BOTANICAL SOCIETY
OF OTAGO

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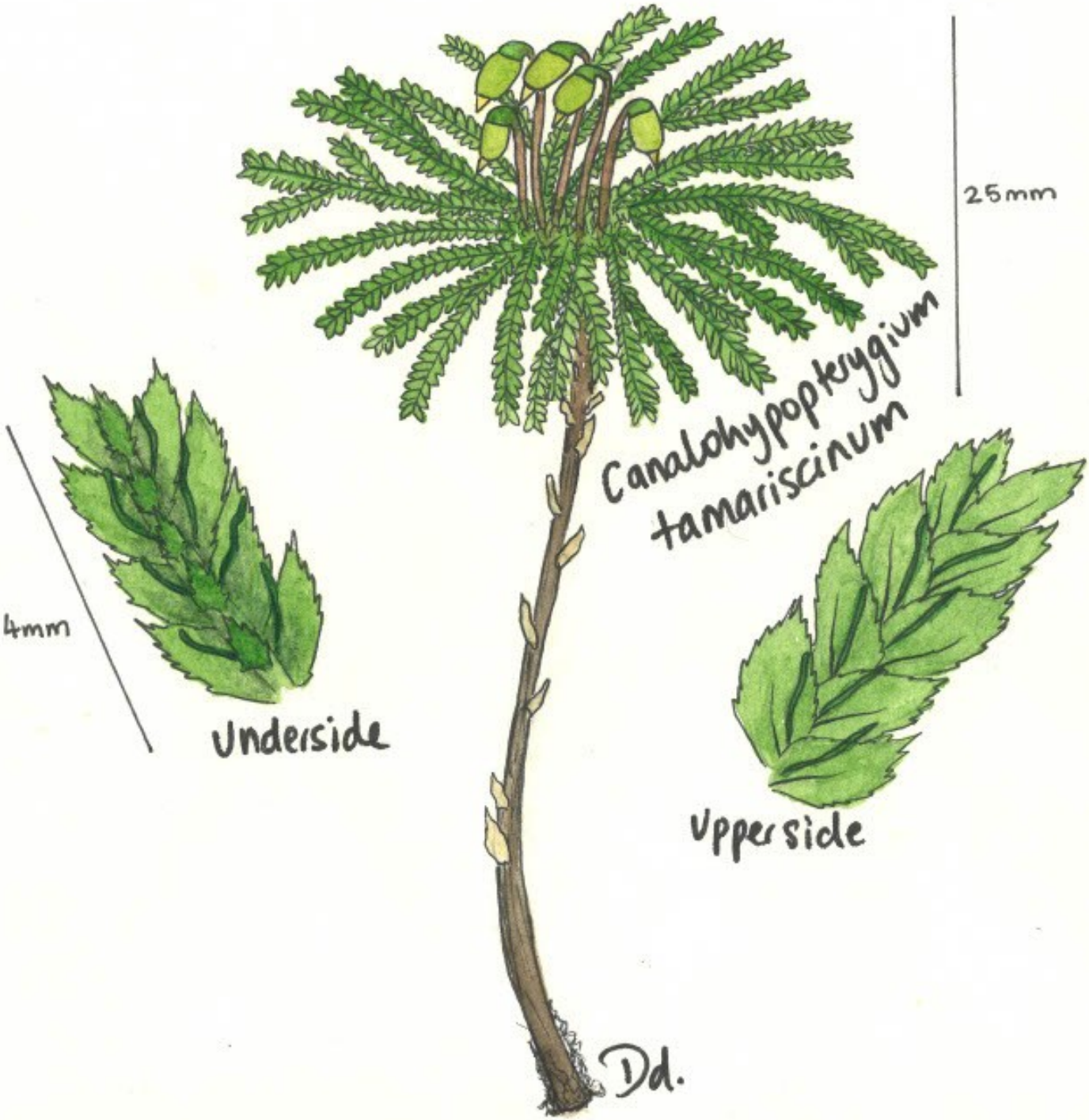

BSO MEETINGS AND FIELD TRIPS NOVEMBER 2022 — APRIL 2023

Location: Talks are hosted by Manaaki Whenua Landcare Research in the main seminar room, 764 Cumberland Street, Dunedin.

9th November 2022, 5:20pm: Drawing Competition. Come along to see the botanical artwork from our drawing competition. Entries close August 1st. There will be an art auction, so come prepared!

19th November 2022, 9:00am: Silver Peaks Possum Hut/Green Ridge circuit. It's going to be botanising on the hoof so to speak as we follow Gold Miners Direct from Steep Hill Road down to the north branch of the Waikouaiti River, then swing left following the river to Possum Hut (now a relic). Climbing up a steepish spur from the hut, we will connect with the Green Hut/Pulpit Rock track which will lead us back to the cars. It is a good track, quite steep in places both downwards and upwards, but only for short bursts. The vegetation is quite modified, comprising of regenerating coastal bush. Good footwear and appropriate clothing needed as the Silver Peaks is exposed. About a 4 hour trip. Contact Robyn Bridges 021 235 8997. If raining on Saturday we will go on Sunday 20th Nov.

11th February 2023, 9:00am: Kuriiti Creek, Hampden. This trip is to a privately owned bush block above Hampden on Kuriiti Creek. This 36ha block was recently purchased and the new family is keen to figure out what is present so they can look after it. Kuriiti creek runs through middle of the block, with the steep slopes containing a mix kānuka and broadleaf/podocarp forest. The understory is damp, with potential for interesting ferns, mosses, and lichens. Grade: the edges of the kānuka bush are accessible from the road. To access the stream and broadleaf/podocarp require a walk down a steep and very rough track. Good walking shoes and willingness to climb back up a 100m hill a must! Contact Gretchen Brownstein brownsteing@landcareresearch.co.nz. Bring water and lunch. Meet at Botany Dept car park 9am. Return time: 3pm 80km / 1hr drive time each way.

15th February, 5:20pm: Tūhura Otago Museum. Come join us for a botanical trip through Tūhura Otago Museum on Wednesday evening. We will get to spend some time after hours with the museum's gardener for a private look around Tūhura Tropical Forest which features over 70 mostly tropical plant species, plus butterflies and birds. Smaller groups (10 at a time) will get a further behind-the-scenes look at Otago Museum's dry collections store which holds internationally significant collections of birds, marine mammals, invertebrates, and a small botanical collection which the museum staff is working to digitize and eventually make available online. Meet at Otago Museum foyer at 5:20pm. Contact Gretchen Brownstein brownsteing@landcareresearch.co.nz to RSVP. Space is limited to 30 people, so a lottery may come into play.

Tūhura Tropical Forest has been featured in recent programmes from Radio New Zealand (www.rnz.co.nz/national/programmes/ourchangingworld/audio/2018810238/caring-for-the-forest) and has been a frequent news maker in the Otago Daily Times since the space opened in 2007.

8th March, 5:20pm: The coastal sand dunes of Otago. Speaker: Teresa Konlechner. Sand dunes are an important feature of the Otago coast. However, the sand dunes of Otago have experienced considerable modification over the last 100 years. Human-induced destabilisation followed by stabilisation by exotic and invasive plants have altered geomorphic processes and the indigenous flora of the dunes. This talk provides an overview of past modification to Otago's dunes. It outlines the state of knowledge regarding the indigenous flora of Otago sand dune habitats and identifies priorities for conservation and restoration of these now uncommon sand dune species.

11th March, 8:00am: All day field trip to Rock and Pillar Range. We will travel to just north of Middlemarch to a carpark at the foot of the Rock and Pillar Range. From here the poled route of the Glencreag track is followed first through regenerating shrubland, then tall tussockland, and finally alpine

cushionfield and rockland. Big Hut (1320 m above sea level) will provide a base for further exploration of the local botanical treasures. The return will be back the same way. This is a steep and arduous trip of c. 1000 m height gain. Participants need to have good fitness and be capable of walking for 3 hrs or more uphill and equivalent downhill. Be prepared for all weather conditions in an exposed alpine environment. The vehicle round trip is approximately 170 km. Depart Botany Department carpark at 8 am. Expected return approx. 6 pm. For more details contact the leader John Barkla mjbarkla@xtra.co.nz

12th April, 5:20pm: Members night. Members are invited to bring items of botanical interest to the monthly meeting and talk about them. Items may be short slide shows, books, photographs, plants or any plant related object that has a story attached. You are invited to get in touch with Angela Brandt (brandta@landcareresearch.co.nz) or Stella Fish (sls.fish@outlook.com), who are organising the meeting, to chat about what you're thinking of bringing or to let them know you want to present a slide show.

15th April, 9:00am: Burns Reserve – one of Dunedin's hidden gems! The 87 hectares of coastal podocarp forest which makes up this reserve, lies on the flanks of Signal Hill high above Ravensbourne, Maia, Burkes and St Leonards. Though established in 1907 by residents concerned at the amount of deforestation on the West Harbour Hills, the Reserve had, until recently, been largely forgotten. Its flora includes good specimens of the original podocarp forest and a fabulous swath of Easter Orchid, *Earina autumnalis* and *Earina mucronata*, growing on a prominent rocky outcrop. The views of Taiaroa Head to Taieri Mouth are spectacular. Meet Botany Department carpark 9am Saturday15th April 2023. Rain date Sunday 16th April 2023. Ring Robyn 021 235 8997

Note: Please review the trip guidelines for participants, drivers and leaders on our website.

Tautuku excursion 2022 (Photo: Karma Chau)

Meeting details: Talks are usually on Wednesday evening starting at 5.30 pm unless otherwise advertised. Talks are to be hosted by Manaaki Whenua Landcare Research in the main seminar room, 764 Cumberland Street, Dunedin. Please check the website before each talk to confirm the location.

