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FERNS AND LYCOPHYTES

DICKSONIACEAE



P.J. BROWNSEY & L.R. PERRIE

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Cover image: *Dicksonia squarrosa*, mature plants showing dead orange-brown fronds littering the ground.

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Introduction

The family Dicksoniaceae is represented in New Zealand by one genus (*Dicksonia*) with three endemic species. One species is widespread, the second occurs from Kaipara Harbour to Stewart Island, and the third is represented by two subspecies, one confined to the far north of New Zealand and the other with a disjunct distribution from Thames to the Ruahine Ranges and also in the Tararua Ranges, Marlborough Sounds and west coast of the South Island. Most species of *Dicksonia* are tree ferns with arborescent trunks, but one of the subspecies in New Zealand is distinguished by the lack of an upright trunk. All species of *Dicksonia* have highly divided fronds that bear hairs rather than scales. The sori are marginal and protected by bivalvate indusia.

Dicksoniaceae M.R.Schomb., *Reis. Br.-Guiana* 3, 1047 (1849) nom. cons.

Type taxon: *Dicksonia* L'Hér.

Terrestrial ferns. Rhizomes long-creeping, decumbent, or erect and forming an arborescent trunk covered in adventitious roots and persistent stipe bases, bearing multicellular hairs. Fronds monomorphic or dimorphic, not articulated to rhizome. Laminae 2-pinnate (not NZ) or 3–4-pinnate (NZ), usually catadromous, coriaceous, bearing multicellular hairs. Veins free. Sori round, borne on abaxial surface away from margins (not NZ), or ovate to round, borne on vein endings of the abaxial surface, at or near the margins of the lamina (NZ); paraphyses present; sori exindusiate (not NZ) or protected by a membranous inner indusium and a reflexed lamina lobe, together forming a bivalvate or cup-like structure (NZ); receptacles slightly elevated, sporangia maturing in gradate sequence. Sporangia with slightly oblique annulus, usually 64 spores per sporangium. Homosporous; spores trilete, granulate or with reticulate lobes surrounding depressed areolae (NZ), or with tuberculae fused into irregular ridges (not NZ), or with a prominent flange separating a tuberculate proximal face and perforate distal face (not NZ), lacking chlorophyll.

Taxonomy: A family of three genera and about 30 species. The family, as construed by Smith et al. (2006), comprises three genera – *Dicksonia*, *Calochlaena* and *Lophosoria*. The latter genus is confined to Central and South America and differs from the other two genera in having exindusiate sori on the abaxial surface of the laminae. It has often been included in its own family (e.g. Kramer 1990). However, in a phylogenetic analysis of tree ferns based on four protein-coding plastid loci, Korall et al. (2006) demonstrated that these three genera formed a well-supported clade, sister to Metaxyaceae, and with some affinity to Cibotiaceae. They also showed that the family Dicksoniaceae, as understood by Kramer (1990) to include also *Thyrsopteris*, *Culcita*, *Cibotium* and *Cystodium*, was polyphyletic. These genera are now all included in different families (Smith et al. 2006).

The family is represented in New Zealand by a single genus, *Dicksonia*, although *Calochlaena* is found in Australia and the Pacific.

The family name Dicksoniaceae M.R.Schomb. is conserved against Thyrsopteridaceae C.Presl.

Distribution: Occurs in Central and South America, south-east Asia, Australasia and the Pacific. One genus and three endemic species in New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 1: Number of species in New Zealand within *Dicksoniaceae* M.R.Schomb.

Category	Number
Indigenous (Endemic)	3
Total	3

Recognition: The Dicksoniaceae comprises terrestrial ferns that have arborescent trunks, or sometimes creeping or decumbent rhizomes, with large 2–4-pinnate fronds bearing hairs, sori that are usually marginal and protected by bivalvate indusia made up of an inner membranous indusium and an outer reflexed lamina flap, sporangia with an oblique annulus, and trilete spores.

***Dicksonia* L'Hér., *Sert. Angl.*, 30 (1789)**

= *Balantium* Kaulf., *Enum. Filic.*, 228 (1824)

Type taxon: *Dicksonia arborescens* L'Hér.

Etymology: Named in honour of James Dickson (1738-1822), British nurseryman, founder member of the Royal Horticultural Society and Linnean Society of London.

Terrestrial ferns. Rhizomes long-creeping, or erect and forming a tall woody trunk, bearing multicellular hairs and buttressed by adventitious roots. Rhizome scales absent. Fronds monomorphic, or dimorphic with the fertile pinnae somewhat reduced. Stipes hairy. Laminae 2-pinnate-pinnatisect to 3-pinnate-pinnatifid, coriaceous, bearing multicellular hairs. Sori ovate to round, borne on vein endings on the abaxial surfaces, at or near the margins of the lamina; paraphyses present as multicellular hairs; sori protected by a membranous inner indusium and a reflexed lamina lobe, together forming a bivalvate or cup-like structure. Spores trilete, granulate or with reticulate lobes surrounding depressed areolae.

-
- 1 Plants with aerial trunks; hairs on underside of pinna midribs and costae uniformly distributed, never woolly 2
 Plants lacking aerial trunks; hairs on underside of pinna midribs and costae in dense woolly patches at costa junctions *lanata* subsp. *lanata*
- 2 Trunks black, bearing aerial buds; stipe and rachis red- or purple-brown, rough; tertiary pinnae decurrent at base to form a continuous narrow wing along costae of secondary pinnae *squarrosa*
 Trunks brown, lacking aerial buds; stipe and rachis pale or yellow-brown, smooth; tertiary pinnae stalked or adnate, not forming a continuous wing along costae of secondary pinnae 3
- 3 Trunks up to 600 mm diam., covered in adventitious roots; basal pair of primary pinnae less than 95 mm long; longest fertile tertiary pinnae adnate at base, divided < halfway to midrib; fine, pale brown hairs c. 1 mm long present on underside of pinna midribs and costae *fibrosa*
 Trunks up to 150 mm diam., covered in stipe bases; basal pair of primary pinnae > 100 mm long; longest fertile tertiary pinnae stalked or sessile, divided > halfway to midrib; fine pale brown hairs c. 1 mm long, and thick rigid red-brown hairs up to 2.5 mm long, both present on underside of pinna midribs and costae *lanata* subsp. *hispida*

Distribution: A genus of 20–25 species distributed in Central and South America, south-east Asia, eastern Australia, New Zealand, and in the Pacific as far east as Samoa; two species in tropical America, two on Juan Fernández Islands, one on St Helena, at least seven in south-east Asia, three in Australia and five in the western Pacific (Large & Braggins 2004; Noben & Lehnert 2013). Three endemic species in New Zealand.

