

Shrubby tororaro  
(*Muehlenbeckia astonii* Petrie)  
recovery plan

2000–2010

THREATENED SPECIES RECOVERY PLAN 31

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Frontispiece (and cover photo): Shrubby tororaro (*Muehlenbeckia astonii* Petrie).  
Photo taken by Jeremy Rolfe, Wellington Conservancy, at Baring Head, Wellington.

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# 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 for a defined period. In focusing on goals and 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.

The Department recognises the valuable contribution of all individuals, groups and organisations participating in this recovery programme. The Department also recognises its obligation in terms of section 4 of the Conservation Act 1987 to give effect to the Principles of the Treaty of Waitangi in relation to its business, and 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 means of expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and tangata whenua. Departmental conservancy Kaupapa Atawhai Advisors are available to facilitate this dialogue.

The plan for *Muehlenbeckia astonii* Petrie was drafted by Peter de Lange in 1998 and then refined in partnership with Maori, in recognition of the species' cultural and spiritual importance to tangata whenua. It was peer-reviewed by scientists and managers both within and outside the Department. The document was then formally approved by the Regional General Manager, Central Region, in February 2000. A review is due after ten years (in 2010), 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.

In 1998 a recovery group consisting of people with knowledge of *M. astonii* and an interest in its conservation was established to review progress in the implementation of this plan, and to recommend to the Department any changes which may be required as management proceeds. The Department of Conservation will consult with relevant Conservation Boards, tangata whenua, and other stakeholders where such consultation will assist with implementation of this plan.

Comments and suggestions relating to the conservation of *M. astonii* are welcome and should be directed to the recovery group via any office of the Department or to the Biodiversity Recovery Unit.

# Whakatauki

*Toi tu te marae o Tane*

*Toitu te marae o Tangaroa*

*Toitu te Iwi*

If the marae of Tane survives  
Likewise the marae of Tangaroa  
The people will live on

‘A quite remarkable shrub is the shrubby pohuehue [*sic.*] (*Muehlenbeckia astonii*), which is of the divaricating form and builds on stony shores irregular rounded masses four feet or more in height. All this would be nothing were it not that the genus consists otherwise of climbing or creeping species, and that the liane-like main stems of this plant betray its relationship to its climbing relatives.’

(Cockayne 1919)

# Abstract

This document summarises knowledge of the distribution and ecology of *Muehlenbeckia astonii* Petrie, and outlines priority recovery goals and objectives for the next ten years. The objectives are mainly directed at protecting remaining plants, enhancing wild populations, establishing insurance plantings and extending knowledge of the plant's biology and ecology. Increasing public awareness of the species and opportunities for public involvement in its recovery are also important aspects of the plan.

## 1. Introduction

The shrubby tororaro (*Muehlenbeckia astonii* Petrie) (Frontispiece), also known as shrub pohuehue, mingimingi, and wiggywig, is a partially or wholly deciduous divaricating shrub of the Polygonaceae family. It has distinctive orange-red, interlaced and wiry zigzag branchlets, and lime-green, heart-shaped leaves, and it grows to 4 metres in height.

It has considerable ecological and cultural significance within the grey scrub (Wardle 1991) ecosystems of eastern New Zealand. With the other four endemic species of *Muehlenbeckia* (Allan 1961) it is recognised as an important (and sometimes the only known) host for many endemic invertebrates, particularly moths (B.H. Patrick pers. comm. 1991). These insects, together with the small sugary fruits of *Muehlenbeckia* species, provide a significant food source for many native species of bird and lizard (de Lange & Silbery 1993).

To Maori these aspects make shrubby tororaro a *taonga* species (R. Solomon pers. comm. 1998). Furthermore, as a member of the dock (*runa*) family, the plant has *rongoa* (medicinal) values.

It is a shrub which is typical of a large group of eastern New Zealand native plants which have become extremely uncommon following human settlement (de Lange & Silbery 1993; Rogers 1996; Widyatmoko & Norton 1997; Given 1998). Surveys and research have demonstrated that most *M. astonii* populations are unlikely to recover in the wild without active management (de Lange & Silbery 1993). The species has been given the IUCN rank of 'Endangered' in Cameron et al. (1993, 1995), and is a 'Category A' priority species for conservation action within the Department of Conservation (Molloy & Davis 1994).

## 2. Distribution

### 2.1 PAST DISTRIBUTION

*M. astonii* is endemic to the south-eastern North Island and eastern South Island (de Lange & Silbery 1993) (Fig. 1). Full information on its past distribution is sketchy, as it was not recognised by European botanists until late in European settlement (de Lange & Pitt 1998) by which time the dry shrublands of eastern New Zealand had been extensively modified by burning and pastoral farming (de Lange & Silbery 1993). Specimens collected by B.C. Aston in 1908 from the mouth of the Wainuiomata River, near Wellington, brought the species to the