Items of botanical interest for our buy, sell and share table are always appreciated. The talks usually finish around 6.30 pm. Keen discussion might continue till 7 pm. Meetings may be held online via Zoom while gathering restrictions remain.

Field trip details: Field trips leave from Botany car park 464 Great King Street unless otherwise advertised. Meet there to car pool. Please contact the trip leader before Friday for trips with special transport and by Wednesday for full weekend trips. A hand lens and field guides always add to the interest. It is the responsibility of each person to stay in contact with the group and to bring sufficient food, drink and outdoor gear to cope with changeable weather conditions. Bring appropriate personal medication, including anti-histamine for allergies. Note trip guidelines on the BSO web site: www.bso.org.nz

Cover art by Daniella Damm: Canalohypopterygium tamariscinum*, one of the many delights of the Pipeline track trip. Drawn from field photos, a fresh specimen, and microscopy during weekly Cryptogang labs.*

FROM THE COMMITTEE

Chairs notes

Gretchen Brownstein

Hope everyone is having a great spring and start of summer. I was doing field work last week (first week of October) and experienced the classic Aotearoa NZ spring trifecta: lambs, daffodils, and 5cm of fresh snow! But there are signs winter is behind us: lots of new growth and lots of flower buds everywhere I look. The tī kōuka (*Cordyline australis*) seem to be putting out more inflorescence than usual. For the last 8 years, I've been counting tī kōuka inflorescence in the Invermay common garden on the Taieri. And for the last four years, flowering has been low to medium levels. I wonder if this year will be a proper mast year for tī kōuka? I also work a project looking at drivers of masting in *Chionochloa* species (tussock grasses), and again its been four years since we've had a mast (or even a flowering). Last year we a grand total of one inflorescence from 50 plants! But I've bet a block of chocolate that this will be *Chionochloa*'s big mast year.

In BSO happenings, it's been great to see people on trips and at talks! And wonderful that we finally got to hold the Baylis Lecture. Heidi Meudt gave a wonderful talk. Heidi has also been working on Geoff Baylis's Wikipedia page, which prompted us to get our own Baylis webpage up. Stella Fish (our wonderful new webmaster) has been working on it and over the coming year, will add more details around who has given lectures and their topics. If you have any suggestions for content (for the Baylis page or any of our other pages on our website), please get in touch.

Also looking forward to catching up with people at the NZPCN conference in December in Queenstown. Hope to see lots of you there.

Happy botanising,

Gretchen

Secretaries notes

Angela Brandt

As another year of ups-and-downs with Covid draws to a close, I want to thank all our members for your patience as we worked through last-minute schedule changes and multiple shifts of locations for our monthly talks. Thanks also for your continued participation and enthusiasm for our events. So many great photos entered in the annual photo competition once again, which resulted in another fabulous calendar - many thanks to John Barkla for putting it together so well! It was also great to finally have Dr. Heidi Meudt give her Baylis Lecture after two postponements due to Covid settings, and wonderful to have so many in attendance, both in person and on Zoom. Next year's programme is shaping up to be quite an exciting one as well. Remember that subscriptions will come due in the new year, so make plans to renew your membership so you don't miss out on receiving emailed updates and timely access to the newsletter!

Editors notes

Lydia Turley

We have decided to change the months in which we publish newsletters to **March, July and November**. This is the first edition at the new schedule, hopefully you've survived the extra month.

As always, a big thank you to all contributors. I really appreciate the effort you put into writing (and drawing) for the newsletter. You are amazing people!

In this edition we have a spectacular cover illustration by Daniella Damm, and two articles written by Botany / Science Communication students. It's always nice to involve new students who might be interested in our group.

If anyone is thinking about writing (or drawing) something for the newsletter, please do! We welcome everything of botanical interest. You can send items in any time, and I'll fit them into the next edition. When submitting articles, please keep formatting to a minimum and send images separately.

Editors guidelines: Suggestions and material for the newsletter are always welcome. We welcome stories, drawings, reviews, opinions, articles, photos, letters – or anything else you think might be of botanical interest. Remember to include photo captions and credits. Please keep formatting to a minimum. Send your feedback, comments or contributions to lydiamturley@gmail.com. Copy for the next newsletter is due on *10 February 2023.* Earlier submissions are most welcome.

New members

A warm welcome to new members Monique Beaumont, C. Stephens, Steven Lawton, Lydia Metcalfe, Marcus Richards, James Arbuckle Becky Kerr and Nancy Longnecker. To our existing members, thanks for your continuing support.

CORRESPONDENCE AND NEWS

2023 Calendar

Calendars cost $15 each and all proceeds go to the Botanical Society of Otago. Available at Department of Botany Reception, between 9.30 a.m. and 11.30 a.m. and 2.30 p.m. to 4.30 p.m., (correct amount of cash only) and at Society meetings. For electronic payments email the Botanical Society of Otago (bso@otago.ac.nz) with your name, address and whether you want to collect the calendar from Botany Department reception or have it posted (add $2.50 for mailing).

Payment by internet banking should include the following details:
Account No: 03 0905 0029158 00
Code: Calendar
Reference: your name

ARTICLES

BTNY365: Research Skills is an undergraduate botany paper at the University of Otago, taught by David Orlovich and Tina Summerfield in Botany and Nancy Longnecker in the Department of Science Communication. One of the students' assignments tasked them with writing a newsletter article to share something they have learned beyond the classroom. The following two articles are examples.

Syntropic agroforestry: humans and nature singing in harmony

Elio Campbell

Oh what a wonderful world it could be if humans became, once again, harmonious with the natural world. Elevated atmospheric greenhouse gas levels, anthropogenic climate change, food insecurity… The list of human-induced strife goes on and on. While the latest and greatest technology and agrochemistry keep being generated to rise to the challenge of fixing human interference, who would have guessed that the answers could be found in nature?

One saving grace that nature presents us with is syntropic agroforestry. This is a sustainable method of farming that was developed by agronomist Ernst Goetsch in Brazil in the 1980s. This approach mimics natural interactions and processes, including successional dynamics, to facilitate a healthy ecosystem of which humans are active members[1].

According to Goetsch (1992), the key principles of syntropic agroforestry are:

- Identifying plant species that are suited to the climate and soils of the specific location and identifying their niches.
- Introducing plant species that can provide beneficial ecosystem services, such as protection from insects and improving soil quality.
- Planting in order that imitates natural succession i.e., colonisers and pioneer species planted first through to late-successional plant species that have long life cycles.
- Pruning plants regularly for fertiliser; for rejuvenation of plants; for better access to light and space; and for speeding the succession process. Removing and mulching introduced plants once they have reached maturity – they have performed their roles and will no longer provide ecosystem services.
- High functional diversity and high, but appropriate, density and composition of all plants.

When these principles are implemented in an ecosystem, soil health and fertility improve – due to high soil organic matter and increased soil permeability[3]. This allows microorganismal and mycorrhizal connections to form with and between the plants, which are key for plant communication and nutrient supply[2]. As a result of syntropy, these ecosystems are highly productive and can thus provide food and habitat for wildlife. This is particularly important in Aotearoa to aid in protecting and conserving native birds[4,5]. Taking a whole-ecosystem approach aligns syntropic agroforestry well with kaitiakitanga Māori, making it useful for progress towards the respectful application of Te Tiriti to land management in Aotearoa.

Syntropic agroforestry also tackles anthropogenically-induced environmental and socioeconomic issues. Increasing plant abundance and diversity on agricultural land – whilst reducing commonplace agricultural processes including monoculture plantations, deforestation, and use of chemical fertilisers, among others – facilitates more niches that complement each other[2,6]. This can thus facilitate a reduction of atmospheric carbon, and therefore, provide a global cooling effect. With more plant diversity and niche complementarity comes higher yields, so syntropic food forests may aid in reducing global food insecurity[2,6].

Syntropy has mainly been utilised in tropical climates thus far, but it can also be adapted to different climate conditions and for successful renaturation of wastelands. There is currently a study in Ehningen, southwest Germany where demonstration plots were set up for syntropic *permaculture* on a spoil heap of a quarry site[8]. Though the project has not yet been completed, the study shows promise of successful adaptation of syntropy to a temperate climate and at a site with poor soil quality due to

its previous use as a quarry. This is helpful for possible future application to Aotearoa, for its temperate regions of the country, such as Southland and Otago. However, a model from von Cossel *et al.*'s study cannot be implemented exactly as it was in southwest Germany. Given that syntropy is based on working *with* natural processes, it is vital that permaculture practices are tailored to the specific location by considering the local climate, geographical features, and ecological status (including measures of current plant species and soil fertility, among other factors)[4].

Syntropic agroforestry has begun to be utilised in Aotearoa by small stakeholders such as the Whangārei-based company PermaDynamics. It is a family-run farm that performs experimentation and research with perennial crops and syntropy. Klaus Lotz is one of the founders of PermaDynamics, has four decades of international experience in sustainable ecosystem management and worked with Ernst Goetsch himself. Lotz was kind enough to speak with me about PermaDynamics' work. He advocates for syntropy saying, 'It is the most potent way to transform any abused soil back to its full potential performance of food abundance and ecosystem function.' PermaDynamics has developed their own food forest, tropical hothouse, mushroom grove, and market garden, all with a practice based on permaculture and syntropy. Their food forest consists of a third exotic companion plants, a third crop plants, and a third New Zealand native plants (including kawakawa, tī kouka, kohekohe, and more), and is 'heavily inhabited by tūī, kererū, fantail, pāteke, [and] kiwi'. PermaDynamics sell their produce, such as banana, cherimoya, and tamarillo; offer online and onsite internship and education programs; and install food farms for clients[2,5].

