ABOVE THE TREELINE

A NATURE GUIDE TO ALPINE NEW ZEALAND

ALAN F. MARK

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ALPHABETICAL LIST OF PLANT GENERA

Note: this list does not include mosses, liverworts, lichens and fungi.

PODOCARPACEAE
The podocarp family


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PODOCARPUS
Totara

'Seed with a foot'

A large Southern Hemisphere genus; one of the 7 native species is an alpine.

Podocarpus nivalis Hook.

'From high altitudes'

SNOW TOTARA, MOUNTAIN TOTARA

A low, sprawling, highly aromatic shrub to 2 m tall, usually without a main trunk. Plants are unisexual; male cones ripen in early summer, while the bright fleshy fruits mature in summer to autumn.

NORTH & SOUTH ISLANDS: Throughout most mountainous areas of the South Island but more local in the North Island, from Te Moehau to the central volcanic mountains and Ruahine Range. **SUBALPINE TO LOW ALPINE:** 700–1500 m. Occurs in subalpine scrub and low-alpine mixed snow tussock–scrub up to the shrubline. Often conspicuous on scree margins and stabilised debris slopes, including moraines.


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LEPIDOTHAMNUS

'Scale (leaved)' bushes.

Of the 2 native species, one reaches the alpine zone.

Lepidothamnus laxifolius

(Hook.f.) Quin. 'Loose-leaved'

PYGMY PINE

A scrambling, usually prostrate, slender shrub with branches up to 1 m or more long. The leaves are often glaucous and rather variable—up to 5 mm long in the juvenile stage but reduced to 1–2 mm in the adult. Most plants are unisexual; male cones shed their pollen in early summer, while the bright-crimson fruits ripen in late autumn and may persist into winter.

NORTH, SOUTH & STEWART ISLANDS: Widespread from the Volcanic Plateau south. **LOWLAND TO LOW ALPINE:** 100–1500 m. A feature of many poorly drained or boggy open sites, particularly sphagnum and cushion bogs, red-tussock grassland and poorly drained snow tussock–herbfield.


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THYMELAEACEAE
The daphne family

KELLERIA

After Engelhardt Keller, German author of an 1838 book on wine

A small genus from open uplands of the southwest Pacific. All 8 indigenous species are alpines and either cushion or low trailing herbs, characterised by minute, 4-petalled, white flowers.

Kelleria dieffenbachii (Hook.) Endl.
After Dr Dieffenbach, early naturalist with the New Zealand Company

Stems are creeping and highly branched. Leaves are short (<4 mm) and canoe-shaped with hairy tips. There are 3–8 flowers, male or female, in a small terminal head.

NORTH, SOUTH & STEWART ISLANDS: Widespread in mountain regions almost throughout. SUBALPINE TO LOW ALPINE: 600–1500 m. Often sparse in tussock grasslands, herbfield and fellfield.

Kelleria villosa Berggren 'With long soft hairs'

Forms pale-green, loose mats with pale-brown, hairy branches and short (3–4 mm) overlapping leaves near the stem tips. There are 3–4 flowers, male or female, in small terminal heads.

SOUTH ISLAND: Widespread but more common on the drier mountains. **Var. *barbata*** Heads, with a dense tuft of hairs at the leaf tip, is confined to the Rock and Pillar Range, Central Otago. SUBALPINE TO HIGH ALPINE: 500–1800 m. Both var. *villosa* and var. *barbata* occur in open snow-tussock grassland, herbfield, cushionfield, fellfield and early snowbanks. Var. *barbata* is Naturally Uncommon.

Kelleria paludosa Heads
'Swampy or marshy', referring to its habitat.

A pale-green, glabrous, loose cushion or creeping herb with light-brown stems and minute white flowers, up to 4 in small terminal heads.

SOUTH & STEWART ISLANDS: From mid-Canterbury south to eastern Fiordland and Stewart Island. LOW TO HIGH ALPINE: 950–2000 m. Often present in bogs, flushes (as a creeping herb) and early snowbanks (as a cushion).

Kelleria multiflora (Cheesem.) Heads
'Many-flowered'

Distinguished by more (5–15) flowers in the heads and leaves that are 4–6 mm long.

SOUTH ISLAND: In the wetter areas from Nelson–western Marlborough, southwards along and east of the Alps to south Westland. SUBALPINE TO LOW ALPINE: 900–1500 m. In snow-tussock grassland, herbfield and fellfield.

Kelleria laxa (Cheesem.) Heads
'Loose', referring to its habit

Forms loose patches (to 30 cm across) with flattened, densely overlapping leaves (4–7 mm long) with hairy tips; there are 3–8 flowers in a head.

NORTH & SOUTH ISLANDS: Volcanic Plateau, Kaimanawa Range south to Nelson and north Westland. SUBALPINE TO HIGH ALPINE: 900–1700 m. Snow-tussock grassland, herbfield and fellfield.

Kelleria croizatii Heads
After Leon Croizat, biogeographer

Forms dense, grey-green, soft cushions to 20 cm across. Flowers minute and usually single.

SOUTH ISLAND: From Nelson and southern Marlborough to southern Fiordland, along and east of the Alps. LOW TO HIGH ALPINE: 1000–2000 m. Snow-tussock grassland, herbfield, fellfield and rocky sites.

1. *Kelleria dieffenbachii*, Foggy Pk, Torlesse Ra, Nov, DP. 2. *K. dieffenbachii*, Porters Pass, Nov, MT. 3. *K. villosa* var. *villosa*, Mid Dome, Southland, 800 m, Nov, DL. 4. *K. villosa* var. *barbata*, Rock and Pillar Ra, 1300 m, Dec, DL. 5. *K. paludosa*, Old Woman Ra, 1400 m, Dec, JB. 6. *K. multiflora*, Camp Saddle, Craigieburn, Jan, KJ. 7. *K. laxa*, Cobb Vly, 1000 m, Nov, CJ. 8. *K. croizatii*, Mt Burns, 1600 m, Jan, KJ.


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CUSHION SPEARGRASSES

Aciphylla dobsonii Hook.f.
After Mt Dobson, where it was first collected

A very distinctive tufted herb that forms hard cushions up to 1 m or more across. The thick rigid leaves are 3-foliate, with 2 leaf-like stipules and a single blade, all with prominent yellow midribs. The spectacular, branched and crowded, yellowish flowerheads rise above the cushions on short stout stems.

SOUTH ISLAND: On the higher greywacke mountains of south Canterbury and north Otago. HIGH ALPINE: 1500–2200 m. Confined to fellfield, especially along exposed ridge crests, where it is often the most conspicuous plant.

