NEW ZEALAND PLANT CONSERVATION NETWORK

TRILEPIDEA

Newsletter of the New Zealand Plant Conservation Network

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Deadline for next issue: Friday 19 November 2021

SUBMIT AN ARTICLE TO THE NEWSLETTER

Contributions are welcome to the newsletter at any time. The closing date for articles for each issue is approximately the 15th of each month.

Articles may be edited and used in the newsletter and/or on the website news page.

The Network will publish almost any article about plants and plant conservation with a particular focus on the plant life of New Zealand and Oceania.

Please send news items or event information to **info@nzpcn.org.nz**

Postal address:
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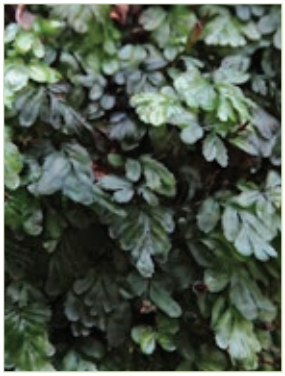
NEW ZEALAND

PLANT OF THE MONTH, p. 2



Hymenophyllum minimum. Photo: Rowan Hindmarsh-Walls.

2021 Favourite plant vote update

Taylor Davies-Colley (taylordaviescolley@gmail.com)

As I write this article there are only seven days remaining of the annual NZPCN favourite plant competition. This year the competition has seen a great level of engagement with the vote and associated media, and as such has done a great job of being a tool for advocacy of our native flora.

With one week remaining the votes stand as:

1. *Leptinella nana*
2. *Clianthus puniceus*
3. *Metrosideros excelsa*
4. *Corybas carsei*
5. *Sophora chathamica*
6. *Muehlenbeckia astonii*
7. *Pseudopanax crassifolius*
8. *Vitex lucens*
9. *Metrosideros umbellata*
10. *Agathis australis*

Despite time running out it is still any plant's game as to who will be in the top spot at the end of the month. However, the voting suggests that the top two are locked in a battle for the win. Currently leading *Leptinella nana* has made a huge climb through the ranks, being out of the top 10 after the first week, then in just the last 2 weeks it raced to the top with the help of some very loyal advocates for this amazing and very threatened species.

Other highlights of the 2021 competition so far include the competition being featured on RNZ with Jesse Mulligan, increased awareness of the threat status of some of our more "common" plants such as *Metrosideros excelsa*, a huge increase in mobile traffic to the website and the website being much better set up to handle mobile users, and some useful tie ins with the concurrently running Bird of the Year competition run by Forest and Bird.

If you are reading this before midnight on 31 October there is still time to have your say by heading to the NZPCN website, finding your plant with the name search, and clicking on the vote button. We will announce the winner via Facebook, and on the website. We will also do a full write up of this year's competition and the winners in the next issue, so keep a look out and may your favourite plant win.

NZPCN AGM Reminder

You may or may not have seen the first announcement of our Annual General Meeting being held on Monday 1 November 2021 at 6.00pm via Zoom. Following the official side of things, we are pleased to announce we will be entertained/informed by a 20–30 minute presentation from NZPCN committee member Dr. Melissa Hutchison.

To register in advance for this meeting please click on the following link: https://us02web.zoom.us/meeting/register/tZwuduqvrDoiHt2AawX4m6-nvvzB-OIxB2e5

Once registered, you will receive a confirmation email containing information about how to join the meeting.

PLANT OF THE MONTH – *HYMENOPHYLLUM MINIMUM*

Rowan Hindmarsh-Walls (rowan.hindwalls@gmail.com)

Hymenophyllum minimum, Mores Bush, Riverton, Southland, 26 October 2015: (left) habitat; (right) growth habit. Photos: Rowan Hindmarsh-Walls.

The plant of the month for October is *Hymenophyllum minimum,* one of twenty five species of *Hymenophyllum* found in the New Zealand region. The species has a scattered distribution throughout the country from about Mount Pirongia south to Rakiura/Stewart Island. It is also found on the Chathams and most of the sub-Antarctic Islands, down to Campbell Island. It can live from the coast up to 1600m altitude and is generally found growing on banks or rocks, but is occasionally seen as an epiphyte (on other plants). Plants can be found in a wide range of habitats from exposed coastal sites, to forest and scrub, to sub-alpine tussock grassland. The species can tolerate a certain level of salt spray, and forms extensive mats at some coastal sites. As this plant is one of the smallest ferns in the country it is often overlooked. The fronds are up to 30 mm in length, with one to six pairs of prominently toothed primary pinnae (like leaflets). The leafy parts of the fronds are generally bright green in colour. The sori (reproductive bodies) are located at the tip of the fronds and each frond only has one sorus, unlike most other *Hymenophylum* species, which have many per frond.

Hymenophyllums can be difficult to identify to species level, as there are many of them and some are quite similar. *Hymenophyllum minimum* is similar in appearance to most of the other small *Hymenophyllum* species with toothed pinnae, such as *H. armstrongii, H. cuppressiforme, H. peltatum,* and *H. revolutum*. This species can generally be distinguished from all but *H. armstrongii* by its single terminal sorus with exerted recepticle, or to put into laymen's terms 'the single fruiting body located at the tip of the frond with a pointy bit sticking out the end'. *Hymenophyllum armstrongii* also only has one terminal sorus (fruiting body), but is much more commonly found as an epiphyte, has fronds which are either undivided (no primary pinnae) or have one to three forks, rather than one to six pairs (as in *H. minimum*), and *H. armstrongii* has no pointy bit or teeth at the tip of the fruiting body. Some of these other species live in similar habitats and have teeth at the tip of the fruiting bodies, but no pointy bit, and mostly have more than one fruiting body per frond, distinguishing them from *H. minimum*.

The species is endemic to New Zealand, with a current threat status of 'Not Threatened' as, although it is scattered, it has a widespread distribution, and is abundant some places. Part of the species' original range has probably been affected by coastal land clearance and development, especially in the southern South Island, but the species has strongholds on the sub-Antarctic islands, where it is protected from most threats except climate change.

The genus name *Hymenophyllum,* meaning 'Membranous leaf' is from the Greek 'hymen' or membrane, and 'phyllon' or leaf, and refers to the transparent filmy fronds. The species epithet 'minimum' means 'of minimal size' or 'very small', and refers to the plants tiny size.

You can view the NZPCN website factsheet for *Hymenophyllum minimum* at: https://www.nzpcn.org.nz/flora/species/hymenophyllum-minimum/

Amandinea delangei (Calicaceae) a new endemic saxicolous lichen from Te Aupouri, Te Ika a Maui / North Island, Aotearoa / New Zealand.

Peter J. de Lange (pdelange@unitec.ac.nz), School of Environmental & Animal Sciences, Unitec Institute of Technology, Auckland.

