Native vegetation remnants of the mid-south Canterbury coast

Mark Davis
Environmental consultant, Christchurch

Introduction

This project was commissioned by the Raukapuka Area Office (Geraldine) of the Department of Conservation. Its purpose was to undertake a reconnaissance survey of remnant native habitats between the Rakaia and Waitaki Rivers, and describe these values in a report. Key sites were to be identified and their values summarised so they could be re-visited and assessed in detail in the future. The rationale for the project was that there was limited knowledge about the ecological values of this coastline, and that known remnants were being lost to coastal erosion and development.

This paper draws extensively from an unpublished report about this coast (Davis 2011). All naturalised plants are denoted by an asterix except where their common names are used.

Methods

Prior to field work being undertaken, field notes from an earlier coastal resource investigation (Davis 1986) were reviewed to identify any remnants noted at that time. Google Earth was then used to confirm possible habitats, but this was of limited value due to poor quality images and because it was apparent that much coastal development had occurred since 1986. Consequently it was decided to simply traverse the coast on an ATV, assessing undeveloped dongas and other potential habitats as they were encountered. The field work was undertaken from January-February 2009, and February-April 2010.

Dongas are coastal gullies that characterise this coastline. Small dongas are formed as a result of water moving underground through different layers of gravels and sediments, then percolating out through coastal cliffs, causing back-cut erosion. On older outwash surfaces dongas were probably active through glacial and post-glacial periods. The larger dongas were characterised by surface streams that were often sourced from springs, though underground water movement may also have contributed to their formation. Dongas continue to be formed by high rainfall events initiating their development on coastal cliffs or benches (Trevor Webb, pers. comm. 10 Sept 2013).

This approach was relatively effective, though it is acknowledged that some cliff top remnants or notable plants are likely to have been missed where access was not available from the beach or adjoining dongas. Aside from this, it was impractical to visit all cliff tops and many are on private land.

Occasionally sites were targeted because of known habitats, e.g. dongas near the Waitaki River, and access permission was sought to visit these sites.

Where remnant habitats or notable species were found, their locations were identified by GPS waypoints. Information about threats and land uses was recorded in a summary spreadsheet and digital photos were taken to illustrate what was described.

The main river mouths (including the Opihi system) were not assessed because of the relatively large areas involved and because their ecological values are described by several existing reports or databases (e.g. Johnson 1992, Steven & Meurk 1996). Wainono Lagoon was not surveyed because of its large size and because it is largely protected. Caroline Bay was not surveyed because of its modified nature and intensive use.

Results

The native vegetation of the coast is summarised below on the basis of habitat types. Only the most important sites are included, given the large amount of information collected.

Mixed gravel and sand rearbeaches

While the beaches of this coast are described as shingle or gravel beaches, they are invariably comprised of mixed gravel and sand, the proportions of which depend on their locations. Adjacent to cliffs the rearbeaches support very little vegetation due to exposure from storm waves. There are, however, other rearbeaches that do support native vegetation.

The best example occurs near Wainono Lagoon where the gravel rearbeach is characterised by large flattened cobbles that support prostrate shrublands. These shrublands are largely comprised of at risk *Muehlenbeckia ephedroides*, *M. complexa*, *M. axillaris*, *Plagianthus divaricatus*, *Calystegia tuguriorum*, exotic grasses and lupin. Other prominent plants are *Plantago lanceolata**, *Cirsium arvense**, *Carduus nutans**, *Achillea millefolium**, *Papaver rhoeas**, *Echium vulgare**, *Galium aparine** and *Senecio glomeratus*. Skinks are present among the shrubs and the lichen/moss-encrusted cobbles.

A little further north, near the Makikihi River, the rearbeach has finer stones and supports extensive *Epilobium microphyllum* among the cobbles, with *Crassula moschata* and *Calystegia soldanella*. Despite lupin being present, *Epilobium microphyllum* and *Calystegia soldanella* can often be the dominant plants here.

Elsewhere any vegetation that occurs on the rearbeaches tends to be largely exotic, with only a few scattered native plants such as *Calystegia soldanella*, *Carex pumila*, *Sarcocornia quinqueflora* and *Isolepis nodosa.*

Sand dunes

Sand dunes or low dune undulations are found immediately south-west of the Rakaia River, and from Kapunatiki Creek to Seaforth Beach. Smaller areas are found on some beaches adjacent to rock reefs south of Timaru.

