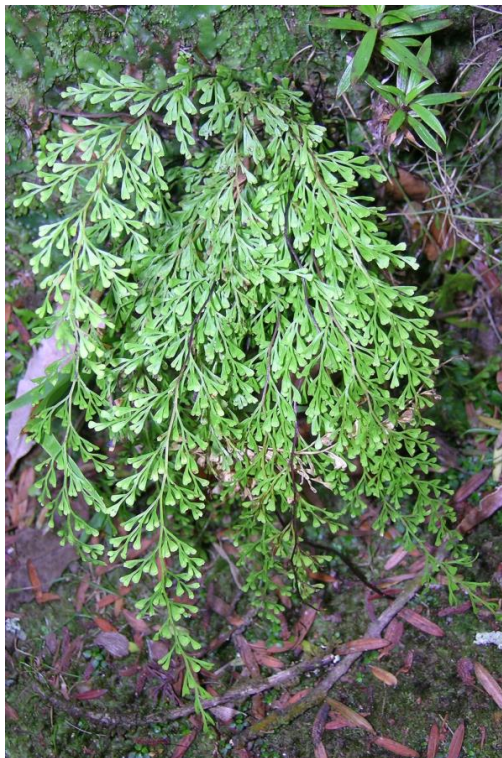




**FLORA OF NEW ZEALAND**  
**FERNS AND LYCOPHYTES**

**LINDSAEACEAE**



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**P.J. BROWNSEY & L.R. PERRIE**

Fascicle 17 – MARCH 2017

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#### CATALOGUING IN PUBLICATION

Brownsey, P. J. (Patrick John), 1948-

Flora of New Zealand [electronic resource] : ferns and lycophytes. Fascicle 17, Lindsaeaceae / P.J. Brownsey and L.R. Perrie. -- Lincoln, N.Z. : Manaaki Whenua Press, 2017.

1 online resource

ISBN 978-0-947525-05-7 (pdf)

ISBN 978-0-478-34761-6 (set)

1.Ferns -- New Zealand - Identification. I. Perrie, L. R. (Leon Richard). II. Title. III. Manaaki Whenua-Landcare Research New Zealand Ltd.

UDC 582.394.7(931)

DC 587.30993

DOI: 10.7931/B1D59W

This work should be cited as:

Brownsey, P.J. & Perrie, L.R. 2017: Lindsaeaceae. *In*: Breitwieser, I.; Wilton, A.D. *Flora of New Zealand - Ferns and Lycophytes*. Fascicle 17. Manaaki Whenua Press, Lincoln.  
<http://dx.doi.org/10.7931/B1D59W>

Cover image: *Lindsaea viridis*. Mature plant with pendent 3-pinnate fronds.

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## Introduction

The large and widespread tropical family Lindsaeaceae is represented in New Zealand by just two genera (*Lindsaea* and *Odontosoria*) and four species. The three species of *Lindsaea* are indigenous and all have a predominantly western distribution in New Zealand. *Lindsaea viridis* is the only endemic species, occurring in dark, wet forest from Great Barrier Island to the central Ruahine Ranges in the North Island, and in coastal areas of Marlborough, Nelson and Westland in the South Island. *Lindsaea trichomanoides* and *L. linearis* both also occur in Australia. In New Zealand, *L. trichomanoides* is a terrestrial forest species widespread in western parts of both islands from Te Pahi to Stewart Island, whilst *L. linearis* occurs on poor soils under scrub or in grassland and sedgeland, with centres of distribution in Northland and Auckland, from north-west Nelson to Wellington, and in the far south of the South Island and Stewart Island. *Odontosoria chinensis* is a casual species recorded once from Kerikeri.

All members of the family in New Zealand are terrestrial ferns with short- to long-creeping rhizomes. They are distinguished by their marginal or submarginal sori that tend to elongate around the edges of the lamina, protected by indusia that are attached at their bases and open towards the margin. Species of *Lindsaea* are also characterised by their red-brown or purple-brown stipes and rachises that are mostly glabrous.

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## ***Lindsaeaceae* C.Presl ex M.R.Schomb., *Reis. Br.-Guiana* 3, 883, 1048 (1849)**

**Type taxon:** *Lindsaea* Dryand. ex Sm.

Terrestrial (NZ) or rarely epiphytic (not NZ) ferns. Rhizomes short- to long-creeping, scaly. Fronds monomorphic or rarely dimorphic, not articulated to rhizome. Laminae 1–4-pinnate (NZ) or rarely undivided or more than 4-pinnate (not NZ), anadromous, herbaceous or coriaceous, glabrous (NZ) or rarely hairy (not NZ). Veins free (NZ), or rarely reticulate (not NZ). Sori oblong or extending laterally or almost continuous around the lamina margin, superficial, borne on abaxial surface, marginal or submarginal; paraphyses present; indusia present, attached at base and sometimes at the sides, opening towards the lamina margin; sporangial maturation mixed. Sporangia with vertical annulus, usually 32 spores per sporangium. Homosporous; spores monolete or trilete, lacking chlorophyll; perispores smooth or granulate.

**Taxonomy:** A family of eight or nine genera and about 200 species (Lehtonen et al. 2010), three-quarters of them in the genus *Lindsaea*.

The lindsaeoid ferns were extensively studied by Kramer and included by him in the Dennstaedtiaceae (Kramer 1990). However, Smith et al. (2006) recognised the Dennstaedtiaceae and Lindsaeaceae as two separate families, the latter encompassing eight genera – *Cystodium*, *Lindsaea*, *Lonchitis*, *Odontosoria*, *Ormoloma*, *Sphenomeris*, *Tapeinidium* and *Xyropteris*. The lindsaeoid ferns were only sparingly sampled in early molecular studies, but a comprehensive analysis of the family by Lehtonen et al. (2010) examined 73% of the species and all but one of the genera. They found six well-supported clades, which they recognised as the genera *Lindsaea*, *Nesolindsaea*, *Odontosoria*, *Osmolindsaea*, *Sphenomeris* and *Tapeinidium*. However, *Ormoloma* was found to be embedded in *Lindsaea*, the status of *Cystodium* and *Lonchitis* as members of the family was ambiguous, and the monotypic *Xyropteris* was not sampled. Although clearly distinct genetically, the genera of Lindsaeaceae are rather poorly defined morphologically, with few characters that can be consistently used to distinguish them. The Lindsaeaceae are believed to be one of the early-diverging lineages amongst the polypod ferns (Lehtonen et al. 2010).

