

Survey of threatened plants on rock outcrops in Christchurch City Council reserves on the Port Hills and Banks Peninsula

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Introduction

Christchurch City Council (CCC) owns several reserves on the Port Hills and Banks Peninsula, and manages these areas for a variety of purposes, including public recreational use and ecological values. Rock outcrops on the Port Hills and Banks Peninsula have particularly high biodiversity values and support a wide range of native flora and fauna, including Threatened and At Risk species.

Botanical surveys of rock outcrops on the Port Hills and Banks Peninsula were carried out for CCC from 2006 to 2010 by Carol Jensen and Alice Shanks (Jensen 2006). The surveys involved measurement of approximately 240 vegetation plots at 16 Council-owned reserves on the Port Hills and one on Banks Peninsula (Misty Peaks Reserve). The surveys were carried out prior to the major series of earthquakes that occurred in Canterbury in 2010-2011. The earthquakes caused enormous disturbance to rock outcrop environments and are likely to have had substantial effects on vegetation cover and composition, as well as populations of threatened and uncommon plants.

In 2022, CCC initiated a project to re-survey Threatened/At Risk (as per de Lange et al. 2018a) and locally uncommon (those listed as “uncommon to rare or very local” by Wilson 2013) plants on rock outcrops in Council-owned reserves on the Port Hills and Banks Peninsula. The aim of the 2022-2023 survey was to understand changes in the distribution and abundance of threatened/uncommon plants since the earthquakes, and to identify threats to their survival and potential management needs. This article presents a summary of the 2022-2023 survey findings and has been abbreviated from a larger report provided to CCC.

Methods

Selection of target plant species and survey locations

The sites selected for the 2022-2023 survey were determined by the 2006-2010 survey results – i.e., plots where Threatened/At Risk and/or locally uncommon plants had been found – and the accessibility of the sites in relation to rock-fall hazard. The 2006-2010 rock outcrop surveys recorded nine Threatened and 21 At Risk vascular plant species, across 95 plots. The 2022-2023 survey focussed on 10 Threatened/At Risk plant species, as well as three locally uncommon species (Table 1, p. 14). Some of these species were found in more than 10 plots in 2006-2010 (*Anogramma leptophylla*, *Asplenium subglandulosum*, *Carex inopinata*, and *Gingidia enysii* var. *peninsulare*), and therefore a subsample of plots with these species was selected for the 2022-2023 survey.

Table 1. Threatened, At Risk, and locally uncommon plant species targeted in the 2022-2023 survey.

Scientific Name	Common Name	Conservation Status (de Lange et al. 2018a)
<i>Anogramma leptophylla</i>	Jersey fern, annual fern	Threatened-Nationally Vulnerable
<i>Carex inopinata</i>	Grassy mat sedge	
<i>Geranium retrorsum</i>	Turnip-rooted geranium	
<i>Myosurus minimus</i> subsp. <i>novae-zelandiae</i>	Mouse-tail *	
<i>Raoulia monroi</i>	Fan-leaved mat daisy	
<i>Daucus glochidiatus</i>	NZ carrot	At Risk-Declining
<i>Pterostylis tristis</i> / <i>tanypoda</i>	Greenhood orchid	
<i>Asplenium subglandulosum</i>	Blanket fern	At Risk-Naturally Uncommon
<i>Celmisia mackau</i>	Akaroa daisy	
<i>Gingidia enysii</i> var. <i>peninsulare</i>	Banks Peninsula aniseed	
<i>Gingidia montana</i>	NZ aniseed	Not Threatened *
<i>Hymenophyllum cupressiforme</i>	A filmy fern	
<i>Rytidosperma corinum</i>	Native danthonia	

* Uncommon on Banks Peninsula (according to Wilson 2013).

Sites surveyed

Surveys of rock outcrops were undertaken between October 2022 and January 2023 by Melissa Hutchison, with assistance from Dave Holland, Joe Potter Butler, Marley Ford, William Reinders, and Nicholas Head (CCC Ecologist). In total, 42 plots were re-visited during spring-summer 2022-2023 (Table 2).

Table 2. Sites visited in the 2022-2023 rock outcrops survey.

