Recovery plan for threatened grassy plants of dry fertile sites

2003–13

THREATENED SPECIES RECOVERY PLAN 52

Department of Conservation
Te Papa Atawhai

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CONTENTS

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ABSTRACT

Five threatened species of monocotyledonous herbs grow on well-drained, fertile substrates in dry regions east of the main divide in the South Island of New Zealand. They are: *Australopyrum calcis* subsp. *calcis, A. calcis* subsp. *optatum, Carex inopinata, Dichelachne lautumia* and *Simplicia laxa.* Little is known of their ecological roles, their former abundance, or the factors that threaten their continued existence.

This recovery plan is intended to provide the basis for remedying the deficiencies in our understanding of these threatened plants. It aims to ensure that viable, self-sustaining populations of all five taxa are established or restored in the wild throughout their known natural range.

1. Introduction

Because of the similarities in biology, habitats and the probable threats faced, five grassy herbs (four true grasses and one sedge) have been grouped in this recovery plan: two limestone wheatgrasses (*Australopyrum calcis* subsp. *calcis* and *A. calcis* subsp. *optatum*), a small sedge (*Carex inopinata*), limestone plume grass (*Dichelachne lautumia*) and *Simplicia laxa*. *Simplicia laxa* was described in 1897; the other four are relatively recent discoveries; all described in the latter half of the twentieth century. Three of the five taxa are considered to be Nationally Endangered, one Nationally Vulnerable and one Range Restricted (Hitchmough 2002).

Specimens of all five plants are low-growing, relatively non-descript and hard to identify. The taxa have extremely limited distributions, currently confined to the South Island, growing east of the main divide. The plants grow in dry sites with fertile base-rich soils which may be alluvial or derived from nearby bluffs of limestone or schist (Table 1). All except *Dichelachne lautumia* occur in shaded sites, and all except *Carex inopinata* are confined to sites on, or under, limestone bluffs or schist tors (Given 1993; Molloy 1994; Clayton-Greene 1998). It is not known whether the plants were limited to these sites in the past, or if these are refugial habitats. Furthermore, little is known about threats to the plants or their ecological roles.

This recovery plan has a term of 10 years from December 2003 to December 2013 (review date: December 2013).

TABLE 1. SPECIES DISTRIBUTION, ABUNDANCE AND HABITAT.

TAXON	LAND TENURE (NO. OF SITES)	CONSERVANCY	POPULATIONS (APPROX. NO. OF PLANTS)	APPROX. AREA	HABITAT TYPE
Australopyrum calcis subsp. *calcis* Limestone wheatgrass	DOC (2)	Nelson-Marlborough	1 (<200)	1–10 ha	Limestone bluff
A. calcis subsp. *optatum* Limestone wheatgrass	Private (3) DOC (1) Covenant (1)	Canterbury	3 (<2000)	10–100 ha	Limestone bluff
Carex inopinata Grassy mat sedge	DOC (3) Covenant(2) Pastoral lease (1)	Nelson-Marlborough Canterbury Otago Southland	6 (<100)	1–10 ha	Limestone bluff, alluvial terrace, rubbly slope, schist tor
Dichelachne lautumia Limestone plume grass	Private (1) DOC(1)	Nelson-Marlborough	2 (<2000)	1–10 ha	Limestone bluff, alluvial terrace
Simplicia laxa	DOC (3) Pastoral lease (1) Open space management agreement (1)	Otago Wellington*	5 (<200)	1–10 ha	Limestone bluff, schist tor

* Old record

Left, top to bottom:

Figure 1. *Australopyrum calcis* subsp. *calcis* (Photo: Shannel Courtney).

Figure 2. *Australopyrum calcis* subsp. *optatum* (Photo: Brian Molloy).

Figure 3. *Carex inopinata* (Photo: Shannel Courtney).

Figure 4. *Simplicia laxa* (Photo: John Barkla).

Below:
Figure 5. *Dichelachne lautumia* (Photo: Jan Clayton-Greene).

2. Context

2.1 OVERVIEW OF SPECIES

2.1.1 Species descriptions and habitats

Australopyrum calcis subsp. *calcis* (Fig. 1) is a slender tuft-forming grass with flat apple-green leaves (Edgar & Connor 2000). It grows up to 50 cm high, has unbranched flower spikes, with spikelets distinctively set at right angles to the stem when mature. Most specimens occur in the shade under trees, right next to a limestone bluff, in lime-rich soils and limestone debris, and a few on the bluff ledges.

Though similar to the first subspecies, *Australopyrum calcis* subsp. *optatum* (Fig. 2) is smaller, shorter and has finer, paler green leaves (Connor et al. 1993). This plant grows on limestone-derived soils in the shade of overhanging bluffs.

Carex inopinata (Fig. 3) is a small inconspicuous member of the sedge family that forms swards of varying density. It has long creeping rhizomes and narrow (<2 mm wide) bright green to yellow-green grass-like leaves (5–30 cm long). Very small teeth occur on the top third of the leaf along the margin and midrib. The flowering stem is shorter than the leaves, with a few male flowers at the top and very few female flowers at the base. This plant has large grey-brown nuts (6–7 mm long) in dark red-brown coats, which are often virtually buried in the centre of tufts (Moore & Edgar 1970; Morgan & Norton 1992). *Carex inopinata* is easiest to identify during the fruiting period (November to February). It has been found in several different habitats, all highly fertile sites, including riparian alluvial terraces under rohutu forest, limestone and schist overhangs, and at a forest margin on a rubbly slope under shrubland.

Dichelachne lautumia (Fig. 4), previously thought to be a species of *Deyeuxia*, is a grey-green grass (45–65 cm high) with untidy robust tufts of leaves which have conspicuous parallel lengthwise red-purple ribs (Edgar & Connor 1999). The relatively compact flower spikes are taller than the leaves. One population of *Dichelachne lautumia* is found mainly on limestone talus, both soil and rocky debris derived from quarrying activities, with a few plants in crevices and on ledges on natural rock faces. The second population is on limestone derived alluvial terraces. All plants are in full light with very little shelter.

