BOTANICAL SOCIETY

OF OTAGO

Newsletter Number 90

June 2020

BSO Meetings and Field Trips June 2020 - October 2020

Due to Covid-19, all field trips are postponed until further notice. Talks will be held via zoom while physical meetings are inappropriate. Please check our website closer to the scheduled event times and watch out for email updates.

10th June, 5.20 pm: Sexy Lichens. Speaker: Dr Allison Knight, Research Associate, Department of Botany. The lichen symbiosis is extraordinary, intertwining organisms from two or even 3 distantly related kingdoms. Lichenised fungi are extremophiles, capable of living in environments well beyond the range of vascular plants. Some can even survive days or years exposed to the vacuum, radiation and temperature extremes of outer space! Intriguingly, lichens are very sensitive indicators of air pollution and can also be useful indicators of climate change. On the lighter side, the Sexy Pavement Lichen grows on the asphalt outside the Botany Department, and covers footpaths and roads all over New Zealand. It has been exploited by the unscrupulous, enticed the gullible and recently caused a global media frenzy. To be held via zoom.

8th July, 5:20 pm: Silken harp chords and the green choir. Speaker: James Crofts-Bennett, Department of Botany. The mutualistic relationship between the plant kingdom and the arachnid order Araneae is remarkable both in nature and how often it is over looked. There is extensive literary coverage on spider abundance and diversity in relation to vegetation texture diversity. So extensive is the research that beyond mere ecological significance, the relationship between spiders and plants has been adapted into agricultural practices! This talk will explore the theory, supporting evidence, then finally practical applications of exploiting this relationship. Research sites range from the William James building green roof to Orokonui ecosanctuary, grassy meadows to glorious podocarp forest and furtive fern villages! Descriptions of tiny tarsal claws guaranteed to make your skin crawl and close encounters with *Aciphylla* sure to incite sympathetic cringing! Come one, come all and behold the union of silken harp chords and the green choir!

11th July, 9:00 am: Field trip to Tavora Reserve, North Otago. Tavora is a coastal reserve near Palmerston managed by the Yellow-eyed Penguin Trust. Over more than 20 years the Trust has transformed the previously marram covered dunes into a showcase of pingao with many associated threatened species including shore spurge, Cooks scurvy grass and sand tussock. This is augmented with advanced riparian planting alongside the stream leading to the dunes. The reserve also has natural populations of the uncommon *Aciphylla subflabellata, Lepidium tenuicaule,* and *Tupeia antarctica* mistletoe hemi-parasitic on ribbonwood trees. We'll do an easy walking circuit of the reserve that takes in all the highlights. Meet at Botany Department carpark at 9am. Contact John Barkla (03 476 3686) mjbarkla@xtra.co.nz

12th Aug 5:20 pm: 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.

15th August, 9:00 am: Trotters Gorge Exploration. If you are like me, then you've driven past the sign post for Trotters Gorge more times than you can count and thought "I really must stop one day for look". So now is your chance! There are a couple of different environments we will explore, with tracks winding up through kanuka forest to the drier ridgelines and then down into broadleaf forest around the

creek. For those who can look past the trees, there are caves (with weta potential) and sea views to be enjoyed. If you would like to come exploring, meet at Botany Department carpark at 9am. Contact Gretchen Brownstein 021 065 8497 or brownsteing@landcareresearch.co.nz.

16th September, 6pm. Geoff Baylis lecture: Name changes among New Zealand ferns: the good, the bad, and the ugly? Taxonomists often claim they receive insufficient support for their task of describing the world's biodiversity. But are they their own worst enemies? Their taxonomic outputs often attract the ire of their intended users because of the changes they prescribe to scientific names. We've still much to learn about the evolutionary history of life, so some taxonomic change is presumably allowable. But how much change is appropriate, and who decides? Fern and lycophyte taxonomy is currently in a particularly pronounced flux. For instance, the scheme prescribed by the international Pteridophyte Phylogeny Group would have New Zealand with no species of *Blechnum*, *Cyathea*, *Lycopodiella*, *Lycopodium*, and *Trichomanes* (changes to c. 20% of the local fern and lycophyte flora!). I'll discuss my objections to this, given my personal opinion that it is important to minimise taxonomic changes while maintaining a taxonomy that still reflects evolutionary relationships (i.e., monophyly). I'll include examples of new and renamed species, and lumped and split fern and lycophyte genera, alongside some relevant examples from among New Zealand's flowering plants. You can decide what's good, bad, or ugly.

Biography: Leon Perrie is a Curator of Botany at Museum of New Zealand Te Papa Tongarewa. His research is focused on the taxonomy and evolutionary history of New Zealand's ferns and lycophytes, and he has co-authored over 100 peer-reviewed publications. A current priority is supporting the completion of the fern and lycophyte chapters for the electronic Flora of New Zealand. He also works with Pacific ferns, especially those of New Caledonia, and he occasionally dabbles with flowering plants (e.g., *Pseudopanax, Schoenus, Sophora*). He was the lead science curator for Te Papa's recent revamp of its principal natural history exhibition: *Te Taiao Nature*.

19th September, 9:00 am: Field trip to Karitane. Karitane is a site of both historical and natural significance, and much work is being done by Kāti Huirapa Rūnaka ki Puketeraki to restore the riparian and coastal habitat. Further details of the trip still to be confirmed. Meet at Botany Dept carpark at 9am. Contact Angela Brandt (brandta@landcareresearch.co.nz).

14th October, 5:20 pm: A search for the co-evolutionary partner(s) of New Zealand's sequestrate fungi. Speaker: Dr Toni Atkinson. New Zealand has long been known as a "land of birds". The idea that the array of sequestrate fungi found here, many of which are colourful, may have arisen through coevolution with birds was first mooted in mycology around 20 years ago. It seemed a natural progression from the widely accepted hypothesis that New Zealand's diverse divaricating plants evolved due to selective pressure from the now extinct moa species. The suggestion appears to have been taken up by mycologists, and is becoming part of the story of science in this land. Last year, an international team using high-throughput sequencing techniques to analyse the DNA in moa coprolites, revealed the first real evidence that moa may have eaten fungi.

But what happens if we take a fresh look at the whole question? Are moa the most likely coevolutionary partners of our sequestrate fungi, out of all the vertebrate and invertebrate inhabitants of prehistoric New Zealand? In this recently humanised but greatly altered land, it is challenging to hold in mind the relationships that might have played out over evolutionary time. What might we have missed?

11th November, 5:20 pm: The 'other half' of New Zealand's flora: how distinct are the non-native plants from the native? Speaker: Dr. Angela Brandt, Ecologist, Manaaki Whenua – Landcare Research. Non-native species make up about half of New Zealand's plant species, and those that have naturalised have added 68 families and 650 genera to the New Zealand flora. Non-native plants that are introduced and then naturalise are not a random subset of the global flora, but how distinct are these species from the native flora as a whole? I will give an overview of recent inventories of native and non-native plant species in New Zealand and the challenges involved in documenting the ever-changing composition and distribution of the 'other half' of New Zealand's flora.

Above the trees in Kahurangi National Park. (Photo: Ian Geary)

Meeting details: Talks are usually on Wednesday evening starting at 5.20 pm with drinks and nibbles (gold coin donation), unless otherwise advertised. Venue is the Zoology Benham Building, 346 Great King Street, behind the Zoology car park by the old Captain Cook Hotel. Please use the main entrance of the Benham Building to enter and go to the Benham Seminar Room, Room 215, located on the second floor. Please be prompt as we have to hold the door open. Items of botanical interest for our buy, sell and share table are always appreciated. When enough people are feeling sociable we go to dinner afterwards: everyone is welcome to join in. 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 (10c/km/passenger to be paid to the driver, please). 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

Contents

Cover: Artwork by James Crofts-Bennett. Scanning iNaturalist for interesting flowers revealed an apparently naturalised Gloriosa superba *in the North Island. Fascinated by the crown of fire and definitely not looking for an easier model after failing to replicate the colours of a* Clianthus puniceus, *I generated this flower OC*

Chair's Notes

Gretchen Brownstein

Well after a reasonably typical 2019, the start of 2020 has turned our world upside down. The COVID-19 pandemic means our 'new normal' includes staying in our bubble and keeping to our neighbourhood. While this has caused disruptions for the BotSoc events, it has also helped us rethink how we run talks, including exploring the use of e-meetings and webinars. The positive flow on effects of this are reducing our carbon footprint and expanding our potential audiences. So, while it's been a rough start to 2020, there are some positive outcomes.

Trips and talks – While COVID-19 put a kibosh on trips in the last six weeks, we did successfully run eight talks and eight trips last year. Our botanical talks ranged the from geological to the artistic, from fungi to restoration and even ventured into the animal world. The trips were just as diverse, with the Fungal Foray to Knights Bush, and the Catlins weekend trip as the ever-popular highlights in the year. The committee works hard to develop a programme that we think will be of interest the membership. It was great to see so many people participating, as it is about getting together to learn and share botanical knowledge.

Membership – This year there are 74 paid members (up seven from last year), which is wonderful to see. A big thank you to Robyn, Mary Anne, and Angela for working on getting the membership database up to date and chasing late payments on the annual subs.

Newsletter – A very big thank you to our editor Lydia for doing a sterling job pulling together the newsletter. We produced three volumes of the newsletter this past year. These had a total of 99 pages, including 15 original articles contributed by our members along with numerous reports on the trips and talks held during the year. Lynn Taylor contributed the cover art for volume 86 marking the 250th anniversary of Solander's visit to New Zealand and Sharon Jones provided the lovely cover art for volume 88. Inside are numerous botanical photos contributed by our talented members.