Low dunes occur immediately south-west of the south Rakaia huts and extend for about 3 km before merging into a low coastal bank. These dunes are dominated by exotic plants such as marram grass, lupin, boxthorn and a variety of herbs. They do, however, support a substantial population of at risk *Poa billardierei* (sand tussock) and a population of about 100 plants of at risk *Ficinia spiralis* (pingao). Other native plants include locally abundant *Carex pumila*, *Calystegia soldanella*, and *Isolepis nodosa*. Sand tussock is dispersed intermittently down the coast for many kilometres on sandy patches on the coastal bank and in the mouths of some dongas (Fig. 1). The total population is estimated to be in the order of 500-550 plants. Johnson (1992) notes that Zotov collected *Poa billardierei* at Wakanui Beach.

Elsewhere, dunes are strongly dominated by marram grass and lupin, the only common native plant being *Calystegia soldanella.*

Coastal cliffs and banks

The main areas of this habitat type occur between the Rakaia River and Kapunatiki Creek, between Timaru and Otaio Beach, and from Morven Beach to the Waitaki River. The loess and gravel banks vary from <1 m to a few metres high, while the gravel and loess cliffs are up to about 12 m high. A tiny area of basalt cliffs occurs on the north side of Timaru city.

Between the Rakaia and Rangitata rivers, low coastal banks, exposed donga spurs and donga mouths sometimes support remnant native habitat characterised by *Zoysia minima*, *Crassula moschata*, *Calystegia soldanella*, *Poa cita*, *Raoulia australis*, mosses, lichens, at risk *Colobanthus brevisepalus* and rare *Ranunculus acaulis* and threatened *Atriplex buchananii* (Fig. 2).

Most sites exposed to salt spray are dominated by *Plantago coronopus** and exotic grasses, though *Colobanthus brevisepalus* sometimes occurs in these habitats with *Leptinella dioica,* rare *Selliera radicans*, and rare *Triglochin striata*.

Cliff tops are dominated by exotic grasses, gorse or marram grass. Depending on the substrate, native plants are sometimes present such as *Muehlenbeckia complexa*, *M. axillaris*, *Calystegia soldanella*, flax (*Phormium tenax*), bracken and rarely silver tussock (*Poa cita*). The cliff faces normally provide habitat for few plants except around the Timaru coast and between Timaru and St Andrews. Immediately south of Timaru the loess cliffs are less steep and notable for large mats of *Muehlenbeckia complexa* and *Disphyma australe*, which in some places cover more than two thirds of the cliff face. Scattered flax, patches of *Puccinellia stricta* and *Leptinella dioica* are also present in places. These plants provide a useful indication of the vegetation that would originally have occupied these cliffs.

Figure 1 Part of a large population of at risk *Poa billardierei* at the sandy mouth of a donga.

Figure 2 The threatened *Atriplex buchananii* on an exposed coastal bench.

Figure 3 Buried forest exposed by sea erosion at Seadown-Seaforth beach.

Figure 4 A typical example of a large dryland donga, this one occurring on the Ashburton Coast.

Loess cliffs near St Andrews are of interest as old tree branches and trunks protrude from the cliff face indicating the remains of former native forest. These may be of paleontological value for helping to clarify what native forests were originally in the area. A breeding colony of spotted shag also occurs near St Andrews. Note that forest remains have also been exposed by coastal erosion at Pareora beach and Seaforth beach (Fig. 3).

The volcanic Dashing Rocks at Timaru are interesting as there is no other place of similar character along this coast. The basalt rocks occur in columns which are partly overlain by loess. At the base of the cliff, rock platforms and sand patches provide limited habitat for salt-tolerant plants including *Puccinellia stricta*, *Leptinella dioica*, *Plantago coronopus**, *Selliera radicans*, *Apium prostratum*, and rare *Spergularia media*. These tiny but interesting plant associations are indicative of the original vegetation on these rock platforms.

Dongas

Dongas are characteristic of the coast between the Rakaia and Rangitata rivers, and to a very limited extent between Morven Beach and the Waitaki River (Fig. 4).

