SUBALPINE BANKS PENINSULA – A HINT OF THE DISTANT ALPS

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Once forested from side to side and from coast to crest, Banks Peninsula is nowhere high enough to rise above a 'natural' or temperature-defined timberline. In an earlier article in this journal (Wilson 1993) I defined the altitudinal zones of the Peninsula in the context of the rest of New Zealand and the wider world. I concluded that Banks Peninsula falls within the cool temperate, oceanic, subhumid bioclimatic cell of Meurk (1984) and projects altitudinally into the subalpine zone.

750 m is a defining elevation on the Peninsula. Many cool temperate/montane species reach their altitudinal limit at about this height. Notable among them are: *Melicytus ramiflorus* (māhoe), *Kunzea ericoides* (kānuka), *Carpodetus serratus* (putaputāwētā), *Pittosporum tenuifolium* (kōhūhū), *Pittosporum eugenioides* (lemonwood), *Olearia paniculata* (akiraho), *Aristotelia serrata* (wineberry), *Coprosma linariifolia*, *C. rotundifolia*, *Cordyline australis* (cabbage tree), *Cordyline indivisa* (tōī), *Urtica ferox* (ongaonga), *Blechnum discolor* (crown fern), *Asplenium bulbiferum*, *Cyathea colensoi*, *Microsorum pustulatum*, *Festuca actae*, *Microlaena avenacea* and *Poa matthewsii* (Fig. 1).

ABOVE 750 METRES

Above 750 m, forest, scrub, shrubland, tussockland, turf and rock are characterised by a suite of upper altitude species. Originally, nearly all of the subalpine terrain on the Peninsula was covered in subalpine forest, right across the highest tops – chiefly of thin-bark tōtara (*Podocarpus hallii*) and broadleaf (*Griselinia littoralis*), with prickly shield fern (*Polystichum vestitum*) abundant on the floor. Cedar (*Libocedrus bidwillii*) was probably common. Shrubs, tussocks and herbaceous plants (e.g. *Dracophyllum*, snow tussock (*Chionochloa*), harebell (*Wahlenbergia*) and *Ourisia* would all have been restricted to small islands of steep rock in a sea of forest.

Burning in Polynesian times removed much of this forest and allowed snow tussock shrubland to expand across summits and along ridges. European fires destroyed most of the remaining forest. Very little old-growth