The *Simplicia* genus contains two species, both found solely in New Zealand. *Simplicia laxa* (Fig. 5) is a low mat-forming spreading grass which often sends out roots from stem nodes. It has narrow, flat, pale green to bluish-green leaves with fine teeth, and fine, open pyramid-shaped seedheads (Zotov 1971; Johnson 1992; Edgar & Connor 2000). A distinctive feature of the foliage is the common tendency for pale brown dead leaves to remain visible, more-or-less erect, slightly curled but not inrolled in the dry state (Johnson 1995). This species grows in base-rich soils in crevices, overhangs and shallow caves of schist tors and limestone bluffs, often in very low light.

2.1.2 Status and species recovery principle

All five plant taxa are threatened: *Australopyrum calcis* subsp. *calcis, Carex inopinata* and *Simplicia laxa* are classified as Nationally Endangered, *Australopyrum calcis* subsp. *optatum* as Nationally Vulnerable and *Dichelachne lautumia* as Range Restricted (Hitchmough 2002).

In terms of the recovery action model[1], the five taxa covered in this recovery plan are all in the 'identify agent(s) of decline' phase. This recovery plan includes elements of all the themes identified in the 'Species Development in the Department' model[2].

2.1.3 Past and present distribution and population trends

As both of the *Australopyrum* subspecies and *Dichelachne lautumia* have been recognised only within the last 25 years, information regarding their historical distributions or abundance is scant.

Australopyrum calcis subsp. *calcis* is known from two extremely restricted sites in the Leatham Valley, South Marlborough (Fig. 6). These sites are in close vicinity: one at the base of a limestone bluff, the other along an old vehicle track at a nearby quarry. There may be up to 200 plants (Molloy 1994).

Two populations of *Australopyrum calcis* subsp. *optatum* occur in North Canterbury (Fig. 6): one is coastal at Mt Cass and the other is inland at three sites on Castle Hill, Flock Hill and Prebble Hill. A third population was recently discovered in South Canterbury at Limestone Valley Rd near Pleasant Point. There is a total of perhaps 2000 plants (Molloy 1994): approximately 100 of these are at Mt Cass, and the largest sub-population of approximately 1000 plants occurs at Prebble Hill.

Historic records of *Carex inopinata* include plants from Castle Hill (Canterbury), Mt Koinga (Otago) and Kowhai Point (South Marlborough) (Molloy 1991a). *Carex inopinata* is now confirmed from six sites in the South Island (Fig. 7): Kowhai Point Scenic Reserve, Castle Hill, Blackstone Hill (near Alexandra, Otago), Jolendale Park (Alexandra), Deep Creek and Tapanui (Southland). There have been no recent sightings at the Mt Koinga site. Recent discoveries (2001, 2003) of populations in Southland and Otago suggest that this plant is more widespread than is currently known. There are 16 clumps at Kowhai Point, all less than 1.5 m in diameter (Jones 1999). At Castle Hill, Molloy (1991b) reported only six wild plants, and seven surviving transplants out of the twelve which were originally planted from cultivated stock. Given (1993) found only four plants, indicating major decline at this site. The Jolendale, Alexandra site contains a small but healthy clump. At Tapanui and Deep Creek there are healthy populations with larger numbers of plants.

Dichelachne lautumia was described by Edgar in 1999 from one restricted site in a limestone quarry at Flaxbourne, coastal South Marlborough (Fig. 6). A rapid survey of perhaps a quarter of the available habitat revealed approximately 600 plants (Clayton-Greene 1998). Druce's 1974 and 1982 records from the Waima

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[1] P. Jansen 2001, cited in unpublished draft Recovery Plan Instructions Template by S. O'Connor and J. Falconer (WGNCR-36725, Department of Conservation, Wellington).

[2] D. Hunt 2001, cited in draft Recovery Plan Instructions Template: see footnote 1.

