

An exploration into the plants of New Zealand and
the habitats they dwell in



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Introduction

Prior to commencing this trip. I completed the horticultural trainee technician scheme at University of Cambridge Botanic Garden, this followed on from further completing the PGG's traineeship in horticultural practices. Plants are at the heart of my horticultural interest, and seeing in gardens I've worked at New Zealand designed or inspired areas has shown to me the lack of knowledge and understanding of the native flora, and the sort of conditions they would face in their native habitats. This interest was no doubt originally stoked by the large landscapes showcased in the film adaptation of J.R.R Tolkien's middle earth.

New Zealand is composed of a wide variety of habitats and ecosystems, from the high mountains and coastal plains of the South Island to the rolling hills and subtropical forests of the north island, the difference in climates between the two being very pronounced. The country (Aotearoa) is larger than the UK at about 103,483 square miles, the former around 94,058, yet the population of New Zealand as of September 2023 was astonishingly only 5,269,200.

New Zealand is well-known for experiencing a great amount of seismic activity, due to being situated at the boundary of the Australasian and Pacific plates, this has given rise to a varied geology which greatly influences where species grow. It also started to form comparatively young and continues to form today, much of the underlying rock is sedimentary from deposits carried down from rivers of the supercontinent Gondwana, and offshore volcanoes spewing ash onto the sea floor. It was about 100 million years ago that volcanic activity started to increase, eruptions, and large fault lines opened beneath Gondwana, and by 85 million years ago a large section called Zealandia split apart and moved into the Pacific Ocean. Much of Zealandia sank as it separated, and around 25 million years ago Zealandia also began to split apart. The sunken part close to the plate boundary was pushed up, creating the land area of New Zealand, and the mountain ranges emerged within only the last 5 million years.

The Southern Alps, located in the South Island, are one of the swiftest rising mountain ranges on the planet, greywacke is the predominant rock due to the sediments mentioned before, whereas in the North Island much of it has been covered by newer layers of volcanic rock.

Itinerary

First week to explore alpine habitats, visiting Arthur's Pass National Park, Mt Hutt Ski Field and Hanmer Springs. Visit to Fisherman's Bay Garden to look at a planting mixing natives and non-natives together.

Second week volunteering at Christchurch Botanic Garden, working only with the native plant collections.

Third week volunteering at Otari-Wilton's Bush in Wellington, focusing on the conservation research they carry out. Fourth week volunteering at Wellington Botanic Gardens. Visiting Percys Reserve with a historic alpine collection.

Fifth- and sixth-weeks volunteering at Auckland Botanic Gardens. Also visiting Fernglen Native Plant Garden, and Joys Plants, well-known propagators and growers of native plants.

Aims

- ❖ To become familiar with the identification of a wide range of New Zealand flora, much is endemic and many of the families not so familiar to me, native alpines, and ferns especially so.
- ❖ To become familiar with the growing requirements of native New Zealand flora, particularly alpines, including observing in the wild.
- ❖ To become familiar with the propagation methods and cultivation techniques gardens employ with these species.
- ❖ To become familiar with the ways in which gardens use and display native flora, similarly the ways domestic gardens employ said species. Thereby gaining ideas on how best to display these species back in the UK.
- ❖ To become familiar with the conservation threats to native flora, such as introduced pests, agricultural activity and the conservation work being done to rectify, such as ex-situ in botanic gardens but also in situ.
- ❖ To become familiar with how the native plant collections are curated, what information is databased and the roles each garden sees itself playing.

First impressions

Looking out of the window over parts of the Southern Alps as we flew towards Christchurch airport showed spectacular mountain scenery, very different to back home but descending towards Christchurch revealed a flat expanse of coastal plain, divided by hedgerows and fences, once settled exploring the city revealed common street trees such as planes, oaks and maples. The meadows



Pictured: Echium vulgare.

beyond the city also were very reminiscent of the English countryside and filled with introduced species, some areas thick with *Echium vulgare*, *Daucus carota*, *Lotus corniculatus*, *Vicia cracca*, *V. hirsuta*, and *Crepis capsillaris*, especially in coastal areas. In the shorter grass both *Trifolium pratense* and *T. repens* flowered aplenty, as well as *Bellis perennis* and *Achillea millefolium*, and in the more open areas *Medicago lupulina*, *Linaria purpurea*, *L. vulgaris* (though to a lesser extent), *Malva sylvestris*, *Verbascum virgatum*, *Atriplex prostrata*, corn poppies and curiously very near the coast *Hedera helix* and *Vinca* though unsure whether planted originally. *Leucanthemum vulgare* was interesting in its random distribution, occurring even high up in Arthur's Pass.

As the only native mammals are bats, when Europeans introduced cattle, they purposefully sowed seed from back home to provide fodder, hence many grasses are not native and many a time I spied clumps of *Holcus lanatus*, *Dactylis glomerata* and *Lolium perenne*. Familiar bird species also reminded one of home, the sound of skylarks in the meadows, sparrows, starlings, goldfinches, greenfinches, blackbirds, thrushes, and many others introduced and now in abundance, in Christchurch we could see from the garden the area opposite in Hagley Park where the first introduced birds were 'liberated' in the region. These were carried out by acclimatisation societies throughout the country. Alder and birch had become a noticeable problem, the former especially in wetlands.

A frequent task for any horticulturalist is weeding, many were very familiar, but some blessedly hadn't made it over yet; *Galium perenne*, *Leontodon saxatilis*, *Erigeron canadensis*, *Ranunculus repens*, bittercress, chickweed, dandelion, *Rumex obtusifolius*, bramble, hedge bindweed, annual speedwells, nightshade, *Euphorbia peplus* and fat hen, all familiar weeds.

Further north of the South Island the coastal flora changed gradually as the milder the climate became, around Christchurch these plants occurred only at or very near the shore, fennel, tree mallow, *Antirrhinum* and *Lagurus ovatus*. These showed the more mediterranean climate around Christchurch itself with dry summers but winters that still experience some cold. Though as I came to understand the prevailing pattern of milder winters is also being felt in New Zealand. In the milder areas many S. African species have started creeping out, particularly problematic *Carpobrotus* as it is in many other parts of the world, *Cotyledon orbiculata* similarly hard to remove being found often on sheer cliff faces, *Agapanthus*, *Senecio elegans*, *Arctotheca calendula*, nasturtium also common and *Selaginella kraussiana* a serious pest, with a wide distribution in the country but restricted to milder lowlands.



Pictured left: *Senecio elegans* flowering.



Pictured right: *Arctotheca calendula* flowering.

Alpines

Arthurs Pass National Park

The village is situated at 739m above sea level. The winters can be harsh, and the summers wet and cool. Here I undertook 3 hikes which gave me a range of species from those in the forests to the sub-alpine area and to beyond the treeline to some of the lower peaks themselves.

The first walk, Oтира Valley Track was short and had a return of the same way, reaching a point where no designated trail continued, but it was advised as one of the best trails for plant hunting. First, I stopped to look down the viaduct which crosses a very steep scree slope, here were foxgloves which I noticed started only once I had started climbing on the way to Arthur's Pass, though didn't go beyond the tree line and were restricted to forest edge, oxeye daisies were also flowering as was the native but poisonous *Coriaria arborea*. Once I reached the start of the track no sooner had I stepped out the car door I spied the first *Celmisia* of the trip in full flower, *C. armstrongii* in amongst rushes.



Pictured: *Coriaria arborea* (top left), *Celmisia armstrongii* (top right), beginning of Otira Valley Track (bottom).

