Newsletter Number 92

February 2021

BOTANICAL SOCIETY

OF OTAGO

BSO Meetings and Field Trips February 2021 - July 2021

10th February 2021, 5:20 pm: Petrified Forests of Zealandia. Speaker: Mathew Vanner, Department of Geology. This talk explores the history of Zealandia's forest tree flora from a palaeontological perspective. Forests are our oldest and most persistent ecosystems and New Zealand, the Chathams and Auckland Islands have all yielded identifiable fossil wood from a range of ages and families. The fossils reveal an unbroken line of conifers, including Araucariaceae and Podocarpaceae, from the Jurassic (~170 Ma) to the Miocene (~10 Ma). New records of angiosperms, (Araliaceae, Myrtaceae, and Legumes), appear in the Eocene (~50 Ma) and other taxa (Casuarinaceae) disappear from New Zealand in the Miocene. Wood characters can be used to investigate palaeoclimate and show when key features developed in New Zealand lineages. My talk illustrates the exquisite preservation of fossil wood, the range of information that can be derived from wood features, and the history of many of the distinctive trees currently growing in New Zealand.

12-14th February: Weekend Field Trip to the Oteake Conservation Park. We plan to stay at the DOC Homestead Camp Site, Hawkdun Runs Road. The camp site has stunning views of the Hawkdun Range. The facilities are basic so you will need to bring a tent. You are responsible for providing your own food but plan to bring a meal for Saturday evening to share with the group. There are a number of tracks accessible from the Homestead Camp Site giving access to the Hawkdun Range, the St Bathans Range and the East and West branches of the Manuherikia River. The vegetation of the Oteake Conservation Park is diverse and very interesting especially in the alpine zone. There are well-developed screes which have their own specialised flora and a number of species reach their southern limit in the region. Final details will depend on the number of people attending and the number of 4WD vehicles available. We will leave Dunedin on Friday evening and return Sunday afternoon. If you wish to go on this trip please contact David Lyttle (03) 454 5470 email djl1yttle@gmail.com

10th March 2021, 5:20 pm: End Peak. Speaker: Cara-Lisa Schloots, Masters student, Botany Department. The End Peak wetland complex is situated within the Mahu Whenua covenants near Wanaka at approximately 1800 m a.s.l. in a south facing basin. It has a variety of vegetation types including uncommon species and a number of plants not typically found at such high altitudes. It is a fine example of a southern hemisphere patterned wetland, and a unique system about which very little is known. My Masters project was carried out over the five months of summer 2018-19 when the wetland complex was free of snow. Cameras were set up at six locations to record water level throughout the growing season from mid-December 2018 until mid-May 2019. Water level patterns were found to vary largely within the wetland complex, although some seasonal changes were observed across all sites. Transects were used to investigate standing vegetation and the seed bank. Plant assemblages also varied across the wetland, although some species were present at all locations. These patterns were related to water level regimes at respective sites. From this we can see that even relatively small wetland areas can contain a remarkable variety of environments and communities, and it is unlikely that such an area will respond as one unit to the climatic changes that are taking place. There will be specific areas and communities within the system which are more threatened, in particular those sites which currently experience more stable conditions and are not adapted to as extreme environmental fluctuations.

27-28th March 2021: Weekend Field Trip to Mahu Whenua. This trip will allow us to explore the flora of a spectacular part of Central Otago not typically accessible to the public. The Mahu Whenua landscape is in the midst of a huge transformation from farmland to conservation land and supports a number of interesting remnant and transitional vegetation types as well as a many rare species including *Olearia lineata, Alepis flavida, Sonchus novae-zelandiae, Pachycladon cheesemanii, Carmichaelia crassicaulis* ssp. *crassicaulis, Azorella exigua, Carex lachenalii* ssp. *parkeri* and *Carex enysii.* There will be a number of options associated with this trip which will suit all interests and abilities. We will depart Dunedin at 07:00 on Saturday, arriving at the hut where we will have lunch at ~13:30. In the afternoon we will explore the beech forest and shrublands up Highland Creek. Depending on interest a group may also head up above the bushline.

Sunday options include remaining at Highland Creek hut to continue exploring that area, heading up the expansive Motatapu Valley via 4WD to explore beech patches, tussock and shrublands, and visiting a spectacular high alpine patterned wetland. This last option includes helicopter flights, which will need to be paid for in advance. There will be a maximum of four people + guide (Cara-Lisa) and the cost will be $260 for the return flight.

We will be leaving at 13:00 and will stop for afternoon tea in Alexandra on our way back to Dunedin. The trip will be taking a maximum of 20 people (you must be a BSO member). You will need to provide your own breakfast, lunch and snacks. Dinner will be a potluck/BBQ. We will be camping next to a hut with toilet and cooking facilities, so you will need to BYO sleeping arrangements (tent/mat/bag etc.). Please register your interest with Matt Larcombe (matt.larcombe@otago.ac.nz, 027 919 9709) by the 22nd March.

10th April 2021, 8:30 am: Quoin Point. This trip offers another opportunity (a previous field trip has been to the mouth of the Akatore River) to look at the distinctive plant communities defined as coastal turfs. These salt tolerant (halophytic) plants are made up of low growing (generally less than 50mm in height), herbs, sedges and grasses, and are well adapted to living in the exposed marine shoreline locations, like this one on the southern Otago coast. Contact Robyn Bridges 021 235 8997.

14th April 2021, 5:20 pm: Seaweed communities – Responses to invasion, climate change and nutrients. Speakers: Gaby Keeler-May, Isla Twigg, Ben Williams, and Nam Chand. This month we have a series of short talks from four Marine Science PhD students.

Gaby Keeler-May is assessing the impacts of the invasive kelp, *Undaria pinnatifida*, in the subtidal rocky reefs of southern New Zealand. Her focuses are to compare invasive and native seaweed contributions to the total biomass of kelp forest ecosystems, to evaluate the distribution and expansion of *Undaria* at sites of past and recent introductions, and to determine the impact of *Undaria* on native kelp abundance and its ability to resettle after large-scale removal.

Isla Twigg's research revolves around the microbial communities of kelp forests. She is interested in how the productivity of different microbial communities changes with environmental conditions, and between species of macroalgae. This involves tracking seasonal patterns in environmental conditions and bacterial productivity, as well as experiments exposing these microbial communities to different types of stress.

Nam Chand will discuss her research on the community habitat and ecophysiology of soft sediment red macroalgal communities in Otago Harbour, with a focus on the red endemic macroalgae *Adamsiella chauvinii*. Specifically the research investigates the algal habitat community and epifauna composition within *A. chauvinii* meadows. Moreover, it will also assess the nitrogen uptake by *A. chauvinii* and other dominant algae within its meadows.

Ben Williams' will talk about the trends in kelp forest decline in New Zealand driven by climate change and anthropogenic stressors. He will also discuss the future for kelp forest reseeding and how this can be used to rebuild degraded fisheries.

12th May 2021, 5:20 pm: BSO Annual General Meeting and Photographic Competition. The photographic competition is a popular and eagerly anticipated event for anyone interested in botanical photography. Enter your best photos and learn what makes a good photograph and how to improve your photographic skills from our panel of expert judges. Your photographs may be chosen for the BSO Calendar so this is your opportunity to have one month of fame. Start organising your entries now and don't wait until the last minute.

Weekend of 21st-22nd May 2021: BSO Fungal Foray to Waikaia Forest. Waikaia Forest at Piano Flat is an isolated remnant of the mixed beech forests (red beech - *Nothofagus fusca*, mountain beech - *Nothofagus cliffortioides* and silver beech – *Nothofagus menziesii*) that once covered much of the area. The area supports a unique invertebrate fauna with several rare species being found there. Beech trees are dependent on various mycorrhizal fungi for their

survival and growth. We plan to look at the fungal diversity of this forest in conjunction with Assoc. Prof. David Orlovich of the Otago University Botany Department as part of his ongoing research. David is planning to go earlier in the week to do some collecting. The BSO foray will take place on the morning of Saturday 22nd and will be followed by a workshop at a base in Waikaia township where we will examine and identify any specimens collected. It is suggested that anyone wishing to participate travel down on Friday evening so they can get an early start on Saturday morning. People can either travel back on Saturday evening or on Sunday. Accommodation is available at the DOC Campsite at Piano Flat or the Waikaia Motor Camp. For further details and to arrange carpooling contact David Orlovich (david.orlovich@otago.ac.nz) or David Lyttle (djl1yttle@gmail.com).

9th June 2021, 5:20 pm: Fungi at Orokonui Ecosanctuary. Speaker: David Orlovich, Department of Botany. I have had the privilege of collecting fungi at Orokonui Ecosanctuary on several occasions since it was established. The ecosanctuary hosts an interesting array of fungi, some of which are associated with particular plant species that grow there, and some that are not known from elsewhere in New Zealand. This informal talk will give an overview of the fungi at Orokonui and showcase some of the interesting finds.

June 2021: Working Bee at Orokonui Ecosanturay. We will spend the morning leading a hand at the ecosanctuary helping with a bit of weeding and seeing if we can add to their plant species list. We will be focusing on expanding the fungi and lichen species lists. In addition, there will be a chance to see the Otago Rare Plants garden (which many of our members have contributed to) and perhaps spy a takahe or tuatara. Details, times and date will be confirmed closer to the time via our website and email.