Committee – A big thanks to the dedicated committee! They do a wonderful job! A shout out to Angela Brandt for her stellar work as secretary. Mary Anne Miller continues to do a wonderful job keeping the accounts in order. A big thanks to Robyn Bridges for looking after the membership and room bookings. Allison and John Knight took charge of providing the yummy nibbles and drinks at the meetings. And to John Barkla for producing the stunning botanical calendar. Thanks to Lydia Turley for not only doing a great job editing the newsletter, but keeping our website and Facebook page up to date. Sadly for us, Esther Dale has resigned from the committee as she is moving to Europe (as soon as travel is allowed again). Esther is the scientific and artistic brain behind the botanical pun badges and fridge magnets. We wish her best of luck on her next adventures. Also, Tina Summerfield and Sarah Kilduff have decided not to stand for the committee again, thank you to both of them for their great contributions. And many, many thanks for all the hard work the rest of the committee puts in: David Lyttle, Ian Geary, David Orlovich, and Sharon Jones.

And lastly, a big thank you to you, our members!! Through members' participation we all have a chance to share and learn botanical knowledge. Also, by engaging with the community through our society we can promote the wonderful world of plants. So thank you for a great year and here's hoping for a positive 2020!

Secretary's Notes

Angela Brandt

I find myself wondering how the past year could have gone so quickly, but I am happy to be able to continue serving the BSO as Secretary. It's been wonderful connecting with all of you via both email exchanges and in person. At this particularly challenging time, it's heartening that we've still been able to connect as much as we have and use technology to share our love of botany (such as via the City Nature Challenge and StayiNatHome projects on iNaturalist) and gather together virtually for our AGM and annual photo competition. Thanks to those who contributed photos and to all of you for being willing to try out a new system for voting for the People's Choice Award and joining in a virtual

meeting. Our strong sense of community will certainly carry us through this!

Statement of Receipts and Payments

Botanical Society of Otago, PO Box 6214, Dunedin North 9059
CC24010
For the year ended 31 March 2020

Operating receipts	**$**
Subscriptions	2215
Calendar sales	1810
Lichen Guide sales	481
Magnet sales	37
Badge sales	15
Donations	629
Interest	4
TOTAL	**5191**

Operating payments	**$**
Calendar printing	1575
Newsletter printing	642
Speaker gifts	126
Baylis lecture	596
Meeting expenses	222
Photo competition prizes	400
JCBLW grants	200
Administration	335
TOTAL	**4096**

Operating surplus	**$1095**

Capital receipts	**$**
Interest	177
From Everyday account	183
TOTAL	**360**

Cash in hand	**$15**

Increase in Bank Accounts and Cash	**$1156**

Treasurer's Notes

Mary Anne Miller

It was a great start to the year as a record number signed up for membership. By the end of March there were 70 paying members compared to 64 for the same date in 2019. Thanks for your support.

Following on from the last Peter Bannister Student Field Grant Fund report in our October 2019 Newsletter, recipient Zoe Lunniss had an article in the Otago Daily Times of 18 May 2020, where she calls for action to conserve *Tupeia Antarctica* around Dunedin. It was good to see her project getting public recognition.

The presented statements are a summary of the last financial year, and were submitted in our annual report to the Charities Commission.

Editor's Notes

Lydia Turley

It's been a strange few months. We had to cancel our March trip, and next moment the whole country was in lockdown. While many of us are itching to get back out into the bush and looking at plants, this has been a good chance to slow down and take a look at what is growing in our own back yards, including many plants that are often overlooked.

We've got a paucity of trip and talk reports in this newsletter, but people have really pulled through with some cool articles (thanks guys!), so we've got some exciting reading for anyone (everyone) missing their plant fix. If you find yourself stuck at home and getting bored, I encourage you to write about your favourite planty thing and send it in for publication in the next newsletter.

Suggestions and material for the newsletter are always welcome from our members. If you are keen to submit stories, drawings, reviews, opinions, articles, photos or letters – or anything else you think might be of botanical interest to our diverse range of members, don't hesitate to get in touch. Send your feedback, comments or contributions to lydiamturley@gmail.com. Copy for the next

newsletter is due on *10 October 2020.* Earlier submissions are most welcome.

Disclaimer: The views published in this newsletter reflect the views of the individual authors and are not necessarily the views of the Botanical Society of Otago.

Editor's guidelines: Try to aim for a 0.5–1 page of 14 pt. Times for news, trip/meeting reports and book reviews and 1–5 pages, including illustrations, for other articles. Electronic submission by email to lydiamturley@gmail.com is preferred. Send photos as separate files and remember to include photo captions and credits.

Statement of Financial Position

Botanical Society of Otago, PO Box 6214, Dunedin North 9059
CC24010
For the year ended 31 March 2020

		2020 ($)	2019 ($)
CAPITAL	**Current Assets**		
	Everyday Account	6,868	6,451
	Audrey Eagle Publishing Account	12,186	11,641
	Business Online Saver Account	5703	5699
	Accounts receivable	0	75
	Inventory – publications, badges, magnets	337	72
	Petty Cash	15	15
	Current Liabilities		
	Sundry payables	0	0
	Working Capital	25,109	23,953
Membership	General	62	57
	Student	8	7
	Total paying members	**70**	**64**
	Life members	2	2
	Complimentary newsletters – libraries & allied societies	25	25
	Newsletters distributed including electronic versions	97	91

New Members

A warm welcome is extended to Hannah Creary, Wen Qing Ng, Don Robertson, Aidan Braid and Taylor Davies-Colley. To our existing members, thank you for your continuing support.

Correspondence and News

John Child Bryophyte and Lichen Workshop 2020 has been cancelled

It has been proposed that the 2021 workshop be held at the same Rotorua location – good things come to those who wait!

Jubilee Award 2020—Applications sought

The Wellington Botanical Society invites applications for an Award of up to $2,600 to encourage and assist applicants to increase knowledge of New Zealand's indigenous flora, and to commemorate the Society's Jubilee in 1989.

Purpose of the award: The Award is open to anyone working in New Zealand. It will be granted for: fieldwork; artistic endeavour; publication; research; propagation or cultivation of NZ native plants for educational purposes and/or other studies which promote the better understanding of NZ's indigenous flora and vegetation. The interpretation of these conditions will be flexible, except that the main criterion will be the furtherance of knowledge or promotion of the intrinsic value of NZ's indigenous flora and vegetation. The Award may be used to defray costs such as travel, accommodation, materials or publication.

Applications for the Award: Applications should be made in typescript to: Secretary, Wellington Botanical Society, PO Box 10 412, Wellington 6143, or by e-mail to kateljordan@gmail.com, by 6 September 2020. There is no prescribed application form, but the following must be provided:

1. The applicant's name,
2. Postal address, telephone number and e-mail address.
3. Any relevant position held
4. A summary statement of the applicant's accomplishments in the field of botany—no more than one page
5. An outline and timetable for the proposed project for which the Award is sought
6. A proposed budget for the project

Selection: The Award will be made to one or more applicants selected by a subcommittee nominated by the general committee of Wellington Botanical Society. Award(s) will be made and applicants informed of the results in writing, by 6 October 2020. Successful applicants will be required to provide, at an agreed time, a short report on what they have achieved, and an account of their expenditure of Award funds. The names of the Award recipients, the value of the Award(s), and a synopsis of the project(s) will be published in the Annual Report of Wellington Botanical Society.

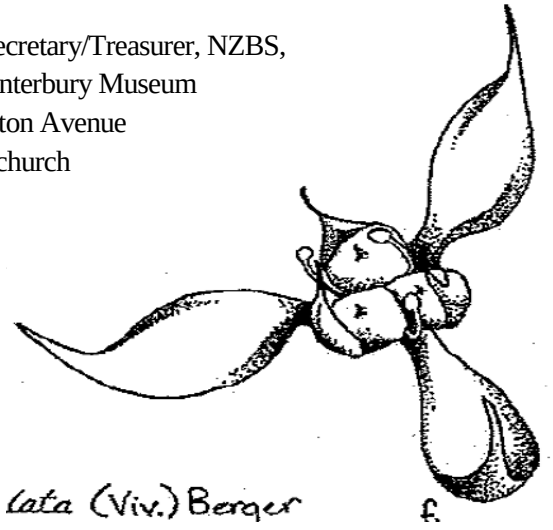
New Zealand Botanical Society

The NZBS was established in 1985 following discussions amongst many people on the need for better communication amongst botanists. A very genuine and widespread interest in what colleagues around the country are doing exists and the publication of a quarterly *Newsletter* has consistently been seen by the membership as the principal purpose of the Society.

The *NZBS Newsletter* publishes contributions under the following headings- News; People; Appointments; Events; Regional Botanical Societies; University Departments; Other Botanical research establishments; Notes and Reports; Current Research; New Plant Records; Fieldwork; Phenology; Short articles; Announcements; Desiderata; Forthcoming meetings and conferences; Meeting/Conference reviews; Theses in botanical science; Book Reviews; and Letters to the Editor. The cover features a different plant portrait each quarter.

We welcome new members. Subscriptions for 2020 are $25, students $12. A full set of back issues is available. Please send payment with complete name and address to

The Secretary/Treasurer, NZBS,
c/o Canterbury Museum
Rolleston Avenue
Christchurch
8013



Articles

Quantifying patterns of epiphytic bryophytes and lichens in Beech forests

Tom Dawes

As a student studying epiphyte ecology, I am acutely aware that much of my work focuses on vascular plants. Two of the most important groups which grow as epiphytes are lichens and bryophytes – the mosses and liverworts. Hence, I've endeavoured to bring a case study on these underappreciated non-vascular plants (including lichens) into my thesis on epiphytes. The right idea came from my supervisor's field course to Nelson Lakes National Park, an outstanding area of great quality beech forest.