Several of the northern dongas contain small remnants of dryland vegetation. Native plants include *Muehlenbeckia complexa*, *M. ephedroides*, *M. axillaris*, *Discaria toumatou*, *Melicytus alpinus*, *Carmichaelia australis*, *Einadia triandra*, *Geranium sessiliflorum*, *Raoulia australis*, *Leucopogon fraseri*, *Crassula moschata*, at risk *Convolvulus verecundus*, at risk *Acaena buchananii*, *Oxalis exilis*, *Calystegia soldanella*, mosses and lichens. Common exotics include grasses, gorse, *Plantago coronopus**, *Hypochoeris radicata**, *Aira caryophyllea** and sheep's sorrel. Native skinks were seen in some of these habitats.

Dongas with sandy mouths sometimes support patches of *Calystegia soldanella*, less common *Carex pumila*, sand tussock, rare *Raoulia australis* and very rare *Tetragonia implexicoma*.

Two large dongas immediately north of the Waitaki River were known to support important dryland remnants in the mid-1980s and they were revisited on this survey. The northern donga was dominated by rampant exotic grass growth caused by irrigation water, and its dryland character has largely been displaced. The southern donga supported the most extensive native coastal shrublands between the Waitaki and Rakaia Rivers (Davis 1986). Unfortunately this survey revealed its shrublands had recently been sprayed with herbicide, and then burned. An estimated 95% of the shrubs were dead, while some of the survivors were moribund (Fig. 5).

The main woody natives in these dongas were *Melicytus alpinus*, *Coprosma crassifolia*, *C. propinqua*, *Discaria toumatou*, *Carmichaelia australis*, *Muehlenbeckia complexa*, *M. axillaris*, and *Solanum laciniatum*. Other plants include *Calystegia tuguriorum*, *Parsonsia capsularis*, *Rubus squarrosus*, *Einadia triandra*, bracken, *Crassula sieberiana*, *Senecio minimus*, *Linum monogynum*,

mosses and lichens. At risk *Leptinella serrulata* was seen on a terrace tread with *Anthosachne solandri*, rare *Poa cita* and an unidentified *Rytidosperma*. No silver tussock or native grassland was seen on the donga floors as they are now dominated by exotic grasses.

Wetlands

Despite the levels of modification that characterise this coast, a number of remnant wetlands still remain. Except for those occurring on private land, all wetlands encountered were surveyed. As an example, Wainono Lagoon was not surveyed because of its size and access requirements across private land. Most of the remaining important wetlands are described below by wetland class.

Swamps

A small but impressive swamp occurs in a small donga near the Rangitata River (Fig. 6). It is about 150 m wide by 75 m deep and contains a relatively high diversity of wetland plants in the context of this coast. It is dominated by flax and *Carex secta*, while other native species include *C. geminata*, *Hydrocotyle novae-zeelandiae*, *Blechnum minus*, *Histiopteris incisa*, *Pteridium esculentum*, *Lemna minor*, *Austroderia richardii*, liverworts and at risk *Urtica linearifolia*. Common exotics include grasses, gorse, watercress, monkey musk and Californian thistle.

Ephemeral wetlands

Kapunatiki Creek meanders down a large donga, which is notable for containing a small ephemeral wetland. The wetland appears to be flooded occasionally by seawater from a rear beach blowout and perhaps by freshwater from the creek. Lower floodplain surfaces are dominated by exotic grasses and other herbs, but native species are locally prominent such as *Muehlenbeckia axillaris*, *Oxalis exilis*, mosses, threatened *Carex cirrhosa* and the at risk sea holly *Eryngium vesiculosum* (Fig. 7). Wetter areas support more native species that can be co-dominant with exotics. They include *Galium* aff. *perpusillum*, *Carex cirrhosa*, *Euchiton involucratus*, *Leptinella dioica*, *Lilaeopsis novae-zelandiae*, *Eleocharis acuta*, *Potamogeton cheesemanii*, *Montia fontana*, *Myriophyllum propinquum*, *Rumex flexuosus*, *Hydrocotyle sulcata*, *Carex gaudichaudiana*, *Centipeda aotearoana*, *Selliera radicans*, *Potentilla anserinoides*, and *Limosella lineata*.