14th July 2021, 5:20 pm: Almost an island - the remarkable flora and habitats of Banks Peninsula (via zoom). Speaker: Melissa Hutchison. Banks Peninsula comprises approximately 100,000 hectares of volcanic hill country, rising to a height of 920 metres above sea level at its highest point (Mt Herbert-Te Ahu Pātiki). The vegetation pattern is influenced by varied altitudinal and climatic gradients, which have contributed to a unique and diverse indigenous flora (>550 vascular plant species and >200 lichen species), including a number of endemic species. Prior to human arrival in New Zealand, the Peninsula was largely covered in indigenous forest, but this was rapidly cleared following European colonisation, and by 1920 was reduced to relatively small, isolated fragments, mainly on steep slopes at higher altitudes. Indigenous woody vegetation cover has increased in recent years through natural succession, with primary forest, secondary growth forest and shrubland now covering about 15% of the Peninsula. More than 2200 hectares of land is currently protected in Department of Conservation and Christchurch City Council reserves, with a further 1500 hectares on private land protected through conservation covenants (>120 covenants). The vegetation and flora of the Peninsula has been by well-documented by legendary botanist Hugh Wilson, but recent ecological surveys have shown that there are still exciting botanical (and lichenological) discoveries waiting to be found!

Meeting details: Talks are usually on Wednesday evening starting at 5.20 pm, unless otherwise advertised. Venue is the Zoology Benham Building, 346 Great King Street, behind the Zoology car park. 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.

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

BSO Meetings and Field Trips **2**

Chair's Notes **6**

Secretary's Notes **6**

Treasurer's Notes **7**

Editor's Notes **7**

Correspondence and News **8**

- **Zoom-accessible BotSoc talks and seminars** **8**
- **35th John Child Bryophyte and Lichen Workshop - Rotorua** **8**
- **Correction** **8**
- **Photo competition advertisement** **9**

Articles **10**

- **Weed seed banks** **10**
- **Lakefront invertebrates are kinda cringe** **11**
- **Ontong Java Nui – a critical element in the evolution of New Zealand's biodiversity** **13**
- **Presentation of Allan Mere Award 2020 to Bill and Nancy Malcolm** **18**
- **Cartoon** **20**

Meeting and Trip Reports **21**

- **Karitane trip, 19th September 2020** **21**
- **Field trip to Trotters Gorge, 3rd October 2020** **22**
- **The 'other half' of New Zealand's flora: how distinct are non-native plants from the native? A talk by Angela Brandt, 11th November 2020** **24**

Committee and BSO contacts **26**

BSO Membership Form 2021 ..... **27**

Cover: Artwork by James Crofts-Bennett. "Inspired, I was! Like a demon, since I broke from the morning council I was driven to finish this daunting penitence! Behold, *Knightia excelsa*!"

Chair's Notes

Gretchen Brownstein

Kia ora tātou. I hope everyone had a lovely summer. My highlight was spending two days at Irihuka sampling turf communities growing on the headland. This was for a long term experiment examining how grazing mediates the invasion of turf communities by both native woody species and exotic species (e.g. pasture grasses). After ten years exotic pasture grasses had invaded in the grazing exclosures, but woody species had yet to establish. The harshness of the environment is a major factor here, as the state of metal on the exclosures shows.

Sampling turf communities at Irihuka. (Photo: G Brownstein)

In BSO news, in December we made a submission on the draft Truby King Recreational Reserve Management Plan. A big thank you goes to Maia Mistral for her stellar efforts to get this over the line.

The annual photo competition is coming up, entries are due at 27th April. This year we have a new category, "Urban Ecology", to go along with "Plant Portrait" and "Plants in the Landscape". As always, broad and creative interpretation of the categories is highly encouraged! Entry forms and further details can be found on the website.

Also check out the website for the 2021 trips and talks line-up. We have got some wonderful events planned this year, so look forward to seeing you there.

Happy botanising!

Secretary's Notes

Angela Brandt

Ngā mihi o te tau hou ki a koutou katoa – a happy new year to all! After such a year as 2020, I'm sure that you, like me, were happy to be able to spend the holidays with NZ-based family and friends, doing essentially normal summer activities (weather-permitting!). But my thoughts are also constantly with all of my family and friends in the USA and elsewhere overseas. I hope those you know outside NZ are keeping safe and well, too.

There are many BSO events to look forward to in 2021, including two exciting weekend trips in February and March, so be sure to mark your calendars and contact the trip leaders to register your interest. As always, keep watch while you're out and about for the perfect photo opportunity to enter into the annual Photo Competition, including for this year's new category, "Urban Ecology".

Finally, I want to note that we now receive digital copies of most newsletters and publications from other botanical societies. So, in addition to the list of newsletters available to peruse in the Otago Botany department tearoom that Mary Anne and Lydia will publish in each issue of the BSO newsletter, I'll send out an email every month or so with other societies' newsletters attached. If you haven't received email notifications or BSO event reminders from me recently, please get in touch so I can make sure we have up-to-date contact details for you.

Treasurer's Notes

Mary Anne Miller

SUBSCRIPTIONS DUE

This year's membership fees are due - see the Membership Form at the back of this publication. If any details have changed please complete the form and return to the Treasurer and pay your fees online or at a meeting. If details haven't changed then pay online as indicated on the form. If unsure whether you've already paid for 2021 send an email and I'll let you know, as quite a few people paid in advance last year.

Cheque-free soon

From the end of February 2021 some banks in New Zealand will **NOT** accept cheques, and all banks and organisations will have phased out cheques by **July 2021**. BSO's bank, Westpac, will discontinue the use of cheques on 25 June 2021. Please keep this in mind when paying subscriptions or purchasing goods.

Items for sale

Contact me if you would like to purchase any of the following:

Botanical Magnets	$1 each or 6 for $5
Botanical Pun Badges	$5 each or 3 for $12
Lichen Guides	$20 each
Moss Guides	$18 each

Publications available on loan

The following hard copy publications were recently received by BSO:

University of Otago Magazine, November 2020
Canterbury Botanical Society Journal 51, 2020

Pipipi, Hinewai Reserve Newsletter, November 2020

Auckland Botanical Society Journal, Volume 75(2) December 2020
Wellington Botanical Society Newsletter, December 2020
NZ Botanical Society Newsletter, No. 142, December 2020
Folia Botanica Extremadurensis, Volume 14 November 2020

If you would like to borrow any of the above please contact me at maryanne.miller53@gmail.com

Editor's Notes

Lydia Turley

Thank you to all our wonderful contributors; your willingness to write for the newsletter is especially appreciated at this time of year. As usual, we have a busy newsletter with a wide variety of content for your enjoyment.

If you have anything you would like published in the next edition, send it in – contributions are always welcome! Copy for the next newsletter is due on *10 May 2021* and earlier submissions are most welcome.

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. We encourage stories, drawings, reviews, opinions, articles, photos or letters – or anything else you think might be of botanical interest to our diverse range of members.

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.

Correspondence and News

Zoom-accessible BotSoc talks and seminars

The BSO is pleased to announce we have joined with Botanical Societies from around the country to make more of our talks and seminars available live via zoom to all our members. We will keep you updated via email and the website with details for the events as they happen throughout the year.

35th John Child Bryophyte and Lichen Workshop - Rotorua

Monday 8th to Saturday 13th November 2021

Organisers: Shirley Kerr shirley@kaimaibush.co.nz ph: 027 463 5353 Anne Redpath annepathred@gmail.com ph: 07 315 7763

Where: The venue is Tui Ridge Park which is situated at 260 Anderson Rd, off Oturoa Road in the Hamurana area.

https://www.tuiridgepark.co.nz/

When: Monday 8th November to Saturday 13th November 2021. Monday afternoon is arrival and set up, with the workshop starting that evening. Pack up will begin late Friday 12th Nov with departure during the morning Sat 13th Nov.

Who: The workshop is open to anyone interested in bryophytes, lichens and/or epiphytes, from novice amateurs to professional botanists. The aims are to gain and share knowledge of, and to encourage an interest in, the mosses, liverworts, hornworts, lichens and epiphytes of New Zealand. Regular attendees are very friendly and willing to help beginners.

Accommodation: Standard cabins. There are 5 standard cabins with a total of 56 beds. Two cabins have two bedrooms, two have three bedrooms and one has four. There is a fully equipped kitchen in each cabin. Each bedroom contains 4 single beds and an ensuite. You will need to bring your own bedding including a pillow. You can hire a linen pack for $10 for the duration of the workshop. This includes 2 towels, two sheets, a pillow and case and 2 blankets/ duvet. The cabin rooms are $90 per night. Camping is available – tents/caravans/ campervans – at $10 pp pn for unpowered and $14 pp pn for powered sites, with ablution blocks nearby. For those who wish to make their own accommodation arrangements, there are plenty of options available in the area - motels, air bnbs etc. Please note that Tui Ridge Park is an alcohol, smoke and profanity free site.

Meals: Dinners will be catered for by Tui Ridge and we will self-cater for our breakfasts and lunches as per usual. Meal costs should be $30-$35 per day.