Site	No. plots visited	Date/s surveyed	Surveyors	Threatened/At Risk plant species recorded in previous 2006-2010 survey
Bowenvale Valley	2	28 Dec 2022	Melissa Hutchison William Reinders	<i>A. leptophylla</i>
Greenwood Park	6	19 Jan 2023	Dave Holland William Reinders	<i>A. leptophylla</i> <i>D. glochidiatus</i> <i>G. retrorsum</i>
Heathcote	13	5 Nov 2022	Melissa Hutchison	<i>A. leptophylla</i>

Valley			Marley Ford	<i>A. subglandulosum</i>
			William Reinders	<i>C. inopinata</i>
			Joe Potter Butler	<i>G. retrorsum</i>
			Tom Ferguson	
John Britten	1	Oct 2022	Nick Head	<i>M. minimus</i> subsp. <i>novae-zelandiae</i>
Misty Peaks	18	8-9 Nov 2022	Melissa Hutchison	<i>C. mackaui</i>
			Marley Ford	<i>G. enysii</i> var. <i>peninsulare</i>
				<i>P. tanypoda / tristis</i>
				<i>R. monroi</i>
				<i>R. corinum</i>
Mt Pleasant	1	19 Jan 2023	Dave Holland	<i>R. monroi</i>
			William Reinders	
Scarborough	1	19 Jan 2023	Dave Holland	<i>G. retrorsum</i>
			William Reinders	

Survey data collected

The previous rock outcrop surveys from 2006-2010 used plots measuring approximately 6 m x 6 m to assess the vegetation. However, it was decided that the plot-based method was too time-consuming and difficult to repeat (plots could not be re-measured with a reasonable degree of accuracy, and it was not possible to re-measure them with the budget available), therefore a different approach was taken for the 2022-23 survey. The 2022-2023 survey used more efficient 'walk-through' methods, whereby the locations of the previous plots were visited, and a search for Threatened/At Risk/locally uncommon plant species was carried out at that point and nearby rock outcrops.

The locations of Threatened, At Risk, and locally uncommon plants were recorded with a hand-held GPS unit, and representative photographs of plants and habitats were taken at each location. Where multiple plants of the same species were found within close proximity to each other, or on a small discrete bluff, the number of plants was counted (or estimated) at each GPS waypoint. If any Threatened/At Risk/locally uncommon plants were found while traversing between the plot locations, they were documented in the same way.

Exotic weeds occurring within close proximity (ca. 5 m) of the target Threatened/At Risk/locally uncommon plants were recorded, and other potential threats to native plants were also noted. Locations of some sparsely distributed, high-impact weeds e.g., old man's beard and wilding conifers, were recorded with a GPS unit.

Incidental observations of Threatened, At Risk, and/or locally uncommon bryophyte and lichen species were also made during the survey.

Results

Summary

In total, 164 GPS waypoints were recorded across six sites during the 2022-2023 rock outcrops survey. Waypoints were made for native and exotic vascular plants, as well as bryophytes and lichens.

Threatened, At Risk, and locally uncommon plant species

- Five Threatened-Nationally Vulnerable plant species were found during the 2022-2023 survey, and GPS waypoints were recorded for four of these species (i.e., excluding kānuka) (Table 3, p.17).
- Five At Risk-Declining plant species and one 'At Risk-Recovering' species (*Epilobium hirtigerum*) were observed. GPS waypoints were saved for three of the At Risk-Declining species. *Epilobium hirtigerum* was recorded for the first time on the Port Hills (at Greenwood Park and Heathcote Valley). This species might have been mistaken for *Epilobium cinereum* in the previous survey. *Hypericum involutum* was found in the Bowenvale Valley. This species was not recorded in the 2006-2010 rock outcrops survey.
- Nine At Risk-Naturally Uncommon plant species were observed, and GPS waypoints were recorded for six of these species. (The three other species are endemic to Banks Peninsula but are common and widespread on the Peninsula.) *Cardamine grandiscapa* was not recorded in the 2006-2010 survey, but this species was first described in 2017, and some of the 2006-2010 plots listed *Cardamine* sp.
- A number of locally uncommon native plant species (i.e., uncommon on the Port Hills/Banks Peninsula) were found at Misty Peaks Reserve: *Aciphylla aurea*, *Anisotome aromatica*, *Celmisia gracilentia*, *Colobanthus acicularis*, *Corybas vitreus*, *Hymenophyllum minimum*, *Notogrammitis heterophylla*, *Ourisia macrophylla* subsp. *lactea*, *Rytidosperma corinum*, and *Scleranthus biflorus*. *Corybas vitreus* and *Hymenophyllum minimum* were not recorded in the 2006-2010 rock outcrops survey. (*C. vitreus* was first described in 2016, see NZPCN 2023a.) The uncommon rock outcrop fern *Pellaea calidirupium* was found in the Heathcote Valley.
- *Myosurus minimus* subsp. *novae-zelandiae* was not found at the GPS waypoint given for John Britten Reserve (Nick Head pers. comm.), and there is some doubt that it was correctly identified in the previous rock outcrop survey (Alice Shanks pers. comm.).
- Some Threatened/At Risk plant species appear to have healthy, secure populations (e.g., *Gingidia enysii* var. *peninsulare*, which was abundant at Misty Peaks), but some other species (e.g., *Anogramma leptophylla*, *Asplenium subglandulosum*, and *Daucus glochidiatus*) appear to have disappeared from some sites where they were recorded in the 2006-2010 survey (e.g., four of the plots at Greenwood Park). Some of the *Carex inopinata* records in the previous survey might have actually been *C. breviculmis*, as the two species cannot be reliably distinguished without seed heads.

