are non-migratory.
- The Cloudy Bay coastline has recently been shown to be of considerable importance for its native invertebrates. Two species of moth are endemic (found nowhere else). Notable species present include a large tenebrionid beetle, a large predatory carabid beetle, the long-winged clapping cicada, and various moth and butterfly species associated with the native woody vegetation remnants.

BLENHEIM ECOLOGICAL DISTRICT - PHOTO ESSAY

WAIRAU LAGOONS AND BOULDERBANK

An estuarine lagoon complex which includes a river mouth and boulderbank. Although quite significantly modified, the Wairau Lagoons form the largest estuarine area between the Waimea Inlet in Nelson and the Waituna Lagoon in Southland. The area is nationally significant as a landform, culturally as a site for 'archaic"/moahunter Maori and paleofaunal remains, and as a site for bird species, particularly the royal spoonbill and caspian tern.

JEFFRIES ROAD KANUKA -

While this site is small and has suffered considerable damage through drought, it is one of only two remaining remnants of forest of any kind in the Blenheim Ecological District. It contains cabbage tree and kowhai, both of which are now also rare within this Ecological District.

GROVETOWN LAGOON –

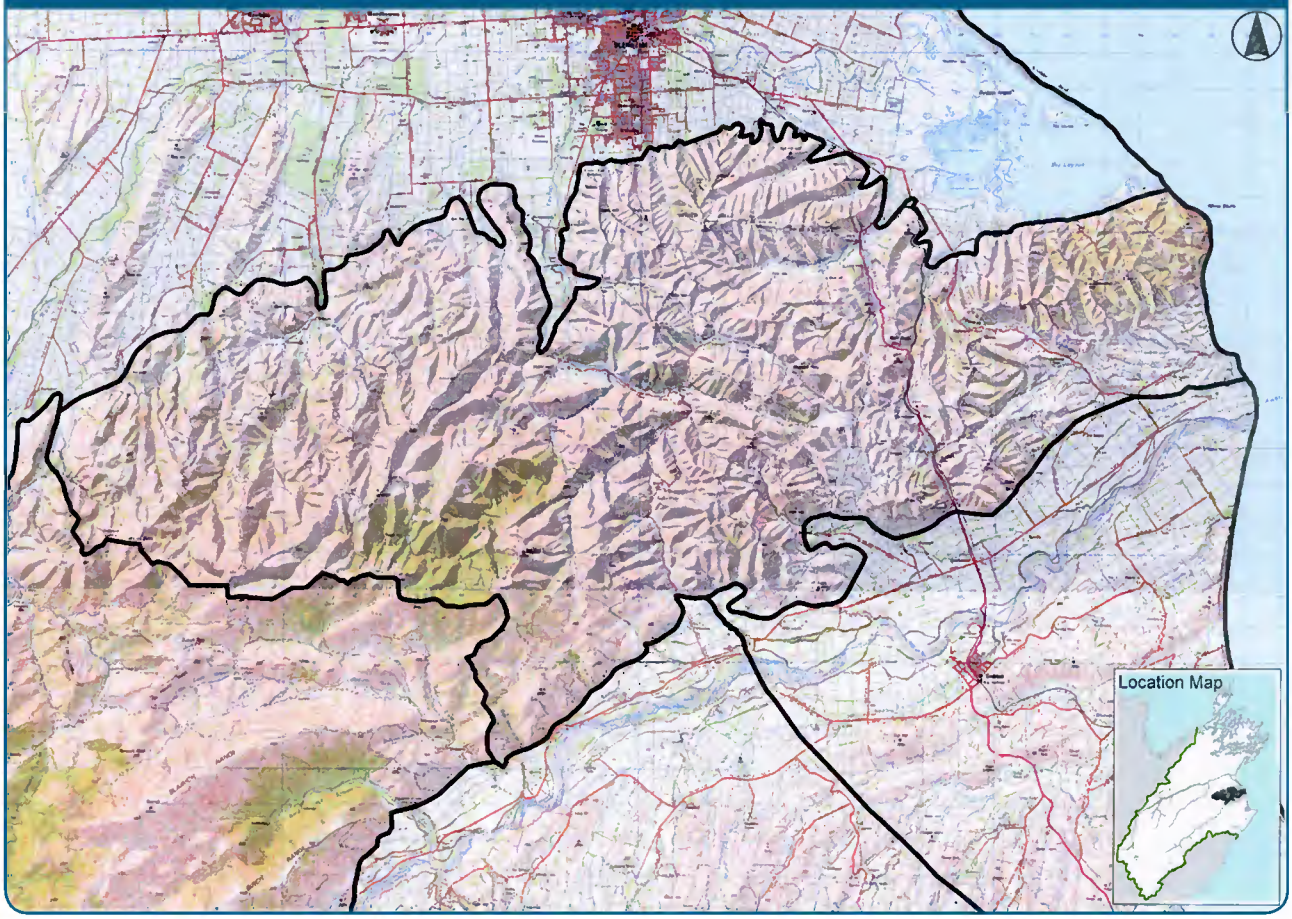
A distinctive oxbow freshwater lagoon which provides habitat to a range of bird and insect species. A community restoration project is underway in this area.

RARANGI WETLANDS AND SHRUBLANDS -

This landform type of dry gravel ridges and associated wetland hollows formed by the retreating shoreline is unique nationally and is unusual internationally. It supports an array of rare plant and insect species.

WITHER HILLS ECOLOGICAL DISTRICT

MAP 7 - WITHER HILLS ECOLOGICAL DISTRICT



OVERVIEW

The Wither Hills Ecological District contains the north-easterly extension of the Southern Alps, which fall to the sea at the cliffs of Te Parinui o Whiti (White Bluffs). The margins of the lower Wairau and Awatere River valleys define the boundary of the District to the north and south respectively. The northern boundary of the Blairich River catchment, a tributary of the Awatere River, forms the western boundary. The District runs from sea level in the east to 968 metres in the south-west. Apart from a small area of alluvial flats along the Taylor River (the only waterway of any size in the District), the land is comprised of dissected hill country, with generally short, steeply incised gullies and valleys. Taylor Pass and Dashwood Pass cross the Wither Hills approximately on a north-south orientation. The Vernon Hills lie east of Dashwood Pass, and form a short hill range between the pass and the sea. Gullies through these hills are often gorged. The sea cliffs at the Wairau Lagoons and White Bluffs are geological features of note.

The bulk of the western and central hills are comprised of Mesozoic greywacke, with basic igneous dykes and extrusions, and very local limestone bands. Northern, eastern and south-eastern hills are underlain by Tertiary mudstones and sandstones, grading into basal conglomerates that often form the surface geology. Early Quaternary glacial outwash deposits make up an area on the south side of the Vernon Hills in the extreme south-east. There is also a small area of low-lying late Quaternary moraine/glacial outwash deposits, on the edge of the Awatere plain. Small areas of recent alluvium are dotted along the northern margin associated with streams that run into the Wairau Plain. The soils are very prone to gully erosion, forming the “badlands” topography visible near Blenheim.

The area has a warm dry climate with high solar radiation and frequent extreme drought. Frosts occur in winter and winds are generally light to moderate.

The original vegetation cover, as suggested by recent research and the survey findings, was probably forest dominated by lowland totara, matai and black beech in the lowlands, with Halls totara and red beech on the higher ground. Other plant associates are likely to have included broadleaf, putaputaweta, akiraho, mahoe, kanuka, five-finger, kowhai and titoki, with ngaio abundant in more eastern parts of the District. Xeric (dry) shrubland would have been confined to bluffs and rocky ground. Wetlands were naturally uncommon. By the time of the first European pastoral endeavours in the early 1850s, the District had been largely deforested by Polynesian fire. Buick (1900) describes how emigrants on the 'Will Watch' en route to Nelson in 1839 "got a glimpse of the Vernon Hills, whose slopes were then covered with long wavy grass" (probably silver tussock). It is interesting to note that these are now largely clad in kanuka, with a lack of burning allowing the forest to return to even the driest margins of the area.

The Wither Hills Ecological District is almost entirely hill country, and is largely managed for merino sheep, with some cattle. Exotic forestry is established in places. Very little of the former pre-human forest cover, and also of the formerly extensive silver tussock grasslands at the time of European arrival, remains in this pastoral landscape. Lower pastoral lands are almost entirely composed of exotic species. Woody weeds such as gorse, broom, barberry, hawthorn, sweet brier, buddleia, willows and boxthorn are widespread and well established.

The only currently protected natural area is a private conservation covenant of dry coastal forest and treeland at White Bluffs, amounting to a mere 0.3% of the area of the ecological district.

SURVEY RESULTS

Of the 25 properties where the owners were approached, 18 were surveyed. A total of 13 significant sites were identified. These have a combined area of 4905ha and make up approximately 16% of the total area of the ecological district. The sites are classified into five basic ecosystem categories or types although almost all sites contain mosaics of vegetation of different types (see Table 6). The majority of sites are kanuka forest, "grey scrub" or silver tussock, or a mixture of these vegetation types, reflecting the long history of modification of the original forest cover and pastoral farming. Among them are small pockets of broadleaved and beech forest. All of the sites are distinctive and special.

TABLE 6 - SITES IDENTIFIED IN THE WITHER HILLS ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites on private land	Total area (ha)	% area of Ecological District
Riparian communities/river bed	1	3	
Kanuka forest & shrubland	6	3795	
Dry shrublands & silver tussock	3	1050	
Rocklands, dry shrublands & silver tussock	1	42	
Inland broadleaved forest	2	15	
Total	**13**	**4905**	**16 %**

ECOSYSTEMS FOUND

Apart from several large sites of kanuka forest and silver tussock, only small remnant indigenous ecosystems remain. The main remaining ecosystem patterns are briefly described below. In many instances vegetation types are mixed and occur within a mosaic. The main types are listed first (as set out in Table 6), followed by several other ecosystem types which occur in very small pockets within other sites.

RIVER BED / RIPARIAN COMMUNITIES

The Taylor River braided riverbed has scattered native shrubs and some mat plants. Riparian margins under forest have native ferns, sedges and herbs, and where they are more open and flood-prone there are often carpets of mosses and low herbs.

KANUKA FORESTS

Extensive tracts of kanuka forest remain in the Vernon Hills to the east, and in the upper Taylor River catchment in the mid-west of the District. Numerous smaller patches in the east of the District were destroyed by fire in late 2000.