Getting there: There is an airport at Rotorua. Intercity buses stop in Rotorua. We can arrange to pick up anyone arriving by bus and plane. The usual car rental companies have pick-ups available at the airport.

Field Trip Options: Field work sites will mainly be on the western and northern sides of Rotorua. More details on field trips in the later circulars.

Correction

Ewen Cameron noticed that in the last newsletter (#91), Figure 1 of John Grehans article *Lucy Cranwell, Leon Croizat, and the biogeography of Manawatāwhi (Three Kings Islands)* (page 14) is incorrectly captioned. The photo shows Lucy Moore (left) and Lucy Cranwell (right).

Enter the Competition and support the Calendar
Entries due April 27th 2021

Categories are:

1. **Plant Portrait**
2. **Plants in the Landscape**
3. **Urban Ecology**

Broad and creative interpretation of the categories is encouraged!

It's easier than ever - no prints required.

To enter just email up to 5 digital photos as JPEG files between 2 – 8 MB to BrownsteinG@landcareresearch.co.nz along with the electronic entry form. Label each image with the category number followed by a caption and email in batches of no more than 16 MB per batch. Entrants must be current members of the Botanical Society of Otago. Entry and membership forms will be posted on the BSO website: https://bso.org.nz/photo-competition

There will be a prize of $50 for the winner of each category. Entries will be judged on technical and artistic merit by a panel of three judges. A separate prize of $50 may be awarded for members' choice on the night. Photos will be displayed and winners will be announced at the meeting on 12th May. Only photos of native plants (with or without people and landscapes) will be considered for the calendar and pictures in landscape orientation are more suitable for this.

Articles

Weed Seed Banks

Peter Johnson

A seed bank can refer to a gene bank, or, for an ecologist, seeds in the soil awaiting their season or year to eventually germinate. For a gardener the seed bank can be those weeds you thought you had extirpated, until the ground is disturbed, perhaps years later. So, some lessons from Broad Bay gardening.

Firstly, Solanaceae: potatoes, tomatoes, and all that. Once we had a septic tank. It filled and blocked when overloaded: Christmas Day, of course, when extra people were staying. A plumber friend came straight away, showed how to bale out the stuff with a paint can on a stick, and into wheelbarrows. I shall spare the details, other than to note how a humic layer was spread deeply over the vegetable garden, and how this soon sprouted to a miniature forest of tomato seedlings: from how many salads from how many previous house owners? Lesson: you should munch all your tomato seeds.

Garden weeding: grab the offenders even at seedling stage, when a sharp eye ─ maybe the botanist's eye ─ learns to identify the culprits even at the cotyledon stage. Solanaceae seem to all have cots of similar elliptic shape: like the pointed paddles used in a waka. You might note the cotyledons in the photo of four *Solanum* species (Fig. 1).

This story has been prompted by a seedling of *Solanum marginatum*, white-edged nightshade, on the left of the line-up. This shrub weed once grew on the western slopes of Quarantine Island in Otago Harbour, until, hopefully, eradicated. Meanwhile we thought to grow one in the garden for its bold, spiny, white-backed leaves, and yellow globose fruits. Some of these set seed, so out went the plant to the bonfire. However, 35 years later, in freshly-bared ground, up pops a seedling. And if a seed can last in the soil this long, then why not twice that, like gorse did in the spoil excavated from under a 70-year old house of a Dunedin friend.

Fig. 1. Solanum marginatum, S. chenopodioides, S. nigrum, *and* S. laciniatum.

The next in line is velvety nightshade, *S. chenopodioides*, a relatively new arrival on Otago Peninsula, recorded only at Company Bay in 2004, and now becoming common in other suburbs and wild places. Thank the birds for that. Then black nightshade, *S. nigrum*, which has been popping up for decades from both the seed bank and fresh seed-rain, and poroporo, *S. laciniatum*, that has been bird-tucker and forest pioneer for countless years: an example of a 'native weed', a category which one tree-hugging friend says is erroneous, but yes, there are indeed native weeds. Think of *Epilobium* and *Muehlenbeckia*.

Fig. 2 has a wee tuft of a native *Carex* which we once grew for its reddish fountains, then banished, ostensibly, until a re-appearance some 30 years later. I am not sure which species, maybe *cirrhosa*; am not growing it on for identification. Now for twin cress, *Lepidium didymum*, formerly *Coronopus didymus*, the seed of which has lain, numerously, in subsoil for the 40 years since our back garden was a sheep paddock. Over that period we have never let it go to seed, but the seed bank has its own idea. Expose the ground and the little green rosettes appear, notably from hard

little clods that must have encased the dormant seeds for so long. Combine sunlight with a single shower of rain and there is the new plant, threatening, if not arrested, to produce its first flowers and bobbly fruits within a fortnight. By contrast, nuisance cresses in the genus *Cardamine* are more controllable, so long as you nab them before the capsules spit out their seeds. In their case seed longevity seldom exceeds 18 months.

Fig. 2. Carex *seedling, twin cress, and* Selaginella.

Lastly, consider *Selaginella kraussiana*, a clubmoss (*Lycopodium*) relative, which you can find as a weed in bush edges around Dunedin. In the garden it sneaks back on you, cryptically hidden in the shade of herbaceous plants. A survivor, since the Devonian, much older than the seed plants and flowering plants, it has no seeds in the seed bank, nor even spores, for these, as my botany text books tell me, develop through a gametophyte stage upon the leafy sporophyte parent. So the dormant propagule is, instead, a delicate miniature sporophyte, persistent despite the lack of a seed-coat equivalent. Its ability to survive in the soil might have been tested, and honed, through the impact winters following asteroid- or comet-events that apparently extinguished the dinosaurs and other phyla. Long live the weeds.

Lakefront invertebrates are kinda cringe

James Crofts-Bennett

In a collaboration between the Otago University and WAI Wānaka, a sortie to the Wānaka lake marina was organized. WAI is in the process of converting a roadside urban green space into a native friendly wetland, something of a layer of protection against roadside pollution running off into the lake. The trip was off to a shaky start. Originally a combined set of a botanist and an entomologist was organized to offer technical expertise. Janice Lord was our designated botanist but due to an injury (wrecked her Harley doing 300 on the motorway) it was down to just me. As I refuse to operate motor vehicles due to cultural taboos, a bus trip had to be organized (uh, thanks WAI).

I was given an afternoon to engage in some reconnaissance. The urban green space was a thin strip running from the marina down to the dinosaur playground. The vegetation was sad trees, yellow flowers and grass (these would later be identified as willow trees, irises and grass). The project was a citizen science gig, and I would be working alongside WAI to help integrate Mount Aspiring college into a program regarding the lakefront and ecological restoration. I had been informed that a lot of the vegetation was already scheduled for removal, but the local grebe (*Poliocephalus rufopectus*) population had successfully produced eggs and staved off the human desire to ravage the lake front. There was a massive construction project occurring over the road, which required heavy use of large vehicles. There were the telltale signs of this impacting the lake side; oil patches on the sand and the large pipe ejecting water from an unearthed spring from the work site. The vegetation was almost entirely introduced articles. *Iris pseudacorus* and *Salix babylonica* (I think) made up the two large charismatic plants, with grass (that's as good as it's getting) and *Lagarosiphon* being the

dominant plants that were immediately overlooked. I retreated for the night as I was fairly confident being outside after 10pm was illegal in Wānaka (to their credit, the community I was set up in was not gated and only had a maximum of two sniper nests per street).

The morning was nice, the lake and mountains were very picturesque. I tried muesli for the first time (it was alright, the fruit was the highlight (that's botanical, grains and fruit are plants)). I reconvened with the WAI crew at the marina. I had noted an abundance of discarded logs amongst the long grass and while we waited for the Mount Aspiring kids to turn up, I flipped a couple. The pickings were rather slim, the common rough woodlouse (*Porcellio scaber*) and the brown centipede (*Lithobius forficatus*) AKA the usual suspects were abundant but nothing much else. There was some cloud cover, so the aerial traffic was meagre early on. The students began to trickle in, and John Darby (of grebe diary fame) turned up to open the programme with a word about the ornate birds (the work of big vertebrate no doubt). There was a cheeky little house sparrow (*Passer domesticus*) that insisted on attacking my shoelaces during the opening lecture. By pure luck, a friend (cheers Tahu) shared a post on social media regarding the grebe diaries earlier in the morning. While such a contrived coincidence is a sign of poor writing, it had set me up with near complete knowledge on what John Darby would be discussing with the students.

I was up next, and having been supplied with a white sheet (fabric, not paper - believe me, you HAVE to specify or you end up with paper) I led the group towards the willow trees with violent intent. The second the kids figured out they could start a ruckus they went nuts and we ended up being showered in invertebrates. The typical affair, two-spot ladybirds (*Adalia bipunctata*, not a bird), potato aphids (*Myzus persicae*, not a potato) and earwigs (*Forficula auricularia*, tricky one this, it actually is an ear but it doesn't like climbing in them). Then we got the cool stuff, a giant *Tetragnatha* with a titanic 30mm body length. He swung his gargantuan legs at my fingers, requesting a hand to return to the canopy. We also disturbed an unruly dobsonfly (*Archichauliodes diversus*, not a dobsonfly (no joke, look it up)) that slapped me in the face before returning to the willow foliage. The kids managed to unearth a ground wētā (*Hemiandrus maculifrons*) that did a sick backflip.