Around Lake Rotoiti, in Nelson Lakes National Park, beech forests dominate the ecosystem, as is typical of many upland areas of South Island New Zealand. The mid-elevational forests here contain three of the five New Zealand beech species – red beech (*Fuscospora fusca*), mountain beech (*Fuscospora cliffortioides*) and silver beech (*Lophozonia menziesii*). These three beech species have vastly different coverages of sooty moulds which drive very different species richness and abundance of epiphytes. Sooty mould, a familiar component of the New Zealand bush, is a general term for many kinds of black, filamentous, saprophytic fungi that coat the surfaces of plants (in New Zealand primarily represented by the families Euantennariaceae and Metacapnodiaceae). In our system, sooty moulds smother the trunks of red beech and mountain beech and epiphytes are few and far between. Whilst on silver beech, which is scarcely affected by sooty mould, epiphytic mosses, liverworts and lichens grow profusely. Hence, because of this sooty mould host specificity, closely related tree species with similar branching architecture host very different epiphyte species richness. This presence of sooty mould is due to the copious honeydew released by the many beech scale insects (*Ultracoelostoma assimile*) which infect the beech trees. Beech scale insects parasitise the phloem of all New Zealand beech species with the exception of Silver beech. The absence in beech scale insect infection on silver beech is likely due to some difference in bark chemistry. Furthermore, even though it is in the same family, silver beech is more distantly related to the other beech species than they are to one another. Regardless of the underlying mechanisms, the pattern in the epiphyte communities is especially interesting from the perspective of an epiphyte ecologist. There are very few examples of structurally-similar, evolutionarily-related, co-occurring tree species hosting vastly different epiphyte communities and biomass.

The geography around our Nelson Lakes site will hopefully allow me to consider some extensions to this original idea. The ridge of the Saint Arnaud Range rises above eastern flank of Lake Rotoiti and has more or less continuous beech forest up to the treeline. It may be interesting to ask how epiphyte communities change up the elevational gradient, especially where they are abundant on silver beech. In other parts of the world epiphytic ferns and orchids show a mid-altitudinal richness peak where more species occur in the mid-elevation forests than close to the treeline or in the lowlands. Do bryophytes and lichens in New Zealand fit such a pattern?

The core idea is a fascinating but seemingly simple piece of ecology. However, challenges remain in scientifically quantifying this pattern, which is important in communicating this story in the scientific community. The main difficulty behind quantifying this pattern is the tricky identification of many of the bryophyte and lichen epiphytes. Separating these taxa often relies on microscopic evaluation, as well as many years of field experience, which I certainly don't have. However, New Zealand has the most

amazing community of experts and enthusiasts who share their wisdom via the wonderful medium of the John Child Bryophyte and Lichen workshop. Attending the 2019 Southland workshop in November allowed me to start building identification skills and introduce the key groups and common species of macrolichens and mosses I may encounter as low-trunk epiphytes in New Zealand's forests. Crucially it made my strategy and aims of identifying some of my Nelson Lakes epiphytes to genus and quantifying the generic level richness a realistic proposal. Working with genera and morphospecies within these genera can be a vitally important tool for ecologists dealing with taxonomically challenging groups. Hopefully, by spring I hope to apply these newfound skills and gather the required data to quantify my Nelson Lakes case study once we are all released from our covid-19 bubbles!

One of the key take-aways is just how much these inconspicuous, hard-to-identify elements of our flora deserve so much more than a second look. Bryophytes and lichens exhibit astonishing diversity and greatly contribute to the species richness of our ecosystems. Finally, the New Zealand bush is far more unique than we often appreciate, with even humble sooty moulds and epiphytes displaying interesting ecological patterns.

Acknowledgments

I would like to express my gratitude to everyone at the John Child Bryophyte and Lichen Workshop who made it such an enjoyable six days, in which I learnt so many things and was able to give a talk on these ideas. Special thanks to Angela Brandt and the whole organising committee who did such a great job, as well as all the experts who taught me so much, especially Allison Knight and her amazing lichen expertise! Thanks also go to the Botanical Society of Otago who contributed to my cost of attending the John Child Workshop and to Wellington Botanical Society who have provided a student grant to support this work.

Identifying fungi in New Zealand

Jerry Cooper
(Reprinted from iNaturalist)

First up some statistics to put the problem into perspective. Most fungi in New Zealand have not been described, do not have names, and so cannot be identified as species on iNaturalist.

Numbers of fungi in New Zealand

A conservative and widely used global estimate indicates there are six fungal species for every vascular plant species on earth. In New Zealand the vascular plants are relatively well-known, and we have about 2,200 indigenous species. We can therefore estimate there are at least 13,000 species of indigenous fungi. The number of introduced and naturalised plants is about 2,500 and many will have specific associated introduced fungi, and in addition there are many thousands more introduced plants in cultivation which may harbor yet more plant-specific fungi. We have not estimated the total numbers of introduced fungi associated with introduced plants, but it will be very significant. To date we have described about 6,000 native fungal species and catalogued around 2,000 species that were clearly introduced. To summarize, we have described less than half of our total number species of indigenous fungi and that is likely to be a significant underestimate. Many of these undescribed indigenous fungi will be small, inconspicuous forms.

For the larger forms (mainly basidiomycete - agarics, brackets and so on, but excluding the ascomycete lichens) we have described about 2,000 indigenous species and we know about a significant number of introduced species, mainly in urban/agricultural/ modified habitats. DNA data from environmental samples together with

sequence 'barcode' data on known species support the estimate that less than half of our indigenous species have been described, even though this group is conspicuous. New Zealand has never committed adequate resources to the professional effort required to describe them. However, in recent years we have documented around 1,000 of these undescribed species, in the sense that we have sequenced collections and we know what they look like. The task of formally describing these species is significant so they won't have proper names any time soon. iNaturalist will only accept published names and so many of the species can be recognised but not named on iNaturalist.

To summarize, we have an estimated 4,000 species of larger fungi that people are likely to see and photograph in natural habitats. 2,000 of those species have names and another 1,000 are known but undescribed. Urban/agricultural/modified habitats are dominated by fewer introduced species (most of the records on iNat fall into this category). Of our indigenous species, over 70% of our species are endemic, known only from New Zealand, with the remaining indigenous species shared with Australia, less often Asia or South America and elsewhere. The urban introduced fungi are mainly from Europe, Australia and much fewer from North America. When you flick through a guide-book or website to track down your observation just keep these facts in mind.

Which fungi should I photograph when I'm out?

Please resist the temptation to photograph everything you see because there is little point! You have the best chance of being able to identify something, or getting somebody on iNat to identify something, if you follow a simple rule. Only make records of fungi that look in good condition, where there are a range of fruitbodies from immature to mature, and where you can get good photos. Sure, you can take a casual phone-camera snap of a mushroom and upload to iNaturalist and sometimes it will be a distinct species we can identify, and it may be a useful record telling us something about occurrence and changes in distribution. Most of the time however it is better to 'walk on by', especially if you are a beginner trying to learn.

What should I photograph?

As I've said, reliably identifying most fungi from photographs is difficult but there are things that increase the probability of correct identification. Photos are needed in their habitat, not taken home and put on a plate. Photos are needed showing ALL the relevant features close-up and with a good colour balance, lighting and focus, and some sense of scale. We need to see the cap, stem, gills, the way the gills are attached to the stem, the stem base, any ring, and the way it is attached to the substrate. Remove it with a fixed blade knife so we can see an intact stem base. Removing a fruitbody to photograph these details will not affect the population. The fungus will have already released millions of spores and the fruitbody is just the 'apple on the tree'. The body of the fungus is the hyphae running through the soil and is unaffected by removing a few fruitbodies and turning them upside down (and leaving them there).

Field notes

The photos are just one aspect of recording. You should make notes about the substrate (soil, wood on a living tree, dead wood etc). The texture of the fungus - tough, fragile, crumbly etc. We need to know the associated species, guessed if it is a potential ectomycorrhizal species. We need to know any odour, the taste (a small bit on the tongue will not kill you – except maybe the Death Cap – which we do have in NZ), any changes to the flesh colour on exposure to air. Ideally, we need to know the colour of the spores from a spore print.

Identifying fungi

On iNaturalist I won't offer identifications for any observation where the user has profile settings making observations, or the accompanying photographs, 'All Rights Reserved'. Unfortunately many new iNat users have those settings.

I also can't offer any good advice on NZ field guides or websites for fungi, not that we have many, because I don't use them. Their accuracy is variable and the coverage necessarily relatively restricted.

Tracking down the correct identification for a species is often hard work and not just a matter of comparing a few photos. It is not just the problem of the vast numbers. Fungal species are remarkably variable in their appearance depending on growth conditions and inherent 'phenotypic plasticity'. You need to be able to recognise the key characters that can be relied upon. You need to develop familiarity with species in all their forms. It requires years of dedication to become proficient in identifying fungi. Most of our fungi cannot be named reliably from photographs alone. We have many superficially similar species that vary only in microscopic characters.

The iNaturalist 'Computer Vision' system is remarkable but often fails badly for fungi and should not be trusted. In particular you should avoid accepting suggestions that don't have 'seen locally' against them. These species are generally found only in the northern hemisphere (and often misidentified). Our native species may look similar to these suggestions but they are not the same.