ROCK OUTCROP, SCARP AND CLIFF COMMUNITIES

Large bluffs dominate the coastal margin, where there are distinctive coastal shrublands nearby. Lowland rocklands are scattered through the pastoral hill country landscape in numerous smaller outcrops. Montane rocklands are confined to the Ned and outcrops in the far west, with a very large suite of plants associated with them.

SILVER TUSSOCK GRASSLANDS

Only one large tract of silver tussockland remains, centred around Dumgree in the middle of the District, with scattered smaller areas nearby. It is also a component of the largely exotic shrubby pastures in the higher country in the west.

DRY SHRUBLANDS ("GREY SCRUB")

Shrublands and scrub, which are remarkably extensive in the head of the Branch River, are largely composed of *Coprosma propinqua*, *C. crassifolia*, matagouri, tauhinu (both species) and *Melicytus* aff. *alpinus* "Waipapa", with *Coprosma* "taylorae" at higher elevations. These merge into the grasslands over wide areas. There are localised pockets of manuka scrub.

BROADLEAVED FORESTS

Broadleaved forests are rare, being confined to conglomerate gorges in the Vernon Hills, and small gully and hill-slope pockets elsewhere. Species mainly include mahoe, five finger and akiraho. Mapou, kowhai and kohuhu are more scattered, with kaikomako and titoki very localised. Scattered matai are associated with these in the lower Branch River.

INLAND WETLANDS

There are a few very small wetlands containing harakeke (lowland flax), raupo and sedges.

BEECH FORESTS AND MONTANE PODOCARP-BEECH FORESTS

Very small remnants of black beech and red beech are scattered through the middle and west of the ecological district, usually amongst kanuka forest. Hall's totara is confined to the highest ground in the west, as scattered wind-shorn trees near ridgelines, and as two areas of forest, treeland and shrubland in the upper Branch River catchment.

SPECIAL FEATURES

Despite the history of great modification by people, there are several features to celebrate.

NATIVE FLORA

- Nationally threatened plants found during the survey include coastal tree broom (*Carmichaelia muritai)*, which is confined to White Bluffs in this ecological district, pink broom (*Carmichaelia carmichaeliae*), coastal mat daisy (*Raoulia* aff. *hookeri*), another mat daisy (*Raoulia monroi*), the local mountain daisies *Celmisia cockayniana* and *C. insignis*, white fuzzweed (*Vittadinia australis*) and the coastal groundsel *Senecio hauwai*.

- Eleven species reach their national northern limit within the Wither Hills Ecological District. These are pink broom (*Carmichaelia carmichaeliae*), coastal tree broom (*C. muritai*), *Celmisia cockayniana*, *Craspedia* "Marfells", NZ lilac (*Heliohebe hulkeana*), *H. pentasepala*, Marlborough rock daisy (*Pachystegia insignis*), *Raoulia monroi*, leafless lawyer (*Rubus squarrosus*), *Senecio hauwai*, and prostrate kowhai (*Sophora prostrata*).

NATIVE FAUNA

- The only birds listed as nationally threatened that are found in the ecological district are grey duck, black shag and NZ falcon (karearea or sparrowhawk). Black-billed gull and black-fronted tern possibly use the braided riverbeds.
- Native bird species commonly recorded in forest areas include bellbird, brown creeper and silvereye, with fantail and grey warbler uncommon but usually present. Shining cuckoo was heard occasionally. South Island tomtit was recorded in only three forest blocks, South Island robin in two and rifleman in one. Ruru (morepork) was not recorded, although given its nocturnal nature it may still be present. Kingfisher was noted along one forest stream.
- A shearwater species was heard one night during the survey, flying across the face of the sea cliffs at White Bluffs.
- There are records of three lizard species in the District, namely common gecko (*Hoplodactylus maculatus*), common skink (*Oligosoma nigriplantare polychroma*) and forest gecko (*Hoplodactylus granulatus*). This is the eastern limit of the forest gecko.
- Five species of native freshwater fish have been recorded in the District. The only one listed as nationally threatened is longfin eel. Two of the other species - northern galaxias and upland bully - may have locally distinct populations because they are non-migratory. Koura (freshwater crayfish) are common in places.

WITHER HILLS ECOLOGICAL DISTRICT - PHOTO ESSAY

DUMGREE –

The only remaining extensive area of silver tussock grassland in the Ecological District. Such grasslands were present before human settlement and became widespread following early fires which removed forest cover. They are now severely reduced.

BRANCH RIVER –

The largest area of native vegetation in the Ecological District showing a mosaic of regenerating kanuka forest, native shrublands and silver tussock, with remnant forest species such as black beech, matai and Hall's totara. These forest species would have once characterised the forested landscape in this area.

TE PARINUI O WHITI/WHITE BLUFFS AND VERNON HILLS –

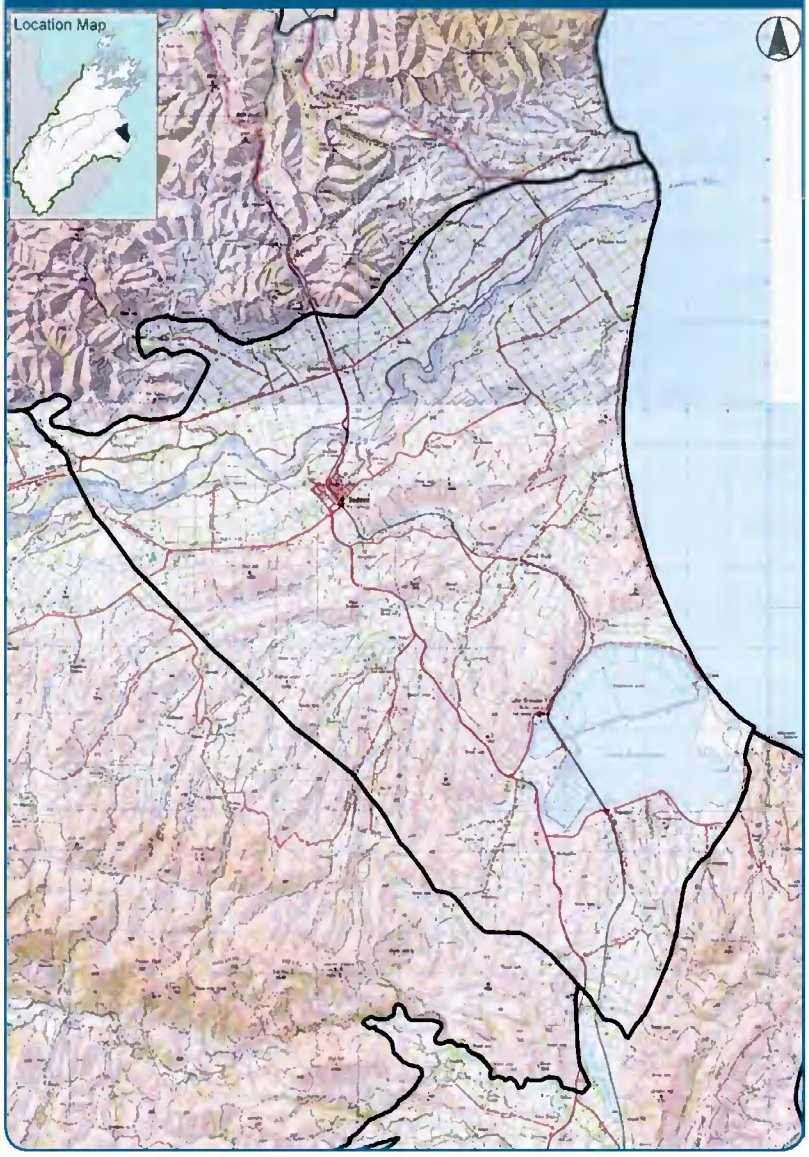
The second largest tract of native forest vegetation in the Ecological District. It includes a range of vegetation including coastal shrublands, broadleaved forests in moist gullies and gorges and extensive kanuka forest.

BRANCH RIVER –

An example of black beech scattered amongst kanuka in one of the last remaining remnants of once common forest.

GRASSMERE ECOLOGICAL DISTRICT

MAP 8 - GRASSMERE ECOLOGICAL DISTRICT



OVERVIEW

The Grassmere Ecological District includes the Clifford Bay coastline, with its north-western boundary defined by the edge of the Awatere river plain where it meets the edge of the Wither Hills. A contour of approximately 150m defines the boundary to the south-west (there are no defining landforms to follow) and the foot of the coastal hills east of Ward defines its south-eastern margin. The land is low lying, running from sea level in the east to 293 m in the north-west. All the stream and river courses run in a generally parallel south-west to north-east orientation. The lowest reaches of the Awatere River pass through the District to the sea, although it drains very little of the area. Drainage is largely confined to a number of winter-borne streams, notably the Blind/Otuwhero River system, and Starborough Creek. Lake Grassmere was an estuarine area up until 1800 years ago and then became a freshwater lake until it was modified by the development of the salt works in the 1940s.

Large areas of the central and southern portions of the ecological district are of Tertiary origin, being composed of sandy mudstones with sandstone bands, concretions and shell beds. There are also localised areas of mudstone and sandstone grading into basal conglomerate and grit. Scientifically important fossil deposits occur in these sedimentary rocks. However, significant areas are overlain by Quaternary terminal moraine and glacial outwash deposits from a range of glacial periods. The northern part of the area is composed entirely of these Quaternary deposits. Tertiary sediments also surface as a long thin band along the coast, north of the Blind River. The area of land between Lake Grassmere and the sea is derived from post-glacial swamp and lagoon deposits, and also includes sand dunes. Many of the soils are derived from loess (wind-deposited rock dust).

The climate is warm and very dry with high solar radiation and frequent extreme drought. Frosts are not common and winds are generally moderate to strong.

Prior to human arrival, the land was largely forested. Subsequent deforestation, in common with most eastern South Island districts, has been attributed to Polynesian fires. The original tree cover has been described as being largely of mahoe-titoki-ngaio coastal hardwood forest with small areas of matai-hinau-mahoe forest, manuka-kanuka scrub and fescue-silver tussock grassland. However, there seems no reason why lowland totara would not also have been a dominant component of the

former tree cover, with matai perhaps dominant on less fertile land. Totara, matai, titoki and hinau are no longer present in natural areas, such has been the loss of forest cover. Moist riparian areas and swamps along low-lying land would have provided habitat for kahikatea. Silver tussock may naturally have been confined to coastal slopes and slips, its later widespread presence inland being fire-induced. The fires of 6-800 years ago resulted in a complete loss of forest by the time of European settlement, when Frederick Weld described the vegetation cover as extensive grassland with only a few miserable manuka shrubs.