Aciphylla leighii Allan
After Mr D. Leigh, who first collected it

Generally similar to but smaller than *Aciphylla dobsonii*, except that the leaves are softer and their tips quite blunt.

SOUTH ISLAND: Fiordland (Darran Mountains). HIGH ALPINE: 1800–2000 m. Confined to fellfield. Naturally Uncommon.

Aciphylla simplex Petrie
'Undivided', referring to the leaves

The cushions and their individual rosettes are similar to those of *Aciphylla dobsonii*, but there are no stipules so the thick rigid leaves are simple. The globose yellow flowerheads are smaller and more compact than in *A. dobsonii*.

SOUTH ISLAND: On the higher mountains of Central Otago and northern Southland. HIGH ALPINE: 1500–2000 m. Confined to fellfield and ledges of rocky bluffs, where it is often prominent.

1 & 2 (detail). *Aciphylla dobsonii*, Mt Dobson, Jan, KJ. 3 & 4 (detail). *A. simplex*, Hector Mts, 1900 m, Jan, JB. 5. *A. congesta*, Gertrude Saddle, 1300 m, Dec, DL. 6. *A. spedenii*, Hummock Peak, Eyre Mts, 1500 m, Jan, DL. 7. *A. crosby-smithii*, Mt Burns, 1450 m, Jan, DT. 8 *A. crosby-smithii*, Mt Burns, 1400 m, Jan, DL.

Aciphylla congesta Cheesem.
'Crowded', referring to the flowerheads

A tufted herb forming loose cushions up to 60 cm across. The dark-green leaves are rather thin and flexible, with leaf-like stipules plus 3–6 leaflets, all reaching a similar level, and large thin sheaths. The stout, almost fleshy flower stems end in crowded, white, globose heads ('snowballs') in both male and female plants.

SOUTH ISLAND: In the high-rainfall region of the southwest—South Westland, western Otago, northwestern Southland, Fiordland. LOW TO HIGH ALPINE: 1200–2000 m. Often one of the most conspicuous species on the more exposed sites in short snow tussock–herbfield, fellfield and early snowbanks. Naturally Uncommon.

Aciphylla spedenii Cheesem.
After J. Speden of Gore, who discovered it

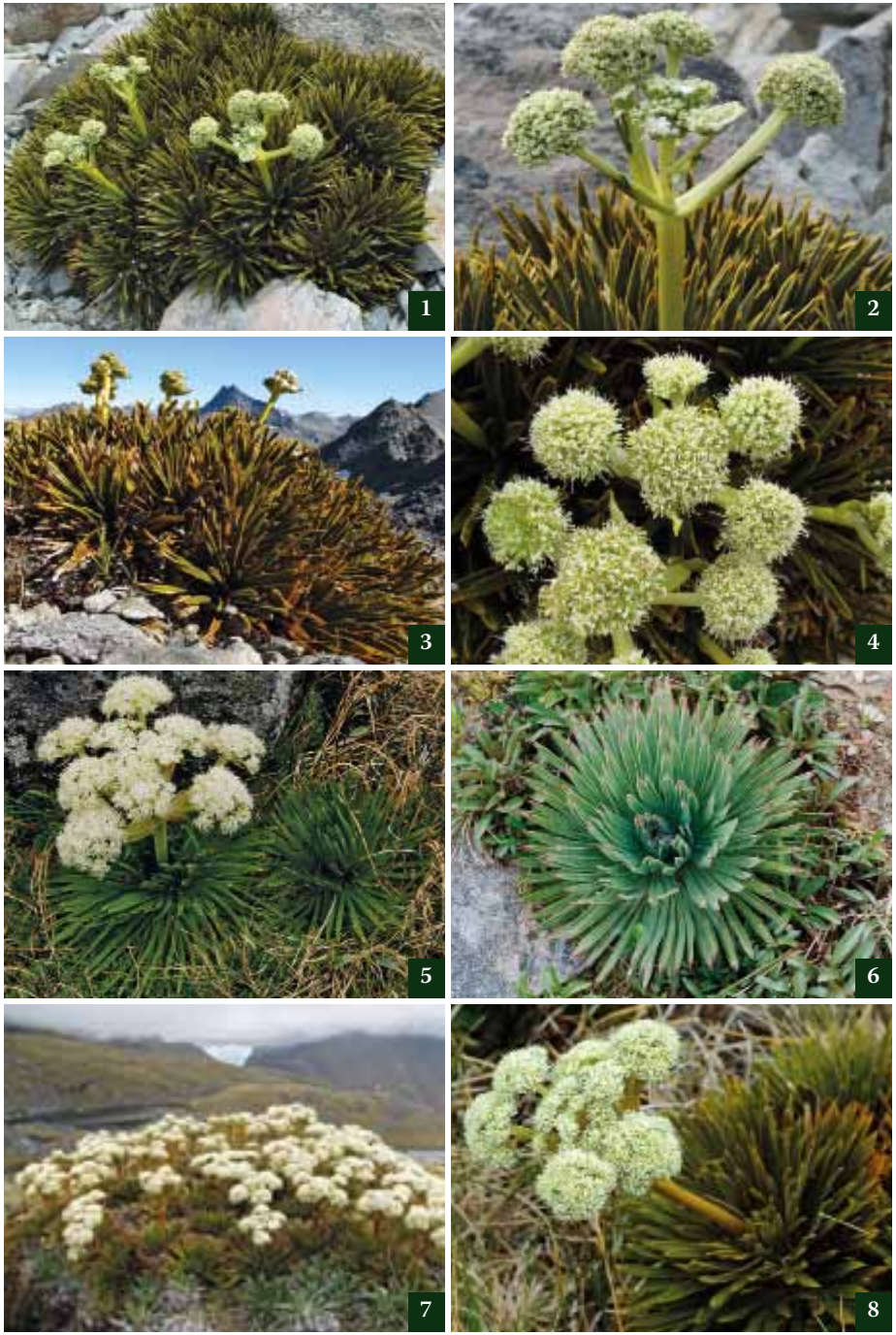
Very similar to *Aciphylla congesta* but slightly smaller in all its parts. It differs mainly in leaf shape: in this species the stipules and 5 leaflets fan out from the top of the sheath and are often red-tipped.

SOUTH ISLAND: Confined to the Eyre Mountains in northern Southland, apart from one record further west, in Fiordland (Gertrude Saddle). HIGH ALPINE: 1700–1900 m. Almost restricted to fellfield, where it may be prominent. Naturally Uncommon.