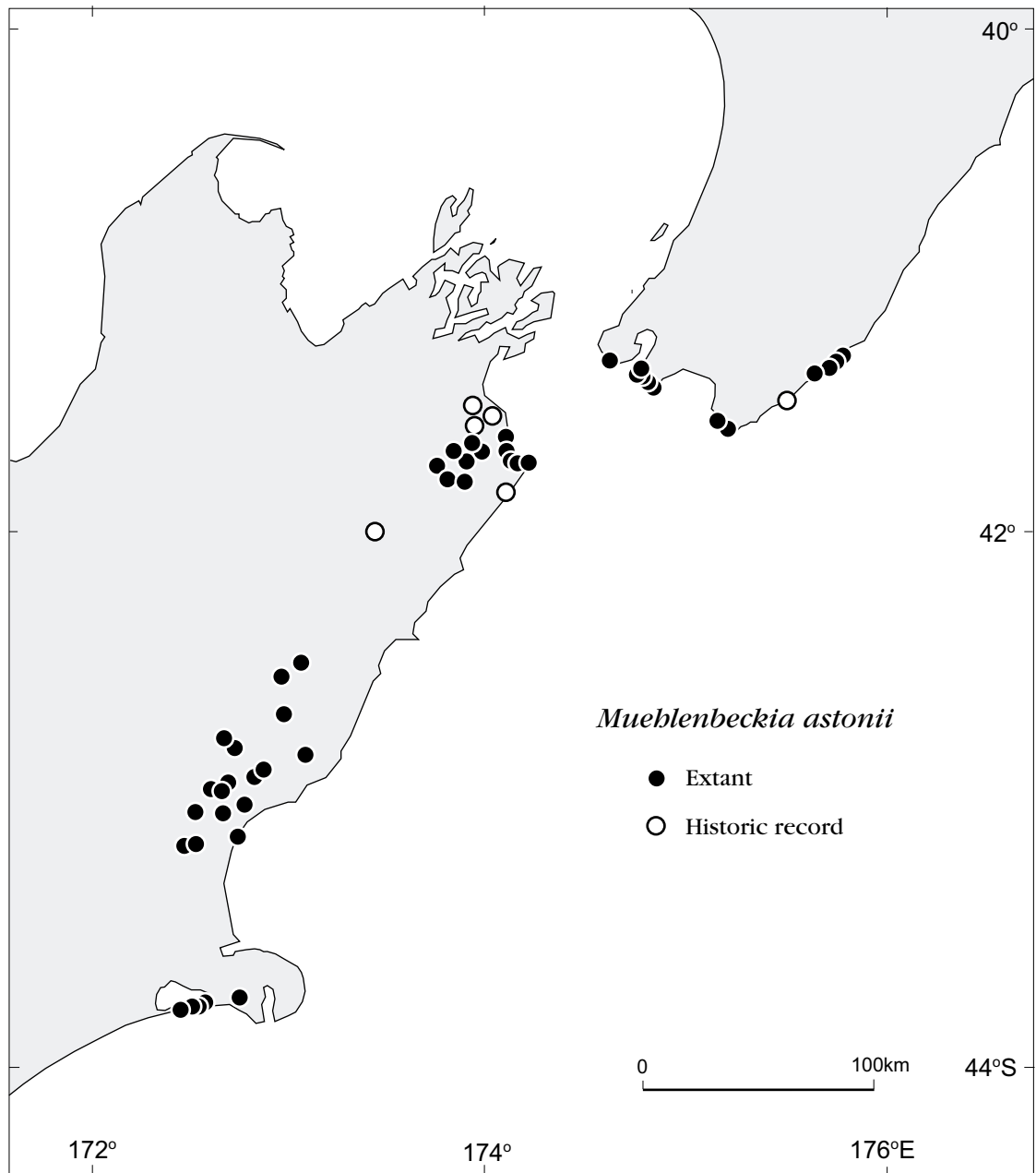


Figure 1. Distribution of shrubby tororaro (*Muehlenbeckia astonii*).

attention of botanists. It was formally described by Petrie (1911) from these specimens (de Lange & Pitt 1998). Following Aston's North Island discovery, the species was collected from the Awatere River, near Seddon, in the South Island (Petrie 1911) and was later found to be locally distributed from Marlborough to Birdlings Flat, Kaitorete Spit (de Lange & Silbery 1993) (Fig. 1). Most north-eastern South Island records resulted from nassella tussock surveys in the 1960s and 1970s by A. Healy of DSIR. Contacting Ngai Tahu to check their historical (cultural) knowledge of the species may assist in broadening understanding of past distribution. The specialist habitats occupied by the species suggest that it was always rather local in occurrence and probably never abundant.

## 2.2 PRESENT DISTRIBUTION

*M. astonii* still occurs in central and eastern New Zealand. It is locally distributed from Honeycomb Light on the eastern Wairarapa coastline (41° 19'S, 175° 50'E) in the North Island, to Kaitorete Spit (42° 50'S, 172° 27'E) in the east of the South Island. Its distribution is mapped in Fig. 1 and summarised by ecological district (McEwen 1987) in Table 1. There are estimated to be 2600 individual plants in the wild (Table 1). The largest extant population is on

TABLE 1. SUMMARY OF THE DISTRIBUTION OF SHRUBBY TORORARO (*Muehlenbeckia astonii*) BY ECOLOGICAL DISTRICT (MCEWEN 1987) SHOWING NUMBERS OF SITES AND PLANTS PRESENT IN AUGUST 1999.

Nearly all populations are on private land.

