NEW ZEALAND PLANT CONSERVATION NETWORK

TRILEPIDEA

Newsletter of the New Zealand Plant Conservation Network

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Deadline for next issue: Friday 20 May 2022

SUBMIT AN ARTICLE TO THE NEWSLETTER

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

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

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

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

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NEW ZEALAND

PLANT OF THE MONTH, p. 5

Juncus distegus.

Research supporting the conservation of the Nationally Critical swamp helmet orchid (*Corybas carsei*)

Carlos A. Lehnebach, Museum of New Zealand Te Papa Tongarewa (carlosl@tepapa.govt.nz)

Conservation of endangered plant species normally includes their propagation from cuttings, seeds, or a combination of both. The resulting plants are then used to reinforce small populations in the wild, reintroduce species to areas where they are now extinct, and establish *ex situ* collections at botanical gardens to serve as back-ups and research material. Propagation, followed by widespread cultivation, has successfully prevented the extinction of species such as *Clianthus puniceus* (kākābeak), *Muehlenbeckia astonii* (shrubby tororaro) and *Tecomanthe speciosa* (tecomanthe). When it comes to orchids, however, conservation of threatened species becomes a long, complex, and challenging endeavour.

Orchids are well-known for their striking and unusual flowers, and their complex, sometimes highly specialised, pollination systems. Orchids, however, have another very distinctive but hidden feature that complicates their propagation. All terrestrial orchids host a fungal associate inside their roots. The fungus helps the orchid to gain access to water and mineral nutrients from the soil, while the fungus receives carbon from the plant. This partnership starts very early in the life of the orchid. In fact, if the orchid seed is not "infected" by the right fungal species, it will not germinate. Unlike many other plants, orchid seeds lack resources to feed the embryo during germination, hence their reliance on the fungus. This mycorrhizal (*fungus-root*) interaction can be species-specific or generalist, with some orchids known to swap fungal partners along their life span. Understanding how these above- and below-ground interactions work, and identifying the organisms they involve (*i.e.* pollinator and mycorrhizal fungus) are fundamental for a conservation programme to succeed.

In the last two years, I have been researching the swamp helmet orchid (*Corybas carsei*; Figure 1), in collaboration with a team of postgraduate students I co-supervised with scientists from Massey University, Ōtari Native Botanic Garden and Victoria University of Wellington. The swamp helmet orchid is one of New Zealand's most threatened orchids and is found only in the Whangamarino Wetland (Waikato) where about 400 individual plants grow. These plants are distributed across an area that is no larger than that of three carpark spaces and, if you were to put all the plants together side by side, they would easily fit in your kitchen sink!

Besides habitat destruction (drainage of wetlands), over-collection by botanists has been put forward as one of the causes for its decline. However, there are only a handful of historical herbarium specimens across New Zealand herbaria. These collections suggest this tiny orchid has always been uncommon and they confirm it once grew in wetlands in Northland.

Figure 1: Lizzie Sharp (Biodiversity Ranger, DoC) and Tingyu Qin (MSc student at Massey University) looking for plants of *Corybas carsei* in flower to hand-pollinate.

Soon after the discovery of the Whangamarino population in the 1980s, the Department of Conservation initiated a research and monitoring programme to inform management actions to maintain this last population and its habitat. Over the last decades, the site has been under a regime of controlled low-intensity burns to prevent competition from surrounding plants and annual surveying of the number of plants, flowering and fruiting events, and damage by browsing. Now that the population has reached over 400 plants, research is needed to understand how to propagate this orchid and establish new populations at other suitable sites. To achieve these goals understanding above- and below-ground partnerships and finding suitable seed germination methods is critical. Also of great importance is measuring the genetic diversity within this single population, as this impacts reproductive fitness and adaptability to environmental changes.

