NEW ZEALAND:

ALPINE FLORA

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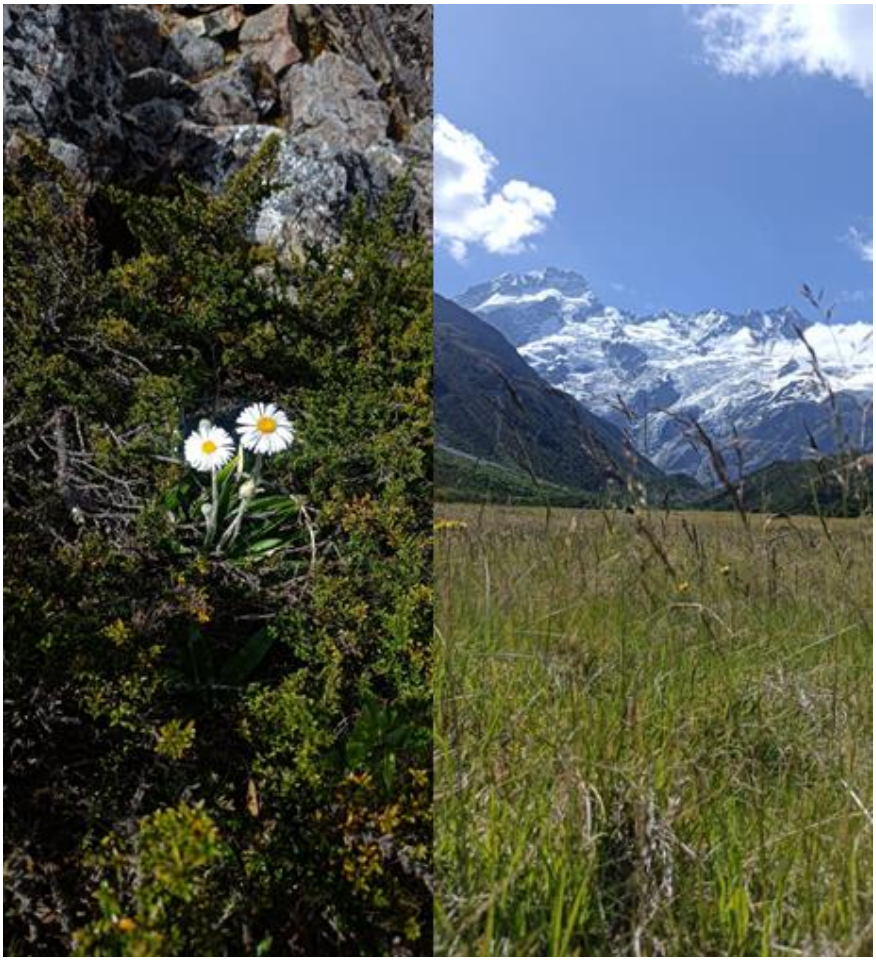


Aims

The main aim of this expedition was to observe the growth of alpine flora, particularly *Celmisia* ssp., in the wild. As well as visiting private and public gardens to record photographic and written data on the cultivation of these species. And to compare my experience working at Kevock Garden Plants, an alpine nursery based in Scotland, and studying my Yr3 of Horticulture and Plantmanship at the Royal Botanic Gardens Edinburgh (RBGE).

New Zealand and Scotland

New Zealand has always been somewhere I dreamt of going, and that dream finally came true when I had the chance to travel around the South and North Island in December 2024.

Before travelling I spoke with people who had been to New Zealand, and found that everyone likened to Scotland. When I got there, I found that these countries do in fact share some commonalities: an oceanic climate with variable weather and regular rain, temperate rainforests, and a linked history with about 1 to 2 million New Zealanders having Scottish ancestry.