Other ephemeral wetlands occur on the north side of the Orari River, and at Pig Hunting Creek. They were assessed through a district council survey and are not described here.

Shallow water (lagoons)

Lagoons that are not directly connected to rivers are characteristically brackish as indicated by the presence of salt tolerant plants. The main species observed in these lagoons is summarised below, though not all will be present at a single lagoon.

Figure 5 Sprayed shrublands in a donga near the Waitaki River.

Figure 6 A small but impressive swamp in a donga near the Rangitata River.

Figure 7 At risk sea holly (*Eryngium vesiculosum*) in an ephemeral wetland of the Kapunatiki Creek donga.

Figure 8 A large expanse of high quality herb turf saltmarsh adjacent to Wainono Lagoon.

Taller species of the margins include flax, raupo, *Plagianthus divaricatus*, *Bolboschoenus caldwellii*, *Schoenoplectus pungens*, *Apodasmia similis*, *Carex secta*, *C. geminata*, *Juncus edgariae*, and occasionally *Austroderia richardii*. Gently sloping shores often support herbs, such as *Plantago coronopus**, *Rumex crispus**, *Selliera radicans*, *Leptinella dioica*, *Atriplex prostrata**, *Chenopodium glaucum*, *Samolus repens*, at risk *Mimulus repens*, *Triglochin striata*, *Puccinellia stricta*, *Sarcocornia quinqueflora*, data deficient *Lachnagrostis littoralis* ssp. *salaria*, *Lilaeopsis novae-zelandiae*, *Isolepis cernua*, *Cotula coronopifolia*, *Juncus articulatus**, *Agrostis stolonifera**, *Ranunculus sceleratus** and *Festuca arundinacea**. Aquatic plants include *Azolla filiculoides*, *Lemna minor*, *Potamogeton cheesemanii*, and *P. crispus**.

The lagoons where these species were seen are Spider Lagoon, Prattley Road Lagoon, Washdyke Lagoon, Normanby Wetland and "Maori Road Lagoon" (2 km south of the Waihao Box).

Turf and herb saltmarsh

Salt-tolerant turf and herb communities are summarised where they are the primary vegetation type, rather than part of a wider mosaic of wetland vegetation.

Species characteristic of this wetland class include *Sarcocornia quinqueflora*, *Selliera radicans*, *Cotula coronopifolia*, *Leptinella dioica*, *Puccinellia stricta*, *Triglochin striata*, *Samolus repens*, *Chenopodium glaucum*, *Mimulus repens*, *Lachnagrostis littoralis* ssp. *salaria*, *Spergularia media*, *Lilaeopsis novae-zelandiae*, and *Crassula sinclairii*. Prominent exotics include *Atriplex prostrata**, *Plantago coronopus**, *Agropyron repens**, *Hordeum marinum**, and *Ranunculus sceleratus**.

The main examples of this wetland class occur at Pig Hunting Creek and in large fields on the north and south side of Wainono Lagoon (Fig. 8). They also occur in depressions and excavated land fronting stopbanks at Seaforth and Seadown beaches and south of "Maori Road Lagoon".

Threatened, at risk, and locally uncommon plants

Sixteen threatened, at risk and data deficient species were recorded during the survey (Table 1, p. 51). Their conservation status comes from de Lange et al. (2013).

In addition to their national conservation status, it is important to recognise the presence of locally rare plants. Habitat destruction or degradation has been pervasive, and this has resulted in an impoverished native flora. Despite this being a reconnaissance survey, an attempt was made to indicate which species are locally uncommon (Table 2, p. 52). It is acknowledged that some sites were visited only briefly and other potential habitats may not have been visited at all, e.g. some cliff tops and dongas.

Identifying the important habitats

In assessing the importance of habitats, the statutory context of National Policy Statements needs to be recognised in the coastal environment, i.e. the *New Zealand Coastal Policy Statement* (Department of Conservation 2010) and to a lesser extent, the *Proposed National Policy Statement on Indigenous Biodiversity* (Ministry for the Environment 2011). They define what constitutes significant areas of indigenous vegetation, and that it is a national priority to conserve such areas. Specific examples include:

- naturally uncommon ecosystems, such as coastal turfs and shingle beaches.
- indigenous biodiversity associated with dunelands and wetlands.
- level IV land environments with < 20% indigenous vegetation remaining.
- habitats of threatened and at risk species.
- habitats which are important for maintaining indigenous biodiversity.
- indigenous habitats and ecosystems that function as ecological corridors and linkages.