Syntropic food forest run by PermaDynamics in Whangārei. Photo courtesy of PermaDynamics (https://www.permadynamics.net/).

Large scale changes at governmental and intergovernmental levels regarding the use of syntropic agroforestry are crucial for widespread benefits to be experienced. However, this must prioritise community-based forests and smallholder farmers[9]. Klaus Lotz of PermaDynamics hopes that syntropy through *silvopasture* farms 'arranged in generous hedgerows' will become common practice in Aotearoa. This could provide resilience to New Zealand agriculture against 'a more chaotic climate, [with] input shortages' and could make Aotearoa 'fossil fuel independent'. Scaling up syntropy practices with machinery – whilst it reduces the amount of labour involved – goes against the principles of the practice that Ernst Goetsch founded it upon. With the right information, citizens can also become key members in facilitating syntropy, either in their own gardens, or in community gardens, or by engaging with local and national government to promote syntropic agroforestry. We must stand up to stand with nature.

Permaculture: a sustainable and self-sufficient framework for agriculture systems that work with natural succession of plants and ecosystems.

Silvopasture: a sustainable agroforestry and land management practice that integrates livestock, crop plants, and trees that benefits all involved, including humans.

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Using Nature's Dynamism to Regenerate Central Otago

Dominic Harrison

Central Otago has always held a deep allure for me. Despite the ethereal beauty of the landscape I can never stop my mind wandering, daydreaming about the species that once inhabited this region and what it must have been like before the destructive forces of human settlement.

Human occupation of this landscape stripped the land of its vegetation cover and left it barren, exposed and arguably degraded. But human action also has the unique opportunity to assist in returning it to a version of its former wilderness that is more adapted and resilient to current and future stressors. Through clear understanding of the forest dynamics of Central Otago and the evolutionary history of the area, grounded in ecological successional theory, there is an opportunity for the barren and arguably degraded landscapes to be returned to a diverse, interconnected ecosystem.

Although Central Otago had native grass and shrubland before human occupation, this was interspersed with late-stage successional stands of totara (drought tolerant), matai (tends to require more moisture), kowhai and beech forest (McGlone *et al*., 1995). With growing awareness and support of government initiatives such as One Billion Trees, more and more projects for regeneration of Aotearoa's natural forests are being undertaken.

To ensure success of these projects an ecosystem-centric approach is essential. The focus of regeneration projects is often the mature/late-stage successional species such as totara, beech and matai. However, because Central Otago lost 98.7% of its vegetation since human occupation, the uptake of these late-stage species is poor and leads to less than desirable results (Walker *et al*., 2003). The focus of regeneration projects on all scales from individual property planting to large scale rewilding must shift to early successional stage species. Using this approach may allow us to wander among the giants again, smell the distinct earthy scents of a beech forest understorey, and see the spiky leaves of mountain totara. This will assist in the global battle to sequester more carbon dioxide from the atmosphere.

Early-stage successional species are nature's way of regenerating after a disturbance event. In this case we can refer to human occupation as the disturbance event. Early-stage species play a critical role in the ecological success of an ecosystem and set the scene for mature stage species. Early successional species assist in providing the optimal eco-system habitat through factors such as shelter, soil nutrient recycling/availability, recruitment of biotic pollinators and dispersers as well as harbouring complex mycorrhizal relationships (Lindenmayer *et al*., 2019). Early successional stage species differ depending on region as they are a function primarily of climate, resource availability and seed availability through a soil seed bank or neighbouring ecosystems. For Central Otago, mānuka and kānuka play integral roles in the establishment of beech forest.

Most trees require or perform better with mycorrhizal relationships. The most common mycorrhizae are known as arbuscular mycorrhizae which are widespread and abundant. However, *Nothofagus* (beech) forms relationships with a much less abun-

dant and highly specific group known as ectomycorrhizal fungi. This potentially explains its poor performance regenerating in previously grazed grasslands, which much of Central Otago is (Dickie *et al*., 2012). Mānuka and kānuka are excellent early successional crops for beech due to their ability to form relationships with both types of mycorrhizae. Planting and encouraging the regeneration of mānuka and kānuka as a nursery crop before planting beech offers biotic and abiotic protection as well as recruiting ectomycorrhizal fungi that beech require. This leads to more successful establishment of mature stands of beech.

Regeneration need not be complex as was highlighted in the nineteenth century by Henry Thoreau.

"In the planting of most seeds of most trees the best gardeners do no more than follow nature, though they may not know it…. So, when we experiment in planting forests, we find ourselves at last doing as Nature does. Would it not be well to consult with Nature in the outset? For she is the most extensive and experienced planter of us all." (Henry Thoreau, On the succession of forest trees, 1860)

The idea that mother nature knows best is heartening and results can already be observed across a private regeneration project encompassing many high-country stations – Soho, Motatapu, Glencoe and Coronet. This land (55,000 hectares) has been progressively destocked, and the difference after ten years of limited or no stock is evident where natural regeneration of pioneer species has seen the expansion of mānuka, kānuka and bracken. This will eventually lead to the spreading of beech forest amongst the mānuka and kānuka. This natural process can be augmented and sped up through planting of nursery-grown early successional species and targeted planting of beech throughout the establishing mānuka and kānuka, especially in areas where beech seed is absent in the soil seed bank. Mahu Whenua is a unique project where the private landowner is partnering with interested parties such as the University of Otago, QEII trust and Department of Conservation to ensure long-term success is achieved.

A photo of the diverse understorey of a beech forest in Glenorchy, a snapshot of what some more areas of Central Otago could be returned to (Photo: Dominic Harrison).

The notion introduced by Henry Thoreau of allowing nature to regenerate and rewild on its own has gained traction amongst some forest ecologists. It raises an important issue in that nature is not static but rather contrarily encompasses a complex dynamism as Pearce (2021) explores in 'A Trillion Trees'. Through palynology, it is evident that vegetation cover has changed consistently, primarily as a function of changing paleo climate. Therefore, as we are currently undergoing one of the fastest climate changes in the sedimentological record as a result of anthropogenic forces, it is a timely reminder to perhaps not become too absorbed in historical vegetation cover and to observe what species are likely to perform well under the predicted future climate regimes of the region. Beech, lancewoods and mountain totara are all drought-tolerant species which have the ability to become re-established throughout Central Otago under the predictions for the likely climate conditions for Aotearoa outlined in the latest IPCC report. Species such as mataī should be carefully considered before integrating into regeneration projects. This is to acknowledge and embrace nature's natural dynamism instead of remaining stagnant in the past with limited success.

Along with the arrival of Europeans, an array of invasive species were introduced that need to be considered alongside the regeneration plan. Wilding pines present a particular challenge in the Central Otago region, due to their drought tolerance and young reproductive maturity age allowing for rapid spreading. Mammalian pests also inhibit development of many woody species.

The multipronged approach of using ecological succes-

sional theory and pest control of invasive species has the possibility of returning significant portions of Central Otago back to a diverse ecosystem, dominated by beautiful pockets of thick bush in gullies and herbaceous woody species up through the higher montane. These will support the reestablishment of native bird and insect niches with the establishment of a more interconnected web of wilderness corridors through the region, leading to a more resilient and diverse array of eco-systems.

Maybe, we will be able to travel through Central Otago and instead of having to shut our eyes to daydream of landscapes possibilities, we will wander amongst the hills and walk through mottled dazzling light making its way through a canopy of mature stands of mosaic forest and vegetation that we assisted in reaching fruition.

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A shining example of our New Zealand liverwort flora.

Stella Fish

Even in the daylight liverworts can be illusive, their shades of green blending into the background framing other more conspicuous members of the forest. However, at night, one in particular is lucent. *Bazzania tayloriana*, 1.3 to 1.5 mm wide and glaucous, it creeps across soil, dead logs and tree fern trunks. Its phyllids are truncated, with three teeth and a waxy cuticle, and when exposed to ultraviolet light it fluoresces a bright blue. So I advise you for your next night walk to take a UV torch and several moments to stop and search for this shining example of our New Zealand liverwort flora.

Close up of a phyllid. Note the strip of vitta, enlarged cells with a singular oil body, and the three teeth at its apex. (Photo: Stella Fish)

Above: Plants fluorescing blue under UV torch.

Left: Glaucous phyllids of Bazzania tayloriana. *(Photos: Stella Fish)*

REPORTS

Does leaf serration have a function? A talk by Bill Lee, 8th June 2022

Gretchen Brownstein

In June Bill Lee gave a very well attended talk entitled "Exploration of the functional significance of serrated leaves in New Zealand forest trees" which considered the question what is the function (if any) of serrations on leaves. Bill, alongside his co-authors Jennifer Bannister and Tammo Reichgelt have spent the last couple years examining this often-overlooked leaf trait to see if they could ascribe a function to it.

A leaf's main function is to photosynthesise (e.g. intercept light, gas exchange, transport liquids) while being able to cope with external forces (e.g. wind, herbivores, and disease). There are many ways of optimising leaf form for an environment, but like all things in life and economics, there are trade-offs between physiological, anatomical and morphological traits. Slow-growing species tend to have long lived, thick, less nutritious leaves and slower photosynthesis; while fast-growing leaves sit at the other end of the spectrum: short-lived, thin, and nutritious. Traits related to leaf thickness, size, nutrient content, and lifespan have been well studied in relation to soil and climate; that is, we understand their function (mostly!). What isn't often considered is leaf shape, why is there such a huge variety of leaf shapes: entire, toothed, undulate, lobed, serrate, etc? What is the functional significance having a certain shape?