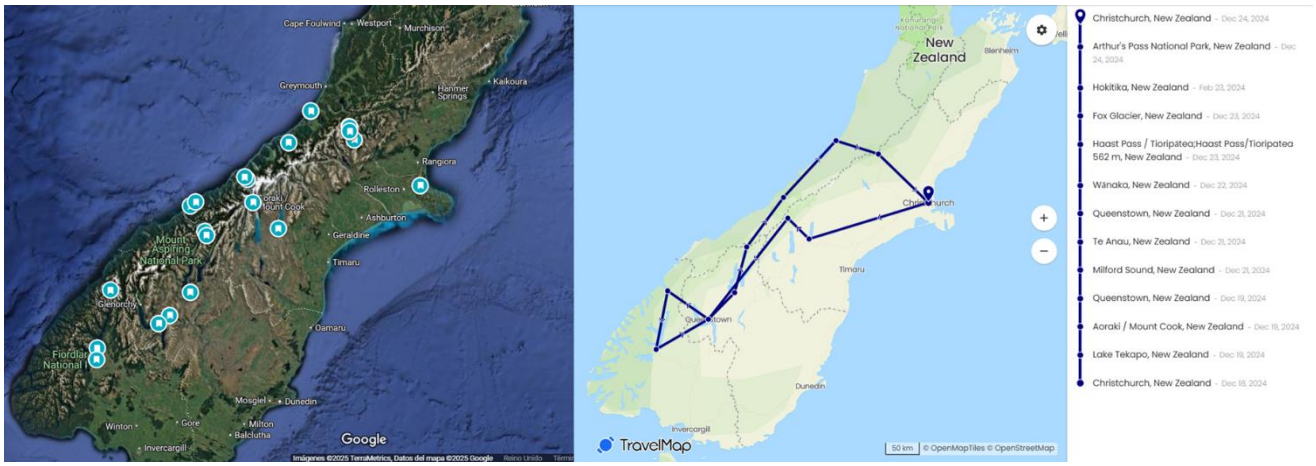
However, the uniqueness of its alpine flora got my attention whilst visiting New Zealand. Over 90% of New Zealand's alpine flora is endemic to the islands. This is due to the isolation after the drift away from the supercontinent Gondwana 170 million years ago, and the non-human contact until the 1300s when the first Polynesian settlers (Māori people) came to New Zealand. One of the most characteristic features of New Zealand’s alpine flora is the white or yellow colour of their flowers (NZAGS, 2024). During my expedition, I encountered several flowers with this characteristic (Figure 1). It has been suggested that the reason for this particular colour is that alpine plants in New Zealand rely on insects, such as flies, for pollination. Due to the cold weather, the colours white and yellow of the petals reflect the sun's rays creating a warm spot in the middle which attracts insects.

Figure 1 - Collection of white and yellow flowers. a) Manuka. b) Celmisia durietzii. c) Gaultheria crassa. d) Muehlenbeckia axillaris. e) Stellaria pungens

To conserve this uniqueness and avoid the entrance of new invasive species, the government has a strict policy when entering the country. You must declare any item you will be using outdoors, such as hiking boots or tents, and these have to be clean to reduce the possibility of contamination. It is strictly forbidden to enter with any food or plant material.

Locations visited.

Due to its mountain range, the South Island (Southern Alps) is the best area for alpine flora hunting. My trip started in Christchurch, and for a week I travelled around the Southern Alps:



- <u>Christchurch Botanical Gardens</u> – As a first stop, I went to these botanical gardens. This is a free open park, with several collections on display including a daffodil woodland, pinetum and rose garden, among others. Sadly, the conservatories were closed but I had the chance to walk along the New Zealand Gardens, a collection displaying endemic New Zealand plants such as the Silver Fern (*Alsophila tricolor* R.M. Tryon – Figure 2, or the Kauri (*Agathis australis* Lindl.*).* In the rock garden collection, called Cockayne Memorial Garden in honour of Dr Leonard Cockayne (a New Zealand botanist), a display of New Zealand native alpines could be found.

  In contrast to RBGE (where I study), the Christchurch Botanical Gardens did not have any biocontrol measures at the entrance and there were several spaces for people to enjoy picnics or outdoor activities.