Biostatus: Indigenous (Non-endemic).

Table 2: Number of species in New Zealand within *Dicksonia* L'Hér.

Category	Number
Indigenous (Endemic)	3
Total	3

Cytology: The base chromosome number in *Dicksonia* is $n = 65$ (Kramer 1990).

***Dicksonia fibrosa* Colenso in Hooker, Sp. Fil. 1, 68 (1844)**

≡ *Balantium fibrosum* (Colenso) Fée, *Mém. Foug.*, 5. *Gen. Filic.*, 341 (1852)

≡ *Dicksonia antarctica* var. *fibrosa* (Colenso) Kirk, *Trans. & Proc. New Zealand Inst.* 10 (app.): xliii (1878)

Lectotype (chosen by Allan 1961): Banks of rivers in Te Waiiti district, *W. Colenso*, Jan. 1842, WELT P003256!

= *Dicksonia sparmanniana* Colenso, *Trans. & Proc. New Zealand Inst.* 12: 363 (1880)

Lectotype (chosen by Allan 1961): Dannevirke, H[awkes] B[ay], Herb. *W. Colenso*, WELT P003314!

= *Dicksonia microcarpa* Colenso, *Trans. & Proc. New Zealand Inst.* 20: 214 (1888)

≡ *Dicksonia fibrosa* var. *microcarpa* (Colenso) C.Chr., *Index Filic.*, 221-222 (1905)

Lectotype (chosen by Allan 1961): S. Dannevirke [Dannevirke], Herb. *W. Colenso*, WELT P003312!

Etymology: From the Latin *fibrosus* (fibrous), a reference to the trunk which is protected by a thick layer of fibrous material.

Vernacular names: kurīpākā; whekī-ponga

Rhizomes erect, forming a woody trunk 2–6 m tall, 150–600 mm diam., or rarely to 1000 mm on Chatham Islands, covered in a thick layer of reddish brown adventitious roots, lacking buds and underground stolons, bearing reddish brown multicellular hairs near the apex. Fronds 1100–3000 mm long, held erect when young, persistent, forming a thick skirt completely obscuring the trunk when old; dead fronds pale brown. Stipes 50–500 mm long, red-brown at very base, becoming pale brown or yellow-brown distally, smooth, often bearing fine golden-brown hairs at the junction with the trunk, densely covered in red-brown multicellular hairs up to 45 mm long proximally, and pale brown or red-brown hairs up to 3 mm long distally. Laminae 2-pinnate-pinnatisect, narrowly elliptic or narrowly

obovate, 950–2800 mm long, 210–600 mm wide, dark green on adaxial surfaces, paler green on abaxial surfaces, coriaceous, harsh, abundantly hairy on abaxial surfaces of rachis, pinna midribs and costae; hairs fine, multicellular, colourless or pale or chestnut-brown, more or less straight, up to c. 1 mm long, uniformly distributed; rachis yellow-brown or pale brown. Primary pinnae in 25–45 pairs, narrowly ovate or narrowly triangular; the longest at or above the middle, 135–390 mm long, 40–115 mm wide, stalked; the basal pair 20–95 mm long. Secondary pinnae narrowly ovate or narrowly triangular, the longest 20–65 mm long, 5–15 mm wide, stalked or sessile. Longest tertiary pinnae 3–10 mm long, 2–3 mm wide, adnate, fertile ones divided less than halfway to midrib; ultimate segments sharply angled. Sori terminating veins at margins of lamina, ovate, c. 1 mm long, slightly elongated along the lamina margin.

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

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

Chatham Islands, Stewart Island.

Altitudinal range: 10–1100 m.

Dicksonia fibrosa occurs in lowland and montane areas of much of the North Island from Kaipara Harbour southwards, with an isolated record from Puketi Forest (WELT P018474) that may be an escape from cultivation (Brownsey et al. 2013). It extends from near sea level, to over 1100 m in the Kaweka and Ruahine ranges. In the South Island, it is found mainly in coastal and lowland areas from north-west Nelson to Lake Mapourika on the west coast, in scattered localities on the east coast from the Marlborough Sounds to the Catlins, and on the south coast as far west as Lake Poteriteri in Fiordland. It is virtually absent from the interior of the South Island. It is also present on Stewart Island where it is described as “rare and local” (Wilson 1982). It occurs from sea level, up to about 400 m around Nelson and in the headwaters of the Kēkerengū River, Marlborough. There is a single record from c. 900 m in the Jordan Stream Reserve, Marlborough.

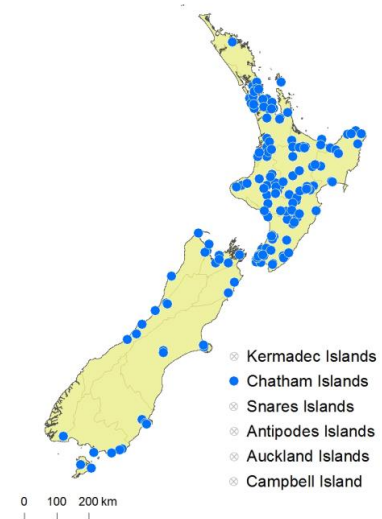


Fig. 1: *Dicksonia fibrosa* distribution map based on databased records at AK, CHR and WELT.

All records north of 37°30' S have been made since 1969, and the northernmost collections made by early botanists such as Cheeseman, Kirk and Petrie came from Raglan and the Mamaku Plateau. Brownsey et al. (2013) investigated the distribution of *D. fibrosa* in the wider Auckland area and concluded that it probably extends naturally to about 36°30' S, reaching the Kaipara region and Te Moehau, but is very uncommon north of a line from Raglan to the Bay of Plenty. Although there are numerous records of the species in the Auckland region, most of these are from populations of just one or two plants, and it is likely that they are naturalised plants that have originated from cultivated sources in urban areas. The frequency of naturalised plants, especially in Auckland City, may be masking the rarity of natural populations at the northern end of its range.

Dicksonia fibrosa has been recorded as naturalised on Hawai'i (Lorence & Flynn 2006).

Biostatus: Indigenous (Endemic).

Habitat: Occurs under tall mānuka and kānuka scrub, on forest margins, or in podocarp and broad-leaved forest in the northern part of its range, and podocarp or beech forest in the southern part. It grows on flood plains, riverbanks, streamsides, swamp margins and on hillsides, but can also tolerate forest margins, open pastures or scrubland.