Bill, Jennifer, and Tammo looked at this in question in the New Zealand context, concentrating on the woody species. Others around the world have suggested that shape is related to thermoregulation, hydraulic constraints, leaf expansion patterns in deciduous species, biomechanical constraints, herbivore avoidance, optimise light interception and/or linked to flower form. Bill *et al.* focused on teeth and serration as it's a feature you can measure on both current plants and fossil specimens, and it occurs in ca 24% of New Zealand's vascular flora. Applying the Climate Leaf Analysis Multivariate Program (CLAMP), they found for modern species, tooth leaves were found more often in cold temperatures generally and in areas with high rainfall and low evapotranspiration. While these results follow those found elsewhere in the world, there is a stronger correlation with rainfall in New Zealand.

Looking closer at the leaf tooth, they surveyed woody New Zealand species (like *Nothofagus fusca, Hoheria ovata, Carpodetus serratus, Laurelia novae-zelandiae*) and, more often than not, found they had associated hydathodes. Hydathodes are water pores, permanently open, variable in form, functionally linked to vein/tracheid endings, and rare. Except, that is, in New Zealand, where most woody species with serrated leaves have hydathodes, while those with entire leaves had no margin hydathodes. Given the link of toothed leaves with high rainfall and low evapotranspiration, they propose that teethed leaves with their hydathodes are associated with the release of positive hydraulic pressure in saturated soils. Bill suggested this could be tested using comparative eco-physiological studies (and made a call for any interested PhD students to get in touch). Aotearoa New Zealand may be the place to solve the functional significance of serrated leaves.

Thanks very much to Bill, Jennifer and Tammo for a great talk.

Field trip to Bull Creek,18th June 2022

Angelina Young

On June 18th, just shy of Winter solstice, four plant-botherers and one inveterate invertebrate-botherer braved the icy roads to visit Bull Creek, east of Milton.

W were joined on site by Warren X, a local who joined our group for the day, and promptly gave us the low-down. It seems that the farmer who leases the land to the "cribbies" (on 30-year leases) had recently put the land on the market, so 35 of said cribbies decided to buy it at $60,000 each, becoming shareholders, and saving the parcel of land from what they thought would inevitably be conversion to pine plantation. There was talk of further restoration efforts. We were starting on a high.

(Photo: Angelina Young)

Otago Bot Soc members will perhaps be very familiar with the forest along Bull Creek from previous trips - the peculiarly large number of *Streblus heterophylla*/Tūrepo seedlings (a veritable hedge at one point) and one beautiful mature specimen by the first bridge; the fern-rich understory (38 species according to John Steel's list); contorted Rātā; the Tōtara, Mataī and Miro, including several juveniles of good size trackside.

John drew our attention to the many vivid red sequestrate fungi dotted about the place. James beautifully captured a selection of other fungi species (some pictured below). We paused at a bank worthy of the Cryptogam Club's attention, had they been in attendance. Gretchen busily sketched her way through the entire walk - throwing down the gauntlet for the next Botanical Art prize. Others went in search of coastal turf species known to populate this weather-beaten stretch of the south (*Colobanthus muelleri, Scleranthus uniflorus et al.*).

Fungi: red sequestrate and others (Photos: James Crofts-Bennett)

Out in the sea air, the Artist, the Amateur, and the Spiderman stuck to Botanical Lite, though incidentally observed some nice *Cladophora sp.* in the rock pools.

Serious drawing work (Photo: James Crofts-Bennett)

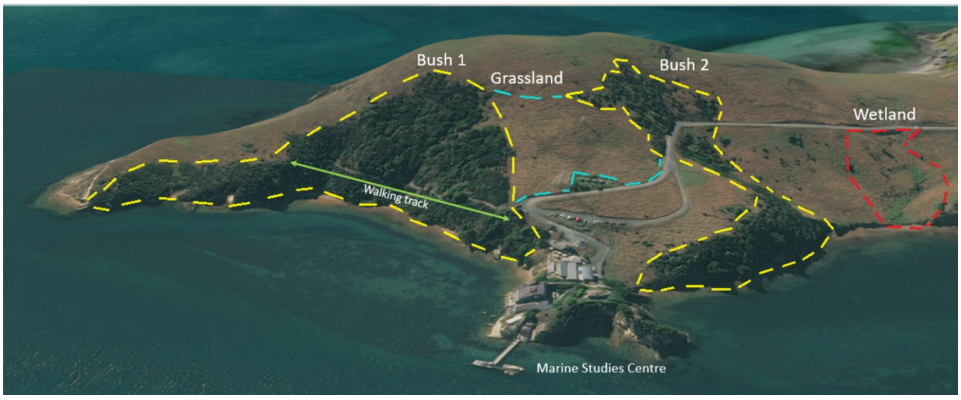
Looking for Shrubs in all the Wrong Places, a talk by Jessica Paull, 13th July 2022

Stella Fish

4th year botany honours student, Jessica Paull, spent her summer on the Portobello Peninsula undertaking a vegetation survey for her studentship. This entailed investigation of roughly 19 hectares to see what plants grew and where. Four sampling blocks were designated, Bush 1, Bush 2, Grassland, and Wetland, with these being split further into sites for ease of sampling. In total 335 species were found, but Jess believes this barely scratches the surface.

Bush 1 was Jess' largest site, positioned past the New Zealand Marine Study Centre. A walking track cuts along the cliff, allowing viewing of the younger forest and its developed understorey. This bush was mostly fenced off from livestock, however, the furthest point was not and is composed of gorse, stunted shrubs and exotic grasses. In total Jess recorded 202 species from this block, with a greater proportion of natives to exotics. Her highlight was the native, at risk/declining *Senecio biserratus* Asteraceae). This ruderal was confined to Bush 1, and only found alongside the walking track and landslips.

Bush 2 differed from Bush 1 in age, structure and size. It is an older forest, evidenced by several remnant trees, but lacks an understorey as most of it had not been fenced off from livestock. Just over half the size of Bush 1, 127 species were recorded, with a greater proportion of natives than exotics. The endemic iris, *Libertia ixioides* (Iridaceae) was recorded from the cliff side above the ocean. This



Jess' sampling block

was the small, fenced-off section, but Jess thought it was more to protect the livestock than the plants!

Bordering the main road and connecting Bush 1 and 2 is the exotic, grazed field of the Grassland. 58 species were recorded, the lowest of all of Jess' blocks, with a greater proportion of exotic species than natives. However, there were islands of diversity. A stunted *Coprosma crassifolia* was found to host at least 13 species! Along the roadside was the only orchid recorded in this survey, the native *Microtis unifolia* (Orchidaceae).

The wetland within the Wetland block is restricted with most of the site being an exotic pasture, however, a closer look revealed more than initially met the eye. There were two areas of interest, the first being a rock wall that supported the road. Found here were several ferns; *Asplenium oblongifolium* (Aspleniaceae), *Blechnum blechnoides* (Blechnaceae), *Dryopteris affinis* (Dryopteridaceae) and *Lomaria discolor* (Blechnaceae). The other was the wetland in question. This had the only *Juncus* (Juncaceae) and *Carex* species (Cyperaceae) found in her sampling. One of the plants Jess highlighted was the endemic *Selliera radicans* (Goodeniaceae), restricted to the Wetland block. In total 95 species were recorded, with 32 being unique.

Of course, a talk by Jess would not be complete without mentioning the bryophytes! She had three first-time additions to the University of Otago Herbarium (OTA) with *Ochiobryum blandum* (Mielichhoferiaceae), found in the Wetland, *Trichostomum brachydontium* (Pottiaceae), found in Bush 1, and *Chenia leptophylla* (Pottiaceae), also found in Bush 1. The last was the apotheosis of the summer sampling as it has only been found once before in the South Island by John Steel.

This vegetation survey has since been used in the first year Ecology paper to investigate ecological requirements of the native *Naultinus gemmeus*, Jewelled Gecko, present on the Portobello Peninsula. Lala Fraser helpfully pointed out that across the Grassland block are tracks facilitating movement between two isolated populations of *N. gemmeus* in Bush 1 and Bush 2.

How Future Climate Change Will Affect Which Parts of New Zealand Contain Suitable Habitats for Southern Beech and Their Associated Fungi, a talk on Zoom by Shar Mathias, 13th July 2002

Alex Wearing

Shar Mathias gave a very interesting talk on her honours project research (for a B.Sc. (Hons) in Plant Ecology at the University of Otago), on the likely effects of climate change on New Zealand southern beech. Spatial modelling techniques in R were used to elucidate how future climate change would make parts of New Zealand less suitable for southern beech and their associated fungi, and to identify which areas contain putative suitable habitats for southern beech under different climate conditions. The results obtained facilitated consideration of the implications of climate changes for New Zealand ecosystems.

Climate change will increase the frequency and range of extremes and disturbance, as well as altering norms. This will affect forests and ecosystem services they provide. New Zealand southern beech comprises *Fucospora fusca* (red beech), *F. solandri var. solandri* (black beech, and *F. solandri var. cliffortioides*, mountain beech), *F. truncata* (hard beech), and *Lophozonia menziesii* (silver beech). There are about 2.9 million hectares of pure beech forest in New Zealand. It is the dominant forest cover on the main mountains of North Island, and most of the western South Island. Mixtures of beech and conifer-broadleaf forest cover about 1.4 million hectares. There are also many isolated stands of beech. Beech is absent from Rakiura/Stewart Island. The extent and widespread distribution of New

Zealand's beech forests makes consideration of how they will be affected by climate change of vital importance.

Shar Mathias's research used species distribution models linking species locations to environmental conditions. These are useful for understanding habitat and niche requirements. Every species has a climate niche, which is the set of temperature and precipitation conditions in the area where it lives and where it can survive.