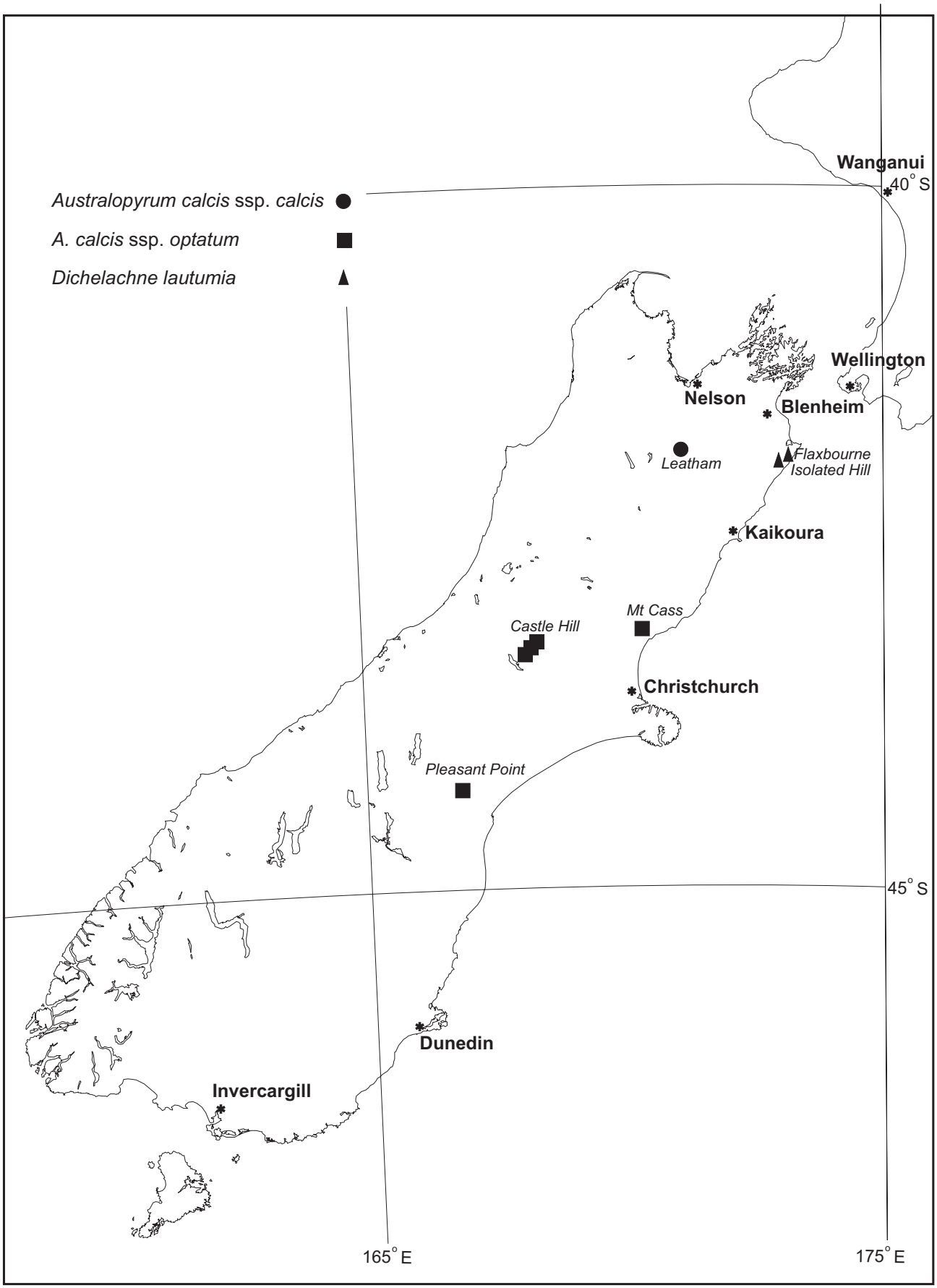

Figure 6. Present distribution of *Australopyrum calcis* subsp. *calcis, A. calcis* subsp. *optatum* and *Dichelachne lautumia*. Flock Hill and Prebble Hill are near the marked Castle Hill site.

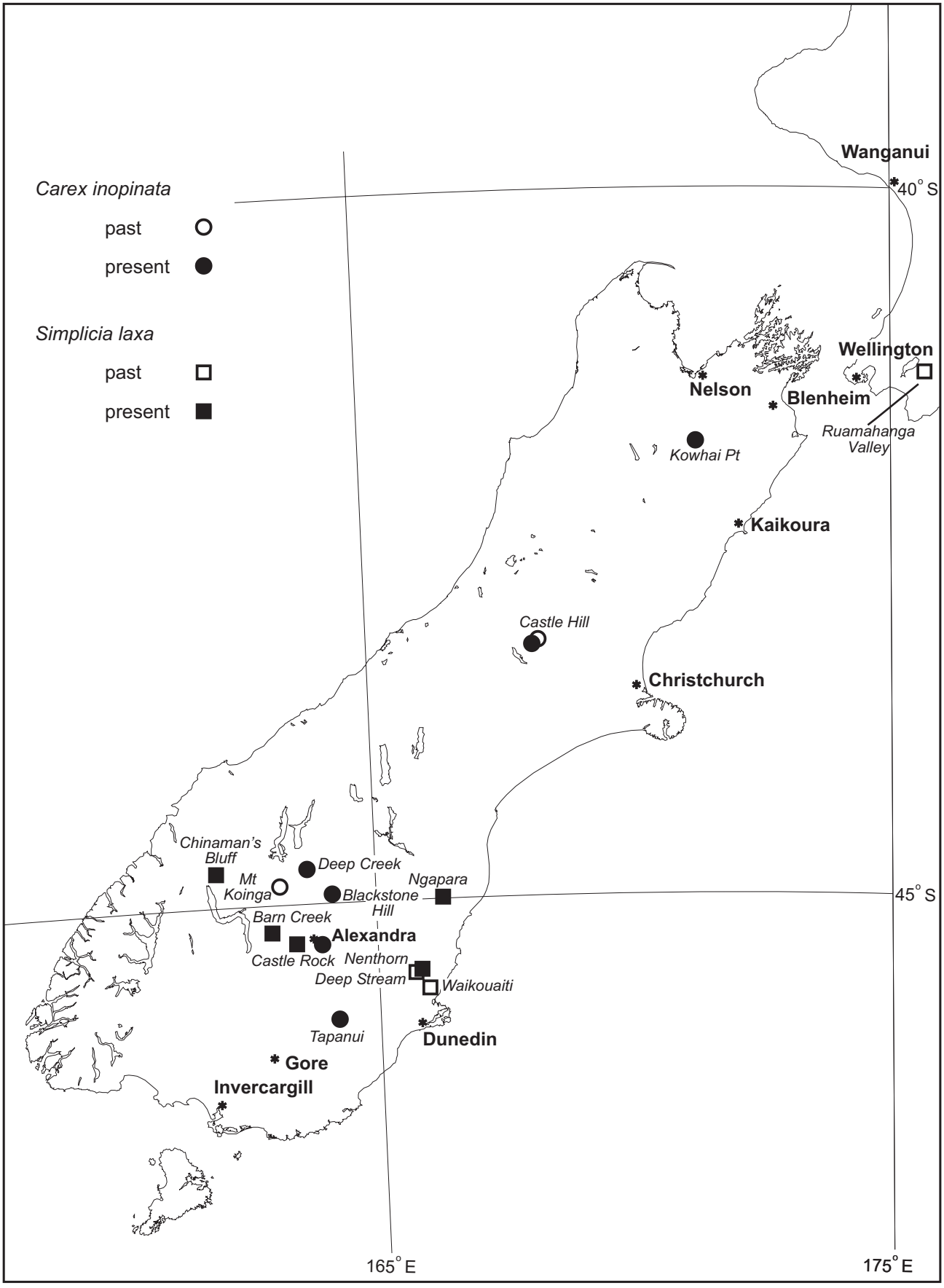

Figure 7. Past and present distribution of *Carex inopinata* and *Simplicia laxa*.