Only tiny remnant indigenous ecosystems remain, little of which are in public ownership. Currently there are three very small protected areas, in total covering just 0.3% of the ecological district. The largest is the Muritai Scientific Reserve and Stewardship Land, containing the rare coastal tree broom and coastal forest and shrubland. The others are parts of dune systems. The most significant ecological weed is marram grass, dominating the native vegetation on the dunes.

SURVEY RESULTS

Of the 13 landowners approached regarding the survey nine were surveyed. A total of 10 significant sites were identified on private land. A further four sites were identified on public land (this includes several large public areas including the Awatere River and Lake Grassmere). The sites on private land have a combined area of 152 ha, which is less than 1% of the total area of the ecological district.

The sites are classified into seven basic ecosystem categories or types, (see Table 7). There has been a virtual elimination of the original forest cover, but there are significant amounts of dunes, forest remnants and shrublands. Among them are small pockets of broadleaved and beech forest. All of the sites are distinctive and special.

TABLE 7 - SITES IDENTIFIED IN THE GRASSMERE ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Sites on Public land	Sites on Private land	Total area of sites on private land (ha) *	% area of Ecological District
Coastal dunes	2	1	1	33 (22)	
Coastal wetland	2	1	1	12 (875)	
Inland wetland	2		2	21	
River bed/Riparian communities	1	1		(600)	
Dry shrubland	2		2	35	
Coastal broadleaf forest	2	1	1	20(17)	
Inland broadleaf forest	3		3	31.5	
Total	**14**	**4**	**10**	**152**	**<1%**

**** Publicly owned sites shown in brackets for information only***

ECOSYSTEMS FOUND

The original vegetation cover of the ecological district has been almost completely eliminated since human arrival. Beach margins and coastal gullies contain much of what remains. The main ecosystem patterns are briefly described below.

COASTAL SAND DUNE COMMUNITIES

There are some areas of dune containing spinifex and a little pingao and sand tussock.

COASTAL WETLANDS

Saltmarsh turfs exist along the eastern margins of Lake Grassmere, as sea water now flows into it as a result of the salt works development. Estuarine conditions exist at the mouth of the Blind River and Awatere River.

INLAND WETLANDS

Several wetlands remain, mostly consisting of small pools and wet ground persisting along some stream courses all year round, containing a few sedges, rushes, raupo and harakeke.

RIVER BED/ RIPARIAN COMMUNITIES

The Awatere River margins are very weedy but there are localised areas of sandy gravels with native herbfield components and occasional shrub remnants such as *Muehlenbeckia astonii*.

DRY SHRUBLAND ("GREY SCRUB")

Several areas of dry shrublands persist on hill slopes and on the margins of coastal gullies.

BROADLEAVED FORESTS (COASTAL GULLIES AND INLAND)

There are a few very small coastal gully forest remnants, made up of ngaio, mahoe and akiraho. A number of gorged tributaries of the Awatere River also shelter small forest and treeland remnants.

SPECIAL FEATURES

Despite the history of great modification by people, there are several features worthy of celebration.

NATIVE FLORA

- Nationally threatened plants found in the ecological district during the survey include coastal tree broom (*Carmichaelia muritai*), dwarf broom (*Carmichaelia vexillata*), sand tussock (*Austrofestuca littoralis*), pingao (*Desmoschoenus spiralis*), sea holly (*Eryngium* aff. *vesiculosum*), shrubby tororaro (*Muehlenbeckia astonii*), *Muehlenbeckia ephedroides*, coastal mat daisy (*Raoulia* aff. *hookeri*), native musk (*Mimulus repens*) and the coastal groundsel *Senecio hauwai*.

NATIVE FAUNA

- Birds listed as nationally threatened are black-billed gull, black-fronted tern, grey duck, banded dotterel, white-fronted tern, black shag, pied shag and NZ falcon (karearea or sparrowhawk).
- Lake Grassmere deserves special mention as an exceptional site for bird life. It is a major feeding and roosting site for large numbers of waders such as bar-tailed godwit, pied stilt, South Island pied oystercatcher and knot, and many species of migrant and vagrant waders have been noted. Seasonally the area also supports large numbers of waterfowl especially grey teal, grey duck/ mallard and the introduced black swan. White-fronted tern has bred there.
- The bird life of the Awatere River is well documented. There are large numbers of breeding banded dotterel (classified as "chronically threatened, gradual decline"), and small numbers of breeding black-fronted tern (classified as "chronically threatened, serious decline"), and pied stilt. Five percent of the South Island population of black-fronted dotterel breed along the mid to lower reaches of the Awatere River. South Island pied oystercatcher and black-billed gull (classified as "chronically threatened, serious decline") frequent the river, but breed mainly outside the ecological district, upriver. Black shag (classified as "at risk, sparse"), little shag, and kingfisher are also present. Backwaters support grey teal and grey duck/mallard. Welcome swallows frequent the open riverbed and spur-winged plover and paradise shelduck the margins, braids and adjacent alluvial pastoral flats. Caspian tern and white-faced heron occur occasionally along the Awatere riverbed.
- Native forest and shrublands are very nearly absent from the District, and the few native bird species recorded from them include bellbird, grey warbler, silvereye and fantail.

- There are records of two lizard species, namely common gecko (*Hoplodactylus maculatus*) and common skink (*Oligosoma nigriplantare polychroma*). Coastal driftwood is a key habitat for the skinks.
- Fourteen species of native freshwater fish have been recorded in the ecological district. The only one listed as nationally threatened is longfin eel. Banded kokopu is regionally uncommon. Two of the other species - northern galaxias and upland bully - may have locally distinct populations because they are non-migratory. The Awatere River catchment, the lowest reaches of which flow through the ecological district, is considered to be of regional importance for freshwater fish and habitat diversity. The catchment is huge and the main river stem that lies in the ecological district is critical for allowing the passage of migratory species between the tributaries and the sea. It is very important for torrentfish, containing the best population in the region and one of the better ones nationally. The Otuwhero (Blind) River catchment drains much of the District. Its flow is ephemeral, although deep pools remain year round. Banded kokopu have been recorded in parts of the upper catchment. Both eel species (longfin and shortfin) are present, and support a part of the Marlborough commercial eel fishery.

GRASSMERE ECOLOGICAL DISTRICT - PHOTO ESSAY

BLIND RIVER MOUTH –

A brackish estuarine area which is mostly cut off from the sea except for periodic flooding or high seas. It contains an extensive area of saltmarsh ribbonwood and two threatened plant species.

CLIFFORD BAY COASTAL GULLIES –

The best remaining example of now very rare coastal forest (mainly akiraho), in this area. Mosaics of scattered shrubs, herbs and grasses occurr on mudstone cliffs.

NINA BROOK -

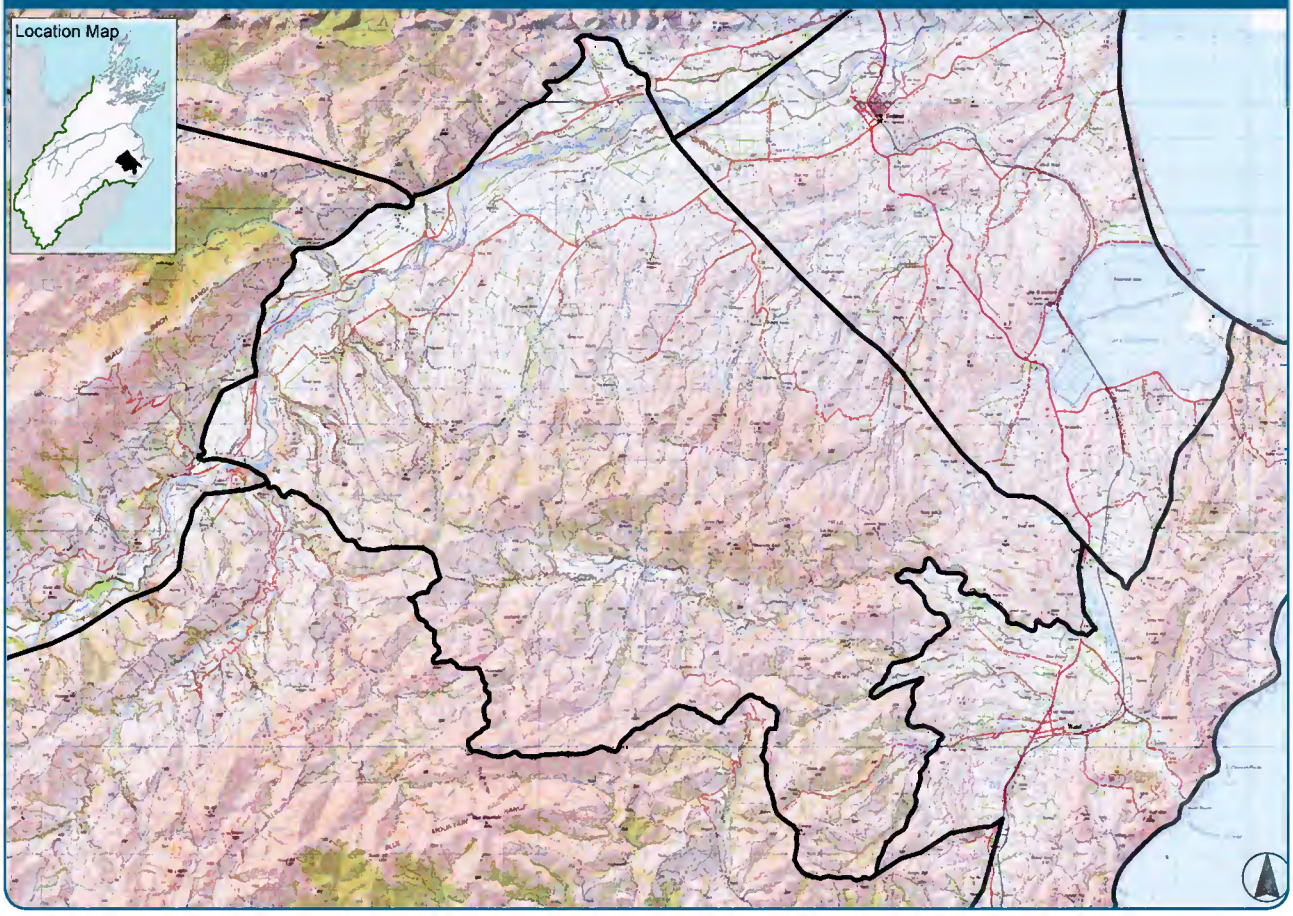
An example of a distinctive gorge landform that has provided a refuge for native species. The shrub cover is predominantly akiraho forest with Marlborough rock daisy on the cliffs and populations of a rare broom species at its northern limit of distribution.