Once started on the track I was very quickly rewarded with more flowers, the patch-forming *Celmisia discolor* which was common along the path margins, *C. semicordata*, and the hard to separate *C. gracilentata* and *C. alpina*. *C. spectabilis* was not flowering but interesting to note its woody base. I also came across the only other *Euphrasia* on this trip, the native yellow-flowering *E. cockayneana*. *Diphasium scariosum* was the first of many of the clubmosses I encountered, and with strobili present to boot, it seemed to avoid the very boggy areas and often protruded from the subshrubs and ground cover species. Many of the lovely alpine subshrubs were to be found along the path margins and exposed rocks, such as *Pentachondra pumila* bearing both fruit and inflorescence, *Podocarpus nivalis* with the protruding seed that is so distinctive to this genus, and *Muehlenbeckia axillaris* along path edge and hugging the head of a large rock; often found this but in considerably drier habitats.



Pictured clockwise: *Euphrasia cockayneana* (top left), *Muehlenbeckia axillaris* (top right), *Podocarpus nivalis* showing fruit distinctive to that genus (bottom right), *Pentachondra pumila* flowering & fruiting with *Diphasium scariosum* to either side (bottom middle), *Celmisia discolor* (bottom left).

Anaphalioides bellidioides also on many of the smaller rock faces. The leaves of *Ranunculus lyallii* immediately stuck out to me but unfortunately, I was warned the flowering season had neared its end by that point, I observed this species in a few other locations, none had leaves which reached the size found along this track. Others that seem to favour stream and trough edges were *Geum cockaynei*, *Parahebe lyallii*, *Pratia angulata* and *Epilobium macropus*.

This area was very wet and peaty but interestingly largely absent of trees, though *Olearia* shrubs were quite frequent and forming shrubbery in places, *Phormium cookianum* grew but often didn't get very high, nor did any seem to be or already had flowered, though they retained a lovely pure golden colour in the leaf. A genus I had never really appreciated until seeing a valley full of it, though *P. tenax* does not bear the grace the former does.

Wahlenbergia albomarginata ssp. *laxa* was to be found all over and didn't seem particularly fussy so long as there wasn't too much competition, towards the end of the walk the rockier the terrain became and so a different range of species. One I later saw in flower on Avalanche peak was *Gingidia montana*, others in leaf such as *Acaena tesca*, *Phyllocladus alpinus*, and other ferns like *Blechnum penna-marina* which I saw mostly towards the top, often in areas of rockfall.



Pictured left: *Celmisia semicordata*.



Pictured right: view of the track towards halfway.



Pictured clockwise: *Epilobium macropus* (top left), *Celmisia alpina/gracilentata* (top middle), *Wahlenbergia albomarginata* ssp. *laxa* (top right), *Pratia angulata* (bottom right), *Anaphalioides bellidioides* (bottom middle), *Parahebe lyallii* (bottom left).

The second walk was the Avalanche Peak trail, a loop starting at the village and reaching the highest point of the trip at a lowly 1833m. On the way to the start revealed the introduced *Euphrasia nemorosa* growing characteristically on the verge by a stream, other weeds had made it this far inland like creeping buttercup and chickweed. In another damp area a *Dracophyllum* sp. grew under a *Fuscospora cliffortioides* (black beech), with a thick ground cover of moss. *Blechnum montanum* grew along the path edge entrance but had smaller fronds than those in more shaded areas, and in

goat pass they became quite prevalent, *Astelia nervosa* also formed a lovely stand-alone clump. No doubt the runoff from the path means water is not short. Very nice, though planted, bushes of *Ozothamnus leptophyllus* were also flowering strongly by the visitor centre.

The walk was a very steep ascent followed by a very steep descent, at first through beech forest, the soil was very thin and little understorey existed, this peak also faced what seemed due north. Took me a while to get my head around this. Therefore, warm in the gaps between the trees. I did quickly come across in the nooks and crannies ferns such a *Hymenophyllum* species and *Notogrammitis billardierei*, in flower were *Celmisia verbascifolia*, *Archeri traversii* and *Ourisia macrophylla*.



Pictured: start of Avalanche Peak trail, note manuka in flower (top left).

Celmisia verbascifolia. (top right).

Hymenophyllum sp. (bottom right).

Archeri traversii (bottom left).



Eventually I came to the treeline, there were some grasses, but these quickly petered out. The wind was decidedly stronger and blessedly cool. I quickly came across carpet plants, such as *Phyllachne colensoi*, *Forstera purpurata*, and *Leucogenes grandiceps*, as well as my first flowering *R. lyallii*. Particularly unexpected to me was the orchid, *Caladenia lyallii*, though generally scattered, and contrary to the more typically grown shrubby species, *Brachyglottis bellidioides* delighted, the closely related *Dolichoglottis scorzoneroides* was unfortunately going over, *Veronica* (syn. *Hebe*) *hectori* oppositely was quite ready to flower. Continuing to the summit the grass became shorter and more cushion plants, unfortunately at this point the camera had used its battery capacity up, but in an accessible spot right on top a *Gingidia montana* was in full flower, not in flower was one of its cousins *A. pilifera*. *Epilobium pycnostachyum* which seemed to grow straight out of the rock, *Helichrysum simpsonii*, *Raoulia grandiflora*, and *Celmisia hectori* all flowering. Mostly shrouded by the cloud was also a substantial ice sheet located on another westerly peak. On the descent little was different apart from more *C. spectabilis* on the edges of paths where it had been eroded by trampling.



Pictured clockwise previous page: view down Arthur's Pass valley (top left), Brachyglottis bellidioides (top middle), Caladenia lyallii (top right).

The final walk here was Goat Pass, a tough all-day hike which runs parallel to the course of the valley in which the village sits. It starts at where multiple rivers meet and showed the type of braided river system commonly found in mountainous habitats, found especially in this habitat is the American *Lupinus polyphyllus* which has become particularly invasive in South Canterbury, choking many of these braided riverbanks. Other species are present with *L. luteus* common on the coast. Amongst other introduced species St. John's wort was also quite common on the higher ridges.

This valley was immediately different with the soil being clay-based, and in some places collected to form pools and boggy areas, ferns were far more numerous and in greater diversity. The forest was more established with quite large specimens, and more species diverse with less erosion apart from where the streams fed into the main river. To note early on I came across a hebe bush flowering and looking happy right beside muddy, stagnant water, *Astelia nervosa* was often to be found around water but usually moving if slowly. Quickly came across *Polystichum vestitum*, *Cranfillia fluviatilis*, *Lomaria discolor*, *Cystopteris tasmanica*, *Parablechnum procerum*.

Soon I was rewarded with another target species, *Drosera spathulata* with flowers not quite open, which I didn't find in boggy areas as I expected unlike our native species, often in gaps amongst the Kanuka shrubs on sandy soil, which was certainly not dry but not sodden. The number of bites I received made me think they weren't doing their jobs well enough, but many remains of their victims could be seen through the lens. A lovely patch of *Acaena anserinifolia* flowered not far from a stream edge, *Viola cunninghamii* also emerging out of the tufted path verge. Another *Ourisia* I found very often along this walk but never flowering, *O. calycina* with thick, glossy leaves rather than the hairy, soft of *O. macrophylla*. Both occurred in close proximity and in very similar conditions. Eventually I reached a point where the trees dwindled, *Lophomyrtus bullata* and *Muehlenbeckia* often on the path edges and steep slopes leading to the river, the former I grow at home and shows perfectly hardy. I climbed away from the river onto a raised bog, *Gleichenia dicarpa* had formed very dense patches in areas and seems the natural progression of the habitat. *Aprostylis bifolia* was the second orchid I came across, the cushion plant *Donatia novae-zealandea* surprised me being in an almost marginal position, and funnily enough had both *Drosera arcturi* and *Gentianella bellidifolia* growing through it. *Dolichoglottis lyallii* was bearing its bright yellow flowers, though this seemed to favour along the boardwalk so not as wet loving as the others.