The Lindsaeaceae are a largely tropical family. They are represented in New Zealand by only three indigenous species of *Lindsaea* and one species of *Odontosoria* that is known as a casual escape from cultivation. The family is also poorly represented in Australia where there are just 15 species of *Lindsaea* (Kramer & McCarthy 1998).

- 1 Laminae 1–3-pinnate-pinnatifid; stipes red- or purple-brown; sori oblong or often extending laterally around the lamina margin ..... *Lindsaea*  
Laminae 3–4-pinnate; stipes pale brown; sori oblong, rarely extending laterally ..... *Odontosoria*

**Distribution:** A pantropical family but with several species extending into temperate regions in South America, east Asia and Australasia (Lehtonen et al. 2010). The greatest diversity is found in the Old World tropics. Two non-endemic genera with four species in New Zealand; one endemic species.

### **Biostatus:**

**Table 1:** Number of species in New Zealand within *Lindsaeaceae* C.Presl ex M.R.Schomb.

<b>Category</b>	<b>Number</b>
Indigenous (Endemic)	1
Indigenous (Non-endemic)	2
Exotic: Casual	1
<b>Total</b>	<b>4</b>

**Recognition:** The Lindsaeaceae comprise predominantly terrestrial ferns with short- to long-creeping rhizomes, mostly 1–3-pinnate, glabrous fronds, marginal or submarginal sori that tend to elongate around the lamina edge, and indusia that are attached at the base and open towards the lamina margin. The sporangia have a vertical annulus.

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## ***Lindsaea* Dryand. ex Sm., *Mém. Acad. Roy. Sci. (Turin)* 5: 413 (1793)**

**Type taxon:** *Lindsaea trapeziformis* Dryand.

**Etymology:** Named in honour of Dr John Lindsay (1785–1803), a surgeon and botanist of Jamaica.

Terrestrial (NZ) or epiphytic (not NZ) ferns. Rhizomes short- to long-creeping, scaly. Rhizome scales non-clathrate, narrowly ovate or trichome-like. Fronds monomorphic or dimorphic. Stipes red- or purple-brown, glabrous. Laminae 1-pinnate to 3-pinnate-pinnatifid (NZ), or rarely undivided or more than 3-pinnate-pinnatifid (not NZ), herbaceous or coriaceous, glabrous or with scattered hairs. Veins free (NZ) or reticulate (not NZ). Sori oblong or extending laterally or almost continuous around the lamina margin, superficial, marginal or submarginal; paraphyses present. Indusia present, attached at base and sometimes at the sides, opening towards the lamina margin. Spores monolete or trilete, perispores smooth or granulate.

**Taxonomy:** The genus *Lindsaea* in Australia and New Zealand was revised by Kramer & Tindale (1976), who recognised 14 species in the region, of which three, *L. linearis*, *L. trichomanoides* and *L. viridis*, occurred in New Zealand. They assigned the Australasian species to two subgenera and six sections, but the molecular analyses of Lehtonen et al. (2010) subsequently showed that these groups were not monophyletic. Instead, Lehtonen et al. (2010) identified 13 clades within *Lindsaea*.

*Lindsaea viridis* belongs to clade II, along with species previously included in sections *Isoloma* and *Sambirania* by Kramer (1967, 1972). The clade extends from Madagascar, through Malesia and western Polynesia, to New Zealand. The sequences in this clade were found to be very divergent, suggesting that the extant species separated a long time ago. A base chromosome number for *L. viridis* of  $x = 44$  has been recorded (Brownlie 1961).

*Lindsaea linearis* belongs to clade VII along with *L. microphylla* Sw., and probably also *L. dimorpha* F.M.Bailey (although the latter species was not sequenced). This is an Australian clade, extending to New Caledonia and New Zealand. The species are dimorphic and cytologically distinct, with  $n = 34$  recorded from *L. linearis* in New Zealand (Brownlie 1958).

*Lindsaea trichomanoides* belongs to Clade X together with three New Caledonian species, *L. rufa* K.U.Kramer, *L. nervosa* Mett. and *L. prolongata* E.Fourn. The clade is biogeographically well-defined, being confined to eastern Australia, Tasmania, New Caledonia and New Zealand. Chromosome numbers of  $n = 40$  and  $n = 42$  have been recorded for *L. trichomanoides* (Brownlie 1957, 1965).

- |          |   |                       |
|----------|---|-----------------------|
| <b>1</b> | Laminae linear, 1-pinnate; fertile and sterile fronds dimorphic; primary pinnae flabellate; indusia strongly toothed .....  | <i>linearis</i>       |
|          | Laminae narrowly elliptic, elliptic, narrowly ovate or ovate, 1–3-pinnate-pinnatifid; fronds not dimorphic; primary pinnae ovate or narrowly ovate; indusia entire or only shallowly lobed or toothed ..... | <b>2</b>              |
| <b>2</b> | Primary pinnae arising at wide angle to rachis; ultimate lamina segments ovate to obovate, apices obtuse or rounded; indusia elongated, curved around the lamina margin .....                               | <i>trichomanoides</i> |
|          | Primary pinnae arising at narrow angle to rachis; ultimate lamina segments narrowly obovate, apices truncate; indusia oblong or slightly extended along the lamina margin, straight .....                   | <i>viridis</i>        |

**Distribution:** A pantropical genus of c.150 species extending into temperate regions of Japan, Australia and New Zealand (Lehtonen et al. 2010); the greatest diversity is in the Old World tropics with 19 species in Madagascar and the Indian Ocean (Roux 2009), 62 in Malesia (Kramer 1971), 15 in Australia (Kramer & McCarthy 1998) and perhaps 25 in the Pacific. Three species in New Zealand; one endemic.