ECOLOGICAL DISTRICT	SITES	TOTAL PLANTS	SAMPLES IN CULTIVATION
Aorangi	1	12	Yes
Eastern Wairarapa	2	9	Yes
Tararua	4	15	Yes
Cook Strait	1	12	Yes
Blenheim	1	?	
Grassmere	6	11	Yes
Flaxbourne	2	2	Yes
Tapuae-O-Uenuku	1	?	
Kekerengu <sup>a</sup>	2	46	Yes
Motunau	2	3	
Waiau <sup>b</sup>	3	4+	Yes
Culverden	2	10	Yes
Waikari	4	20	Yes
Low Plains	4	9	Yes
Akaroa	1	12	
Ellesmere <sup>c</sup>	1	c. 2500	Yes
Totals	37	c. 2600	

<sup>a</sup> The Cape Campbell site has a Department of Conservation covenant.

<sup>b</sup> Two natural plants and restoration planting in Balmoral Conservation Area.

<sup>c</sup> Thirty planted individuals at this site are protected by Department of Conservation (Baird 1990).



private land at Kaitorete Spit, where there are about 2500 plants (K. Wardle pers. comm. 1999). Juveniles have been reported from Cape Turakirae, Cape Campbell (Jan Clayton-Greene, pers. comm. 1998), and the lower Waipara Gorge (D.R. Given, pers. comm. 1999).

## 3. Species biology and ecology

### 3.1 BIOLOGY

*M. astonii* is a deciduous divaricating shrub which has been recorded as living for more than eighty years. It has a deep complex root system (P.J. de Lange unpubl. data) and is therefore likely to be able to maximise use of available groundwater in dry conditions. Its occurrence in ephemeral wetlands, however, suggests that it is also tolerant of periodic inundation.

It produces insect-pollinated flowers and quick-maturing (10–15 days) fruit over many months in summer and autumn (de Lange & Silbery 1993; P.J. de Lange unpubl. data). Individual plants are either female or ‘inconstant males’ (sensu Lloyd 1975; Godley 1979). Thus seed may be produced by pollination of female ovules, or through selfing of ‘inconstant males’. However, seed produced through selfing of ‘inconstant males’ has low viability (<5%) (P.J. de Lange unpubl. data). Isolated female plants frequently develop fruit, but the seed so formed lacks an endosperm, unless males of other *Muehlenbeckia* species are present, in which case hybrid seed is formed (K.D. Adam & P.J. de Lange unpubl. data).

Animals probably disperse the fruit. Seeds have been found, for example, in gecko (*Hoplodactylus maculatus* s.l.) faeces. Birds have been observed eating fruit (Miles Giller, pers. comm. 1999). Mice have also been seen eating the fruit, but examination of their stomach contents shows the seed to be very finely ground (Jan Clayton-Greene pers. comm. 1998) and, therefore, unlikely to germinate.

*M. astonii* can be grown by vegetative or sexual propagation. Cuttings strike best in early spring just before leaf burst. Out-crossed seed germinates readily, and seedlings are frequent under bushes in cultivation.

### 3.2 ECOLOGY

Much of the information available on the ecology of *M. astonii* is anecdotal. Autecological study of the species is urgently required.

*M. astonii* has most frequently been collected from free-draining, highly fertile sites such as riparian and/or coastal localities, including consolidated sand or shingle dunes, rocky bluffs, and loess-covered hillslopes (de Lange & Silbery 1993). In several North Island locations it has been collected from uplifted coastal terraces and ephemeral wetlands (e.g. Pahaoa River mouth and near

Honeycomb Light). In the South Island, *M. astonii* occasionally extends well inland and occurs to around 300 metres above sea level. Molloy suggests that it is often associated with limestone outcrops and rendzina-type soils in the South Island (B.P.J. Molloy, pers. comm. 1998). Given has noted that in North Canterbury it is often adjacent to limestone while not actually growing on the limestone itself (D.R. Given unpubl. data).

The absence of broad-leaved tree and shrub species is a feature of many habitat types where *M. astonii* is present. These species are limited by summer drought, whereas *M. astonii* colonises sites that are dry in summer. The species often occurs on soils with moderate to high fertility, though some South Island populations occur on well-leached dryland soils.

It is not known whether current relict populations occur in optimal habitat for the species or whether they have been forced to occupy marginal situations.

## 4. Causes of decline and threats

Several factors are believed to threaten the survival of *M. astonii* in the wild. These are discussed in detail by de Lange & Silbery (1993). In particular, the first two of those listed below have been major causes of decline.

### 1. **Habitat fragmentation and destruction**

The predominantly coastal, riparian, and colluvial habitats occupied by *M. astonii* were among the first in the country to be used for farming. The resulting fragmentation of habitat has led to isolation of individuals, dispersal limitation, recruitment failure, and prevention of new colonisation. Presence of stock, arable farming, and vegetation clearance have played a large part in reducing numbers.

### 2. **Predation and trampling**

*M. astonii* is susceptible to browsing by introduced species such as possums, horses, cattle, sheep, goats, rabbits and hares. Seeds are eaten by rodents. Seedlings are especially vulnerable to browsing by the common garden snail, and introduced slugs. Trampling and rubbing or ring-barking by livestock can kill whole branching systems of mature plants.

### 3. **Disease**

Some wild specimens of *M. astonii* have been observed with severe scale infestations and an associated fungal smut (both species as yet unknown). In extreme cases such infestations have killed entire sections of mature plants.

### 4. **Recruitment failure through single-sex populations**

Although non-reproducing plants can maintain themselves to a certain extent by vegetative extension, there is the risk of one sex-type being eliminated from

a population leading to a lack of recruitment. In the five North Island *M. astonii* populations and some of those of the South Island, there is no out-crossing because female plants are now widely separated from 'inconstant males' (de Lange & Silbery 1993).