Definitive identification based only on photographs is often impossible. All we can provide is varying degrees of probability about it being this species or that species based on circumstantial evidence. In New Zealand we also have a problem with the species that have been described in the past. Often the original descriptions are inadequate or ambiguous or they don't recognise the full range of variability. Our understanding is improving rapidly because of gene sequencing which allows us to more objectively define species concepts and potentially to uncover the full range of morphological variability within species. This process of disentangling, refining and improving the confusing historical work is ongoing. All this leads to uncertainty in identification and sometimes persistence of incorrect assertions and ongoing debate. Disagreements may seem confusing, annoying and unhelpful to many. From my perspective it is good science in action, although sometimes frustrating when faced with entrenched dogma.

If you really want identifications to be as accurate as possible then you will need a high-power microscope with an attached camera and some key chemicals like Potassium hydroxide solution and Melzer's reagent. You will need access to the technical literature (often expensive books or journal articles behind paywalls) and you will need to develop an understanding of the large amount of technical jargon. The ultimate identification method is gene/genome sequencing, which is becoming easier and cheaper, but nevertheless requires significant expertise to analyse the data appropriately. Mycology can become a very expensive and demanding hobby.

Collections

It is very tempting to make collections of fungi and take them home – perhaps to eat them, make a spore print, do microscopy, make a reference collection etc. You should keep in mind that in many situations it is illegal to make such collections. You need written authorisation from the landowner (including DOC and local/regional council/iwi).

Edibility

I will generally not respond to questions on edibility but I will answer questions on toxicity. Many people will show allergic reactions to some fungi whilst others do not. Many fungi cause gastric upset or vomiting whilst others are deadly. When you buy a foodstuff from the supermarket you can be sure that health and safety measures have been considered. When you eat something from the 'wild', especially if you don't know precisely what it is, you are playing Russian Roulette. If you do eat something, then make sure you take good records before you eat it. That will help the medics and eventually the coroner. Don't eat anything that isn't in pristine condition. Many fungi and moulds contain some of the most carcinogenic substances known (next to radioactivity). You will not die tomorrow but just give it a few years. Of course some (very few in New Zealand) are good edible species and not known to cause problems. Just make sure you are absolutely sure you have one of them.

Conserving biodiversity as well as species

John Grehan

If biodiversity were no more than a list of species the term would add nothing to our understanding of the natural world, and conservation of biodiversity would be little more than the preservation of species as objects in an outdoor collection. It would not matter whether species conservation was achieved by maintenance of current habitats, or by transfers to artificial enclosures (nature preserve, zoo, botanical garden etc.). While artificial maintenance may be the only practical option for some species, it is generally recognized that the biological and physical structure of the environment is also something of scientific value and meaning for conservation. Since all species are the result of evolution in space and time, the conservation of biodiversity is more than the preservation of objects – it is also about preserving their geography.

The science of biogeography has profoundly changed our understanding of how animal and plant species diverge in geographic space in response to geological change. These developments have important implications for the conservation of biodiversity, because they highlight a geographic structure for biodiversity that cannot be encapsulated solely by the listing and preservation of species. This recognition was first developed in New Zealand over three decades ago under the conceptual umbrella of panbiogeography (e.g. Matthews 1989). These studies showed how the evolutionary differentiation of New Zealand's biota (as species, genera, families etc.) is closely related to Mesozoic tectonics and geology. This is consistent with a New Zealand origin for New Zealand's biodiversity, in contrast to the prevailing view that all endemic species were colonists that originally came from somewhere else – either before geological separation from Gondwana, or more recently by drifting or flying over the surrounding oceans.

The idea that the immediate ancestors of all endemics had to have arrived from somewhere else was formulated into a general theory of evolution by Charles Darwin. Many species are allopatric with their relatives – they occupy different localities. Darwin theorized that allopatry results from a sequence of accidental, but often directional, dispersals from a smaller geographic location (centre of origin). Allopatry evolves by movement of organisms, so there is no necessary relationship between divergence, distribution, and the Earth’s tectonic structure. But this belief is not supported by the observed correlations between distribution and tectonics. The geographic relationship is consistent with a process of differentiation in a widespread

ancestor disrupted by geological or climatic events (Craw *et al*. 1999, Heads 2012a).

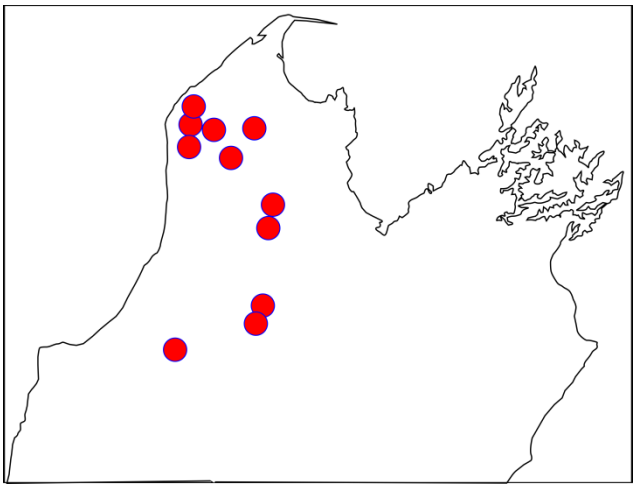


Fig. 1. *Distribution localities of* 'Coprosma' talbrockiei *in northwestern South Island of New Zealand. From Heads (2017b).*

Since all animal and plant species are the result of geographic divergence, their phylogenetic and geographic relationships reflect their evolution, even if they later undergo range expansion or contraction. These relationships can be investigated through biogeographic analysis of distribution and phylogeny. This approach is illustrated here by the distribution of a rare New Zealand species, '*Coprosma*' *talbrockiei* and its relatives (Heads 2017b, Thureborn *et al*. 2019). The limited distribution of '*C.*' *talbrockiei* in north west Nelson (**Fig. 1**) may be of conservation interest in terms of species management, but on its own the species provides no information on the phylogenetic and distributional context and its significance for biodiversity. The species belongs to a clade of three species also comprising *Durringtonia* in eastern central Australia and *'Coprosma' moorei* of southeastern Australia (**Fig. 2**). In this phylogenetic pattern '*C.*' *talbrockiei* exists as one of three allopatric and disjunct taxa, and its closest evolutionary relationships are not with true *Coprosma* species in New Zealand.

The individual distributions of *'C'. talbrockiei* and its trans-Tasman relatives are biogeographically significant. *Durringtonia* is centred on the McPherson-Macleay Overlap, a biogeographic region which marks a distributional boundary and centre of endemism for many taxa. It is tectonically associated with the Mesozoic New England orogeny and the Jurassic-Cretaceous Clarence-Moreton basin. The distribution of '*C.*' *moorei* is centred on the Otway-Bass-Gippsland Basin system, located around the Bass Strait of today. This represents a site of major Mesozoic rifting (Heads, 2014). In New Zealand, the distribution of *C. talbrockiei* lies within the Western Tectonic Province made up of Gondwanan continental crust. The species range extends east only to the geological boundary with the Eastern Tectonic Province (made up of Pacific terranes) (**Fig. 3**). Its northern boundary corresponds with the Taranaki metamorphic core complex, and the southern boundary with the Paparoa metamorphic core complex (zones of rapid extension and uplift in the Cretaceous). These tectonic correlations are consistent with an original ancestral range that formed a curving arc off the eastern coast of Gondwana prior to the tectonic extension that generated the Tasman Sea (Heads 2017b).

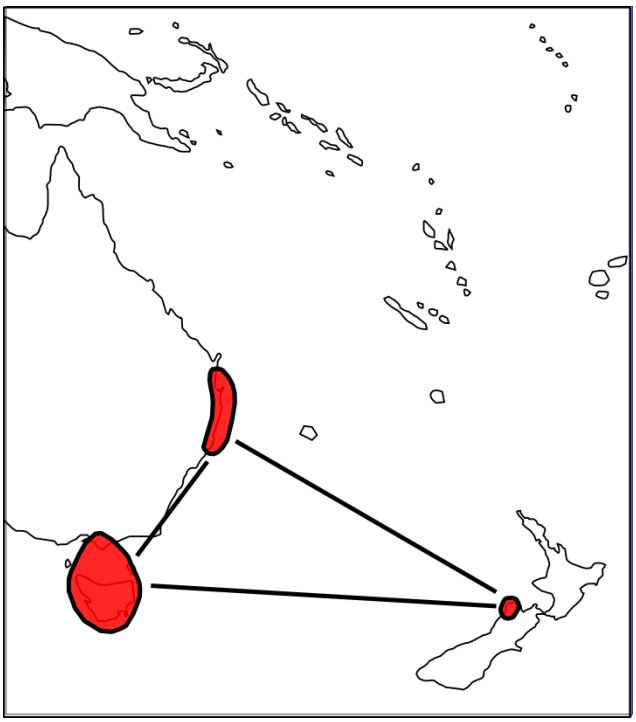


Fig. 2. *Tasman clade comprising* 'Coprosma' talbrockiei *in New Zealand,* 'C' moorei *in southeastern Australia and*

Tasmania, and Durringtonia in eastern Australia. From Heads (2017b).