**Biostatus:** Indigenous (Non-endemic).

**Table 2:** Number of species in New Zealand within *Lindsaea* Dryand. ex Sm.

Category	Number
Indigenous (Endemic)	1
Indigenous (Non-endemic)	2
<b>Total</b>	<b>3</b>

**Recognition:** In New Zealand, species of *Lindsaea* can be distinguished from the related *Odontosoria* by their red-brown stipes, 1–3-pinnate laminae, and sori that often extend laterally around the lamina margins. *Odontosoria* has pale brown stipes, 2–4-pinnate laminae, and sori that are usually oblong.

**Cytology:** A wide range of base chromosome numbers have been reported in *Lindsaea*, including  $x = 34, 40, 42, 44, 47$  and  $50$  (Lehtonen et al. 2010).

## ***Lindsaea linearis* Sw., J. Bot. (Schrader) 1800(2): 78 (1801)**

≡ *Adiantum lineare* (Sw.) Poir., *Encyc. Suppl.* 1, 139 (1810)

Holotype: N. Hollandia [Australia], S P5554 (image!; see Kramer & Tindale 1976)

= *Lindsaea lunata* Willd., *Sp. Pl.* 5 (1), 421 (1810) nom. illeg.

Holotype: Nova Hollandia [Australia], Herb. Willdenow, B-W 20050-01 0 (!online)

= *Lindsaea trilobata* Colenso, *Trans. & Proc. New Zealand Inst.* 16: 345 (1884)

≡ *Lindsaea linearis* var. *trilobata* (Colenso) C.Chr., *Mém. Acad. Roy. Sci. (Turin)* 5: 398 (1906)

Lectotype (selected by Brownsey & Perrie 2016): Wangaparapara [Whangaparapara], Great Barrier Island, Herb. W. Colenso ex Herb. C.P. Winkelmann, WELT P002771!

**Etymology:** From the Latin *linearis* (linear), a reference to the shape of the lamina in this species.

Rhizomes short- to long-creeping, up to 100 mm long (in herbarium specimens), 0.8–1.7 mm in diameter, with stipes arising 1–9 mm apart; bearing scales. Rhizome scales linear or narrowly ovate, 1–2 mm long, 0.1–0.2 mm wide, golden brown. Fronds dimorphic; fertile fronds 50–500 mm, rarely up to 700 mm long, held upright; sterile fronds 20–420 mm long, weakly ascending or prostrate. Stipes 50–390 mm long on fertile fronds, 10–150 mm long on sterile fronds, dark red-brown, glabrous or bearing scattered hairs up to 0.3 mm long. Rachises red-brown throughout, not winged, glabrous or bearing scattered hairs up to 0.4 mm long. Laminae 1-pinnate, linear, tapering to the apical pinna, 20–370 mm long in fertile fronds, 12–380 mm long in sterile fronds, 5–24 mm wide, light green on both surfaces, herbaceous, glabrous or bearing hairs up to 0.4 mm long near junction of pinnae with rachis. Primary pinnae in 8–44 pairs on fertile fronds, 3–27 pairs on sterile fronds, widely spaced especially proximally, flabellate; the longest at or below the middle, sessile or short-stalked, 3–13 mm long, 2–9 mm wide (the sterile slightly larger than the fertile); outer margin entire or shallowly lobed on fertile pinnae, crenate on sterile fronds. Sori extended along outer margins of pinnae; indusia extending laterally 3–12 mm, straight or slightly convex, free margin strongly toothed.

**Distribution:** North Island: Northland, Auckland, Volcanic Plateau, Gisborne, Southern North Island.

South Island: Western Nelson, Sounds-Nelson, Westland, Otago, Southland, Fiordland.

Chatham Islands, Stewart Island.

Altitudinal range: 15–1160 m.

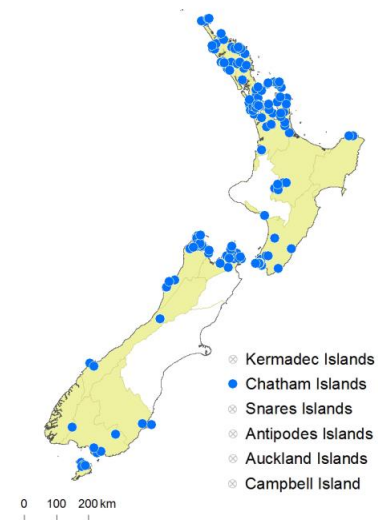
*Lindsaea linearis* has a patchy distribution in New Zealand and is apparently largely absent from eastern parts of both main islands. In the North Island it occurs in coastal and lowland sites from Te Pahi to Waikato and western Bay of Plenty, near East Cape, and around Wellington. It also occurs at higher elevations, from 750 to 1160 m, in the central North Island. In the South Island it occurs in coastal and lowland areas of north-west Nelson and the Marlborough Sounds, reaching 380 m on D'Urville Island. It is also known from scattered lowland sites in Westland, in the far south from Dunedin to Fiordland, and from Stewart Island and the Chatham Islands.

Also Australia (Western Australia, South Australia, Queensland, New South Wales, Victoria, Tasmania) and New Caledonia.

**Biostatus:** Indigenous (Non-endemic).

**Habitat:** *Lindsaea linearis* is a terrestrial fern of poor soils, most frequently found growing under mānuka, kānuka, gorse or bracken, in grassland or sedgeland, but sometimes in kauri forest, or along tracks and on forest margins. It tolerates clay, peat, greywacke, gumland, pākihi, serpentine and ultramafic substrates, and is found on dry banks as well as in *Sphagnum* and peat bog.