Tetragnatha *(Photo: James Crofts-Bennett)*

We returned to the marina carpark to start making spider hotels. The hotel design could be flexible, seeing as the more content added to the main chassis only improved the available internal habitat for invertebrates. With this in mind, we challenged the kids to get creative and tailor the hotel content to their own tastes. This resulted in some interesting concepts, one trap went heavily on wire and made a jungle gym that would favour web spinning spiders. Another went big on tubes, creating a vertical array of tubes and sticks to appeal to ground spiders. During this process the sun came out briefly and we got a sudden flurry of insect air traffic. Native bees (*Leioproctus fulvescens*) and hoverflies (*Melangyna novaezelandiae*, *Helophilus hochstetteri*) swarmed the small stand of daisies (no idea) directly adjacent to the dock entrance. The introduced bees (*Apis mellifera*, *Bombus terrestris*, *Bombus subterraneus*) also turned up, visiting the irises. We were also treated to the sight of Smith's dragonfly (*Procordulia smithii*)

chasing red damselflies (*Xanthocnemis zealandica*). I assumed this was a reference to classical literature that went over my head. I was starting to notice that the invertebrate fauna was remarkably similar to that found in my garden back in Balclutha. We live right over the road from the river, and Smith's dragonfly and both the New Zealand damselflies are fairly common sights. Both native and introduced bees and the native hoverflies are fairly abundant in our garden as are earwigs and ladybirds. In a direct comparison between what was observed on the lakefront and my garden, the only invertebrate that I hadn't seen back home was the dobsonfly (the ground wētā in Balclutha are probably *H. maia*).

Bee is Leioproctus fulvescens *(Photo: James Crofts-Bennett)*

I'm not sure what kind of spin to put on this information. The majority of the invertebrates noted are common, introduced species. Much the same as the plant side of things (and the birds, come to think of it). There was a notable lack of spider species, and only one native noted (*Steatoda lepida*) so I couldn't honestly recommend lake Wānaka as a vacation site. Thankfully, the lack lustre array of invertebrates (no offence) noted means that future listings can only improve. WAI has already planned to replant with native vegetation and future surveying is on the calendar to monitor how the invertebrate composition changes (if at all). Fingers crossed?

Ontong Java Nui – a critical element in the evolution of New Zealand's biodiversity

John Grehan
Research Associate, McGuire Center for Lepidoptera and Biodiversity, Gainesville, Florida, USA

In my younger days my family would occasionally visit Castle Point on the southern east coast of the North Island where I enjoyed clambering over the large outcrop of fossiliferous limestone, and walking along the crest to gaze out over a seemingly never-ending Pacific. Immediately below, the outcrop dropped precipitously into deep ocean, so one could almost feel embedded within the ocean itself (Fig. 1). It was not until some decades later that I came to appreciate that the ocean was directly significant for much of New Zealand's terrestrial and coastal biodiversity – not so much for what was within the water, but for what was hidden beneath. Hidden from view was a vast magma platform known as the Hikurangi Plateau. This geological formation extends over an area of 400,000 km^2 which is considerably larger than the 270,000 km^2 comprising terrestrial New Zealand. Since the Hikurangi Plateau is entirely submarine, there is no obvious relationship with the origin of New Zealand's terrestrial life. But geological reconstructions of its structure and origin correspond to a particular range of biogeographic patterns that indicate a shared history and evolution.

Hikurangi Plateau originated about 123 million years ago as a byproduct of the Earth's largest recorded volcanic eruption. This took place in the central Pacific at a time when the modern Pacific plate was only in its initial stages of expansion. The massive outpouring of magma over the seafloor accumulated in a series of huge plateaus. Sometimes referred to as Large Igneous Provinces, these plateaus could reach tens of kilometres in depth and included portions that

extended above sea level. Most of the plateaus and associated islands have since been transported great distances by plate movement. The largest plateau was Ontong Java Nui which covered an area of at least 5,000,000 km^2, a size similar to that of modern day Australia (Chandler 2012). Some of the Ontong Java Nui plateau overrode the newly formed Pacific spreading ridge and this resulted in some fragments being transported east to South America and south to Antarctica while three fragments were dispersed west – the Manihiki Plateau now located in the central west Pacific northeast of Tahiti, the Ontong Java plateau adjacent to the Indo-Australia plate by the Bismark Archipelago and the Solomon Islands, and the Hikurangi Plateau adjacent to New Zealand (Davy *et al*. 2008, Hockmuth *et al.* 2015, 2019, Zhang & Chao 2016, Hoernle *et al.* 2020).

Fig. 1. Between Castle Point and the Pacific looking out across the submarine Hikurangi Plateau. From https://www.theworldisacircus.com/2017/01/castle-point-in-pictures/ Reproduced with permission.

The three-way breakup of Ontong Java Nui involved two or three spreading centres – Ellice Basin separating Ontong Java, the Osbourn Trough separating the Hikurangi (Fig. 2) and possibly an unidentified rift (Zhang & Chao 2016) or shear zone (Hochmuch *et al*. 2015) between Hikurangi and Ontong Java that has since been lost to subduction along the Kermadec Trench. Rifting of the Hikurangi Plateau began about 119 Ma as it moved southwest, and lasted until about 100 Ma when the plateau collided with the Chatham Rise (Hochmuth *et al.* 2015, Zhang & Chao 2016, Reyners *et al.* 2017). Before arrival of the Hikurangi Plateau, the Pacific Plate was subducting under the Indo-Australian plate of east Gondwana. The Hikurangi Plateau collided with the North Chatham Rise Gondwana plate margin about 110 Ma, and there was about 10 Ma of subduction before the plateau choked the subduction zone at the collision boundary.

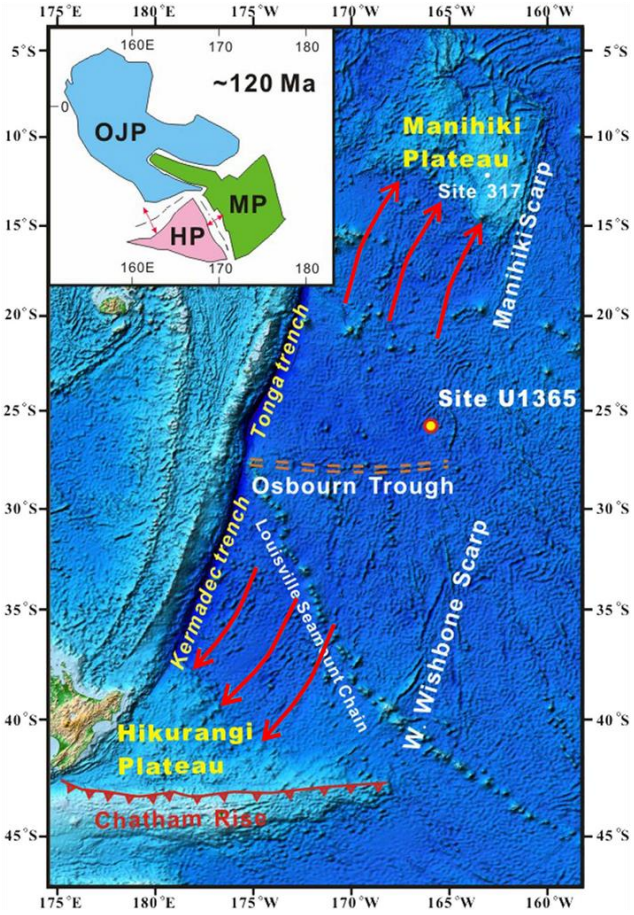


Fig. 2. Bathymetric map and inset showing the current position of the Osborn Trough with respect to the Manihiki and Hikurangi plateaus. Red arrows indicate direction of plateau displacement. Inset, structure of Ontong Java Nui about 120 Ma before it broke up into three components. Modified from Zhang & Li (2016, Fig. 1).