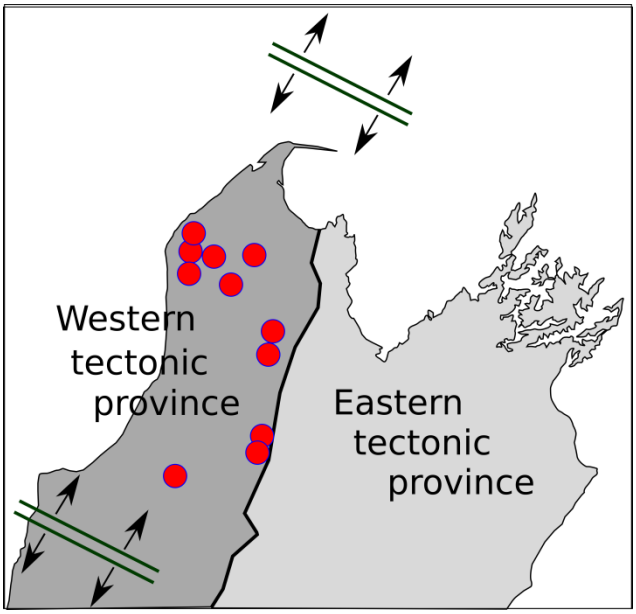


Fig. 3. *Distribution of* 'Coprosma' talbrockiei *mapped onto Mesozoic tectonic provinces of the northern South Island. Parallel lines – metamorphic core complexes to the south (Paparoa) and north (Taranaki) From Heads (2017b: fig. 5).*

There is also a broader tectonic correlation to be made. The '*C'. talbrockiei* group is localized around the Tasman basin, while its close relatives are represented by *Normandia* only in New Caledonia, and *Coprosma* s.str. which is widespread between China and across the Pacific to South America (**Fig. 4**). Overlap among any of the three groups occurs only in southeastern Australia and Nelson, and otherwise the three are completely allopatric. While this allopatry makes no sense in terms of ecology or chance dispersal, it is compatible with the vicariance of a widespread ancestor into three groups. These evolved more or less in situ, and have maintained their distinct distributions, apart from some local overlap. The original break among the three is spatially correlated with the extensive Mesozoic volcanism and intrusion that occurred along the Whitsunday/Median Batholith zone. This igneous belt (preserved in New Zealand and Queensland) was broken apart by formation of the Tasman Sea basin (Heads 2017a).

The *Coprosma* example is just one among hundreds demonstrating that the evolutionary structure of New Zealand's biodiversity is closely correlated with Mesozoic as well as Cenozoic tectonics (e.g. Heads 2017a). The geological relationship is also consistent with New Zealand endemics originating locally as allopatric members of formerly widespread ancestors that already occupied both New Zealand and other regions. Many molecular studies have proposed young clade-ages, but these estimates are calibrated by fossils, and so they can only provide minimum clade ages – they cannot falsify the older origins predicted from tectonic correlation (Heads 2012b).

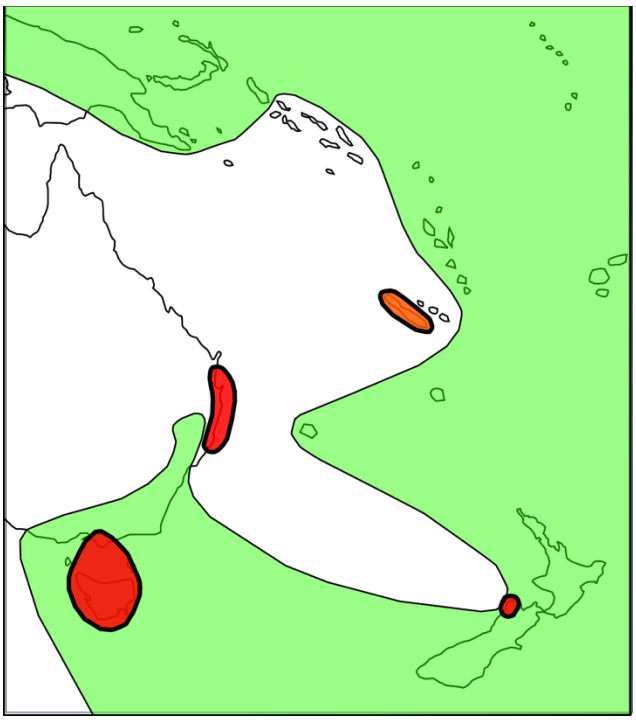


Fig. 4. Allopatry and overlap between three Coprosma *groups. Red shading – Tasman group (*'C.' talbrockiei, 'C.' moorei, Durringtonia*); orange shading –* Normandia*; green shading –* Coprosma *s.str. Distribution from Heads (2017b: fig. 4).*

Panbiogeographic evidence supports the view that Earth and life evolved together, and that conservation science needs to focus on the phylogenetic and biogeographic structure of a region rather than individual taxa or habitats. Distribution maps represent one of the most valuable forms of documentation about a group for both theoretical and practical purposes,

including conservation management (Heads 2017a). The integration of these maps shows that New Zealand's biodiversity and that of the world in general, is made up of a network of connections between biogeographic boundaries and centres called nodes. This biogeographic structure can and should be integrated into a biodiversity Atlas. This would identify the evolutionary significance of individual localities and guide the selection of taxa and habitats that should be protected (Grehan 2000, 2011; Heads 2017a).

The best way of ensuring conservation of the main aspects of diversity is to protect the biogeographic nodes. But without knowledge and understanding of this evolutionary structure it is not possible to evaluate the impact of conservation programs on the structure of biodiversity. An example of the potential impact of ignoring biogeography is the translocation of species to new habitats. If applied uncritically, and without awareness of the biodiversity structure of a habitat, the introduction of a new species not previously known to occur there could have highly detrimental impacts. For example, transfer of birds and wetas to islands where they have never been recorded could devastate the structure of invertebrate biodiversity on these islands. In cases where the island represents a centre of endemism and an evolutionarily significant node (e.g. Codfish Island) this could result in a critical loss (Heads 2017a). These potential impacts show that effective biodiversity conservation requires biogeographic analysis and interpretation.

Awareness of the evolutionary structure of biodiversity should greatly enhance Māori interest in maintaining a relationship with the natural world and its resources. According to Harmsworth & Awatere (2013), the traditional Māori world view acknowledges a natural order comprising a dynamic system built around the living and the non-living. This is concordant with the panbiogeographic idea of an integrated evolutionary structure ('natural order') in the distributions of New Zealand's animal and plant taxa. This understanding of biodiversity also shares the Māori concern with understanding the total environment and its connections rather than just its parts. In this approach, kaitiakitanga, active stewardship or guardianship of the environment, will be greatly enhanced by knowledge of the evolutionary structure of biodiversity, instead of just some parts as an artificial collection of objects (species and their environmental containers).

I remain hopeful that conservationists and conservation scientists will come to recognize the value of biogeographic mapping for conserving the main aspects of New Zealand's biodiversity. It is also my belief that the panbiogeographic framework will be useful for Māori to meet their biodiversity conservation goals. On a positive note for the future, panbiogeographic studies show that a surprising amount of New Zealand’s biodiversity structure remains intact. Even small relics of bush in gullies and on steep land can hold surprising diversity. The geographic records of biodiversity embedded within the landscapes of New Zealand are waiting to be read. Who will be there to read them?

Acknowledgments

I am grateful for review of the draft ms from Michael Heads, Fathima Iftikhar, Julie Knauf, Karen Mahlfeld, and Lou Sanson.

References

Craw, R.C., Grehan, J.R. & Heads, M.J. 1999. *Panbiogeography: tracking the history of Life.* Oxford University Press. 229 pp.

Grehan, J.R. 2000. Atlas of biodiversity: Mapping the spatial structure of life. *Biodiversity* 1: 21-24.

Grehan, J.R. 2011. Introduction to panbiogeography: method and synthesis. In de Carvalho, C.J.B. & Almeida, E.A.B (Eds.) *Biogeographia da América do Sul: padrõs & processos.* Roca, São Paulo, pp. 65-98.

Harmsworth, G.R & Awatere, S. 2013. *Indigenous Māori knowledge and perspectives of ecosystems*. In Dymond J.R. (Ed.) Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, pp. 284-286.

Heads, M. 2012a. *Molecular panbiogeography of the tropics.* University of California Press, Berkeley. 562 pp.

Heads, M. 2012b. Bayesian transmogrification of clade divergence dates: a critique. *Journal of Biogeography* 39: 1749-1756.

Heads, M. 2014. *Biogeography of Australasia: A molecular analysis.* Cambridge University Press, Cambridge. 493 pp.

Heads, M. 2017a. *Biogeography and evolution in New Zealand.* Taylor & Francis, Boca Raton. 636 pp.

Heads, M. 2017b. Metapopulation vicariance in the Pacific genus *Coprosma* (Rubiaceae) and its Gondwanan relatives. *Australian Systematic Botany* 30:422-438.

Matthews, C. (Ed.) 1989. *Panbiogeography special issue.* New Zealand Journal of Zoology 16 (4): 471-815.

Thureborn, O., Razafimandimbisom, S.G., Wikström, N., Khodabandeh, S.A. & Rydin, C. 2019. Phylogeny of Anthospermeae of the coffee family inferred using clock and nonclock models. *International Journal of Plant Science* 180:386-402.

Sexy Car Lichens

Allison Knight

Forget the Sexy Footpath Lichen (once June's talk is over). The sexy car lichen is much cooler. David Lyttle has long been keen for me to come and identify the much admired lichens that Belinda has carefully cultivated on her sexy little Starlet. So one sunny day BL (before Lockdown) I ventured out to their idyllic and historic lifestyle block on Centre Rd. Such an ideal place for growing lichens on unwashed cars. Plenty of dust with trace elements to leach out, with agricultural fertiliser floating around and bird droppings to further stimulate growth. Add rain and sunshine and you've got everything an adventurous lichen needs to grow vigorously.

Fig. 1: *The Sexy Pavement Lichen (as iNaturalist calls it)* Xanthoparmelia scabrosa, *being admired on Belinda's car*.