## 5. Introgression

While land development has led to a decline in the numbers of *M. astonii*, it has been beneficial to other species in the genus, producing conditions ideal for introgression with *M. complexa* and *M. australis* (de Lange & Silbery 1993).

## 6. Competition

It is a reasonable supposition, though yet to be rigorously tested, that *M. astonii* is a poor competitor with more vigorous shrubby and/or broad-leaved species. It seems to require relatively open seral habitats. In the Wellington region, *Ozothamnus leptophyllus* (tauhinu) is very common on these sites; it has almost certainly expanded because of human modification of the environment and is therefore acting more-or-less as a weed species. It also harbours the same type of scale and fungal smut which kill *M. astonii*. The extent to which this and other species such as *M. complexa* and *M. australis* act as competitors or as shelter plants is still to be determined.

## 7. Other factors

In the North Island, many *M. astonii* plants grow within loose gravel. In situations close to urban areas the demand for building aggregate has resulted in the loss of plants. For example, the near elimination of the greater part of the Wainuiomata river-mouth population in the mid 1970s was a result of gravel extraction (A.P. Druce pers. comm. 1990).

# 5. Past conservation efforts

Three populations of *M. astonii* are legally protected, with restoration planting being carried out at each site (Cape Campbell, Balmoral Conservation Area, and Kaitorete Scientific Reserve). Young plants have been planted at Turakirae as part of revegetation research being conducted by Dr David Norton. Monitoring is being carried out at these sites.

Representative samples of plants from all the known North Island populations and some of those of Marlborough and Canterbury are in cultivation, with insurance collections held by Victoria University of Wellington, and Hutt and Wellington City Council gardens, Landcare Research Ltd at Lincoln, and the University of Waikato. In the garden at the Department of Conservation's South Marlborough Area Office at Renwick, plants from the Seddon area are producing heavy crops of seed and seedlings. Marlborough District Council has plantings in the Wither Hills, and several nurseries around the country have provenanced plants.

It is being promoted as a garden plant (Metcalf 1972), for hedging, and even, in Wellington City, as a natural traffic barrier along motorways

## 6. Long-term recovery goal

*Manage Muehlenbeckia astonii and promote interest in its recovery so that viable populations of the species and its associated communities are restored, self-sustaining and protected in the wild throughout the natural range of the species.*

## 7. Options for recovery

The species is readily cultivated, grows well from seed and cuttings, and, provided that the range of threats affecting growth in the wild are minimised, plants show an immediate and rapid response to management (P.J. de Lange unpubl. data). The threats facing *M. astonii* are not unique, being common to many of New Zealand's threatened woody plants. Measures to manage these threats have been tried, with varying degrees of success, for a range of ecologically comparable species, e.g. *Carmichaelia muritai*, *Hebe cupressoides*, *Helicbrysum dimorphum* and *Olearia hectorii*, and these techniques and experiences can be used to optimise the recovery of *M. astonii*. For the above reasons, it appears that the recovery potential of *M. astonii* is excellent.

### **Option 1: Ex situ cultivation of plants**

This option aims to maintain a genetically variable reservoir as a safeguard against further losses in the wild by cultivating a representative sample of plants from each ecological district. It will reduce the loss of genetic diversity in the species but it will not increase numbers in the wild.

### **Option 2: Protection of existing wild populations, and enhancement with supplementary planting where necessary**

This option aims to increase the viability of populations in the wild. It provides for protection of existing *M. astonii* plants from animal browsing, and, where necessary, enhancement of populations by planting cultivated stock into natural habitats. It may also require planting of associate species of the *M. astonii* community. It gives the potential to increase the genetic diversity of remnant populations, making them more viable.

### **Option 3: Establishment of new populations in the wild**

This option goes beyond protection and enhancement of existing populations to the establishment of new wild populations at suitable legally protected sites. It increases not only the viability, but also the number of wild populations.

#### **Options summary**

To reverse the current decline of *M. astonii* a combination of Options 1-3 will be used. The common theme to these options is the recognition that the gene pool is significantly fragmented, and is undergoing further loss. Management will aim to halt genetic loss and enhance the species' chances of survival.

## **8. Recovery plan**

### **8.1 OBJECTIVES FOR THE TERM OF THE PLAN**

**Objective 1.** Involve stakeholders including landowners, iwi, local government, and the public in the recovery of *Muehlenbeckia astonii* by June 2002.

**Objective 2.** Consult with iwi at all stages of plan development and implementation. Determine the whakapapa of *Muehlenbeckia astonii*, its taonga and rongoa values and any other uses by June 2002.

**Objective 3.** Protect existing populations, ensuring that one population of *Muehlenbeckia astonii* is legally and physically protected in each ecological district throughout the former range of the species by June 2010.

**Objective 4.** Refine information on the current distribution and conservation status of *Muehlenbeckia astonii* by June 2005.

**Objective 5.** Establish ex situ populations of *Muehlenbeckia astonii*:

- (i) as 'insurance' populations by June 2004;
- (ii) to promote horticultural use as opportunities arise.

**Objective 6.** Set up a restoration project for one existing population of *Muehlenbeckia astonii* in each relevant conservancy by June 2005.

**Objective 7.** Promote further research into the biology, ecology, ethnobotany, ecological biogeography, and conservation management of *Muehlenbeckia astonii*, prioritising and circulating research ideas annually.