River in a neighbouring ecological district are considered to represent this species.

Historic records indicate that *Simplicia laxa* was found in the Wairarapa, in Otago at Deep Stream and at Waikouaiti (Kirk 1897). More recently this species has been found at Castle Rock (Zotov 1971) and North Otago (by Molloy in 1991). Johnson (1995) described *Simplicia laxa* as persisting at only three sites in Otago (Castle Rock, Ngapara and Nenthorn); however subsequent populations have been found at Chinaman's Bluff and Barn Creek, also in Otago (Fig. 7).

2.1.4 Agents of decline and threats

Because of the relatively recent recognition of three of these plants, and the cryptic nature of the other two, observations have been infrequent. Little is known about the causes of decline or the threats faced, but they are likely to include:

- **Habitat loss** through invasion by exotic herbs and grasses or browsing of associate shrub and canopy species: a major factor threatening all five plants.
- **Animal use of the habitat** is a severe threat to *Simplicia laxa,* except where overhangs are too low or narrow. This species is subject to occasional grazing by sheep and/or rabbits (J. Barkla pers. comm. 1999) as well as trampling, compaction, and fouling associated with sheepcamps. The other four plants appear to be unpalatable, although the recently found Limestone Valley Rd population of *Australopyrum calcis* subsp. *optatum* exhibits a marked difference in health between plants in fenced and unfenced areas.
- **Human land use** resulting in habitat disturbance and direct destruction are threats to *Carex inopinata* at Castle Hill and Kowhai Point, and to *Simplicia laxa* at Ngapara.
- **Destructive natural events.** Small population size and unstable habitats makes these species vulnerable to unpredictable natural destruction.
- **Fire** is potentially a serious threat where plants are surrounded by dry pasture or growing under scrub.
- **Lack of legal protection.** Nine of the 19 sites currently occupied by these plants are protected under the Conservation Act. These are Kowhai Point and Tapanui—*Carex inopinata;* Waima—*Dichelachne lautumia*; Leatham Valley (two)—*Australopyrum calcis* subsp. *calcis*; Castle Hill—*Carex inopinata, Australopyrum calcis* subsp. *optatum;* Nenthorn, Chinaman's Bluff and Castle Rock—*Simplicia laxa.* Blackstone Hill and Jolendale (*Carex inopinata)* and Limestone Valley Rd (*Australopyrum calcis* subsp. *optatum*) have protective covenants on the title, and Ngapara (*Simplicia laxa*) is subject to an open space management agreement. The remaining six sites are unprotected, with plants growing on privately owned or leasehold land.

2.1.5 Past and current management

Australopyrum calcis subsp. *calcis*

Nelson-Marlborough: A survey in the Leatham Valley of bluffs similar to those on which *Australopyrum calcis* subsp. *calcis* currently occurs, found no further plants. Monitoring has been set up to determine the effects of exclusion of sheep, competition with other grasses, growth and seeding in relation to

canopy cover, and population trends. Seed and plants have been translocated to the base of a nearby bluff with very little success. *Australopyrum calcis* subsp. *calcis* is in cultivation.

Australopyrum calcis subsp. *optatum*

Canterbury: Enhancement planting and habitat restoration is occurring at Castle Hill. Populations on Prebble Hill, Flock Hill, Mt Cass and Limestone Valley Rd have been surveyed informally. Monitoring to detect changes in plant numbers and size has been set up at Mt Cass and Castle Hill. *Australopyrum calcis* subsp. *optatum* is in cultivation.

Carex inopinata

Nelson-Marlborough: Monitoring and habitat restoration are taking place at Kowhai Point. In 2000, 650 plants from cultivated stock were translocated to three sites in the nearby Branch and Leatham river valleys. Monitoring was established and a further 300 plants were translocated into the Branch during spring 2001. A plan has been written for the management of the Kowhai Point reserve, and includes recommendations for conserving this species (Jones 1996).

Canterbury: Castle Hill plants are being cultivated and planted back into the wild. Habitat is being created in the form of shrubland planting. Monitoring has been set up (Nick Head pers. comm. 1999). There is a draft restoration plan for the species at this site (Given 1993). A local recovery group has been established. Survey at historic sites has failed to find any plants at the type locality.

Otago: Plants were found in a covenanted area at Blackstone Hill during *Carmichaelia kirkii* work in 2001. Further survey is planned. A small healthy population was found in Jolendale Park, Alexandra, in 2002. Tenure review survey in 2003 turned up a population at Deep Creek. Historic records have been followed up unsuccessfully.

Southland: Plants were found for the first time in Southland during a survey to support an application for the protection of an area of private land near Tapanui. Subsequent surveying discovered more plants. The area has now been purchased with assistance from the Nature Heritage Fund.

Dichelachne lautumia

Nelson-Marlborough: Preliminary surveys have been conducted at both sites, but did not include the entire potential habitat for the species (Clayton-Greene 1998).

Simplicia laxa

Otago: Surveys have been conducted at some potential and all known sites. Annual monitoring of plant numbers occurs at Castle Rock, where a small exclosure has been set up and *Hieracium lepidulum* is controlled. Surveillance monitoring of all sites continues. Familiarisation visits have been conducted for iwi and other interested people at some sites. Three provenances are in cultivation (Johnson 1995). Reports have been written explaining how to identify the plant, its field status and ecology (Johnson 1992, 1995). An advisory committee has been formed for the Ngapara site and a management statement published.