Taking account of these requirements, it is clear that this coast supports many significant native habitats despite the extent of modification in this coastal environment. Some of the most important examples of these habitats are highlighted below.

The *Poa billardierei* population appears to be the largest in Canterbury and there is a nearby small population of *Ficinia spiralis* in the same dune system. *Atriplex buchananii* and *Ranunculus acaulis* were also found nearby along with areas supporting *Zoysia minima*, *Poa cita* and other native plants. The combined value of dunes, rear beaches, banks and cliff tops make the South Rakaia Huts to near Kyle a very important section of coast.

Some dongas contain valuable remnants of native woody plants and herbs. A few contain small wetlands and a number will provide important habitat for katipo spiders, native invertebrates and lizards. In particular the dongas between the Rakaia and Rangitata rivers are notable for their distinctive dryland habitats and associated grassland flora. All dongas occur in acutely threatened land environments (<10% indigenous vegetation remaining), though some may have no indigenous vegetation remaining at all.

The small flax swamp on the south side of the Rangitata is the best example of a flax swamp seen during the survey, and it also supports the at risk swamp nettle (*Urtica linearifolia*). Additional plant species will be present beyond those listed, and its faunal values merit further assessment. The ephemeral wetland at Kapunatiki Creek is a rare habitat type, which supports a surprising assemblage of wetland plants including threatened and at risk species.

Saltmarsh habitat between Horseshoe Lagoon and Seaforth Beach comprises one of the largest areas of near-continuous native habitat on this coast. It is important as saltmarsh continues to be removed by farm development and perhaps coastal erosion, e.g. Saltwater Creek in North Canterbury, Allandale flats in Lyttelton Harbour, and Pig Hunting Creek. The nearby Washdyke Lagoon is an important wetland for its mosaic of plant and animal habitats.

The coastal cliffs from Timaru to St Andrews are notable for supporting large patches of *Disphyma australe* and dense *Muehlenbeckia complexa*. No other cliffs in the study area support such remnants, perhaps because these cliffs are sloping rather than near-vertical. Additional values include a shag colony and the exposure of the remains of historic forests.

Pig Hunting Creek is important as it represents saltmarsh habitat associated with a waterway rather than a lagoon. Smaller areas of saltmarsh are associated with other creeks in the area, but this is by far the most extensive. The nearby Normanby wetland is quite compact and has a substantial mosaic of saltmarsh and shallow water habitat.

The cobble beaches near Wainono Lagoon support the only extensive native shrublands occurring on beaches in the study area. Good populations of *Muehlenbeckia ephedroides* and other shrubs are present, and the presence of *Epilobium microphyllum* nearby is an unusual feature. The area also provides valuable habitat for lizards, invertebrates and a large nesting colony of black-backed gulls. There are important ecological relationships between the cobble beach habitats, adjoining saltmarsh and the shallow water habitats of Wainono Lagoon.

Wainono Lagoon and its associated saltmarshes constitute the most important wetland complex between the Rakaia and Waitaki Rivers. The area of saltmarsh is the second largest in Canterbury after Lake Ellesmere/Te Waihora and it supports substantial populations of *Mimulus repens* (now *Thyridia repens*). Detailed survey work is likely to reveal further plant diversity.

The two dongas immediately north of the Waitaki River are important for their remnant shrublands. Despite the destruction of shrublands in the southern donga, what remains may still represent the best shrublands of their type in the study area. *Coprosma crassifolia* is particularly abundant and is not found elsewhere along this coast. With conservation management these degraded dongas could be improved, providing irrigation water is diverted elsewhere.

Habitat threats

The main threats identified along this coast are outlined below, though they are by no means all the threats that were observed.

Weeds

Sand dunes and other sandy habitats are threatened by marram grass, tree lupin, gorse, boxthorn and exotic grasses. False tamarisk occurs intermittently but it has the potential to spread on unstable substrates as well as more stable ones, perhaps including riverbeds.