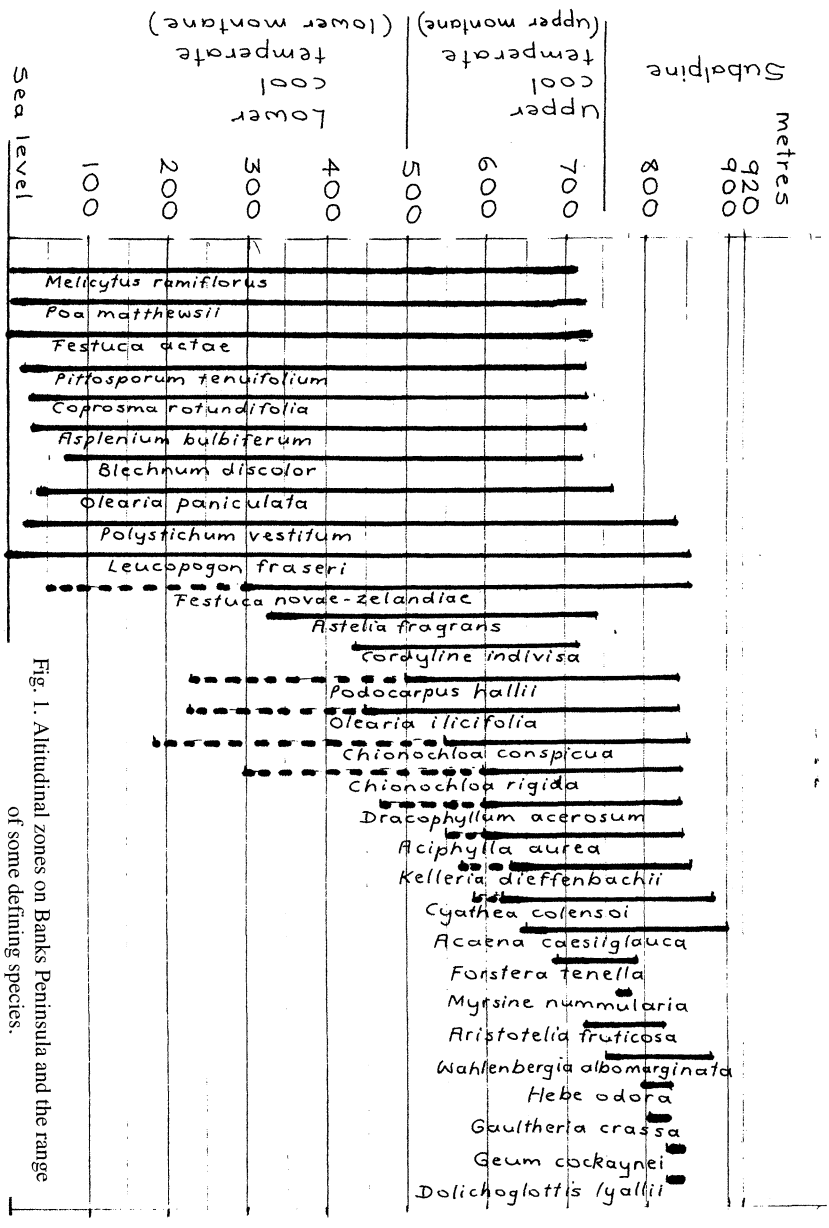

Fig. 1. Altitudinal zones on Banks Peninsula and the range of some defining species.

subalpine forest survives, but there is some regenerating forest and scrub above 750 m, with abundant thin-bark tōtara, mountain holly (*Olearia ilicifolia*), broadleaf, *Dracophyllum*, *Hebe* and *Coprosma.* Cedar is regenerating in a few places, although mostly below 750 m, in the upper edge of the montane zone. The best subalpine forest and scrub is currently on Mts Sinclair and Fitzgerald (Fig. 2).

Many of the species contributing to subalpine vegetation on the Peninsula are found lower down as well. Even in pre-Polynesian times they would have grown on naturally open sites such as bluffs, cliffs, waterfalls and slips. A few (e.g. *Ourisia lactea*, *Schoenus pauciflorus*, *Celmisia mackaui*) still find a toehold on wet coastal cliffs as they have done for millennia. Māori and European burning provided many previously highly restricted upland plants with greatly expanded opportunities. A handful of species, though, are restricted to the highest tops (e.g. *Forstera tenella*, *Acaena caesiiglauca*, *Pentachondra pumila*).

Mapping the subalpine terrain reveals how limited it is in extent (Fig. 3). Some 20 summits rise above 750 m; only 11 of them exceed 800 m. All the land above 750 m barely adds up to one half of one percent of the Peninsula's total area, equating to about 500 ha.

The most extensive subalpine tract is centred around Mt Herbert, the highest point at 920 m. A substantial number of the Peninsula's subalpine plants are recorded only from the Mt Herbert/Mt Bradley area. Notable are *Hebe odora*, *Gaultheria crassa*, an unnamed rhizomatous *Celmisia*, *Dolichoglottis lyallii*, *Epilobium macropus*, *Geum cockaynei*, *Acaena dumicola* and *Lycopodium australianum* (=*Huperzia australiana*) (Table 1).