2.1.6 Recovery potential

Determining what constitutes suitable habitat, and creating regimes which provide a balance between the threat of encroaching weeds and that posed by animal use of habitat or direct browse, will require experimentation and collaboration between scientists, landowners and managers. Where the plants occur on farmland, it will be necessary to work with landowners and leaseholders to find conservation solutions which are sustainable within the framework of pastoral land management. Some of the sites are now covenanted or on land administered by the Department of Conservation, and are no longer grazed. Increased competition with exotic grasses may become an issue due to the removal of grazing. Some trials will be possible with *in situ* populations, but it is vital that populations are also maintained *ex situ*.

2.1.7 Preferred option for recovery

Populations of *Carex inopinata*, *Simplicia laxa,* and both subspecies of *Australopyrum calcis* are in cultivation, and it is likely that *Dichelachne lautumia* will also be readily cultivated. It will therefore be possible to safe-guard against further loss of genetic diversity by maintaining a representative sample of plants in *ex situ* plantings. However, consideration of the wider environment where the plants naturally occur is also important. Protection of wild populations from threats will prevent extinction of the taxa and assist in rehabilitating threatened dry fertile ecosystems. The conservation strategy outlined in the remainder of this document therefore recognises that both *ex situ* cultivation and management of populations in the wild are necessary for the recovery of the five plants included in this recovery plan.

2.2 STRATEGIC DIRECTIVES

This recovery plan supports National Priority Outcome 1.2 in the Department's Statement of Intent for 2002–05:

'No avoidable human-induced extinctions of indigenous terrestrial, freshwater and marine species have occurred and, where practicable, representative populations of all indigenous species have long-term security in predominantly natural habitats within their natural range.'

2.3 CULTURAL IMPORTANCE

None of the five plants is known to have any cultural significance to Maori, though some of the bluffy sites they occupy may do so.

2.4 PUBLIC AWARENESS

Despite high public use of the habitat in which they occur, the low-growing and relatively non-descript nature of the plants covered in this recovery plan is likely to have contributed to the lack of awareness that surrounds them.

3. Goals

3.1 LONG-TERM RECOVERY GOAL

By 2030 at least two wild populations of each plant with its associated communities are restored and self-sustaining in every conservancy within which the plant occurs.

This means having mixed age, secure and naturally reproducing populations in the wild, each containing 500 or more individuals to reduce the risks associated with inbreeding.

3.2 GOALS FOR THE TERM OF THE PLAN

1. To encourage public awareness and protection of these plants and their habitats.
2. To identify existing populations of the plants, control known agents of decline, and foster or establish *ex situ* collections and wild populations of the plants.
3. To support research on habitat requirements, competition and browsing threats, reproductive ecology and potential management methods.

4. Implementation

A timeline for the following actions is outlined in Appendix 1.

4.1 COMMUNITY RELATIONS

Topic 1: Stakeholders

Because many of these plants occur in small populations on private land, it is essential that their conservation has a high level of landowner support. The plants are difficult to identify, but there are potential advantages in landowners' familiarity with grasses and their management. Castle Hill, which provides habitat for *Carex inopinata* and *Australopyrum calcis* subsp. *optatum*, has high spiritual value to Maori. Maori may consider several of the other sites to be waahi tapu (sacred), particularly where there are rocky bluffs, overhangs or small caves. Castle Hill and Ngapara (*Simplicia laxa*) also have a high level of recreational use. Consultation throughout the development and implementation stages of this plan and maintenance of dialogue with interested parties are crucial.

Issue

A lack of awareness regarding the plants and their conservation status results in a lack of the support necessary for recovery actions.

Objective 1

Key stakeholders are identified, are made aware of the conservation status of the plants and are supportive of actions which ensure their recovery.

Actions

1.1 Create publicity material (fact sheets) with clear drawings and photographs of the plants by June 2004 (Recovery Group Leader in consultation: High Priority).

1.2 Identify all stakeholders, particularly landowners, iwi and local government personnel, initiate contact and determine what role they would like to have by June 2004 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

1.3 Conduct further familiarisation visits to current sites with relevant staff and interested individuals where necessary by June 2005 (Technical Support Officers: High Priority).

1.4 Maintain contact with key stakeholders at least once every three years (Biodiversity Programme Managers, Technical Support Officers: High Priority).

1.5 Arrange for 'Friend of Threatened Plant' certificates and photographs of the plants for landowners by June 2005 (Technical Support Officers, Biodiversity Programme Managers: Medium Priority).

1.6 Use opportunities for publicity on the plants as they arise, with a minimum of one promotional event per year per conservancy (Biodiversity Programme Managers, Technical Support Officers, Community Relations staff; Medium Priority).

4.2 MANAGEMENT

Topic 2: Threat management, agents of decline

Of the threats already identified, habitat loss is the most important. A weed control programme at Castle Rock (*Simplicia laxa*) and habitat restoration programmes at Kowhai Point (*Carex inopinata*) and Castle Hill (*Carex inopinata* and *Australopyrum calcis* subsp. *optatum)* have been implemented. These programmes will continue and will be critiqued by the Recovery Group. Further programmes will be set up to control threats as more knowledge becomes available through research (see Actions 8.3 and 8.4).

Issue

Obvious agents of decline, such as habitat loss, are operating on some populations of these plants and will destroy them if control measures are not taken.

Objective 2

Known threats to declining populations are controlled.

Actions

2.1 Critique current pest management programmes and if necessary recommend and implement changes by June 2005 (Recovery Group, Technical Support Officers, Biodiversity Programme Managers: High Priority).

2.2 Critique current habitat restoration efforts and if necessary recommend and implement changes by June 2005 (Recovery Group, Technical Support Officers Biodiversity Programme Managers: High Priority).