Saxicolous lichens tend to be poorly represented in New Zealand herbaria, in part because they can be difficult to collect without destroying them but also because of storage issues as they are invariably firmly attached to rocks, samples of which are often too large or awkward to accommodate easily in herbarium collections. Irrespective of this problem, John (Jack) Elix (based at the Australian National University, Canberra, Australia) has, for at least the last six years, been patiently working through the Buellioid lichens (Calicaceae) of Australasia and the South Pacific. Buellioid lichens usually have a white or greyish thallus, often deeply cracked, and the fruiting bodies, the apothecia, are usually black (Fig. 1). There are several key genera found in New Zealand considered 'Buellioid' including *Amandinea*, *Buellia*, *Rinodina* and *Rinodinella*, amongst others. Jack's work has revealed that New Zealand Buellioid lichens are much more diverse than had been believed and, as judged by the treatment in Galloway (2007), many of the species Galloway treated there remain either poorly understood or in need of revision (e.g., consider the recent name changes and new species of Buellioid lichens listed in de Lange et al. (2018)). A few years ago, Jack asked if I might collect him specimens, and so I have, mostly from Northland, but also the Chatham Islands, and I also forwarded him a duplicate set of Kermadec specimens collected in May 2011. From the latter Jack described a new species *Buellia insularicola*, from specimens I collected on Cheeseman Island, though it is also known from Lord Howe (Elix & de Lange 2017).

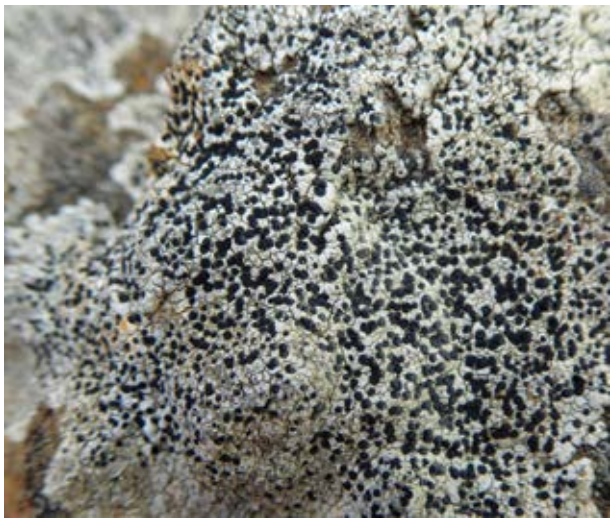


Fig. 1. *Rinodinella fertilis* var. *fertilis*, Te Wakatehaua (The Bluff), Oneroa o Tohe (Ninety Mile Beach), a 'typical' Buellioid lichen. Photo: P.J. de Lange.

The type of *Amandinea delangei* (Elix & Mayrhofer 2021) was collected on 1 January 2017 when my close friend the late Kamera Raharaha (13 February 1961 – 14 February 2020), son Theo (Fig. 2), and I were driving down Oneroa o Tohe (Ninety Mile Beach) from Te Paki stream mouth to Hukatere. On the way we stopped briefly at Te Wakatehaua (The Bluff) (Fig. 3) to examine the rock pools. It was low tide, and Kamera, ever the keen marine biologist, was desirous of showing us the plethora of life that flourishes in the rock pools associated with that outcrop. That was awesome of course but the lichen cover on Te Wakatehaua caught my eye more, so I left them to it.

Fig. 2. Kamera Raharaha and Theo de Lange sitting outside Kamera's whare, Otaipango (Henderson Bay), Te Aupouri. Photo: P.J. de Lange.

Te Wakatehaua (Fig. 3) is a weathered basalt outcrop, the eastern flank of which is mostly covered in sand, and here the surface is often trampled by people, or occupied by cars, tractors, bikes and tourist buses. The summit is covered in a halophytic flora described in detail by de Lange (1996), while the western side is terminated by a series of small cliffs dropping down to an exposed shore platform. People often visit Te Wakatehaua to try their luck at fishing, and for the scenic views it provides of Oneroa o Tohe and Matapia Island.

Fig. 3. Te Wakatehaua (The Bluff), Oneroa o Tohe (Ninety Mile Beach) as seen from the air looking south on 14 April 1959. Photo colorised from a black and white image: © Whites Aviation, CC BY 4.0)

On our visit I lacked the necessary equipment for sampling saxicolous species, i.e., rock hammer, rock chisels etc, as all I had was a small pocket knife and my hands. So, whilst Theo and Kamera found treasure after treasure in the rock pools, including, no less, a plastic crocodile wedged within a rock crevice in a deep pool (see https://inaturalist.nz/observations/4925872), I did my best to prise off potentially interesting lichens. I soon found that Te Wakatehaua had, aside from lots of Teloschistaceae, numerous Buellioids, but time was limited and the rock hard so I prised off what I could, and then with the tide turning we were off.

Later than evening, back at Kamera's whare, Otaipango (Henderson Bay), I sorted out the specimens I had, photographed them, posting many of these observations on iNaturalist NZ (e.g., https://inaturalist.nz/observations/4939458, https://inaturalist.nz/observations/4930806), and then put them in packets. One problem with saxicolous lichens is that it is virtually impossible to get samples of one species, there are nearly always several on the same rock fragment, often intermixed. However, I did my best, and when back in Auckland I posted off the primary set to Jack Elix, retaining duplicates where I could, which I lodged in UNITEC as that herbarium specifically caters for lichen specimens (de Lange & Blanchon 2018).

Toward the end of 2017 Jack wrote back with his determinations. Amongst them was a lichen he called *Amandinea* c.f. *litoralis*. His uncertainty I assumed was due to the inadequate sample sent, it never occurred to me that the lichen was potentially a new species.

During February 2021, whilst on the Chatham Islands, I received a series of emails congratulating me on the new species of lichen named after me. These emails mystified me, internet was poor there and I had no idea what people were talking about. Eventually, I was sent the relevant paper. It transpired that the *Amandinea* c.f. *litoralis* I had collected from Te Wakatehaua had been described as a new species, *Amandinea delangei* Elix et H.Mayrhofer.

When I returned to New Zealand from the Chatham Islands I wrote to Jack about the new species. Jack explained that the specimen I sent he had placed as 'near' *A. litoralis*, noting some differences, which with further work confirmed that it was a new species. Jack said that he and Helmut Mayrhofer felt it would be a nice surprise to have it named for me, as I had helped them in their studies by providing a range of specimens from remote northern North Island locations, and also from island groups such as the Kermadecs.