**Objective 8.** Identify sites suitable for the establishment of new communities within the former range of *Muehlenbeckia astonii* by June 2001. Set up new sites by June 2010 only if restoration initiatives fail.

## 8.2 WORK PLAN

To meet each objective and fulfil the long-term goal the following actions must be carried out. Many of the actions can proceed concurrently, as summarised in the timeline at the end of this section (Fig. 2). Progress towards achieving the objectives will be monitored and reported on at Recovery Group meetings.

### **Objective 1. Involve stakeholders including landowners, iwi, local government, and the public in the recovery of *Muehlenbeckia astonii* by June 2002.**

#### Explanation

It is essential that the conservation of *Muehlenbeckia astonii* has a high level of landowner, iwi, local government, and other public involvement. This is especially so because >90% of known populations occur on private land. Maintenance of dialogue with iwi, landowners, conservation groups, and other interested parties is crucial.

**Responsibility:** Area and Conservancy biodiversity and community relations staff.

**Priority:** High.

#### **Action 1**

Identify relevant iwi, landowners and other interested parties and establish a working relationship with them by June 2001.

#### **Action 2**

Arrange briefings on *Muehlenbeckia astonii* for relevant iwi, landowners, Conservation Boards, Transit New Zealand, all local bodies with the species within their jurisdiction, Landcare groups, and Federated Farmers by June 2001. Promote the inclusion of *M. astonii* sites on schedules of areas of significance in district schemes.

#### **Action 3**

Re-contact councils, Transit New Zealand, and landowners every two years.

#### **Action 4**

Produce a brochure to use at the above briefings by June 2001.

#### **Action 5**

Design appropriate items for sale or as giveaways to use at the above briefings and other advocacy opportunities (T-shirt, fridge magnet, certificates acknowledging 'Custodian of Threatened Plant' status, photos of the plant, etc.) by June 2001.

#### **Action 6**

Conduct one promotion action in each relevant conservancy (Wellington, Nelson/Marlborough, Canterbury) every year.

### **Action 7**

Empower landowners, iwi, and organisations such as Landcare groups, Federated Farmers, and botanical societies to manage and monitor the species, particularly on private land, as opportunities arise.

### **Objective 2. Consult with iwi at all stages of plan development and implementation. Determine the whakapapa of *Muehlenbeckia astonii*, its taonga and rongoa values and any other uses by June 2002.**

#### Explanation

Because of Section 4 of the Conservation Act, 1987, the Ngai Tahu Claims Settlement Act 1998, the ownership of many *Muehlenbeckia astonii* populations by iwi, and because *M. astonii* has taonga and rongoa values, iwi were consulted throughout the development of this plan, and it is imperative that they continue to be closely involved in its implementation.

The exact Maori name for *Muehlenbeckia astonii* is not known (de Lange & Silbery 1993). However, its close relationship to the tororaro (*M. complexa*), which has shrub-like tendencies, rather than the lianoid *Muehlenbeckia* vines, collectively referred to as 'pohue' and 'pohuehue' (see discussion by de Lange & Silbery 1993), suggests that the use of 'shrubby tororaro' is not inappropriate. The interim use of this name has been sanctioned by Kaikoura representatives of Ngai Tahu, until such time as a consensus of its appropriateness can be established. 'Shrub pohuehue' and 'wiggywig' are also names that are in use around the country, while 'mingimingi' is used for this and a number of other small-leaved divaricating shrub species.

A whakapapa needs to be determined for this plant to find its place, and restore its mauri. It is taonga and has rongoa values. Understanding these necessitates dialogue with iwi. Any effects this knowledge may have on the approach taken to the recovery of the species will be incorporated into future management.

It is recognised that non-Maori cultures have an interest in this plant as well, and their views will also be sought and incorporated.

**Responsibility:** Conservancy and Area biodiversity staff, Kaupapa Atawhai Managers.

**Priority:** High.

### **Action 1**

Make contact with Te Runanga o Ngai Tahu annually, undertake an annual briefing for iwi on management progress and invite ongoing input. Maintain contact through Kaupapa Atawhai Managers and the relevant runanga.

### **Action 2**

Determine a whakapapa for *Muehlenbeckia astonii* by June 2002. Approach local iwi to provide this.

### **Action 3**

Produce a list of uses and local names for the species by June 2001. Each conservancy should produce their own list to be amalgamated by the Recovery

Group and incorporated into the Threatened Plant Information database being developed by Biodiversity Recovery Unit.

**Objective 3. Protect existing populations, ensuring that one population of *Muehlenbeckia astonii* is legally and physically protected in each ecological district throughout the former range of the species by June 2010.**

**Explanation**

There are only two legally protected sites in Canterbury and one in South Marlborough, covering about 40 natural plants and larger numbers of planted individuals. Legal protection must therefore be seen as a high priority. It is important to work with landowners to protect plants through establishing covenants or by other means. The priority is to have at least one natural *M. astonii* occurrence protected in each ecological district within the former range of the species (Table 1). Any covenant option or informal interim measures such as fencing will be considered to prevent any further loss of plants on private land. Priority for protection will be given to those sites which are self-sustaining, have potential for future habitat restoration, or are close to known plants whose in situ protection is impractical, and are recognised as being excellent sites for restoration or translocation (see Objectives 6, 8).