The environmental variables used were temperature and precipitation, and for soil conditions, pH and carbon. The model is interested in extremes, affecting the ability of species to persist at a site. Future conditions were modelled for the date 2070 and undertaken for two scenarios, limited change and major change. The models were created and validated for each southern beech species. Maps were created of suitability probability for the establishment and survival of southern beech species.

The results of Shar Mathias's modelling suggest that all the beech species will experience range reductions, but different species will respond differently. Each beech species has its own niche and variables affecting distribution differ between species. Red beech is likely to migrate south. Black/mountain beech is predicted to experience extensive range reductions, except in the southern South Island. Hard beech is less cold tolerant. It was predicted to favour sites in the north-west of the South Island, parts of central North Island, and the Catlins (which is far removed from its current distribution). The modelling indicates that hard beech may have the greatest tolerance of high temperatures. Silver beech had a patchier response compared to the other beech species. Conditions were more suitable south of Christchurch and were elsewhere less suitable. Silver beech was affected more by soil conditions such as carbon and pH levels. For all species more extreme climate scenarios lead to greater range losses.

If future climate conditions are such that southern beech distributions are altered, parts of the southern South Island may become more suitable for establishment and growth. But there are problems of beech dispersal. Consideration needs to be given to soil conditions, interactions with associated fungi, browsing effects, the state and fate of vegetation and ecosystems that may be replaced, and to the status (public or private) of the lands that may be colonized by southern beech. Any changes in the distribution of southern beech species will lead to a cascade of changes with respect to other tree species, and other plant species growing in forests (e.g., shrubs, herbs, epiphytes, ferns, mosses, fungi, birds and insects).

Ectomycorrhizal fungi are likely to have key roles in facilitating future shifts in the distribution of beech species. Individual beech trees are infected by a phylogenetically diverse set of mycorrhizal fungi, and this phylogenetic diversity is also likely to reflect a broad physiological diversity[1]. The distribution and ecology of mycorrhizal associates may influence the different abilities of these trees to change their range[1].

The limitations of the modelling were discussed by Shat Mathias. It does not factor in the history of New Zealand's beech forests since the last glaciation, and since people arrived. Also, it would be desirable to include consideration of the relative roles of climate and historical factors in the central South Island beech gap, and the current absence of beech on Rakiura/Stewart Island.

Climate change is predicted to make much of New Zealand more prone to fire. There will be increases in hot and dry conditions that help fires occur more frequently, spread faster, burn longer and more intensely. There are also likely to be more extreme winds. Hotter weather saps moisture from vegetation, turning it into dry fuel that helps fire spread. The upshot is likely future shifts in the composition, structure and functions of ecosystems. Southern beech species are moderately flammable[2]. Many invasive woody species such as *Pinus* and *Ulex europaeus* are favoured by fire[2].

Climate change could be too rapid for southern beech species to successfully disperse to new sites in some, or many instances. Geographic and land-use barriers may be too formidable to cross. The responses of other woody species to climate change, both native and introduced (especially wilding pines) will influence redistribution outcomes for southern beech. In some areas, beech species may literally have nowhere to go to. Direct intervention by people may be required.

Climate change scenarios are changing. Transformations may occur at different scales and/or more rapidly leading to greater extremes. There are also lots of uncertainties with respect to long-term composition, successional, and distributional trajectories of southern beech.

Shar Mathias gave an excellent presentation on Zoom. Her knowledge of and enthusiasm for southern beech species was very apparent. The research presented involved an impressive amount of effort and time with respect to creating, analyzing and presenting the data, and is to be commended.

Notes

1. Johnston, P.R. 2010. Causes and consequences of changes to New Zealand's fungal biota. *New Zealand Journal of Ecology*, 34, 1, 175-184.

2. Perry, G. L. W., Wilmshurst, J. M. and McGlone, M. S. 2014. Ecology and long-term history of fire in New Zealand. *New Zealand Journal of Ecology*, 38, 2, 157-176.

Field trip to Mihiwaka (Lichens), July 16th 2022

Allison Knight

A crisp sunny day was a bonus for botanising as we strode off up Cedar Farm Road towards the summit of Mihiwaka (Fig. 1). Lichens were all around. A ruffled grey foliose *Parmotrema perlatum*, lover of light, lay on a fallen twig. Near the ditch *Placopsis microphylla* and other bulls-eye lichens made pale splashes on the damp rocks. Their purplish grey cephalodia contain nodules of cyanobacteria that can photosythesize even when sodden, as well as fix nitrogen from the atmosphere to create extra fertiliser. Some of the pale patches on rocks jutting out from the shady bank higher up were crustose *Trapelia* sp. On the smooth-barked trees in the regenerating forest shading the bank it was *Phlyctis* sp. that made pale paint-like splashes. In the shadiest, dampest spots the banks above the ditch were a solid mass of bryophytes. Rusty spots on the rocks beside the road were likely to be crustose *Porpidia* or *Lecidea* spp., some species of which can cunningly concentrate iron leached out of the rock (Fig. 2).

Fig. 2. Rusty crust, stalked Baeomyces heteromorphus *and fertile, perforated* Cladia aggregata *agg. (Photo: Allison Knight)*

Several fruticose (bushy) lichens lay sprawled among the rocks, looking less bushy than usual after being flattened by all the rain and frost. Pale grey rambling *Stereocaulon ramulosum* sported knobbly cephalodia jutting out from branches and brown apothecia (fruiting bodies) at the tips. The pale, hollow branches of *Cladonia scabriuscula* were adorned with green squamules looking like tiny green leaflets

Fig. 1. Gretchen, David, Marcus, Lydia and Adrian setting off up Cedar Farm Road. (Photo: Allison Knight)

Fig. 3. Scaly, branched Cladonia scabriuscula*. (Photo: Allison Knight)*

(Fig. 3). A fertile *Cladia aggregata* agg. (Fig. 2) had more evenly green hollow, inflated branches with tiny brown apothecia at their tips. The perforations along the branches help distinguish *Cladia* from *Cladonia*, while *Stereocaulon* has solid branches. Too late, I remembered that Dan Blanchon of Unitech is working on *Cladia*. He even has one named after him – *Cladia blanchonii*.

Clusters of bright pink apothecia on the roadside rubble caught everyone's eye. They rose up on white stalks from the white crust of *Dibaeis arcuata* (Fig. 4). Nearby the slightly drabber *Baeomyces heteromorphus* sported beige apothecia on shorter, fatter, duller and sometimes branched stalks rising out of a crust that is green when wet. These two crusts with stalked apothecia are often confused. An orange jelly fungus, *Heterotextus miltinus*, on a fallen twig beside the road took the prize for lusciousness and brilliant colour (Fig. 5).

Fig. 4. Pink fruited Dibaeis arcuate. *(Photo: Allison Knight)*

Fig. 5. Orange jelly fungus, Heterotextus miltinus *(Photo: Allison Knight)*

Beyond the road, the track to Mihiwaka started off through a monoculture of *Pinus radiata*. I saw very few lichens as I focused on getting above tree line. Only a small clump of *Cladonia darwinii* on a decomposing stump caught my eye, though there were a surprising number of different fern species.

Once out into the subalpine scrub lichens abounded again, particularly on the volcanic rocks – most likely weathered phonolite according to Marcus, our geology expert. Great clumps of *Stereocaulon ramulosum* stood out from the banks. I hurried past several species of flat foliose *Xanthoparmelia*, including the infamous sexy pavement lichen, *X. scabrosa* and the brown, *X. verisidiosa* which manufactures melanin as a sunscreen when needed and also creates a chemical that can turn UV light into visible light (Fig. 6). Pale *Lecanora farinosa* creeps in at the bottom of Fig. 6. It's one of the most common white 'paint splash" crustose lichens on subalpine rocks. Its discoid apothecia are covered with fine pruina (crystals) that may protect from invertebrate grazing.

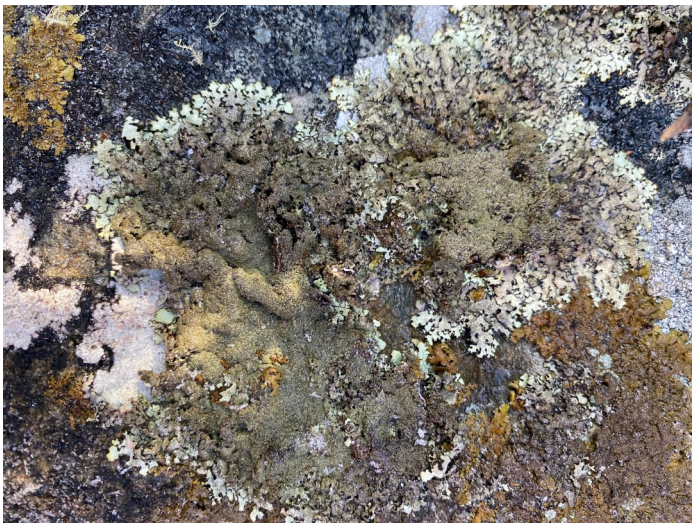


Fig 6. Brown Xanthoparmelia verisidiosa *and greenish* Xanthoparmelia *spp. above white crustose* Lecanora farinacea *(Photo: Allison Knight)*

Placopsis perrugosa (Fig. 7) is a bulls eye lichen with protruding pink cephalodia. It's a good example of a placodioid lichen. The tips of its snakeskin textured lobes are almost foliose and can be prised off the rock. The central portion, though, is distinctly crustose, with fungal hyphae extending into the substrate. To get a herbarium sample of this would need a rock hammer and a cold chisel. A free-living species of the filamentous alga *Trentepohlia* is scattered around this *Placopsis*, standing out with it's orange sunscreen. Some lichens make an algicide to prevent *Trentepohlia* from overgrowing them. Other lichens incorporate species of *Trentepohlia* as the photobiont (photosynthesizing) partner in the symbiosis.