Pollination and genetic diversity of the swamp helmet orchid

These two topics were investigated by MSc student Tingyu Qin (Tina) from Massey University (supervisors Dr Alastair Robertson, Dr Vaughan Symonds and Dr Jennifer Tate). Tina's research included a number of pollination experiments used to determine whether this orchid is self-incompatible (fruits are formed only if pollen from a genetically different plant fertilises the flower) and pollinator-dependant (the pollen can only reach the stigma if aided by an external agent). Hand-pollination experiments on *C. carsei* required a steady hand and precision work as the flower hardly reaches a centimetre long and the pollinia (a mass of pollen grains typical of orchids) is only a few millimetres (Figure 2). As noted in past surveys, only a few plants flower each year and we had only about 30 flowers to work on between 2020 and 2021. Fortunately, some of our hand-pollination treatments were successful. Besides confirming *Corybas carsei* is a self-compatible and pollinator dependant species, Tina was able to obtain seeds for germination experiments (more about these below).

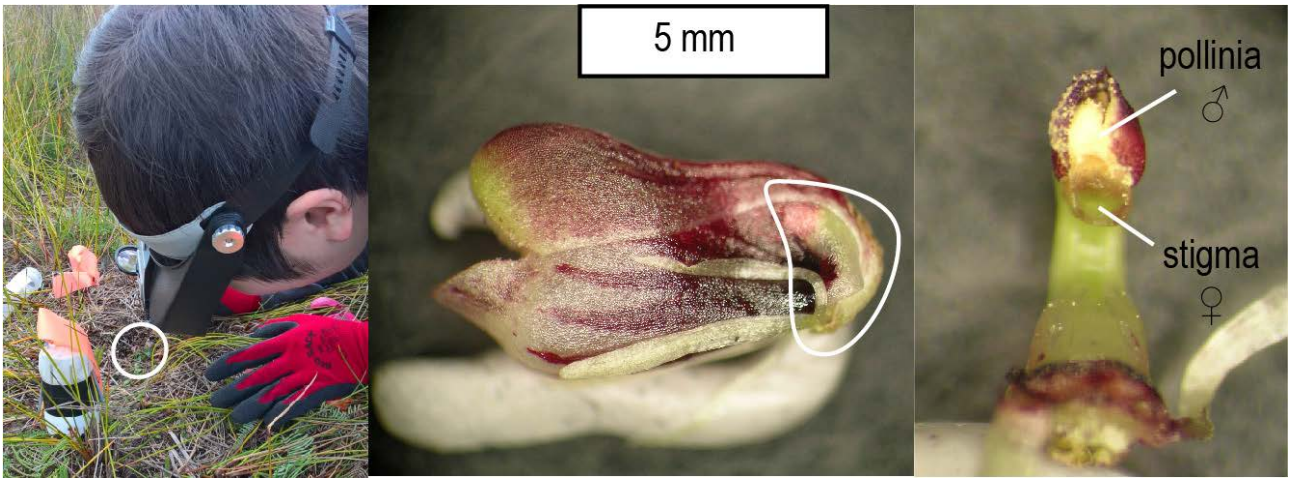

Figure 2: Tina setting up a pollination experiment (two plants encircled in white) (left), close up view of the flower (position of reproductive structures encircled in white) (centre) and column with male and female structures (right).

Based on previous research on *Corybas*, it is very likely that fungus gnats or other small Diptera are involved in the pollination of the swamp helmet orchid. *Corybas* are nectarless orchids and therefore do not reward their pollinators for their service. These nectarless orchids rely on deception to attract pollinators and consequently their visitation is very low. It is not surprising then that the pollinator of the swamp helmet orchid has remained a mystery. After 10 hours of filming and 1 hr of direct observations, spread across three visits, we did not observe any insects entering the flowers but only two flies landing nearby. Identifying these insects from the footage was impossible, as they were too small. Observations across the entire flowering period are likely to reveal what pollinates this tiny orchid. To do this, however, a system with cameras connected to a long-lasting power source is needed because daily visits to the site will damage the vegetation by trampling and cause compression of the peat.