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. Adjacent land use may be critical. Changes in land use such as tree planting, drainage, road realignment, and goat farming could have major effects. Landowners, Transit New Zealand and councils will be encouraged to discuss these issues.

Any protection measures will be undertaken in consultation with all interested parties.

**Responsibility:** Conservancy and Area biodiversity staff, land administration staff, planners.

**Priority:** High (long-term).

**Action 1**

Initiate advocacy as mentioned in Objective 1 including information about all avenues for protecting sites: Nga whenua rahui, Nature Heritage Fund, QEII covenants, DOC covenants, district plan listings, voluntary agreements, fencing, pest control, etc. Welcome approaches from landowners with suitable sites and act on them within 6 months.

**Action 2**

Approach owners of *M. astonii* sites to discuss options for legal and physical protection by June 2002.

**Action 3**

Ensure that one population of *Muehlenbeckia astonii* is legally and physically protected in each ecological district throughout the former range of the species by June 2010.



**Action 4**

Facilitate legal and physical protection of insurance plantings and translocation sites by June 2010.

**Action 5**

Negotiate written agreements with Transit New Zealand and Councils on the protection and management of roadside specimens of *M. astonii* by June 2004.

**Action 6**

Make submissions or negotiate as appropriate whenever significant changes are proposed to land use adjacent to *M. astonii* sites.

**Objective 4. Refine information on the current distribution and conservation status of *Muehlenbeckia astonii* by June 2005.**

Explanation

Although the general distribution and status of *M. astonii* throughout its former range is now documented (e.g. de Lange & Silbery 1993), the level of knowledge varies from location to location. In some areas knowledge is still imperfect, and localised areas where the species may occur require more detailed survey. The possibility that the species extends into Hawkes Bay and northern Otago needs investigation. The somewhat cryptic nature of the species means that it could easily have been overlooked.

Priorities for survey will be determined on the basis of historic records and any new records made known to us as a result of public awareness initiatives.

In conducting surveys it will be recognised that some sites may be waahi tapu, and there will be liaison through Kaupapa Atawhai Managers with regard to these sites.

**Responsibility:** Conservancy and Area biodiversity staff.

**Priority:** Medium-high.

**Action 1**

Follow up all historical records by June 2002.

**Action 2**

Follow up new records within 6 months of receiving them.

**Action 3**

Survey for the species in the following areas by June 2005:

- Eastern Wairarapa coastline from Honeycomb Light to Hastings (Wellington),
- Grey scrub communities of the northern Wairarapa, foothills south of Mt Somers, and the Waitaki River valley (Wellington),
- Flaxbourne River valley (Nelson/Marlborough),
- Coast from Waima to Blind River (Nelson/Marlborough),
- Cape Campbell farms (Nelson/Marlborough),
- Area between Waipara and Waiau Rivers, east of Culverden Basin (Canterbury),
- Coastal area of Canterbury Plains south to Timaru (Canterbury).

**Objective 5. Establish ex situ populations of *Muehlenbeckia astonii*:**

**(i) as ‘insurance’ populations by June 2004;**

**(ii) to promote horticultural use as opportunities arise.**

**Explanation**

The small size and fragmented nature of the North Island and most South Island populations means that they are particularly vulnerable to a wide range of threats. While in situ protection is ideal, this plan recognises that it is not always practical. While the loss of wild occurrences is unfortunate, the further loss of genetic diversity from these populations can be avoided through ex situ means. Permission will, therefore, be sought from landowners to sample material for cultivation within ex situ ‘insurance’ populations. This measure will help prevent the further loss of genetic diversity within the species.

Insurance plantings will be established within the former range of *M. astonii*, and on occasion outside this range if the situation requires. They will be within conservancy area office gardens, marae, school grounds, council amenity plantings, botanic gardens, and any other land offered to the recovery team for this purpose. *M. astonii* grows well in horticultural situations as well as being a suitable plant for amenity plantings, and traffic islands, and for hedging or shelterbelts in dry-country situations. Ideally plants will be raised from all known wild individuals (or using a statistically acceptable sampling procedure) within vulnerable, unsecured sites. All plantings will be provenanced, with good records kept. This will provide an ex situ reservoir of provenanced genetic material for use in population restoration and translocation.

**Responsibility:** (i) Conservancy and Area biodiversity staff.

(ii) Conservancy and Area community relations and biodiversity staff.

**Priority:** (i) High.

(ii) Medium.

**(i) Insurance plantings**

**Action 1**

Determine secure sites for insurance populations by June 2002.

**Action 2**

Establish an ex situ insurance population of *M. astonii* plants from each geographic grouping in each conservancy by June 2004: Wellington - 4 groups, Nelson/Marlborough - 3 groups, Canterbury - 5 groups.

**Action 3**

Secure long-term protection for suitable sites if necessary.

**Action 4**

Carry out plantings according to the Australian Native Plant Conservation Guidelines or Botanic Gardens International Guidelines until the Biodiversity

Recovery Unit of the Department of Conservation establishes a standard operating procedure for translocation and ex situ cultivation of plants.

**Action 5**

Harvest material from insurance plantings and disseminate it to nurseries as required so that material is available for restoration, new communities, and for Action 7 below.

**Action 6**

Monitor all ex situ insurance populations at least once every two years.

**(ii) Horticultural plantings**

**Action 7**

Promote use of *M. astonii* in landscape plantings by other parties such as Landcare groups, landowners, councils, Papatipu Runanga, general public for shelterbelts, hedgerows, amenity plantings, gardens, etc.