Fig. 7. Bulls eye lichen, Placopsis perrugosa *along with orange free-living alga,* Trentepohlia *sp. (Photo: Allison Knight)*

Further up the mountain the white crusts on the rocky outcrops became more exciting. I clambered through the flax and subalpine scrub to get closer to one enticing patch. Dax the dog got so excited she clambered up to the top of the cliff while I was peering through my hand lens. Here was a warty *Pertusaria* that I'd been hoping to find for my collaboration with Jennifer Bannister. But was it the elusive *P. otagoana*, with only one spore/ascus, or the noble *P. knightiana*, that contains a lichexanthone that glows under UV light, or could it be *P. subverrucosa*, that has similarly large spores, but no xanthones. Only closer examination will tell. How wonderful to have a geologist on board to help take the sample and tell me what it was growing on.

Once the excitement died down I noticed a fine greyish *Cladia* in the *C. aggregata* aggregate that might interest Dan growing out of clumps of *Andreaea*, a almost black alpine moss. We enjoyed lunch on the summit in the sun with glorious views of snow-capped mountains in every direction, from the Lammerlaws in the south to the Kakanuis in the north. Casting my eyes downward, I saw a very robust *Cladia* in the shelter of the *Dracophyllum longifolium*, and clumps of the very finely branched pale cream *Cladonia confusa*. Patches of yellow-green *Rhizocarpon geographicum* brightened the summit rocks. This is another lichen that can turn UV light into visible light. It is also a remarkably tough species that has survived for over a year exposed to the full force of outer space. What mere plant could do that?

David and I meandered back down, making the most of the sunshine and the botany. Some of the subalpine divaricating shrubs in the open wet areas were fuzzy with the fruticose beard lichen, *Usnea*. At first glance all the fuzz looked pretty much the same, but later, under the microscope, Jennifer's expert eye detected at least 4 species: Surprisingly, *Usnea cornuta* was the most common, while *U. inermis, U. oncodes* and the red-spotted *U. flavocardia* were hiding amongst it. *Usnea* can be distinguished from other twig lichens by the strong cartilaginous strand (axis) that runs long the centre of its branches. Fruticose *Ramalina glaucesens* has flattened branches. A less common pale, branched lichen on the shrubs was foliose *Hypotrachyna sorocheilum* (*Everniastrum sorocheilum*), which has long black hair-like cilia protruding from its elongated lobes. Foliose *Hypogymnia subphysodes* was another pale, branched lichen lurking on twigs and branches. It has hollow lobes and a smooth black lower surface. A tiny patch of orange *Teloschistes velifer* provided a spot of colour.

Closer inspection of a decorticate log in the wet area revealed a cluster of cupped *Cladonia* species (Fig. 8) that included the red-fruited *C. pleurota* and *C. macilenta*. A photo revealed a *Parmelia* sp. with the distinctive elongated slit-like pseudocyphellae of that genus. Crammed in crevices on the log was a very low, dense colony of *Cladia aggregata* agg. Various mosses and liverworts were scattered around, especially on the damp, shady sides, with some sphagnum on the boggy trackside.

Fig. 8. Cluster of cupped Cladonia *spp. on a log in the bog, with* Parmelia *sp. bottom right. (Photo: Allison Knight)*

On the way back down the road David couldn't resist stopping to take more photos of the bright pink *Dibaeis arcuata*. While he set up his camera I poked around and found two more species of *Cladonia*. The tiny pixie-cup lichen, *C. fimbriata* is very common and covered in very fine vegetative propagules (soredia). *Cladonia verticillata*, now elevated from *C. cervicornis* subsp. *verticillata*, is much less common and I was delighted to be able to photograph its tiered cups (Fig. 9). A brilliant end to a brilliant day. Thank you, Lydia, for organising it.

Fig. 9. Cladonia verticillata*, with a second tier of cups arising from the centres of the lower cups. (Photo: Allison Knight)*

What's Cooking with Kānuka? An Investigation into the Reality or Otherwise of the Ten Species of *Kunzea* in New Zealand, a talk by Matt McGlone, 10th August 2022

Alex Wearing

Once upon a time, identifying kānuka was straightforward. *Kunzea ericoides* was widely distributed throughout New Zealand, and *K. sinclairii* was present on Great Barrier Island[1]. A wide range of regional and site variations in *K. ericoides* were lumped together in one species. But identification got more complicated in 2014 following a major revision of the genus *Kunzea* undertaken by Peter de Lange[2]. *Kunzea* was split into ten species. One upshot of this revision is that it can be difficult to distinguish between species of kānuka in areas where more than one species is present.

Matt McGlone has revisited the de Lange revision of *Kunzea*. His talk on kānuka could be construed as a mediation on the ongoing debate between lumpers and splitters in taxonomy, but the discussion on the current status of kānuka was much more comprehensive and nuanced.

Kānuka is New Zealand's most important successional tree. Kānuka is very abundant and kānuka forests and shrublands sustain a wide range of plants, animals and fungi. Of New Zealand trees, it ranks fifth for stems per hectare, tenth for basal area, and twelfth for stem density. Kānuka makes a very significant contribution of biomass to natural forest regeneration. It is fire-adapted and highly flammable. Climate change will make many areas in New Zealand more prone to fire, and the dynamics of kānuka in different landscapes may also change. Kānuka can invade agricultural landscapes, and in the past was often pejoratively viewed as a weed. It provides stock shelter and its establishment and spread can reduce rates of erosion. Kānuka has the potential to provide sustainable sources of firewood, and is also an important source of floral nectar for honey production

In Otago, kānuka occurs as extensive stands of mature trees (e.g., Silverpeaks), as a colonist of degraded pasture in coastal and inland Otago and forms a tree-line species on some ranges in Central Otago. It occurs as tall trees and as low dense bushes. Current and possible successional sequences in Otago's kānuka forests and shrublands are many and varied[3].

In 1983, Joy Thompson transferred kānuka from *Leptospermum* to *Kunzea*[4]. The de Lange revision, which involved 15 years of study, is based on morphological, cytological and DNA sequence data, and experimental hybridizations. It created ten species[5], all endemic to New Zealand, seven of them new. Some species have restricted distributions. One species (*K. triregensis*) is endemic to the Three Kings Island, and one species (*K. sinclairii*) is endemic to Great Barrier Island[5]. The North Island has seven species, with four endemics[5]. The South Island has four species, with one endemic[5].

In the de Lange revision the most widespread kānuka is *K. robusta*. This species is very variable. According to Matt McGlone, at Pelorus Bridge, Marlborough, *K. robusta* can be up to 30 metres tall with

thick trunks, and hundreds of years old. In dry sites, such as on the Port Hills, Christchurch, the same species can be stunted and spindly. The kānuka species occurring in the Dunedin area is *K. robusta* (which is widespread), and at some sites trees are more than 20 metres tall (e.g., Cedar Creek, Volco Bush, near Dunedin). *K. serotina* occurs further inland. Overall, there is wide variability within different species; for example: tall and weeping versus short and tight. Southern species often have juveniles with divaricating forms.

Matt McGlone said that in New Zealand taxonomy there is a tendency for tag names to become varieties, and then for varieties to become species. He also pointed out the problems of distinguishing and differentiating many species. The upshot is that field identifications often have little validity.

Matt McGlone reviewed the identification key devised by de Lange. He said the key was very complex, not clear, not obvious, and there were lots of technical terms that most users would have to look up in a glossary of plant taxonomic terms. In terms of user-friendliness, it is several degrees removed from a plant guide such as Wilson and Galloway's Small-leaved Shrubs of New Zealand[6].

In the de Lange descriptions there is a strong reliance on variations in the length and hairiness of leaves, and differences in inflorescences. There is a lot of description of bark characteristics accompanied by a lot of technical words. But there is lots of variation of bark characteristics within species. I have observed this on *K. robusta* growing at Mt Cutten near Dunedin where bark is shaggy, curled or tight, or somewhere in-between.

Matt McGlone outlined the results of a recent study (of which he was one of the researchers) which uses microsatellite markers to study genetic variation in the ten new species of kānuka[7]. It noted that many plants appeared intermediate between species suggesting that hybridism was common. Analysis showed that there was a high degree of genetic similarity between most species. Restricted and widely distributed species were compared. There was limited differentiation between the widely distributed species. Analysis of latitude data suggested the presence of clines (i.e., graduations in one or more characteristics within a species, especially between different populations) from north to south. This study suggested that keeping the current ten species would be appropriate to promote biodiversity conservation[7].

Matt McGlone reported some of the results of a 2020 study that he undertook that involved surveying 60 kānuka populations (20 individuals per population) in the South Island and the southern North Island. Samples were taken from four species. There were no clear results from genetic clustering by species. With respect to genetic clustering by region there was differentiation by different regions. Discrimination was in terms of location and environmental conditions rather than by species.

The concept of a species was discussed. Reference was made to C.T. Regan's 1926 comment that [a species is] "whatever a competent taxonomist chooses to call a species." Ideally, to be biologically meaningful, a species should be ecologically distinct, and unable to reproduce with other species, or if it can reproduce, have unfit offspring. Individual species should be distinguishable by fixed and unique differences from close relatives.

There are several issues to consider with respect to the current ten species of kānuka. Different species of kānuka successfully interbreed with close relatives, form viable hybrids, and can produce hybrid swarms. They do not occur in sympatry with other species. Diagnosis is based on quantitative traits that can be very variable. There is confusion in field determination, and a reliance on difficult to discern features for differentiation of species.

More species is not necessarily better. The creation of poorly supported species devalues robust species, creates identification problems, wastes time and laboratory efforts, and may divert conservation efforts. Many of the new kānuka species have restricted distributions and this had led to their listing on New Zealand's endangered species database.