The new species Elix & Mayrhofer (2021) is distinguished by the grey-white to pale grey crustose, areolate to subsquamulose, thallus with a granular-sorediate upper surface; by the broadly adnate and then sessile apothecia; and by the non-amyloid medulla, an inspersed subhymenium, the 1-septate, *Physconia*- then *Buellia*-type ascospores, which are 12–16 × 6–9 µm. The conidia are curved, filiform conidia, 16–25 µm long. Notably there are no lichen substances detectable. Morphologically, it can resemble specimens of *A. litoralis*, a species not actually present in New Zealand (c.f. de Lange et al. 2018 where we said it was; that record was based on what is now the type material of *Amandinea delangei*), whose thallus surface is not sorediate and which has an inspersed subhymenium (Blaha et al. 2016). Of the New Zealand species, *Amandinea rangitatensis* Elix et H.Mayrhofer, an apparently South Island endemic, also has a sorediate upper thallus surface, but that species differs from *A. delangei* in having larger ascospores (14–[17.1]–20 × 7–[9.2]–11 µm), whose spore-walls are strongly rugulate, while the subhymenium is non-inspersed, and chemically that species contains atranorin (Elix & Mayrhofer 2017).

Amandinea delangei is thus far known only from the type material, with the holotype lodged in CANB and the isotype held in UNITEC (Fig. 4) . Nothing is known about the new species abundance and very little about its ecology, that's a job for me to sort out I guess. In the interim, like so many New Zealand lichens we know very little about it, beyond the assumption it is a coastal species and that it should be searched for on coastal exposures of rock.

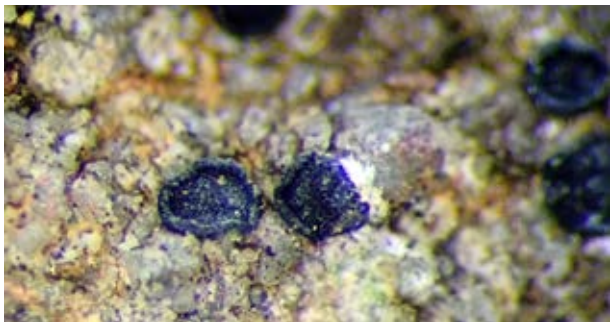


Fig. 4. *Amandinea delangei* Elix et H. Mayrhofer, image of isotype—*P.J. de Lange 13389, T.J.P. de Lange & K.A. Raharaha*, UNITEC 9233. Photo: P.J. de Lange.

Acknowledgements

Thanks to Jack Elix and Helmut Mayrhofer for their interest in the specimens I have sent them to date, and subsequent correspondence. Also, thank you to Andrew Marshall and Dan Blanchon who drew to my attention via the internet the naming of *Amandinea delangei*.

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Where are we at with myrtle rust; Restoration planting and the risk of spreading disease

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I am an ecologist and during recent fieldwork we came across a mature ramarama tree beside an area that may undergo restoration planting. Ramarama is one of those species that is proving to be very susceptible to myrtle rust, so we wondered should we be using any myrtle species at all in the restoration area?

Myrtle rust[1] is caused by a fungus, and plants in the Myrtaceae family (myrtles) are at risk from dieback and death. This includes New Zealand's native pōhutukawa, mānuka, kānuka, rātā, ramarama, rōhutu, maire tawake/swamp maire, as well as introduced species such as bottle brushes, eucalyptus trees, guava, lilly pilly (monkey apple), willow myrtle, and feijoa.

Ramarama infected with myrtle rust. Photo courtesy of Graeme Atkins and used with permission.

Myrtle rust has had severe consequences for some species overseas. Of the 64 introduced species known to occur in New Zealand, at least 33 are considered susceptible to infection, and of the 28 indigenous species at least 14 are known to be susceptible[2].

Myrtle rust is spread by wind but can also be spread by insects, people and machinery brushing up against infected plants, and by moving infected plant material. Honeybees and other insects have even been observed collecting or eating the spores. All these avenues can introduce the disease to new hosts and new areas.

Pustules with bright yellow spores form on new leaves, shoots, flowers and fruit. Up to 90% of new growth can be infected, causing death of branch tips and infected fruit dropping off before it ripens. Repeated infection then kills the plant, whether it is a seedling or a mature tree. Populations of adult and juvenile ramarama and rohutu trees have been killed within two years of infection, including near Rotorua, and on the East Cape around Gisborne. This is likely to cause localised extinction[3]. Myrtle rust is of grave concern to iwi as it has the potential to affect both iconic and taonga trees and species, including large mature pōhutukawa and rare species of rātā.

Myrtle rust is still rapidly spreading, and how it spreads can be unpredictable. Climbing rata vines in remote areas inside the Raukumara ranges[4] have been infected. In January 2021 myrtle rust was confirmed within the Waitākere Ranges[5] in Auckland. In May 2021, it was discovered in Ōtautahi-

1 Scientific names for myrtle rust (*Austropuccinia psidii*), and indigenous species ramarama (*Lophomyrtus bullata*), pohutukawa (*Metrosideros excelsa*), manuka (*Leptospermum scoparium*; at least 3 different species), kānuka (*Kunzea*, 10 different species), rātā (9 different species of *Metrosideros*, northern rata is *Metrosideros robusta*), rōhutu (*Lophomyrtus obcordata* and *Neomyrtus pedunculata*), and maire tawake/swamp maire (*Syzygium maire*).

2 https://www.myrtlerust.org.nz/assets/Uploads/Suseptible-MR-Species.pdf and additional observations.

3 Sutherland R., Soewarto J., Beresford R., and Ganley B. 2020: Monitoring *Austropuccinia psidii* (myrtle rust) on New Zealand Myrtaceae in native forest. *New Zealand Journal of Ecology (2020) 44(2)*: 3414. https://newzealandecology.org/nzje/3414.pdf

4 https://www.gisborneherald.co.nz/environment/20210413/vigilance-the-key-to-preventing-myrtle-rust/

5 https://www.nzherald.co.nz/nz/myrtle-rust-discovered-in-aucklands-waitakere-ranges-for-the-first-time/N3TBVRUZTOEWUALU5ONJFEX5EU/?fbclid=IwAR3_26VtW5aux4a3Z15eQAStaWKJRxgcAA4ZecmA7ubsi3mfq2i5pUoZuu8

Christchurch, the furthest south an established infection has been seen[6]. Christchurch had generally been considered a low-risk environment for myrtle rust, which thrives in warm moist areas. In June 2021, it was discovered on ramarama in Zealandia[7] and the trees were removed to prevent further spread. The map of reported infections as of 13 August 2021[8] is shown. Once a tree or shrub is infected then the quantity of myrtle rust spores in that vicinity increases quickly and this puts other non-yet infected plants in the Myrtaceae family at greater risk of infection. If you find something that looks like myrtle rust then please do not to touch it or try to collect samples as this may increase the spread of the disease. Instead, we encourage you to take photographs of the infection and the host plant. You can then upload these and report the location on the Myrtle Rust Reporter on iNaturalist NZ[9], where experts can check and confirm whether the observations are correct. People may also want to think about replacing vulnerable myrtles in gardens, especially non-native plants like lilly pillys. If we can keep infections down in gardens, spore numbers in the environment will reduce and native plants in the bush will have a reduced chance of infection.