**Action 8**

Supply information about planting and maintenance of plants.

**Action 9**

Make plants available for Arbor Day and Conservation Week plantings.

**Action 10**

Keep records of known ex situ occurrences, including details of site, owner/contact person, date planted, provenance, numbers.

**Objective 6. Set up a restoration project for one existing population of *Muehlenbeckia astonii* in each relevant conservancy by June 2005.**

**Explanation**

Of those populations or plants which are currently protected, none has original integrity or structure, and some level of restoration will be necessary, e.g. re-introduction of a missing sex-type. The nature of the restoration process to be entered into will be determined during the survey and protection process.

There is the potential, using mainland island principles of integrated threat management and restoration, to create a model grey scrub-*Muehlenbeckia astonii* community.

**Responsibility:** Conservancy and Area biodiversity staff.

**Priority:** High.

**Action 1**

Set up a minimum of one restoration project for a self-sustaining grey scrub community containing *M. astonii* and its associate plant and animal species in each relevant conservancy by June 2005.

### ***Action 2***

Assist other groups with restoration initiatives as opportunity arises, wherever possible encouraging coverage of all gene pools in the region. Advocate for restoration during meetings with associates (Objective 1).

### **Objective 7. Promote further research into the biology, ecology, ethnobotany, ecological biogeography, and conservation management of *Muehlenbeckia astonii*, prioritising and circulating research ideas annually.**

#### Explanation

Knowledge of *M. astonii*, its biology and ecology, is far from complete. Although basic aspects of the species' ecology, reproductive biology, and physiology are now documented, scope remains for experimental studies, and it is not yet fully certain how to restore or establish viable populations in the wild. Preliminary studies suggest that introduced grasses and weeds will prevent seedling establishment and harbour pests and diseases (de Lange & Silbery 1993; D.A. Norton & P.J. de Lange unpubl. data). The response of the plant to fencing, or different browsing regimes requires testing. While some research programmes, e.g. Turakirae translocation, Cape Campbell covenant, are now in place to devise a methodology for the successful translocation of the species and to test for seedling establishment, results from these projects will not be known until 2001 at the earliest. The problem of introgression, and the possibility that wild hybrids could be used to reconstitute the species from sites where it is now extinct deserve further appraisal. There is also a need to determine the genetic structure of the species and the constitution of natural gene pools. Apart from these issues there are many other aspects of the species' biology which need further study to maximise chances of reversing the current decline. This goal recognises the important synergy that should exist between conservation research and management.

**Note:** See Section 9 for a preliminary list of research ideas put together at the recovery group meeting 1998.

### ***Action 1***

Set up a 'live' list of research topics on computer by June 2001. Develop this list further as problems and issues are identified. Prioritise research ideas annually at Recovery Group meetings. Promote the list in the Department of Conservation research funding round and send it to potential research providers (Crown Research Institutes, Universities, Polytechs, etc.) annually after each recovery group meeting.

### ***Action 2***

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

### ***Action 3***

Keep up-to-date with relevant research. 'Network' between group members as appropriate.

**Objective 8. Identify sites suitable for the establishment of new communities within the former range of *Muehlenbeckia astonii* by June 2001. Set up new sites by June 2010 only if restoration initiatives fail.**

**Explanation**

The protection of some *M. astonii* populations will prove impractical. It is also possible that some wild populations will not respond to protection measures and/or restoration planting. In these situations it may be necessary to establish new wild populations in safe sites where conditions for the successful establishment of *M. astonii* populations are considered optimal. Considering the current absence of legal protection for most *M. astonii* sites, it is recommended that new wild populations be established wherever there are suitable and legally protected sites available.

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

1. Site occurs within the known historical distribution limits of the species.
2. Site meets the habitat requirements of the species.
3. Threats to the species within the site are considered manageable.
4. Site has some form of legal protection and/or long-term management agreement.
5. Plants of local provenance are available for translocation. (On occasion it may prove necessary to introduce plants from the next nearest available source, for example, if one sex-type is no longer present in the ecological district (see de Lange & Silbery 1993).)

***Responsibility***

Actions 1 and 4: Conservancy and Area biodiversity staff of all three conservancies.

Actions 2 and 3: Actions 2 and 3 need be implemented only where Objective 6 (Set up a restoration project) is not achievable.

***Priority***

Actions 1 and 4: High.

Actions 2 and 3: Low unless restoration initiatives fail.

***Action 1***

Identify sites which meet the above criteria by June 2002, adding to the list in future any sites which are recognised to be suitable.

***Action 2***

Identify necessary resources and potential sources of plant material by June 2003.

***Action 3***

Establish, by June 2010, one new community in any of the three relevant conservancies where Objective 6 cannot be implemented.

#### Action 4

As opportunity arises, encourage other groups to adopt the above criteria and to establish new populations. Assist them with technical advice where necessary.

OBJECTIVE	ACTION NO.	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1.	1. Identify associates										
	2. Brief iwi, etc.										
	3. Re-contact										
	4. Brochure										
	5. Design T-shirt										
	6. Annual promotion										
	7. Empower others										
2.	1. Iwi annual brief										
	2. Whakapapa										
	3. Uses and names list										
3.	2. Approach owners										
	3. Protect sites										
	4. Legal & physical protection										
	5. Protect roadsides										
4.	1. Historic follow-up										
	2. New records										
	3. Survey										
5.	1. Choose insurance sites										
	2. Ex situ plantings										
	5. Plants to nurseries										
	6. Monitor ex situ										
6.	1. Restoration										
7.	1. Research list										
8.	1. Identify translocation sites										
	2. Identify resources										
	3. Set up new populations										

Figure 2. Timeline for objectives and actions.