**Recognition:** *Lindsaea linearis* is recognised by its dimorphic fronds (the sterile prostrate and the fertile erect), linear pinnate laminae, and flabellate primary pinnae. The indusia extend along the



**Fig. 1:** *Lindsaea linearis* distribution map based on databased records at AK, CHR and WELT.



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margins of the pinnae and are strongly toothed. The fertile pinnae often droop and shrivel in the poor, dry soils that the plant can tolerate.

**Cytology:**  $n = 34$  (Brownlie 1958). This number is unique in the genus and the lowest recorded for *Lindsaea* (Lehtonen et al. 2010).

**Notes:** The name *Lindsaea lunata* Willd. is a superfluous name, citing the earlier name, *L. linearis* Sw. in synonymy. The fact that *L. linearis* is not listed elsewhere by Willdenow (1810) indicates that he regarded it as a synonym, and that he was not simply comparing the two.



**Fig. 2:** *Lindsaea linearis*. Prostrate sterile fronds of young plants.



**Fig. 3:** *Lindsaea linearis*. Sterile frond of young plant showing flabellate pinnae.



**Fig. 4:** *Lindsaea linearis*. Sterile fronds showing red-brown stipules and rachises.



**Fig. 5:** *Lindsaea linearis*. Plants showing prostrate sterile fronds and erect fertile fronds.



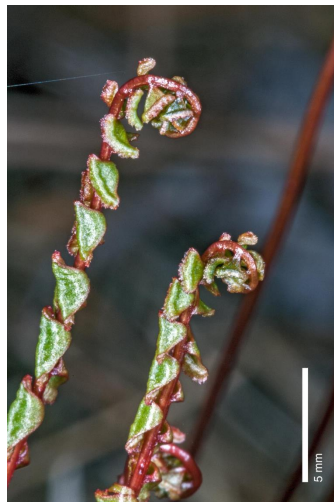
**Fig. 6:** *Lindsaea linearis*. Plants showing prostrate sterile fronds and erect fertile fronds.



**Fig. 7:** *Lindsaea linearis*. Mature fertile fronds showing red-brown stipes and rachises.



**Fig. 8:** *Lindsaea linearis*. Flabellate pinnae on fertile fronds bearing toothed indusia opening away from lamina margin.



**Fig. 9:** *Lindsaea linearis*. Apices of fertile fronds showing glabrous, red-brown rachises.

### ***Lindsaea trichomanoides* Dryand., *Trans. Linn. Soc. London* 3: 43, t. 11 (1797)**

≡ *Adiantum trichomanoides* (Dryand.) Poir., *Encyc. Suppl.* 1, 140 (1810)

≡ *Schizoloma trichomanoides* (Dryand.) Kuhn, *Festschrift zu dem Fünfzigjährigen Jubiläum der Königstädtischen Realschule zu Berlin* 346 (1882)

Holotype: New Zealand, Dusky Bay, *Arch. Menzies*, BM 001044445! (see Kramer & Tindale 1976); isotype E 00163923 (!online)

= *Adiantum cuneatum* G.Forst., *Fl. Ins. Austr.*, 84 (1786)

≡ *Lindsaea cuneata* (G.Forst.) C.Chr., *Index Filic.*, 392 (1906) nom. illeg. non *Lindsaea cuneata* Willd. 1810

Lectotype (selected by Kramer & Tindale 1976): Nova Zeelandia [New Zealand], *Forster* 338, GOET 012823 (!online); syntypes BM 001044446 (!online), UPS-T 25014

= *Lindsaea lessonii* Bory in Duperrey, *Voy. Monde, Crypt.*, 278, t. 37, f. 2 (1829)

≡ *Lindsaea trichomanoides* var. *lessonii* (Bory) Hook.f., *Bot. Antarct. Voy. II (Fl. Nov.-Zel.) Part II*, 19 (1854)

≡ *Lindsaea cuneata* var. *lessonii* (Bory) C.Chr., *Index Filic.*, 395 (1906)

Holotype: Baie des Iles, Nouvelle-Zélande [Bay of Islands, New Zealand], *Lesson s.n.*, *voy. Coquille No. 119*, P 00633789! (see Kramer & Tindale 1976)

**Etymology:** From the Greek *Trichomanes* (a filmy fern), and *-oides* (like), a reference to the perceived similarity of this fern to some species of *Trichomanes*.

Rhizomes short- to long-creeping, up to 200 mm long (in herbarium specimens), 1–2 mm diameter, with stipes arising 1–15 mm apart; bearing scales. Rhizome scales narrowly ovate, 0.8–2 mm long, 0.2–0.5 mm wide, red-brown. Fronds monomorphic, 70–440 mm long, held upright. Stipes 20–240 mm long, red- or chestnut-brown, glabrous or with scattered scales proximally. Rachises chestnut-brown, sometimes becoming pale brown distally, very narrowly winged distally, glabrous. Laminae usually 2-pinnate to 2-pinnate-pinnatifid, rarely 1-pinnate-pinnatifid or 3-pinnate, ovate to narrowly ovate or narrowly elliptic to elliptic, tapering to a pinnatifid apex, 35–260 mm long, 15–100 mm wide, green on both surfaces, herbaceous, glabrous. Primary pinnae in 5–14 pairs below pinnatifid apex, widely spaced especially proximally, arising at a wide angle to the rachis and usually not overlapping, ovate or narrowly ovate; the longest below the middle, 9–90 mm long, 5–24 mm wide, apices acute or obtuse, bases short-stalked; proximal pinnae divided into one or more secondary segments or pinnae in the proximal half (except in the smallest fronds). Secondary pinnae gradually decreasing in length along each primary pinna to the distal end; the longest secondary pinnae ovate or elliptic or obovate, 4–18 mm long, 2–9 mm wide, apices acute or obtuse or rounded, bases stalked or sessile sometimes partly or completely divided into tertiary segments up to 6 mm long and 4 mm wide; the distal secondary pinnae obovate, elliptic or oblong or narrowly oblong, apices acute or obtuse, bases adnate. Sori more or less continuous around outer margins of ultimate segments; indusia extending laterally around lamina segments, curved, free margin entire or shallowly lobed.

