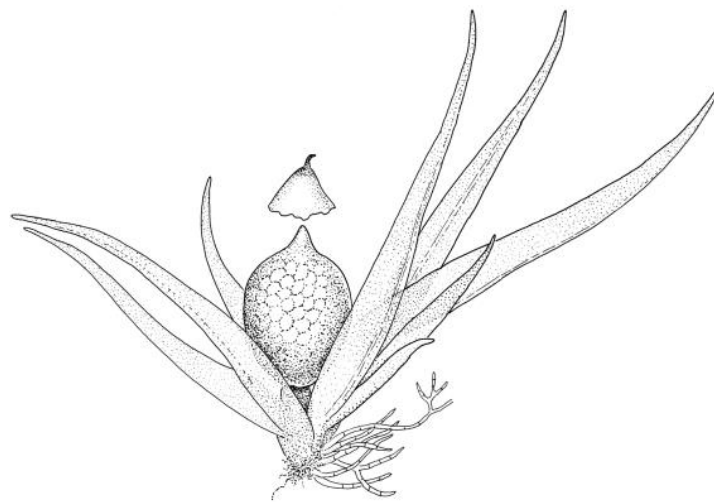


**FLORA OF NEW ZEALAND**  
**MOSESSES**

**EPHEMERACEAE**



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**A.J. FIFE**

Fascicle 4 – JUNE 2014

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Cover image: *Ephemerum sessile*, habit with capsule, protonema and calyptra. Drawn by Rebecca Wagstaff from J.K. Bartlett 19830, CHR 405918.

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## Introduction

The Ephemeraceae are represented in N.Z. by only three species in two genera. It is the only moss family considered to be represented in N.Z. only by adventive species; all three species are known from few collections from disturbed soil in the North I. The protonemata are characteristically persistent and, as the family name implies, the plants are short-lived. All are minute species with sessile and globose capsules considerably less than 1 mm in diameter. There is no dehiscence mechanism in *Ephemerum*, and only a rudimentary one in *Micromitrium*.

The family is traditionally placed close to the Funariaceae but differentiated from that family by having stomata with two guard cells. Recently published molecular studies, however, place some members of the Ephemeraceae near to, or even in, the Pottiaceae. The family is retained here because of its distinctive and unique morphology. All the species can be found only with the use of a hand lens and it seems likely that dedicated searching during cooler parts of the year would extend the known distributions of the three species.

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## Ephemeraceae

**Plants** minute, with a persistent creeping or subterranean **protonema**. **Stems** very short, mostly without central strand. **Leaves** very small, narrow and elongate, acuminate; **laminal cells** thin-walled and lax, smooth or less often prorate. **Costa** weak or lacking.

**Mostly dioicous. Male plants** minute, bud-like, with or without paraphyses. **Setae** very short (<0.5 mm) or apparently lacking; **capsules** spherical or ellipsoid, lacking a neck, indehiscent or splitting irregularly near mid capsule; **exothecial cells** thin-walled and lax; **annulus** lacking; **stomata** superficial, 2-celled; **columella** usually resorbed at maturity. **Peristome** nil. **Calyptra** mitrate or cucullate, either deciduous or persistent. **Spores** large.

**Taxonomy:** A family of minute and short-lived mosses, traditionally placed (Brotherus 1924) close to the Funariaceae but differentiated from it by having stomata, when present, with two guard cells. Recent molecular studies (Cox et al. 2010) as well as some recent assessments (Goffinet et al. 2009; Holyoak 2010) place some members of the Ephemeraceae, or the entire family, in the Pottiales, near to (or even in) the Pottiaceae.

However, the family is retained as separate here, largely because of its distinctive and unique morphology, and also for convenience and to conform with its treatment in the *Flora of Australia* by Stone (2006). Stone (1996) provided a useful revision of the Australian members. She appears to have considered all the seven species she treated to be indigenous (and several endemic) members of the Australian flora, although the distribution (Smith 2004) of *E. recurvifolium* suggests that it, at least, may be adventive in that country. The contrast between the numerous allegedly indigenous/endemic Australian species and the three species occurring in N.Z., all interpreted here as adventive, is great. It is also surprising that no species occurring in N.Z. is reported from Australia (Stone 2006).

A still useful revision of the North American species, with micrographs illustrating variation of leaf morphology of all those species, was published by Bryan & Anderson (1957).

The members of this family nearly all occur on damp bare soil, in spring, winter, and autumn, when competition from higher plants is minimal. The three N.Z. representatives are known only from the NI; all appear to be adventive species from the northern hemisphere.