Eventually I reached the beginnings of the stream running the other direction of the valley, this involved navigating its course to begin with. Much of the vegetation repeated itself, but of note reaching the end, were tree ferns, *Kunzea* in flower and stands of wild *Psuedowintera colorata*. Unfortunately seeing *Myosotis explanata* in flower wasn't possible, but I still managed to see it being grown elsewhere.

Pictured right: view of some of the fern understory.





*Pictured clockwise: view of valley entrance (top left), *Aprostylis bifolia* (top right), *Viola cunninghamii* (middle right), *Ourisa calycina* (bottom right), *Gleichenia dicarpa* (bottom left).*



Pictured left: *Donatia novae-zealandea* along with others self-seeded amongst. Pictured right: *Drosera arcturi*.

Mt Hutt

Leaving Arthur's Pass, heading towards Christchurch, the beech tree gave way to Kanuka and Manuka thickets and then sheep-grazed grassland and around castle hill the geology shifted to heavily limestone. Rows of foxgloves abounded along the valley edges and yellow *Ranunculus* sp. brightened up many of the ditches and streamsides. Here in the very short meadows many of the common British native calcicoles could be found, such as *Dianthus armeria*, *Hieracium lepidulum*, *Sedum acre*, and *Rosa rubiginosa*. I stopped at Kura Tawhiti Conservation area, a location suggested for seeing a different species of forget-me-not, this was an interesting fortress-like outcrop of rocks and here lots of planting, mostly grasses, had been done with areas roped off from public access. The soil was quite dry, and the outcrops provided only intermediate relief. Not much was flowering and unfortunately *Brachyglottis haastii* with lovely silver-haired leaves had gone over, *Gentianella corymbifera* was not quite ready and the species I was looking for, *Myosotis colensoi* had finished as well, though still flowering was *Geranium cockayneana* and *Anisotome aromatica*. There is very limited access to private land in New Zealand in general, which in this area is better for observing due to less erosion and trampling.

Along the way to Mt Hutt ski fields I came across many interesting alpines, often growing on cliff faces along the roads but also on the scree slopes and in the road themselves sometimes. *Epilobium petraeum* or *brevipes*, more *E. pycnostachyum*, *Helichrysum* and *Leucogenes*. Surprising to me and something I did not see often was our native *Parentucellia viscosa* (yellow bartsia), possibly feeding off the nearby birds-foot trefoil, or *Securigera varia*, as little grass was around. Trailing over many of rocks was *Raoulia beauverdii*, *Colobanthus* seemed to prefer the gaps in the strata, bit like what is tried to be resembled in crevice gardens. Though, clearly in the wild the force of erosion means this

is a very precarious gamble. *Aciphylla aurea* wasn't flowering but in a damp area, amongst *Phormium* and walled in by *Dracophyllum*, *A. scott-thomsonii*, possibly female, was looking stupendous. *Leptinella pyrethrifolia* had gone to seed, *Veronica pinguifolia* and *Acaena caesiiglauca* flowered along the road edge, the latter where it was quite flat, so no doubt found enough soil to keep it going. I found three more *Celmisia*, *C. cockaynena* with very distinctive, reduced ray-florets though out of reach for photographing, the others *C. lyalii* and *C. angustifolia* only in leaf. I also came across more *Aciphylla* on the slopes beneath the road, and a budded *Craspedia incana* in the road edge.

Eventually I reached a point where mist whistled over the ridge to my right, the clouds hid the very top of the mountain and the path became lost in the clouds. Just pass an interesting section of schist I came across another target plant, *Raoulia eximma*, truly fascinating forms where the plants have covered and moulded into the shape of the rocks around them. Further up they weren't restricted to just the cliff faces and one area looked exactly like a crevice garden had been plonked on top off a hill.



Pictured: view from Kura Tawhiti Conservation Area (top), *Epilobium pycnostachyum* (bottom left), *Myosotis colensoi* (bottom middle), *Helichrysum simpsonii* (bottom right).



Pictured left: *Raoulia eximma*. Pictured right: *Aciphylla scott-thomsonii*.



Hanmer Springs

Located northwest of Christchurch, slightly inland it seemed very parched, the town itself sits on flat plain surrounded by lower mountains, the wind was certainly more noticeable. At the start of the trail, I quickly came across *C. semicordata*, some very large and the whiteness varied in how much sun the plants were receiving. One underneath Kanuka had very little to no covering, many lay completely shrivelled up and past the point of recovery, however *Juncus* lined the path edges where rainwater runs off. Introduced weeds were inevitably present such as *Galega officinalis* and gorse. *C. durietzii* and *C. incana* were also flowering, and *C. verbascifolia* had gone to seed showing the difference of altitude. Of note flowering were also *Thelymitra hatchii*, *Brachyglottis lagopus*, and a large *Veronica* bush. Unfortunately, the target plant, *Gentainella corymbifera* ssp. *gracilis*, was not quite ready to open. Scrambling up a very loose slope revealed tight clumps of *Helichrysum simpsonii* in flower. Curiously pines are invasive here, elsewhere seemed little to no seeding.



Pictured previous page: view looking towards Hanmer Springs (left), *Thelymitra hatchii* (right).

The gardens

Christchurch Botanic Garden

Christchurch was very interesting to learn from the native plant curator due to their experience as part of having previously worked at Department of Conservation (DOC), but also the garden's continued collaboration with the governmental body. It was also very interesting in being the oldest garden I visited, founded in the early 1860s, therefore the planting is often traditional with much of the mature tree collection consisting of common European species. The garden is flat, the soil alluvial and the annual rainfall for the city is only around 575mm. It was also highlighted that the latitude of New Zealand is more akin to France than Britain, Invercargill the southernmost city being around the 46th parallel, Paris 48th, and Auckland 36th while Marseille is around the 43rd.

Highlights

The native plant section focused on different aspects of New Zealand flora, the Canterbury section representing flora found in this dry region, here I learnt the region has less than 0.5% of its native vegetation left. One bed for flora found only on limestone contained *Geranium socolateum*, *Australopyrum calcis* ssp. *optatum*, *Ranunculus callianthus*, *Leptinella calcarea* & *C. minor*, *Wahlenbergia matthewsii*, and *Veronica cupressoides*. A top-dressing of lime chippings and initial application of lime was all that was needed for the PH was already on the alkaline side, positioned in an open, sunny position to mimic natural conditions. The soil was still cool and moist below as we weeded, mostly don't irrigate natives but other sections do quite heavily. By this bed is a lovely specimen of *Carmichaelia stevensonii* with *Pachystegia rufa* below.

A different bed was for the Banks Peninsula flora, of note were *Muehlenbeckia ephedrioides* (dead sticks), *Carmichaelia crassicaulis*, *Pachystegia rufa*, *Raoulia monroi*, *Aciphylla subflabellata* which looked very brown but not dying, *Hibiscus trionum*, and *Aceana buchananii*. Mulched with large pebbles maybe to recreate gravel beds, and one task (pictured right) was deadheading the *Austropyllum* which self-seeds prolifically.