2.3 Review management annually, making recommendations for the following year (Recovery Group: High Priority).

Topic 3: Legal and physical protection

Thirteen of the 19 sites known to support these plants are legally protected; the remaining six sites are on unprotected private land or pastoral lease. It is important to work with landowners to protect plants and habitat through establishing covenants or management agreements. Priority for protection will be given to those sites which are self-sustaining, have potential for habitat restoration, or are recognised as being excellent sites for population enhancement. Legal protection will not necessarily guarantee the survival of plants. Physical protection must be given high priority in any situation where pests are threatening the plants. However, fencing may not be ideal where grazing is controlling competition. Adjacent landuse may be critical. Changes in landuse such as tree planting could have major effects. Landowners and councils will be encouraged to discuss these issues.

Issue

The lack of long-term security for some populations increases their vulnerability and therefore their risk of extinction.

Objective 3

Representative sites are legally and physically secure.

Actions

3.1 Ensure that one population of each plant is physically protected in each conservancy in which it occurs by June 2008 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

3.2 Ensure that one population of each plant is legally protected in each conservancy in which it occurs by June 2013 (Biodiversity Programme Managers, Technical Support Officers: Medium Priority).

3.3 Use the Resource Management Act process or negotiate as appropriate whenever significant changes are proposed to landuse on or adjacent to sites (Planning staff, Technical Support Officers, Biodiversity Programme Managers: Medium Priority).

Topic 4: *Ex situ* plantings

The small population sizes of these plants means that they are particularly vulnerable to a wide range of threats. While *in situ* protection is ideal and is the long-term aim of management, it is important to hold *ex situ* collections as insurance against total loss in the wild. Consequently, material needs to be collected for cultivation in *ex situ* 'insurance' sites. Where possible, *ex situ* plantings should be established within the known geographic range of the species, or as close as possible to a known site when it is the only one. These will mainly be within Conservancy Area Office gardens and botanic gardens as these species are not particularly showy as horticultural specimens. Some may be planted on marae and school grounds, in council amenity plantings, and on any other suitable land offered to the Recovery Group for this purpose. All plantings will be provenanced with good records kept, providing a reservoir of material for use in population restoration and translocation.

Issue

There are few populations of these plants, some of which are very small and vulnerable. This increases their risk of extinction.

Objective 4

Ex situ collections are established for each known population.

Actions

4.1 Select suitable secure sites for *ex situ* plantings by June 2005 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

4.2 Collect material, propagate, plant out and document by June 2007 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

4.3 Investigate the possibility of seedbanking by June 2008 (Technical Support Officers: Medium Piority).

Topic 5: Restoration: enhancing existing populations

At sites where plants are present in small numbers it may be appropriate to propagate more from that site or nearby sites, to increase numbers and thus make populations more viable.

Issue

Some populations of these plant are very small and vulnerable. This increases their risk of extinction.

Objective 5

Existing natural populations of each plant are enhanced.

Actions

5.1 Assess populations to determine the need for, and appropriateness of, enhancement plantings by June 2006 (Recovery Group: High Priority).

5.2 Collect material from natural populations or relevant *ex situ* populations, propagate, and plant back in natural sites where necessary and document by June 2009 (Biodiversity Programme Managers: High Priority).

Topic 6: Restoration: establishing new populations

Australopyrum calcis subsp. *calcis* and *Dichelachne lautumia* only occur at two known sites, making them extremely vulnerable. For others, protection at particular sites may prove impractical. It is also possible that some wild populations will not respond to protection measures and/or restoration planting. In any of these situations it may be necessary to establish new wild populations in safe sites where conditions are considered to be optimal.

When considering the establishment of new wild populations, the following criteria will be used:

- The site is within the historic distribution limits of the species.
- The site meets the habitat requirements of the species.
- Threats to the species within the site are considered manageable.
- The site has some form of legal protection and/or long-term management agreement.
- Plants of local provenance are available for translocation.

Issue

There are few populations of these plants, and some of are very vulnerable. This increases their risk of extinction.

Objective 6

New wild populations are established where necessary.

Actions

6.1 Determine which plants require establishment of new wild populations by June 2005 (Recovery Group: High Priority).

6.2 Identify sites which meet the criteria outlined in Topic 6 by June 2006 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

6.3 Identify necessary resources and potential sources of plant material by June 2007 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

6.4 Establish one new community for each plant identified in Action 6.1 by June 2013 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

4.3 RESEARCH

Topic 7: Research priorities

Knowledge of the ecology of the five plants covered in this Recovery Plan is far from complete. Research topics need to be identified, prioritised and promoted both within and outside the Department of Conservation.

Issue

Uncoordinated research actions will not provide the information required to facilitate management of the plants and ultimately prevent extinction of the species.

Objective 7

Co-ordinated approach to research will provide information required for management.

Actions

7.1 Develop a list of research topics for each plant, to be prioritised and updated annually, by June 2005 (Recovery Group: Medium Priority). A preliminary list, not prioritised, is attached as Appendix 2.

7.2 Prioritise research ideas annually at recovery group meetings (Recovery Group: Medium Priority).

7.3 Promote the list (developed in Action 8.4) in the Department of Conservation research funding round, and send it to potential research providers (Crown Research Institutes, Universities, Polytechnics etc.) annually after each recovery group meeting (Recovery Group: Medium Priority).

7.4 When research is undertaken, invite researcher(s) to recovery group meetings and ensure that relevant information and progress reports are fed back to conservancies (Recovery Group: Medium Priority).

Topic 8: Distribution

The number of known *Carex inopinata* sites has doubled recently as a by-product of other work. The cryptic nature and scattered distribution over wide areas raises the possibility that the rarity of this plant, and perhaps the other four, may be apparent rather than real. Priorities for survey will be determined on the basis of historic records and any new records made known to the Recovery Group as a result of public awareness initiatives. Through conducting surveys, some sites may be recognised as waahi tapu, and there will be liaison through Kaupapa Atawhai Managers with regard to these sites.

Issue

The current known distribution of these plants is unlikely to be the full picture because of their cryptic nature and because ostensibly similar habitat is unsurveyed. This leads to inaccurate assessment of conservation status and inappropriate prioritisation of management effort.