Aciphylla crosby-smithii Petrie
After J. Crosby-Smith, who first collected it

A rigid, semi-woody herb with bronze-coloured rosettes, usually forming cushions up to 60 cm or more across. The leaf-like stipules plus 7 (or 8) pairs of leaflets are thick and rigid, with prominent but smooth margins and midribs; their tips are rather abruptly narrowed into sharp points. The stout flower stems end in a fairly broad head with leafy bracts.

SOUTH ISLAND: Confined to southeastern Fiordland. LOW ALPINE: 1400–1600 m. May be locally common on fairly exposed rocky slopes in snow tussock–herbfield. Naturally Uncommon.



CELMISIA
Mountain daisies

From the Greek name Celmis, one of the attendants of Cybele, the Phrygian mother of the gods

A large Australasian genus of more than 60 species, centred in New Zealand. More than 50 of the 60 species described from the mainland reach the alpine zone. They rank with the snow tussocks as among the most important and characteristic groups of alpine vegetation. Their flowerheads are distinctive yet rather uniform between species, but there is a remarkable assortment of vegetative forms and leaf shapes within the genus. Hybridism is widespread and several have been named, although they are not often common in the field.

Celmisia sessiliflora Hook.f.
'With sessile flowers'

SILVER CUSHION MOUNTAIN DAISY

Forms dense, hard, greenish-grey cushions up to 1 m across. The thick rigid leaves (10–20 × 1.5–2.5 mm) are erect when young but later become reflexed. Flower stems are very short so that the heads open among the leaves. They usually elongate (to 3–5 cm) as the fruits ripen.

SOUTH & STEWART ISLANDS: Widespread in mountainous regions throughout. **SUBALPINE TO HIGH ALPINE:** 700–1800 m. Most important in short snow tussock–herbfield on permanently damp sites. It also occurs in cushion bogs, early snowbanks and on the less-exposed sites in fellfield and cushion vegetation.

Celmisia argentea Kirk 'Silvery'

SILVER CUSHION MOUNTAIN DAISY

The habit is similar to that of *Celmisia sessiliflora* but the individual rosettes are smaller and more tightly packed, and the cushions more silvery. Its leaves are usually smaller (6–12 × 0.5–1.5 mm), as are the flowerheads (1.5–2.5 vs 2–3 cm across), but as in *C. sessiliflora*, they open among the leaves and the stalks elongate as the fruits ripen.

SOUTH & STEWART ISLANDS: From eastern and Central Otago southwards. **MOSTLY SUBALPINE TO HIGH ALPINE:** 600–1400 m. Usually in cushion bogs overlying peat (herbmoor), but on the Central Otago ranges it may occur in well-drained cushionfield.

Celmisia clavata Simpson & Thomson
'Club-shaped', referring to the shape of the leafy branches

STEWART ISLAND SILVER CUSHION DAISY

It is similar to *Celmisia argentea* except for the stems, which are highly divided near their tips to form terminal leafy branches that are distinctly club-shaped.

STEWART ISLAND, SUBALPINE TO LOW ALPINE: 600–900 m. In cushion bogs overlying peat. Naturally Uncommon.

Celmisia philocremna D.R. Given 'Crag-loving'

EYRE MOUNTAINS DAISY

A very distinctive subshrub that forms hard compact cushions up to 1 m across and 15 cm thick. Its small, very thick, leathery leaves (18 × 4 mm) are shining bright to yellowish green and almost glabrous above (except when young), with strongly recurved margins, while the lower surface is completely covered in soft, felt-like, pale-yellow tomentum. Pale flower stalks reach 8–10 cm, with many small, narrow, densely woolly bracts that are tightly clustered in the bud and around the base of the flowerhead when it opens (to 3 cm across).

SOUTH ISLAND: Confined to the central Eyre Mountains, northern Southland. **LOW TO HIGH ALPINE:** 900–1600 m. Locally common on exposed rock bluffs in snow tussock–herbfield and fellfield. Naturally Uncommon.

1. *Celmisia sessiliflora*, Mt Robert, DP. 2. *C. sessiliflora*, Mt Robert, Jan, KJ. 3. *C. argentea*, Rock and Pillar Ra, 1250 m, Jan, DL. 4. *C. argentea*, Rock and Pillar Ra, Jan, AK. 5. *C. clavata*, Mt Rakeahua, Stewart Is, Feb, MT. 6. *C. philocremna*, Eyre Mts, 900 m, Jan, NS. 7. *C. philocremna,* Mt Bee, Eyre Mts, 1180 m, Jan, DL.

petal-like, but the outer ones are light brown and smaller.

SOUTH ISLAND: Widespread on the higher mountains from central Canterbury southwards. HIGH ALPINE: 1200–2000 m. A plant of highly exposed, virtually snow-free sites in fellfield and cushionfield.

Raoulia hectorii Hook.f.

After Sir James Hector, geologist and explorer

Var. *hectorii* forms hard, silvery-green mats up to 1 m or more across. Their tightly packed, short, erect, leafy branches are enclosed by small, tightly overlapping, tapered leaves (2–4 mm long) that are obviously thickened at the tip and covered in silvery tomentum. The small flowerheads (c. 4 mm across) at the stem tips are enclosed by pale, straw-coloured scales with tapered tips.

SOUTH ISLAND: On the higher and drier mountains from south Canterbury southwards through Central Otago to eastern Fiordland (Mt Burns). HIGH ALPINE: 1200–2000 m. One of the most important plants of cushionfield in all but the most exposed sites.

Var. *mollis* Buchan. ('with soft pubescence, like velvet', referring to the cottony base of the leaves) is similar apart from its brownish-green colour, cottony leaf bases and habitat. It occurs in permanently moist hollows within the cushionfield. It should probably rank as a separate species. Naturally Uncommon.

Raoulia eximia Hook.f. 'Exceptional'

Forms very dense, light-grey to dull-green cushions up to 2 m across and 30 cm or more thick. Both the leaves and stems are very tightly packed, but the dense covering of long soft hairs on both surfaces of the rounded leaf tips gives a velvety texture to the cushions. Small flowerheads (c. 3 mm across), sunken among the leaves at the stem tips, have 10–15 minute crimson florets.

SOUTH ISLAND: On the drier greywacke mountains from mid-Canterbury to north Otago, but recent DNA studies mean the inclusion of plants from northwest Nelson and north Westland, previously considered to be *Raoulia rubra*. This indicates much greater variation in *R. eximia* than previously thought. HIGH ALPINE: 1100–1800 m. This remarkable plant usually occupies frost-shattered but relatively stable rocks in both dry and wet fellfield.