This Hikurangi Plateau/Gondwana margin collision was to have some profound geological consequences for the geography and geology of East Gondwana. Firstly, the previously descending Pacific slab became detached as it sank further into the asthenosphere where the resulting melting and upwelling of magma that broke through the East Gondwana crust created a new spreading ridge separating Zealandia from

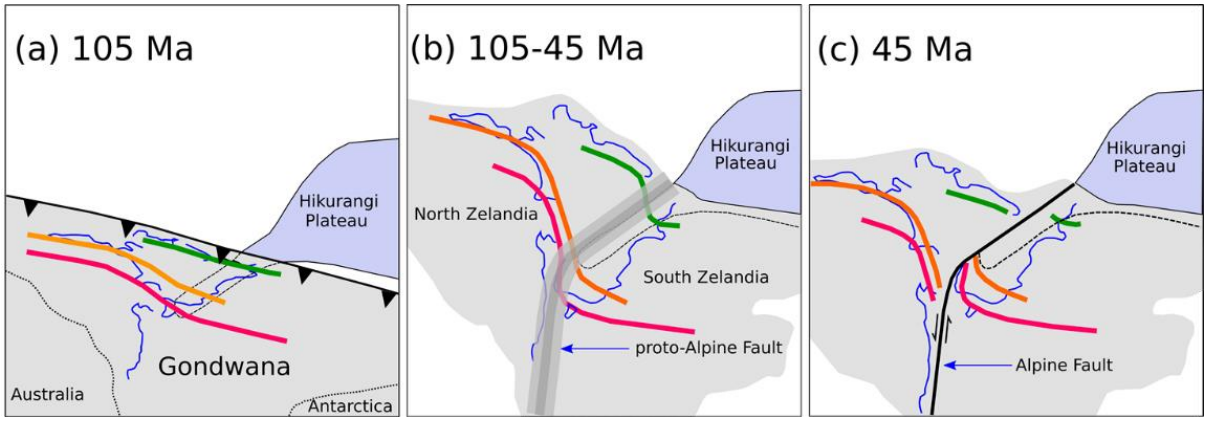


Fig. 3. Geological model for the origin of a pre-Alpine fault: (a) straight subduction zone and terrane alignments, (b) Late Cretaceous–Paleocene oroclinal bending focused on a proto-Alpine Fault zone between present-day northern and southern Zealandia, (c) Middle Eocene situation with sinistral displacement of the earlier oroclinal bends along an incipient Alpine fault. Line with points – plate boundary with points in the direction of the overriding plates. Geological belts: green line – Esk Head Melange, orange line – Dun Mountain-Matai Terrane, red line – Median Batholith. Modified from Mortimer (2018 Fig. 3).

Antarctica (Hoernle *et al*. 2020). The collision also coincides with the predicted formation of a proto-Alpine fault or rift zone between north and south Zealandia about 105 Ma (Fig. 3) that later became the precursor of the modern Alpine Fault (Schellart *et al*. 2006, Mortimer 2018, Lamb & Mortimer 2020).

When the large magmatic plateaus were first formed in the central Pacific, their terrestrial landscapes, in the form of individual islands or island archipelagos, would have been colonized by organisms that already existed in the vicinity. These organisms would have inhabited pre-existing islands, some of which may have included 'subcontinental'- sized island arcs, such as the Pacific island arc-derived Guerrero terrane which forms nearly half the area of modern-day Mexico (Clennett *et al.* 2020). Even though individual volcanic islands would be subject to erosion and submergence, organisms capable of dispersing onto newer volcanoes in the region could persist over millions of years. In this process of sequential island colonization, animal and plant groups would maintain a long-term presence, even though the individual islands they occupied are ephemeral and often short lived. This process is the same as mainland species persisting as metapopulations encompassing multiple disjunct habitats that are constantly being formed or lost (Heads 2018, 2019).

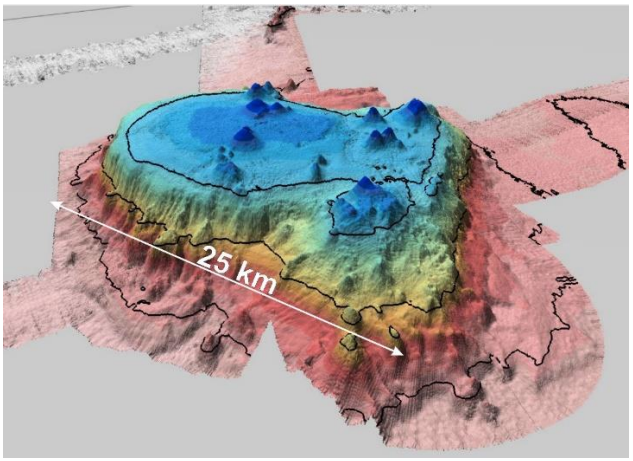


Fig. 4. Topography of the Polar Bear Seamount, Hikurangi Plateau, showing contours at depths of 3000, 2500 and 2000 m. The original island was eroded down to near sea-level to become a guyot before subsiding as the underlying Hikurangi Plateau cooled. Smaller volcanoes later erupted on the eroded surface. Topographic model derived from multibeam depth data collected on survey SO168 by the Research Vessel R/V Sonne. Image contributed by Bryan Davy. See also Davy et al. (2008).

The biological potential for the Hikurangi Plateau to support and transport a central Pacific island biota is indicated by the presence of numerous guyots (former islands) and ridge-associated underwater seamounts that originally extended above sea level (Fig. 6). An illustrative example is the Polar Bear Seamount (Fig. 4) with an area of 320 km^2. The former island would have been

larger in area than New Zealand's Great Barrier Island at 285 km^2. Although now submerged by erosion and subsidence, these seamounts are evidence for the existence of former islands which would have supported a terrestrial biota on the plateau. Through metapopulation persistence involving multiple succeeding islands, these organisms could have been tectonically transported from the central Pacific to the eastern coast of Gondwana (Heads 2017). The full range of islands can never be known since a large proportion of the plateau has been subducted.

There is now good evidence for former terrestrial landscapes on the Ontong Java Nui plateau and its derivatives, as well as other Pacific plateaus and intra-plate hotspots (Heads 2012). This geological structure provides a geological and geographic mechanism for the persistence of ancestral terrestrial and coastal marine distributions within the Pacific basin, and also for vicariance of ancestral populations through tectonic transport. An illustrative example is the plant genus *Fuchsia* in which a New Zealand-Tahiti clade is disjunct from its closest relatives in Central-South America (Fig. 5). This pattern corresponds to the initial vicariance of a Pacific ancestor split apart by seafloor spreading at the East Pacific Rise. As noted in molecular studies, the molecular divergence date of 8 Ma for the Tahitian *Fuchsia* species predates the 1.4 Ma age of the Tahiti islands, so the species must have previously occupied older islands that have since subsided. While it might be tempting to attribute the New Zealand-Tahiti connection to chance dispersal, this would not explain the existence of similar patterns in other groups, such as *Cyanoramphus* parrots and *Andracalles* weevils. But a shared vicariance event via a tectonic event such as seafloor spreading at the Osborn Trough would explain all of these groups (Heads 2017).

Many taxa on the Chatham Islands, the East Coast and Northland regions of the North Island have central Pacific affinities. This is consistent with their ancestors having been 'scraped off' the Hikurangi Plateau. As the original islands inhabited by their ancestors submerged and became subducted beneath the Zealandia coast, those animal and plant taxa capable of dispersing onto adjacent or nearby land of East Gondwana could survive, even if there was no direct terrestrial connection (Heads 2017). This is normal ecological dispersal of species and allows survival and sometimes range expansion; it is very different from the process of long distance chance dispersal used to explain evolutionary divergence of allopatric sister groups. With the subduction of the buoyant Hikurangi Plateau up to 100 Ma, the Chatham Rise will have been high above sea-level. Subsequent cooling and subsidence of the subducting plateau, as well as Chatham Rise erosion, will have led to its eventual submergence below sea-level.

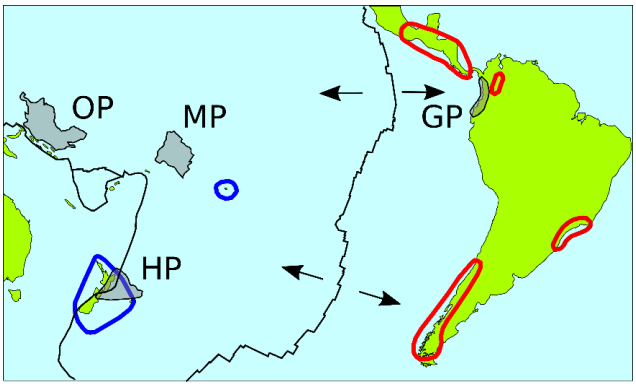


Fig. 5. Distribution of a New Zealand-Tahiti Fuchsia *clade (blue outline) and its nearest relatives in Central and South America (red outlines). HP – Hikurangi Plateau, OP – Ontong Java Plateau, MP – Manihiki Plateau, GP – Gorgona Plateau. Arrows – direction of modern tectonic movement away from the East Pacific Rise. Modified from Heads (2017: Fig. 10.3).*

Through successive integration of multiple island biotas on the Hikurangi Plateau, many clades can 'pile up' around the Plateau along the Chatham Rise and North Island. This can result in triangular shaped distributions paralleling the western and southern edges of the plateau. These distributions represent the biogeographic equivalent of an accretionary wedge of geological strata (Heads 2017). This shared geological mechanism explains why the distribution pattern is shared by taxa with a range of dispersal abilities

(Fig. 6). Other taxa established in New Zealand this way may have dispersed more widely and are now represented over most or all of New Zealand, as in *Fuchsia.*