Pampas grass occurs on rearbeaches near Wainono Lagoon and it is clearly spreading. *Atriplex halymus** shrubs occur in the same habitat and they too may have the potential to spread. *Sedum acre** occurs on and behind the rearbeach near Wainono Lagoon and it appears to be spreading because of disturbance from off-road vehicle use. Other key weeds of stable surfaces include gorse, broom, tree lupin, exotic grasses, *Plantago coronopus** and boxthorn.

Some rearbeaches and cliffs near the Timaru city coast support large patches of exotic iceplant, which may displace native iceplant and other natives such as *Calystegia soldanella*. Prickly saltwort (*Salsola kali**) was found at three localities between the Rakaia River and Washdyke Lagoon. This plant is regarded as a strand weed in Northland and it has the potential to compete with native plants (Shannel Courtenay, pers. comm.).

The main weeds of saltmarsh are *Plantago coronopus**, exotic grasses and potentially saltmarsh rush (*Juncus gerardii**), which was seen at Washdyke Lagoon. This species is listed as an environmental weed by Howell (2008). Willows, exotic rushes and grasses are the main weeds in freshwater wetlands, though gorse and iris may be local problems. Reed canary grass (*Phalaris arundinacea**) is widespread in drains near Wainono Lagoon and is spreading into adjacent saltmarsh. It is also present in wetlands northeast of the Orari River.

Domestic stock

Stock impacts (especially cattle or cows) are a local threat on fragile dunes that support *Poa billardierei*, *Ficinia spiralis* and other native plants, as they have killed some plants by trampling or physically pulling them out. Further south, there is evidence of cattle accessing the cobbled beaches near the Waihao River. Minor sheep pugging of saltmarsh has occurred locally, but this is likely to be greater where these habitats occur on farmland.

Off-road vehicles

Off-road vehicle use is a major threat near hut settlements and some road ends. It damages fragile habitats such as dunes and other sandy areas, and kills plants such as *Poa billardierei* and *Ficinia spiralis*. The disturbance of some habitats also facilitates weed spread, e.g. of *Sedum acre** on rearbeaches near Wainono Lagoon. Vehicle use is a serious concern in wetlands, as illustrated by damage at Pig Hunting Creek and near Wainono Lagoon.

Irrigation water and effluent

Irrigation water is seriously impacting the two Waitaki dongas and the dryland habitats of dongas generally. The combination of increased water and increased nutrient levels is resulting in dryland habitats being overwhelmed by lush exotic grasses and wetland weeds. On the other hand, irrigation is supplementing the water supply for some wetlands and is probably creating new ones behind rearbeaches. This may be positive, though it depends on the nutrient content of irrigation water as high nutrient levels generally favour exotic plants and animals.

Another concern is nutrient and sediment run off from farmland into wetlands. This could be ameliorated by the use of buffer zones around wetlands (and native habitats generally).

Vegetation clearance and drainage

Spraying and burning of native vegetation is a threat as illustrated by the destruction of shrubland in a Waitaki donga and the historic burning of a flax swamp. Localised spraying of gorse or willows could also cause collateral damage to native vegetation. Areas of remnant native vegetation or wetlands could also be developed for farming purposes, as has happened immediately south of the Orari River. A large feedlot was developed in a donga near Wakanui Beach and this destroyed some terrace risers (Steven & Meurk 1996).

Existing drains around some wetlands are a concern because of their on-going effects on wetland hydrology and nutrient levels, e.g. Wainono Lagoon, Washdyke Lagoon, and Pig Hunting Creek. While most are historical in nature their effects should not be ignored. The development of new drains should be prevented to minimise further damage to wetlands.

Coastal erosion

Coastal erosion is a poorly understood threat to native biodiversity. This coast is eroding, but what is not known is the extent to which native habitats can migrate inland with the retreating coastline. If coastal drains and stopbanks are rebuilt further inland, the effects on native habitats could be unpredictable. If it is done sensitively, saltmarsh and other wetland habitats could potentially be maintained or enhanced.