But to start at the beginning, what exactly is a lichen, you might ask. It's an ancient symbiosis between a fungus (or two), a green alga and/or a cyanobacterium. Or, as Robyn Bridges likes to tell it to her grandchildren, "Freda Fungus took a fancy to Alex Alga, and they set up house together. Freda built the house to provide shelter for Alex, and she also concentrated micronutrients from air and water. When it rained she let sunlight in to provide energy for Alex to work his photosynthetic magic and provide enough carbohydrates to feed them both. Around 10% of the time, especially where conditions were damp and shady, Freda shacked up with Cyril Cyanobacterium instead. Cyril could photosynthesize even when the house was sodden wet, and had the added advantage of being able to fix nitrogen from the air. The neighbours were grateful for this extra fertiliser, too. Occasionally Freda invited Cyril to come

and live with her and Alex and he lived closed off in his own little brain-shaped nodule, quaintly called a cephalodium (from Latin cephalicus = head). Their association had the best of all worlds, wet or dry, and formed a formidable trio".

Here's an addition for more advanced children to explain a fourth partner that has recently been discovered. In the Parmeliaceae, one of the biggest and most successful lichen families, which the sexy pavement lichen belongs to, Freda always invites Fanny fungus to come and live with her and Alex. Fanny hides away in the ceiling and helps make the outer cortex waterproof, and also helps Freda and Alex manufacture all sorts of useful chemicals, including a toxin, vulpinic acid (from Latin vulpus = fox), that is potent enough to kill wolves and foxes. Fanny hid away in the ceiling so successfully that for over 150 years lichenologists looking down microscopes failed to find her. While Freda, in over 99% of lichens, is an ascomycete fungus with fruiting bodies more or less shaped like a disc, Fanny is a basidiomycete yeast-like lichen that reproduces asexually by budding. Alex alga only reproduces sexually under exceptional circumstances, if at all. So Freda is still the sexiest and most dominant member of the symbiotic household.

This symbiotic microcosm we call a lichen has its own microbiome, too. Lichens really are miniature ecosystems and are so self-sufficient that all they need to survive they can concentrate from air and water, with light thrown in. Lichens are so resilient that they can survive in extreme ecosystems where no vascular plant dares to go, including in full exposure to outer space – without needing a space suit! Lichens were early colonizers on land and helped make it habitable, just as they are pioneer species on disturbed land now, even pioneering the disturbing artificial surfaces of Belinda's car. Our normally rock-living native *Xanthoparmelia scabrosa* has adapted better than most to the invasion of humans, and is happy to return the favour by invading all manner of artificial substrates. Not only does it spread out over footpaths and along roadsides, it gleefully decorates glass, metal, brick, tile, rubber, aluminium, plastic and more. On the car it happily grew over glass, rubber and painted metal (see Fig 1).

Staid and constrained vascular plants need to put their roots down to attach themselves and to draw up enough nutrients and water to circulate round their fancy vascular circulatory systems. Lichens don't have a vascular system, and rely on diffusion, which keeps them small, but tough. Because they are self-sufficient and merely need to perch on the surface they can live on an amazing number of substrates. Don't be fooled by the fact that some of them have rooty sounding rhizines – these are merely attachment structures.

Fig 2*: Fertile* Xanthoparmelia scabrosa *with brown disc-shaped fruiting bodies, orange blob at bottom* Teloschistes velifer*, grey blob* Physcia caesia.

So how do you identify a lichen? The cop-out way is to ask me, but the first step is relatively

easy. Lichens are arbitrarily divided into 3 main growth forms, Foliose, Fruticose and Crustose. If you use your imagination Foliose lichens are kind of leaf-like, in that their lobes are generally flattened and have a distinct upper and lower surface. Often they don't exactly hang free, but they can usually be detached from the substrate using water and a little gentle persuasion. Sometimes the lobes are so narrow and so closely hugging the substrate that you might mistake them for the spreading crust of a Crustose lichen, like the little grey blob at the bottom of Fig 2. This is actually a foliose *Physcia*, *P. caesia*. The spreading foliose and fruticose lichens might, or might not, be protecting the paint from weather.

Luckily for Belinda she doesn't appear to have any crustose lichens on her car, because these hug the substrate so closely that their fungal hyphae actually penetrate the surface a millimetre or so. This could let water in beneath the paint and accelerate rusting and paint flaking. When the earth was young this penetration was extremely beneficial, because over aeons it helped weather rock and gradually create soil for vascular plants to inhabit. If you have a 'strong and enduring as rock' pebble coated roof or wall you wouldn't want crustose lichens growing on the very appealing pebble habitat, because the lichen is likely to attach to the pebbles more tightly than the pebbles are attached to their substrate, and loosen the lovely 'rock solid' veneer.

The third main growth form covers the shrubby or Fruticose (from the Latin frutex, meaning shrubby). The little orange blob of *Teloschistes velifer* at the bottom of Fig. 2. is fruticose. Moira Parker thinks that 'twiggy' would be a better description than 'shrubby' for fruticose lichens, because they don't have any 'leaves' (except perhaps some *Cladonia*, that have a primary thallus of leaf-like squamules that sometimes decorate the fruticose stems that hold the fruiting bodies – but we won't go into all the annoying exceptions here).

This brings us to the next sexy bits. Firstly, how did the lichens get on the car in the first place? They don't produce seeds, do they? One reason I called the fungal partner Freda is because she is the only one in the symbiotic relationship that reproduces sexually. The big brown discs on the Sexy Car/Footpath lichen in Fig 2 are made entirely of fungal tissue and they release microscopic sexual ascospores (because they are made in a sac-like ascus) formed by meiosis. These spores are so light they can be carried considerable distances by the wind, especially up there on Centre Road where it comes whooshing across the ocean from the Antarctic. Once a spore settles, which it is more likely to do in a grainy, dusty nook than on a shiny clean surface, the embryonic Freda fungus has to find an Alex alga to snuggle up with before they can form a lichen symbiosis.

Vegetative reproduction is much easier. The fuzz on the surface of the sexy lichen is formed by a mass of projecting vegetative propagules, called isidia, which contain both alga and fungus already snuggled up together, just waiting to be given the chance to form another lichen. Isidia are easily detached by wind, water or abrasion and could easily have been loosened and thrown up onto the car as Belinda drove over country roads rich in sexy lichens. Once one *Xanthoparmelia scabrosa* took hold it in turn would produce many isidia that could easily start more identical lichens, and this is what the bulk of lichens on the car are. The main form of reproduction of the other two lichens in Fig. 2 is by fluffy little vegetative propagules called soredia. *Physcia caesia* sometimes grows on roadsides, though not nearly as profusely as the sexy pavement lichen. It also decorates the spectacularly lichen encrusted rocks in David's wonderful rock garden, so it shouldn't have been too hard for it to make the leap. *Teloschistes velifer* is possibly in David's rock garden, too. It

also grows on twigs, so perching birds could dislodge soredia, or even carry them in dirt or grooves on their feet. Carriage of vegetative propagules by birds was often invoked to explain long distance dispersal of lichens (before cars were invented). Carriage of microscopic spores by long distance winds has also been invoked, but that brings in the mystery of how the heavier alga ever got there to form a partnership

So, lichens are fungi that discovered agriculture and that enabled them to live almost anywhere in the world (millions of years later humans made the same leap forward). But how do you give just one scientific binomial name to a complex symbiotic association that reproduces in a recognizable form? Freda fungus gets the nod, because, like the farm owner, she is genetically unique, so the lichen farm is named after her. There is less diversity in the photosynthesizing algal and cyanobacterial crops, and they can be shared among many different fungi. Sometimes, Freda farmer changes crops to suit changing climatic conditions, either invisibly, by using different strains of alga, or occasionally dramatically, by kicking out Alex alga and bringing in Cyril cyanobacteria, or vice versa. This can cause problems in the field, and in the herbarium, because the lichens associated with the two 'crops' can look dramatically different even though the name of the 'farmer' has not changed.

In summary, Belinda's splendidly decorated car illustrates the fact that lichens are complex, resilient and ever fascinating organisms. If climate change or Covid-19 decimates the human population lichens will be the first to colonise the abandoned cars. You could help them on their way by not washing yours!

Meeting and Trip Reports

Weekend Field Trip to Invercargill, 21st-23rd February 2020

David Lyttle

After assembling in Invercargill the group drove to Bluff where we started the field trip with a visit to Motupohue Scenic Reserve on Bluff Hill. The track leaves the carpark above Bluff township and heads down the hill through a patch of remnant podocarp/rata forest. Although the forest had been milled in the past the structure of the forest was largely intact with many mature podocarps present. Several species of filmy ferns were recorded, including *Hymenophyllum demissum*, *Hymenophyllum flabellatum* and *Hymenophyllum revolutum*. The track continued down to the hill striking the Stirling Point coastal track where we found a number of plant species once common on the southern coasts but now very restricted to areas that have escaped modification. Numerous herbaceous species including *Epilobium komarovianum*, *Epilobium pedunculare*, *Plantago triandra*, and *Gentianella saxosa* were observed growing in the damp peaty turfs alongside the track. *Gentianella saxosa* is very common along these southern coasts and often the entire plant is covered in conspicuous white flowers. Two coastal *Myosotis* species, *Myosotis pygmaea* and *Myosotis rakiura* were also present. *Myosotis pygmaea* is a tiny, annual species with minute flowers. *Myosotis rakiura* is perennial with large white flowers but unfortunately was not in flower at the time of our visit. Other plants seen were *Leptinella traillii* subsp. *pulchella*, a local endemic confined to the northern shores of Foveaux Strait (subsp. *traillii* is found on the southern side of the strait on Stewart Island), *Mazus arenarius*, *Centella uniflora* - which was fruiting heavily - and *Pimelea prostrata* subsp. *ventosa*, the local Foveaux Strait form of this *Pimelea* species. In

an open ditch draining the track we found a colony of the rare pygmy sundew, *Drosera pygmaea*. This plant is considered to be at risk-relict under the NZ Threat Classification System.