Recognition: *Dicksonia fibrosa* is recognised by its thick fibrous trunk, skirt of persistent entire dead fronds, and crown of short-stalked and rather narrow fronds. The pair of basal primary pinnae are less than 95 mm long. New fronds are produced in flushes in spring, and are initially held upright, gradually drooping lower as they mature and die to form the skirt.

Cytology: n = 65 (Brownlie 1954, 1957).

Notes: This species was first collected by Colenso during his journey through the Urewera Ranges in 1841–42, and later published as *D. fibrosa* in the *Tasmanian Journal of Natural Sciences* (Colenso 1845). Until recently, this has been accepted as the earliest validly published description (Brownsey et al. 1985). However, Colenso sent a specimen (No. 289) and a copy of an unpublished description to W.J. Hooker in a letter dated 1 September 1842 (see St. George 2009). Hooker then used Colenso's

specimen and description to draw up his own description for inclusion in *Species Filicum* (Hooker 1844). He specifically says about *D. fibrosa*, “of this species I only possess portions of a large frond, with copious fructifications. But, happily, Mr Colenso's description is before me, from which I have been able to improve the specific character”. He attributes the name to Colenso, includes a portion of Colenso's description in quotation marks, and cites Colenso's article in the *Tasmanian Journal of Natural Science*, albeit without volume or page numbers. Hooker did not intend to pre-empt Colenso, expecting Colenso's description to have been published before his, but in the event *Species Filicum* appeared in print first, and is the first validly published description for the species. Because Hooker attributed the name and part of the description to Colenso, the species must be cited as *Dicksonia fibrosa* Colenso in Hook. (K. Gandhi, pers. comm. – Art. 46.2 Note 1).

There are two specimens collected by Colenso from the Te Waiiti district – one at WELT (P003256), and the other at K (*Colenso* 289). Both specimens are very similar, comprising three pinna pairs from the mid-portion of the lamina. The sheet at K also has an unattached pinna, while that at WELT has a portion of the frond apex. Allan (1961) lectotypified the WELT specimen.

Colenso also described the species twice more as *D. sparmanniana* and *D. microcarpa*, but these are just minor variants of his original species. There are several syntype specimens of both *D. sparmanniana* and *D. microcarpa* in WELT, but, for both taxa, the description by Allan (1961) of the type material on a particular sheet (e.g. “...a portion of the rachis with 7 pinnae...”) constitutes lectotypification.

Dicksonia intermedia Colenso ex Hook. & Baker (1874), cited under *D. fibrosa* by Allan (1961), is a *nomen nudum*.

The status of *D. fibrosa* as a species distinct from the Australian *D. antarctica* requires further investigation. Hooker (1867) could not find any difference between the two and treated the New Zealand plant as *D. antarctica*. Kirk (1878) reduced it to a variety of *D. antarctica*, noting its smaller size, hairy rachis, more compact habit and less coriaceous texture. Cheeseman (1925) accepted it as *D. fibrosa* only rather reluctantly, stating that it was “very close indeed to the Australian *D. antarctica*”, differing in being a smaller plant with densely hairy rachises and smaller sori. Cheeseman's recognition of *D. fibrosa* has been followed by later authors (e.g. Allan 1961; Brownsey et al. 1985). Page & Hollands (1992) identified a number of characters for distinguishing Australian and New Zealand species of *Dicksonia* in cultivation in Britain, including *D. antarctica* and *D. fibrosa*. However, many of the measurements given do not apply to the two species in the wild, and the comparison is therefore of limited value. In fact, the most striking difference between the two species, not mentioned by any of the above authors, is that *D. fibrosa* has a thick skirt of dead fronds surrounding the trunk, which *D. antarctica* lacks. The primary pinnae of *D. antarctica* are generally broader than those of *D. fibrosa*, and the stipes often rather longer. Also, Janssen et al. (2008) found a small genetic difference between the two species, which may be significant given the deceleration of molecular evolution observed in tree ferns (Korall et al. 2010). These differences suggest that two species should continue to be recognised for the time being.



Fig. 2: *Dicksonia fibrosa*: mature plant with skirt of dead fronds.



Fig. 3: *Dicksonia fibrosa*: mature plant with skirt of dead fronds.



Fig. 4: *Dicksonia fibrosa*: thick trunks surrounded by skirts of dead fronds.



Fig. 5: *Dicksonia fibrosa*: obovate mature fronds, showing the pinnae decreasing in size proximally to a very short stipe.



Fig. 6: *Dicksonia fibrosa*: crown of trunk, showing fronds with very short stipes and basal pinnae.



Fig. 7: *Dicksonia fibrosa*: trunk and stipe bases covered in hairs.



Fig. 8: *Dicksonia fibrosa*: abaxial surface of lamina with pale brown hairs on the costae, showing marginal sori protected by an inrolled lamina margin and true inner indusium.



Fig. 9: *Dicksonia fibrosa*: mature plant showing a flush of young fronds surrounded by a ring of mature fronds, and a skirt of dead fronds around the trunk.

***Dicksonia lanata* Colenso ex Hook., Sp. Fil. 1, 69 (1844)**

≡ *Balantium lanatum* (Colenso ex Hook.) Fée, *Mém. Foug.*, 5. *Gen. Filic.*, 341 (1852)

Holotype: New Zealand, *W. Colenso 271*, Herb. Hooker., K! (photo WELT E470/10)

Etymology: From the Latin *lanatus* (woolly), a reference to the woolly hairs on the underside of the laminae of this species.

Vernacular names: stumpy tree fern; tūākura; tūōkura

Rhizomes either prostrate, up to 50 mm diam., branching and stoloniferous, or erect, forming a woody trunk 0.2–2 m tall, 50–150 mm diam., covered in brown adventitious roots and brown stipe bases; lacking buds, bearing red-brown multicellular hairs near the apex. Fronds 400–2000 mm long, held erect, falling when old; dead fronds orange-brown. Stipes 210–1170 mm long, red-brown at very base, becoming chestnut-brown or yellow-brown or green distally, or occasionally green throughout, smooth, often bearing fine golden-brown hairs at the junction with the rhizome, densely covered in red-brown multicellular hairs up to 35 mm long proximally, and pale brown or chestnut-brown hairs to 8 mm long distally. Laminae 2-pinnate-pinnatisect to 3-pinnate (sterile pinnae) or 3-pinnate-pinnatifid (fertile pinnae), ovate or triangular, 240–1130 mm long, 140–700 mm wide, coriaceous, smooth, abundantly hairy on abaxial surfaces of rachis, pinna midribs and costae; hairs more or less straight and rigid, interspersed with shorter fine hairs, or in dense woolly patches; rachis yellow-brown or green. Primary pinnae in 13–23 pairs, ovate, narrowly ovate, triangular or narrowly triangular; the longest below the middle, 95–425 mm long, 35–165 mm wide, stalked; the basal pair 100–340 mm long. Secondary pinnae narrowly ovate or narrowly triangular, the longest 20–85 mm long, 7–25 mm wide, stalked. Longest tertiary pinnae 3–14 mm long, 1.5–6 mm wide, stalked or sessile or adnate, the fertile ones divided more than halfway to midrib; ultimate segments slightly rounded. Sori terminating veins at margins of lamina, ovate, 1–2 mm long, slightly elongated along the lamina margin.