Matt McGlone concluded his talk by saying that morphological discrimination of the ten species was weak, genetic discrimination insignificant, and that *Kunzea* taxonomy is currently not fit for purpose. He noted that the long-standing separate species *K. sinclairii* hybridizes with *K. robusta* on Great Barrier Island. Just because something is very different does not mean it is a separate species. Reference was made to the cabbage (*Brassica oleracea*) co-

nundrum - one species with many, very different forms. A proposal was made for creating subspecies based on ecotypes (i.e., a population or subspecies that is adapted to local environmental conditions). This seems more appropriate than an alternative proposition that Matt McGlone made termed the "nuclear option," that there should be reversion to a single species *K. ericoides* for the North and South Islands.

It was suggested by Matt McGlone that there are four species of *Kunzea* in New Zealand: *K. sinclairii, K. robusta, K. amathicola*, and *K. serotina*, but that it is quite possible, that in the future, the number of kānuka species recognized may be different from now.

Matt McGlone gave a wide-ranging and thought-provoking talk, with clearly stated and definite opinions. The questions and observations of botanists in the audience who had previous experience of studying kānuka added to the value of meeting. It was a memorable event.

Notes

1. Allen, H.H. 1961. *Flora of New Zealand*. Volume 1. Government Printer, Wellington. There were also two varieties, and several collected plants with tag names.

2. de Lange, P. J. 2014. A revision of the New Zealand Kunzea ericoides (Myrtaceae) complex. *PhytoKeys*, 40, 1 -185.

3. Allen, R.B., Partridge, T.R. Lee, W.G., and Efford, M. 1992. Ecology of Kunzea ericoides (A. Rich) J. Thompson (kānuka) in east Otago, New Zealand. *New Zealand Journal of Botany*, 30, 135-149.

4. Thompson, J. 1983. Redefinition and nomenclatural changes within the Leptospermum suballiance of Myrtaceae. *Telopea*, 2, 379-383.

5. There are possibly more than 50 species of Kunzea in Australia. Different online sources list different numbers of species.

6. Wilson, H. and Galloway, T. 1993. *Small-leaved Shrubs of New Zealand*. Manuka Press, Christchurch.

7. Heenan, P. B.., McGlone, M. S., Mitchell, C. M., Cheeseman, D. F. and Houliston, G.J. 2022. Genetic variation reveals broad-scale biogeographic patterns and challenges species' classification in the Kunzea ericoides (kānuka, Myrtaceae) complex from New Zealand. *New Zealand Journal of Botany*, 60, 2-26.

Field trip to Rutherford's Bush, Otago Peninsula, 13th August 2022

Moira Parker and David Lyttle

The bush remnant informally known as Rutherfords Bush is situated on steep slopes in the Hereweka Harbour Cone block, belonging to Dunedin City Council. Our group of 19 followed a walking track across paddocks from Highcliff Road to Rocky Knob, overlooking the main bush. Moira Parker and Alf Webb gave a short introduction to the area and pointed out 2 bush remnants on the Hereweka Harbour Cone block that were fenced from stock in 2009/10 leading to widespread regeneration of seedlings and ferns. It is proposed to fence Rutherford's Bush in the near future.

Having decided to meet up for lunch at the site of the Rutherford's farmstead, different groups set off in various directions to investigate the area. One group started along an old farm track above the bush and before long were closely examining the damp vertical bank. David Lyttle was part of this group and his observations are recorded below:

After spending some enjoyable minutes inspecting the damp trackside bank for orchids and Epilobiums (2 species of orchid were found and three species of *Epilobium*), a trio of Bot Soc members adventured down the middle of Rutherfords Bush in search of the herb *Australina pusilla* that David had previously seen. As we slid down the hill under a canopy of kōtukutuku (*Fuchsia excorticata*), there was some discussion of possible hybridisation with *F. perscandens*), mānatu (*Plagianthus regius*), māhoe (*Melicytus ramiflorus*) and kōwhai (*Sophora microphylla*). About halfway down we found an unwanted addition to the species list, lesser celandine (*Ficaria verna*), but a short moment later Angelina found *Australina pusilla,* the species that we had been searching for. The small half metre square patch was tucked under some low kōtukutuku stems on damp open clay/rocky ground. We continued down to the stream; here the understory was dense ferns including *Asplenium gracillimum, Blechnum fluviatile, Blechnum lanceolatum, Lastreopsis glabella* and *Leptolepia novae-zelandiae* with some *Coprosma* in the mid tiers. We had the standard *Coprosma* discussions and decided that there were four species present: *Coprosma rubra, Coprosma areolata, Coprosma propinqua,* and *Coprosma crassifolia.*

Happy with our finds, we carried on up the hill through a stand of kowhai and out into an open gully where we found several large shrubs of *Coprosma rubra*. We met up with the others at the old Rutherford farmstead and enjoyed the views across the Peninsula while eating lunch.

A few juvenile kowhai have established, despite grazing (Photo: Moira Parker)

The group that Moira was part of proceeded at a faster pace along the track, then headed down through the scattered *Coprosma* shrubs to the southern slope. Despite stock grazing we found several isolated juvenile kowhai (*Sophora microphylla*) on the open grassy slope adjacent to the mature kowhai forming the bush canopy. Several vines were present among the shrubs; bush lawyer (*Rubus cissoides*), New Zealand jasmine (*Parsonsia heterophylla*), white rata (*Metrosideros diffusa*) and pohuehue (*Muehlenbeckia australis*). We made our way up the slope, crossed a fence and followed the flagging tape past a massive narrow-leaved lacebark (*Hoheria angustifolia*) to an old broadleaf (*Griselinia littoralis*) supporting an extensive *Dendrobium cunninghamii*. No flowers at this time of year, but even so a spectacular orchid. Mature and immature silver fern (*Cyathea dealbata*) as well rough tree fern (*Dicksonia squarrosa*) were seen close by. From here the canopy was higher and the damp rocky ground was hard going. We saw a variety of ferns and saplings, *Clematis foetida*, a few sprawling stems of the 'At Risk' *Brachyglottis sciadophila* and dense mats of *Australina pusilla* among the boulders.

We managed to work around rock slabs close to the surface, and negotiate mounds of bush lawyer and with Alf Webb leading the way we made it to the south side of the bush and emerged into the paddock.

As we headed downhill elders (*Sambucus nigra*) that had recently been killed were visible in the bush interior as well as fuchsia (*Fuchsia excorticata*) on the bush edge damaged by cattle. We continued up the other side of the gully to meet the rest of the group at the lunchtime rendezvous. It was pleasing that several Peninsula residents, not all members of Bot Soc, were able to join us for this field trip.

From left to right Alf Webb, Lise Wallis, Jenny Winter, David Woods and Daniella Damm (Photo: Moira Parker)

Burgeoning Horns and Other Delights: field trip to the Pipeline track, 10th September 2022

Daniella Damm

On the 10th of September, the Cryptogang - a group of botany students and cryptogam (not cryptocurrency) enthusiasts - led a keen bunch of BotSoc members up to the start of the Pipeline track on Leith Saddle.

The forest was fully enveloped in mist when we arrived, so we added our extra layers and zipped up jackets. We knew we were not about to be warmed up by any physical exertion; this was a Cryptogang expedition. And in pure Cryptogang fashion, the first 40 (at least) minutes of the walk was spent within view of the beginning of the track. Lichens, mosses, ferns, liverworts, bugs and *Coprosma* identification attempts held our attention and slowed our pace most effectively. We were almost successful in tricking a BotSoc newbie into tasting some really-yummy

-not-at-all-spicy *Pseudowintera colourata* leaves, but an well-meaning intervention spoiled our fun.

Eyes on the ground and on tree trunks with hand-lens' on standby we admired all sorts of cryptic delights. In the lichen department there were the easily identifiable *Menegazzia* lichens (a foliose lichen genus with inflated lobes which are characteristically perforated), *Pseudocyphellaria rufovirescens* with its foxy brown marginal apothecia and the fluffy byssoid lichen *Coenogonium implexum* to name a few. A standout liverwort was *Pachyschistochila colensoanum* with it's lettuce-like ruffled appearance, which close up is almost boat-shaped with leafy compartments (you might have to see it to believe me).

There weren't just botanical cryptics to see. Our resident arachnologist James gave us an insight into the bug world, pointing out many little crawlies including *Cycloctenus fugax*, the local scuttling spider with its cryptic colouration.

Cyclotenus fugax *(Photo: James Crofts-Bennett)*

Eventually, we made it to the first bridge. We stopped to bask in the rare pockets of sunshine and were treated to some of James's Aunties ginger slice. A culinary delight to say the least!

Re-fuelled, we continued on. John and Angelina had already gone across and back again, alarming some rogue goats on the other side. We crossed the first bridge, enjoying the sunny views across into the canopy and down to the stream. We then began to delve deeper down a shady path leading to the next bridge.

One by one we went across the narrow, rather questionable bridge and were transported into another world. The very definition of lush. Every bit of ground, every fallen log, every branch was generously embellished with bryophytes (and lichens). It was the Cryptogangs dream destination! I was just about giddy with excitement.

Some of us rock-hopped our way across the stream to explore the nooks and cryptogam-laden branches on the other side. It was there we spotted the first hornwort, growing horns and all on a branch hanging over the water.

Bringing a little sample to show the others, we came back to the green grove, where we discovered there were more hornworts hidden amongst other liverworts and mosses with burgeoning horns of their own.

A highlight of this spot was the abundance of *Canalohypopterigium tamariscinum* sporophytes. Next to the stream there was a nook where the ground was carpeted in this umbrella moss. Sporophytes standing proudly like little families atop each one. Stella told us that you don't often find *C. tamariscinum* with sporophytes, so this discovery felt extra special.