To measure genetic diversity Tina removed the leaf of 41 plants, some of them were the same plants used in mycorrhizal studies (see below). Later in the lab she extracted DNA from them and used 20 genetic markers that she developed exclusively for *Corybas carsei* to investigate how much genetic diversity exists in the population and whether clonal propagation occurs at the site. Tina has submitted her thesis in early March 2022 and results from her research will be published soon. At this stage, I can only say results are not very favourable for *C. carsei*. This is not unexpected considering the small size of the population.

Identifying fungal partners and the effect of fire on the fungal community

These topics were explored by MSc student Jennifer Alderton-Moss at Victoria University of Wellington (supervisors Dr Andrew Munkacsi and Karin van der Walt). Identification of fungal associates involved digging out soil and vegetation from around robust plants and then cutting off a section of the plant called the root collar. It is here that the mycorrhizal coils (or pelotons) are normally more abundant. Tubers were left unharmed and reburied so the plant can regenerate. Once in the lab, Jennifer teased out fungal pelotons from the root collar, selected and cleaned a few, and then grew them on plates with different culture media (Figure 3). The aim was to grow the mycorrhizal fungus and use it for taxonomic identification (using DNA sequences) and germination experiments.

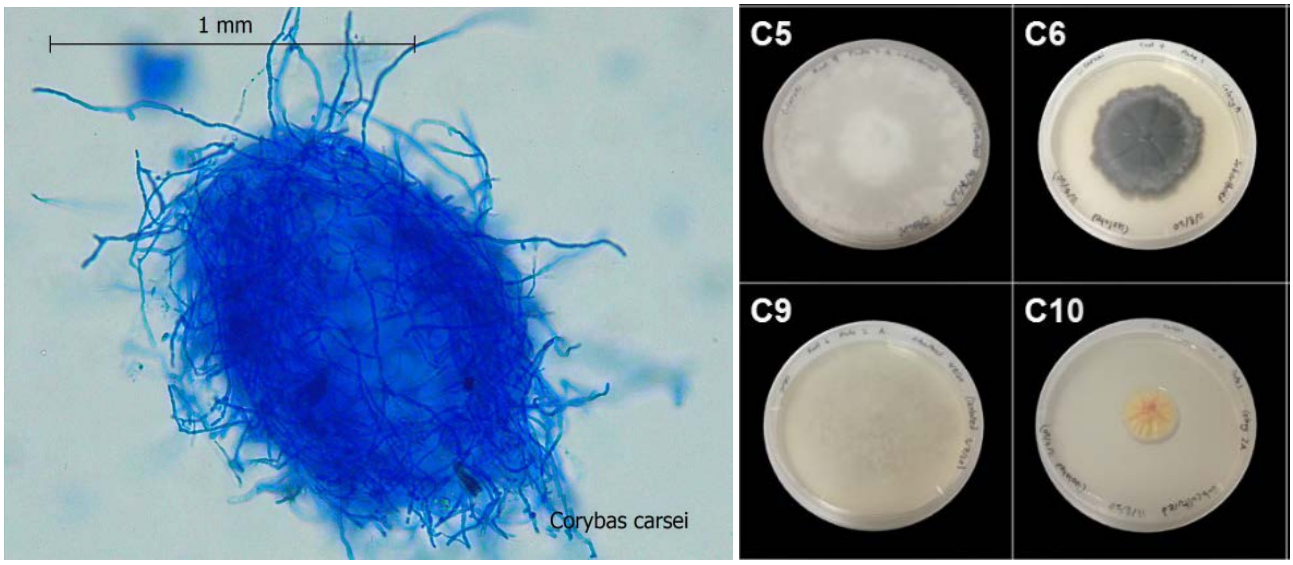

Figure 3: Peloton (stained blue for contrast purposes) (left) and Petri dishes with culture of four of the 11 fungi isolated from *Corybas carsei* (right, photo by J. Alderton-Moss).