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

South Island: Western Nelson, Sounds–Nelson, Westland.

Altitudinal range: 10–1400 m.

In the North Island *D. lanata* occurs in coastal and lowland forest from North Cape to Coromandel, and in montane forest or open scrub from Thames south to the Ruahine Ranges, with an outlying population in the southern Tararua Ranges. It is apparently absent from much of Taranaki, the Tararua Ranges and the east coast, although there is a single dubious record from Mt Egmont (WELT P005570, without collector, date or specific locality). It occurs from near sea level to 1100 m in the Urewera region and 1400 m in the Ruahine Ranges. In the South Island it grows mainly in coastal and lowland forest, occurring on Mt Stokes in the Marlborough Sounds, and along the west coast from north-west Nelson to Lake Moeraki, South Westland. It reaches 750 m above Boulder Lake, north-west Nelson.

Biostatus: Indigenous (Endemic).

Habitat: In the northern part of its range it occurs in lowland kauri, podocarp or taraire forest, in mature mānuka or kānuka scrub, and occasionally in gumland. South of Thames it is found in open scrub, and in podocarp, beech or broadleaved forest.

Recognition: *Dicksonia lanata* has smooth fronds and ovate or triangular laminae. It has two distinct subspecies (Brownsey & Perrie 2014). One is a short-trunked plant found principally in kauri forests north of Auckland. It is distinguished from *D. squarrosa* by its brown rather than almost black trunk and stipe bases, and also lacks the orange-brown dead fronds and aerial buds of that species. It is distinguished from *D. fibrosa* by its narrower trunk and lack of a skirt of dead fronds. The second subspecies is very distinctive in being a prostrate plant, lacking a trunk. It produces stolons and grows as thick, tangled colonies.

Cytology: n = 65 (Brownlie 1961)

Notes: As with *D. fibrosa*, this species was first collected by Colenso during his journey through the Urewera Ranges in 1841–42, and later published as *D. lanata* in the *Tasmanian Journal of Natural Sciences* (Colenso 1845). Until recently, this has been accepted as the earliest validly published description (Brownsey et al. 1985). However, Colenso sent a specimen (No. 271) and copy of an unpublished description to W.J. Hooker in a letter dated 1 September 1842 (see St. George 2009). Hooker then used Colenso's specimens and descriptions to draw up his own description for inclusion in *Species Filicum* (Hooker 1844). He attributed the name to Colenso, and cites Colenso's article in

the *Tasmanian Journal of Natural Science*. Hooker did not intend to pre-empt Colenso, expecting Colenso's description to have been published before his, but in the event *Species Filicum* appeared in print first, and is the first validly published description for the species. Because, in this case, Hooker attributed only the name to Colenso, without any part of Colenso's description, the species must be cited as *D. fibrosa* Colenso ex Hook. (K. Gandhi, pers. comm. – Art. 46). The specimen collected by Colenso from the shores of Waikare Lake in December 1841 (WELT P003258), and cited by Allan (1961) as the type, was not seen by Hooker and therefore cannot be considered part of the original material.

Dicksonia laevis Heward in Hooker (1844), cited in the synonymy of *D. lanata*, is a *nomen nudum*.

***Dicksonia lanata* subsp. *hispida* (Colenso) Perrie & Brownsey, *New Zealand J. Bot.* 52: 349 (2014)**

≡ *Dicksonia lanata* var. *hispida* Colenso in Hooker, *Sp. Fil.* 1, 69 (1844)

Lectotype (selected by Brownsey & Perrie 2014): Mt Wananake [Whananaki], E. Coast, N[ew] Z[ea]land], *W. Colenso* 351, Herb. Hooker., K! (photo WELT E470/1).

Etymology: From the Latin *hispidus* (rigid), a reference to the rigid hairs on the underside of the laminae of this subspecies.

Vernacular names: stumpy tree fern; tūākura; tūōkura

Rhizomes occasionally creeping, but usually erect, forming a short woody trunk 0.2–2 m tall, up to 150 mm diam., covered in brown adventitious roots and brown stipe bases; lacking buds, bearing red-brown multicellular hairs near the apex. Fronds 500–2000 mm long, held erect, falling when old; the fertile pinnae often markedly reduced compared with the sterile; dead fronds orange-brown. Stipes 210–1170 mm long, red-brown at very base, becoming chestnut-brown, yellow-brown or green distally, or occasionally green throughout, smooth, sometimes bearing fine golden-brown hairs at the junction with the rhizome, densely covered in red-brown multicellular hairs up to 25 mm long proximally, and pale brown or red-brown hairs to c. 3 mm long distally. Laminae 2-pinnate-pinnatisect to 3-pinnate (sterile pinnae) or deeply 3-pinnate-pinnatifid (fertile pinnae), ovate or triangular, 420–1130 mm long, 200–700 mm wide, darker green on adaxial surfaces, coriaceous, smooth, the sterile segments usually flat or slightly involute; abundantly hairy on abaxial surfaces of rachis, pinna midribs and costae; hairs fine, multicellular, colourless or pale brown, up to 1 mm long, straight or slightly curled, uniformly distributed, interspersed with red-brown, thicker, rigid hairs up to 2.5 mm long; rachis yellow-brown or green. Primary pinnae in 15–23 pairs, ovate or triangular; the longest below the middle, 125–425 mm long, 50–165 mm wide, stalked; the basal pair 100–340 mm long. Secondary pinnae narrowly ovate or narrowly triangular, the longest 25–85 mm long, 8–25 mm wide, stalked. Longest tertiary pinnae 4–14 mm long, 1.5–4 mm wide, stalked or sessile or adnate, divided more than halfway to midrib; ultimate segments slightly rounded, usually bearing a single sorus. Sori terminating veins at margins of lamina, ovate, 1–1.5 mm long, slightly elongated along the lamina margin.