Much of the Christchurch area was former swamp and fen which has been drained to allow construction and agriculture, meaning poor drainage is not a problem in the gardens. An area is therefore naturally dedicated to wetland flora with only 10% of the country's original wetlands left, of note was the lowland *Drosera binata* growing amongst *Mazus novaezeelandiae* ssp. *impolitus*, only in damp areas under shade, particularly by the boardwalk but certainly not marginal. Other than native bulrush, *Cyperus ustulatus* could be made out. *Coprosma rotundifolia*, *Olearia hectorii*, and *O. lineata* are some of the trees and shrubs favouring riparian conditions.



A few borders are to represent some of the flora of the Chatham islands, an archipelago with great diversity and often with giantism, *Astelia chathamica* was very attractive, *Geranium traversii* and the prostrate *Veronica chathamica* were flowering, the uniquely soft *Aciphylla dieffenbachii* had gone to seed and of note growing were *Veronica barkeri*, *Myosotidium hortensia*, and *Meliclytus chathamicus*. One area for New Zealand *Phormium* cultivars, showcasing the morphological difference as well between *P. tenax* and *P. cookianum*, such as 'Liquorice & Lime', 'Variegata', 'Yellow Wave', *P. cookianum* ssp. *hectori* 'Tricolor'.

The first area we worked in was the Cockayne Memorial Garden, dedicated to the prominent botanist Leonard Cockayne. One area was alpines in a woodland glade, a job was clearing *Solanum nigrum* and *Lactuca muralis*, both very common weeds across the board, the native *S. aviculare* which in some places had reached maturity and was producing fruit, also was quite weedy in the garden, especially along both edges. Flowering was *Anisotome lyllii*, *Microtis uniflora*, *Lobelia linnaeoides*, *Mentha cunninghamii*, *Craspedia diversifolia*, and *Leptinella nana*. Many of these were part of a rockery that had become hidden by a shrub planted on the top, *Arthropodium candidum* was encouraged originally but manages to self-seed very freely and can smother many of the groundcovers. *Raoulia hookeri*, *Gunnera prorepens*, *Astelia nivicolosa*, *A. colensoi*, and *Aciphylla glaucescens* present. Of note was a very threadbare *Libocedrus bidwillii* which grew on the edge of the lawn, another smaller one grew at the bottom of the Chatham Islands beds and looked far healthier, possibly being by the canal helps and the shadier position. In one area we pulled out *Corynocarpus laevigatus* seedlings, which can be slightly thuggish but not very hardy.



Above: *Carmichaelia stevensonii*

The fernery was interesting in that it used to be heated but with the climate changing over the years, it no longer needs to be and *Ptisana salicina* survives unprotected, even though native range is north-western half of the North Island. Of note, the walls are lined by old tree fern trunks, which grow naturally in pine plantations and are harvested when clear felled, *Metrosideros perforata* was

climbing up in many places, also present *Blechnum colensoi*. Similarly in an old elm stump elsewhere in the garden *Griselinia lucida* has been planted due to its often, but not strictly, epiphytic nature.

Other areas had cultivars of native species displayed, interesting in what has been cultivated, such as *Dodonaea viscosa* 'Purpurea', *Corokia*, *Cordyline*, *Coprosma propinqua* and *Lophomyrtus*. Particularly nice, a glaucous form of *Phyllocladus alpinus*. In one bed their native stinkhorn fungus (*Aseroe rubra*) was producing fruiting bodies. Lastly the collections held under glass, in the nursery and scattered about was certainly entertaining, in one greenhouse saw the plants being grown

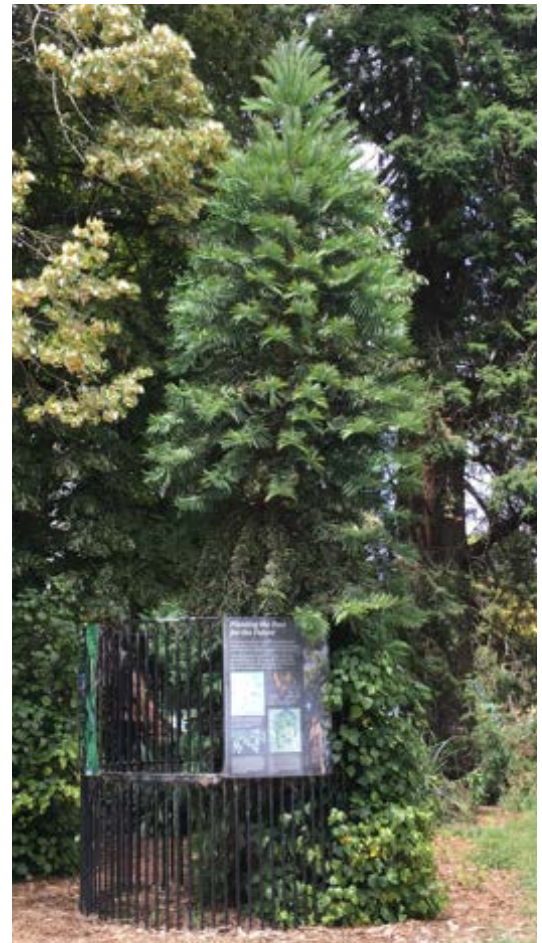


and propagated for ex-situ conservation. For instance, plugs dug up from the wild with a rare *Cardamine* sp. supposedly present, awaiting identification, *Utricularia* was flowering nicely. Others of note, *Macrolearia chathamica* native to Chatham Islands, and a hybrid of *Clematis marmoraria*, that's also out in the alpine area, and *C. paniculata*, *C. x cartmanii* which resembles the former in leaf but grows more like the latter. Outside *Craspedia rugosa* seedlings were growing in trays of pure stone, a very rare species known only from one site around Lake Heron, *Montigena novae-zelandiae* though not rare was nice to see. *Carmichaelia exsul* from Lord Howe Islands was flowering well, but very lax in habitat so benefits from others to prop it up, though not flowering the long leaves of *Sophora longicarinata* we also looked at.

Pictured right: curiously the first *Wollemia nobilis* planted in New Zealand, as recent as 2013 to celebrate the garden's 150th anniversary, others have been planted elsewhere but none looked as healthy, growing next to a *Tillia tomentosa*, other places probably too much irrigation.

Kaitorete Spit

This was an interesting trip which showed a host new host of species, the spit is made up of greywacke gravel washed down from the mountains, very little to no sand further inland, but increasing just before the foreshore. Here we saw *Convolvulus waitaha*, *Calystegia soldanella*, *Rumex neglectus*, *Pimelea prostrata*, *Carex pumila*, *Craspedia thinicola* (syn. 'Kaitorete'), more *Muehlenbeckia axillaris* and *M. ephedrioides*. Most interesting was the *Raoulia australis* which dies off quite randomly, often crown the crown, leaving rings and edges to regrow. Some areas are roped off as hares were in abundance, but some reckoned this lack of grazing by sheep means a gradual loss of diversity, *Ficinia spiralis*, as well as *Poa billardierei*, is an important grass but is also targeted by hares and rabbits.