Six other Threatened or At Risk plant species were observed during the survey but the number of plants present and their GPS locations were not recorded:

- *Aciphylla subflabellata* (grassland speargrass, spaniard, kurikuri) – At Risk-Declining.

- *Festuca actae* (Banks Peninsula blue tussock) – At Risk-Naturally Uncommon.
- *Hebe strictissima* also known as *Veronica strictissima* (Banks Peninsula hebe) – At Risk-Naturally Uncommon.
- *Heliohebe lavaudiana* also known as *Veronica lavaudiana* (Banks Peninsula sun hebe) – At Risk-Declining.
- *Kunzea robusta/ericoides* (kānuka) – Threatened-Nationally Vulnerable.
- *Leptinella minor* (Banks Peninsula button daisy) – At Risk-Naturally Uncommon.

Table 3. Threatened, At Risk, and locally uncommon plant species recorded in the 2022-2023 rock outcrops survey. Sites: BV = Bowenvale Valley, GP = Greenwood Park, HV = Heathcote Valley, MP = Misty Peaks, MT = Mt Pleasant, SC = Scarborough.

Plant species	No. GPS points	No. plants or patches ¹	Site	Conservation Status (de Lange et al. 2018a)
<i>Anogramma leptophylla</i> (Figure 1, p. 18)	9	59	BV GP HV	Threatened-Nationally Vulnerable
<i>Carex inopinata</i>	1	1	HV	
<i>Geranium retrorsum</i>	6	12	BV HV	
<i>Raoulia monroi</i>	3	7	MP MT	
<i>Geranium solanderi</i>	7	16	BV GP HV SC	At Risk-Declining
<i>Hypericum involutum</i>	1	1	BV	
<i>Linum monogynum</i>	3	3	BV	
<i>Epilobium hirtigerum</i>	3	22	HV SC	At Risk-Recovering
<i>Asplenium subglandulosum</i> (Figure 2, p.18)	8	12	HV	At Risk-Naturally Uncommon
<i>Cardamine grandiscapa</i>	1	1	MP	
<i>Celmisia mackau</i> (Figure 3, p. 19)	17	155	MP	
<i>Chenopodium allanii</i>	1	1	HV	
<i>Gingidia enysii</i> var. <i>peninsulare</i>	66	1628	MP	
<i>Senecio matatini</i> subsp. <i>basinudus</i>	3	3	BV	
<i>Colobanthus acicularis</i>	1	1	MP	
<i>Corybas vitreus</i>	1	1	MP	Not Threatened
<i>Hymenophyllum minimum</i>	1	1	MP	

¹ Estimated minimum number of plants or patches present (separate plants or patches were not always counted at each waypoint).



Figure 1. Jersey fern (*Anogramma leptophylla*), Heathcote Valley (5 Nov 2022).



Figure 2. Blanket fern (*Asplenium subglandulosum*), Heathcote Valley (5 Nov 2022).



Figure 3. Akaroa daisy (*Celmisia mackaui*) below Brasenose / Ōteauheke, Misty Peaks (9 Nov 2022).

At Risk, Data Deficient, and locally uncommon lichen species recorded in the 2022-2023 rock outcrops survey

Three At Risk and two Data Deficient lichen species were recorded during the 2022-2023 survey (Table 4, p. 20). In addition, five lichen species that are considered to be uncommon on the Port Hills/Banks Peninsula were observed (Table 4). Two of these species (*Cladonia verticillata* and *Pertusaria spilota*) had not been recorded on Banks Peninsula before.

In recent years, I have been compiling a list of lichen species found on the Port Hills and Banks Peninsula (i.e., Banks Ecological Region) using a variety of sources: Lintott and Lintott (1996), Flora of NZ lichens, Australasian Virtual Herbarium records, iNaturalist observations, and personal observations by Allison Knight, David Glenney, and Marley Ford. The list currently contains more than 330 taxa, including 29 species that are classified as At Risk-Naturally Uncommon, and 30 Data Deficient species (de Lange et al. 2018b).