Identification of fungal partners by culture, however, has its downside. Only culturable species will grow. To avoid this bias, Jennifer also took a meta-genomics approach. This methodology allows identification of the entire fungal community associated with the swamp helmet orchid. She also used this approach to characterise the fungal community in the soil at the orchid site. Her metagenomics study will help us to identify whether orchid fungal partners are present at the site and understand how prescribed burns affect, or have affected, the fungal community over time. We are very thankful

to Dr Lara Shepherd (Te Papa's geneticist) for helping us with this technique. Jennifer is currently writing up her thesis and a summary of her results will be shared in a later issue of *Trilepidea*.

Germination experiments

In November 2021 we collected the fruits formed by eight flowers that were hand-pollinated in September. We have used these seeds to trial different germination methods at the Lions Plant Conservation Lab (Ōtari Native Botanic Garden - Wellington). Our goal is to find a protocol suitable to germinate the seeds with the help of its mycorrhizal partner (symbiotic germination) and without it (asymbiotic germination). If seed and fungus meet and the partnership is formed, the seed coat will break apart and the first roots (rhizoids) will develop as shown in Figure 4. This is a long and slow process but, if successful, it will result in seedlings that we can be later reintroduced to sites where the orchid was previously found or planted in other suitable sites. Karin van der Walt (Conservation & Science Advisor – Ōtari) is also investigating how long seeds can remain viable and methods to keep them in long-term storage while maintaining their viability. Again, there will be more about this in future issues of *Trilepidea*.

Figure 4: Germination experiments of *Corybas carsei* seeds at the Lions Plant Conservation Lab (Ōtari Native Botanic Garden – Wellington) (left) and close up view of seed germinating and forming rhizoids after 12 weeks (right, photo by K. van der Walt). White arrow points to ungerminated seed; green arrows point to rhizoids.

Future directions

Although some aspects of this project are still in progress, it is already clear that a few areas will require further research. For instance, more research on pollination is needed. We have not been able to identify the pollinator nor the pollination strategy used by this orchid. Once the pollinator of *C. carsei* is identified research about the pollinator's biology, local abundance and distribution across New Zealand will be required. The latter is important because it will determine, along with the distribution of the fungal partner, the places where *C. carsei* can be translocated or re-introduced. Understanding the effect of fire on the life cycle and abundance of the pollinator is also important. Second, research on seed biology is urgently needed as this will provide guidelines for collection and long-term storage (i.e. seed baking). If seed banking is to be implemented, then methods for long-term storage of the orchid mycorrhizal partner will also be necessary.

As mentioned earlier, orchid conservation can be a long, complex, and challenging endeavour. I should also add fascinating, as research in this field could not help but reveal the interconnectedness and balance that exist between the different organisms in an ecosystem.

Acknowledgements

We thank Lizzie Sharp, Kerry Jones and other DOC staff for their assistance with this project. This research was funded as part of DOC's Te Mana o te Taiao Threatened Species Research Workstream (contract number 2020-11: DOC-6230989).

PLANT OF THE MONTH – *JUNCUS DISTEGUS*

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

The plant of the month for April is *Juncus distegus,* one of eighteen native species of *Juncus* found in the New Zealand region. The species is found throughout the North, South and Chatham Islands but has a patchy and localised distribution, and seems to be most common in the east of the South Island. This species is found in in a variety of habitats from seasonally wet pasture to cloud forest, and can be found from the coast up to montane areas.

Juncus distegus: (left) Akaroa, 26 April 2019. Photo: Marley Ford. (centre, right) Clarence Valley, Molesworth, 13 January 2022: inflorescence, pith. Photos: Rowan Hindmarsh-Walls.