Fishermans Bay Garden

This is a small but interesting private garden to visit, unfortunately the time to get out meant the battery gave out too. It's situated on Banks Peninsula, a long extinct volcano, in a south-facing cove which no doubt means growing plants is far easier due to the shade and shelter, especially with a shelterbelt of pines. *Aloe* trees and citrus attest to its mildness and drainage, though some irrigation was going most plants looked less frazzled or stressed than where are they growing at the botanics. Straw mulch or pea sticks were used for moisture retention in many places, much of the planting is common herbaceous species in the UK. Of note, *Myotosidium* looking less burnt and healthier, possibly greater shade but also the type of mulch more suited than bark, similarly the banks of hebe seemed naturally compact but healthy due to thinner soil and wind pruning. Native *Chionochoa* used effectively to line boundaries and in prairie plantings, *Celtica gigantea* works well planted under *Cordyline*, grey *Astelia* contrasting well with red dahlias, and *Muehlenbeckia* does not suit topiarising into columns unless very regularly pruned.

On the way from Christchurch to Wellington, we stopped in a small town briefly, I noticed growing *Pachystegia insignis* (pictured right) which is quite a common garden plant, though seemed to be very happy under the shade of a *Metrosideros excelsa*; a ubiquitous street town found only around the coast on the South Island but not restricted in the north. *Myoporum laetum*, *Cotula coronopifolia*, and *Muehlenbeckia complexa* were also flowering.



Otari Wilton's Bush

This is the only botanic garden in the country dedicated to New Zealand flora, named after the landowner Job Wilton, who preserved 7 hectares of the original forest, the remaining 93 hectares has mainly been left to naturally regenerate, and 5 hectares of plant collections. Wellington is quite hilly, the winds can be substantial meaning the temperature is often quelled unlike Christchurch, frosts are uncommon but not unheard of, and the soil is clay-based. Rains are less seasonal than on the South Island and can occur throughout the year.

Many of the species were ones growing at Christchurch, and some areas were of similar veins, such as the Chatham Island border, *Craspedia minor* and *Lepidium rekohuense* were new though. One area displayed epiphytic plants as the climate is far more humid, though it used to be shaded more from canopy that has disappeared, on tree fern trunks *Dendrobium cunninghamii* and *Parsonsia capsularis* were flowering; *Muehlenbeckia complexa*, *Metrosideros colensoi*, *M. fulgens* and *Clematis* were trained on some of the others. *Pittosporum cornifolium* and *Brachyglottis kirkii* had curiously been planted into the tops of the trunks, the media wrapped with moss and hessian. *Pyrrhosia* spp. grew abundantly on the trees and rocks, humidity being moderate. A clump of *Psuedopanax ferox* provided scant shade, and interesting to know many had been rotting off due to wetter summers, counter to that the wetland area had been drying out more, though the former is only short-lived.



*Pictured above left and right: maps explaining the themes of the different areas. Left: an interesting *Metrosideros bartlettii* which has been planted on a frame designed to rot, the legs are filled with moss and eventually the tree will be self-supporting.*



Pictured: *Brachyglottis kirkii* being grown epiphytically on old tree fern trunks.

Another area had coastal flora of the Wellington region, though many can also naturally be found on the north tip of the South Island. Much I saw previously on Kaitorete, but very interesting that one of the founders of the garden (Otari Open Air Native Plant Museum as it was known then), Dr Leonard Cockayne is buried beneath one of the beds. *Coprosma repens* I have seen becoming invasive in the Scilly Isles was present and *Tetragonia* ssp. Of note *Brachyglottis compacta* restricted to Castle Point, on the Wairarapa Coast. In the Plants for the Home Garden borders nearby were thick, healthy carpets of *Leptinella dioica* and *L. rotundifolia*, *Euphorbia glauca* and *Craspedia uniflora* var. *maritima* flowering. *Carmichaelia williamsii* distinctive in its flattened branches, *C. muritai* was in full flower.

One area was to display adaptations, here was *Coriaria sarmentosa*, *Sonchus kirkii* which very closely resembles European weedy sowthistles, left along path edges but pulled if in amongst other things, and *Carmichaelia odorata* grown as a standard. One area is for temporary display and changes periodically, at the time *Eryngium vesiculosum*, the only native species in the genus, was doing very well, seemed not particularly fussy besides open, sunny position in gravelly soils or those with frequent disturbance. *L. minor* had similarly formed a substantial patch. By it stands a conical *Helichrysum lanceolatum* shrub, though not sure what is lanceolate about it. *Muehlenbeckia astonii* and *Corokia x virgata* half-heartedly displayed as hedging plants, though the former doesn't take kindly to children.

One area thoughtfully situated on a slope was designed to represent the channels and ridges of a braided river, very hard to make it look natural. Another with the volcanic rock that is common along much of the north island coast (pictured right), planted prior is a *Myoporum laetum* which makes a lovely mature specimen, the white of the *Austroderia* and other grasses, and the pale green of *Blechnum penna-marina* contrasted well against the dark volcanic rock, *Pachystegia minor* was also flowering. Most had finished flowering in the rock garden, but *Plantago triandra* & *Muehlenbeckia ephedrioides* were, very different from the potted ones at Christchurch. Weeding was quite difficult because of mistaking the native *Oxalis magellanica* for one of the introduced ones.

In the bush garden was much previously known about, the *Piper excelsum* interestingly this side of the Cook Straits is often very bedraggled from foliage damage caused most often by the Kawakawa looper (*Cleora scriptaria*). *Melicytus ramiflorus* & *Metrosideros diffusa* both flowering. The highlight of the bush are the very old specimens of *Dacrydium cupressinum* (rimu), the oldest around 800 years, the top heavy with epiphytic *Collospermum hastatum* but unfortunately large branches polled



due to safety concerns, another at 400 years has a *Metrosideros robusta* (northern rata) growing through it. *Pennantia baylissiana* native to Three Kings Island, *Cyathea dealbata* was quite prolific, sticking to the drier ridges and path edges, in some cases the ground eroding beneath them.

Kiatoke Regional Park

This was an unexpected but fascinating trip to collect seed of *Brachyglottis kirkii* in the wild, travelling to the park mentioned above, we located plants that had been GPS recorded already, tagged, and numbered to tie phenology data to individual plants as well as whether they have been damaged by grazers. The viability and amount of seed is also noted because of nearing summer end the viability tends to drop, especially *Asteraceae*. That was the easy bit, the hard bit was reaching them in such dense undergrowth. They also were mostly growing from the ground, one in the garden has been planted into an old tree fern trunk but seems excessive in light of this trip. The hike up revealed a drier terrain than what I saw in Arthur's Pass, but humid enough to sustain the epiphytic *Asplenium flaccidum*, plants better adapted to drier conditions but also not as hardy, such as *Hymenophyllum nephrophyllum*, *Sticherus cunninghamii*, *Metrosideros parkinsonii*. Orchids we came across early on, the seed heads of *Thelymitra* and *Corobas oblongas*, but also *Orthoceras novae-zeelandiae* in flower (pictured right).



Following this was a very interesting tour of the lab, where research into ex and in-situ conservation is carried out, such as looking at seed banking techniques for native species, especially recalcitrant ones. The biggest research project though is on orchids, isolating the fungal partners, such as for *Gastrodia* and *Corybas*, allowing seeds to be propagated in gardens for future conservation. Outside in a sealed plastic frame potted *Celmisia mangaweka* are kept allowing controlled pollination, to diversify the restricted gene pool of this species, only found on one cliff it is not recognised by many.



Pictured left: seedlings germinating in the growth chamber. Middle: orchid seed through the microscope. Right: hyphae of fungal partner.