**Distribution:** North Island: Northland, Auckland, Volcanic Plateau, Gisborne, Taranaki, Southern North Island.

South Island: Western Nelson, Sounds-Nelson, Westland, Canterbury, Fiordland.

Stewart Island.

Altitudinal range: 10–1050 m.

*Lindsaea trichomanoides* occurs in lowland and montane areas throughout much of the North Island from Te Pahi southwards, but is uncommon in the east. It extends from near sea level up to c. 1050 m on Mt Hauhungatahi but is rare above 750 m. In the South Island it occurs in the Marlborough Sounds, north-west Nelson, and along the West Coast to Fiordland and Stewart Island. It extends from near sea level to 600 m on the Heaphy Track, north-west Nelson. There is a collection from Bush Stream, Waimakariri (CHR 521359), which is the only precise record for the eastern South Island, although there is another from “Central Otago” (CHR 600330).

Also Australia (New South Wales, Victoria, Tasmania).

**Biostatus:** Indigenous (Non-endemic).

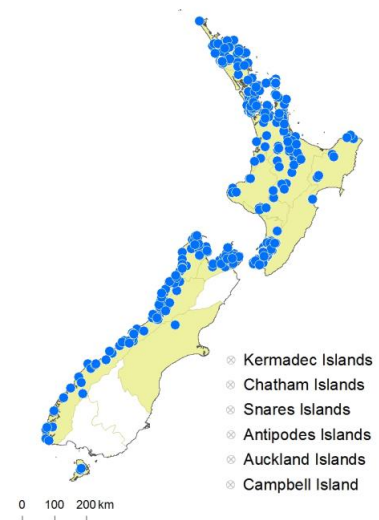
**Habitat:** *Lindsaea trichomanoides* is a terrestrial fern found under kauri, podocarp, broadleaved and beech forest, or under mānuka and kānuka. It usually grows on the ground, or at the base of tree trunks, amongst tree roots, in litter or humus hummocks, on logs, on stream and track banks, or in damp gullies.

**Recognition:** *Lindsaea trichomanoides* is recognised by its monomorphic fronds with red-brown stipes and rachises. The laminae are very variable in shape and dissection – usually 2-pinnate to 2-pinnate-pinnatifid, but sometimes only 1-pinnate-pinnatifid or as much as 3-pinnate. The primary pinnae arise at a wide angle to the rachis and rarely overlap. The ultimate segments are ovate to obovate with obtuse or rounded apices. The indusia curve around the margins of the ultimate segments with the free margin more or less entire.

**Cytology:** n = 42, 43 (Brownlie 1957, as *Lindsaea cuneata*).

**Notes:** The species was first recorded in New Zealand as *Adiantum cuneatum* (Forster 1786). However, the combination *Lindsaea cuneata*, made by Christensen (1905–1906) and used in earlier Floras, is preoccupied by *L. cuneata* (Willdenow 1810).

The name *L. lessonii* Bory has frequently been used at varietal rank for pinnate forms of *L. trichomanoides*. However, Kramer & Tindale (1976) and Brownsey & Smith-Dodsworth (2000) treated these forms as just part of the range of variation in *L. trichomanoides*.



**Fig. 10:** *Lindsaea trichomanoides* distribution map based on databased records at AK, CHR and WELT.

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Lehtonen et al. (2010) found no DNA sequence differences between *L. trichomanoides* and *L. rufa* Kramer from New Caledonia (Kramer 1967). The two species are also very similar morphologically, and their relationship requires further investigation.



**Fig. 11:** *Lindsaea trichomanoides*. Mature plant growing in leaf litter on forest floor.



**Fig. 12:** *Lindsaea trichomanoides*. Arching fronds of mature plant.



**Fig. 13:** *Lindsaea trichomanoides*. Mature 2-pinnate frond.



**Fig. 14:** *Lindsaea trichomanoides*. Mature 2-pinnate frond with red-brown rachis becoming green distally.



**Fig. 15:** *Lindsaea trichomanoides*. Mature 2-pinnate frond with red-brown rachis becoming green distally.



**Fig. 16:** *Lindsaea trichomanoides*. Mature 2-pinnate-pinnatifid frond.



**Fig. 17:** *Lindsaea trichomanoides*. Abaxial surface of fertile pinnae showing entire indusia opening away from lamina margin.



**Fig. 18:** *Lindsaea trichomanoides*. Abaxial surface of fertile pinnae showing sori and indusia continuous around much of lamina margin.

***Lindsaea viridis* Colenso, *Tasmanian J. Nat. Sci.* 2: 174 (1845)**

≡ *Odontosoria viridis* (Colenso) Kuhn, *Festschrift zu dem Fünfzigjährigen Jubiläum der Königstädtischen Realschule zu Berlin* 26 (1882)

≡ *Stenoloma viride* (Colenso) C. Chr., *Index Filic. Suppl.* 3, 174 (1934)

≡ *Sphenomeris viridis* (Colenso) Brownlie, *Trans. Roy. Soc. New Zealand* 87: 197 (1959)

Lectotype (selected by Allan 1961): Deep glens, dense woods, near Tauranga, Jan. 1842, W. Colenso, WELT P003226!