Objective 8

The distributions of all five plants are accurately determined.

Actions

8.1 Visit sites of all historic records that have not been surveyed in the last ten years by June 2005 (Biodiversity Programme Managers, Technical Support Officers: High Priority).

8.2 Inspect sites of new records within six months of receiving them and record appropriately, vouchering if possible (Biodiversity Programme Managers, Technical Support Officers: High Priority).

8.3 Compile a schedule of priority sites for survey of suitable habitat within the range of these plants by December 2004 (Recovery Group: Medium Priority).

8.4 Review schedule (Action 2.3) annually (Recovery Group: Medium Priority).

Topic 9: Monitoring

Monitoring of key populations is important to determine trends, to indicate where management effort is most needed, and to indicate long-term effects of management. It is important that monitoring provides answers to the right questions.

Issue

Current monitoring designs vary within and between conservancies, limiting the usefulness of data collected. Some monitoring may not provide the information we are seeking and therefore wastes resources.

Objective 9

Population trends of all five plants are monitored.

Actions

9.1 Critique current monitoring programmes for the plants and recommend changes or additions where appropriate by June 2005 (Recovery Group: High Piority).

9.2 Standardise monitoring method and form for each plant by June 2005 (Recovery Group: Medium Piority).

Topic 10: Autecology

Knowledge of the ecology of the five plants covered in this Recovery Plan is far from complete. The preferred habitats, for example, are not known. Several of the plants are currently found only in shaded situations. These may be relict habitats where the species continue because of lack of competition, or these may be their preferred habitats. Morgan & Norton (1992), for example, showed *Carex inopinata* to prefer shaded sites but this plant has also been observed to thrive in cultivation in full light.

Issue

Our lack of basic biological and ecological knowledge is leading to difficulty in identifying how to conserve these threatened plants. This increases their risk of extinction.

Objective 10

Knowledge of the biology and ecology of the plants is sufficient to facilitate their conservation.

Actions

10.1 Research the habitat requirements for the five plants covered in this recovery plan, particularly for *Carex inopinata* and *Simplicia laxa* (Recovery Group: High Priority).

10.2 Research the reproductive ecology of each plant so that factors affecting seed production, viability, dispersal and seedling establishment are understood (Recovery Group: High Priority).

Topic 11: Agents of decline

There have been suggestions, for all five plants, that introduced grasses and weeds may prevent seedling establishment and outcompete existing plants. Uncertainties also exist regarding the palatability of some of the plants and the potential for browsing.

Issue

Because the agents of decline are unknown, control mechanisms and management directions are uncertain.

Objective 11

Causes of decline are determined where these are not known.

Actions

11.1 Research competitive effects of the flora associated with each of these plants (Recovery Group: High Priority).

11.2 Research the effects of herbivory on the plants, including interactions with competitors (Recovery Group: High Priority).

Topic 12: Management methods

The results of ecological and threat research will need interpretation as the interactions involved are likely to be complex. Experimentation will be required to determine appropriate management methods.

Issue

The complexity of interactions between these plants, their environment and threats increases the chances of poor management decisions and the likelihood of extinction.

Objective 12

Management methods are found which provide a sustainable balance between threat control and ecological requirements for each plant.

Action

12.1 Research appropriate management methods (Recovery Group: High Priority).

5. Acknowledgements

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Appendix 1

TIMELINE FOR OBJECTIVES AND ACTIONS

OBJECTIVE	ACTION	PRIORITY	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Objective 1	1.1 Publicity material	High	■									
	1.2 Identify stakeholders	High	■									
	1.3 Familiarisation visits	High	■	■								
	1.4 Maintain contact	High	■	■	■	■	■	■	■	■	■	■
	1.5 Certificates	Medium	■	■								
	1.6 Annual promotion	Medium	■	■	■	■	■	■	■	■	■	■
Objective 2	2.1 Critique pest management	High	■	■								
	2.2 Critique habitat restoration	High	■	■								
	2.3 Review management annually	High	■	■	■	■	■	■	■	■	■	■
Objective 3	3.1 Ensure physical protection	High	■	■	■	■	■					
	3.2 Ensure legal protection	Medium	■	■	■	■	■	■	■	■	■	■
	3.3 Negotiate adjacent landuse	Medium	■	■	■	■	■	■	■	■	■	■
Objective 4	4.1 Select *ex situ* sites	High	■	■								
	4.2 *Ex situ* planting	High	■	■	■	■						
	4.3 Investigate seedbanking	Medium		■	■	■	■					
Objective 5	5.1 Assess enhancement need	High	■	■	■							
	5.2 Enhancement planting	High	■	■	■	■	■	■				
Objective 6	6.1 Determine need for new populations	High	■	■								
	6.2 Identify suitable sites	High	■	■	■							
	6.3 Identify resources	High		■	■	■						
	6.4 Establish new communities	High			■	■	■	■	■	■	■	■
Objective 7	7.1 List research topics and update	Medium	■	■								
	7.2 Priorities research topics	Medium	■	■	■	■	■	■	■	■	■	■
	7.3 Promote research list	Medium	■	■	■	■	■	■	■	■	■	■
	7.4 Invite researchers to meetings	Medium	■	■	■	■	■	■	■	■	■	■
Objective 8	8.1 Visit sites of historic records	High	■	■								
	8.2 Inspect sites of new records	High	■	■	■	■	■	■	■	■	■	■
	8.3 Schedule of survey sites	Medium	■									
	8.4 Review schedule annually	Medium	■	■	■	■	■	■	■	■	■	■
Objective 9	9.1 Critique current monitoring	High	■	■								
	9.2 Standardise monitoring methods	High	■	■								
Objective 10*	10.1 Research habitat requirements	High										
	10.2 Research reproductive ecology	High										
Objective 11*	11.1 Research competitive effects	High										
	11.2 Research effects of herbivory	High										
Objective 12*	12.1 Research management methods	High										

* Objectives and associated actions are dependent upon obtaining funding.