Distribution: North Island: Northland, Auckland.

Altitudinal range: 10–550 m.

Dicksonia lanata subsp. *hispida* grows primarily in coastal and lowland forest, and locally in montane forest, from North Cape to the northern Kaipara Harbour and Great Barrier Island. It grows from near sea level, reaching 450 m on Great Barrier Island, and 550 m in the Tutamoe Ecological District.

Biostatus: Indigenous (Endemic).

Habitat: *Dicksonia lanata* subsp. *hispida* occurs most frequently in lowland kauri, podocarp or taraire forest, but is also found in mature mānuka or kānuka scrub, and occasionally on gumland.

Recognition: *Dicksonia lanata* subsp. *hispida* is a short-trunked tree fern found most commonly as an understorey plant in kauri forest. It is distinguished from subsp. *lanata* by the presence of a trunk, and by the presence of rigid, multicellular, red-brown hairs among shorter, pale brown hairs on the abaxial surfaces of the costae and pinna midribs. It lacks the dense patches of long, woolly, curled hairs present in subsp. *lanata*, but the hairs are sometimes slightly clustered in sterile fronds.

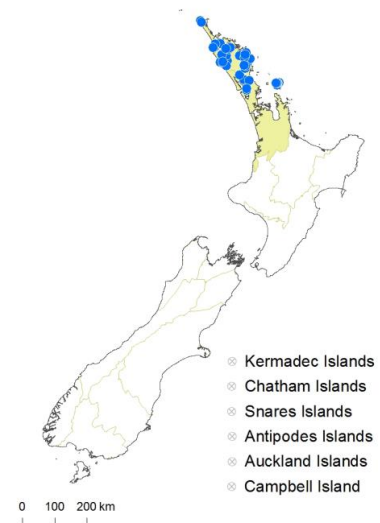


Fig. 10: *Dicksonia lanata* subsp. *hispida* distribution map based on databased records at AK, CHR and WELT.

In the absence of hairs, subsp. *hispida* can sometimes be distinguished by its darker green laminae; sterile lamina segments, which tend to be flat or slightly involute; fertile pinnae, which are sometimes markedly reduced compared with the sterile; somewhat longer and narrower tertiary pinnae; and only one sorus on the lowermost ultimate segments of the tertiary pinnae.

Notes: This taxon was first collected by Colenso from the Bay of Islands and a specimen (No. 351) sent to William Hooker at Kew in a letter dated 20 May 1844, together with a manuscript entitled *Filices Novae* in which it was described as a new variety (see St. George 2009). Colenso later published the variety as *D. lanata* var. *hispida* in the *Tasmanian Journal of Natural Sciences* (Colenso 1845). However, before then, Hooker cited Colenso's specimen and his full description in *Species Filicum* (Hooker 1844). Hooker did not intend to pre-empt Colenso, expecting Colenso's description to have been published before his, but in the event, *Species Filicum* appeared in print first, and is the first validly published description for the variety. Because Hooker attributed the name and full description to Colenso, the variety must be cited as *D. lanata* var. *hispida* Colenso in Hooker (Art. 46.2 Note 1). The variety was raised to subspecific rank by Brownsey & Perrie (2014).



Fig. 11: *Dicksonia lanata* subsp. *hispida*: mature plant showing fronds arising from a short trunk.



Fig. 12: *Dicksonia lanata* subsp. *hispida*: mature plant showing fronds arising from a short trunk.



Fig. 13: *Dicksonia lanata* subsp. *hispida*: mature plant showing fronds arising from a short trunk.



Fig. 14: *Dicksonia lanata* subsp. *hispida*: mature frond.



Fig. 15: *Dicksonia lanata* subsp. *hispida*: adaxial surface of fertile frond.



Fig. 16: *Dicksonia lanata* subsp. *hispida*: abaxial surface of sterile frond showing uniformly distributed, fine, pale brown hairs interspersed with rigid, red-brown hairs. Scale bar = 1 mm.



Fig. 17: *Dicksonia lanata* subsp. *hispida*: abaxial surface of sterile frond showing uniformly distributed hairs, not bunched at costa junctions.



Fig. 18: *Dicksonia lanata* subsp. *hispida*: abaxial surface of fertile frond showing young sori.



Fig. 19: *Dicksonia lanata* subsp. *hispida*: abaxial surface of fertile frond showing uniformly distributed, fine, pale brown hairs interspersed with rigid, red-brown hairs. Scale bar = 1 mm.

Dicksonia lanata Colenso ex Hook., *Sp. Fil.* 1, 69 (1844) subsp. *lanata*

≡ *Dicksonia lanata* Colenso ex Hook., *Sp. Fil.* 1, 69 (1844) var. *lanata*

Etymology: From the Latin *lanatus* (woolly), a reference to the woolly hairs on the fronds of this species.

Vernacular names: stumpy tree fern; tūākura; tūōkura

Rhizomes prostrate, up to 50 mm diam., branching and stoloniferous; lacking buds, bearing red-brown multicellular hairs near the apex. Fronds 400–1750 mm long, rarely to 2000 mm long, held erect, falling when old; the fertile pinnae only slightly reduced compared with the sterile; dead fronds orange-brown. Stipes 230–1000 mm long, red-brown at very base, becoming yellow-brown or sometimes green distally, smooth, often bearing fine golden-brown hairs at the junction with the rhizome, densely covered in red-brown or chestnut-brown multicellular hairs up to 35 mm long proximally, and pale brown or chestnut-brown hairs to 8 mm long distally. Laminae 2-pinnate-pinnatisect to 3-pinnate (sterile pinnae) or 3-pinnate-pinnatifid (fertile pinnae), ovate or triangular, 240–760 mm long, 140–500 mm wide, pale green on both surfaces, coriaceous, smooth, the sterile segments often slightly revolute; hairy on abaxial surfaces of rachis, pinna midribs and costae; hairs fine, multicellular, pale brown or chestnut-brown, woolly, curled or with occasional straight ones, up to 5 mm long, in dense patches at costa junctions; rachis yellow-brown or green. Primary pinnae in 13–19 pairs, ovate, narrowly ovate or narrowly triangular; the longest below the middle, 95–270 mm long, 35–105 mm wide, stalked; the basal pair 80–230 mm long. Secondary pinnae narrowly ovate or narrowly triangular, the longest 20–60 mm long, 7–17 mm wide, stalked. Longest tertiary pinnae 3–11 mm long, 3–6 mm wide, stalked or sessile or adnate, the fertile ones divided more than halfway to midrib; ultimate segments slightly rounded, bearing a single sorus, or sometimes a pair of sori on the lowermost segments. Sori terminating veins at margins of lamina, ovate, 1–2 mm long, slightly elongated along the lamina margin.