- |    |   |                             |
|----|---|-----------------------------|
| 1  | <b>Protonema</b> sparse; <b>capsules</b> not apiculate, dehiscent by a weakly differentiated row of equatorial cells, c. 0.25 mm diam.; <b>calyptra</b> minute (consisting of the unexpanded archegonium), persistent at the capsule apex ..... | <i>Micromitrium tenerum</i> |
| 1' | <b>Protonema</b> abundant; <b>capsule</b> apiculate and cleistocarpous, $\geq 0.4$ mm diam.; <b>calyptra</b> mitrate, deciduous .....   | 2 ( <i>Ephemerum</i> )      |
| 2  | <b>Leaves</b> costate, entire or nearly so; <b>perigonial buds</b> present at base of fertile stems; <b>stomata</b> present in upper $\frac{1}{2}$ of capsules; <b>spores</b> coarsely bullate-papillose .....                                  | <i>Ephemerum sessile</i>    |
| 2' | <b>Leaves</b> ecostate, coarsely spinose-toothed; <b>perigonial buds</b> not present at base of fertile stems; <b>stomata</b> restricted to extreme base of capsules; <b>spores</b> finely papillose .....                                      | <i>Ephemerum serratum</i>   |

## *Ephemerum* Hampe, *Flora* 20: 285 (1837)

**Type taxon:** *Ephemerum serratum* (Hedw.) Hampe

**Plants** minute, with abundant creeping and often lustrous **protonema**. **Stems** <0.5 mm, in cross-section lacking central strand. **Leaves** narrowly lanceolate or linear, acuminate, entire, toothed, or spinose; **laminal cells** lax and mostly thin-walled, rectangular below,  $\pm$  rhomboidal above, smooth (in N.Z. material) or prorate. **Costa** variably developed, often absent.

**Dioicous, pseudodioicous, or autoicous. Male plants** bud-like, without paraphyses. **Setae** rudimentary or lacking; **capsules** cleistocarpous, mostly spherical or ellipsoid, with a small, solid apiculus, lacking neck; **columella** usually resorbed at maturity; **exothecial cells** thin-walled and lax; **stomata** superficial, 2-celled. **Calyptra** mitrate, enclosing only the capsule apex. **Spores** large, usually reniform, coarsely or finely papillose.

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**Taxonomy:** A moderate-sized genus widely distributed but with a preponderance of species in northern temperate regions. Thirty-two species were treated by Brotherus (1924). Stone (1996) recognised six species from Australia, with several of them occurring in western or tropical parts of that continent. Surprisingly, there appears to be no species overlap between Australia and N.Z., but several of the species treated by Stone do not occur in temperate parts of south-east Australia (where the greatest floristic similarity is expected). Six species (plus intraspecific taxa) were accepted for Europe by Holyoak (2010) and four species from eastern North America by Crum & Anderson (1981). Molecular phylogenetic studies may be required to demonstrate how closely allied the component species are.

### ***Ephemerum serratum* (Hedw.) Hampe, *Flora* 20: 285 (1837)**

≡ *Phascum serratum* Hedw., *Sp. Musc. Frond.*, 23 (1801)  
European type not seen.

**Protonema** lustrous. **Leaves** erect-spreading, lanceolate, the largest 1–2 × 0.2–0.3 mm, coarsely spinose-toothed nearly throughout, the teeth mostly spreading at 45 deg. or more; **upper laminal cells** elongate-rhomboidal, c. 75–120 µm long, smooth, scarcely differentiated from cells at leaf base. **Costa** absent.

**Dioicous.** **Capsules** spherical, red-brown, c. 0.4 mm diam., with a short, stout apiculus; **stomata** few, restricted to capsule base. **Spores** yellow-brown, broadly elliptic or weakly reniform, 60–90 × 54–60 µm, finely papillose in N.Z. material.

**Illustrations:** Plate 1. Bryan & Anderson 1957, figs 36–42; Crum & Anderson 1981, fig. 218; Smith 2004, fig. 124, 1–4 (as *E. serratum* var. *serratum*).

**Distribution:** NI: N Auckland (Royal Oak, Pakuranga, Manukau).

Adventive. North America\*, Europe including Britain\*. Reported from China and Morocco (Smith 2004).

**Habitat:** Occurring at low elevation on damp, compacted soil, often among introduced grasses.

**Notes:** Very poorly known in N.Z.; only six collections, collected in autumn, winter and spring (to late October) from a restricted area in the city of Auckland, have been seen. It seems likely that specific search in disturbed soil habitats in cooler parts of the year would extend the known distribution of this species.

### ***Ephemerum sessile* (Bruch) Müll.Hal., *Syn. Musc. Frond.* 1, 33 (1848)**

≡ *Phascum sessile* Bruch, *Jahresber. Pollichia* 2: 49 (1844)  
≡ *Ephemerum crassinervium* subsp. *sessile* (Bruch) Holyoak, *J. Bryol.* 32: 130 (2010)  
European type not seen.