CLIFFORD BAY COAST –

A duneland system with significant native elements including extensive areas of spinifex and the rare pingao. The introduced marram grass is a threat and is likely to win out over native species in the long term unless controlled.

FLAXBOURNE ECOLOGICAL DISTRICT

MAP 9 - FLAXBOURNE ECOLOGICAL DISTRICT



OVERVIEW

The Flaxbourne Ecological District is bounded by the Awatere River valley to the north-west, while its southern and western boundaries are largely defined by the catchment margin of the Flaxbourne River, and its north-eastern boundary with the Grassmere Ecological District lies along a contour line at approximately 150 m asl. The District lies within 4.5 km of the Kaikoura coast at its nearest point. The land lies between 40 and 822 m above sea level, with altitude generally increasing from the north-east to the south-west. The mid to upper Flaxbourne River catchment dominates the southern sector, with numerous small gully tributaries. Its upper catchment widens into a shallow basin, bound steeply to the north by the Haldon Hills that span the centre of the District. The northern sector comprises ridges and gullies that run northward from the Haldon Hills to the Awatere River plain. Some of these gullies dissect the much smaller Little Haldon Hills. Many of these northern gullies are deeply incised, featuring deep vertical cliff systems.

Much of the Flaxbourne River catchment and the Haldon Hills are dominated by Mesozoic greywacke. The northern foot slopes of the Haldon Hills are comprised of Tertiary mudstone and sandstone grading into basal conglomerate. Quaternary terminal moraine deposits dominate the Awatere River plain, overlain to the south by more recent post-glacial alluvium that has subsequently been dissected into low-lying ridges. Some recent alluvium occurs close to the margins of the current course of the Awatere River. Two major active faultlines, the Awatere and Clarence Faults, cross the ecological district on a south-west to north-east orientation. The Awatere faultline lies approximately along the north-western boundary, and is responsible for a number of fault-induced wetlands and a lake. Upton Brook has an important fossil site. Soils are derived from wind deposited loess or the underlying rocks.

The climate is warm and dry with high solar radiation and frequent drought. Frosts occur in winter and the area is moderately windy.

The pre-human vegetation of the Flaxbourne Ecological District has been described as small areas of matai-totara-hinau-mahoe forest, extensive mahoe-five finger-mapou forest and kanuka/manuka forest, and some black beech forest in the south. However, the survey revealed that totara was once widespread on the hill country. Very small remnant stands or isolated trees of black beech, matai and lowland totara still exist in the south, and it is logical to assume that they too would have once been widespread, dominating lowland forest canopies, with Halls totara abundant on the higher slopes. Most of the forest was destroyed by fire in the centuries prior to European settlement. The flat, wide stream valleys in the north of the District once held extensive harakeke flaxlands (hence the name), although only one area remains today. Wetlands were, and still are a feature of the Awatere faultline, but were only ever of local occurrence. Very little native vegetation remains in the low-lying lands of gently undulating foothills and the Awatere River plain. Land use in the Flaxbourne Ecological District is currently almost entirely pastoral.

Only tiny remnant indigenous ecosystems remain, of which very little is in public ownership or formally protected. There are only two protected natural areas, one a small reserve with pockets of native forest and scrub and the other a considerably larger private covenanted area of mixed vegetation containing the majority of the only population of red rock daisy (*Pachystegia rufa*), endemic to the Little Haldon Hills. Together these two areas make up 0.55% of the ecological district.

SURVEY RESULTS

Of the 35 properties where the owners were approached, 21 were surveyed. A total of 24 significant sites were identified on private land. A further two sites were identified on public land (this includes the Awatere River bed). The sites on private land have a combined total area of about 1165ha which is approximately 4.1 % of the total land area of the ecological district.

The sites identified are classified into seven basic ecosystem categories or types (see Table 8). Several of the sites are riparian or associated with rivers. Most of the rest are hillslope mosaics of mixed native vegetation. All of the sites are distinctive and special.

TABLE 8 - SITES IDENTIFIED IN THE FLAXBOURNE ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Sites on Public land	Sites on Private land	Total area of sites on privately owned land (ha) *	% area of Ecological District in private hands
Inland wetland	3		3	27	
River bed/Riparian	1	1		(700)	
Silver tussock grassland, bracken & "grey scrub"	1		1	120	
Rock /dry shrubland/tussock	2		2	160	
Dry shrublands	7		7	216	
Kanuka-manuka forest,	5		5	550	
Broadleaved forest	7	1	6	92 (15)	
Total	**26**	**2**	**24**	**1165 ha**	**4.1%**

**** Publicly owned sites shown in brackets for information only***

ECOSYSTEMS FOUND

The original vegetation cover of the ecological district has been largely eliminated since human arrival. The main ecosystem patterns are briefly described below.

INLAND WETLANDS

Wetlands are extremely rare, with very localised areas of harakeke flaxland, and *Carex secta* sedgeland.

RIPARIAN RIVERBED COMMUNITIES

The Awatere Riverbed vegetation is substantially exotic, but there are localised areas of the mat-forming native plants *Raoulia australis* and *Muehlenbeckia axillaris*. Some gentle slopes and terraces, particularly those associated with the Flaxbourne River and streams south of it, may hold narrow bands of kanuka treeland and open forest, with kowhai and manuka locally common.

ROCK OUTCROP, SCARP AND CLIFF COMMUNITIES

Rocklands are common, particularly on the Haldon and Little Haldon Hills, where large bluffs are present. These support a diverse assemblage of herbs, ferns, grasses and shrubs.

SILVER TUSSOCK GRASSLANDS, DRY SHRUBLANDS ("GREY SCRUB") AND BRACKEN FERNLANDS

Hilly pastoral lands are largely comprised of exotic grasses with abundant silver tussock grassland, bracken fernland, and variable densities of hill slope shrublands composed of tauhinu, *Coprosma propinqua*, *C. crassifolia*, matagouri and porcupine shrub (*Melicytus* aff. *alpinus* "Waipapa"). Shady slopes in the Haldon Hills locally support areas of a whatariki-bracken association. Young kanuka regeneration is widespread, particularly through bracken.

KANUKA, MANUKA AND BROADLEAVED FORESTS

Forest areas are almost exclusively confined to steeply incised gullies and valleys, generally on more southerly aspects. These are comprised mostly of kanuka and occasionally manuka, with smaller areas of mixed broadleaved forest, usually present as narrow strips along gully bottoms and foot slopes, below more substantial stands of kanuka forest. Broadleaved tree species commonly include mahoe, ngaio, five-finger and akiraho, with kowhai, cabbage tree, kohuhu and mapou less common. Very locally, titoki and kaikomako are present. Rare trees of the original primary canopy still occur, namely black beech, matai, and lowland totara. Halls totara, once widespread from the plentiful evidence of logs on the hill slopes, does not appear to persist in the wild within the District.

SPECIAL FEATURES

Despite the history of great modification by people, there are several features worthy of celebration.

NATIVE FLORA

- Nationally threatened plants found in the ecological district during the survey include red rock daisy (*Pachystegia rufa*), deciduous tree daisy (*Olearia hectorii*), sea holly (*Eryngium* aff. *vesiculosum*), shrubby tororaro (*Muehlenbeckia astonii*), *Muehlenbeckia ephedroides*, the mistletoe *Tupeia antarctica*, two small-leaved clematis species (*Clematis marata* and *C. petriei*), white fuzzweed (*Vittadinia australis*) and the native bedstraw *Galium trilobum*.
- One species reaches its national northern distribution limit within the Flaxbourne Ecological District, although it was recorded in the past from further north (Pelorus Bridge): deciduous tree daisy (*Olearia hectorii*).
- Two species are endemic to the District. The red rock daisy (*Pachystegia rufa*) is confined to the Haldon and Little Haldon Hills, and *Craspedia* "Haldon Hills" which is confined to the Haldon Hills.

NATIVE FAUNA

- Birds listed as nationally threatened that are found in the ecological district are black-billed gull, black-fronted tern, grey duck, banded dotterel, black shag, pied shag, kereru (NZ pigeon) and NZ falcon (karearea or sparrowhawk).
- Bellbird, brown creeper and silvereye are common in forest areas. Fantail, grey warbler and shining cuckoo are uncommon but usually present. South Island robin was recorded in one location, rifleman and kereru in three locations with all three species being confined to the far south of the ecological district. Ruru (morepork) was inevitably overlooked because of its nocturnal nature. Kingfisher was noted along one forest stream.
- Hill country grasslands, with shrublands and rocklands hold low numbers of native species, with only Australasian harrier hawk (kahu) common. Pipit was scarce, and NZ falcon was noted only at one site, in the Haldon Hills.
- Wetlands are now rare and only one site, Lake Jasper, held any water birds during survey visits, including pukeko, scaup, grey teal, grey duck and pied shag.
- The Awatere River supports large numbers of breeding banded dotterel (classified as "chronically threatened, gradual decline") and black-billed gull (classified as "chronically threatened, serious decline"), and reasonable numbers of breeding South Island pied oystercatcher, black-fronted tern (classified as "chronically threatened, serious decline") and pied stilt within the District. Five percent of the South Island population of black-fronted dotterel (classified as "chronically threatened, gradual decline") breed along the mid to lower reaches of the Awatere, largely down-river in Grassmere Ecological District, although they regularly frequent this section. Black shag and little shag breed locally. Backwaters support numbers of grey teal and grey duck/mallard. Welcome swallow frequents the open river bed and spur-winged plover and paradise shelduck the margins, braids and adjacent alluvial flats. Caspian tern and white-faced heron are present occasionally along the Awatere River bed. The Flaxbourne River supports occasional black shag, grey duck/mallard, paradise shelduck and kingfisher. Banded dotterel, pied oystercatcher and pied stilt have bred there in the recent past.
- There are records of four lizard species in the ecological district, namely the Kaikoura gecko (*Hoplodactylus* "Kaikoura", classified as "at risk"), spotted skink (*Oligosoma lineoocellatum*, classified as "chronically threatened"), common gecko (*Hoplodactylus maculatus*), and common skink (*Oligosoma nigriplantare polychroma*). All are recorded from within the Flaxbourne River catchment. Common gecko was observed under old Hall's totara logs in steep pasture high on the Haldon Hills during the survey. The type locality of the Kaikoura gecko near the Flaxbourne River is one of only two known localities for this species. Its status requires further investigation.
- Only four species of native freshwater fish have been recorded in the District so far. The only one listed as nationally threatened is longfin eel. Banded kokopu and torrent fish, recorded lower in the Awatere River, are most likely to be present. The Flaxbourne River catchment drains much of the ecological district, but to date the mid to upper reaches have not been surveyed.