Figure 2 - Christchur Botanic Gardens. b)Silver fern (Alsophila tricolor) c)Kauri (Agathis australis) d)Oak planted by prince Albert Edward

- <u>Lake Tekapo</u> – This lake is 83 km^2 with a bright blue colour due to the rock dust from the glaciers that feed it, and was surrounded by grassland and lupins (*Lupinus* L. – Figure 3). *Lupinus* L. is an invasive species introduced in the 1940s as an ornamental plant and has self-seeded around the Mackenzie Basin since then.

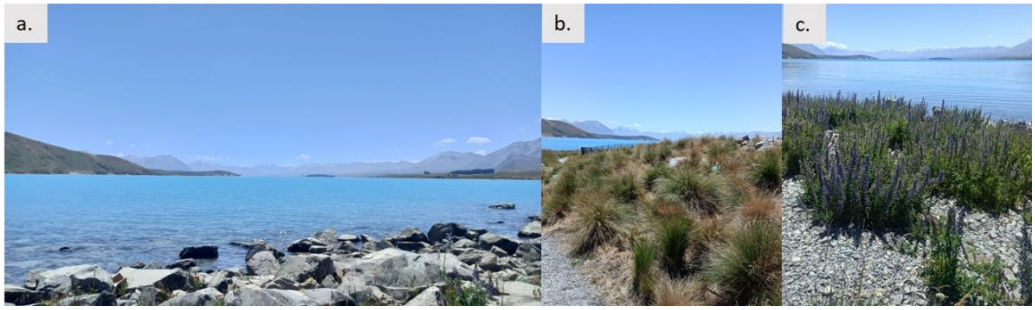


Figure 3 - a) Lake Tekapo b) Grassland c)Lupinus.

- Mt.Cook and Tasman Lake – My next stop was the Hooker Valley track in Mt.Cook to the Tasman Lake. In the first part of the track, while still at low altitude the landscape was mostly grassland and lupin (Figure 4), but as I ascended, the climate turned colder and the lupins made way for Large Mountain Daisy (*Celmisia semicordata* Petrie), Scarlet snowberry (*Gaultheria crassa* Allan*)* and Snow Tōtara (*Podocarpus nivalis* Hook) (Figure 4). As I had the opportunity to see *Celmisia ssp.* growing in the wild, I could observe that most *Celmisia* Cass. grew in small clumps of two to five individuals, in rocky and mostly incline soils, and around small vegetation like grasses or shrubs (*G.crassa*). At the end of the track at Tasman Lake, most of the vegetation consisted of Spaniards (*Aciphylla colensoi* Hook.f*).*

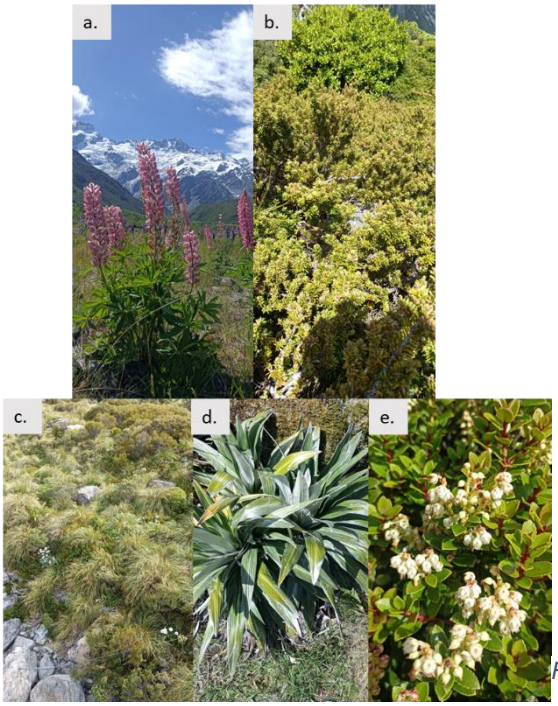


Figure 4 a) Lupin and Mt.Cook in the background. b) Podocarpus nivalis. c)Grass tusslocks with Celmisia species. d) Celmisia semicordata. e) Gaultheria crassa

- Queenstown Gardens and Peninsula Vista – This is a public park set in the Queenstown Peninsula with a pinetum planted with exotic conifers such as *Pinus ponderosa* Douglas*, P.radiata* D.Don and *Pseudotsuga menziesii* Franco*.* I took a small hike to Bob's Peak in the Ben Lomond Scenic Reserve. From there, I had a scenic view of Queenstown Bay, Cecil Peak, The Remarkables and the Wakatipu Lake (Figure 5). Most of the forests around Ben Lomond were plantations of Douglas fir (*P.menziesii)*, with some mountain beeches (*Nothofagus clliffortioides* Hook.f.) and grassland tussocks.