1. *Raoulia hectorii* var. *hectorii*, Old Man Ra, 1600 m, Dec, DL. 2. *R. hectorii* var. *hectorii*, Old Man Ra, Jan, KJ. 3. *R. hectorii* var. *mollis*, Hector Mts, 1400 m, Jan, JB. 4. *R. hectorii* var. *mollis*, Old Woman Ra, MT. 5. *R. eximia*, Iron Hill, Dec, DP. 6. *R. eximia*, Mt Arthur, 1550 m, Jan, DL. 7. *R. mammillaris*, Ben More, 1400 m, Oct, PM. 8. *R. mammillaris*, Mt Cheeseman skifield, 1550 m, Feb, SC.

Raoulia mammillaris Hook.f.

'Breast-like', referring to the shape of the cushion surface

Its habit is similar to that of *Raoulia eximia* but the cushions rarely reach 1 m across. Also, the shorter hairs at the leaf tips (barely exceeding the tips, but a good lens is needed to see this) give the cushions a harsh texture, not soft as in *R. eximia*. Flowerheads are usually larger (up to 6.5 mm across), but more distinctive are the inner bract scales that surround the heads;

BORAGINACEAE
The borage family

MYOSOTIS
Forget-me-nots

'Mouse-ear', referring to the leaves

Contains c. 50 mostly temperate species, some 34 of which are native to New Zealand. Of these, 18 reach the alpine zone, but several are local in occurrence.

Myosotis pulvinaris Hook.f.
'Cushion-shaped'

CUSHION FORGET-ME-NOT

Forms soft, grey, rounded cushions up to 10 cm across. Individual stems are erect (1–3 cm long), unbranched above and crowded with small, silky-hairy leaves (5–7 × 3–5 mm). Towards the west and south of its range, the cushions are looser and the leaves greener because they have fewer and shorter hairs. Small white flowers occur singly among the leaves at the stem tips and may cover most of the cushion.

SOUTH ISLAND: On the higher mountains of Central–western Otago, northern Southland and southeastern Fiordland (Hunter Mountains). HIGH ALPINE: 1300–1900 m. Usually present in exposed cushionfield and fellfield.

Myosotis glabrescens L.B. Moore
'Almost glabrous'

The cushion habit and single flowers resemble those of *Myosotis pulvinaris* but only the young leaves are hairy.

SOUTH ISLAND: The Otago lakes district, within the range of *M. pulvinaris*, but it has not been collected recently. HIGH ALPINE: 1200–1600 m. Usually in fellfield. Data Deficient.

Myosotis cheesemanii Petrie
After T.F. Cheeseman, well-known early New Zealand botanist

Forms loose greyish cushions, with the colour and hairiness matching that of *Myosotis pulvinaris*. Two distinct features are branching near the tips of the short erect stems and flowers occurring 2–4 together in a small head rather than singly.

SOUTH ISLAND: Apparently confined to the Pisa Range, Dunstan Mountains and Mt Kyeburn, Central Otago. HIGH ALPINE: 1400–1600 m. Locally common in cushionfield. Nationally Endangered.

Myosotis albosericea Hook.f.
'With whitish hairs'

YELLOW FORGET-ME-NOT

Forms loose silvery mats with many narrow spathulate leaves (3 cm × 3 mm) that are densely covered in stiff straight hairs. The short unbranched flower stems carry several yellow flowers, c. 5mm across.

SOUTH ISLAND: Confined to the southern Dunstan Mountains, Central Otago. HIGH ALPINE: 1550–1700 m. Locally common in cushionfield around Leaning Rock, Dunstan Mountains. Nationally Critical.

Myosotis elderi L.B. Moore
After N.L. Elder, who noted it on the Tararua Range

A small rosette herb, usually with a few short, trailing branches that form patches up to 8 cm across. The rosette leaves have numerous long, soft, spreading hairs but only on the upper surface. Short flowerheads carry up to 12 congested, white (or blue or pinkish) flowers (4–8 mm across) in which the anthers barely protrude beyond the corolla tube and the styles are much longer than the calyx lobes.

NORTH & SOUTH ISLANDS: Tararua Range; much more widespread on South Island mountains—Canterbury, Central and western Otago, South Westland and Fiordland. LOW TO HIGH ALPINE: 1000–1700 m. Usually on loose fine debris in fellfield or in open snow-tussock grassland or herbfield.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1. *Myosotis pulvinaris*, Old Man Ra, 1680 m, Jan, DT. 2. *M. pulvinaris*, Old Man Ra, Jan, DP. 3 & 4 (detail). *M. glabrescens*, Hector Mts, Feb, MT. 5. *M. cheesemanii*, Mt Kyeburn, 1500 m, Dec, DL. 6. *M. albosericea*, southern Dunstan Mts, 1500 m, Dec, SN.

HEBE

From Greek mythology: the goddess of youth

A largely New Zealand genus of almost 100 species, about half of which reach the alpine zone. Important among the several criteria used in recognising species are: the position (lateral or terminal) and degree of branching of the flowerhead; leaf size (in the whipcord group they are reduced to small scales); in the leafy species, the presence or absence of a sinus (see Glossary) and, if present, its shape. Despite these and the more usual criteria of geographic distribution, plant size, and leaf size, margins and colour, the genus is not an easy one to master. Groupings of species adopted here follow Michael Bayly and Alison Kellow's 2006 *Illustrated Guide to New Zealand Hebes*, which also includes *Leonohebe*, and which is somewhat informal but an aid to identification. The order is also to assist comparison and identification.

THE WHIPCORD GROUP

Hebe tetragona (Hook.) Andersen

'Four-angled', referring to the branches

Veronica tetragona Hook.

Subsp. *tetragona* is a rigid, yellowish-green, low, spreading or bushy shrub. The whipcord stems are distinctly 4-angled, with narrow, strongly keeled and pointed scale leaves. Plants vary in the degree of overlapping and appression of the leaves and pronouncement of their tips. Compact flowerheads are at the branch tips.

Subsp. *subsimilis* (Col.) Bayly & Kellow ('rather similar', to subsp. *tetragona*) is generally smaller, with branches more rounded and leaves less keeled.

NORTH ISLAND: Subsp. *tetragona* occurs from Hikurangi southwards through the central North Island mountains to the northern Ruahine Range, where it is replaced by subsp. *subsimilis*, which is also on the Tararua Range and Mt Taranaki. SUBALPINE TO LOW ALPINE: 700–1700 m. The only whipcord species in the North Island, it occurs in mixed tussock–scrub, tussock–herbfield and in the low scrub covering vast areas of pumice on the central volcanoes.

Hebe hectorii (Hook.f.) Ckn. & Allan

After Sir James Hector, early geologist and explorer

= *Veronica hectorii* Hook.f.