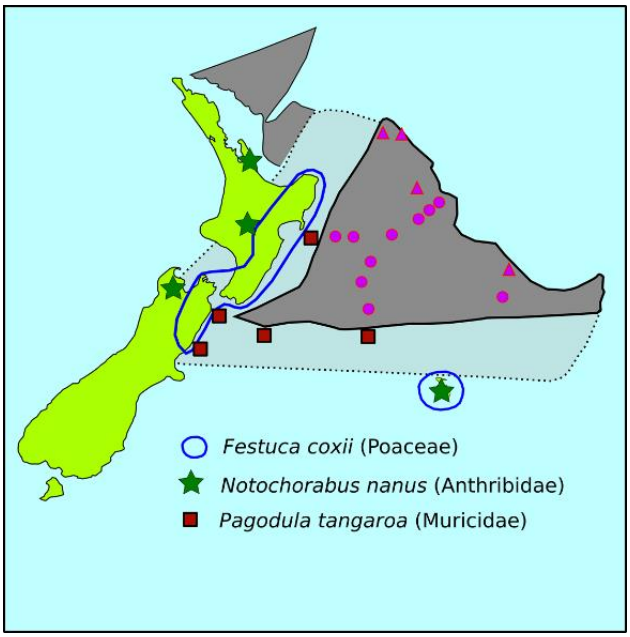


Fig. 6. Tectonic correlation between the Hikurangi Plateau (dark grey for current extent, pale grey for subduction) and the distributions of three taxa. Circles – guyots, triangles – ridge seamounts. Modified from Heads (2017: Fig. 3.10). Distribution of Notochorabus nanus *from Craw (1988).*

The spatial correlation between animal and plant distributions and the structural geometry and evolution of the Hikurangi Plateau illustrates how the panbiogeographic approach may be applied to the evolution of biodiversity at a very local geographic level. This approach shows that the same geographic pattern may not only be shared between organisms and geological structures, but that these patterns are shared between organisms with very different ecological dispersal mechanisms. The spatial correlation might be dismissed as a 'coincidence' but this explains nothing. In particular, it does not address how organisms share the same geographic pattern and geological correlation despite contrasting ecological requirements and mobility in both terrestrial and marine environments. Dismissal of spatial correlation also fails to explain the trans-Pacific pattern. If it is just 'chance' for such patterns to exist, why are these organisms not everywhere else? And why are they absent from adjacent regions? In the case of *Fuchsia,* why is it in the Pacific only in SE Polynesia (at Tahiti), and no other Pacific islands if it is just a matter of accidental trans-oceanic dispersal?

Lee *et al*. (2013) referred to *Fuchsia* as having an "unusual biogeographic pattern", but the trans-Pacific/SE Polynesia pattern is one of the most prominent features of global biodiversity (cf. *Hebe*). Knowledge of the main global distribution patterns is essential in order to avoid thinking that a particular pattern is unusual (and thus explicable by chance dispersal). Panbiogeographic analysis has shown many times that patterns that might appear to be exceptional are commonplace (Craw *et al.* 1999, Heads 2012). Biogeographic patterns and their geological correlates provide a scientific basis for recognizing the real existence of biodiversity as an evolving process of interconnected localities rather than as an arbitrary collection of isolated or unique objects such as species (Heads 2017, Grehan 2020a, b).

Acknowledgments

I am very grateful to Bryan Davy (GNS Science, Lower Hutt, New Zealand) for providing an illustration of Polar Bear Seamount and comments on the ms, to Lieselot De Brauwer for the Castle Point photo, and to Guoliang Zhang (Key Laboratory of Marine Geology and Environment, Qingdao, China) for permission to reproduce the tectonic model in Fig. 2. I am also most appreciative for helpful improvements to the ms from Michael Heads.

References

Berry, P.E., Hahn, W.J., Sytsma, K.J., Hall, J.C. & Mast, A. 2004. Phylogenetic relationships and biogeography of *Fuchsia* (Onagraceae) based on noncoding nuclear and chloroplast DNA data. *American Journal of Botany* 91: 601–604.

Chandler, M.T., Wessel, P., Taylor, B., Seton, M., Kim, S.-S., & Hyeong,, K. 2012. Reconstructing Ontong Java Nui: Implications for Pacific absolute plate motion, hotspot drift and true polar wander. *Earth and Planetary Science Letters* 331-332: 140–151.

Clennett E.J., Sigloch K., Mihalynuk M.G., Seton M., Henderson M.A., Hosseini K., Mohammadzaheri A., Johnston S.T., Müller, R.D. 2020. A quantitative tomotectonic plate reconstruction of western North America and the eastern Pacific Basin. G*eochemistry, Geophysics, Geosystems* DOI: 10.1029/2020GC009117

Davy, B., Hoernle, K. & Werner, R. 2008. Hikurangi Plateau: Crustal structure, rifted formation, and Gondwana subduction history. *Geochemistry, Geophysics, Geosystems* 9:1-31.

Grehan, J.R. 2020a. Conserving biodiversity as well as species. *Botanical Society of Otago Newsletter* 90: 14–18.

Grehan, J.R. 2020b. Lucy Cranwell, Leon Croizat, and the biogeography of Manawatāwhi (Three Kings Islands). *Botanical Society of Otago Newsletter* 91:14–19.

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

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

Heads, M. 2017. *Biogeography and Evolution in New Zealand*. CRC Press. Boca Raton. 636 pp.

Heads, M. 2018. Metapopulation vicariance explains old endemics on young volcanic islands. Cladistics 32: 392–212.

Heads, M. 2019. Recent advances in New Caledonian biogeography. *Biological Reviews* 94: 957–980.

Hockmuth, K., Gohl, K. & Uenzelmann-Neben, G. 2015. Playing jigsaw with Large Igneous Provinces – a plate tectonic reconstruction of Ontong Java Nui, West pacific. *Geochemistry, Geophysics, Geosystems* 16: 3789–3807.

Hockmuth, K., Gohl, K.,Uenzelmann-Neben, G. & Werner, R. 2015. Multiphase magmatic and tectonic evolution of a large igneouos province – Evidence from the crustal structure of the Manihiki Plateau, western Pacific. *Tectonophysics 7*50: 434–457.

Hoernle, K., Timm, C., Hauff, F., Tappenden, V., Werner, R., Jolis, E.M., Mortimer, N., Weaver, S., Riefstahl, F. & Gohl, K. 2020. Late Cretaceous (99-69 Ma) basaltic intraplate volcanism on and around Zealandia: Tracing upper mantle geodynamics from Hikurangi Plateau collision to Gondwana breakup and beyond. *Earth and Planetary Science Letters* 29: 1–12.

Lamb, S. & Mortimer, N. 2020. Taking time to twist a continent—Multistage origin of the New Zealand orocline. *Geology* 49: 1–5.

Lee, D.E., Conran, J.G., Bannister, J.M., Kaulfuss, U. & Mildenhall, D.C. 2013. A fossil *Fuchsia* (Onagraceae) flower and an anther mass with in situ pollen from the early Miocene of New Zealand. *American Journal of Botany* 100: 20521–2065.

Mortimer, N. 2018. Evidence for a pre-Eocene proto-Alpine Fault through Zealandia. *New Zealand Journal of Geology and Geophysics* 61: 251-259.

Reyners, M., Eberhart-Phillips, D., Upton, P. & Gubbins, D. 2017. Three-dimensional imaging of impact of a large igneous province with a subduction zone. *Earth and Planetary Science Letters* 460: 143–151

Schellart, W.P., Lister, G.S. & Toy, V.G. 2006. A Late Cretaceous and Cenozoic reconstruction of the Southwest Pacific region: Tectonics controlled by subduction and slab rollback processes. *Earth-Science Reviews* 76:191–233

Timm, C., Davy, B., Haase, K., Hoernle, K.A., Graham, I.J., de Ronde, C.E.J., Woodhead, J., Bassett, D., Hauff, F., Moritmer, N., Seebeck, H.C., Wysoczanski, R.J., Caratori-Tontini, F. & Gamble, J.A. 2014. Subduction of the oceanic Hikurangi Plateau and its impact on the Kermadec arc. Nature Communications DOI: 10.1038/ncomms5923

Zhang, G.-L. & Li, Chao. 2016. Interactions of the Greater Ontong Java mantle plume component with the Osbourn Trough. *Scientific Reports 6*: 1–8.

Presentation of Allan Mere Award 2020 to Bill and Nancy Malcolm

Allison Knight

On 27 November 2020 Anthony Wright, President of the New Zealand Botanical Society, flew to Nelson to present the prestigious Allan Mere to Bill Malcolm, who also received it on behalf of the late Nancy Malcolm.

Bill and Nancy Malcolm were nominated for the Allan Mere Award by Nelson Botanical Society, supported by Auckland, Wellington, Canterbury and Otago societies as well as 10 individuals, including 3 from overseas.

A selection of the support for the outstanding contribution of Bill and Nancy to New Zealand and international botany follows (adapted from

the New Zealand Botanical Newsletter #141, September 2020)

"…Nancy began the couple's interest in macro-photography when she won a prize in a natural history photography contest. By reversing a wide-angle lens…and adding extension tubes, she captured extremely close-up images of New Zealand plants. Bill and Nancy developed this interest, which led to the publication of *NZ's alpine plants inside and out: how NZ's plants survive in their harsh mountainous environment*. Lavishly illustrated, this book took the botanical world by storm because of the quality of the close-up and microscopic images. The text revealed Bill's expertise as a plant physiologist."

" …a follow-up book, *The Forest Carpet* drew attention to New Zealand's little noticed forest plants and the covering of mosses, lichens, liverworts, hornworts, fork-ferns and lycopods. This book gives not only stunning portraits of these tiny plants, but microscopic cross-sections showing their cellular structure."