Figure 5 - a) Panoramic view from Bob's Peak. b) Conifer forest in Queenstown Bay. c) Grassland at Peninsula Vista.

- Milford Sound – On the way to Milford Sound (in Fiordland), the landscape changed from grassland and agricultural fields with some invasive species such as broom (*Cytisus scoparius*

Link*)* and *Picea abies* H.Karst. These species could be seen along fields and roads in the South and North Islands. The mountains were bare of native vegetation due to intensive sheep grazing, which could also be seen around all of South Island (Figure 6).

Figure 6 - Grazing fields.

After two hours of driving, the scenery changed to a beech forest and temperate rainforest. Although no alpines grow in these forests, it is worth mentioning as there were several highlights including a peculiar *Pseudopanax crassifolius* K.Koch growing on *Nothofagus cliffortioides (*Figure 7*.b)*, along with a range of ferns and bryophytes.

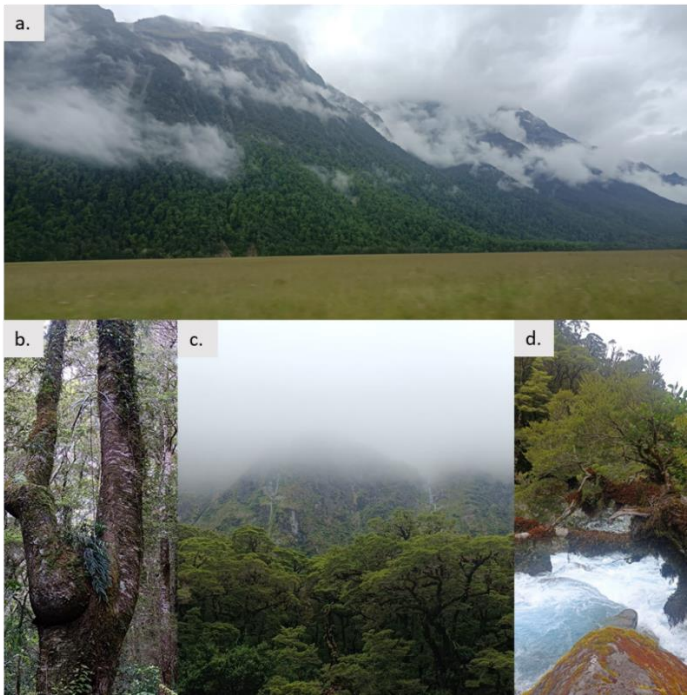
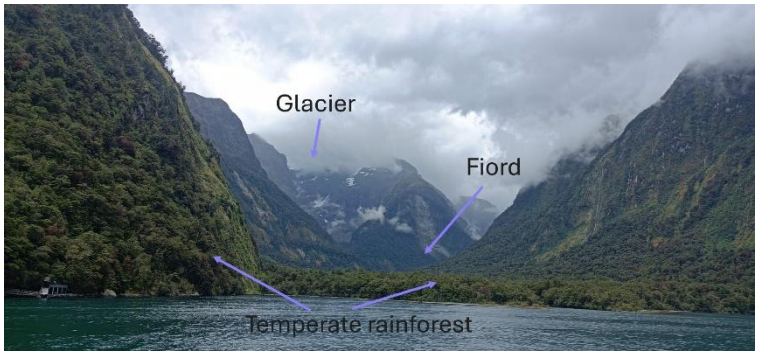


Figure 7 - a) Grassland and temperate forest (Eglinton Valley). b) Pseudopanax growing on Nothofagus cliffortioides. c) Temperate rainforest.