Subsp. *hectorii* is a robust bushy whipcord shrub, up to 1 m tall, usually highly branched with many short (3–10 cm) but stout (2.5–3.5 mm across) erect branches that are rounded, except for their squarish tips. Scale leaves are broad and thick (2–2.5 mm long), rounded on the back and typically with broad blunt tips. Short flower spikes at the branch tips are crowded to form small terminal heads. Subsp. *hectorii* now includes *Hebe laingii* Ckn.

Subsp. *demissa* (G. Simpson) Bayly & Kellow ('low-lying', referring to the habit); *Veronica hectorii* subsp. *demissa* (G. Simpson) Garn.-Jones, has minutely pointed leaves (and now includes *H. subulata* G. Simpson), while **subsp. *coarctata*** (Cheesem.) Bayly & Kellow ('compressed', referring to the leaves); *Veronica hectorii* subsp. *coarctata* (Cheesem.) Garn.-Jones has narrower branches and rounded leaf tips.

SOUTH & STEWART ISLANDS: Subsp. *hectorii* is widespread from the Aoraki/Mt Cook district, southwards in the higher-rainfall regions to Foveaux Strait, while subsp. *coarctata* extends from Nelson to north Westland, and subsp. *demissa* is in Central Otago and the southern lakes district. SUBALPINE TO HIGH ALPINE: 900–1800 m. Often prominent in snow tussock–herbfield and mixed snow tussock–scrub. Small forms may extend into shallow snowbanks and moist depressions in fellfield and cushionfield.

Hebe propinqua (Cheesem.) Ckn. & Allan

'Resembling', referring to its similarity to *Hebe armstrongii*

Veronica propinqua Cheesem.

A distinctive, highly branched, spreading, dark-green whipcord shrub, up to 1 m tall. The many branches are slender (1–2 mm wide) and rounded, with distinctive thick, rounded scale leaves without a midrib. Small flowerheads develop at the branch tips.

1. *Hebe tetragona*, Richmond Ra, 1500 m, Jan RB. 2. *H. hectorii* subsp. *hectorii*, Mt Burns, DL. 3. *H. hectorii* subsp. *demissa*, Eyre Mts, 1200 m, Jan, DT. 4. *H. hectorii* subsp. *coarctata*, Mt Arthur, 1400 m, Jan, DL. 5. *H. hectorii* subsp. *coarctata*, Lake Sylvester, Jan, DP. 6 & 7. *H. propinqua*, Mt Bee, Eyre Mts, 1200 m, Mar, DL.


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CHIONOCHLOA
Snow tussocks, snow grasses

'Snow grass'

An Australasian genus of some 25 species, concentrated in New Zealand. Of the 23 mainland species, 17 reach the alpine zone, 5 of them with subspecies. Distributions range from local to widespread. The long-lived snow tussocks are usually the most prominent members of the low-alpine vegetation and give it much of its character. Most have a tussock or bunched habit (a few are sward-forming and therefore not 'snow tussocks') and their leaves have a short (1 mm) ligule as a ring of hairs. Flower characters are quite distinctive for the genus but rather uniform within it. Spikelets are large and contain several florets, while the flowering glumes each have a conspicuous awn, which is usually bent or twisted at the base. Vegetative features (leaf and sheath features and colour) are much more variable and therefore have been used to recognise most of the species and subspecies. Most species flower irregularly. A major distinction is whether the dead leaves persist or separate from the sheath (and whether the sheath persists or fractures), although subspecies within 2 species (*Chionochloa pallens* and *C. rubra*) are inconsistent in this feature. Nevertheless, it provides a useful start with identification and is used here.

PERSISTENT LEAF BLADES

Chionochloa australis (Buchan.) Zotov
'Southern'

CARPET GRASS

A distinctive, mat-forming, low-growing grass, up to 15 cm tall, which forms extensive carpets. Emergent flower stems, with usually purplish florets, may reach 40 cm tall.

SOUTH ISLAND: Nelson, northwest Canterbury and North Westland, north of Arthur's Pass. **LOW TO HIGH ALPINE:** 900–1800 m. It usually carpets large areas with its dense sward. Because it lies down-hill, steep slopes, which it favours, may be very slippery to cross.

Chionochloa oreophila (Petrie) Zotov
'Mountain-loving'

SNOW-PATCH GRASS

Forms small pale tussocks c. 15 cm tall, which may form an extensive turf.

SOUTH ISLAND: Widespread along and near the Alps, from Nelson to Fiordland. **MOSTLY HIGH ALPINE:** 1200–2000 m. Usually common in snowbanks, where it may form a complete turf; less important on stable sites in fellfield.

Chionochloa macra Zotov
'Slim', referring to its common name

SLIM SNOW TUSSOCK

Forms small, soft, spreading tussocks, up to 50 cm tall, with persistent, dark-brown, often purplish, rounded leaf sheaths. Leaves are 60 × 5 mm, dull green and flat to somewhat rounded. The ligule is 0.6 mm long, and flowerheads are up to 60 cm tall.

SOUTH ISLAND: Widespread on the drier interior mountains from northern Marlborough to central Southland. **MONTANE TO HIGH ALPINE:** 500–1900 m. It usually replaces *Chionochloa rigida* at higher altitudes south of the Rakaia Valley, but elsewhere it is common over a wide altitudinal range and restricted to shady slopes at lower altitudes.

Chionochloa nivifera Connor & K.M. Lloyd
Referring to its tolerance of prolonged snow-lie

FIORDLAND SNOW TUSSOCK

It resembles *Chionochloa macra* but has a shorter, more spreading habit and a western distribution.

SOUTH ISLAND: Southeastern Fiordland. **LOW TO HIGH ALPINE:** 1100–1600 m. Locally dominant among *C. crassiuscula* tussock grassland and areas with more prolonged snow-lie. Naturally Uncommon.

Chionochloa juncea Zotov
'Junceous', referring to the rounded, slightly rolled, *Juncus*-like leaves

NORTH WESTLAND TALL TUSSOCK

A tall (70 cm), rush-like tussock with narrow (1 mm), rolled, pointed leaves and very dark-brown sheaths. The flower stems emerge to be 90 cm tall.

SOUTH ISLAND: Confined to the coastal ranges northeast of Westport. **SUBALPINE TO LOW ALPINE:** 600–1100 m. Locally common on permanently wet sites in tussock grassland and shrubland on the Denniston Plateau and other foggy coastal ranges. Declining.