## 9. Research priorities

1. What are the main characteristics of a natural *Muehlenbeckia astonii* plant and animal community? Define a model community structure for the species. Collate information on current and known past distribution and habitat to allow the prediction of sites for further survey, and choice of sites for restoration and new population plantings. Factors to consider: relationship to forest/grey scrub/shrublands, soils, climate, aspect, drainage, proximity to coast, altitude, role of disturbance, associated species of plants, mycorrhizae, birds, lizards, invertebrates, role of rodents and potential threats.
2. Confirm threats to *Muehlenbeckia astonii*: competition (or beneficial shelter) from other native plants and weeds, browsing, trampling, germination problems, hybridisation, etc.
3. Investigate the value of grey scrub communities for land management purposes such as hedging, shelterbelts, water and soil conservation, ecosystem restoration, and corridors for wildlife including invertebrates. This would facilitate advocacy efforts to demonstrate the importance of protecting communities containing *Muehlenbeckia astonii*.

4. What is necessary to restore a grey scrub ecosystem containing *Muehlenbeckia astonii*? (Dr David Norton, University of Canterbury, has started a two-year project on this, but more research will be required.)
5. Investigate mechanisms for legal protection of populations, particularly insurance plantings in such places as council plantings, traffic islands, botanical gardens, school grounds.
6. Investigate the physiology of *Muehlenbeckia astonii* including the mechanisms which give it drought tolerance.
7. Document the ethnobotany of *Muehlenbeckia astonii*.
8. Document the pattern of genetic variation throughout the geographic range of *Muehlenbeckia astonii*. Can discrete gene pools be identified? What are the implications for management? Does *Muehlenbeckia astonii* act as a keystone species in its relationship with other organisms, especially invertebrates and lizards, and how does its decline affect those with which it has mutualistic associations?

## 10. Review date

The indicative review date for this recovery plan is June 2010 unless new information necessitates major changes in management before this time.

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## 12. References

- Allan, H.H. 1961: *Flora of New Zealand. Volume 1*. Wellington, Government Printer.
- Baird, A. 1990: *Muehlenbeckia astonii*. *Rarebits 1*: 7.
- Cameron, E.K.; de Lange, P.J.; Given, D.R.; Johnson, P.N.; Ogle, C.C. 1993: New Zealand Botanical Society threatened and local plant lists (1993 revision). *New Zealand Botanical Society newsletter 32*: 14-28.
- Cameron, E.K.; de Lange, P.J.; Given, D.R.; Johnson, P.N.; Ogle, C.C. 1995: New Zealand Botanical Society threatened and local plant lists (1995 revision). *New Zealand Botanical Society newsletter 39*: 15-28.
- Cockayne, L. 1919: *New Zealand plants and their story*. (2nd edn) Wellington, Government Printer.
- de Lange, P.J.; Silbery, T. 1993: Saving the shrubby tororaro (*Muehlenbeckia astonii* Petrie) - an urban approach to threatened plant conservation. In: Froggatt, P.; Oates, M. (eds) *People, plants & conservation: Botanic Gardens into the 21st Century*. Christchurch, Royal New Zealand Institute of Horticulture.
- de Lange, P.J.; Pitt, F.D.H. 1998: Typification of *Muehlenbeckia astonii* Petrie (Polygonaceae). *New Zealand Journal of Botany 36*: 305-306.
- Given, D.R. 1998: An assessment of the endangered plants of New Zealand. Pp. 227-242 in: Peng, C.-I.; Lowry, P.P., II (eds) *Rare, threatened and endangered floras of Asia and the Pacific rim. Institute of Botany, Academia Sinica Monograph Series 16 (Taiwan)*.
- Godley, E.J. 1979: Flower biology in New Zealand. *New Zealand Journal of Botany 17*: 441-466.
- Lloyd, D.G. 1975: Breeding systems in *Cotula*. IV: reversion from dioecy to monoecy. *New Phytologist 74*: 125-145.
- McEwen, W.M. (ed.) 1987: *Ecological regions and districts of New Zealand*. (3rd rev. edn) Wellington, Department of Conservation.
- Metcalf, L.J. 1972: *The cultivation of New Zealand trees and shrubs*. Wellington, A.H. & A.W. Reed.
- Molloy, J.; Davis, A. 1994: *Setting priorities for the conservation of New Zealand's threatened plants and animals*. (2nd edn) Wellington, Department of Conservation.
- Petrie, D. 1911: Description of new native phanerogams. *Transactions of the New Zealand Institute 43*: 254-257.
- Rogers, G.M. 1996: Aspects of the ecology and conservation of the threatened tree *Olearia hectorii* in New Zealand. *New Zealand Journal of Botany 34*: 227-240.
- Wardle, P. 1991: *Vegetation of New Zealand*. London, Cambridge University Press.
- Widyatmoko, D.; Norton, D.A. 1997: Conservation of the threatened shrub *Hebe cupressoides* (Scrophulariaceae), eastern South Island, New Zealand. *Biological Conservation 82*: 193-201.