A day with ranger Tom

The last trip at Otari proved very useful for learning more about the conservation issues and the work being done in-situ, as well as the conditions Wellington species face. One day I managed to go and look at some of the work the rangers do in the reserves and parks. First stop Berhampore Nursery, a council nursery which grows 100,000 plants a year for revegetation projects in the district, meaning some mechanisation is warranted such as I saw a mechanical pot filler being used, including drilling a hole for the root ball to slot into, and overhead sprinklers which can be driven under, meaning little time wasted using hoses. Many interesting coastal species such as *Peperomia urvilleana*, *Pachystegia insignis*, and *Disphyma australe* which bore very intricate fruit capsules, other of note the leafless *Clematis afoliata*, *Raukaua anomalus*, *Sophora microphylla*, *Melicytus crassifolius*, *Aciphylla squarrosa*, and *M. astonii* bearing its curious translucent, black seeded fruits. To note, all plants go out in 1ltr pots, autumn/early winter, and are watered only once. We looked at some of the seed prep, phenology and locations noted on the record-keeping of what was being collected and ordered. Community groups can also request plants. Afterwards I was shown the myriad ways of killing the different invasive mammals, a task undertaken wholeheartedly here.

Following this we went to visit *Te Kopahou Reserve*, which straddles part of the coast south of the city, to see if *Aciphylla* seed had ripen yet, which they proved to have not. The weather had turned from the previous few days of near total sunshine to the more common overcast skies, reaching the wind turbine, lauded for being the first commercial turbine to operate in the country, gave diminished views over the harbour and the nature reserve. Here we saw more *Euchiton* sp., *Leptinella squalida* ssp. *squalida* (restricted somewhat to the south of the North Island), *Astelia trinervia*, and flowering *Euphrasia cuneata* (right), and *Raoulia*



glabra. *Styphelia nesophila* bearing distinctive orange berries. On the coast we looked at an area that had been planted by community groups, *Glaucium flavum* I noticed in a couple of places going to seed, a non-native Tom targets heavily for removal. Glasswort, *Coprosma prorepens*, *Apium prostratum*, *Pimelea prostrata*, and substantial clumps of *Raoulia australis* in flower, supposedly scented.

The final note was half a day working at gardens in central Wellington, next to the harbour, where *Muehlenbeckia astonii* had proved too successful and self-seeded prolifically, *Olearia solandri* also interestingly is pruned to try and resemble its natural windswept shape in this windy part of the country.



Pictured clockwise: Berhampore Nursery hardening off area (top left), *Raoulia glabra* (top right), *Raoulia australis* in flower (bottom right), Red Rocks area along the coast showing community plantings below sea cliffs (bottom left).

Wellington Botanic Garden

Founded by the late 1860's, the gardens are mostly traditional and slightly larger than Christchurch at 25 hectares, much of the planting similarly follows traditional European style, though the climate being far milder meaning the alpine rock garden contained very few alpines, lots of S. African flora instead.



The main areas with native flora are restricted to the Streamside Garden, removing *Cyperus* was the main task here, but also weeding precariously on the very steep slopes. *Calceolaria tripartita* was very abundant in this area, though not native, as is the *Blechnum gibbum* which had been planted at some stage. Of note were *Psitana salicina* (left) which weren't flagging due to being right next to the stream itself, and *Lobelia physaloides* flowering which was also enjoying the shady bank.

The fernery and Threatened Plants section contains many of the tree ferns I saw throughout the gardens,

Cyathea dealbata, *Dicksonia squarrosa*, *D. fibrosa*, etc. A *Muehlenbeckia astonii* had been used very effectively by topiarising round a bench, *Davalia mariesii* being grown on top of a chimney pot to replicate an epiphytic environment somewhat. *Tradescantia fluminensis* interestingly was one of the more prolific weeds and hard to remove effectively as bits can easily root if dislodged. A small area of the herb garden had native plants with traditional uses, *Myrsine australis* which was common in all the gardens and most of the wild areas I visited, restricted to forest edge and regenerating ground, and *Scandia rosifolia* (right) which I only recall seeing there.

The Australian Garden was very interesting if somewhat neglected, grass strips and banks mean lots of self-seeding into the borders. *Acacia cognata* 'Green Mist' planted on the high raised bed made standout specimens, the weeping crowns allowing people to walk under and the narrow leaves moving easily in the wind. *Anigozanthos flavidus*, *Felicia* sp, *Grevillea* 'Red Mantle', *Cordyline stricta*, *Crocea saligna*, and were flowering, *Brachyscome multifida*, somewhat chlorotic prostrate *Banksia serrata*, and a coastal form of *Banksia grandis* had gone over, and *Dianella tasmanica* used as a groundcover under the eucalypts. Large scoria had been tried as a border mulch to replicate the red earth, not only costly, but very poor at weed suppression and retaining soil moisture, also very obstructing for weeding through. A specimen of *Dendrobium kingianum* did seem to be doing reasonably well on the side of a eucalyptus tree, one slowly dying from a fungus, in the rotting hole of a removed trunk or large branch.





Pictured above: *Cordyline stricta* inflorescence. Pictured right: *Muehlenbeckia astonii* bench.



Percy's Scenic Reserve

This was an interesting garden with a focus on the hardy alpinists and fortunately I managed to go behind the scenes and see the collection, which is mostly out of bounds to visitors. Not a location most people would associate with growing alpinists, due to being at sea level and the high humidity can be a challenge. In the old alpine house, many had been double-potted into terracotta to try and keep the roots cool, and all had been top-dressed with large stones, possibly more effective at cooling than grit. Most had collection locations or provenance, conservation status for some, labels for cultivation notes such as damp or dry, and some with trays to maintain consistent dampness and high humidity. In flower was *Myosotis forsteri*, *M. australis*, and *Ophioglossum petrolatum*, many *Celmisia* had expectedly gone to seed, interesting mains water is used here unlike at Otari where rainwater is specified, others being grown included the very small *Luzula celata*, *Astelia skottsbergii*, *A. petriei*, *Coprosma brunnea* bearing berries, and *Leptinella lanata*.

In another glasshouse *Earinia autumnalis* and *Gratiola sexdentata* were blooming, and the final greenhouses had some of the high alpine species but even with a ventilation system that directed coolish air at the level of the plants, the temperatures were still 28 & 35°C respectively. Mt Cook buttercups had small leaves to those in Arthur's Pass and some yellowing, and *Raoulia eximia* had only small amounts of green growth left on them. Others were doing quite well such as the hairy *Ranunculus insignis*, as well as *R. callianthus* and to a lesser degree *R. royii*. Some *Celmisia* looked fairly happy in the heat, but all with thick, leathery leaves, *C. angustifolia* slightly sticky but *C. viscosa* & *C. densiflora* quite so, but *C. dallii* without stickiness, *C. traversii* not so happy. Not alpine but nice to see bearing an inflorescence *Carmichaelia monroi*.

The final stop was the prop house with heavy shading and open sides to increase airflow, humidity not being a consideration, though possibly keeps many of the alpinists not for fear of damp, especially in the winter. A couple of species found on the Three King Islands such as *Meryta sinclairii* which is very common in cultivation and saw as far south as the coastal town I stopped after leaving Christchurch, admittedly in a very sheltered location, and *Coedes* (syn. *Pisonia*) *brunoniana* which has curious sticky fruits occasionally trap birds. Most were in straight compost, not really needing the pumice and grit used for the alpinists or coastal species like *Atriplex cinerea*.



Pictured clockwise: Earinia autumnalis (top left), old alpine house (top right), Ophioglossum petrolatum (middle right), prop house (bottom right), new alpine houses (bottom left).