The views of the fiords at Milford Sound were astonishing, and we were able to observe the only place in the world where a glacier, a fiord and a temperate forest can be seen simultaneously, as well as the longest naturally occurring straight line in the world, the Alpine Fault, which starts in Milford Sound and runs up South Island.



- Wanaka tree – One night was spent in Wanaka, a small town in the bay of Wanaka Lake and Mt. Alpha. Here I saw the famous Wanaka Tree, a *Salix* L. growing in the lake. This particular tree used to be a fence post that rooted and started growing in the middle of the lake.

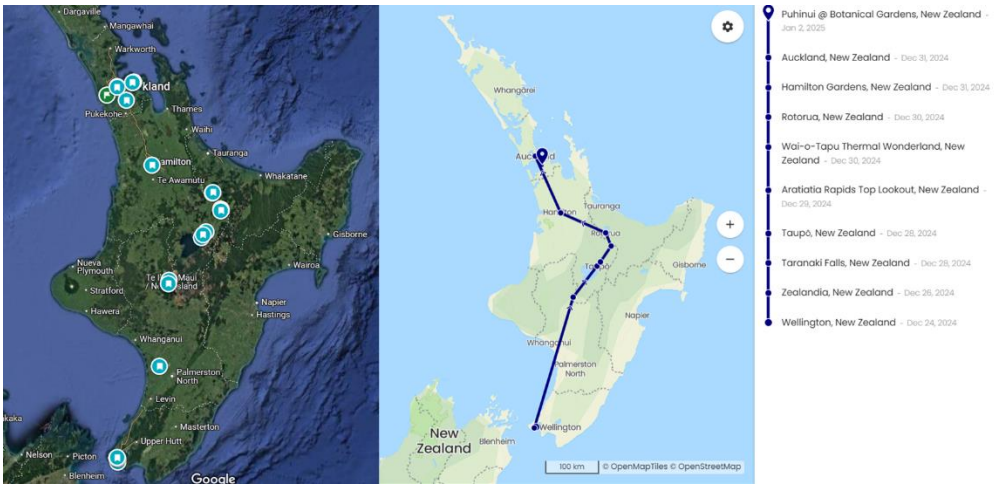
- Fox Glacier and Lake Matheson– The plan for the day of hiking Fox Glacier was aborted because of the weather conditions. Instead, I took a small hike to Lake Matheson. This walk took me through a temperate rainforest (Figure 8) where several ferns (*Blechnum fluviatile* Lowe, *Sphaeropteris medullaris* Bernh. or *Gleichenia dicarpa* R.Br.), and New Zealand Flax (*Phormium tenax* J.R. Forst & G.Forst), a native and endemic plant of New Zealand which every part was used by Māori.

Figure 8 - a) Temperate rainforest. b) Gleichenia dicarpa. c) Phormium tenax

- Arthur's Pass - Arthur's Pass is known to be a key spot for alpine flora hunting, thus, it was no surprise to find a great variety of *Celmisia* ssp. and other alpines in a small lookout (Figure 9). As previously observed, *Celmisia* ssp. were growing on steep rocks, surrounded by *Podocarpus nivalis* and *Coprosma pseudocuneata* W.R.B.Oliv. among other low shrubs.

Figure 9 - a) Otira viaduct lookout. b) Celmisia durietzii. c)C.spectabilis and Coprosma pseudocuneata

The second part of my trip was in the North Island, where alpines can be found around the volcanoes of the central plateau (Tongariro), Mt Taranaki or Tararua.



- <u>Zealandia and Wellington Botanical Gardens</u> – Wellington – Zealandia is a regenerating forest and sanctuary on the outskirts of Wellington. The sanctuary consists of more than 500 acres of reintroduced native wildlife. This includes birds, like the Tieke (*Philesturnus rufusater*), Tūī (*Prosthemadera novaeseelandiae novaeseelandiae*) and the little spotted Kiwi (*Apteryx owenii*); reptiles and invertebrates like the tree Wētā (*Hemideina*), the Moko Kakariki (*Naultinus elegans punctatus* – gecko) and the Tuatara (*Sphenodon punctatus)*; and plants, such as Mamaku – Black tree fern (*Cyathea medullaris* Sw.), Nīkau (*Rhopalostylis sapida* H.Wendl. & Drude) and the Rewarewa (*Knightia excelsa* R.Br.) (Figure 10).