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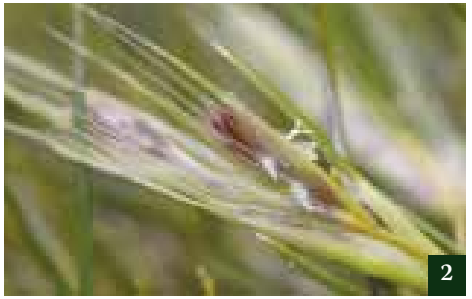
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1. *Chionochloa australis*, Rachel Ra, 1800 m, Dec, GC. 2. *C. australis*, L. Tennyson, Dec, MT. 3. *C. oreophila* (background) and *C. macra* (foreground), Harris Mts, Feb, MT. 4. *C. macra*, Hawkdun Ra, 1400 m, Jan, JB. 5. *C. nivifera*, Electric River, Fiordland, 1350 m, Apr, KL. 6. *C. juncea*, Denniston Plateau, 660 m, Mar, KL.

CRUSTOSE LICHENS

Thalli of custose lichens are very closely attached to the substratum (they have no lower cortex) and cannot readily be separated from it. They spread over substrata in often complex mosaics, separating from each other by black or brown lines (of prothallus) and looking very much like countries on a map. The surface may be smooth or rough, and continuous or cracked into patterns. Apothecia often contrast in colour with the thallus. In some crustose lichens the thallus all but disappears, leaving only the scattered apothecia.


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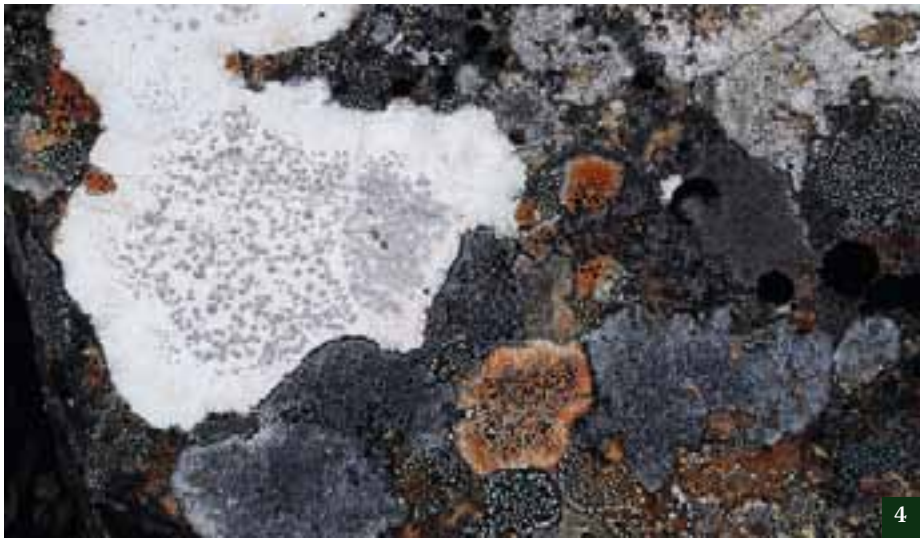
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1. *Lecanora polytropa*. 2. *Lecanora epibryon* ssp. *broccha*. 3. *Ramboldia sanguinolenta*. 4. *Lecanora farinacea,* DL. 5. *Haematomma alpinum*. 6. *Rhizocarpon geographicum*. 7. *Labyrintha implexa*. 8. *Tephromela atra*. 9. *Brigantiaea fuscolutea.* All photos (except 4) JL.


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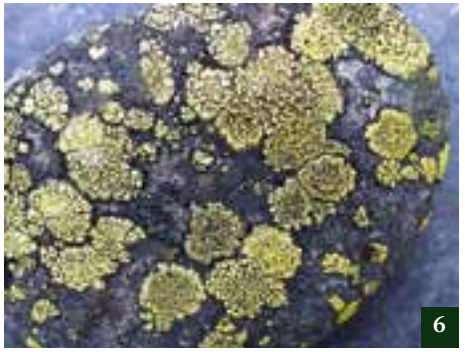
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FUNGI

Fungi decompose organic matter, releasing nutrients to be reused by plants; help plants take up nutrients from the soil; live inside plants, some producing chemicals that deter herbivores; and help plants compete with each other, shaping the vegetation communities above the treeline. Most of the time, fungi are hidden from view, but when they reproduce, many fungi emerge to produce spores, held high on fruiting bodies with a wide range of shapes, sizes and colours. The ephemeral nature of fungal fruiting bodies makes finding them an exciting experience. Correct identification often requires detailed microscopic examination, but with experience, many can be identified in the field, at least to genus level.

CUP FUNGI

Cup fungi reproduce sexually by producing spores on flat, saucer-shaped, cup-shaped or flask-shaped fruiting bodies. Many cup fungi form lichens—symbiotic associations with green algae and/or cyanobacteria (see page 376). Other cup fungi above the treeline are saprotrophs, living on decaying plant material.

Peziza nivalis is a snowbank species well known in the Northern Hemisphere and discovered in New Zealand in 2000. The brown cup-shaped fruiting bodies are produced near snowbanks as the snow is melting back.

GILLED FUNGI & PUFFBALLS

Above the treeline, the fungi commonly known as mushrooms, toadstools, brackets and puffballs are predominantly saprophytic, decaying and living off dead plant matter including wood in soil. Some, like *Omphalina* and the wax-caps (*Hygrocybe*), associate with bryophytes in alpine areas. Similar in appearance to *Omphalina* is *Lichenomphalia*, which forms symbiotic associations with algae.

The genus *Entoloma* has distinctive, angular spores. While it is well known from forest sites, it is also reported from montane areas in Australia and the Northern Hemisphere. *Entoloma perzonatum* occurs on mossy soil in alpine areas, as well as grassy and forest sites.

The firmly attached scales on the cap, white gills and ring on the stalk make *Lepiota* and its relatives fairly easy to identify in the field.


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1. *Peziza nivalis*, Broken River skifield, PJ. 2. *Omphalina* sp., Rangitaiki Conservation Area, JC. 3. *Lichenomphalia* sp. Lammerlaw Ra, DL. 4. *Entoloma perzonatum*, Mt Tennyson, Garvie Mts, DL. 5. *Hygrocybe* sp., Lammerlaw Ra, DL. 6. *Lepiota* sp. aff. *aspera*, Rangitaiki Conservation Area, JC.

male is mainly charcoal black. The female's call is an incessant, high-pitched cry, while the male makes quiet honking calls. Paradise ducks are common and widespread throughout New Zealand, particularly in the high country in tussock grasslands, wetlands and riverbeds. They are one of the few endemic birds to have benefitted from the clearing of native forests, preferring the soft grasses and clover of irrigated pastures.