Map of reported infections as of 13 August 2021. Sourced from https://plantandfood.maps.arcgis.com/apps/webappviewer/index.html?id=db12ae762a0a4e3eb8c61b1f67120c3b

Beyond Myrtle rust survey

Manaaki Whenua-Landcare Research is currently undertaking a survey on who and how people survey for myrtle rust. The Beyond Myrtle Rust MBIE project has designed a survey for individuals, groups, and organisations involved in researching, monitoring and responding to myrtle rust infestations. The aim of the survey is to find out what myrtle rust activities are currently being carried out and the motivations for conducting these activities.

The survey is expected to take between 10–15 minutes and participation is voluntary. Individuals will not be identified by name, however, the survey would like to know what organisation, if any, participants belong to. The survey will not use the responses to scrutinise an individual's or organisation's activities, but they will be used to assess the range of observations/surveillance being carried out on myrtle rust at an individual or collective level.

The survey will then use this information to provide information and policy advice to government. Follow this link to the survey: Myrtle rust survey [10]

6 https://nzppi.co.nz/Myrtle-rust-found-in-Christchurch-more-expected-in-region/19776-5789ee2b-d816-4b75-b9a1-e5a3ec0b1a20/

7 https://www.nzherald.co.nz/nz/wellingtons-zealandia-records-its-first-known-case-of-myrtle-rust/IDMROACPSVLSVHHNZQDYU4UT2M/

8 https://plantandfood.maps.arcgis.com/apps/webappviewer/index.html?id=db12ae762a0a4e3eb8c61b1f67120c3b

9 https://inaturalist.nz/projects/myrtle-rust-reporter

10 https://survey.landcareresearch.co.nz/jfe/form/SV_1GryJkDiliubcuq?RID=MLRP_0olp7JNuCTAYnMq&Q_CHL=email&fbclid=IwAR01nZODhOQ-1UBJ3sj76sh4Z13a7VKsf-aViWw1tCa63Yaad5NwRPIhTd0

Restoration planting

Myrtle species such as mānuka and kānuka are used a lot in restoration planting. Ramarama was also occasionally used, as well as being a popular garden or hedge plant. A number of restoration projects have also been planting northern rātā and pohutukawa. Using these myrtle species could increase the risk of introducing myrtle rust to a new site and increases the number of hosts within a site. Good hygiene will also be required for pest animal and plant management activities, as it is possible to carry spores on clothing and gear. Some species are more prone to infection than others such as ramarama, rōhutu, and maire tawake/swamp maire.

If you would like to know more about myrtle rust and the plants it affects, please visit www.myrtlerust.org.nz.

At Cardno we will be taking a precautionary restoration approach in the vicinity of known myrtle species that have proven to be highly susceptible to myrtle rust. Which plant species will be used for restoration and appropriate hygiene measures will be assessed on a case by case basis.

Solitary ramarama tree near a potential restoration area. What is the best way to protect this tree from myrtle rust infection?

Walking through a grove of dead adult ramarama on the East Coast. All seedlings succumbed to myrtle rust two years ago and local extinction seems likely. Photo courtesy of Graeme Atkins and used with permission.

Botanical rarities of the upper Clutha River/Mata Au, Central Otago

Geoff Rogers (bogpine@xtra.co.nz)

This article deals with a portfolio of vascular plant rarities, mostly herbs, of the upper Clutha River/Mata Au catchment, a region at the westernmost edge of the rain-shadow basins of Central Otago. Most accounts of the flora and vegetation of inland Otago tend to focus on the patchwork of relict shrubs and trees spared the fires that transformed the pre-human woody landscape to today's signature grasslands (e.g. Yeomann 2020). This collation, however, deals with the rich assembly of small plants that augments that woody flora. It is a compilation of records by both Government and private botanists from the last 40-years of fossicking.

Geomorphically, Central Otago's interior basins and ranges arise from subdued rates of tectonic compression, producing broad concave basins separated by convex ranges. The sediments infilling the basins are entirely alluvial and colluvial in origin. But the upper Clutha River/Mata Au basin at the western margin of rain-shadow Otago sits at the landform transition from that subdued, rolling relief of the interior to the rapidly-rising mountains sculpted by ice of the Southern Alps/Kā Tiritiri o Te Moana. Thus, the sediments infilling the upper Clutha River/Mata Au basin are of glacial as well as fluvial origins. The post-glacial, outwash gravels intermixed with lateral and terminal moraines from the glaciers that excavated Lakes Wanaka and Hawea have formed extensive, dramatic, alluvial terraces that extend down catchment 53 km to Cromwell.

Those terraces, particularly the bouldery gravels of their levees, provide habitat for many diminutive herbs that have miraculously outlasted the waves of nature suppression from farming, horticulture, viticulture and life-style conversion, much of it during the last 25 years. Colloquially referred to as the green wave, the pace of conversion on the basin floor continues unabated and it is time to profile some of the precarious, diminutive botanical assets remaining.

The order of species appearing here does not imply a value priority, rather it follows a broad down-catchment sequence from the lakes.

Mazus novaezeelandiae subsp. *impolitus* f. *impolitus*

Nationally, *Mazus novaezeelandiae* subsp. *impolitus* f. impolitus (Threatened – Nationally Endangered, de Lange et al. 2018) is predominantly a coastal species in scattered populations from mid Canterbury and central Westland northwards (Heenan 1998: Fig. 11). However, there are four records from Central Otago on riverine herbaceous turf of the Clutha River/Mata Au – at Earnscleugh near Alexandra, Lowburn near Cromwell, Luggate and below the river outlet at Lake Wanaka (Peter Johnson pers. comm. 2020; Heenan 1998: Fig. 11). Subsequent land use changes have likely obliterated the Earnscleugh and definitely drowned the Lowburn sites of these records and recent searches of the Luggate and Lake Wanaka outlet sites have been fruitless. Nevertheless, the species was recently discovered by John Barkla in a 2 square metre area at Butterfields Wildlife Management Area near Albert Town on the margins of a pond in an ox-bow or cut-off meander of the Hawea River. Its habitat can be water-inundated for many months of the year (Fig. 1).

Fig. 1: There is just one contemporary record of *Mazus novaezeelandiae* subsp. *impolitus* f. impolitus in Otago at Butterfields Wildlife Management Area near Albert Town, Wanaka discovered by John Barkla. Its oxbow habitat is water inundated during the winter. Photo: Geoff Rogers.

Solenogyne christensenii

Following John Barkla's initial discovery and the fascinating account of the taxonomic detective trail leading to the naming of *Solenogyne christensenii* (de Lange et al. 2020) (assessed as *Abrotanella christensenii*: Threatened – Nationally Critical by de Lange et al. 2018), we have observed the species over the last two summers at its discovery site bordering the Clutha River/Mata Au below its outlet at Lake Wanaka (Fig. 2). There are three small clusters of plants containing <100 rosettes in total within a 20 metre linear span of riparian herbfield beneath a scrub-low forest cover of *Leptospermum scoparium* and *Kunzea serotina*. Furthermore, over the two summers since its naming, John Barkla and I have unsuccessfully searched extensive, ostensibly identical, habitat around the lower confines of Lake Wanaka and on both banks of the Clutha River/Mata Au above and below the discovery site. Fluctuating river levels and river-bank scouring in peak river flows render this only known site vulnerable to erosion and even obliteration (Fig. 3). The species has a curiously-long flowering season from early December to early May. Although there is an early 20th century record from Hanmer Plains (de Lange et al. 2020), at present this can be considered a Clutha River/Mata Au basin endemic.