Figure 10- Zealandia. a) Cyathea medullaris. b) Rhopalostylis sapida. c) Knightia excelsa

While visiting the sanctuary, I could appreciate the conservation work that both volunteers and staff were doing and biosecurity measures. One of the main measures I noticed against predators was the fence surrounding the sanctuary, stopping any mammal, except humans, from getting in. The fence goes both up in height, to stop cats and possums, but also down deep in the ground, to stop hedgehogs.

The next stop after Zealandia was Wellington Botanical Gardens. Just like Christchurch Botanical Gardens, this was an open park, with free access and without any biosecurity measures. There were a few collections, such as the Begonia house, herb and vegetable garden and arid collection. Most of the plantings outside these collections were native species (Figure 11). It was interesting to see the use of tree fern bark and trunks as fence posts and bed borders. This is a sustainable way of using a common element that serves its function well and provides a great aesthetic.

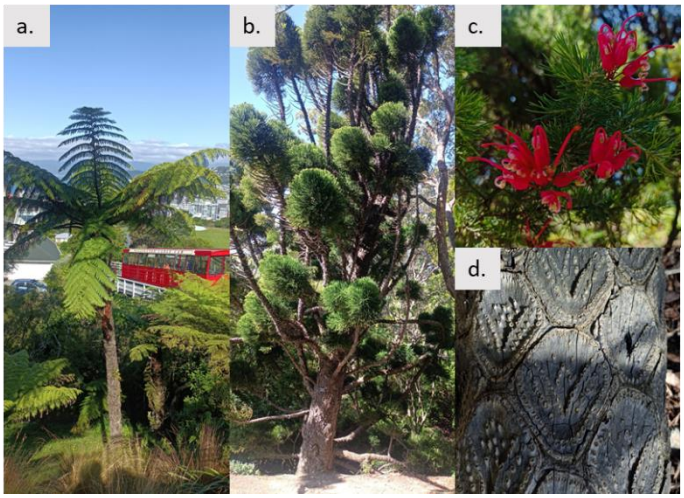


Figure 11 - Welligton Botanic Gardens. a) Cable car. b) Araucaria cunninghamii Mudie/ Grevillea rosmarinifolia A.Cunn/ Tree fern trunk.

- Tongariro National Park – I made two stops at Tongariro National Park, the first one at Whakapapa (Mount Doom in Lord of the Rings). The terrain is volcanic with barely any vegetation except for *Celmisia spectabilis* Hook.f., *C.belliidioides* Hook.f. and *C.incana* Hook.f growing in association with *Brachyglottis bidwillii* Hook.f. and *Polemonium pulcherrimum* Hook (Figure 12).

Figure 12 - a) Celmisia spectabilis growing in association with Brachyglottis bidwilli. b) C.belliidioides. c) C.spectabilis d) Polemonium pulcherrimum e) C.incana

The next stop was the Taranaki Falls. To reach these, I took a brief hike through open grasslands and beech forest (*N.cliffortioides*). It was interesting to observe the growth of *Celmisia* ssp. in both areas. In the first area – open grasslands – several species of *Celmisia*: *C.spectabilis spp spectabilis, C.rutlandii* Kirk. could be found. In the beech forest, I noted *C.morganii* Cheeseman, *C.markii* W.G.Lee & Given and *C. adamsii* Kirk (Figure 13).