The nest is usually in a hollow log or in a hole in the ground, but in forest it may sometimes be high in a hollow tree, or in the mountains, high on a steep rock face, far from any water. Up to 10 white eggs are laid, and the ducklings take c. 8 weeks to fledge, by which time they have plumage that is a similar colour to that of the male. During the moulting season in late summer, breeders and fledglings gather together in large flocks on open water, such as alpine lakes and tarns, for protection and safety until their flight feathers regrow and they are able to fly again after a couple of months.

Circus approximans

HARRIER

Readily distinguished by their slow, effortless flight, these 'hawks' (55 cm) are well distributed throughout New Zealand. Common in open country, they favour wetlands, high-country tussockland, scrubland and forest margins. Adults, particularly in high-country areas, may disperse from their breeding area to regular, warmer wintering-over areas. Pastoral development has helped the harrier's spread, as has the high number of road-killed possums and rabbits in rural areas. Such kills are a welcome source of additional food, particularly in the cold winter, when young harriers find it difficult to survive. Nests are built on the ground, often in swampy places, and the female lays 3–5 off-white eggs. Only the female incubates and feeds the chicks, while the male hunts and brings food to the nest. Fledging takes c. 45 days, and the young finally disperse c. 7 weeks after fledging. The harrier's plumage may be any shade of brown, from the dark black-brown of a recently fledged juvenile, through mid-browns to the the pale grey-brown of very old males.

Falco novaeseelandiae

FALCON

The falcon (45 cm) is distinguished from the harrier by its smaller size, darker plumage, pointed wings and more rapid flight. Widespread but rare throughout New Zealand, falcons are more common in the south, preferring the high country. The 'eastern' falcon is by far the most abundant of several noticeable 'forms' of our native falcon. It is a bird of the open high country of the eastern South Island, but there is also a smaller darker form, the 'bush' falcon, living in the forested hill country of the North Island and northwest South Island, and a more coastal 'southern' falcon in Fiordland, Stewart Island and the Auckland Islands. Falcons hunt small birds, lizards and insects, and will occasionally take prey as large as rabbits. They prefer hunting live prey, unlike harriers, which will often make do with carrion. The nest is usually a simple scrape in the ground on a rock ledge, on a slip face or under a rock overhang or a fallen log. In bush country it may be in a clump of *Astelia* perched high in a tree. Three or 4 chestnut-brown, blotched eggs are laid; these are mainly brooded by the female, while the male brings food to the nest. Chicks fledge in 30–35 days and are usually independent 2 months later. Often heard before it is seen, the falcon's call is a rapid 'kek-kek-kek'.

Gallirallus australis

WEKA

Weka (53 cm) are characteristically inquisitive, flightless native birds that once inhabited a variety of habitats, from the coast to the alpine zone. Weka declined dramatically between 1900 and the 1940s, becoming extinct through most of the North Island and on the east coast of the South Island. Like so many of our flightless native birds, their range has diminished through being hunted by introduced mammals, such as ferrets and stoats, as well as dogs. Where you can still find them (and often it is they that will find you), weka stalk around, their tails flicking nervously, as they keep a wary eye out for food such as insects or other invertebrates, lizards, the

1. *Circus approximans*, Clent Hill, Ashburton Lakes, RM. 2. *Falco novaeseelandiae*, Skippers Ck, Richardson Mts, MS. 3. *Gallirallus australis*, Newton Ck, Westland, RM.

GECKOS

NAULTINUS
Green geckos, mokokakariki

Naultinus stellatus Hutton 1872
NELSON GREEN GECKO

The Nelson green gecko is one of New Zealand's most beautiful geckos and exhibits a large variety of colour patterns over its geographic range to enable it to camouflage against the dominant vegetation of the area. Colours range from almost entirely olive-green in the far northwest of the South Island to predominately brown around Nelson Lakes. Some specimens have bold blotches and crosses of white, pink and olive green. This medium-sized gecko (up to 80 mm) is arboreal and generally lives in forest (including beech forest) and manuka–kanuka scrub, extending to the alpine zone in places. It has been recorded at 1500–1600 m on both the St Arnaud and Robert Ranges of Nelson. Because of its beauty, Nelson green geckos are prized by lizard-poachers. At Risk, Declining.

Naultinus gemmeus McCann 1955
JEWELLED GECKO

Jewelled geckos are medium-sized, up to 80 mm, bright lime-green with contrasting white diamonds or stripes on their backs. They can be sighted basking on popular walking tracks in the South Island mountains, casually ambling away when disturbed. Males in parts of Canterbury are brown and can be confused with *Woodworthia* species. Jewelled geckos occupy altitudes from sea level (Banks and Otago peninsulas) to 1500 m (in south Canterbury) and are found in a wide range of habitats, such as podocarp forests, tussock grasslands, shrublands and alpine herbfields. At Risk, Declining.

PREVIOUS PAGE: Cascades gecko, TJ. 1 & 2. Nelson green gecko, Nelson Lakes, TJ. 3. Jewelled gecko, Aoraki/Mt Cook, TJ. 4. Cupola Basin gecko, Nelson Lakes NP, TW.

MOKOPIRIRAKAU
Forest geckos, mokopirirakau

Mokopirirakau "Cupola Basin gecko"
The Cupola Basin gecko remains a mystery species, as yet undescribed. This elegantly patterned gecko is likely to be a new nocturnal alpine gecko that is geographically isolated from sister species. It was first discovered in 1968 above the treeline of the Cupola Basin near St Arnaud in Nelson Lakes National Park. A second specimen was found in 2007; it was thought to have been washed down the Sabine River, probably with a snow-and-rock avalanche. A recent expedition to unravel its taxonomic mysteries located a possible specimen at 1550 m within a bluff system in the Cupola Basin. Like all *Mokopirirakau* species, the most distinctive features are the orange mouth lining and long slender toes. Data Deficient.


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MOTHS

A bewildering array of diurnal (day-flying) moths greets the visitor above the treeline in all parts of New Zealand. They range in size from wingspans of just 1 mm up to 3 cm, with colour patterns varying from black and hairy through to bright orange and striped. All have a close relationship with certain plants and live in particular habitats, with a synchronised life history and precise emergence time. This predictability leads to a distinct seasonality for the moth fauna, with species emerging from early spring right through to late autumn and early winter, even when the first snow is in patches on the ground.