After lunch we headed on to Tiwai Peninsula. This is a low shingle spit that separates Awarua Bay from Foveaux Strait. This area is accessed from the road to the Tiwai aluminium smelter and is normally closed to the public. The area is sparsely vegetated with low-growing coastal plants and scattered patches of grey scrub and is largely unmodified with much of the original vegetation remaining. The Peninsula is interesting in another respect; species that are typically found in montane grassland occur at sea level. In addition to two species of *Raoulia* (*Raoulia glabra* and *Raoulia* sp) we found *Coprosma petriei*, more typical of inland montane basins, *Mentha cunninghamii*, two species of *Leptinella* and quite unexpectedly (for me anyway) the shrubby *Olearia*, *Olearia nummularifolia*. Species representative of the more usual coastal communities included *Muehlenbeckia axillaris*, *Selliera radicans*, *Pimelea prostrata* subsp *ventosa* and the ubiquitous *Gentianella saxosa*.

On Saturday evening we enjoyed the hospitality of Chris and Brian Rance, a takeaway dinner followed by a presentation by Brian and myself on aspects of the botanical fieldwork led by Heidi Meudt and Ant Kusabs from Te Papa that we both had participated in.

On Sunday morning we looked at two further sites in Otatara. The first was the Otatara Scenic Reserve which is a predominantly totara/ podocarp forest on old sand dunes. It also contains kahikatea (*Dacrycarpus dacrydiodes*) and pokaka (*Elaeocarpus hookerianus*) as well as the usual mix of lowland broadleaf species. The uncommon *Coprosma* species *Coprosma pedicellata* was one of the more notable plants we observed on this site. There were further treats in store at the second site we visited. Bowman's Bush is a site owned by the QEII National Trust. Jesse Bythell who is the local QEII representative showed us round and located a colony of the saprophytic orchid *Gastrodia molloyi.*

The final event of the weekend was a tour of the Southland Community Nursery which has been established by Chris and Brian Rance on their property at Otatara. In addition to the nursery, the Rances have set up a Nature Education Centre for schools and volunteer groups involved in ecological restoration projects. We toured the nursery which mainly grows plants for restoration projects then moved on to the rare plant collection then headed out round the pond through the restoration plantings to a delightful, relatively new hut built in the outer reaches of the property. See their website https://www.southlandcommunitynursery.org.nz /education-centre/ for more information about their activities. The scope of Chris and Brian's activities is awesome and it was a great privilege be able to visit their nursery and be shown through their own restoration projects.

Finally I would like to thank our Invercargill hosts, Brian and Chis Rance, Jesse Bythell, Dave Toole and Lloyd Esler for their hospitality and sharing their botanical knowledge of their region with us.

Participants: Brian Rance, Chris Rance, Ivan Lin, Jesse Bythell, Lloyd Esler, Damien Collie,

Neill Simpson, Barbara Simpson, David Lyttle, Dave Toole

New Caledonia: a Botanist's Paradise, a talk by Peter Johnson, 11th March 2020

Alex Wearing

For most New Zealanders, New Caledonia is probably associated with images of palm-lined beaches and diving in tropical seas. Geologists will be interested in the globally rare presence of rocks derived from mantle forced to the surface. Ornithologists will be intrigued by the intelligence of the New Caledonia crow (*Corvus moneduloides*), and the enigmatic almost flightless kagu/cagou (*Rhynochetus jubatus*), the only surviving member of the Rhynochetidae. Botanists can admire the attractions of New Caledonia's indigenous conifers (13 species of *Araucaria*, five species of *Agathis*, and the world's only parasitic conifer, *Parasitaxus usta*) and *Nothofagus* (five species).

Peter Johnson's talk was based on two trips to New Caledonia. The first was as botanist in a 1978 DSIR entomology expedition to make plant collections from areas that were visited for insect collecting. The second visit was on a holiday in 2019. The talk was more than a botanical and ecological excursion. There were interesting observations and reflections on a wide range of topics. The talk was also visually stimulating. There were superb photographs of plants, landscapes, and cultural features (including, but not restricted to, cuisine, graffiti, and local people). I was intrigued by a photograph of a fruit and vegetable market displaying a wide variety of temperate vegetables such as carrots, courgettes, and onions. The photographs were supplemented by watercolours painted during the 2019 visit. These were effective at bringing attention to particular - often quirky fine-scale - aspects of New Caledonia's land and life.

New Caledonia is 2,384 km north-west of New Zealand in the Tropic of Capricorn. It has a land area of 18,576 km^2 (about the size of Northland). The main island of Grande Terre has an area of 16,372 km^2, and is 400 km long and 50-70 km wide. It is divided along its length by mountain ranges with the highest point Mt Panie at 1629 m. New Caledonia is part of the continent of Zealandia. The mantle derived rocks are mostly ultramafic peridotite[1]. Weathering of peridotite has led to formation of red lateritic soils enriched in nickel, but depleted in calcium[2]. This causes vegetation to be stunted over extensive areas. The lee west coast of Grande Terre has wide dry plains that have been extensively transformed, and the less transformed windward east coast has rain forest descending to sea level.

The first humans arrived in New Caledonia about 3,500 years ago. The indigenous people of New Caledonia are Kanak who are Melanesians. James Cook was the first European to visit New Caledonia in 1774. He bestowed the name New Caledonia because the mountains in the north-east reminded him of Scotland[3].

New Caledonia is considered to be the smallest of the world's significant biodiversity hotspots. It has about 3,150 indigenous vascular plants (the exact number of species varies from reference to reference), compared to about 2,500 for New Zealand. But New Caledonia has less than 10% of New Zealand's land area. The difference in diversity probably reflects a tropical setting, and the geological, geomorphic, edaphic, rainfall and altitudinal diversity of Grande Terre. New Caledonia's indigenous flora is about 77% endemic, whereas the New Zealand indigenous flora is about 82% endemic. For gymnosperms, the numbers of indigenous gymnosperms are 44 for New Caledonia and 21 for New Zealand. New Caledonia does not seem to have experienced many plant extinctions

compared to other tropical islands, but environmental transformations have restricted the ranges and reduced the populations of many species, and many plant species are threatened by the possibility of extinction. New Caledonia has introduced problem plant species, many associated with cattle grazing systems on cleared land and other disturbed sites.

The sites visited by Peter Johnson in 1978 included the *Araucaria biramulata – Nothofagus codonandra* forests on Mt Dore, the *Agathis* forests of Mt Rembai, and the *Nothofagus baumanniae* forest of Mt Mou which had a fern-rich understory. From the material collected Peter Johnson was able to contribute to a 1979 paper *Leaf vernation in* Nothofagus[4].

Images from the 2019 visit cover a wide range of localities and vegetation types: dense evergreen rainforest, dry sclerophyllous forest at lower elevations, maquis (ultramafic scrub-like heath mostly in the south), grassy and woody savannahs, halophytic vegetation (e.g. mangroves), and wetlands. Plants depicted included species native to New Caledonia such as *Melaleuca quinquenervia* (broad-leaved paperbark), and genera shared with New Zealand such as *Weinmannia*, *Metrosideros*, *Elaeocarpus*, *Podocarpus*, *Dodanaea*, and *Dracophyllum*. The variety and attractiveness of many wayside flowers was noted.

People have had, and continue to have, a profound effect on the plants and vegetation of New Caledonia. Traditionally, Kanak considered their environment their 'food safe' which had to be managed properly in order to provide an ongoing food supply. In many areas, current land-uses and land-use intensity are not sustainable. New Caledonia has many threats to its environment: open-cast mining, deforestation, cattle farming, and wildfire. There also problems with introduced animals such as rusa deer (*Rusa timorensis*). All the aforementioned can lead to substantial erosion, soil loss and depletion desertification, and sedimentation of water bodies, with deleterious consequences for indigenous plants. In recent years, much more attention has been directed to New Caledonia's plants and their conservation.

The internet has many sites and articles which persuasively demonstrate the distinctiveness, attractiveness, and significance of the New Caledonia's plants. Peter Johnson was equally persuasive with his words and images. By the end of the talk I very much wanted to have the opportunity to travel to New Caledonia and see this botanist's paradise for myself.

Notes

1 & 2. Mortimer, M. and Campbell, H. (2014). *Zealandia: Our Continent Revealed*. Penguin, Auckland.

3. Polynesian migration between the 11th and 18th centuries. British and American whalers visited in the early- to mid-19th century, and there was a mid-19th century trade in sandalwood (*Santalum*). Christian missionaries arrived in the 1840s. France laid claim to New Caledonia in 1853 and established a penal colony in 1864. The first Kanak revolt occurred in 1878. Kanaks did not get the right to vote until the mid-20th century. During World War II the number of American soldiers based in New Caledonia was comparable to the then resident population. New Caledonia had killings linked to an independence movement and a military presence in the late 20th century. New Caledonia is still tied to a distant country, as a 'special collectivity' of France. A 2018 referendum on independence was lost. New Caledonia has a population of about 270,000 (2019), of which almost two-thirds live in the capital Noumea and its environs. The Kanak currently make up about 40% and Europeans about 29% of the population. Minerals products and alloys (mostly nickel) are the main exports. Much of the land is unsuitable for agriculture and a large amount of food is imported. Tourism is less developed than in many Pacific nations.