Curiously, one of the key upper montane/subalpine species, the narrow-leaved snow tussock *Chionochloa rigida*, appears to be absent from the Mt Herbert region. Instead, *C. conspicua*, overall a lower-altitude species, forms more or less the same kind of tall tussockland that on other high summits is formed by *C. rigida.* I have wondered about possible reasons for this anomaly; it may be that the more rounded summits of the Herbert area originally left few or no sites sufficiently free of forest and scrub for light-demanding *Chionochloa rigida. C. conspicua* is much more shade-tolerant, and was doubtless present on Mt Herbert during forested times. But perhaps chance played an important role determining what survived and what succumbed to the destructive fires of human settlement.

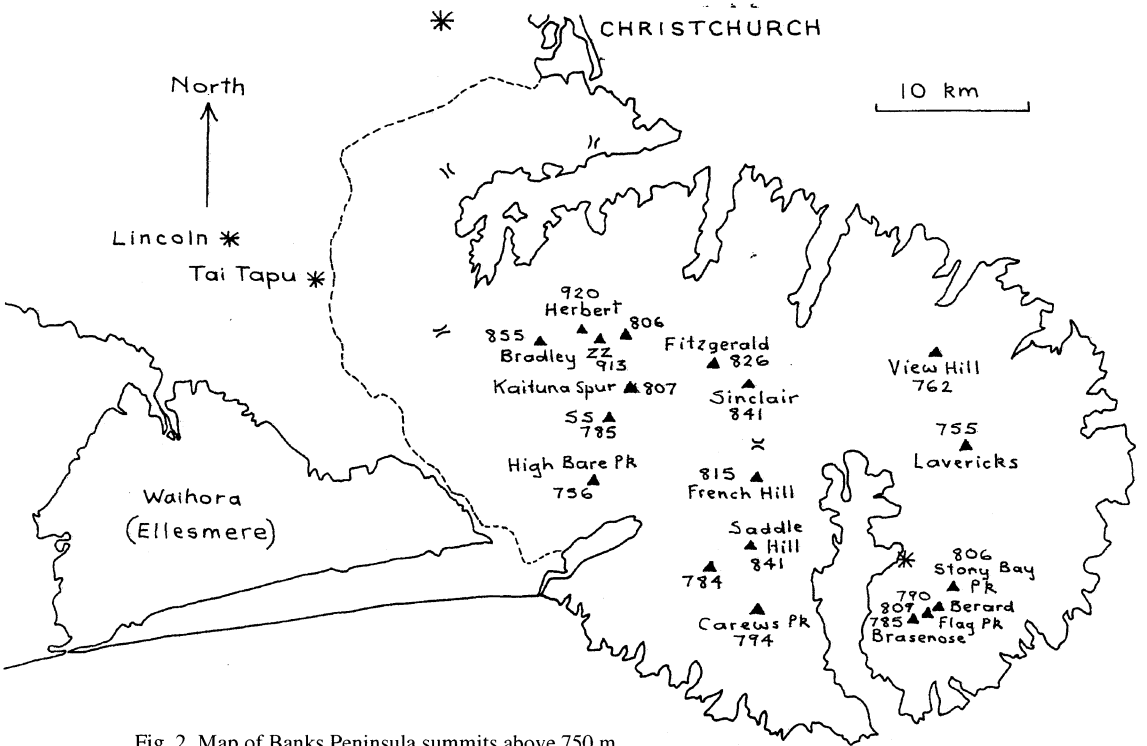

Fig. 2. Map of Banks Peninsula summits above 750 m.