The plant is rhizomatous (produces swollen root structures underground) and perennial. It forms small fairly dense clumps in wet ground. The species is quite short in stature compared to other similar round stemmed species, but can reach 75cm tall. The round flowering stems are dark green or yellowy orange green in drier habitats. These are surrounded by shiny red brown sheaths near their bases. The flower inflorescences are borne near the top of the flowering stems, and have two small clusters of flowers, which later develop into dark brown shiny capsules up to 3mm long.

Juncus distegus is comparable in appearance to many other round stemmed *Juncus* species which grow in similar wet habitats. It is similar to and often found with other native species such as *J. australis, J. edgariae, J.pauciflorus* and *J. usitatus.* It can also be found with similar exotic species such as *Juncus effusus var. effusus.* It can be conclusively distinguished from all these species by its pith on the inside of the stems, which is divided by very evenly spaced air pockets. Most other species have either solid pith or pith that is not continuous but divided by uneven air pockets. Other distinctive features of the species are its two, few flowered inflorescences, its short stature, and its sometimes orangey green colouration.

Juncus distegus has a conservation status of 'At Risk – Naturally uncommon', as it has a scattered distribution and is probably threatened by habitat loss and competition from exotic weeds across all of its range. Wetland modification and drainage, as well as intensive agriculture, threaten the species, as it is often able to survive in rough grazed pasture that is not cultivated, but not regularly cultivated pasture.

The genus *Juncus* (rushes) is large, with around 300 species worldwide that are scattered all over the globe. New Zealand native species are found in many wet habitats from the coast right up to the alpine zone. There are also many exotic species that have naturalised in this country.

The name *Juncus* is the Latin word for rush. The species epithet *distegus* 'with two shelters' is from the Greek words "di" (two) and "stege" (a roof, cover) and refers to the two flower clusters at different levels in the inflorescence.

You can view the NZPCN website factsheet for Juncus distegus at: https://www.nzpcn.org.nz/flora/species/juncus-distegus/

Prasophyllum hectorii at Erua

Bill Campbell (billcampbell@xtra.co.nz) *Originally published in NZ Native Orchid Group Journal 165, March 2022.*

On Tuesday 4 January 2022 I called in to Erua Road, Erua, to try to relocate some plants of *Thelymitra formosa* I had observed there a number of years previously, but which had eluded me on subsequent visits. In the past I have focused on one side of the road only, but apart from *Thelymitra cyanea*, which is common, there are usually not a lot of orchids to be seen.

On this visit *Thelymitra cyanea* numbers were well down on other years and the only other orchid I saw on that side of the road was a single specimen of *Orthoceras novae-zeelandiae*.

Given the lack of orchids I decided to have a quick look on the other side of the road, where more wetland habitat is accessible. *Thelymitra cyanea* was present and it was only a few minutes before I came across a healthy population of *Prasophyllum hectorii* (At Risk – Declining), made obvious from a distance by the distinctive tall flower scapes.

I counted in excess of 30 flowering plants in just a few minutes and a subsequent visitor to the location counted more than 50 plants over a wider area. More extensive searching (I was pushed for time by that stage) may establish that the colony is significantly larger.

All of the plants observed were in obvious depressions sparsely vegetated by a single rush species. This is obviously the preferred habitat, so any further searching should focus on such habitat. The largest of the depressions would have been less than 10 square metres, making the search areas quite compact.

Three views of. *Prasophyllum hectorii* in flower, Erua Road, 4 January 2022. Photos: Bill Campbell.

Although *P. hectorii* is documented as being present in the central plateau area, a search of iNaturalist failed to find any observations recorded from that area. This suggests that *P. hectorii* is not often encountered, as one would anticipate that most observations, particularly of flowering plants, would be posted online. It is flowering at a time when many people are out and about on holiday, so one would expect it such a conspicuous species to be observed if present.

Mapping the distribution and assessing the population status of this species in the central North Island may be a very worthwhile summer project for someone in the future.