**Protonema** lustrous. **Leaves** erect-spreading, linear-ovate, the largest c. 1.5–2.0 × 0.2 mm, entire or nearly so; **upper laminal cells** elongate-rhomboidal, smooth, moderately differentiated from the elongate-oblong cells at leaf base. **Costa** filling the subula, usually weak in lower leaf, smooth.

**Autoicous.** **Perigonal buds** present at base of fruiting plants, c. 0.3 mm, upper portion of bracts widely spreading. **Capsules** spherical, yellow-brown, 0.4–0.6 mm diam., with a stout apiculus; **stomata** few, scattered throughout exothecium. **Spores** yellow-brown, broadly elliptic or weakly reniform, 69–81 × 54–60 µm, coarsely bullate-papillose.

**Illustrations:** Plate 1. Smith 2004, fig. 123, 7–9.

**Distribution:** NI: S Auckland (near Meremere).

Adventive. Europe\* including Britain. Also recorded from Israel, Turkey, and Morocco by Smith (2004).

**Habitat:** Known in N.Z. from only two collections from damp soil in paddocks at low elevation; they were collected in April and July 1980 by J.K. Bartlett.

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**Notes:** The two known collections are from Island Block and Amokura, both near Meremere. The material from Amokura was cited by Bartlett (1984, p. 185) as *E. crassinervium*, and this report (based on an incorrect determination by Fife) is reflected in the record of this species in Fife (1995). However, re-examination of the material shows the laminal cells in the Meremere material are smooth rather than prorate, and the leaf margins entire. In both collections, perigonal buds can be demonstrated at the base of fertile shoots. The plants are thus interpreted here as autoicous; the sexuality of this species was interpreted by Smith (2004) as pseudodioicous in Britain. The stomata here are few, and scattered in the upper portion of the exothecium. The N.Z. material compares well to material from France *in herb.* Beckett. This species was treated as a subspecies of *E. crassinervium* (Schwägr.) Hampe by Holyoak (2010) but this view is not adopted here.

### ***Micromitrium* Austin, *Musci Appalach.*, 10 (1870)**

**Type taxon:** *Micromitrium austinii* Sull.

**Plants** minute, mostly with sparse **protonema**, scattered or gregarious. **Stems** extremely short. **Leaves** erect, the lower lanceolate-acuminate, the upper narrowly lanceolate and long acuminate, entire or weakly and bluntly serrulate above; **laminal cells** thin-walled, rectangular below, in upper leaf hexagonal-rhombic. **Costa** absent or rarely present.

**Synicous, autoicous** or **rarely dioicous**. **Setae** lacking; **capsules** sessile, globose, lacking an apiculus, lacking neck, dehiscing near the middle by a row of weakly differentiated cells; **columella** resorbed at maturity; **exothecial cells** thin-walled and laxly hexagonal; **stomata, annulus, and peristome** lacking. **Calyptra** minute and delicate. **Spores** medium-sized to large, mostly reniform.

**Taxonomy:** Closely allied to *Ephemerum* from which it is distinguished by capsules that lack apical projections and have a minute, persistent calyptra (consisting of the remains of the archegonium). The majority, perhaps all species, lack stomata and nearly all have ecostate leaves. A genus of c. 10 species, mostly distributed in North and South America; one species occurs in N.Z. Most of the species in the genus were previously treated in the genus *Nanomitrium* Lindb.

### ***Micromitrium tenerum* (Bruch & Schimp.) Crosby, *Bryologist* 71: 116 (1968)**

≡ *Phascum tenerum* Bruch & Schimp., *Laubm. Eur. Monogr.*, 2 (1835)

≡ *Nanomitrium tenerum* (Bruch & Schimp.) Lindb., *Not. Sallsk. Fauna Fl. Fenn. Forh.* 13: 409 (1874)  
European type not seen.

**Plants** exceedingly minute, with sparse and persistent **protonema**. **Leaves** widely spreading, linear-lanceolate, the largest c. 1.0–1.5 × 0.2–0.25 mm, bluntly toothed or nearly entire above. **Costa** absent.

**Reportedly autoicous** (♂ not seen in N.Z. material). **Capsules** c. 0.25 mm diam., red-brown, dehiscing above the equator; **stomata, annulus, and peristome** absent. **Spores** 30–36 µm, coarsely bullate-papillose, somewhat triangular in polar view, the proximal surface retaining 3 somewhat flattened surfaces and occasionally with a weak trilete scar, the distal surface rounded.

**Illustrations:** Plate 1. Smith 2004, fig. 123, 1–3.

**Distribution:** NI: N Auckland (Pakuranga, Pōkeno), S Auckland (Kōpuku).

Adventive. North America, Europe\* including Britain, East Asia.