Over the last five years, I have found several lichen species that had not previously been recorded on Banks Peninsula, including:

- *Lobothallia radiosa* (<https://inaturalist.nz/observations/54108744>).
- *Peltula euploca* (<https://inaturalist.nz/observations/54108737>).

- *Ramalina fimbriata* (<https://inaturalist.nz/observations/24924411>).
- *Trapeliopsis congregans* (<https://inaturalist.nz/observations/36313909>).
- *Tuckermannopsis chlorophylla*) – classified as Data Deficient (<https://inaturalist.nz/observations/35845996>).

Further lichen surveys of rock outcrops, forest remnants, and other habitats on Banks Peninsula will undoubtedly add additional species to the list for the Peninsula and yield more records of Data Deficient species.

Table 4. At Risk, Data Deficient, and locally uncommon lichen species recorded in the 2022-2023 rock outcrops survey. Sites: HV = Heathcote Valley, MP = Misty Peaks.

Scientific Name	Conservation Status (de Lange et al. 2018b)	Status on Port Hills/ Banks Peninsula ¹	Site
<i>Leptogium malmei</i> ²	At Risk-Naturally Uncommon	Uncommon	MP
<i>Ramalina fimbriata</i>		Uncommon	MP
<i>Teloschistes fasciculatus</i>		Uncommon	MP
<i>Dermatocarpon miniatum</i> var. <i>complicatum</i> ³	Data Deficient	Uncommon. Distribution and abundance are poorly known in New Zealand (NZPCN 2023b).	HV
<i>Pertusaria spilota</i> ⁴		Uncommon.	MP
<i>Cladonia verticillata</i>	Not Threatened	Uncommon. First record on Banks Peninsula.	MP
<i>Coccocarpia palmicola</i>		Uncommon	MP
<i>Lobothallia radiosa</i>		Uncommon. First recorded on Banks Peninsula in 2020 (Hutchison 2020a).	HV
<i>Peltula euploca</i>		Probably uncommon. First recorded on Banks Peninsula in 2020 (Hutchison 2020b).	HV
<i>Usnea acromelana/ ciliata</i> ⁵		Uncommon	MP

¹ M. Hutchison, pers. obs.

² Observed by Marley Ford (<https://inaturalist.nz/observations/142198717>).

³ Observed by Marley Ford (<https://inaturalist.nz/observations/141219688>).

⁴ Identified by Jennifer Bannister (from a specimen collected by Marley Ford).

⁵ It is difficult to separate these two similar species.

Weed species recorded in 2022-2023

A number of exotic weed species were recorded during the 2022-2023 survey (Table 5). Six of these species are classified as pests in the Canterbury Regional Pest Management Plan (RPMP), and six are listed as 'Organisms of Interest' in the RPMP (CRC 2018). An exotic liverwort species, crescent-cup liverwort (*Lunularia cruciata*), was also recorded in the Bowenvale and Heathcote Valleys.

GPS waypoints were saved for some sparsely distributed weed species that pose a major threat to indigenous biodiversity and/or have the potential to spread more widely in Council reserves and other natural areas:

- Boxthorn (*Lycium ferocissimum*)
- Hawthorn (*Crataegus monogyna*)
- Old man's beard (*Clematis vitalba*)
- Serrated tussock/nassella (*Nassella trichotoma*)
- Wilding conifers – Douglas fir (*Pseudotsuga menziesii*) and *Pinus radiata*.

Table 5. Exotic weed species recorded in the 2022-2023 rock outcrops survey. Sites: BV = Bowenvale Valley, GP = Greenwood Park, HV = Heathcote Valley, MP = Misty Peaks, MT = Mt Pleasant, SC = Scarborough.

Scientific Name	Common Name	Status in Canterbury RPMP (CRC 2018)	Site
<i>Aeonium</i> sp.	Aeonium		SC
<i>Aloe maculata</i>	Soap aloe		SC
<i>Centranthus ruber</i>	Spur valerian	Organism of Interest	HV
<i>Clematis vitalba</i>	Old man's beard	Sustained Control Pest ¹	HV
<i>Cotyledon orbiculata</i>	Pig's ear	Organism of Interest	HV SC
<i>Crataegus monogyna</i>	Hawthorn	Organism of Interest	MP SC
<i>Cytisus scoparius</i>	Scotch broom	Sustained Control Pest ¹	GP SC
<i>Eschscholzia californica</i>	Californian poppy		HV
<i>Foeniculum vulgare</i>	Fennel		SC
<i>Linaria purpurea</i>	Purple toadflax		HV
<i>Lycium ferocissimum</i>	Boxthorn	Organism of Interest	HV
<i>Marrubium vulgare</i>	Horehound	Organism of Interest	HV
<i>Nassella trichotoma</i>	Serrated tussock	Sustained Control Pest	GP
<i>Pinus radiata</i>	Monterey pine	Progressive Containment ²	MP
<i>Polypodium vulgare</i>	Common polypody	³	HV
<i>Pseudotsuga menziesii</i>	Douglas fir	Progressive Containment ²	MP
<i>Rubus fruticosus</i> agg.	Blackberry	Organism of Interest	GP