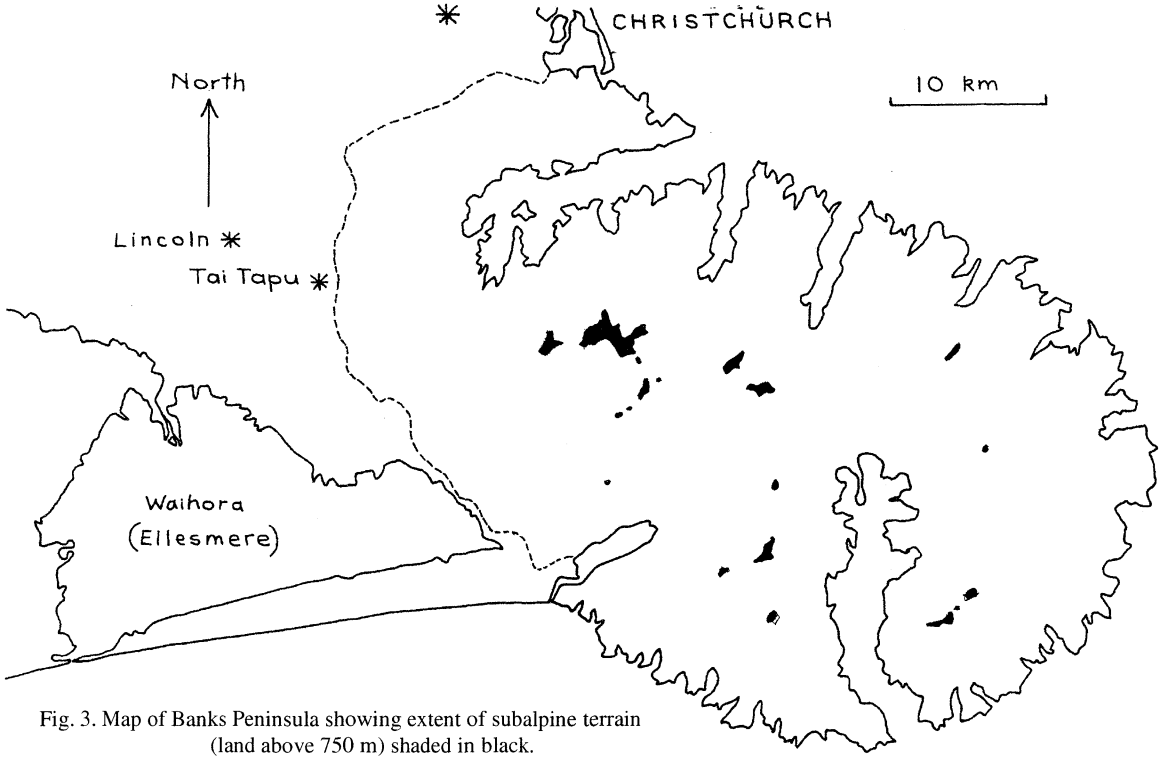

Fig. 3. Map of Banks Peninsula showing extent of subalpine terrain (land above 750 m) shaded in black.

PAST AND FUTURE CLIMATES

It is a sobering thought that a 1-2° C rise in average temperature could snuff out the subalpine zone on Banks Peninsula like a candle flame. Conversely, it is fascinating to consider what the Peninsula was like during the coldest periods of glacial times. 18 000 years ago, at the peak of the Otiran glaciation, bioclimatic zones were probably around 850 m lower than they are now, though sea level was also some 130 m lower. This would have put timberline at about 300 m above present sea level, or 430 m above the ice age sea level. Half of the present area of Banks Peninsula would have been under alpine vegetation. The rest would have been subalpine – presumably mostly subalpine forest and scrub, but perhaps also a considerable amount of open ground below timberline because of the extremes and variability of glacial climate.

One could therefore assume that a truly alpine flora existed on the Peninsula then, including many species that were eliminated by warming and by forest expansion as the last ice age gave way to the present balmy interglacial. Under the present climate, timberline would lie at about 1150 or 1200 m, some 300 m above the summit of Mt Herbert, and the current subalpine flora is probably only a surviving portion of what was here 18 000 years ago.