Fig 2: Rosettes of *Solenogyne christensenii* within mossy herbfield on a moist bank bordering the Clutha River/Mata Au. Photo: Geoff Rogers.

Fig. 3: The adjacent river and flood-scoured sand terrace demonstrate the vulnerability to erosion from high river flows of the only known site of *Solenogyne christensenii*. Photo: Geoff Rogers.

***Myosotis* aff. *glauca* (a) (WELT SP104520; "Mata Au")**

Myosotis aff. *glauca* (a) (WELT SP104520; "Mata Au") (Threatened – Nationally Critical, Taxonomically indeterminate, de Lange et al. 2018) was discovered in 2013 by Brian Rance and myself amongst *Kunzea serotina* scrub, low forest in the Hikuwai Conservation Area (62 ha) at Albert Town, Wanaka. Its known extent is c. 5 hectares of a terrace of glacial outwash gravels, at a 50 metre elevation above the Clutha River/Mata Au. The taxon shows a unique suite of character traits compared to other pygmy *Myosotis*. Plants are more erect than other pygmy forget-me-nots, have two colour morphs (glaucous grey-green leaves with purple stems or entirely brown) and flexuous patent to erect trichomes (J. Prebble pers. comm. 2021) (Fig. 4; Fig. 5; Fig. 6). Monitoring over eight years shows it has a spring annual life cycle, similar to *Ceratocephala pungens*, *Myosotis brevis* and *Myosurus minimus* subsp. *novae-zelandiae* (Rogers et al. 2002; Rogers & Overton 2007). Using nMDS molecular analyses of morphological characters measured on herbarium specimens placed the taxon within a cluster containing *Myosotis antarctica* subsp. *antarctica* and *M. brevis* but not *M. glauca*, although with high uncertainty (Fig. 6 Prebble *et al.* 2018).

Fig. 4 (left): *Myosotis* aff. *glauca* (a) (WELT SP104520; "Mata Au") has two colour morphs, the first with glaucous grey-green leaves and purple stems. Photo: Geoff Rogers.

Fig. 5 (right): The second colour morph of *Myosotis* aff. *glauca* (a) (WELT SP104520; "Mata Au") is entirely brown. Photo: Geoff Rogers.

Fig. 6: The habitat of *Myosotis* aff. *glauca* (a) (WELT SP104520; "Mata Au") at Hikuwai Conservation Area at Albert Town, Wanaka is light gaps within *Kunzea serotina* woodland on a summer-arid, sand-veneered, bouldery river terrace Photo: Geoff Rogers.

Curiously, despite our best efforts, we know of just the one scattered population of many hundreds of plants annually at Hikuwai, although there are several other conservation reserves covering outwash gravel terraces with similar *Kunzea*-dominated woodland, stretching from Wanaka 25 kilometres down-river to Queensbury. The plant is reliably visible between September to early December, when it withers and disappears as summer drought advances. Dense aggregates of plants occupy poorly-vegetated mounds of rabbit faeces, pointing to the organic matter and fertility benefits of this topdressing on the underlying raw, sandy soils. This taxon can co-occur with *Myosotis brevis* and, rarely, *M. drucei*.

Montia sessiliflora

In Otago, *Montia* [=*Neopaxia*] *sessiliflora* (Not Threatened, de Lange et al. 2018) is mainly a species of the uplands on damp soils of stream banks, seepages, fellfield and within rock crevices (Heenan 1999). However, the type is from the bed of the Cardrona River at Ballantyne Bridge, Wanaka, a site I have unsuccessfully searched of late. Nevertheless, there is an extant population nearby at the Hikuwai Conservation Area at Albert Town, near the site of *Myosotis* aff. *glauca* (a) (WELT SP104520; "Mata Au") on the same drought-prone, outwash gravel terrace (Fig. 7). Peter Heenan (1999) described two entities from Otago that appear to be vegetatively different from *Montia sessiliflora*, but they lack any corresponding floral differences. As described, neither variation is represented in the Hikuwai plants, which Peter Heenan describes as typical of *M. sessiliflora* (pers. comm. 2019).

Fig. 7: *Montia sessiliflora* at Hikuwai Conservation Area at Albert Town, Wanaka also occupies light gaps within *Kunzea serotina* woodland. Photo: Geoff Rogers.

Montia sessiliflora is included here because it occupies what appears to be atypical, drought-prone, gravels and because of its geographic proximity to the type.

Spring annuals: *Myosurus minimus* subsp. *novae-zelandiae*; *Myosotis brevis*; *Ceratocephala pungens*

New Zealand mousetail (***Myosurus minimus* subsp. *novae-zelandiae***) (Threatened – Nationally Vulnerable, de Lange et al. 2018) is the most widespread of the three southern spring annuals highlighted as an ecological guild in Rogers et al. (2002). There are scattered populations in several of the conservation reserves located on the outwash terraces from Lake Wanaka to Queensberry near Tarras. The Hikuwai Conservation Area has sporadic populations on sand and silt veneers to the bouldery gravels on pavements and depressions where water ponding occurs in winter. A further beneficial habitat driver is accumulations of rabbit droppings (Fig. 8).

Fig. 8: New Zealand mousetail (*Myosurus minimus* subsp. *novae-zelandiae*) with its distinctive seed capsules and minute green flowers is a sporadically distributed, spring annual in Central Otago. Photo: Geoff Rogers.

Myosotis brevis ((Threatened – Nationally Vulnerable, de Lange et al. 2018)) often co-occurs with mousetail, again on summer-dry, semi-bare, boulder pavements (Fig. 9). But it has two other habitats:

- Short herbaceous and mossy turf of seepages and tarn margins.
- Saline soil pavements.

Its conspicuous, stiff, sometimes curved, hairs, often subtended by tuberculate bases on upper leaf surfaces, obtuse leaf apices, two leaf colour

Fig. 9: *Myosotis brevis* with its conspicuous upright hairs subtended by tuberculate bases and minute, cream to pale yellow flowers. Photo: Geoff Rogers.

morphs—bronze and green—and minute, cream to pale yellow flowers are useful diagnostic features amongst the pygmy Myosotis group. Myosotis brevis occurs throughout the basin on semi-consolidated but bare bouldery gravels of terrace batters and flats from the lake outlets to Lowburn north of Cromwell.