<i>Sedum acre</i>	Stonecrop		HV
<i>Ulex europaeus</i>	Gorse	Sustained Control Pest ¹	HV MP

¹ Also included in Site-led Programmes.

² Wilding conifers are any introduced conifer tree, including (but not limited to) any of the species listed in Table 4 (CRC 2018), established by natural means, unless it is located within a forest plantation, and does not create any greater risk of wilding conifer spread to adjacent or nearby land, other than the forest plantation that it is a part of.

³ Classified as an ‘Unwanted Organism’ by the Ministry for Primary Industries.

Management Issues

Weeds

- Rock outcrop weeds are a major threat to *Asplenium subglandulosum* at Heathcote Valley, particularly pig’s ear (Figure 4), common polypody (Figure 5, p. 24), and spur valerian, as they occupy the same habitats as blanket fern. Other exotic weeds such as *Aeonium* spp., *Aloe maculata*, *Linaria purpurea*, and *Sedum acre* are not as widespread on the Port Hills at present but also pose a serious threat to native rock outcrop plants.



Figure 4. Pig’s ear (*Cotyledon orbiculata*) smothering blanket fern (*Asplenium subglandulosum*) habitat in the Heathcote Valley (5 Nov 2022).



Figure 5. Common polypody (*Polypodium vulgare*) (arrowed) invading blanket fern (*Asplenium subglandulosum*) habitat in the Heathcote Valley (5 Nov 2022).

- Exotic crescent-cup liverwort (*Lunularia cruciata*) may be a threat to *Anogramma leptophylla*, as it is invading potential establishment sites for the fern, and may also crowd out native liverworts (e.g., *Plagiochasma rupestre*) in these habitats.
- Exotic woody weeds are a threat to native rock outcrop vegetation, *Celmisia mackaui*, and regenerating native shrubland at Misty Peaks, particularly wilding conifers (e.g., Douglas fir, *Pinus radiata* (Figure 6, p. 24)), hawthorn, and gorse.
- Pine needles from the adjacent pine/conifer plantation are being deposited onto some rock outcrops at Misty Peaks. It was evident that some of the planted conifers at Misty Peaks had been controlled/removed, but ideally conifers would be controlled or removed from a wider buffer zone around the rock outcrops.
- Dense exotic grass is a threat to some low-growing native plant species (e.g., *Anogramma leptophylla*, *Geranium retrorsum*, *G. solanderi*, *Gingidia enysii* var. *peninsulare*, *Hypericum involutum*, and *Raoulia monroi*). Removal or suppression of grass (e.g., through planting of native woody species) could be trialled at some *Anogramma* sites in the Bowenvale Valley.

Native vegetation

- Dense patches of *Muehlenbeckia complexa* and *Microlaena stipoides* were present in the *Anogramma leptophylla* habitats in the Bowenvale Valley, and these native plants could be smothering the fern or competing for space. Localised hand trimming at some *Anogramma* sites could be trialled.



Figure 6. Wilding *Pinus radiata* sapling in *Celmisia mackaui* habitat below Brasenose / Ōteauheke, Misty Peaks (9 Nov 2022).

Pest animals and livestock

- Cow pats were observed on some rock outcrops at Misty Peaks.
- Possums – lots of possum pellets were seen at Misty Peaks. Possums may browse on palatable threatened species, as well as associated native vegetation that may be providing cover or shelter for threatened plants.

Recreational use

- Rock climbers at Heathcote Valley (Cattlestop Crag) and Misty Peaks (Brasenose / Ōteauheke) may be having detrimental effects on threatened plants, bryophytes, and lichens. Climbers may pull out native plants in cracks and scrape off lichens from rock faces, and clear/disturb native vegetation to create access tracks to crags. Development of new climbing routes should be discouraged.

Monitoring/survey

- Further survey and monitoring of rock outcrops on the Port Hills and Banks Peninsula is recommended, in order to provide a more complete picture of the distribution, abundance, and trends in Threatened/At Risk plant and lichen populations across a wider range of sites.

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