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

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

Altitudinal range: 80–1400 m.

In the North Island *D. lanata* subsp. *lanata* occurs in montane forest or open scrub from Thames and Te Aroha south to the Ruahine Ranges, with an outlying population in the southern Tararua Ranges, but is apparently absent from Mt Taranaki. It occurs from about 250 m in southern Coromandel, up to 1100 m in the Urewera region and 1400 m in the Ruahine Ranges. In the South Island it grows mainly in coastal and lowland forest, occurring sporadically in the Marlborough Sounds, and along the west coast from north-west Nelson to Lake Moeraki, South Westland. It grows from about 80 m, reaching 750 m above Boulder Lake, north-west Nelson.

Biostatus: Indigenous (Endemic).

Habitat: In the North Island, *D. lanata* subsp. *lanata* is found in open scrub, and in montane podocarp, beech or broadleaved forest. In the South Island it occurs at lower elevations in mixed podocarp or beech forest.

Recognition: *Dicksonia lanata* subsp. *lanata* is very distinctive in being a prostrate plant, lacking the trunk of subsp. *hispida*. It produces stolons and grows as thick, tangled colonies. It can usually be recognised in most of its range by the dense patches of long, woolly, curled, pale or chestnut-brown hairs that are present on the abaxial surface of the lamina at the costa junctions. Rigid, red-brown hairs are usually absent. However, populations around Thames, at the northernmost limit of the subspecies, are uncharacteristic in having long, rigid, straight, chestnut-brown hairs that are more uniformly distributed. The hairs are longer than in subsp. *hispida* and are chestnut-brown rather than red-brown. The hair characters of these populations do not accord with those of either subspecies. However, the lack of a trunk suggests that the plants belong to subsp. *lanata*.

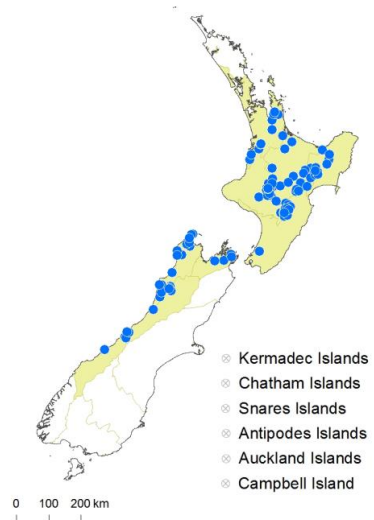


Fig. 20: *Dicksonia lanata* subsp. *lanata* distribution map based on databased records at AK, CHR and WELT.

In the absence of hairs, subsp. *lanata* can sometimes be distinguished by its paler green laminae; sterile lamina segments, which tend to be slightly revolute; fertile pinnae, which are only slightly reduced compared with the sterile; somewhat shorter and broader tertiary pinnae; and more than one sorus on the lowermost ultimate segments of the tertiary pinnae.

Cytology: $n = 65$ (Brownlie 1961)



Fig. 21: *Dicksonia lanata* subsp. *lanata*: mature plant showing fronds arising from a prostrate, underground rhizome.



Fig. 22: *Dicksonia lanata* subsp. *lanata*: mature frond.



Fig. 23: *Dicksonia lanata* subsp. *lanata*: yellow-brown stipe bases with chestnut-brown hairs.



Fig. 24: *Dicksonia lanata* subsp. *lanata*: abaxial surface of sterile frond showing dense patches of chestnut-brown woolly hairs at costa junctions.



Fig. 25: *Dicksonia lanata* subsp. *lanata*: adaxial surface of fertile frond.



Fig. 26: *Dicksonia lanata* subsp. *lanata*: abaxial surface of fertile frond showing dense mats of chestnut-brown woolly hairs, especially at costa junctions.



Fig. 27: *Dicksonia lanata* subsp. *lanata*: abaxial surface of fertile frond showing marginal sori protected by an inrolled lamina margin and true inner indusium.



Fig. 28: *Dicksonia lanata* subsp. *lanata*: close up of abaxial surface of sterile frond showing dense patches of chestnut-brown woolly hairs at costa junctions. Scale bar = 1 mm.



Fig. 29: *Dicksonia lanata* subsp. *lanata*: close-up of abaxial surface of fertile frond showing dense patches of chestnut-brown woolly hairs at costa junctions. Scale bar = 1 mm.

***Dicksonia squarrosa* (G.Forst.) Sw., *J. Bot. (Schrader)* 1800(2): 90 (1801)**

≡ *Trichomanes squarrosum* G.Forst., *Fl. Ins. Austr.*, 86 (1786)

≡ *Balantium squarrosum* (G.Forst.) Kunze, *Index Filic.*, 11 (1850)

Lectotype (selected by Nicolson & Fosberg 2003): New Zealand, Herb. G. Forster 311, BM 001048398!

= *Dicksonia gracilis* Colenso, *Trans. & Proc. New Zealand Inst.* 15: 306 (1883)

≡ *Dicksonia squarrosa* var. *gracilis* (Colenso) C.Chr., *Index Filic.*, 221 (1905)

Lectotype (selected by Allan 1961): Dannevirke, H[awkes] B[ay], Herb. W. Colenso, WELT P003310!

Etymology: From the Latin *squarrosus* (rough), a reference to the harsh fronds of this species.

Vernacular names: harsh tree fern; rough tree fern; whekī

Rhizomes erect, forming a woody trunk up to 7 m tall, 90–200 mm diam., covered in dark brown hairs and persistent black stipe bases; forming aerial buds that sometimes grow out to form multiple trunks; bearing underground stolons and often forming extensive groves. Fronds 1250–2400 mm long, falling

when old; dead fronds orange-brown. Stipes 210–660 mm long, dark purple-brown, rough, often bearing fine golden-brown hairs at the junction with the trunk, densely covered in red-brown or yellow-brown multicellular hairs up to 45 mm long proximally, and red-brown hairs to 10 mm long distally. Laminae 2-pinnate-pinnatifid (sterile) to 3-pinnate-pinnatifid (fertile), elliptic or obovate, 1000–1400 mm long, 400–600 mm wide, dark green on adaxial surfaces, paler green on abaxial surfaces, coriaceous, very harsh, densely hairy on abaxial surfaces of rachis, pinna midribs and costae; hairs rigid, multicellular, red- or purple-brown, more or less straight, up to 5 mm long, uniformly distributed, with finer yellow-brown hairs near costa junctions; rachis red-brown or purple-brown. Primary pinnae in 35–45 pairs, narrowly ovate or narrowly triangular; the longest at or above the middle, 200–420 mm long, 55–145 mm wide, stalked; the basal pair 100–250 mm long. Secondary pinnae narrowly triangular, the longest 30–75 mm long, 8–20 mm wide, stalked. Longest tertiary pinnae 4–12 mm long, 2–3 mm wide, decurrent to form a narrow wing along the costa of the secondary pinna, divided less than halfway to midrib; ultimate segments sharply angled. Sori terminating veins at margins of lamina, ovate, c. 1 mm long, slightly elongated along the lamina margin.