"…Bill and Nancy's exceptional talents and dedication have made the world of New Zealand lichens, bryophytes and ferns available to researchers, enthusiasts and the public. ….Together they have co-authored numerous publications in book and electronic form, most of which they published and distributed internationally through their own Micro-Optics Press. Written in accessible language and profusely illustrated with outstanding photography, clear diagrams and beautiful, scientifically accurate artwork, the reach of these publications is wide – from fellow botanists and botany students to natural history enthusiasts and anyone with an interest in plants. Often in collaboration with other experts on mosses and lichens they have made a valuable contribution to the knowledge base of conservation initiatives…..

Bill's copious academic research from 1962 to the present spans plant ecology and ecophysiology, issues in science and society and the systematics and functional biology of lichens and mosses. He is the discoverer and co-author of four new lichen genera (*Badimiella*, *Labyrintha*, *Podotara* and *Polycornum*), more than 30 new lichen species and several new combinations. He has also edited and produced Australasian Lichenology for over 20 years, leading its development from a society newsletter to a respected international journal.

Bill was one of the co-founders of the Nelson Botanical Society in 1989, and Bill and Nancy contributed much to that society, Wellington Botanical Society, Forest and Bird, and the University of the Third Age over many years. They have also led and contributed expertise to numerous annual lichen and moss workshops around New Zealand and in Australia over 3 decades. Through their efforts, and by hosting numerous national and international researchers and students, assisting with field work and transport, and providing essential local knowledge they have added to the understanding and documentation of native flora, particularly in the biodiverse Nelson region. Their talents as botanical artists and photographers have supported many projects, from original art work for *Flora of Australia*, technical and scientific support for Sir David Attenborough's TV series *Private Life of Plants*, and over 700 detailed comparative photographs for Bayly and Kellow's *An illustrated guide to New Zealand's Hebes* (2006)."

"Without a doubt their greatest international fame spread through their publication *Mosses and other bryophytes: an illustrated glossary*, first published in 2000…..and an expanded 2nd edition followed in 2006. It is difficult to comprehend the effort of producing such a work, with nearly 1400 detailed photographs to highlight specific morphological features, many of them obtained from NZ species. Here every bryological term one would ever find in a flora or identification key are clearly defined and illustrated."

This book earned them "…international acclaim, being awarded the prestigious Hattori Prize by the International Association of Bryologists in 2007."

"Bill and Nancy have done more than anyone else in NZ, professional or otherwise, to make accessible to NZers our (exceptionally diverse) bryophyte and lichen floras by means of highly illustrated books on these subjects prepared to a standard unmatched anywhere else in the world."

Many of Bill and Nancy's books, generously donated by them, are valuable reference books in the Otago Herbarium.

Bill continues to produce and update high quality reference material. Recently he has sent an electronic copy of the latest version (xii 2020) of his superb *Illustrated Key to New Zealand Mosses*. This will soon be available on the BSO website.

Thank you, Bill and Nancy, for your immense contribution to New Zealand Botany, and especially for drawing attention to the often overlooked mosses, liverworts and lichens.

Cartoon by Di Batchelor

Meeting and Trip Reports

Karitane trip, 19th September 2020

James Crofts-Bennett and Lydia Turley

Two carloads of people set off to explore the beach and old Pā site at the end of Karitane.

The first part of the trip was spent wandering along the path beside the estuary where everyone got delayed looking at garden plants. James spotted "a soft looking" plant, the introduced *Echium pininana*, and recoiled from the fiberglass like filaments covering the plants' surface. He noted a difference between previously recorded araneae and what was found. Notably an influx of introduced arachnids with distinct habitat boundaries (those considered native are found in vegetation and under fallen wood, those introduced are found on manmade structures).

Fuchsia excorticata *(Photo: Angela Brandt)*

Many of the students spent a significant amount of time poking around in rockpools while the gardens were investigated. They found ten arachnids (nine araneae and one acari), two piscians (both teleosts), eleven pancrustaceans (four hexapods, four decapods, two isopods and one cirriped), five avians and eleven mollusks (two chitonids and nine gastropods).

For some reason, a flax leaf was pulled out at the base. The veins were strongly pigmented (orange-red), so a cross-section was cut and examined (can confirm, the leaves have veins).

I spotted some plants growing in an understory that looked like parsnips. John was somewhat confused when I asked what the parsnip-like plants were. Turns out, the parsnip-like plants actually were parsnips! I never knew that they grew wild! I dug one up to take home for dinner, but forgot it at our lunch stop.

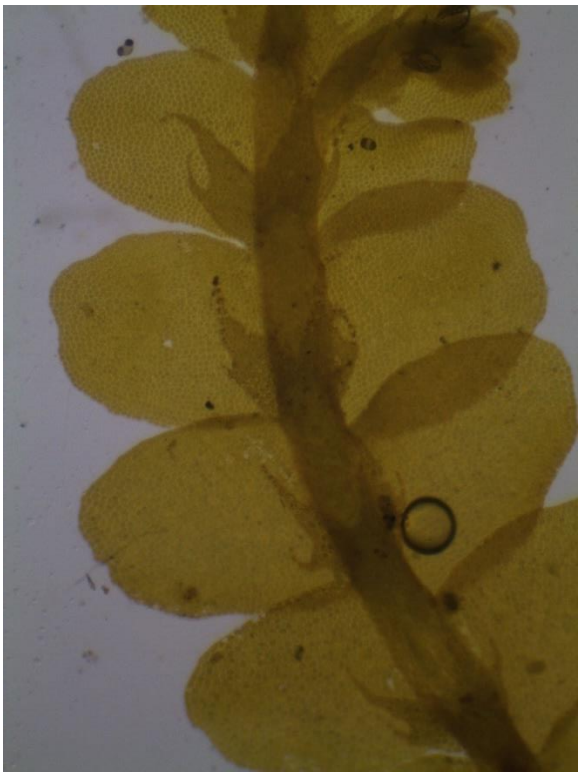
Lunch was at a nice grassy spot on the hill with a good view. After lunch we negotiated a "cliff" down to Butterfly Bay to nosey at more sea-side vegetation. A disappointing lack of butterflies were observed, but someone (John? Probably) offered the fact that the word "butterfly" comes from something to do with the colour of butterfly poo. A quick google search suggests that this claim is not well supported, but it makes a good story to tell impressionable people on field trips. A pretty jointed seaweed was spotted, but botanical findings at this bay were otherwise scarce.

Butterfly Bay (Photo: James Crofts-Bennett)

Back up on the high ground, cabbage trees had been planted in a ring around the old Pā site. James demonstrated how to make a sound like a weka call by rubbing cabbage tree leaves between the thumb and index finger. There were patches of natives, clearly planted, and the experts were generally not impressed by the choice of species or location. *Olearia lineata* was spotted growing on the cliff edge.

The next beach, on the other side of the hill, was even more lacking in vegetation. As if to compensate, waves crashing against a rock provided an exciting display.

Field trip participants: Kacey McKenzie, Jessica Paull, Finn Dobbie, Rionagh Nogher, Angela Brandt, Paul Maurice, John Steel, Lydia Turley, James Crofts-Bennett.



Chiloscyphus semiteres *from Butterfly Bay. Often found under other plants, but because of its size -leaves +/- mm long - it is barely noticed which is sad as in a clump it is rather beautiful (Photo: John Steel)*

James has a report for this trip dated 12020. This can be obtained by contacting him or the editor.

Field trip to Trotters Gorge, 3rd October 2020

Jessica Paull

Trotters Gorge is a protected scenic reserve with jutting cliffs composed of conglomerate of the Horse Range Formation and a mixture of native and introduced vegetation. The gorge and surrounding area were originally named for an early Otago settler and his family, W.S. Trotter. Good weather brought eleven people to the Trotters Gorge trip, a decent turnout which provided a lot of excellent company. This trip offered a chance to observe several rare or uncommon endemic plants.

Upon arrival, it only took about an hour and a half to make it out of the parking lot and into the bush, excitingly setting a new record for the Botanical Society! We all decided to stick together and go on the cave route which would bring us past many small caves. Midway through the track, we were rewarded with a promising small cave, which ended up being full of Weta. Much to my surprise (and relief) they were not the Giant Weta I've heard about, and instead were the more moderately-sized Cave Weta.

Cave Weta on cave ceiling (Photo: James Crofts-Bennett)

The first rare plant find of the day was the fern *Notogrammitis ciliata*. The unlobed fern is identified from the long marginal and sori hairs. Trotters Gorge is considered to be the southern limit for this species, making it a definite highlight in the trip.

The lichen *Ramalina pollinaria* was our next exciting find; a minute lichen that might have been missed if not for the many keen eyes within the Botanical Society. This lichen is considered threatened at a nationally critical level, and is only found at Trotters Gorge within all of New Zealand.

Ramalina pollinaria *growing on a rock wall (Photo: Jessica Paull)*

Further up the track we started seeing *Pimelea pseudolyallii*. Being an alpine plant, the uncommon white flower was only present near and at the summit. The scent of the flower was mesmerising, and is the best-smelling flower I have ever encountered to date.

Another notable mention of the day was *Monoclea forsteri*, an abundant liverwort along the riverbed that mysteriously lacks any fruiting bodies. In fact, the liverwort supposedly only fruits in the North Island making its presence in Trotters Gorge a relative mystery.