**Etymology:** From the Latin *viridis* (fresh-green), a reference to the bright green fronds of this species.

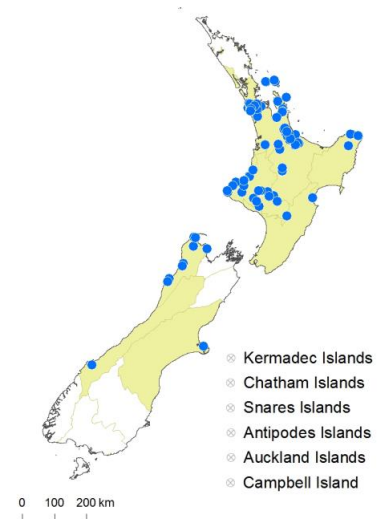
Rhizomes erect to short-creeping, up to 30 mm long (in herbarium specimens), 1.5–2 mm diameter, with stipes closely inserted; bearing scales. Rhizome scales narrowly ovate, 2–5 mm long, 0.2–0.5 mm wide, red-brown or golden brown. Fronds monomorphic, 40–400 mm long, laxly arching or pendent. Stipes 10–140 mm long, purple-brown or red-brown, glabrous. Rachises purple-brown or red-brown, becoming pale brown distally, narrowly winged distally, glabrous. Laminae 2-pinnate to 3-pinnate-pinnatifid, narrowly elliptic or narrowly ovate, tapering to a pinnate apex, 30–300 mm long, 8–80 mm wide, bright green on both surfaces, herbaceous, glabrous. Primary pinnae in 7–20 pairs below terminal pinna, widely spaced especially proximally, arising at a narrow angle to the rachis and often overlapping, ovate or narrowly ovate; the longest below the middle, 5–90 mm long, 3–24 mm wide, apices acute or obtuse, bases short-stalked, divided into secondary pinnae. Secondary pinnae gradually decreasing in length along each primary pinna to the distal end; the longest secondary pinnae elliptic, 3–22 mm long, 1.5–11 mm wide, apices obtuse, bases stalked, sometimes divided into tertiary segments. Tertiary pinnae narrowly obovate, 4–7 mm long, 1–4 mm wide, apices truncate, bases stalked or adnate. Sori oblong or broader than long; indusia extending laterally 1–3 mm, more or less straight, free margin entire or slightly toothed.

**Distribution:** North Island: Auckland, Volcanic Plateau, Gisborne, Taranaki, Southern North Island.

South Island: Western Nelson, Westland, Canterbury.

Altitudinal range: 0–850 m.

In the North Island, *Lindsaea viridis* occurs in lowland to montane areas from Great Barrier Island to the Bay of Plenty, East Cape, Waikato and Taranaki, but has not been recorded south of the central Ruahine Ranges. There is an isolated 19th century record from Petane, Hawke's Bay (WELT P006895), but the species is otherwise absent from the east coast. It ranges from c. 30 m in Taranaki and at East Cape to 850 m on Mt Pirongia but is rare above 450 m. In the South Island it occurs in lowland sites of north-west Nelson as far south as Charleston, with outlying populations in the Cascade Valley near Jacksons Bay (CHR 311100; only approximately plotted on the map), and on Banks Peninsula. It ranges from near sea level to 100 m. There are early records that suggest it once had a wider distribution. There is a collection in the Armstrong Herbarium made in 1868 from Pigeon Bay (CHR 633526), but the species has not been recorded from Banks Peninsula since then (Wilson 2013). Also, Kramer & Tindale (1976) cite a collection made by Sinclair and Haast in 1860 from the "Province of Canterbury" (K, *n.v.*) and Cheeseman (1925) cites a Buchanan collection (*n.v.*) from the "Sounds of the West Coast". These localities cannot be precisely identified but are almost certainly outside the known distribution indicated on the map.



**Fig. 19:** *Lindsaea viridis* distribution map based on databased records at AK, CHR and WELT.

**Biostatus:** Indigenous (Endemic).

The species was given a conservation status of 'Naturally Uncommon' by de Lange et al. (2013).

**Habitat:** *Lindsaea viridis* is a terrestrial fern that grows in dark podocarp and broadleaved forest, on damp banks and rock faces, on rocks and boulders in streams, on river banks, beside waterfalls, and on road cuttings, often with mosses. It is an uncommon species, most frequently found above c. 100 m.

**Recognition:** *Lindsaea viridis* is recognised by its monomorphic fronds, purple-brown stipes and rachises, and narrowly elliptic to narrowly ovate laminae that are 2-pinnate to 3-pinnate-pinnatifid. The primary pinnae arise at a narrow angle to the rachis and often overlap. The ultimate segments are narrowly obovate and truncate. The indusia are oblong or slightly wider than long, and straight rather than curved.

**Cytology:** n = c. 88 (Brownlie 1961).



**Fig. 20:** *Lindsaea viridis*. Mature plant with pendent 2-pinnate fronds.



**Fig. 21:** *Lindsaea viridis*. Mature plant with pendent 2-pinnate-pinnatifid fronds.



**Fig. 22:** *Lindsaea viridis*. Mature plant with pendent 3-pinnate fronds.



**Fig. 23:** *Lindsaea viridis*. Mature plant with pendent fertile frond.



**Fig. 24:** *Lindsaea viridis*. Adaxial surface of fertile 3-pinnate frond showing truncate lamina segments.



**Fig. 25:** *Lindsaea viridis*. Abaxial surface of fertile frond showing oblong entire indusia opening away from lamina margin.

## ***Odontosoria* Fée, *Mém. Foug.*, 5. *Gen. Filic.*, 271 (1852)**

**Type taxon:** *Odontosoria uncinella* (Kunze) Fée

**Etymology:** From the Greek *odonto-* (toothed), and *soros* (sorus), a reference to the appearance of the sori.

Terrestrial ferns. Rhizomes short- to long-creeping, scaly. Rhizome scales non-clathrate, narrowly ovate or trichome-like. Fronds monomorphic. Stipes pale brown, glabrous. Laminae 2–4-pinnate, herbaceous or coriaceous, glabrous. Veins free. Sori oblong or slightly extended laterally, superficial, marginal or submarginal; paraphyses present. Indusia always present, attached at base and sides, opening towards the margin. Spores monoletate or trilete, perispores smooth or granulate.