FLAXBOURNE ECOLOGICAL DISTRICT - PHOTO ESSAY

FLAXBOURNE RIVER –

This area has good examples of riverbed and riparian bluff vegetation including forest species like akiraho, manuka and kanuka, Marlborough rock daisy and other shrubs, lancewood and species like leafless clematis which are rare elsewhere in this Ecological District.

DIVISION CREEK HEADWATERS –

A mosaic of rockland, gully forest, bracken fernland, "grey scrub" and silver tussock grassland. Several rare species are present in small remnant areas of forest and rockland within this mosaic.

TACHALLS CREEK –

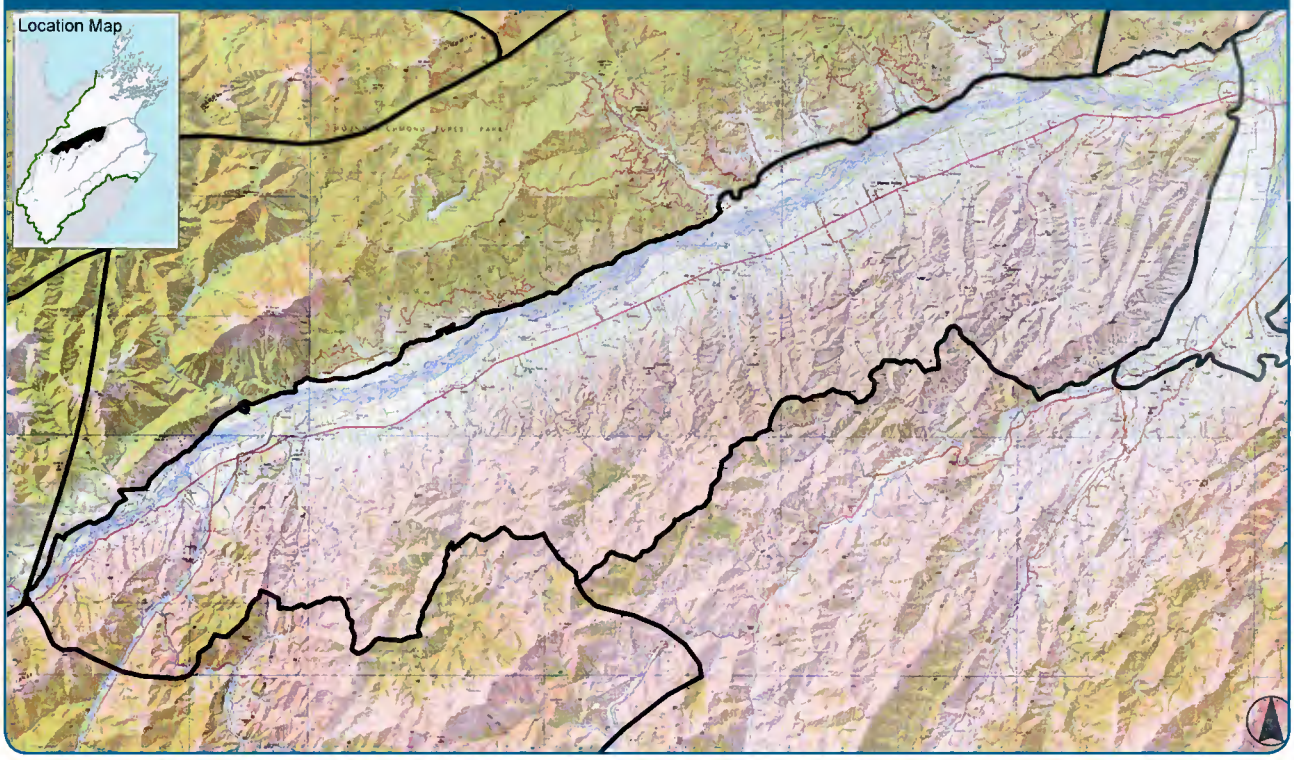
A forested gully system merging into bracken fernland and tussock grassland on the upper slopes. The forest is diverse with mixed broadleaved species and the only stand of black beech (once common) in the Ecological District.

STARBOROUGH CREEK –

This area of swamp associated with the ephemeral Starborough Creek is by far the largest area of harakeke flaxland remaining in the Ecological District. Drainage, damage by heavy stock and weed infestation (willows and privet are present), are all potential threats to this type of habitat.

HILLERSDEN ECOLOGICAL DISTRICT

MAP 10 - HILLERSDEN ECOLOGICAL DISTRICT



OVERVIEW

The Hillersden Ecological District forms a long narrow arm in the Wairau Valley and includes the north-west facing hill country south of the Wairau River and the alluvial terraces on both sides of the river. The Richmond Range lies to the north. The ecological district extends to the Waihopai River confluence in the north-east, and to the Wash Bridge in the south-west. The western boundary runs up and over the northern portion of the Raglan Range. The land lies between 75 -1448 m above sea level, reaching its highest point at Mt Impey. It runs approximately 10 km back from the Wairau River into the hills to the tributary catchment heads in most cases, with the largest tributaries being the Wye River and Boundary Creek. The steeply dissected land falls in approximately parallel north-running ridges and valleys to the Wairau River. In the far west the very lowest reaches of the Branch and Leatham Rivers are included. Also included are the high and low terraces and their associated terrace risers on both sides of the Wairau River, as well as the braided riverbed and the floodplain.

The geology is not complex. Half of the area and most of the hill country is comprised of Mesozoic greywacke and argillite that is highly sheared, well indurated, graded and bedded. The gentler eastern hills are comprised of Tertiary mudstones and sandstones grading into basal conglomerate and grit. All of the Wairau River plain, which constitutes a third of the ecological district, is recent post-glacial alluvium. Along the western upper end of this plain are a number of Quaternary terminal moraine and glacial outwash gravel deposits. A very small area of Carboniferous schist occurs on the south-bank margins of the Wairau River. This geology is much more extensive to the north. The Branch River faulted terraces are of national importance as a classic example of progressive displacement of late Quaternary terraces by right lateral slip on the Alpine Fault. The Wairau River braids are of regional importance as an excellent representative example of braided riverbeds in Marlborough rivers. Soils are derived from loess or the underlying rocks and are of low to medium fertility.

The climate is generally mild, but with high solar radiation and a distinct rainfall gradient (increasing both inland and with altitude). Summers are typically dry and winters cool. Winter frosts are common and snow occasionally lies on the hills.

Pre-human vegetation of the ecological district has been described as probably a diverse mosaic of podocarp, beech and hardwood forest, shrublands of kanuka, manuka, kowhai and matagouri and silver tussock grassland, with perhaps some warm temperate rainforest on the lowest ground in the east. However, there seems to be no ecological reason why forest would not have covered all areas other than deep swamps. Silver tussock and shrubland would have been confined to rocky outcrops where tree cover was absent or minimal, and where slips caused open conditions. This survey confirms the existence of very small remnants of mature Halls totara, matai, red beech, black beech and broadleaved species located in the mid to western parts of the ecological district, that can only be interpreted as being the highly modified remnants, or their progeny, of the original pre-human forest cover. Most of the original forest was destroyed by fire in the centuries prior to European settlement.

The Hillersden Ecological District is now predominantly a landscape of pastoralism and exotic forestry. Only remnant and largely secondary indigenous ecosystems remain, of which very few are in public ownership or formally protected. Five protected natural areas together cover 2.9% of the ecological district. They mostly contain kanuka forest, with a small amount of beech forest and a wetland.

SURVEY RESULTS

Of the 31 properties where the owners were approached, 27 were surveyed. A total of 28 significant sites were identified on private land. A further nine sites were identified on public land (this includes the Wairau River bed). The sites on private land have a combined total area of 3660 ha which is approximately 7.5% of the total land area of the ecological district.

The sites are classified into six basic ecosystem categories or types, (see Table 9). Many of the sites are riparian or associated with rivers, and there are several small wetlands. Most of the remaining sites are hillslope mosaics of mixed native vegetation, predominantly kanuka forests. All of the sites are distinctive and special.

TABLE 9 - SITES IDENTIFIED IN THE HILLERSDEN ECOLOGICAL DISTRICT

Ecosystem type	Total number of sites	Sites on Public land	Sites on Private land	Total area of sites on privately owned land (ha)*	% area of Ecological District in private hands
Inland wetland	8	2	6	6 (8)	
River bed /Riparian communities	1	1		(6000)	
Dry shrublands	8		8	645	
Silver tussock grassland & “grey scrub”	2		2	470	
Kanuka forest	13	5	8	2470 (1677)	
Beech-kanuka-broadleaved forest on alluvium	5	1	4	69 (20)	
Total	**37**	**9**	**28**	**3660**	**7.5%**

** Publicly owned site shown in brackets for information only*

ECOSYSTEMS FOUND

The original vegetation cover of the Hillersden Ecological District has been largely eliminated since human arrival although some larger areas of kanuka forest are present. The main ecosystem patterns are briefly described below.

INLAND WETLANDS

Very small wetlands are scattered along the Wairau River plain, most of them associated with the Wairau Fault. In the west these are dominated by a range of sedges, but from around the mid-part of the ecological district eastward, harakeke becomes the principal species.