I know of no records of ***Ceratocephala pungens*** (Threatened – Nationally Critical, de Lange et al. 2018) from the outwash gravels of the upper Clutha River/Mata Au but it does occur within the catchment at altitude. We have records at several sites within the Bendigo Conservation Area on the mid-valley slopes of the southern Dunstan Mountains, always on bare silty and gravelly pavements that are mediated by sheep and rabbit activity (Fig. 10). Of the three spring annuals highlighted here, it is the most intolerant of inter-plant competition (Rogers et al. 2002; Rogers & Overton 2007).

Fig. 10: *Ceratocephala pungens* is known from just a few semi-arid open pavements in Central Otago and the Mackenzie Basin. Photo: Geoff Rogers.

Muehlenbeckia ephedroides

This "bunch-of-sticks" species is known from five populations from the study catchment: adjacent the Glendhu Bay Track on the lake-shore fetch zone of southern Lake Wanaka; 0.5 kilometres north of the end of the Lake Hawea Track on a primary terrace of the Hawea River (Fig. 11); on a terrace levee alongside the Upper Clutha River Track, 1 km northwest of the end of Stevenson Road, near Wanaka Airport; on a primary terrace of the Clutha River/Mata Au at the Mata Au Scientific Reserve between Luggate and Tarras; and at Mahaka Katia Scientific Reserve near Lowburn, where it occurs on a levee margin of a bouldery terrace (Threatened – Nationally Vulnerable, de Lange et al. 2018) (Fig. 12).

Fig. 11 (left): Arne Cleland, Mary Bruce and Brian Rance surveying the terrace levee habitat of *Muehlenbeckia ephedroides* above the Hawea River near Albert Town. Photo: Geoff Rogers.
Fig. 12 (right): Distinctive *Muehlenbeckia ephedroides* is a perennial, semi-woody liane from well-drained stony pavements. It is highly palatable to rabbits, with most stems decapitated. Photo: Geoff Rogers.

The habitat at all sites is excessively well-drained bouldery gravels free of other competing plants. All populations suffer preferential browse by rabbits (Fig. 11). Vulnerable species like this are why DOC Alexandra have a sustained rabbit control programme at Mahaka Katia Scientific Reserve (MKSR) north of Cromwell.

Peter Johnson remembers this species from riparian habitat at the entrance to the Cromwell Gorge of the Clutha River/Mata Au, a site likely now flooded by Lake Dunstan (Peter Johnson pers. comm. 2018).

There are hybrids between *Muehlenbeckia ephedroides* and *M. axillaris* at some of these sites.

Convolvulus waitaha

On a narrow gravel terrace supporting a walking/cycling track bordering the Clutha River/Mata Au, Shaun Collins spotted a few plants of *Convolvulus waitaha* (Not Threatened, de Lange et al. 2018), evident only from its bold flowers secreted amongst a smothering sward of exotic-grasses. Further searching revealed plants on a second habitat type nearby: bare silt and gravel banks of a terrace riser. Figures 13 and 14 show the morphological plasticity of its leaves in response to the contrasting amounts of exposure and light within the grass sward versus the bare bank. Nationally, *Convolvulus waitaha* is a sporadic species of mainly coastal sites from southern Wairarapa southwards (de Lange 2021), with sporadic inland records of eastern South Island, often from limestone substrates.

Fig. 13 (left): *Convolvulus waitaha* shows morphological plasticity in its leaves in response to light and exposure: sheltered plants have hastate to deltoid leaves. Photo: Shaun Collins.
Fig. 14 (above): Exposed plants of *Convolvulus waitaha* have obtuse, coriaceous leaves. Photo: Shaun Collins.

Carex albula

Several populations of *Carex albula* (Threatened – Nationally Vulnerable, de Lange et al. 2018) have been obliterated by vegetation clearance and pasture `improvement' in the basin. I know of one plant only at the Cromwell Chafer Beetle Nature Reserve, near Cromwell (Fig. 15). *Carex albula* has a narrow regional range from the Waitaki River catchment, including the Mackenzie Basin, to Central Otago.

Fig. 15: The dry, stony terrace habitat of *Carex albula* in the Clutha River/Mata Au basin has dramatically contracted in the last 20-years. This is the one plant I know at the Cromwell Chafer Beetle Nature Reserve. Photo: Mike Thorsen.

Myosotis goyenii

We have two unofficial records of *Myosotis goyenii* (At Risk – Naturally Uncommon, de Lange et al. 2018), both from the rocky batters of primary outwash terraces bordering the Clutha River/Mata Au: the first from Peter Johnson is from the true-left, just upstream from the Albert Town SH 6 bridge; the second from John Barkla near the Luggate Red Bridge. Although both records are unvouchered due to low numbers of plants, repeat searches of both sites have been unsuccessful.

Daucus glochidiatus

Our native carrot (*Daucus glochiatus*) (At Risk – Declining, de Lange et al. 2018) seems to have suffered a rapid decline over the last 30-years and is now extinct over large parts of its range (NZPCN species factsheet: https://www.nzpcn.org.nz/flora/species/daucus-glochidiatus/). In Central Otago, it is known from just one local and sparse population between Luggate and Queensberry centred on Poison Creek Reserve (Fig. 16). Its habitat is the toe of dry hill slopes on rubbly and silty colluvium amongst low woodland of mostly *Kunzea serotina*. It may well occur but has never been recorded on the outwash gravel terraces of the adjacent basin floor. It is easily confused with introduced upright hedge-parsley (*Torilis japonica*) and wild carrot (*Daucus carota*). It behaves as a spring/early summer annual. The recurring theme for this, as with many, rare, rain-shadow, dryland herbs, is its baffling absence from widespread, ostensibly suitable, habitat.

Fig. 16: In Otago, our native carrot *Daucus glochidiatus* is confined to a small part of the upper Clutha River/Mata Au basin down river from Luggate, within open *Kunzea serotina* scrub. Photo: Geoff Rogers.

Leptinella conjuncta

The minuscule *Leptinella conjuncta* (Threatened – Nationally Critical, de Lange et al. 2018) came to scientific attention when Tony Druce and colleagues first visited the arid, bouldery river terraces bordering the Clutha River/Mata Au at Lowburn, north of Cromwell, then known as Pisa Flats, on March 11, 1989 (Druce et al. 1993). Repeat surveys of Pisa Flats never extended its habitat extent beyond that initial c. 3 square metres of boulder levee. Then, c. 4 years ago, we chanced upon a second population on another but older, terrace levee, but, again, highly localised at <10 square metres of coverage (Fig. 17; Fig. 18). Three additional populations were subsequently discovered in wider Central Otago and one in south Canterbury, leading to its taxonomic description by Heenan (2009). In more detail, those five sites are: MKSC (Pisa Flat), Lowburn, north of Cromwell; lower Nevis valley (a tributary of the Kawarau River); Fiddlers Flat, near Falls Dam, upper Manuherikea River; Lindis Crossing near Tarras close to the confluence of the Lindis River and the Clutha River/Mata Au; and I spotted it during a Maryburn Station tenure review inspection in the Mackenzie Basin.