**Taxonomy:** As circumscribed by Lehtonen et al. (2010), *Odontosoria* includes many species that were previously treated in *Sphenomeris*. It remains poorly defined morphologically, albeit genetically distinct from the other genera of Lindsaeaceae.

**Distribution:** A pantropical genus of more than 20 species (Kramer 1990; Lehtonen et al. 2010), with 12 in the Neotropics and the remainder in the Old World tropics and Pacific islands. Absent from Australia (Kramer 1990). One species casual in New Zealand.

**Biostatus:** Exotic; casual.

**Table 3:** Number of species in New Zealand within *Odontosoria* Fée

Category	Number
Exotic: Casual	1
<b>Total</b>	<b>1</b>

**Recognition:** In New Zealand, *Odontosoria* can be distinguished from species of *Lindsaea* by its pale brown stipes, 3–4-pinnate laminae, and sori that are usually oblong. Species of *Lindsaea* have red-brown stipes, 1–3-pinnate-pinnatifid laminae, and sori that often curve around the lamina margins.

### ***Odontosoria chinensis* (L.) J.Sm. in Seemann, *Bot. Voy. Herald*, 430 (1857)**

≡ *Trichomanes chinense* L., *Sp. Pl.*, 1099 (1753) — as *chinensis*  
≡ *Sphenomeris chinensis* (L.) Maxon, *J. Wash. Acad. Sci.* 3: 144 (1913)  
Type: not designated (Jarvis 2007)

**Etymology:** *chinensis* (Latin) – from China.

**Distribution:** North Island: Northland.

Altitudinal range: c. 10 m.

Known only from one collection at Kerikeri, Bay of Islands.

Occurs naturally in the Old World tropics from Madagascar to Polynesia. It has a tendency to become weedy (Kramer 1990).

**Biostatus:** Exotic; casual.

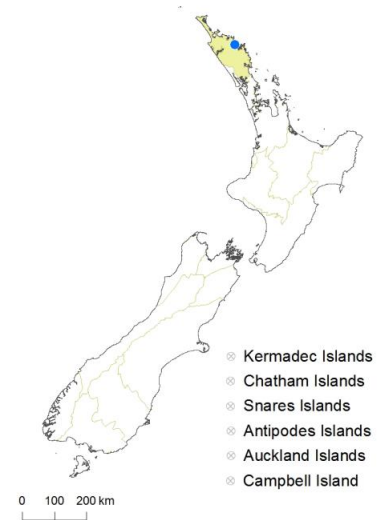
**Habitat:** Recorded as self-sown in a pot of *Lastreopsis glabella*, which it eventually smothered.

**First record:** Heenan et al. (2004, p. 802 – as *Sphenomeris chinensis*). Voucher AK 284226, 2003.

**Recognition:** *Odontosoria chinensis* is recognised by its terrestrial habit, short-creeping rhizomes, pale brown stipes and rachises, 3–4-pinnate laminae, and narrowly obovate ultimate segments. sori are oblong, and the indusia are attached at the base and sides, opening towards the margin.

**Notes:** *Odontosoria chinensis* was previously commonly known as *Sphenomeris chinensis*.

It is sometimes sold in New Zealand garden centres incorrectly labelled as the native species *Lindsaea viridis* (Heenan et al. 2004). It is distinguished from that species by its pale brown stipes and rachises, broader laminae, and widely spaced pinnae that arise at wider angles.



**Fig. 26:** *Odontosoria chinensis* distribution map based on databased records at AK, CHR and WELT.



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## Acknowledgements

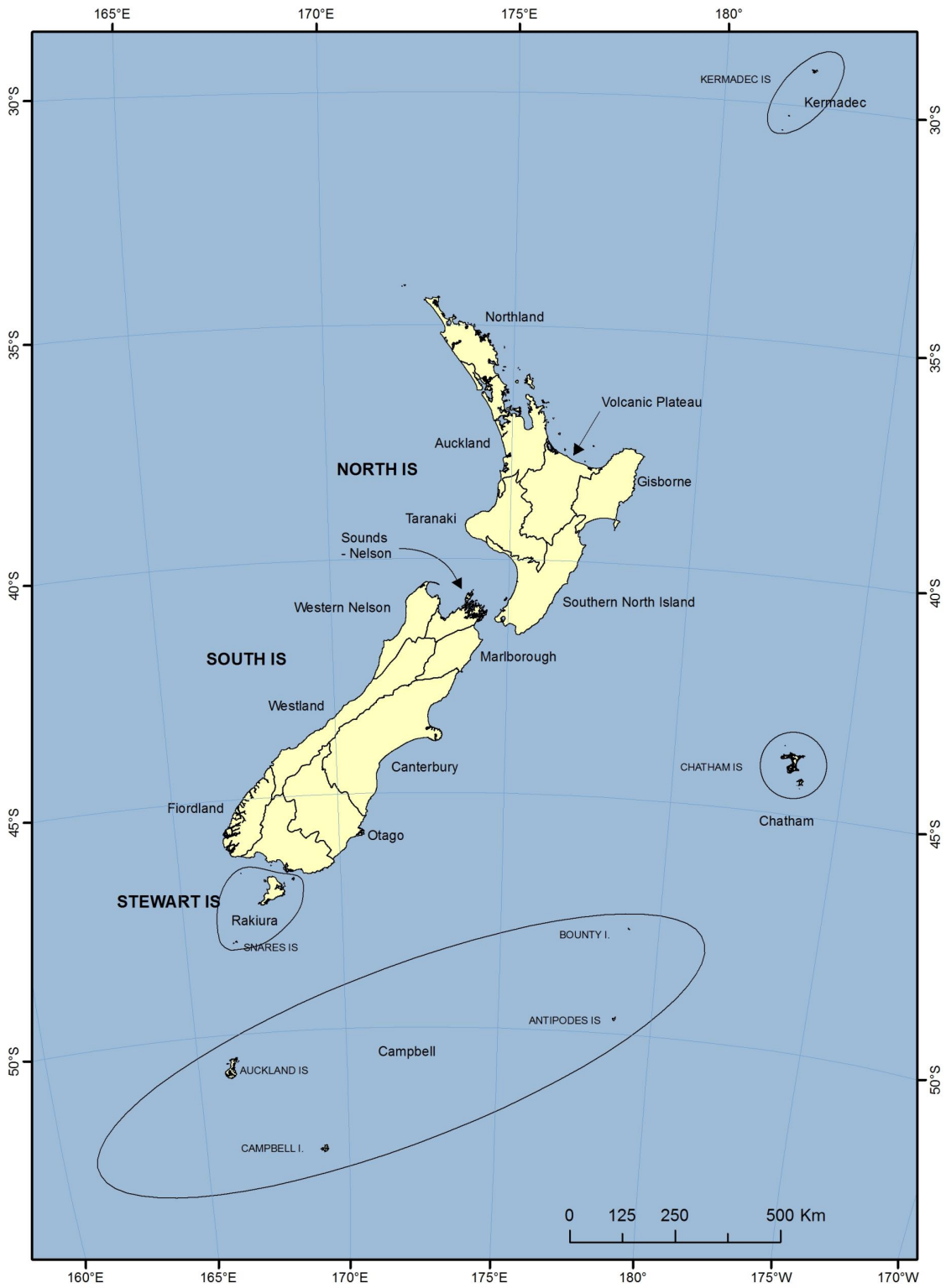
We thank the staff at AK, CHR and WELT for loans of specimens and for databasing and providing spreadsheets of collection data. We are grateful to staff at CHR for the preparation of maps and for assistance in editing and formatting the text, to Jeremy Rolfe for images of *L. linearis* and *L. trichomanoides*, and to Samuli Lehtonen for reviewing the manuscript.