RIVER BED /RIPARIAN COMMUNITIES

The Wairau River plain is now almost devoid of native vegetation, and is largely managed for improved pasture. Forests on the Wairau River plain are confined to small pockets of alluvial kanuka and, more rarely, riparian kowhai and kohuhu. Old mans beard and woody weeds (crack willow, gorse, broom and buddleia especially) are common near the Wairau River.

SILVER TUSSOCK GRASSLANDS

The loss of the former extensive silver tussock grasslands, so widespread at the time of European settlement, has been almost complete, with only two remaining tracts identified in the mid-west of the ecological district.

DRY SHRUBLANDS ("GREY SCRUB")

The hill country is primarily composed of rough pastures of mainly exotic species with a variable shrubland presence, merging into shrublands and scrub, particularly in the middle and west of the ecological district. The eastern third of the ecological district, south of the Wairau River, generally lacks any native woody vegetation. Matagouri, *Coprosma propinqua*, tauhinu and, away from the western areas, *C. crassifolia*, make up the bulk of the shrubland vegetation.

KANUKA FORESTS WITH BROADLEAVED AND BEECH MOSAICS

On the hill country to the south of the District, locally extensive kanuka forests exist in the Goat Stream, Wye River and Boundary Creek catchments that run from valley bottom to ridgeline. Lancewood is locally co-dominant across large areas, merging into lancewood associations and mixed broadleaved-beech forest along gullies, valley bottoms and lower side slopes. Black beech, red beech, broadleaf, putaputaweta and *Coprosma linariifolia* components of mixed broadleaved-beech forest are typical, with mahoe, akiraho, cabbage tree and kohuhu becoming increasingly scarce to the west. Lemonwood and narrow-leaved lacebark are very local. Red beech tends to occur at higher elevations than black beech but there is considerable overlap. A number of very small pockets of matai and Hall's totara also still survive in deeply incised gullies, the very last remnants of once extensive podocarp forest cover.

UPLAND SHRUBLAND COMMUNITIES

The upland shrublands at the highest elevations locally include *Dracophyllum filifolium*. These merge into locally extensive upland rocklands and, on the Raglan Range, screes and sub-montane herbfields. Wilding exotic conifers pose a considerable threat in the uplands.

SPECIAL FEATURES

Despite the history of tremendous modification by people, there are several features worthy of celebration.

NATIVE FLORA

- Nationally threatened plants found in the ecological district during the survey include the sedge *Carex inopinata*, the willowherb *Epilobium chionanthum*, the shrub *Teucridium parvifolium*, the mistletoes *Tupeia antarctica* and *Korthalsella salicornioides*, white fuzzweed (*Vittadinia australis*) and the local endemic daisy *Celmisia insignis*.

- The dwarf broom *Carmichaelia corrugata* and the sedge *Carex inopinata* both reach their northern limits in the ecological district. Coral shrub (*Helichrysum coralloides*) is at its northern limit, either in Hillersden Ecological District or the adjacent Waihopai Ecological District.

NATIVE FAUNA

- Birds listed as nationally threatened that are found in the ecological district are black-billed gull, black-fronted tern, grey duck, banded dotterel, black shag, kereru (NZ pigeon) and NZ falcon (karearea or sparrowhawk).

- Native bird species commonly recorded in forest areas during the survey were bellbird, grey warbler, brown creeper, silvereye and fantail. South Island tomtit was present locally. Rifleman was recorded in only one location, South Island robin in two, kereru in four, and tui in five. A ruru (morepork) was heard once, although this species is likely to be more common that this indicates because of its nocturnal nature. Kingfisher was noted along one forest stream.
- Upland grasslands, shrublands and rocklands revealed low numbers of native species, with only Australasian harrier hawk (kahu) common. Pipit was scarce, and falcon was seen singly on only seven occasions.
- Wetlands are few and small in size and birds were rarely associated with them as such. Pukeko were seen at only three sites.
- Riverbeds were not surveyed to a great extent. However, the bird life of the Wairau River is well known. There are large populations of breeding black-fronted tern and black-billed gull (classified as "chronically threatened, serious decline"), and notable numbers of breeding banded dotterel (classified as "chronically threatened, gradual decline"), South Island pied oystercatcher, pied stilt, black-backed and red-billed gulls. Black shag and little shag breed locally. The Wairau River has one of the largest breeding populations of black-fronted tern which is in serious decline nationally. Backwaters support numbers of grey teal and grey duck/mallard. Welcome swallow frequents the open riverbed as well as other open habitats. Spur-winged plover and paradise shelduck use the river margins, braids and adjacent alluvial pastoral flats. Caspian tern and white-faced heron are occasional along the Wairau riverbed.
- There are records of only two lizard species in the District, common gecko (*Hoplodactylus maculatus*) and common skink (*Oligosoma nigriplantare polychroma*).
- Twelve species of native freshwater fish have been recorded in the ecological district. Three are listed as nationally threatened: dwarf galaxias, lamprey and longfin eel. Four species – dwarf galaxias, alpine galaxias, northern galaxias and upland bully – are non-migratory and may be genetically isolated in their catchments, differing from other populations. The Wairau River catchment, the mid reaches of which flow through the ecological district, is considered to be of regional importance for freshwater fish and habitat diversity. All watercourses drain into the Wairau catchment. Recent fish surveys on the tributary streams and rivers that drain the true right have located seven species including alpine galaxias. Significant lengths of Boundary Creek and Parker Stream (Wye River) pass through native forest that would have been the original natural situation for all the streams in the ecological district prior to human arrival. These are the very last sizeable remnants of forested stream courses and are therefore of unique value.

HILLERSDEN ECOLOGICAL DISTRICT – PHOTO ESSAY

WAIRAU RIVER -

The largest river in Marlborough and one of the country's unique braided river systems. This type of habitat supports large breeding populations of river dependent birds, including the nationally important black-fronted tern and regionally important black-billed gull, black-fronted dotterel, pied stilt, and black-backed gull.

UPPER WAIRAU FAULT WETLAND -

A group of six small wetlands of moderately low fertility are a feature of the Wairau River terrace faults in the Hillersden Ecological District. Each has unique elements – this is the only one on a low terrace and supports several threatened plant species.

PARKER STREAM –

This site is a large area of an upper catchment with a diverse range of vegetation types and plant species including 50 species of trees and shrubs and 33 species of ferns. Remnants of red beech, black beech and Halls totara occur within the predominantly kanuka forest. The site is large enough to support bird species like South Island robin, kingfisher and eastern falcon, all of which are relatively rare in the ecological district.

HAYCOCK RIDGE –

An example of the shrub-rocklands which are found along the highest ridgelines in this Ecological District and provide habitat for a range of plant communities.

SUMMARY OF ECOLOGICAL SURVEY RESULTS

As outlined for each ecological district above, a variety of native ecosystems remain on private land throughout South Marlborough. Despite the high degree of past modification and loss of the original vegetation cover and native wildlife, there are still excellent opportunities for ecological protection, enhancement and restoration. Opportunities for conservation range from protecting small remnants of special plants to managing extensive tracts of land in a way that balances both conservation and production values.

Table 10 shows the number of properties surveyed in each ecological district, along with the number and total area of sites.

Overall, a good proportion of landowners voluntarily participated in the ecological surveys, although the Waihopai and Flaxbourne rates of participation were only about 55%.

265 sites were identified with a combined area of 21, 240 hectares, or approximately 6.6% of the total land area of the combined ecological districts.

TABLE 10 - SUMMARY OF ECOLOGICAL SURVEY RESULTS

Ecological Districts	No. Properties Surveyed	No. Properties Declined	No. of Sites	Combined Area (ha)	% of total land area
Kekerengu	18	3	55	1340	4.3 %
Medway	13	3	70	4656	14.6 %
Waihopai	18	15	55	5274	5%
Blenheim	11	1	9	268	<1%
Wither Hills	18	7	13	4905	16 %
Grassmere	9	4	10	152	<1%
Flaxbourne	21	14	24	1165	4.1%
Hillersden	27	4	29	3660	7.5%
Totals	**135**	**51**	**265**	**21420 ha**	**6.6% (average)**

Table 11 shows the main ecosystem types identified, and their distribution and extent across the eight ecological districts. The sites together contain most of the remaining high-value habitats for native fauna and flora in the lowlands and mid-altitude lands of South Marlborough.

TABLE 11 - ECOSYSTEM TYPES - DISTRIBUTION AND EXTENT (HECTARES - PRIVATE LAND ONLY)

Ecosystem Type	Kekerengu	Medway	Waihopai	Blenheim	Grassmere	Wither Hills	Flaxbourne	Hillersden	Totals (ha)
Rarangi Beach system				200					200
Inland wetland	2		59	65	21		27	6	180
Coastal wetland	21				12				33
Coastal dunes	53				33				86
Coastal rock	20								20
Kanuka forest	66	1090	1370	4		3795	550	2470	9345
Manuka forest	2	17	21						40
Riverbeds/Riparian	63	746	400			3			1212
Rock, cliff, scarp	99	203	338			42	160		842
Limestone	133	613							746
Silver tussock	51	260	1069				120	470	1970
Shrublands	354	125			35	1050	216	645	2424
Beech forest		1432	1583						3015
Broadleaved (coastal)	266				20				286
Broadleaved (inland)	60	45	109		31	15	92	69	421
Podocarp	145								145
Treelands	5	2		0.2					7.2
Subalpine shrublands		123	325						448
Totals (ha)	**1340**	**4656**	**5274**	**269.2**	**152**	**4905**	**1165**	**3660**	**21420.2**

CHARACTERISTICS OF REMAINING ECOSYSTEMS

The sites identified by the survey extend from the coast to the inland mountains, and the ecosystems include shore communities, wetlands, riparian communities, rock outcrop and cliff communities (including distinctive limestone areas), tussock grasslands, dry shrublands, lowland forest remnants, regenerated forests and inland/upland forests.

Some ecosystem types have been severely depleted, for instance inland wetlands and podocarp and broadleaved forests. Others like kanuka forest, shrublands and silver tussock, have probably increased in area, as these species regenerate following fire-induced land clearance, replacing the original forest where pasture cover cannot be maintained.

Sites range in size from less than one to hundreds of hectares but the majority are small remnant areas. Most common are secondary gully forests and shrublands that are protected by steep slopes along a stream, or occupy shaded slopes that are less favoured for grazing. Bluffs, isolated rock outcrops and cliffs along streams and the coast, are sites where original species have survived fire and grazing.