Fig. 17: *Leptinella conjuncta* is at its most vigorous within *Raoulia australis* cushions. Its capitula are supported on wiry scapes. Photo: Geoff Rogers.

Fig. 18: The terrace levee at Mahaka Katia Scientific Reserve where *Leptinella conjuncta* was brought to botanical attention. The levee is also the habitat of *Craspedia* (a) (CHR 511522; Clutha River) and *Lepidium solandri*. The recently planted cherry orchard to the south is symptomatic of the dramatic loss of this stony terrace ecosystem in the last 25-years. Photo: Geoff Rogers.

The species shows two micro-habitats at most sites: either *Raoulia australis* cushions or within the matrix of sparsely-vegetated gravel (Heenan 2009).

For decades, the Pisa Flat site was rangeland-farmed with merino sheep. The land tenure change and creation of the MKSR there in 2001 led to destocking and ongoing suppression (but not eradication) of rabbits by DOC Alexandra. However, its bouldery, scabweed habitat there seems to have had increasing annual cover of St John's wort (*Hypericum perforatum*) since removal of the sheep. Interestingly, last summer St John's wort was dramatically defoliated by a leaf-feeding beetle (*Chrysolina hyperici*) first released in New Zealand as a biocontrol agent in 1943 (Syrett 1997).

Craspedia (a) (CHR 511522; Clutha River)

Craspedia (a) (CHR 511522; Clutha River) (Threatened – Nationally Critical, de Lange et al. 2018) also came to botanical attention during Tony Druce's visit to Pisa Flat at Lowburn in 1989. Druce et al. (1993) describe it as having greyish white leaves with both surfaces densely covered in cottony hairs that mat together to form a felt. It grows within *Raoulia australis* mats and within the boulder matrix (Fig. 19). In the 3 years following the 2001 creation of the MKSC, Ilse Breitwieser (pers. comm. 2021) recorded "hundreds of plants including thriving seedlings at its levee discovery

Fig. 19: *Craspedia* (a) (CHR 511522; Clutha River) with its felt-like, leaf hairs is an endemic and rather cryptic herb of a stony terrace levee at Mahaka Katia Scientific Reserve. Photo: Geoff Rogers.

site. The population grew on the levee surface and extended down the contiguous terrace batter facing Lake Dunstan. However, most flowering plants had decapitated scapes, possibly due to rabbits because, presumably, sheep had already been removed. A survey on 4–5 November 2010 recorded 65 flowering plants and 357 juveniles.

In recent years there have been very low numbers of plants (often <10 annually) at that original site and none on the levee batter, coupled with little evidence of flowering. Then, during a 2020/21 summer census, John Barkla and I found another population on a similar terrace levee site, 500 metres distant. But we recorded just 24 plants total in the two levee populations, again with no conclusive evidence of flowering. Thus, the difference in plant frequency from the early 2000s to the last few years is dramatic, pointing to detrimental change in ecological drivers accruing from the tenure/land use change. Fortunately, the plant is a priority for taxonomic resolution (Ilse Breitweiser, pers. comm. 2020) but just as pressing is investigation of its alarming population decline. Presently, most plants appear unthrifty with 4 or less leaves, perhaps due to nutrient-impoverishment. Also, there is no evidence of foliar browse by invertebrates or rabbits (contrast the vulnerability of flowers and fruits). Recent observations over consecutive seasons show most present plants are not summer-`green', surviving over the winter into the following spring.

Lepidium solandri

The subject of conservation concern from its slow decline across its north Canterbury to Otago range, *Lepidium solandri* (Threatened – Nationally Critical, de Lange et al. 2018) has three small, declining populations at MKSR (Fig. 20). All three have had sporadic, experimental exclusion of rabbit herbivory using small, steel mesh cages (Fig. 21). Threats to it are numerous, not least its difficulty with recruitment because inflorescences and infructescences are decapitated by rabbits and sheep (evident from the MKSR cages). Nevertheless, it invests heavily in vegetative survival via its deep tap root, often leading to its sporadic inter-annular, surface appearance (e.g. Galloway QEII covenant) (Rob Wardle pers. comm. 2021).

Fig. 20: *Lepidium solandri* is a cryptic, long-lived, perennial herb of dryland basin and valley floors as evident at Mahaka Katia Scientific Reserve. Photo: Geoff Rogers.

Fig. 21: Steel cages over *Lepidium solandri* on its stony terrace habitat at Mahaka Katia Scientific Reserve deflect rabbit herbivory that compromises seed reproduction. Photo: Geoff Rogers.

Myosotis uniflora

One of the few semi-woody native forget-me-nots, *Myosotis uniflora* (At Risk – Naturally Uncommon, de Lange et al. 2018) occurs at MKSR, where it is restricted to levees (Fig. 22). Beyond the upper Clutha River/Mata Au catchment, specifically MKSR, it has a sparse presence mainly on braided river beds and consolidated moraines of Canterbury, particularly the Mackenzie basin.

Fig. 22: Cushions of semi-woody *Myosotis uniflora* have striking yellow flowers highlighting its otherwise cryptic presence on stony pavements at Mahaka Katia Scientific Reserve. Photo: Geoff Rogers.

Carex decurtata

Carex decurtata (Data Deficient, de Lange et al. 2018) is a short-statured, erect sedge from stony terraces in the Mackenzie Basin and Central Otago. Unusually for a sedge, it is palatable to rabbits. In the upper Clutha River/Mata Au basin, I know of it from Lindis Crossing QEII Covenant and MKSR only, where it grows in *Raoulia australis* mats (Fig. 23).

Fig. 23 Heavily rabbit-browsed *Carex decurtata* in its typical habitat—a *Raoulia australis* mat—at Lindis Crossing QEII Covenant site near the confluence of the Lindis River and the Clutha River/Mata Au. Photo: Geoff Rogers.

Convolvulus verecundus

Convolvulus verecundus (Threatened – Nationally Vulnerable, de Lange et al. 2018) is a cryptic plant (unless in flower) of deltoid, hairy, silvery-grey leaves that grows on the bony gravel terraces at MKSR (Fig. 24). MKSR may be its only Otago site. There, it can occupy cushion mats of *Raoulia australis*, a signature species of scabweed communities. MKSR is typical of one of its two habitat types in its south Marlborough to Central Otago range—summer-dry, sparsely-vegetated alluvium and rock pavements. The other habitat is limestone scarps and pavements in Canterbury.

Fig. 24: In common with other special herbs of the upper Clutha River/Mata Au catchment, *Convolvulus verecundus* favours mats of *Raoulia australis*. The foliage cluster is at top left. Photo: Geoff Rogers.