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

South Island: Western Nelson, Sounds–Nelson, Marlborough, Westland, Canterbury, Otago, Fiordland, Southland.

Three Kings Islands, Chatham Islands, Stewart Island.

Altitudinal range: 0–900 m.

Dicksonia squarrosa occurs throughout the North Island in coastal to montane forest. It grows from near sea-level to 860 m in the Kaweka and Ruahine ranges. In the South Island it is largely confined to coastal and lowland sites, but reaches 500 m near Haast, and 900 m at Jordan Stream, Marlborough.

Biostatus: Indigenous (Endemic).

Habitat: Occurs under mānuka, tawa, pōhutukawa, podocarp, beech and broadleaved forest, or in second-growth forest, open scrub, on forest margins, and occasionally in dune hollows or open pasture. It often grows along creek banks, or on poorly-drained or swampy soil. It frequently forms extensive groves; the dense shade, combined with the dead fronds that cover the ground, tends to discourage germination of any other species underneath the grove.

Recognition: *Dicksonia squarrosa* is readily recognised by the black stipe bases on the trunk, the presence of aerial buds, the very harsh fronds, and the characteristically orange-brown dead fronds. There are red-brown, rigid, multicellular, uniformly distributed hairs on the abaxial surface of the costae. If the crown or upper part of the trunk is damaged, the aerial buds may grow out to form a multi-headed tree fern. The stoloniferous habit means that the species often grows in groves, with a mixture of young and old trunks.

Cytology: n = 65 (Brownlie 1954, 1957)

Notes: There are two syntype specimens of *D. gracilis* in WELT but Allan (1961) effectively identified the lectotype by describing uniquely the material on the sheet (“... a small part of a rachis with 6 pinnae ...”).

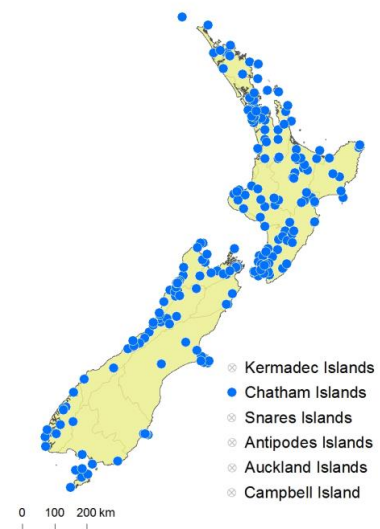


Fig. 30: *Dicksonia squarrosa* distribution map based on databased records at AK, CHR and WELT.



Fig. 31: *Dicksonia squarrosa*: mature plants growing in a grove, showing orange-brown dead fronds.



Fig. 32: *Dicksonia squarrosa*: mature plants growing a grove, showing orange-brown dead fronds.



Fig. 33: *Dicksonia squarrosa*: mature plants showing dead orange-brown fronds littering the ground.



Fig. 34: *Dicksonia squarrosa*: crown of mature plant showing dark purple-brown to black stipe bases covering the trunk.



Fig. 35: *Dicksonia squarrosa*: trunk and stipe bases covered in hairs.

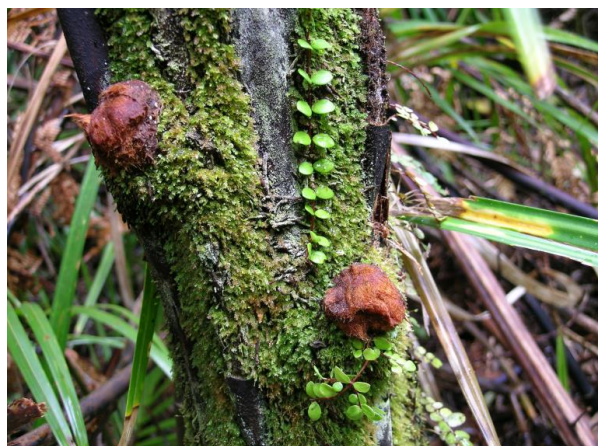


Fig. 36: *Dicksonia squarrosa*: aerial buds on trunk.



Fig. 37: *Dicksonia squarrosa*: koru or crozier covered in long, red-brown hairs.



Fig. 38: *Dicksonia squarrosa*: portion of stipe covered in long, chestnut-brown hairs growing from rough, purple-brown, expanded bases.



Fig. 39: *Dicksonia squarrosa*: abaxial surface of lamina with rough, purple-brown hairs on the costae, showing marginal sori protected by an inrolled lamina margin and true inner indusium.