Once the botanising was done for the day (is it ever, really?), the walk back to the car park began. Botanists are, of course, known for their rapid pace in forested terrain, so an intense competition to reach the parking lot first was sparked. After a fierce battle, Ivan stole 1st place and James 2nd, his commando roll putting him ahead just enough to leave me in 3rd place. To end off the trip I cooled off for a bit in the grass making daisy chains, and we all had a wee chat before saying our goodbyes. Overall, a very successful field outing, I'd say.

Notogrammitis ciliata *(top) and soral hairs (below) (Photo: Jesscia Paull)*

Field trip attendees: David Lyttle, James Crofts-Bennett, John Steel, Jessica Paull, Angela Brandt, Gretchen Brownstein, Ivan Lin, Adrian Smith-Beech, Rionagh Nogher, Finn Dobbie, and Kacey Hutchinson.

A copy of the species list can be obtained from John Steel (john.steel@otago.ac.nz).

Trotters Gorge in Otago, New Zealand (Photo: Jessica Paull)

The 'other half' of New Zealand's flora: how distinct are non-native plants from the native?, a talk by Angela Brandt, 11th November 2020

Alex Wearing

Non-native/ introduced/exotic/alien/adventive plants are ubiquitous in New Zealand. Currently, they constitute about half of the New Zealand flora, and it seems likely that at some future time, they will outnumber native species. The introduction and subsequent spread of non-native plants are often facilitated, both intentionally and unintentionally, by people. In urban and agricultural areas non-native plants are usually dominant both in terms of species diversity and phytomass. Disturbed substrates provide entry points for many non-native plants, but so do gardens. In 2000, biogeographer Peter Holland wrote that New Zealand was undertaking an uncontrolled experiment in cultural biogeography[1]. This experiment is ongoing in 2021. It is akin to biological roulette. More and better information should increase knowledge, understanding, and management/control of problem non-native plants, and aid prediction with respect to identifying possible future problem plants.

National, regional and local government agencies, and non-governmental organizations, produce inventories of problem plants, and strategies for their control and/or elimination. These lists grow with each new edition. The 'war on weeds' is ongoing, as new 'enemies' continue to enter the fray, and the 'field of operations' continues to expand. New Zealand is increasing its commitment to research in and the widespread application of weed biocontrol.

Whether it is broom (*Cytisus scoparius*) reinvasion and sycamore (*Acer pseudoplatanus*) re-sprouting on a neglected suburban section, or wilding pine 'takeover' at the landscape scale, the success of non-native plants invites speculation as to whether the set of non-native plants in New Zealand has distinctive attributes that facilitate their success, initially as entrants, and subsequently as significant components of plant communities.

Angela Brandt gave an excellent and comprehensive talk on the introduced species that are present in New Zealand. She stated that plants which are introduced and subsequently naturalise in New Zealand are not a random subset of the global flora and asked the question "how distinct are the non-native plants from the native?" Her answer was based on extensive research by herself and a team of collaborators, and involved trawling through a range of published and unpublished sources of information to produce a large dataset of New Zealand native and non-native plants[2]. Information was collected on plant species identity, form, lifeform, distribution in New Zealand, prediction of naturalisation risk and impact, and – if applicable – economic and/or environmental weed designation. Decisions were made with respect to applicability when using plant species attributes data obtained from other parts of the world. The naturalised and native plant data were compared to discern key taxonomic and functional characteristics.

It was stressed that such inventories are difficult to compile because the information (i.e. the plants) is very dynamic. Many non-native species are still in 'controlled' spaces, but in the future many will 'escape'. Plant species may be naturalised for some time before becoming problems. Different areas have different stories with respect to establishment, spread, and role in plant communities and ecosystem processes. There are nuances to be considered such as plants being assigned the status of economic and environmental weeds, and the challenges presented and the goals sought across differently managed and valued landscapes.

Some of the data[2] presented by Angela Brandt was literally 'mind-blowing' (i.e. surprising and

shocking). Non-native plants have added 68 families and 650 genera to the New Zealand flora and 182 genera are characterised as environmental weeds. The naturalised flora is more taxonomically diverse than the native flora. In *c*. 2020, there were more than 2500 non-native species, of which about 1800 were naturalised. Naturalised plants constitute about 44% of the vascular flora. There are also over 1000 casual (i.e. not currently naturalised) non-native plant species.

From the data set Angela Brandt extracted some nuggets[3]. The naturalised flora has more herbaceous species, more annuals, and fewer perennials. A greater proportion of herbaceous and annual species will have an impact on ecosystem processes such as decomposition and nutrient cycling. There are a lot of naturalised legumes. Non-native gymnosperms are very different from native gymnosperms. The naturalised flora has relatively more herbaceous species and fewer woody species. In the category of environmental weeds there are fewer herbaceous species and more woody and climbing species. With respect to functional traits tree leaf nitrogen content was 49% greater in naturalised tree species.

New Zealand was divided into 16 regions. More northerly and more populated regions have more naturalised species, but there is high non-native plant richness in all regions and many plants are widespread. The regions of Northland, Auckland, Waikato, Bay of Plenty, Manawatu, Wellington, Canterbury and Otago all have more than 800 naturalised plant species. More than 77 % of naturalised environmental weeds occurred in more than eight regions.

The use of functional plant traits to identify which attributes are likely to promote and increase rates of naturalisation, and their impacts on plant community composition and ecosystem processes, are seen as promising areas of research.

Many non-native plants have potential to expand their range. Some non-native species seem to have gone 'native'. For example, lodgepole pine (*Pinus contorta*) can reproduce at a younger age than in their home range. Hawkweeds (*Hieracium* spp.), white clover (*Trifolium repens*), and sheep's sorrel (*Rumex acetosella*) have acquired genetic traits (new ecotypes) that differ from their home range plants, and which probably facilitate survival and spread in their 'new' New Zealand habitats. Information on environmental attributes and site factors adds to the understanding of the potential and actual impacts of non-native plants. Changing the moisture regime can affect site invasion by non-native plants. At Wairepo kettlehole (near Omarama, inland South Canterbury), more plant invasion occurs at the drier end of the moisture spectrum. Native shrubland fragments in eastern South Island lowlands are modified by irrigation applied following conversion to dairying, facilitating invasion by non-native plants.

The research of Angela Brandt and her co-researchers have greatly added to the knowledge of non-native plants in New Zealand, and to their impacts on native plants and processes. At the end of Angela Brandt's talk my personal knowledge had definitely increased. It is to be hoped that this data and the knowledge generated is taken up and widely applied, and that New Zealand's botanic landscapes are made 'better' as a result.

References

1. Holland, P. 2000. Cultural landscapes as biogeographical experiment: a New Zealand perspective. *Journal of Biogeography*, 27, 1, 39-43.

2. The data sets are available at MWLR DataStore: https://datastore.landcareresearch.co.nz/group/nz-non-native-flora-traits

3. Brandt, A.J. *et al*. 2020.Naturalised plants transform the composition and function of New Zealand flora. *Biological Invasions*. DOI: 10.1007/s10530-020-02393-4

Botanical Society of Otago

Patron: Audrey Eagle

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

Email: bso@otago.ac.nz

Committee 2020 -2021

Chair: **Gretchen Brownstein**	BrownsteinG@landcareresearch.co.nz
Vice Chair: **John Barkla**	mjbarkla@xtra.co.nz
Secretary: **Angela Brandt**	BrandtA@landcareresearch.co.nz
Treasurer: **Mary Anne Miller**	maryanne.miller53@gmail.com
Newsletter and Website Editor: **Lydia Turley**	lydiamturley@gmail.com
Programme: **Robyn Bridges**	robyn.j.bridges@gmail.com
Publications (Native plants of Dunedin): **David Lyttle**	djl1yttle@gmail.com
Publications (Lichens): **Allison Knight**	allison.knight.nz@gmail.com
University Liaison: **Matt Larcombe**	matt.larcombe@otago.ac.nz
Student Liaison: **Ian Geary**	ian.j.geary@gmail.com
Botanical art: **Sharon Jones**	sharon.jones388@gmail.com
Committee: **David Orlovich**	david.orlovich@otago.ac.nz
Committee: **Taylor Davies-Colley**	taylordaviescolley@gmail.com
Committee: **Aidan Braid**	aidanbraid @gmail.com

Please submit copy for next newsletter to Lydia Turley by 10th May 2021

This Newsletter was published on 29 January 2021.
ISSN 0113-0854 (Print) ISSN 1179-9250 (Online)

Buttons for botanical pundits – still available at BSO meetings

BOTANICAL SOCIETY
OF OTAGO

Membership Form

2021

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: $ ……..

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

☐ **Internet Banking:** Account No: 03 0905 0029158 00 (Westpac)
Code: 2021 sub
Reference: *your name*

If a new subscription or details have changed from last year, please send a completed form to the Treasurer at the address below or to bso@otago.ac.nz

BSO Treasurer
P.O. Box 6214
Dunedin North, 9059
New Zealand

BOTANY DEPARTMENT

UNIVERSITY OF OTAGO

Permit Post
NEW ZEALAND
PERMIT No. 1007

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

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

BOTANICAL SOCIETY

OF OTAGO