Appendix 2

RESEARCH IDEAS

1. Autecology

(a) What is the preferred habitat of these taxa? What are the light requirements for maximum growth and seedling germination of *Australopyrum calcis* subsp. *calcis*, *A. calcis* subsp. *optatum*, *Carex inopinata* and *Simplicia laxa*? (This should include experimentation in the wild as well as in a glasshouse.)

(b) What are the nutrient requirements of these five taxa? Could their habitats have been enriched by the presence of ground-dwelling birds in the past?

(c) Investigate the reproduction ecology of these five taxa.

2. Threats

(d) What is the response to competition of each of the taxa covered by this plan?

(e) What is the palatability to cattle, deer, sheep, goats, possums, rabbits and hares of each of the taxa covered by this plan?

(f) Investigate the role of browsers in maintaining or destroying the habitats of these taxa.

3. Management-habitat manipulation

(g) By what methods can areas of habitat be kept free of aggressive weeds such as exotic grasses, hawkweed, catsear and woody colonisers? Can fire, herbicides, cultivation, hand-weeding, grazers be useful tools?

(h) Investigate the potential for creating new habitat for these taxa, either in previously disturbed sites such as quarries, or by creating new disturbance. Natural processes of colonisation and vegetation development in quarried sites are often very slow (Davis et al. 1985) which may give native species an advantage over exotics.

(i) Investigate the potential for using artificial stock shelters to take pressure off areas of habitat which are currently being used by stock as campsites (Butler 1987).

(j) Investigate other management methods for these taxa.

Recovery plans

This is one of a series of recovery plans published by the Department of Conservation. Recovery plans are statements of the Department's intentions for the conservation of particular plants and animals over a defined period. In focussing on objectives for management, recovery plans serve to guide the Department in its allocation of resources, and to promote discussion amongst a wider section of the interested public.

This plan summarises knowledge of the distribution and ecology of five plants and outlines priority recovery objectives and actions for the next ten years. The plants are: *Australopyrum calcis* subsp. *calcis* Connor et Molloy (Poaceae), *A. calcis* subsp. *optatum* Connor et Molloy (Poaceae), *Carex inopinata* Cook (Cyperaceae), *Dichelachne lautumia* Edgar (Poaceae) and *Simplicia laxa* Kirk (Poaceae).

After preliminary consultation with landowners and iwi, an initial draft was prepared and refined by scientists and managers, both within and outside the Department. A further draft of this plan was then circulated to relevant Conservation Boards, landowners, iwi and other interested parties. After further refinement the plan was formally approved by the Southern Regional General Manager in October 2003. A review of this plan is due after ten years (2013), or sooner if new information leads to proposals for a significant change in direction. This plan will remain operative until a reviewed plan is in place.

The Department acknowledges the need to take account of the views of tangata whenua and the application of their values in the conservation of natural resources. While the expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and the tangata whenua. Departmental Conservancy Kaupapa Atawhai Managers are available to facilitate this dialogue.

A recovery group consisting of people with an interest in the conservation of the five species has been established. The purpose of the recovery group for Threatened Grassy Plants of Dry Fertile Sites is to review progress in the implementation of this plan and to recommend to the Department any changes which may be required as management proceeds. Comments and suggestions relating to the conservation of the plants are welcome and should be directed to the recovery group via any office of the Department of Conservation.

Published recovery plans

No.	SPECIES	YEAR APPROVED
51	Mudfish (*Neochanna* spp.)	2003
50	Kiwi (*Apteryx* sp.)	2003
49	*Powelliphanta* land snails	2003
48	North Island *Oligosoma* spp. skink	2002
47	Tuatara	2001
46	Chatham Island fantail, Chatham Island tomtit and Chatham Island warbler	2001
45	Forbes' parakeet and Chatham Island red-crowned parakeet	2001
44	New Zealand shore plover	2001
43	Chatham Island shag and Pitt Island shag	2001
42	Chatham Island mollymawk, northern royal albatross, Pacific mollymawk	2001
41	Chatham Island tui	2001
40	Black robin	2001
39	Parea	2001
38	Chatham Island oystercatcher	2001
37	Chatham petrel	2001
36	Chatham Island taiko	2001
35	Hoiho	2001
34	Pygmy button daisy	2001
33	*Hebe cupressoides*	2000
32*	Inland *Lepidium*	2000
31	*Muehlenbeckia astonii*	2000
30	North Island kokako	1999
29*	Weka	1999
28*	*Pittosporum patulum*	1999
27	*Cyclodina* skinks	1999
26	Coastal cresses	1999
25	Threatened weta	1998
24	Striped skink	1998
23*	Fairy tern	1997
22*	Blue duck	1997
21	Kakapo	1996
20	Stitchbird	1996
19*	Brown teal	1996
18*	Native frogs	1996
17*	New Zealand (Hooker's) sea lion	1995
16*	*Dactylanthus taylorii*	1995
15*	Bat (peka peka)	1995
14	Otago and grand skinks	1995
13*	Giant land snail	1995
12*	Takahe	1994
11*	South Island saddleback	1994
10*	New Zealand dotterel	1993
9*	Tuatara	1993
8*	Kowhai ngutukaka	1993
7*	Subantarctic teal	1993
6*	Mohua (yellowhead)	1993
5	Chevron skink	1993
4	Black stilt	1993
3*	Whitaker's and robust skinks	1992
2	Kiwi	1991
1*	North Island kokako	1991
—*	Yellow-eyed penguin	1991

*Out of print. In-print issues are available free of charge from DOC Science Publishing, Science & Research Unit, P.O. Box 10-420, Wellington. All recovery plans from No.25 (1998 and later) are available on the DOC website www.doc.govt.nz > Publications > Science and Research > Biodiversity Recovery Unit