Discussion

With three endemic taxa – *Solenogyne christensenii*, *Myosotis* aff. *glauca* (a) (WELT SP104520; "Mata Au") and *Craspedia* (a) (CHR 511522; Clutha River) - and many other rare and/or threatened entities, this is a biogeographically significant herbaceous group of mostly small herbs. Both within the study catchment and at their broader national extent, almost all are in decline due to intensified land conversion of their dryland, lowland, semi-wild ecosystems. Many of these species are geographically-linked to the Mackenzie Basin, where outwash gravels of the Tekapo, Pukaki and Ohau valleys provide similar, stony terrace habitats.

Advocating for the heritage values of this stony terrace flora, when threatened by indiscriminate vegetation clearance or antagonistic vegetation change, is a tall order because of their cryptic and often taxonomically-challenging identity, the 'wasteland' perception of their habitats and because they are a specialised botanical and ecological research proposition. Unlike the woody, sedge and rush flora, they are unsuitable for native plant revegetation initiatives undertaken by community groups because of their poorly understood and narrow-niche habitat characteristics. Fortunately, tenure review of pastoral leases fringing the upper Clutha River/Mata Au catchment enabled the creation of several rare plant and lowland ecosystem-focused reserves. Protection of rare rain-shadow ecosystems is an outcome of tenure review sometimes overlooked or undervalued by NGO conservation advocacy groups lobbying for the processes' cessation.

Remarkably, these plants occupy landforms created by glacial retreat and fluvial outpouring of post-glacial gravels, with the last phase over just the last 15,000 years. Yet, throughout the Pleistocene, this basin landscape has seen multiple glacial/interglacial-interstadial cycles of gravel-infilling followed by terrace formation from river down-cutting in periods of comparative landform stasis. Thus, the plants' life histories often show adaptation or dependency on site instability, particularly pavement erosion providing rejuvenation of soil fertility.

That raises the intriguing question of the role of extinct herbivorous birds in their life history and ecology, particularly ground disturbance and nutrient cycling. Paleoecological studies using moa coprolites, predominantly from Central Otago, show the preferential importance of small herbs (and grasses) in the diet of moa…indeed the diet of a range of moa species of different feeding guilds (Lee et al. 2010; Wood et al. 2008; Wood et al. 2020). (Avian herbivory included other bird groups beside moa such as many ducks and a goose, in combination with lizard frugivory.) In broad terms, many life history aspects of these herbs would have been tied to avian and lizard herbivory. For instance, *Ceratocephala pungens* has an ecology likely tied to ground scarification by birds (Rogers et al. 2002;

Rogers & Overton 2007), uric acid-boosted soil fertility and seed characters clearly adapted to dispersal via feathers (Thorsen et al. 2009).

In combination, five fundamental ecosystem changes have penalised our lowland dryland grass and forb flora:

- Loss of avian mutualisms or dependencies (what surrogate role for introduced animals?).
- Loss of the scrub, woodland and low forest that produced dappled-light understoreys for herbs and grasses. Removal has increased summer aridity.
- Removal of the geomorphic and animal disturbance factors that provided habitat disturbance and rejuvenation (Rogers et al. 2005; Walker et al. 2009).
- Competition from aggressive, adventive, grasses and herbs.
- Wholesale land clearance.

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Contact details required

Alan Mark is revising his book "Above the Treeline: A nature guide to alpine New Zealand" and would like to make contact with some of the original photograph contributors, whose email addresses have been misplaced or changed since the original version was published in 2012.

If you are, or know, one of the following individuals can you please make contact with Alan Mark via email at alan.mark@otago.ac.nz.

Kees Green, John Hunt, Doug Logan, Paul Morris, Graham Pritchard, Brett Robertson, Graham Robertson, Steven Stephenson, Sandra Witherspoon.

Your assistance in this matter will be very much appreciated.

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A copy of the Application Form and the Rules of the award may be downloaded from the Auckland Botanical Society website under: Lucy Cranwell Fund

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All field trips postponed or cancelled until Covid-19 restrictions allow for their resumption. Meetings are being held via Zoom only at present.

Waikato Botanical Society

Field Trip: Friday 5 November to Sunday 7 November to Coromandel. (Combined with Rotorua Botanical Society) **Meet:** At campground. **Grade**: Easy to moderate.	**Leaders:** Graeme Jane and Gael Donaghy, email gtjane@kinect.co.nz, ph. 07 570 3123.

Rotorua Botanical Society

Field Trip: Friday 5 November to Sunday 7 November to Coromandel. (Combined with Waikato Botanical Society) **Meet:** At campground. **Grade**: Easy to moderate.	**Leaders:** Graeme Jane and Gael Donaghy, email gtjane@kinect.co.nz, ph. 07 570 3123.
Field Trip: Saturday 27 or Sunday 28 November (tbc) to Taupo reserves and geothermal sites. **Meet:** The Rotorua carpark at 8.00am or in Taupo at a time to be confirmed. **Grade**: Easy,	**Leader:** Chris Bycroft, email chris.bycroft@wildlands.co.nz ph. 027 498 5513.

Wellington Botanical Society

Field Trip: Saturday 6 November to Otaki Gorge wetland. **Meet:** Waikanae Railway Station north end carpark at 9.30am.	**Co-Leaders:** Helen White, email wellingtonbotsocmembership@gmail.com, ph. 022 413 5194 and Owen Spearpoint, email owen.spearpoint@gw.govt.nz, ph. 027 285 8083.

Nelson Botanical Society

Field Trip: Sunday 21 November to the Nelson mineral belt. Please refer to the website: https://www.nelsonbotanicalsociety.org/trips-meetings, for more details.	**Leader:** Helen Lindsay, email helenlindsay3@gmail.com.

Canterbury Botanical Society

Meeting: Monday 1 November at 7.30pm. **Speaker**: Paul Broady. **Topic**: Microbes and Climate Change.	**Venue:** Knox Church, Bealey Avenue. (Please note change from usual venue).
Field Trip: Saturday 6 November to Mt. Cloudsley, Castle Hill. **Meet**: Yaldhurst Hotel carpark (15 Old West Coast Road) at 8.30am or at the Springfield toilets at 9.30am. **Grade**: Difficult.	**Leader:** Melissa Hutchison, email fieldtrips@canterburybotanicalsociety.org.nz or phone 03 960 7051 to book or to check for cancellation. Numbers limited to 15.
Spring Camp: Friday 12 November to Sunday 14 November at Kaikoura.	**Camp Organiser:** Tom Ferguson. Please email Tom at fieldtrips@canterburybotanicalsociety.org.nz if you are interested in participating.

Botanical Society of Otago

Meeting: Wednesday 10 November at 5.20pm. **Speaker:** Duncan Nicol. **Topic:** Modelling Niches and Phylogeny in Celmisiinae (Asteraceae).	**Venue:** Room 215, 2nd Floor, Zoology Benham Building, 346 Great King Street.
Field Trip: Saturday 20 November to Truby King Recreation Reserve, Seacliff. **Meet:** Botany Department carpark (464 Great King Street North) at 9.00am. **Grade:** Moderate.	**Contact:** Maia Mistral, email mistral.maia@gmail.com.