Auckland Botanic Garden

Located in the north of the North Island, the climate is classed as subtropical but frosts can occur, though rarely. The garden is very young, opening to the public as late as 1982, it describes itself as a 'South Pacific' garden and contains little of the European styles found in the other gardens; one of the main aims of the garden is public education, including showing the public species and cultivars best suited to the Auckland climate. The topography quite flat, the soil also clay, quite heavy in some places, recent flooding had been quite severe and wetter summers has been causing problems in the Gondwana Arboretum.

Highlights

One of the main areas I worked in was The Native Plant Ideas Garden, very green and textural, as few native plants are colourfully or elaborately flowered. Of interest seashells used as an effective weed mulch but a by-product of dredging, so no longer used, *Haloragis erecta* coppiced and somewhat weedy here.



Pictured: Muehlenbeckia astonii had been shaped architecturally with *Rhopalostylis sapida* as centre pieces (left), myself cloud pruning *Podocarpus totara*.

A very interesting tour was given by the garden's manager, Jack Hobbs (below right), on his breeding work of *Leptospermum* and *Veronica* (syn. *Hebe*). The former we were shown a small area devoted with beds designed into the shape of a manuka seed capsule, high soil beds to improve drainage, bred for denser bark to increase resistance to *Ericoccus coriaceus* and thereby sooty mould, latter similarly and most recent *Hemerocallis* for rust resistance. We went over the history of manuka breeding and some of the important stages reached, as well as his methodology. Looking at the hebes showed interesting differences, full sun ideal but the local humidity problematic for mildew and leaf spot fungus also; *V. obtusata* had never flowered, even after many years in the ground, due to lack of winter chill.

The Harakeke collection was another highlight, the name for *Phormium tenax*, Wharariki for *P. cookianum* though here the climate is too hostile for it, seeing the different traditional forms and their uses. The harvesting method was also interesting and used as a technique for aiding airflow

through the plants and to reduce pest and disease build up, such as slugs causing tearing, fungal spots and moulds. In the South African garden *Eucomis comosa* we removed flowers and seed heads due to weediness, *E. zambesiaca* we left be, *Brunsvigia josephinae*, *Bauhinia galpinii*, and *Alberta magna* were flowering as well. *Arthropodium cirratum* found throughout gardens I visited, often planted under trees, we also removed seed heads on mass.

The native plant trail revealed familiar species, but some not such as *Laurelia novae-zelandiae* with typical buttress roots, *Coprosma virescens*, *Dacrydium dacrydioides*, and *Freycinetia banksia*. Next to this is the Threatened Plant Garden with the North Island *Picris burbidgeae*, an interesting task was salting the saltmarsh but very hard to maintain such an environment artificially, *Plantago coronopus* problem weed, to note was *Ileostylus micranthus* (small-flowered mistletoe) growing on *Plagianthus divaricatus* as it naturally does in the wild). Species flowering included *Lepidium oleraceum*, *Lobelia anceps*, and *Pimelea orthia* which is restricted to a certain part of the North Island.



Pictured previous page: Jack Hobbs talk (top left), Native Threatened Plants Garden (top right), Pippa demonstrating the harvesting technique for *Phormium* (bottom right), *Hemerocallis* trial beds (bottom left).

One day was spent at the nursery which proved very informative about native plant prop, coir was uniquely used here. More revegetation growing, up to 60,000 plants and due to myrtle rust a spraying regime of every 10 days! Learnt interesting methods for seed prep such as separating *Sophora* seeds from the pods, nicking the coats using nail clippers, using pins to tease out sees from spiky *Entelea*, rock tumblers to remove flesh from *Vitex lutescens* seeds, in the nursery another species of mistletoe had seeds glued onto manuka. As well as looking round the garden to learn how to identify when fully ripe, or already spent or not viable. One day I did work in the Auckland Domain, another public garden in the centre of the city, mostly unbotanical but interesting in the greenhouses which are not allowed to be limewashed and with the strong sun, due to the remaining hole in the ozone layer, scorching is a big problem.

The final highlight was the Gondwana Arboretum which showed the different growing requirements for the closely related trees, members of *Araucariaceae*, restricted to different Australasian islands. Here I saw the difference between *Agathis* species such as the distinctive *A. atropurpurea* which refers to the bark, and *A. montana* bearing silvery cones, all were grafted onto *A. australis* to better cope with the growing conditions. Similarly, the Australian *Araucaria bidwillii* used for that genus, *A. columnaris* carried quite a bit of brown, most likely too much moisture, bark mulch possibly too thick, though *A. heterophylla* did not seem to suffer. It was also interesting that the S. American *A. araucana* self-seeded but none of the pacific species did.



Pictured left: nursery area for revegetation. *Pictured right:* substantial dieback on *Araucaria columnaris*.



Fernglen Native Plant Gardens

An interesting garden set up by the renowned plantsmen Muriel and Bill Fischer. Now looked after by the council but somewhat removed from its heyday. Quite a shaded, humid site, the rockery impressed with *Xeronema callistemon* grown in large pots to restrict the roots, similarly now being tried at Auckland by growing in pots buried to restrict the roots, mulched with scoria, perlite and grit mix. Though they had found scorch a problem of late; *Leptinella* browns off but always seems to recover. The alpine house had ultimately failed to work because of the humidity, sprinklers had also

caused fungal problems for some of the shrubs. The gully was quite interesting to see the regeneration that had formed closed canopy now, nikau palms quite prolific, possibly too much, and floods had caused some wash out, but the palms seemed to tolerate quite wet conditions. Interesting species such as *Elingamita johnsonii*, the bog-loving *Gahnia xanthocarpa*, *Coprosma rhamnoides*, *Weihnmania silvicola*, *Dracophyllum sinclairii* and *Toronia toru*.

The highlight certainly was the fern house, *Leptoteris superba* (Prince of Wales fern) had been grown with a metal tray to stop the fronds touching the ground as they can deteriorate easily, but the more you looked the more self-seeders emerged. *Lecanopteris pustulata* grew on the tree fern walling, but the roof was fairly open with enough shading from the mature Kahikatea and *Hoheria*. Of note, also *Asplenium polyodon* and in drier shade *Parapolytichum microsorum*, not a fern *Astelia hastata* on a bank top.



Pictured previous page clockwise: Leptoteris superba (top left), Fern House (top right), Joy's Plants Nursery Native section (bottom right), Rockery (bottom left).

Joy's Plants Nursery

This was the final stop and very informative, the wealth of propagation of native plants is extensive and much of what Auckland showed me had been learnt from him. Many tips and tricks I learnt about seed treatment as all are sown outside with minimal protection, the mix being on the sharp side and him preferring to keep drier rather than wetter.

What I learnt

Identification

Heteroblasty and *divarication* are terms that applies to a large proportion of native flora, and ones not particularly familiar to me previously. The former refers to the stark difference between juvenile and adult forms, many confusing to identify in the early stages. The latter is one where trees or shrubs branch at around 90 degrees or more, many do both, such *Pennantia corymbosa* with juvenile leaves that resemble duck feet in shape. On the Avalanche trail I similarly saw both juvenile and adult forms of *Raukaua simplex*. I saw in the gardens both species of *Melicope*, *M. simplex* with the distinctive joint and *M. ternata*. *Parsonsia heterophylla* itself goes through 3 different leaf forms.