All three **tiger moths** in the genus *Metacrias* are found above the treeline, sometimes reasonably common in alpine grassland. They have brightly coloured males that fly rapidly in the hot sunshine, seeking out a female hidden under a rock in a nest of larval silk and hairs, along with the empty pupal shell. She is simply a buff-coloured, flightless ball of eggs. The densely hairy larvae feed on a variety of grasses and herbs, and are very mobile and conspicuous in their open habitat. As the female is incapable of flight, it is the larvae that are responsible for the spread of the population. It may seem surprising but the large, fast-moving, hairy larvae have stopped me in my car as they crossed the Upper Hollyford Road in northern Fiordland! The largest species, *M. erichrysa*, is found in the wetter mountains of the Alps, from Fiordland and north to the Ruahine Range in the North Island. The smaller *M. huttoni* is an eastern and central South Island alpine species, and *M. strategica* is a low-alpine species of the southeastern South Island down to sea level.


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Approximately 90 diurnal geometrid moths from 11 genera inhabit New Zealand's alpine zone. The largest genera are *Notoreas, Dasyuris, Paranotoreas* and *Aponotoreas*. Many more, particularly in the genera *Asaphodes* and *Xanthorhoe*, are easily disturbed in daytime and behave as if they were diurnal also. Most of these are brightly coloured and often striped, and look like miniature butterflies, even in their butterfly-like stance, with the wings held together over the body. Although most are described and quite well known, more species continue to be uncovered, such as one orange-brown species from the top of Banks Peninsula, where it lives in low-alpine wetlands, and another bright-orange species in the genus *Asaphodes* from wetlands on Mount Hutt in central Canterbury. All are fussy feeders: the larvae of *Notoreas* feed only on certain related plants, such as *Pimelea* and *Kelleria*, both from the daphne family (Thymelaeaceae); *Dasyuris* caterpillars feed on the carrot family (Apiaceae), represented mainly by *Aciphylla* and *Anisotome.*

Many of the geometrid moths are large diurnal moths with wingspans 2–3 cm, and they fly fast over alpine shrubs and grasslands. The majestic *Dasyuris hectori* has a striking black-and-white-striped underside. It flies rapidly over rocky areas high up on the eastern and central South Island mountains to 1900 m, whereas the tiny *Notoreas ortholeuca*, exquisitely marked in yellow and black, is found in high-alpine snowbanks to 2100 m on the Otago mountains.

Orange underwings in the genus *Paranotoreas* are often seen, as they delight in sunbathing on tracks and rocks above the treeline. With larvae

1. *Metacrias huttonii*, Old Man Ra, 1450 m, Dec. 2. *Asaphodes exoriens*, male, Mt Cardrona, 1500 m, Feb. 3. *Asaphodes nephelias*, female, Kakanui Mts, 1350 m, Feb. 4. *Dasyuris leucobathra*, Rock and Pillar Ra, 950 m, Nov. 5. *D. callicrena*, Rock and Pillar Ra, 1440 m, Dec. 6. *Notoreas ortholeuca*, Old Man Ra, 1650 m, Feb. 7. *N. chioneres*, The Remarkables, 1750 m, Mar. 8. *Paranotoreas ferox*, Kakanui Mts, 1440 m, Feb. 9. *P. opipara*, Hump Ra, 1000 m, Dec. All photos BP.


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GRASSHOPPERS: 1. *Paprides dugdalei*, Table Hill, Stewart Is, 700 m, Dec, BP. 2. *Brachaspis nivalis*, Kakanui Mts, 1600 m, Nov, BP. 3. *Sigaus australis*, Takitimu Mts, 1400 m, BP. WETA: 4. *Deinacrida connectens*, St Bathans Ra, 2050 m, Feb, BP. 5. *D. talpa* male, Mt Faraday, BR 6. *D. elegans* female, GG. 7. *Hemideina maori*, Rock and Pillar Ra, 1300 m, Dec, JD.

Both of the genera *Alpinacris* and *Paprides* contain very attractive green species and have species pairs, with one southern and one northern South Island species. The former are often snowbank species, with *A. tumidicauda* common on Central Otago and eastern Fiordland mountains, while *A. crassicauda* is widespread in northwest Nelson above the treeline. With their orange-coloured abdomen tips, these are easily distinguished grasshoppers.

In *Paprides*, the sleek green *P. dugdalei* is widespread in the low-alpine zone of southern mountains including Stewart Island, while *P. nitidus* in found from northwest Nelson south to the mountains of Canterbury.

The cryptic grey grasshoppers in the genus *Brachaspis* are scree specialists, where they are well camouflaged and adapted. Again, 2 species are found above the treeline, with *B. nivalis* distributed from the mountains of northern Otago to Marlborough, whereas *B. collinus* is found above the treeline from north Canterbury to northwest Nelson, but with an area of overlap with *B. nivalis*. Where they occur on the same alpine area, *B. collinus* is found higher and is a larger species that is also found in grassland in addition to the extensive screes.

WETA

Four groups of New Zealand's iconic weta are found above the treeline. All are flightless and some are surprisingly large-bodied, among the heaviest insects known. **Giant weta** in the genus *Deinacrida* are represented by 11 species, 6 of which live above the treeline. Most widespread is the scree weta, *D. connectens*, which inhabits the South Island mountains from Nelson and Marlborough south to the Takitimu Mountains of western Southland. This range is not continuous as it is missing from much of Central Otago and northern Southland. It is a high-alpine species, found as high as 2500 m but usually around 1500 m in scree and fellfield areas where there appears to be little vegetation apart from lichens and the occasional dead animal to feed on. Adults hide by day, deep within rocky areas. They grow to 8 cm in length.

In the Paparoa Range in the northwest of the South Island lives a burrowing giant weta, *Deinacrida talpa*. It is smaller than the other alpine weta, growing to slightly less than 5 cm. Another smaller species, *D. tibiospina*, is confined to the mountains of northwest Nelson at about 1500 m. The bluff weta, *D. elegans*, is a more widespread and a much larger species, found from the mountains of Canterbury to Marlborough up to 1600 m. This steel-blue, long-legged species lives in rock crevices in very steep terrain and is by necessity very agile. Meanwhile the large *D. pluvialis* lives in more luxuriant vegetation in the Alps, from Fiordland to the Mount Cook region. Lastly, a large species, *D. parva*, is found above the treeline in the Seaward and Inland Kaikoura ranges of coastal Marlborough, where it inhabits steep and rocky sites.

Surprisingly, one species within the **tree weta** group is found above the treeline. The large-bodied *Hemideina maori* has a widespread but patchy distribution in the South Island from northern Southland northwards. Typically, one male guards a harem of females in their rocky habitat between 1200 and 1500 m, and they feed on a variety of live and dead vegetation.