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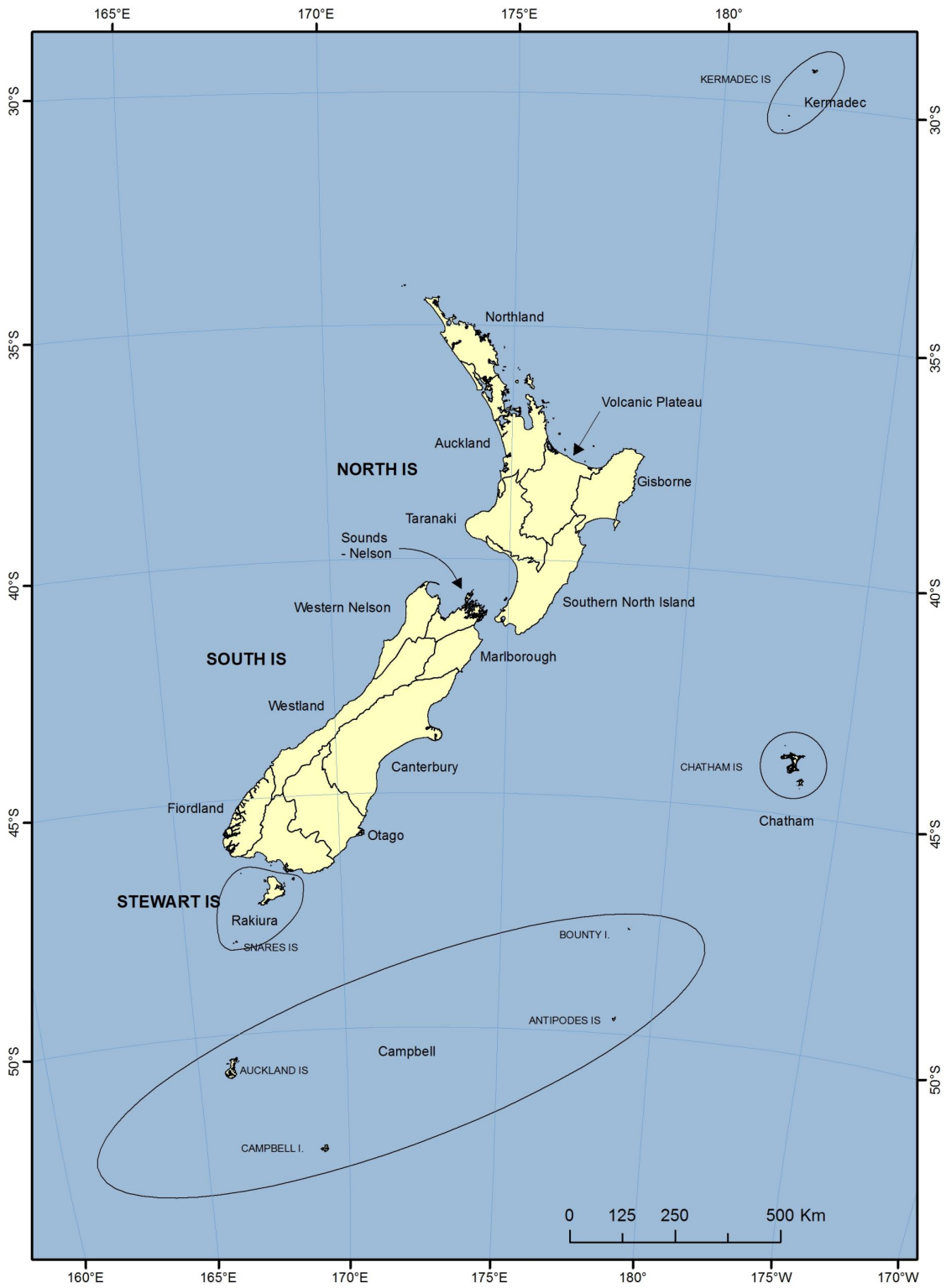
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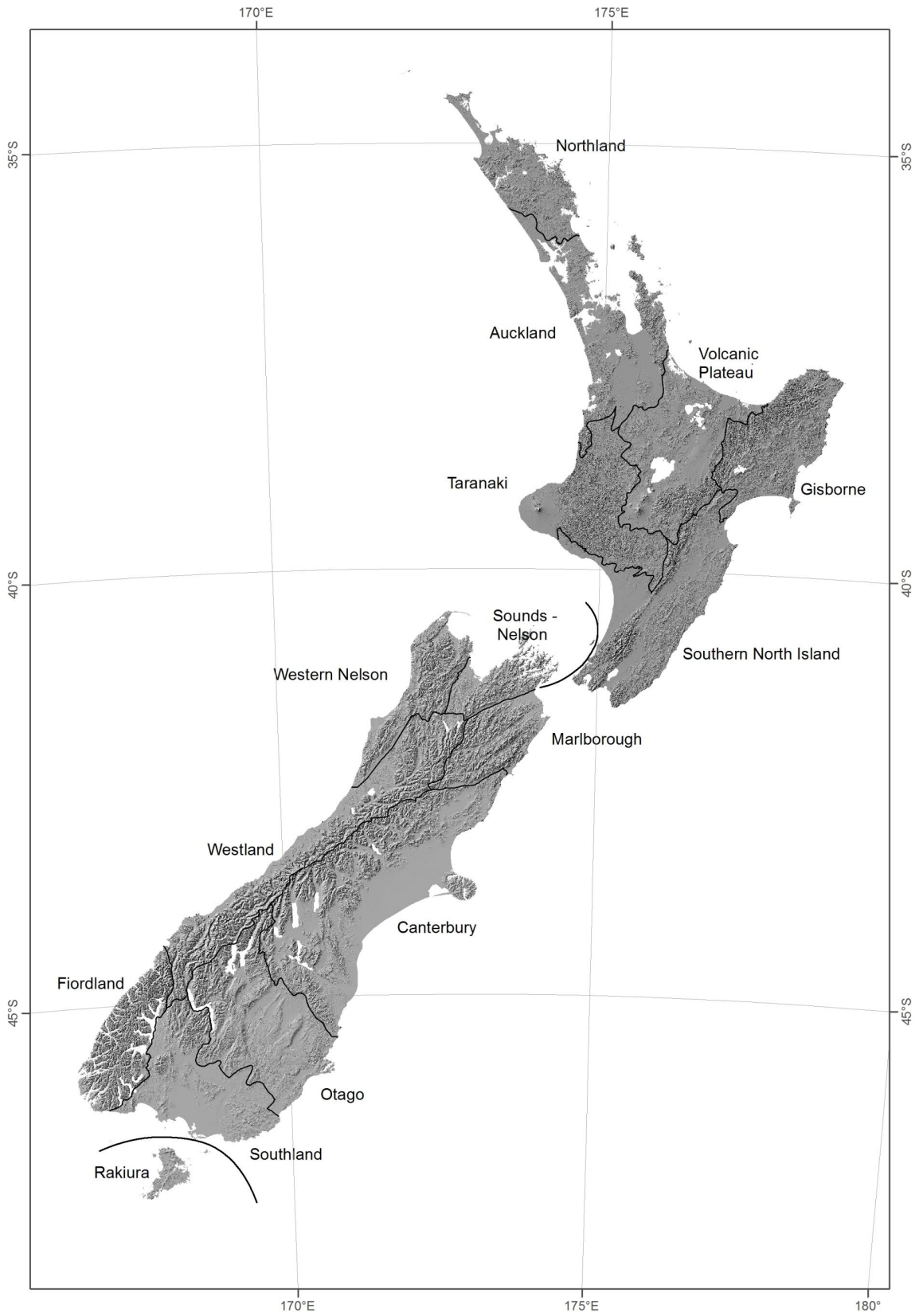
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Map 1: Map of New Zealand and offshore islands showing Ecological Provinces



Map 2: Map of New Zealand showing Ecological Provinces

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