If global warming were to raise altitudinal zones on the Peninsula by only a couple of hundred metres, some of the subalpine flora would persist on bluffs and cliffs and on ground kept open by continuing human agency. Others would almost certainly disappear. Some of the species are patchily distributed now, as though dispersal has been chancy, or as though they are not securely established in the landscape, or possibly as though human activity has significantly disrupted and reduced their natural distribution patterns. Apart from the richer subalpine flora on Mt Herbert, clearly related to its greater elevation, some plants are restricted to one or a few summits and absent from other summits that seem suitable for them. Examples are *Pentachondra pumila* and *Myrsine nummularia* (Table 1). Isolated high summits, such as View Hill (762 m), Lavericks Peak (755 m), and High Bare Peak (756 m) which only just poke up into the subalpine zone, lack almost all of the species that could be considered to belong to a Banks Peninsula subalpine florula. Summits just a little higher but closer to more extensive high ground, e.g. Berard (790 m), Brasenose (785 m), and an unnamed 784 m peak above Bossu Road, support a more substantial subalpine element.

Table 1. Distribution of subalpine flora on Banks Peninsula.

+ = present − = recorded by others in past	Mt Herbert, Mt Bradley Kaituna Spur	High Bare Peak	Mt Fitzgerald Mt Sinclair	French Hill, Saddle Hill Bossu Rd, Carews Peak	View Hill	Lavericks Peak Panama Rock	Stony Bay Peak Flag Peak
Acaena anserinifolia	+	+	+	+	+	+	+
Acaena caesiiglauca	+			+			+
Acaena dumicola	+						
Aciphylla aurea	+		+	+			+
Aciphylla subflabellata	+	+	+	+		+	+
Anaphalioides bellidioides	+	+	+	+	+	+	+
Anisotome aromatica	+		+		+	+	+
Aristotelia fruticosa	+		+				
Asplenium richardii	+		+				
Asplenium trichomanes	−			+			
Blechnum montanum	+		+				+
Blechnum penna-marina	+	+	+	+	+	+	+
Brachyglottis lagopus	+	+		+		+	+
Carex colensoi	+	+	+	+			+
Carex dissita	+						
Carex wakatipu	+			+			
Celmisia gracilenta	+			+		+	+
Celmisia mackaui							+
Celmisia '*rhizomatous*'	+						
Centella uniflora	+			+			+
Chionochloa conspicua	+		+	+		+	+
Chionochloa rigida			+	+		+	+
Colobanthus apetalus				+			+
Colobanthus strictus	+		+	+			+
Coprosma propinqua	+	+	+	+	+	+	+
Coprosma rhamnoides	+	+	+	+	+	+	+
Coprosma *sp.* '*t*'	+	+	+	+	+	+	+
Coriaria sarmentosa	+						+
Corokia cotoneaster	+	+		+			+
Corybas macranthus	+			+	+	+	+
Corybas trilobus	+	+	+	+	+	+	+

+ = present
– = recorded by others in past

	Mt Herbert, Mt Bradley Kaituna Spur	High Bare Peak	Mt Fitzgerald Mt Sinclair	French Hill, Saddle Hill	Bossu Rd. Carews Peak	View Hill	Lavericks Peak Panama Rock	Stony Bay Peak Flag Peak
Cyathea colensoi	+		+	+			+	+
Deschampsia chapmanii	+							
Deschampsia tenella	+							
Discaria toumatou	+	+		+				+
Dolichoglottis lyallii	+							
Dracophyllum acerosum	+		+	+			+	+
Epilobium atriplicifolium	+	+	+	+	+		+	+
Epilobium brunnescens	+							+
Epilobium macropus	+							
Epilobium pubens	+	+	+	+			+	+
Euchiton polylepis	+							
Euchiton traversii	+		+					+
Euphrasia zelandica	+							
Festuca novae-zelandiae	+	+	+	+	+		+	+
Forstera tenella	+							+
Galium propinquum	+	+	+	+			+	+
Gaultheria crassa	+							
Gaultheria depressa *var.* nov.zel	+		+	+				+
Geranium microphyllum	+	+	+	+	+		+	+
Geum cockaynei	+							
Gingidia enysii	+		+					+
Gingidia montana	+			+				+
Gonocarpus incanus	+			+				+
Grammitis billardierei	+		+	+			+	+
Grammitis ciliata	+							
Grammitis patagonica	–			–				
Grammitis poeppigiana	+		+	+				+
Griselinia littoralis	+	+	+	+	+		+	+
Gunnera monoica	+			+				+
Hebe odora	+							
Hebe salicifolia	+	+	+	+	+		+	+
Hebe strictissima	+	+	+	+	+		+	+
Helichrysum filicaule	+	+	+	+	+		+	+
Heliohebe lavaudiana	+		+	+				+