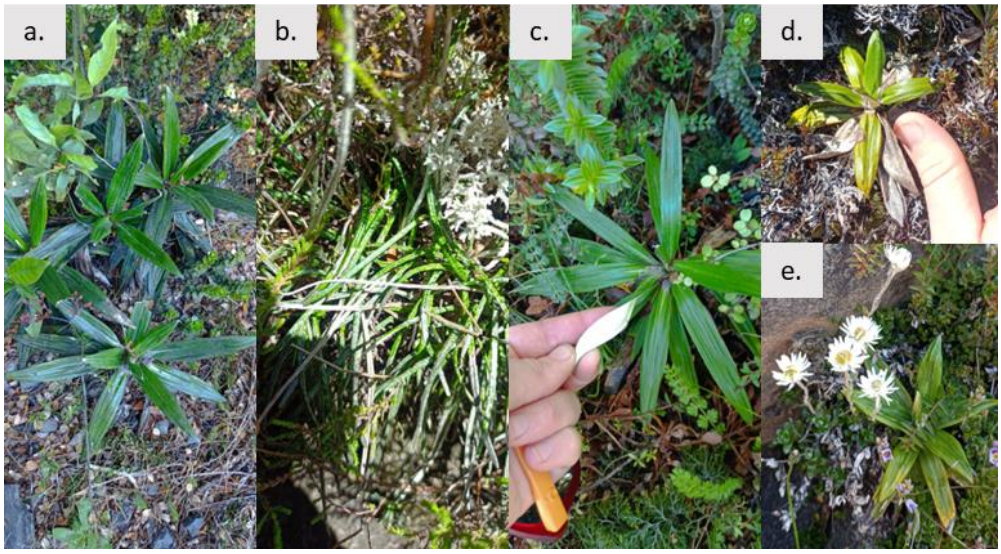


Figure 13 - a) C.adamsii. b) C. markii c) C. morganii d) C.spectabilis ssp.spectabilis e) C.rutlandii

- Waiotapu and Rotorua thermal pools – These are not alpine areas, but it was very interesting to see active thermal pools. Predominant vegetation included Mānuka (*Leptospermum* scoparium R.Forst. & G.Forst) and Kānuka (*Kunzea ericoides* A.Rich), ring fern (*Paesia scaberula* A.Rich) and Arching clubmoss (*Lycopodium cernuum* L.) (Figure 14). These plants are adapted to this area, surviving in acidic soils and sometimes extreme temperatures of over 80ºC.

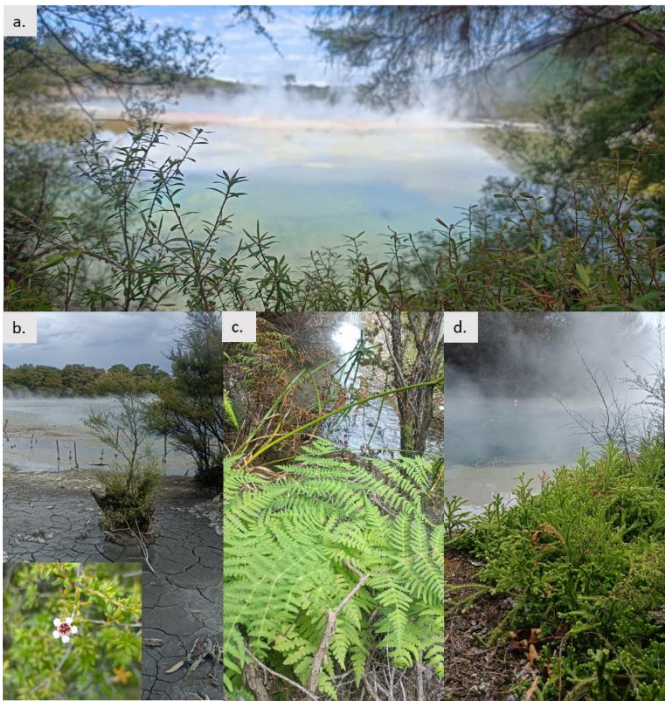


Figure 14 - a) Waiotapu thermal pool b) Leptospermum scoparium c) Paesia scaberula d) Lycopodium cernuum

- Hamilton Gardens – These gardens portrayed a variety of garden designs, such as Indian, Egyptian and Japanese styles (Figure 15). I loved seeing the differences between styles, and how horticulturists there had overcome the difficulties of growing the tender plants characteristic of some designs. Instead of using characteristic plants for each style, native or hardy plants were utilised while still retaining the same effects (the Indian and Tropical design was a particularly inspiring example). A Māori vegetable garden was also depicted, with each plant grown on a mound to improve drainage and productivity.