Some of these sites are clearly under stress. Two features that are indicators of this are evident. Firstly, often a site is dominated by one species such as kanuka, akiraho or tauhinu, since only the very best adapted species (drought tolerant and unpalatable) can survive. Secondly, other species will be present but occur in very low numbers, for instance beech or totara. A single individual might survive miles from its nearest neighbour, indicating that local extinction is happening over time.

In spite of all this, owing to the complexity of the landscape there is a surprising degree of diversity and, often, whole properties have a high degree of natural character. This means that there are widespread sources for species to regenerate and the potential for survival and recovery is considerable. The more common types of vegetation are able to sustain themselves within normal farming practice by maintaining a mosaic with productive species: kanuka, manuka, tauhinu, matagouri, coprosma scrub, common native broom and coastal shrub daisy are examples.

One of the most important reasons why the South Marlborough area can maintain a good degree of diversity is the wide occurrence of places where fire, stock and wild animals cannot reach, for instance rocky outcrops, river gorges and coastal cliffs. Such places have notably greater species diversity because they have remained less disturbed for longer periods. Examples include ngaio surviving on coastal cliffs or river gorges. A small population of kawakawa, a species no longer found anywhere else in the northern Kekerengu ecological district, is found growing on a bluffy area. More significantly, the open rock habitat is the home of scattered populations of most of the local endemic Marlborough plants such as pink broom, rock daisy, NZ lilac (*Heliohebe hulkeana*) and shrub groundsel (*Brachyglottis monroi*). These are plants of great importance. Throughout the area there are a few places where larger populations occur. For instance the shrub groundsel has in most places been eradicated by goats, but there is a very good population found in a Medway gully system. This same stream is also home to the largest population of lancewood found through the survey, probably because a few adults from the original forest have been able to survive. Sometimes a relict stand of original trees is protected from fire by a boulder field composed of rocks that have fallen from bluffs above them, notably broadleaf and akiraho.

Limestone gorges and bluffs are especially important. Owing to its highly erodible character limestone can be cut to form spectacular gorges which, while sheer, can also form ledges where plants grow well. Remnants of more common species such as totara, titoki and kaikomako survive in these places, as well as a range of calcicols (species that prefer soil high in calcium). Among these are very local species like *Wahlenbergia matthewsii*. *Senecio hauwai* is a calcicol that grows only on the soft mudstone cliffs near Cape Campbell. These are examples of the importance of soil type in the flora of the area.

Because the climate of the north-east can be extremely dry, many widespread species that are common in surrounding districts, are rare. Prominent in this category are lowland forest trees and shrubs such as silver tree fern, lemonwood, rangiora and tree fuchsia. These species are not mentioned in lists of rare species on a regional basis but they add special character at a local scale. When a picture of plant distribution is built up, the existence of a single individual of an otherwise common species can make a site especially important. A kowhai on Mt Misery in the far north-east is notable, even though kowhai becomes common further inland. A cluster of black beech in Tachalls Creek inland from Ward represents the most low altitude specimens in the area. A single nikau in the lower Woodside Creek is a link between populations at Tuamarina to the north and the Kaikoura coast to the south.

The characteristic of local rarity underscores an important ecological principle that is a feature of this area: when extremes such as drought are experienced, very small habitats created by moisture, temperature or substrate become vital for maintaining species diversity. There are transitions in species composition from the coast inland and from low altitude to high altitude. These changes reflect shifts in the amount of rainfall and mean annual temperature, making almost every patch of natural habitat slightly different from the next.

CONSERVATION MANAGEMENT ISSUES

Understanding which habitats and species are present is the first step in securing their survival. The second step is to identify what is needed for survival both in terms of natural processes such as regeneration, and also the modification or removal of factors that threaten survival. The third step is to provide the means to achieve these changes.

Loss of natural vegetation following centuries of fire is undoubtedly the most important factor in creating the present pattern of small isolated remnants, including remnants of secondary vegetation. The removal of forest has now largely ceased, and in places where land has been retired, some very impressive patterns of regeneration are occurring.

FENCING AND STOCK

Domestic stock (sheep, cattle and deer) in general destroy native vegetation and undergrowth - particularly in forest and wetland sites - and prevent regeneration. This occurs through grazing, trampling (especially in wet areas) and opening up places for weed invasion. As older plant individuals die they cannot be replaced and species gradually become locally extinct in this way. Given the location of natural remnants within a productive farming landscape, the fencing of wetlands, gully forests and shrublands on shaded slopes, is essential if long-term survival of indigenous plant communities is the aim. Fencing is proceeding in several key sites and in many instances can provide benefits for both the farming operation and conservation. However, in situations where severe weeds such as old mans beard and wilding pines are present, continued grazing by stock is preventing proliferation of the weeds and is therefore beneficial for the time being. Occasional grazing in some sites is also beneficial for management of rank grass, particularly where the grass overtops slower growing native communities. The maintenance of silver tussock grasslands and dry shrublands is generally compatible with stock presence, except where cattle numbers are intense.

FERAL ANIMALS

Feral pigs, deer, possums, rabbits and hares are present, to varying degrees, over much of the South Marlborough area and are responsible for damage to native vegetation and prevention of regeneration. There is some control carried out on most properties, although this is very variable. Goats are more widespread, roving over large areas, and effective control would require a collaborative and coordinated control programme. In particular, targeted control of goats, possums and hares in and around important bluff and rock habitats, would be beneficial.

Mustelids (ferrets, stoats and weasels), rodents (rats and mice), feral cats and hedgehogs also occur throughout the South Marlborough area and, as in the rest of New Zealand, they are largely uncontrolled and are responsible for great damage to the small native fauna (birds, lizards and larger invertebrates).

WEEDS

Weeds pose local threats to survival in some instances.

Old mans beard is a major problem in some areas, actively smothering vegetation and providing a challenge to control given its ability to seed and spread profusely and the fairly long life of its seed in the ground. It is beyond the capacity of individual landowners to control in several places, even though biological control agents are present and are having some effect. The Council has carried out a detailed survey of its distribution and intensity and is considering options for targeted control in important sites.

On the coast, marram grass has invaded most dune systems and is a major threat to the last remnants of native sandbinding vegetation and the mat daisy populations. Local control will be necessary for these special communities to survive long into the future. Exotic iceplant (*Carpobrotus edulis*) requires localised control as it is invading the best remaining coastal stonefield ecosystem, smothering the native plants.

Wilding pines are scattered throughout most rocky areas and rough hillslopes. They are capable of growing from sea-level to 1000m altitude and with an increase of forestry as a land use are likely to be more prevalent in future. While relatively easy to control in the early stages, they have the potential to rapidly proliferate and destroy the integrity of native vegetation.

Broom is common in places and can invade bluffs preferred by many of the endemic plants. Cotoneaster, buddleia, gorse, hawthorn, barberry, willows, Himalayan honeysuckle, sweet brier and blackberry are localised but widespread weeds and require vigilance. For some of these weeds, exclusion of stock and prevention of fire and other disturbance, may be sufficient for the regeneration of native vegetation to prevail.

Insect pests can be a local problem. For instance, mealy bugs appear to be responsible for the death of cabbage trees, and scale insects of rock daisy, in some areas.

FIRE

Natural fires would have been a feature of South Marlborough in the past. They would not have been very frequent, but sufficiently so to maintain considerable areas of successional (seral) vegetation. Burning is a traditional technique for clearing silver tussock, bracken and dry shrubland on hill farms in South Marlborough. So long as it is used sparingly, is not too intense and takes place after natural seedfall, it can be compatible with the long-term maintenance of this type of native vegetation in the landscape. However, the careless use of fire can be detrimental, especially given the extremely dry conditions that can occur.

FARM DEVELOPMENT AND SUBDIVISION

Intensification of farming, changes in land-use and land subdivision are pressures within parts of the South Marlborough area. They can pose threats to remaining native vegetation and natural habitats. However, if designed with an ecological awareness and healthy biodiversity in mind, these changes can be positive for both conservation and productivity.

WATER ABSTRACTION

With intensification of lowland land-use, particularly for viticulture, the demand for water is putting great pressure on what is a very precious commodity for conservation in a naturally dry landscape. The increasing use of dams to capture and store water has potential to drown the remnant habitats in gullies and limit flows downstream. Proposals to divert the flows of rivers, for instance for power generation or irrigation, can be a serious threat to the fauna and flora that rely on the aquatic and braided gravel systems. The well-being of rare fish and birds could also be under threat. Retaining sufficient water to maintain smaller wetlands is a challenge in places.

CONSERVATION OPPORTUNITIES

PROTECTION

Many private landowners in South Marlborough support the concept of protection of natural values on their land. Prior to the carrying out of the ecological surveys some landowners were already protecting special sites. A number of new initiatives are now underway following the surveys. These include formal conservation covenants through the QE II National Trust, management agreements, fencing, weed control and animal pest control, usually to the benefit of farm management and productivity, as well as to farm ecology.

There are proven methods that can be applied to diminish or remove most of the existing threats to natural sites and values, although some pest and weed issues are major challenges. Some of these threats are beyond the resources of private landowners and are a matter of regional concern. These include old mans beard, wilding pines and feral possums, goats and pigs. The Council recognises this and is investigating the control of old mans beard, goats and wilding pines in some areas. It is already involved in widespread possum and ferret control along with the Animal Health Board.

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

Potential alternatives to pastoral farming or forestry for deriving an income from the hill country, are being developed. These may be relevant to Marlborough in the future. They include earning "carbon credits" through fostering the regeneration of native forest to capture carbon dioxide from the air and sequester it in growing forests that have long-term security. This may be an option for the more fertile lowland parts of the South Marlborough area with a high rainfall, and is already underway in North Marlborough. Also 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 matagouri, kanuka and manuka vegetation.

RESTORATION

A number of ecosystem types are very depleted and many remaining sites are small and fragmented. Although there is a natural ability of many species to regenerate given the right circumstances, some species cannot, simply because they are too few in number, sometimes down to single individuals. In many cases the propagation and replanting of plants is needed to establish a centre from which natural regeneration is possible. Sometimes species known to have been in an area have gone and need assistance to return. Lowland totara near Cape Campbell is an example.