Irrigation water is exacerbating cliff erosion in some areas, e.g. south of Morven Beach where water is percolating through cliff sediments and causing cliff collapses. This is likely to be occurring in other localities where extensive irrigation occurs adjacent to coastal cliffs.

Summary and conclusions

The great majority of this coast is highly modified and some indigenous habitats have been lost since 1984, mostly to farm development. Increased irrigation and dairy farming is likely to hasten the loss of indigenous habitats through habitat clearance, stock trampling and grazing, irrigation water runoff, and nutrient increases in dryland habitats. Off-road vehicle use is damaging sensitive dune communities, saltmarsh and rearbeach vegetation. Remaining habitats are threatened by a suite of weeds affecting all habitat types especially sand dunes, dryland dongas, rearbeach shrublands and wetlands.

Despite these losses and threats, highly significant indigenous habitats remain. While most are small and modified, the coast immediately southwest of the South Rakaia Huts and Horseshoe Lagoon support semi-continuous dune/bank and saltmarsh habitats, respectively. Wainono Lagoon is known as a wildlife habitat but is also notable for its adjoining areas of saltmarsh and impressive rearbeach shrublands. Pig Hunting Creek and Normanby wetland both support substantial saltmarsh communities. Elsewhere indigenous habitat is restricted to loess cliffs near Timaru, individual dongas, wetlands and small remnants on coastal cliff tops or banks. A surprising number continue to support threatened or uncommon species.

Local authorities have statutory obligations to protect indigenous biodiversity on this coast, and to prevent or mitigate adverse effects. Initiatives are needed to control off-road vehicle use, to prevent stock access to beaches and dunes, and to prevent further habitat loss through land development. Further wetland drainage should be prevented, and attempts should be made to ameliorate the effects of existing drains on wetlands. Lastly, secure protection should be sought for key sites on private land to prevent their loss or degradation.

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Table 1 Threatened and at risk plants recorded in the native vegetation remnants of the mid-south Canterbury coast.

Species	**Conservation status**
Atriplex buchananii	Nationally vulnerable
Carex cirrhosa	Nationally vulnerable
Lepilaena bilocularis	Nationally vulnerable
Acaena buchananii	Declining
Convolvulus verecundus	Declining
Eryngium vesiculosum	Declining
Ficinia spiralis	Declining
Muehlenbeckia ephedroides	Declining
Poa billardierei	Declining
Sonchus kirkii	Declining
Urtica linearifolia	Declining
Colobanthus brevisepalus	Naturally uncommon
Leptinella serrulata	Naturally uncommon
Mimulus repens (= Thyridia repens)	Naturally uncommon
Tetragonia tetragonioides	Naturally uncommon
Lachnagrostis littoralis ssp. salaria	Data deficient

Table 2 Locally uncommon plants recorded in the native vegetation remnants of the mid-south Canterbury coast.

Species	Occurrence
Anthosachne solandri	One locality
Blechnum penna-marina	One locality
Calystegia tuguriorum	Scattered through several localities
Carmichaelia australis	Four localities
Coprosma crassifolia	Two localities
Coprosma propinqua	Two localities
Cordyline australis	A few localities
Crassula sieberiana	One locality
Discaria toumatou	Scattered through several localities
Disphyma australe	Locally common on some central cliffs
Einadia triandra	Scattered through several localities
Epilobium microphyllum	Locally common on one beach only
Geranium sessiliflorum	One locality
Glossostigma diandrum	One locality (identification uncertain)
Leptinella squalida x *dioica*	One locality (identification uncertain)
Leucopogon fraseri	One locality
Linum monogynum	One locality
Melicytus alpinus	Scattered through several localities
Muehlenbeckia axillaris	Scattered through several localities
Oxalis exilis	A few localities
Parsonsia capsularis	One locality
Poa cita	Scattered through several localities
Pteridium esculentum	Scattered through several localities
Ranunculus acaulis	One locality
Raoulia australis	Scattered through several localities
Rubus squarrosus	One locality
Rumex flexuosus	One locality
Ruppia polycarpa	One locality
Rytidosperma buchananii	One locality
Schizeilema nitens	One locality
Solanum laciniatum	A few localities
Stellaria gracilenta	A few localities
Tetragonia implexicoma	A few localities
Zoysia minima	Northern benches only