As well as learning the identifying features of the species mentioned in this report, I also managed to learn some of the characteristics of some genera and new families, for instance *Coprosma* often resembles many other plants, but domatia on the lower surface give it away. The grey, fissured bark of *Psuedopanax*, the difference of stem colour in *Piper excelsum* from whether it grows from north of the North Island, purple margins to *Geranium socolateum*, *Dianella* toothed margins and midrib, and very interestingly the difference between Australian and New Zealand *Acaena*, the latter only ever has one umbel per inflorescence.

Ecology

Four out of five species found in New Zealand are endemic and generally I noticed restricted in the number of herbaceous perennials, geophytes, and wetland plants, centred instead on mostly trees and shrubs. There are very few grassland species due to no mammals to graze before Europeans arrived, therefore it's a very quick succession to bush, so grazing is the biggest cause of halting forest regeneration and introduced grasses and herbs outcompete a lot of the delicate grassland species. Native species often have special mechanisms to aid germination and seem to germinate more sporadically and often slowly compared to European species, that are wired to establish before the onset of winter. I also came to realise many are not long-lived,

Many species are pollinated by birds, this we saw with bellbirds pollinating *Phormium* though apparently starlings have learnt to do this as well, many are also eaten by birds preparing them for germination. The only native bees are solitary curiously, hence there being only 3 genera in *Fabaceae* native, most are bird-pollinated. It was interesting to note at Auckland Botanic they had found *Pimelea eremitica* giving little seed, often they ripen near the ground, and they suspected sparrows eating the seed, so put up a bird scarer that appeared to be working. In the gardens we saw possum damage which occurs high up in the trees, rats are also a big problem, stripping bark, squirrels never made it here, deer and goats especially problematic because of erosion.

Cultivation

Much of the country apart from upland regions have a far longer season growth, in many cases it's continuous growth all year, this I noted quickly at Christchurch. The oaks and other European species were of a size that would take probably upwards of 500 years, here in less than 200, meaning many grow soft, though eucalypts curiously do not fall over without warning like they can in the UK. Native species seem to grow slower than these introduced species do here but still faster than in colder climates, for trees and shrubs it seemed growing together and allowing natural systems to function is key, leaving leaf litter and mulching with bark was used quite liberally in all the gardens I volunteered at. An example of this is at Christchurch where previously *Piper excelsum* failed to grow, every year frosts would kill it off, but now after around 35-40 years of trees maturing around them and the build-up of organic matter they come through unscathed, even being weedy, a testament to creating a functioning ecosystem. In general, native bush is quite drought tolerant and the native sections received little irrigation comparative to others.

In the gardens it was very interesting seeing familiar species without the diseases associated with them, sycamore without tar spot, horse chestnut without leaf miner damage, lily without beetle damage, elms without borer or disease. But some pests are a problem which are less so in the UK, thrips outside and especially on *Rhododendron*, *Phytophthora* can be quite problematic, and scale and mealybug especially in *Phormium* crowns. On *Astelia* zigzag patterns could be seen from the *Charixena iridoxa* (*Astelia* zig-zag moth), I came across the caterpillar damage and themselves of *Sabulopteryx botanica* on *Teucrium parviflorum*, interestingly this was discovered in the garden and first described with the specific epithet *botanica*, a nod to the garden, the notched marks of the cabbage tree moth, and on *Gomphocarpus physocarpus* monarch butterflies feed.

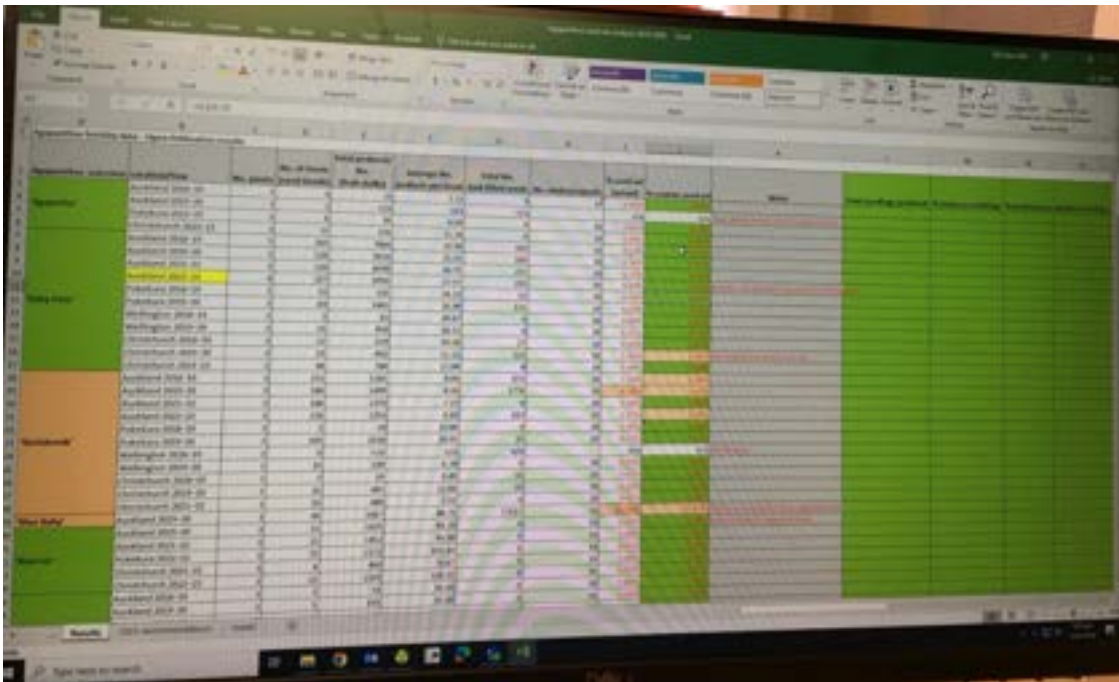
Visiting alpine habitats showed the variety of soil types different plants favour, and the amount of exposure & rainfall they tolerate. On Avalanche peak, sections of soil regularly break off, revealing a soil with high amounts of fines but still mostly light, friable and with no large grits, very few places above treeline on the walk showed signs of drying out, not even these clods.

Another key element was learning how to propagate these plants, and in most of the gardens I had time in the nursery, all used primarily wood bark-based compost due to the size of the forestry industry, peat rarely used and coir not much. Soil-based media also due to biosecurity I saw very little. One thing to note was the bark compost was consistently coarse and not as well rotted as what I would have expected, but not much seemed to mind and fungus was usually present, a thought that by disturbing roots also disturbs the fungus and possibly isn't beneficial. Sand was used heavily at Christchurch for native prop, often sowing straight onto sand, I used quite a coarse prop sand when potting on in the different gardens.

Curation

During this time, I also wanted to see how the collections are curated, a predilection for those working in botanic gardens. This I certainly achieved, and it was interesting to note the wide variety of databases used, Auckland & Otari the familiar IrisBG, Wellington BG-Base, and Christchurch curiously one the council themselves created. It was also interesting to note the scope of the horticulturalists place to place, some gardens have record officers but at Christchurch horticulturalists accession plants as well as dead them off, and other curation tasks; the conservation and research requests also come through them primarily. At Auckland it was very useful exploring how the trial work is recorded, how that information is used and the legislation New Zealand has for invasive species and movement of plant material, such as the *Agapanthus* trial (below) which Christchurch also are a part of. This is to find cultivars with less than 2% seed viability as Auckland Council have banned its sale, other trials have been to find roses resistant to fungal pathogens. Due to

biosecurity measures the cost of importing new species or cultivars is also quite prohibitive, unless it can be proved it was grown pre-1993.



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