Canalohypopterygium tamariscinum *sporophytes through a handlens (Photo: Daniella Damm)*

Another notable cryptogam find from this wonderland was the large *Sticta latifrons*. The picture (next page) doesn't do it's size justice. It reminded me of a staghorn fern with its long, wide lobes spreading out confidently, pride of place above the stream.

We stayed there in the lush little bryophyte world, discovering little bits and pieces of magic through our hand lens's and enjoying the fresh forest air until it was time to go.

Thanks to Stella Fish and Kacey Hutchison our liverwort and lichen experts from the Cryptogang, and

to Robyn Bridges, James Crofts-Bennett, Joshua Harrison, Allison Knight, Florence Schuch, Tom Smith, Jo Sinclair, John Steel and Angelina Young for coming!

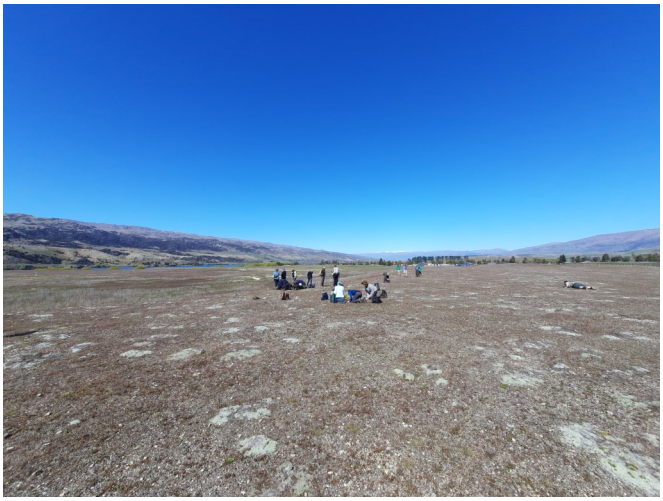
Sticta latifrons *(Photo: Daniella Damm)*

If you would like a copy of the species list, contact john.steel@otago.ac.nz

Mahaka Katia Scientific Reserve/Pisa Flats, 1st October 2022

Stella Fish

The sky was a forget-me-not blue, the sun was a forget-me-not yellow, and the snow capping the mountains was a forget-me-not white. Who knew one plant could be so versatile? But *Myosotis* wouldn't be the only flowering genus seen that day. Over twenty members of the Botanical Society had gathered at Mahaka Katia Scientific Reserve/Pisa Flats to search for cryptic spring annuals amongst what at first glance appeared to be a desolate, gravel terrace.



Botanising at Pisa Flats under a forget-me-not blue sky. (Photo: Stella Fish)

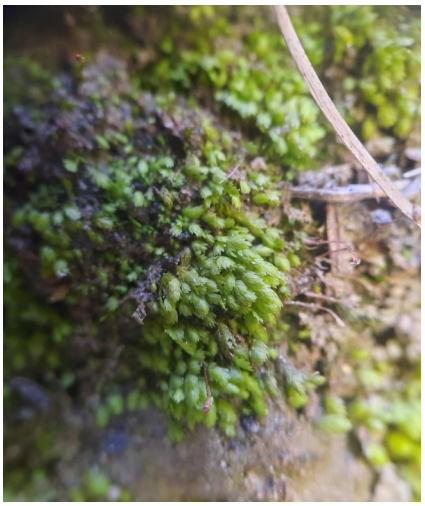
After a site introduction from Geoff Rodgers, and recommendations to view the endemic *Leptinella conjuncta* dotting the terrace edge, the search began. At first the plants were elusive, but once one's eye was in one could see the blue splash of the introduced *Veronica verna*, the green clumps of *Colobanthus brevisepalus* with its characteristic hair tip, and crawling amongst them, the instars of an eleven-spotted ladybird, *Coccinella undecimpunctata*. The sight of many botanists with their faces and hand lenses pressed to the ground may have been rather amusing for any passersby. However, it was a necessary pose to view some of the plants, such as the native *Crassula colligata* subsp. *colligata*, its flower smaller than a pinky nail. While photographing this David demonstrated a handy tip, gardening round the specimen with a pair of tweezers for a tidy picture!

The blue Veronica verna *surrounded by its hairy leaves. (Photo: Stella Fish)*

Crassula colligata *subsp.* colligata *flower, only 2 mm wide! (Photo: Stella Fish)*

Eventually we descended to the next terrace, its beginning full of grasses, pink blooms of *Erodium botrys*, and scattered *Xanthoparmelia semiviridis*. Small, gleaming mudflats interrupted the green and with

Pink Erodium botrys. *(Photo: Stella Fish)*

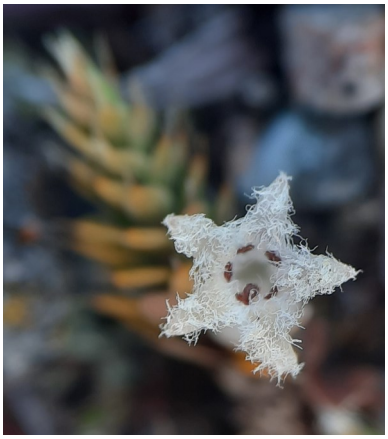


Fissidens *sp. sheltered in a rabbit hole. (Photo: Stella Fish)*

closer inspection revealed the camouflaged *Atriplex buchananii*, a botanical highlight for Jo. Numerous rabbit holes, one of which with a dense coating of *Fissidens* sp., pocketed the ground. While trying to photograph this charming moss I was reminded that the redback spider, *Latrodectus hasselti*, had been known to spin webs in these holes. Who knew bryology could be so dangerous?

Left: Dry resurrection lichen, Xanthoparmelia semiviridis. *Right: Camouflaged* Atriplex buchananii *(Photos: Stella Fish)*

This final terrace overlooked the Clutha River, an ideal spot for lunch, with several members, including me, taking the chance to lie down and relax under the Central Otago sky. But even this couldn't keep us away from the plants for too long. Several cushions of the sunny *Myosotis uniflora* were found, a tick off the bucket list for several Bot Soccers, but they did not outshine some of the other plants. Glaucous patches of the spiral *Raoulia australis* were found beside the grey patches of the distichous *R. monroi* for easy comparison. These cushion plants were occasionally studded with the moss imitator, *Scleranthus uniflorus,* and nearby the bearded flowers of *Leucopogon nanus* dotted the ground. The trip culminated with the newly described, *Craspedia argentea*, the Pisa Flat woolly head, being found, helped in part by the large cages erected over them.



Bearded Leucopogon nanus. *(Photo: Stella Fish)*

Sunny Myosotis uniflora. (*Photo: Stella Fish)*

Participants: Arne Cleland, Barbara Simpson, Brittany Loft, Christopher Stephens, Dani Damm, David Lyttle, Dhana Pillai, Geoff Rogers, James Crofts-Bennet, Janet Ledingham, John Steel, Jo Sowry, Joshua Harrison, Justine Davis, Lydia Turley, Marcus Richards, Neill Simpson, Skye Horton, Stella Fish, Tom Smith, and apologies if I have missed anyone.

The plants highlighted are but a fraction of what were observed, for a copy of the species list contact john.steel@otago.ac.nz.

Glaucous, spiral Raoulia australis*. (Photo: Stella Fish)*

Grey, distichous Raoulia monroi. *(Photo: Stella Fish)*

Botanical Society of Otago

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Reflections, Rakeahua River. *Photograph by David Lyttle. Peoples Choice winner 2022.*

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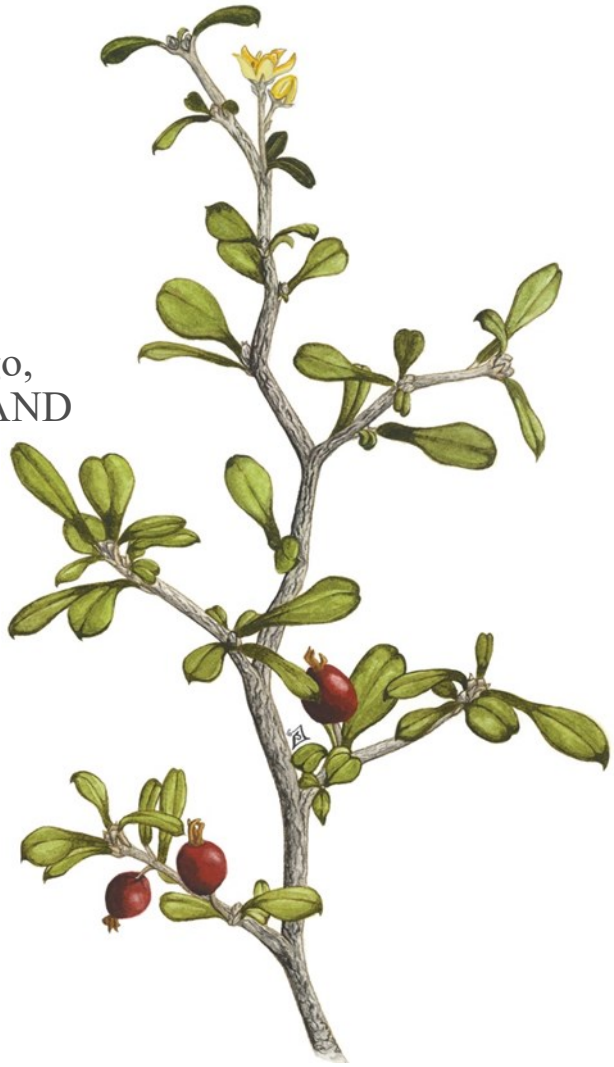

Right: Corokia cotoneaster *branch (Artist: Sharon Jones)*

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