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	Mt Herbert, Mt Bradley Kaituna Spur	High Bare Peak	Mt Fitzgerald Mt Sinclair	French Hill, Saddle Hill Bossu Rd, Carrews Peak	View Hill	Lavericks Peak Panama Rock	Stony Bay Peak Flag Peak
Hierochloe redolens	+	+	+	+			+
Hydrocotyle 'montana'	+	+	+	+	+	+	+
Hymenophyllum minimum				+			+
Hymenophyllum multifidum	+		+	+		+	+
Hypolepis millefolium	+	+	+	+	+	+	+
Isolepis habra	+						+
Juncus gregiflorus	+	+	+	+	+	+	+
Juncus novae-zelandiae	+		+				+
Kelleria dieffenbachii	+		+	+			+
Leptinella dioica x squalida	+	+	+	+			+
Leucopogon fraseri	+		+	+			+
Libertia ixioides	+	+	+	+	+	+	+
Libocedrus bidwillii	+		+				+
Luzula ?picta *var.* limosa				+			
Luzula rufa	+	+	+	+			+
Lycopodium australianum	+						
Lycopodium fastigiatum	+						+
Lycopodium varium	+		+	+		+	+
Melicytus alpinus	+	+	+	+	+	+	+
Microseris scapigera	+						
Muehlenbeckia axillaris				+			
Muehlenbeckia complexa	+	+	+	+	+	+	+
Myosotis 'drucei'	+						+
Myrsine divaricata	+	+	+			+	+
Myrsine nummularia							+
Nertera depressa	+			+			+
Nertera setulosa	+	+		+			
Olearia bullata			+	+			+
Olearia ilicifolia	+		+	+	+	+	+
Olearia nummulariifolia	+		+				
Ophioglossum coriaceum	+			+			+
Oreomyrrhis colensoi	+		+	+	+	+	+
Ourisia lactea	+		+	+		+	+

+ = present
– = recorded by others in past

	Mt Herbert, Mt Bradley Kaituna Spur	High Bare Peak	Mt Fitzgerald Mt Sinclair	French Hill, Saddle Hill	Bossu Rd. Carews Peak View Hill	Lavericks Peak Panama Rock	Stony Bay Peak Flag Peak
Ozothamnus leptophyllus	+						+
Parahebe lyallii	+		–	–	+		
Pentachondra pumila			–	+			+
Phormium cookianum	+	+	+	+	+	+	+
Plantago raoulii	+			+			+
Poa cita	+	+	+	+	+	+	+
Poa colensoi	+			+			+
Podocarpus hallii	+		+	+	+	+	+
Polystichum vestitum	+	+	+	+	+	+	+
Prasophyllum colensoi			+	+			+
Pratia angulata	+						+
Pseudopanax colensoi	+	+	+	+			+
Pteridium esculentum	+	+	+	+	+	+	+
Ranunculus foliosus	+		+	+			+
Ranunculus multiscapus	+	+		+			+
Ranunculus reflexus	+	+	+	+	+	+	+
Raoulia glabra	+			+	+		+
Raoulia monroi	+						+
Raoulia subsericea	+			+	+		+
Rubus cissoides	+	+	+	+	+	+	+
Rytidosperma buchananii			+				
Rytidosperma clavatum	+	+	+	+	+	+	+
Rytidosperma gracile	+	+	+	+	+	+	+
Rytidosperma thomsonii	+			+			+
Rytidosperma unarede	+	+	+	+	+	+	+
Scleranthus brockiei	+			+			
Senecio wairauensis	+		+	+	+	+	+
Uncinia rubra	+		+	+			+
Urtica incisa	+			+			+
Viola cunninghamii	+	+	+	+			+
Viola filicaulis	+		+				+
Wahlenbergia albomarginata	+		+	+			

How Many Species?