References

de Lange, P.J.; Rolfe, J.R.; Barkla, J.W.; Courtney, S.P.; Champion, P.D.; Perrie, L.R.; Beadel, S.M.; Ford, K.A.; Breitwieser,I.; Schonberger, I.; Hindmarsh-Walls, R.; Heenan, P.B.; Ladley, K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington. 82 p.

NZPCN 2022 conference student scholarship profile

Alex Fergus and Luke Liddell (fergusa@landcareresearch.co.nz and llid035@aucklanduni.ac.nz)

In anticipation of our 2022 conference in December in Queenstown we will be including brief profiles of our four NZPCN conference student scholarship recipients in *Trilepidea*. To support student participation at the 2022 conference we have sponsored the registration costs of the first four students who registered and submitted a poster or spoken presentation abstract. This month we've asked Luke Liddell a few questions about his botanical background and the work he'll be presenting at the conference.

How did you first become involved in botany/plant ecology/native plant conservation/ecological restoration?

I grew up in a small town surrounded by native forest, so I started learning all the local plants when I was in primary school. I'd get plant ID books for birthdays/Christmas and I've been passionate about native plants ever since.

Briefly describe the background to the research you are presenting at the NZPCN 2022 conference

My NZPCN conference presentation is titled "Wild Harvested Totara Berries as an Incentive for Conservation on Private Land".

In the summer of 2020-2021 I took part in the University of Auckland's Innovation and Entrepreneurship Summer Lab programme. I had originally planned to work on an idea for sustainable energy storage. However, after signing up I realised my maths was wrong and that idea was totally unviable. Instead, I decided to work on a project looking at the potential of native berries as a novel food product, which developed into the work on wild-harvested totara berries that I'll be presenting at the conference.

Beyond study, where, in a mythical world of limitless science funding, are you hoping your botany/plant ecology/native plant conservation/ecological restoration career path will lead?

There are so many options. It'd be great for my native berries project to become a successful business. I'd also love to work as a scientist: plant conservation, ecological restoration, and global plant biogeography are all major interests I want to pursue.

EcoNet Weed App

The EcoNet Charitable Trust was set up to meet a need expressed by a number of conservation groups for decent systems to manage their operations and activities.

The result is the Conservation Activity Management System (CAMS) built using Microsoft Dynamics CRM and ArcGIS Online Hub Premium.

The EcoNet advisory board comprises a range of experience in ecology and IT has spent several years planning and managing the introduction of this system

The first tool in CAMS GIS has been in use since November 2021. The CAMS Weed App is on desktop as an ArcGIS Web App and a beta version on ArcGIS Field Maps is available for smart phones.

The app enables users to record a weed site, details around the location and property and to record actions on the weed in real time on your phone or back at your home/office on your desktop. It is easy to position the GPS pin in exactly the right location.

One can quickly and easily record and update the core data about weed locations and their status.

New features allow you to optionally record:

- multiple visits to the weed location on different dates
- the height, area, number of stems present at the date visited
- the number of moth plant pods etc collected
- the number of volunteers who worked on the site and the hours they worked

- the treatment method and herbicide used (to allow tracking of the effectiveness of treatments)

Other features include:

- each volunteer can have their own named user login
- a property layer is available to advanced users undertaking projects
- all ESRI ArcGIS features are available to advanced users

To make it easier for volunteers to have a manageable workload, one can set up a map with the volunteer sector layer overlaying the weed locations layer. This allows one to allocate a manageable piece of work to volunteers in their local street(s). One can also display a layer with data collected in the survey tool.

The app is used by the STAMP moth plant team (facebook.com/groups/societytotallyagainstmothplant) and by other restoration group users who are reporting on the top 20 plus most invasive environmental weeds. There are currently over 22,000 weed locations recorded in the CAMS Weed Map with over 80 users registered.

The CAMS roadmap includes future integration with iNaturalist.nz and Trap.NZ, and between CAMS CRM and GIS.