**P.J. Brownsey and L.R. Perrie**

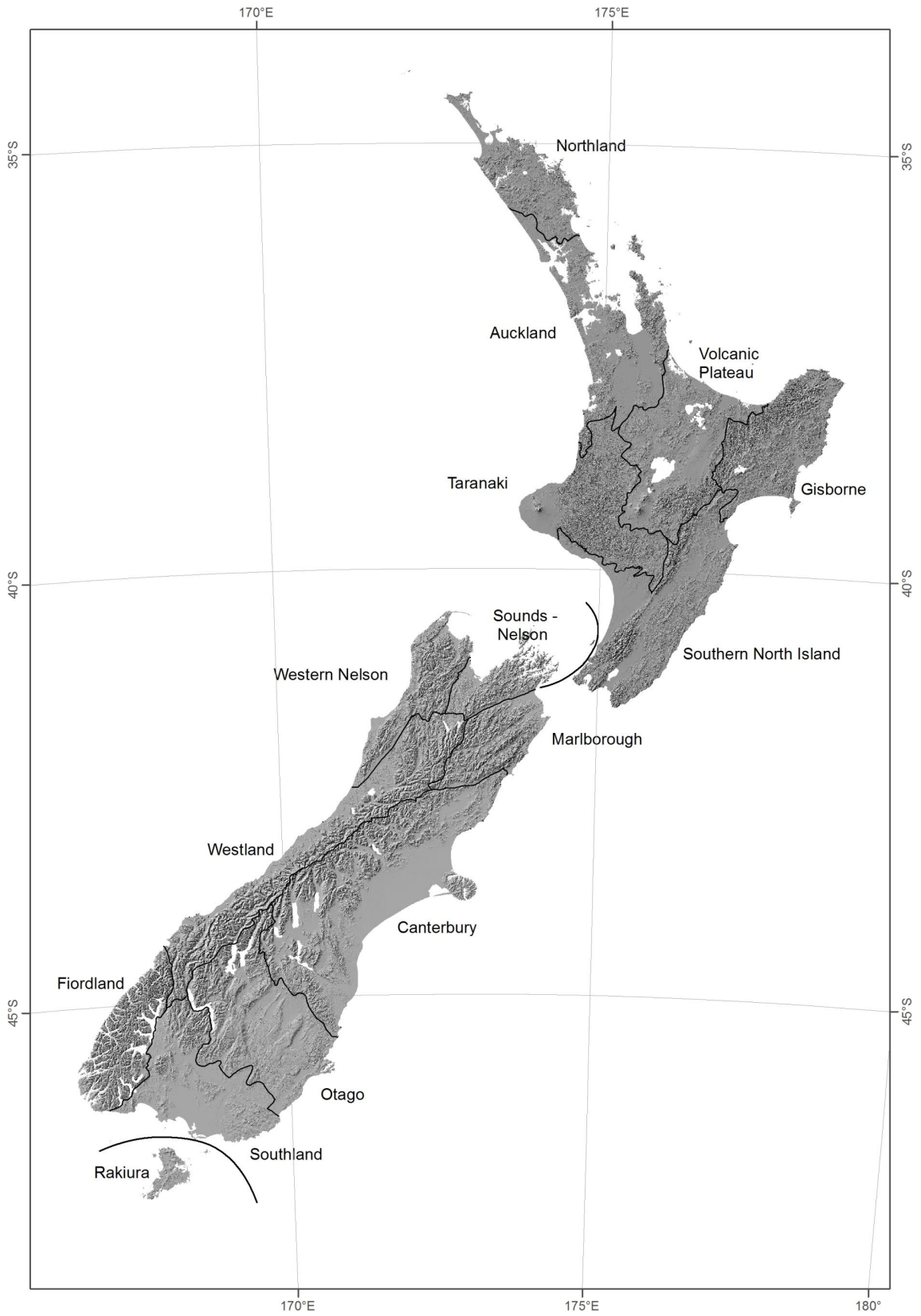
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**Map 1:** Map of New Zealand and offshore islands showing Ecological Provinces



**Map 2:** Map of New Zealand showing Ecological Provinces

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