A landscape approach to restoration, whereby fragmentation is gradually reduced, is an important principle, building on the natural tendency for forest to regenerate along streams. Because of the high degree of endemism and the extreme climatic conditions, ideally only locally sourced plant material should be used. That way the particular characteristics of the ecological district will be retained, and the restoration is more likely to succeed, as plants should be suited to the local conditions.

There are good opportunities for ecological restoration throughout South Marlborough. These include:

- re-watering and planting around wetlands (native trees including cabbage tree 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 shrubby tororaro (*Muehlenbeckia astonii*), fierce lancewood (*Pseudopanax ferox*), mistletoes, coastal tree broom (*Carmichaelia muritai*), weeping broom (*C. stevensonii*) and pink brooms (*C. glabrescens* and *C. carmichaeliae*);
- restoration of shrublands, forests and tussock grasslands through encouragement of regeneration;
- planting to enhance and complement bush and shrubland remnants, for instance totara and black beech; and,
- intensive local control of animal pests to encourage the return of native birds and other small fauna.

ECOLOGISTS' CONCLUSIONS AND RECOMMENDATIONS

The survey has shown that many private landowners in South Marlborough support the concept of protection of natural values on their land. The voluntary, supportive and non-regulatory partnership approach adopted by the MDC 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 conservation covenants, management agreements, fencing, weed control and animal pest control, usually to the benefit of farm management and productivity as well as the natural values on the property.

It is recommended that the established follow-up process, through the MDC'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 South 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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APPENDIX ONE: CRITERIA FOR ASSESSMENT OF AREAS OF ECOLOGICAL SIGNIFICANCE

A: MARLBOROUGH DISTRICT COUNCIL ECOLOGICAL ASSESSMENT CRITERIA

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 considerable human assistance to maintain its ecological integrity and processes.

B: DEPARTMENT OF CONSERVATION PROTECTED NATURAL AREAS PROGRAMME ASSESSMENT CRITERIA

The following selection criteria are based on those described for the PNAP selection criteria described by Myers, Park and Overmars (1987) and were used to assess each natural area for its suitability as a recommended area for protection (RAP):

Representativeness:

The extent to which an area represents or exemplifies the components of the natural diversity of an Ecological District.

Diversity and Pattern:

Natural diversity refers to the range of the natural physical and biotic components in the landscape including species, plant and animal communities, ecosystems, landforms, soil sequences and dynamic systems and processes. Pattern describes the arrangement of species, communities and habitats according to spatial and environmental gradients.

Naturalness:

A measure of how close an area approximates its pre-human condition; associated with this is the degree to which exotic plant species are a component in the area.

Rarity and Special Features:

Rarity is a measure of the paucity of numbers or occurrences of elements of natural diversity (e.g. species, communities). The categories of nationally threatened plant and animal species used in this report are those currently used by the DoC (Molloy et al. 2002). Special features include additional biotic and abiotic features of significance such as species with limited distributions, local rarity, type localities, spectacular or unusual geological landform features.

Size and Shape:

The size and outline of a protected area may affect the ultimate success of maintaining viable community samples. Generally, large areas are more viable than smaller ones and the best shape is that with the smallest perimeter. These provisions need to be assessed against the provision of natural barriers present in the area such as waterways and ridges, and the requirement of buffering or edge effects.

Long-term Viability:

The degree to which an area is able to retain its inherent natural values over time. This includes its autonomy and self-regulating capacity, and an ability to resist direct and indirect human effects.

Fragility and Threat:

An assessment of the vulnerability of, and threats to, the significant features of an area. Fragile ecosystems in New Zealand include wetlands and sand dune systems.

Buffering:

The inclusion of perimeter barriers such as modified forest or scrub, may be beneficial for the long-term effective functioning of a natural] area by reducing external influences.

APPENDIX TWO: NOTABLE PLANTS OF SOUTH MARLBOROUGH

NOTABLE PLANTS OF SOUTH MARLBOROUGH: THREATENED PLANTS, DISTRIBUTION LIMITS, REMNANTS AND ANOMALIES

This is a selection of the key plant species that stand out in South Marlborough for their rarity, threatened status, unexpectedness, remnant status or representing extremes of geographic distribution. It is not meant to be a comprehensive distribution map for each species, rather a series of botanical highlights for the South Marlborough area. It is based on:

- North, M. 2004. Wairau Ecological Region – Blenheim, Grassmere, Flaxbourne, Wither Hills and Hillersden Ecological Districts. Survey report for the Protected Natural Areas Programme. Occasional Publication No. 60. Department of Conservation, Nelson (PNAP report).
- Simpson, P. 1991. The characteristics, condition and conservation needs of indigenous vegetation in the lower Wairau catchment, Marlborough. Department of Conservation & Nelson-Marlborough Regional Council.
- Other observations from the SNA surveys.

Threatened status shown in “inverted commas” taken from:

- de Lange, P.J. et al. 2004. Threatened and uncommon plants of New Zealand. NZ Journal of Botany 42: 45-76.

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 MARLBOROUGH

	COMMON NAME	BOTANICAL NAME		
1	Kahikatea	*Dacrycarpus dacrydioides*	D, R	A rarity in South Marlborough
2	Climbing groundsel	*Brachyglottis sciadophila*	T	"Chronically threatened, gradual decline" - very rare in Marlborough
3	Swamp maire	*Syzigium maire*	R	A rarity in South Marlborough
4	Weeping tree broom	*Carmichaelia stevensonii*	T, R	"Chronically threatened, gradual decline" - Nationally rare South Marlborough endemic
5	Fierce lancewood	*Pseudopanax ferox*	T	"At risk – sparse" - regionally unusual
6	Native verbena	*Teucridium parvifolium*	T	"Chronically threatened, gradual decline" - Nationally rare, regionally unusual
7	NZ lilac	*Heliohebe hulkeana*	D	South Marlborough endemic, distribution limits (northern, inland)
8	Leafless clematis	*Clematis afoliata*	D	Distribution limits (northern, inland)
9	Small-leaved clematis	*Clematis quadribracteolata*	A, D	Regionally uncommon
10	Tarata (Lemonwood)	*Pittosporum eugenioides*	D	Common nationally, rare in South Marlborough
11	Narrow-leaved lacebark	*Hoheria angustifolia*	D, R	Common nationally, rare in South Marlborough
12	Lowland totara	*Podocarpus totara*	D, R	A rarity in South Marlborough though common in the past
13	Matai	*Prumnopitys taxifolia*	D, R	Uncommon in South Marlborough
14	Kaikomako	*Pennantia corymbosa*	D	Common nationally, rare in South Marlborough
15	Titoki	*Alectryon excelsus*	D	Common nationally, rare in South Marlborough
16	NZ passionvine	*Passiflora tetrandra*	D	Common nationally, rare in South Marlborough
17	Ngaio	*Myoporum laetum*	D	Common nationally, rare in South Marlborough
18	Rangiora	*Brachyglottis repanda*	D	Common nationally, rare in South Marlborough
19	Marlborough rock daisy	*Pachystegia insignis*	D	South Marlborough endemic, distribution limits (northern, inland and upland)
20	Indeterminate mapou	*Myrsine montana*	A	An uncommon plant
21	Wire plant	*Muehlenbeckia ephedroides*	T, D	"At risk, sparse" - A dryland plant, rare in South Marlborough
22	Shrubby tororaro	*Muehlenbeckia astonii*	T, R	"Acutely threatened, nationally vulnerable"
23	Hector's tree daisy	*Olearia hectorii*	T	"Acutely threatened, nationally vulnerable", very rare in South Marlborough
24	Red rock daisy	*Pachystegia rufa*	D	Found only in the Haldon Hills
25	Pink broom	*Carmichaelia carmichaeliae*	T, D	"Nationally vulnerable" - South Marlborough endemic, distribution limits
26	Coastal tree broom	*Carmichaelia muritai*	T, D	"Nationally critical" - South Marlborough endemic, distribution limits
27	Cockayne's daisy	*Celmisia cockayniana*	D	South Marlborough endemic, distribution limits

	COMMON NAME	BOTANICAL NAME		
28	Prostrate kowhai	*Sophora prostrata*	D	South Island dryland plant, distribution limits (northern, inland)
29	Coral shrub	*Helichrysum coralloides*	D	South Marlborough endemic, distribution limits
30	Grassy mat sedge	*Carex inopinata*	T	"Acutely threatened, nationally endangered"
31	Scented shrub daisy	*Olearia odorata*	D	Nationally common, unusual in South Marlborough
32	Nikau palm	*Rhopalostylis sapida*	D	Rare in South Marlborough though common nationally
33	Lowland ribbonwood	*Plagianthus regius*	D	Common nationally, rare in South Marlborough
34	Black beech	*Nothofagus solandri*	D	Common nationally, rare in South Marlborough
35	Hinau	*Elaeocarpus dentatus*	D	Common nationally, rare in South Marlborough
36	Tree hebe	*Hebe parviflora*	D	Reaches national southern limit on Kekerengu coast
37	Coastal mat daisy	*Raoulia* aff. *hookeri*	T, D, R	"Chronically threatened, gradual decline" - Regionally and nationally rare
38	Pingao (Golden sand sedge)	*Desmoschoenus spiralis*	T, D, R	"Chronically threatened, gradual decline", formerly very common
39	Sand tussock	*Austrofestuca littoralis*	T, R	"Chronically threatened, gradual decline"
40	Yellow mistletoe	*Alepis flavida*	T, R	"Chronically threatened, gradual decline" - very rare in Marlborough
41	Pate	*Schefflera digitata*	D	Common nationally, rare in South Marlborough
42	Puka	*Griselinia lucida*	D	Common nationally, rare in South Marlborough
43	Mamaku (Black tree fern)	*Cyathea medullaris*	D	Common nationally, rare in South Marlborough
44	Ponga, Silver fern	*Cyathea dealbata*	D	Common nationally, rare in South Marlborough
45	Slender coprosma	*Coprosma virescens*	D	Common nationally, rare in South Marlborough
46	Dwarf mistletoe	*Korthalsella lindsayi*	D, A	Rare in South Marlborough
47	Ranunculus macropus	*Ranunculus macropus*	T	"Chronically threatened, gradual decline"
48	Swamp nettle	*Urtica linearifolia*	T	"Chronically threatened, gradual decline"
49	Mazus novaezeelandiae ssp impolitus	*Mazuz novaezeelandiae* ssp *impolitus*	T	"Chronically threatened, serious decline"