The CRM will allow easy integration of GIS based conservation activities with the management of volunteers, group members, stakeholders, property owners and contractors. It will be a game-changer for community led restoration groups.

CAMS weed app is one of many in our development road map. EcoNet can arrange access to the weed app for a small fee. Some umbrella groups are funding access so if you are part of one please ask them. Please contact us on office@econet.nz for more information.

Thank you to our conference sponsors!

The NZPCN would like to thank our sponsors for showing their commitment to plant conservation networking by supporting our conference. For more information regarding our conference sponsors please follow this link https://www.nzpcn.org.nz/nzpcn/events/conference-2022/2022-conference-sponsors/.

If you or your organisation is in a position to show your support please contact us now for a sponsorship package at fergusa@landcareresearch.co.nz.

UPCOMING EVENTS

If you have events or news that you would like publicised via this newsletter please email the Network (info@nzpcn.org.nz).

If you are intending to participate in one of the advertised meetings or field trips please check with the appropriate Botanical Society beforehand to confirm details.

Auckland Botanical Society

Meeting: Wednesday 4 May at 7.30pm. **Speakers:** Graeme Jane and Gael Donaghy. **Topic:** The flora of Gargano (Italy).	**Venue:** Unitec, School of Natural Sciences, 139 Carrington Road, Mt. Albert (Gate 4, Building 115, Room 1028)..
Field Trip: Saturday 21 May to Paparoa Pa, Paparoa. **Meet:** Start of the Paparoa Pa Walkway, State Highway 12, Paparoa at 10.00am.	**Leader:** Jack Warden, email warden899@hotmail.com, ph. 021 203 3484.

Rotorua Botanical Society

Field Trip: Saturday 7 May to Moutohora (Whale Island), combined with Eastern Bay Forest and Bird. **Meet:** White Island Rendezvous carpark (time to be confirmed). **Grade:** Medium.	**Leader:** Jo Bonner, email coastlandspn@xtra.co.nz, ph. 027 471 5684.

Wellington Botanical Society

Field Trip: Saturday 7 May to Forest Loop Walk, Whareroa Farm Reserve**. Meet:** Whareroa Farm carpark at 9.30am.	**Co-Leaders:** Leon Perrie, email leon.perrie@tepapa.govt.nz, ph. 027 419 1378 and Lara Shepherd, email lara.shepherd@tepapa.govt.nz, ph. 027 363 5854.
Meeting:: Monday 16 May at 7.30pm. **Speaker:** Members' meeting to share.	**Venue:** Lecture Theatre M101, ground floor Murphy Building, west side of Kelburn Parade.

Nelson Botanical Society

Field Trip/Meeting: Please refer to the website: https://www.nelsonbotanicalsociety.org/trips-meetings, for details.

Canterbury Botanical Society

Meeting: Monday 2 May at 7.30pm. **Speaker:** Lisa Danseur. **Topic:** The influence of the spatial distribution of microhabitat on invertebrate community composition in a New Zealand tussock grassland.	**Via Zoom only.**
Field Trip: Saturday 7 May to Korowai/Torlesse Tussocklands Park wetlands. **Meet:** Yaldhurst Hotel carpark at 8.30am, the Springfield toilets at 9.15am or at the Lyndon day shelter at 9.45am.	**Contact:** Email fieldtrips@canterburybotanicalsociety.org.nz or phone 027 366 1246 to confirm participation.

Botanical Society of Otago

Field Trip: Saturday 7 May to the Leith Saddle Track. **Meet:** Botany Department carpark (464 Great King Street North) at 9.00am.	**Contact:** Matt Larcombe, email matt.larcombe@otago.ac.nz, ph. 027 919 9709.
Meeting: Wednesday 11 May at 5.30pm - AGM and photographic competition.	**Venue:** Otago Pioneer Women's Association Inc. building, 362 Moray Place, Dunedin Central.