How diverse is this subalpine florula? Table 1 lists 129 native species, but my selection is pretty subjective. Some plants growing above 750 m on Banks Peninsula belong to species that occur only at those altitudes; others span the whole 920 m range from coast to crest; others are almost exclusively lower-altitude and just sneak into the lower subalpine zone here and there; others are exclusively upper montane and subalpine. Kānuka is an interesting case. Widespread across the Peninsula, it grows into an erect tree up to an altitude of around 750 m. It occurs up to 830 m, but above 750 m, and also on very wind-exposed sites as low as 550 m, it occurs only as a low, stunted shrub. So I have left it out of Table 1, and indeed at the beginning of this article listed it as an indicator of the upper boundary of the montane zone. Other species with a similar altitudinal range on Banks Peninsula but known to extend upwards into the alpine zone in the Southern Alps (e.g. *Blechnum penna-marina*, *Celmisia gracilenta*) I have included in Table 1.

It could be said that out of about 540 vascular plants native to Banks Peninsula, about 150 contribute to subalpine vegetation above 750 m. Of these, about 65 are more or less strictly upper montane and subalpine species. Fewer than 10 are restricted to sites above the 750 m contour.

Naturalised exotics dominate much of the Peninsula landscape at present. The subalpine zone is no exception, but overall the highest altitude vegetation is probably less diluted by alien invaders than low altitude vegetation. At least 26 naturalised exotic vascular plant species are common above 750 m, including *Agrostis capillaris* (browntop), *Anthoxanthum odoratum* (sweet vernal), *Dactylis glomerata* (cocksfoot), *Holcus lanatus* (Yorkshire fog), *Poa pratensis* (smooth meadow grass), *Cerastium fontanum* subsp. *vulgare* (perennial mouse-ear chickweed), *Hieracium pilosella* (mouse-ear hawkweed), *H. lepidulum* (tussock hawkweed), *Hypochoeris radicata* (catsear), *Leontodon taraxacoides* (hawkbit), *Linum catharticum* (fairy flax), *Rumex acetosella* (sheep sorrel) and *Taraxacum officinale* (dandelion). My records show gorse (*Ulex europaeus*) up to 855 m but broom (*Cytisus scoparius*) only up to 700 m.

Listing the native genera of upper altitude species on Banks Peninsula reads like a roll call from the distant Alps: *Acaena*, *Aciphylla*, *Anisotome*, *Brachyglottis*, *Celmisia*, *Chionochloa*, *Colobanthus*, *Dracophyllum*,

Euphrasia, *Forstera*, *Gaultheria*, *Geum*, *Gingidia*, *Hebe*, *Kelleria*, *Leucopogon*, *Ourisia*, *Parahebe*, *Pentachondra*, *Raoulia*, *Rytidosperma* and *Wahlenbergia.* There are two species of *Gentiana* on Banks Peninsula (*grisebachii* and *serotina*) but they are decidedly rare and local, and fail the list because they are known only from below 750 m.

This subalpine element in the flora of Banks Peninsula is significant and fascinating, but only a fraction of the rich flora in the high mountains far to the west.

REFERENCES

Meurk, C. D. 1984: Bioclimatic zones for the antipodes – and beyond? *New Zealand Journal of Ecology 7*: 175-181.

Wilson, H. D. 1993: Bioclimatic zones and Banks Peninsula. *Canterbury Botanical Society Journal 27*: 22-29.

White mountain violet *Viola cunninghamii*