4. Philipson, W. R. and Philipson, M.N. 1979. Leaf vernation in *Nothofagus*. *New Zealand Journal of Botany*, 17, 3: 417-421.

John Child Bryophyte Workshop 2019

Penelope Gillette

Approximately 40 attendees from all about New Zealand, plus a few from Australia and the United States, came together to share ideas, techniques and enthusiasm for the study of bryophytes and lichens at an annual six day workshop in November. The most recent John Child Bryophyte and Lichen Workshop (JCBLW 2019) was held at a Central Southland location – nestled amongst some of the lesser known gems of the province, allowing participants to explore a rich range of sites including alluvial forest flats, hill slope podocarp forest, hardwood-podocarp forest, beech forest, shrubland, red tussockland and some rock outcroppings. Both bryophytes and lichens occupy microhabitats, and many specialise in the type of substrate they dwell on – thus, a richness of sites and diversity of niches available to visit during this workshop was significant to the potential number of species we found.

The weather was generally fine, with rain at times (e.g. upon arrival) - this was of course Southland! Hot sunny days worked out well for our slow pace while out on field trips (though once in the bush, who really notices the weather?).

In Central Southland, lying between the Hokonui Hills and the Tokanui Hills, Taringatura lends its name to a hill range, a scenic reserve and the restored church campground at which the workshop was held.

Although Taringatura Hills have been largely denuded of native plant cover, next to the camp, in 14-hectare Taringatura Scenic Reserve, there are remnants of lowland podocarp forest surrounded by shrubland and regenerating native bush. This provided a nearby resource for workshop studies and recreational wandering. Much of the bush surrounding camp appears covered with *Muehlenbeckia australis,* which I like to think of as one of nature's plaster species because under what seems to be impenetrable, the bush remnant is healing; at Camp Taringatura, Pohuehue (*M. australis*) is suppressing exotic plants such as hawthorn, elderberry, flowering current and gorse while natives including bryophytes and lichens are thriving in the shaded understorey.

Camp Taringatura was originally a church camp, but has been opened up to the public to hold events, with a couple who manage the camp, living on-site. I stayed in my tent, but there was plenty of basic accommodation, similar to Borland Lodge, and thanks to John Steel and Liz, the catering this year was superb! Some considered renaming this workshop the JCBL Gourmet Workshop…

(Photo: Angela Brandt)

The event was held in the camp hall, which was spacious and well-heated by a wood-burning stove. Microscopes supplied by the University of Otago and Manaaki Whenua - Landcare

Research were set up on tables, so people could study specimens collected on the field trips.

(Photo: Melissa Hutchison)

The schedule for day 2 was a field trip to Forest Hill preceded by a beginners' introductory session at the fore mentioned Taringatura Scenic Reserve. First we sat in a circle and experts on various subjects were introduced. David Glenny delivered for the liverworts group, Allison Knight led the lichens group and Matt Renner managed the moss group.

Despite the diversity of their specialities a common need among bryologists, lichenologists and general enthusiasts is SOMETHING to safely transport specimens collected from the field… "With great earnestness, we sought to match the experts' exact folds in the A4 sheets that would become our specimen envelopes. Each fold had a sensibly explained reason which played a role in keeping our precious findings in good condition. A gasp of wonder then escaped our lips when the second expert made some deviation from the first design, again backing the modification with very sound reasoning. When the third expert, Matt Renner, produced another design the room exploded in laughter for how could he be serious? Yet, he maintained his composure and carefully explained the utility of his folds. Sensationally satisfied, with our new collection packet techniques, we were able to settle down again and think of bryophytes and lichens." – Gavin White recalls this as a unique first-timer's experience.

At Forest Hill most people went to the loop track on the west side to hunt for lichens, liverworts, mosses and other plants. Specimens collections were brought back to the Camp where people had practice at studying and identifying them using microscopes. Some took a lichen to drawing their collections. Others put their specimens with identifications on the display table set up for reference, viewing, keeping records, and learning.

(Photo: Penelope Gillette)

In the evening we had the Tom Moss Student Award talk, which is given at each annual workshop by candidates for a scholarship provided by the JCBLW and administered by Wellington Botanical Society. Candidates apply with an abstract to present at the workshop, and the judges will discuss who should be awarded the scholarship. There was only one candidate this time, but Tom Dawes gave an excellent presentation on his past and present research from hornwort evolution to epiphytic communities and sooty mould on beech trees.

On the third day, two field trip options were originally scheduled, but the trip to Mt Burns/ Eldrig Peak was cancelled due to snow, so we all went to Dolamore Park & Croydon Bush near Gore. Brian Rance from Southland DOC led this field trip sharing his local knowledge of the area. A born and bred Southlander who has lived and worked as a botanist in this region for 20+ years, Brian also played a significant role in scoping out locally rich sites for our field trips. Croydon Bush loop track provided beautiful specimens including some examples of Southland's most common "non-vascular" species:

Leucobryum javense
Ptycomnion acicularis –photo
Weymouthia mollis
Weymouthia cochlearifolia
Dendrohypopterigym filiculiforme
Peltigera dolichorhiza
Plagiochila deltoidea
Plagiochila fasciculate
Plagiochila stephensoniana

(Photo: Penelope Gillette)

That evening, Allison Knight gave an informative and amusing talk about lichens (of course) but specifically focusing on one of New Zealand's most common lichens, *Xanthoparmelia scabrosa*, also known as 'sexy pavement lichen'! I believe she will be giving this talk to BSO in the near future, so I won't go into more detail.


(Photo: Angela Brandt)

On day four, Jesse Bythell, QEII Southland rep. led us through two QEII National Trust covenants; in the morning we went to Milligan's, in the afternoon to Whyte's.

On the fifth day we went to Dunsdale Recreation Reserve on the southern flank of the Hokonui Hills, originally set aside as a water supply reserve for Invercargill.

On the morning of the last day we packed up and took a last opportunity for making and renewing contact with fellow botanists/ bryologists/ lichenologists from around the country.

The workshop was positively stimulating and useful to me; I am very grateful for the financial support from Otago Botanical Society that enabled me to attend. Species list from workshop available upon request.

AGM and photo competition, 13th May 2020

Gretchen Brownstein

On 13th May we held the first ever BSO zoom meeting for the AGM and results of the photo competition judging. And it worked pretty well! The AGM was over quick (as always). The highlights included our membership numbers are looking really good, thanks in part to people wanting to vote for the People's Choice award in the photo competition, and welcoming three new members to the committee: Matt Larcombe, Aidan Braid, and Taylor Davies-Colley.


Zoom meeting participants (Screenshot: Peter Johnson)

We then had a great presentation from Peter Johnson sharing his and the other judges, Kelvin

Lloyd and Rob Morris, comments and thoughts on the photo competition entries. As always, they had some lovely insights on the photos, pointing out how various features in the photos worked together to bring out the story. It was interesting to see how a title or caption for the photos added, or sometimes changed, the interpretation of the image. We also got a wee insight to how the judges deal with deadlocked votes. But onto what you really want to know: who won! Drum roll please. Plant Portrait went to Ian Geary for Hokitika Haastia - Bright flowers of an otherwise well camouflaged *Haastia sinclairii* var. *sinclairii* at Lathrop Saddle, Hokitika. Plants in the Landscape went to John Barkla for Alpine tarns. Plants and People also went to John Barkla for Takitimu camp. The People's Choice, by a very wide margin, went to Ian Geary for Hokitika Haastia. Peter thinks this is the first time the people agreed with the judges. Thank you to all three judges for their time and efforts. If you would like to see all the wonderful entries, head over the BSO website.

There were 38 entries for Plant Portrait, 17 for Plants in the Landscape and 7 for Plants and People, giving a respectable total of 62 photos.

Bright flowers of an otherwise well camouflaged Haastia sinclairii *var*. sinclairii *at Lathrop Saddle, Hokitika (Photo: Ian Geary)*

Alpine tarns (Photo: John Barkla)

Takitimu camp (Photo: John Barkla)

Botanical Society of Otago Patron: Audrey Eagle

Website: http://www.bso.org.nz

Email: bso@otago.ac.nz

Committee 2020

Please submit copy for next newsletter to Lydia Turley by 10th October 2020

This Newsletter was published on 29 May 2020.
ISSN 0113-0854 (Print) ISSN 1179-9250 (Online)

Buttons for botanical pundits – still available at BSO meeting

BOTANICAL SOCIETY
OF OTAGO

Membership Form

2020

Title: …… Name: ……

Postal address (work or home): ……

……

E-mail address: ……

Phone: work: ( ) …….. home: ( ) ……..

	Please tick one box			
	Emailed *Newsletter*		Hardcopy *Newsletter*	
Student	$10		$20	
General	$20		$30	

Subscription Rate (one of the above): $ ……..
Donations welcome: $ ……..
Total: $ ……..

☐ **Cheque:** Make payable to:
Botanical Society of Otago
and post with a completed form to**:**
The Treasurer, BSO
P.O. Box 6214
Dunedin North, 9059
New Zealand

☐ **Cash:** Lodge the correct amount with a completed form at a BSO meeting.

☐ **Internet Banking:** Account No: 03 0905 0029158 00 (Westpac)
Code: 2020 sub
Reference: *your name*
If a new subscription, please send a completed form to the Treasurer at the above address or to bso@otago.ac.nz

BOTANY DEPARTMENT

UNIVERSITY OF OTAGO

Botanical Society of Otago, PO Box 6214, North
Dunedin 9059, NEW ZEALAND

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

BOTANICAL SOCIETY

OF OTAGO