Figure 15 - Hamilton Gardens: a) Japanese style b) Indian c) Egyptian d) Tropical e) Māori

- Auckland Botanical Gardens – On my last day in New Zealand I visited the Botanical Gardens in Auckland. Along with some common collections such as a pinetum, rose garden and rock garden, there was also a New Zealand Natives and New Zealand Endangered Garden. Both collections aimed to highlight the importance of the conservation of New Zealand flora, since most of it is endemic to certain regions of the islands. When displaying species, there was an effort to recreate their natural habitat, not only with endangered species, but all plants associated too.

Key species

The trip aimed to observe native New Zealand alpine flora in the wild and private/botanical gardens, with a special interest in *Celmisia* ssp.

Figure 16 - Celmisia semicordata.

Celmisia species are native to New Zealand, growing mostly on subalpine/alpine grasslands and montane biomes at high altitudes, though some can grow at low altitudes. Currently, there are 65 catalogued species, all of which are evergreen with green to silvery entire or toothed leaves and some hairs present on one or both sides. *Celmisia* ssp. flowers are daisy-like, always white in colour and growing on long stalks. The blossoming season is summer (December to March) and only produces viable seeds when crossed with other individuals (same or different species) (Manaaki Whenua, 2025).

Mountain daisies tend to grow in clumps, as observed in the wild (Figure 16), and more than three species are always present in an area. I observed this tendency in Tongariro National Park, where at least five different species were found.

Nursery cultivation:

Although in New Zealand *Celmisia* ssp. can be sown outside, in the UK this is not recommended as the weather conditions are more extreme. There are two main problems when growing *Celmisia* ssp. from seed. The first, as mentioned before, is that the seed is only viable when two different individuals are crossed. The second, *Celmisia* ssp. seed viability is short-lived, and thus seeds need to be sown as soon as possible. These also need to be sown surface-level, and kept at 15ºC for one to six months before germination. Transplanting outside needs to be done in spring when the conditions are more favourable.

As *Celmisia* ssp. grow in alpine and montane biomes, drainage plays an important role in their cultivation, and they will die if waterlogged. They do well in full sun or light shade and acidic moist soils.

It is important to bear in mind when cultivating these species that they only produce fertile seeds when crossed. Precaution needs to be taken because they also tend to self-cross with other *Celmisia* species resulting in hybrids.

(Alpine Garden Society, 2018)

Personal experience and learning

This was a trip for first-time experiences. It was my first time in the Southern hemisphere and in New Zealand. It was also my first time doing a field trip observing plants that we grow at Kevock Garden, (the nursery I worked in) in the wild. New Zealand did not disappoint and I found myself loving even more alpine plants but also finding new interests such as ferns. It was a great experience to broaden my views, to put into practice the skills I have learnt during my HND in Horticulture and to start new hobbies like botanical drawing.

One thing that surprised me was the amount of agricultural land and grazing fields around both North and South Island. Most of the East coast of South Island was grazing fields for sheep and cattle, with most of the mountains bare of trees, with only grasses present. An interesting element in most of these fields was the presence of hedgerows, which have been used as fences, windbreaks and for animal biodiversity purposes.

This intense pastoral agriculture started with the first European colonizers who saw New Zealand as the new pastoral country in the South hemisphere, as England was in the North. Sadly, to achieve that they burned more than 80% of the forests.

A highlight of the trip was the importance of conservation and the role of the government in this; from applying for the Visa, where an extra 'Tourist Tax' is paid (which helps efforts to take care of the National Parks); to the biosecurity checks you have to go through upon arrival to NZ (either by boat or plane); and all the signs on National Parks or small hikes. The government has made conservation of all plants and animals a priority. Programmes on eradicating present pests and invasives have been carried out for years while saving species almost endangered like the kākāpō and Chatham Island black robin. All these efforts and successes are an example to the rest of the world of how, despite taking time, conservation is possible.

Overall, I found this trip enlightening. New Zealand is an astonishing country with unique flora and landscapes, a rich history and welcoming people. I would love to go back someday to keep travelling and discovering new places and plants along the way.

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