**Habitat:** On damp soil at low elevations; one collection occurred in association with *Ephemerum serratum*.

**Notes:** Distinguished from the species of *Ephemerum* occurring in N.Z. by the much sparser protonema, the smaller diameter and dehiscent nature of the capsule, the presence of a minute and persistent calyptra, as well as leaf and spore characters. This species is considered critically endangered in Britain (Smith 2004).



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# Conventions

## Abbreviations and Latin terms

Abbreviations	Meaning
A	Auckland Islands
A.C.T.	Australian Capital Territory
<i>aff.</i>	allied to ( <i>affinis</i> )
agg.	aggregate
Ant	Antipodes Islands
a.s.l.	above sea level
<i>auct.</i>	of authors ( <i>auctorum</i> )
B	Bounty Islands
C	Campbell Island
c.	about ( <i>circa</i> )
cf.	compare with, possibly the species named ( <i>confer</i> )
<i>c.fr.</i>	with fruit ( <i>cum fructibus</i> )
Ch	Chatham Islands
<i>comb. nov.</i>	new combination ( <i>combinatio nova</i> )
D'U	D'Urville Island
et al.	and others ( <i>et alia</i> )
et seq.	and following pages ( <i>et sequentia</i> )
ex	from
fasc.	fascicle
<i>fide</i>	according to
GB	Great Barrier Island
HC	Hen and Chicken Islands
Herb.	Herbarium
<i>hom. illeg.</i>	illegitimate homonym
I.	Island
ibid.	in the same place ( <i>ibidem</i> )
incl.	including
<i>in herb.</i>	in herbarium ( <i>in herbario</i> )
<i>in litt.</i>	in a letter ( <i>in litteris</i> )
<i>inter alia</i>	among other things ( <i>inter alia</i> )
Is	Islands
K	Kermadec Islands
KA	Kapiti Island
LB	Little Barrier Island
L.D.	Land District or Districts
<i>leg.</i>	collected by ( <i>legit</i> )
loc. cit.	in the same place ( <i>loco citato</i> )
l:w	length:width ratio
M	Macquarie Island
Mt	Mount
<i>nec</i>	nor
NI	North Island
no.	number
<i>nom. cons.</i>	conserved name ( <i>nomen conservandum</i> )
<i>nom. dub.</i>	name of doubtful application ( <i>nomen dubium</i> )
<i>nom. illeg.</i>	name contrary to the rules of nomenclature ( <i>nomen illegitimum</i> )
<i>nom. inval.</i>	invalid name ( <i>nomen invalidum</i> )
<i>nom. nud.</i>	name published without a description ( <i>nomen nudum</i> )
<i>non</i>	not
N.P.	National Park
N.S.W.	New South Wales
N.T.	Northern Territory (Australia)
N.Z.	New Zealand
op. cit.	in the work cited ( <i>opere citato</i> )
pers. comm.	personal communication

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PK	Poor Knights Islands
P.N.G.	Papua New Guinea
<i>pro parte</i>	in part
Qld	Queensland
q.v.	which see ( <i>quod vide</i> )
RT	Rangitoto Island
S.A.	South Australia
<i>s.coll.</i>	without collector ( <i>sine collectore</i> )
<i>s.d.</i>	without date ( <i>sine die</i> )
sect.	section
SEM	scanning electron microscope/microscopy
<i>sensu</i>	in the taxonomic sense of
SI	South Island
<i>sic</i>	as written
<i>s.l.</i>	in a broad taxonomic sense ( <i>sensu lato</i> )
<i>s.loc.</i>	without location ( <i>sine locus</i> )
Sn	Snares Islands
<i>s.n.</i>	without a collection number ( <i>sine numero</i> )
Sol	Solander Island
sp.	species (singular)
spp.	species (plural)
<i>s.s.</i>	in a narrow taxonomic sense ( <i>sensu stricto</i> )
St	Stewart Island
<i>stat. nov.</i>	new status ( <i>status novus</i> )
subg.	subgenus
subsect.	subsection
subsp.	subspecies (singular)
subsp.	subspecies (plural)
Tas.	Tasmania
TK	Three Kings Islands
U.S.A.	United States of America
var.	variety
vars	varieties
Vic.	Victoria
viz.	that is to say ( <i>videlicet</i> )
vs	versus
W.A.	Western Australia

## Symbols

Symbol	Meaning
µm	micrometre
♂	male
♀	female
±	more or less, somewhat
x	times
>	greater than
<	less than
≥	greater than or equal to
≤	less than or equal to
=	heterotypic synonym of the preceding name
≡	homotypic synonym of the preceding name
!	confirmed by the author
*	in distribution statements, indicates non-N.Z. localities from which material has been confirmed by the author

Technical terms conform to Malcolm, B.; Malcolm, N. 2006: *Mosses and other Bryophytes: an Illustrated Glossary*. Edition 2. Micro-Optics Press, Nelson.

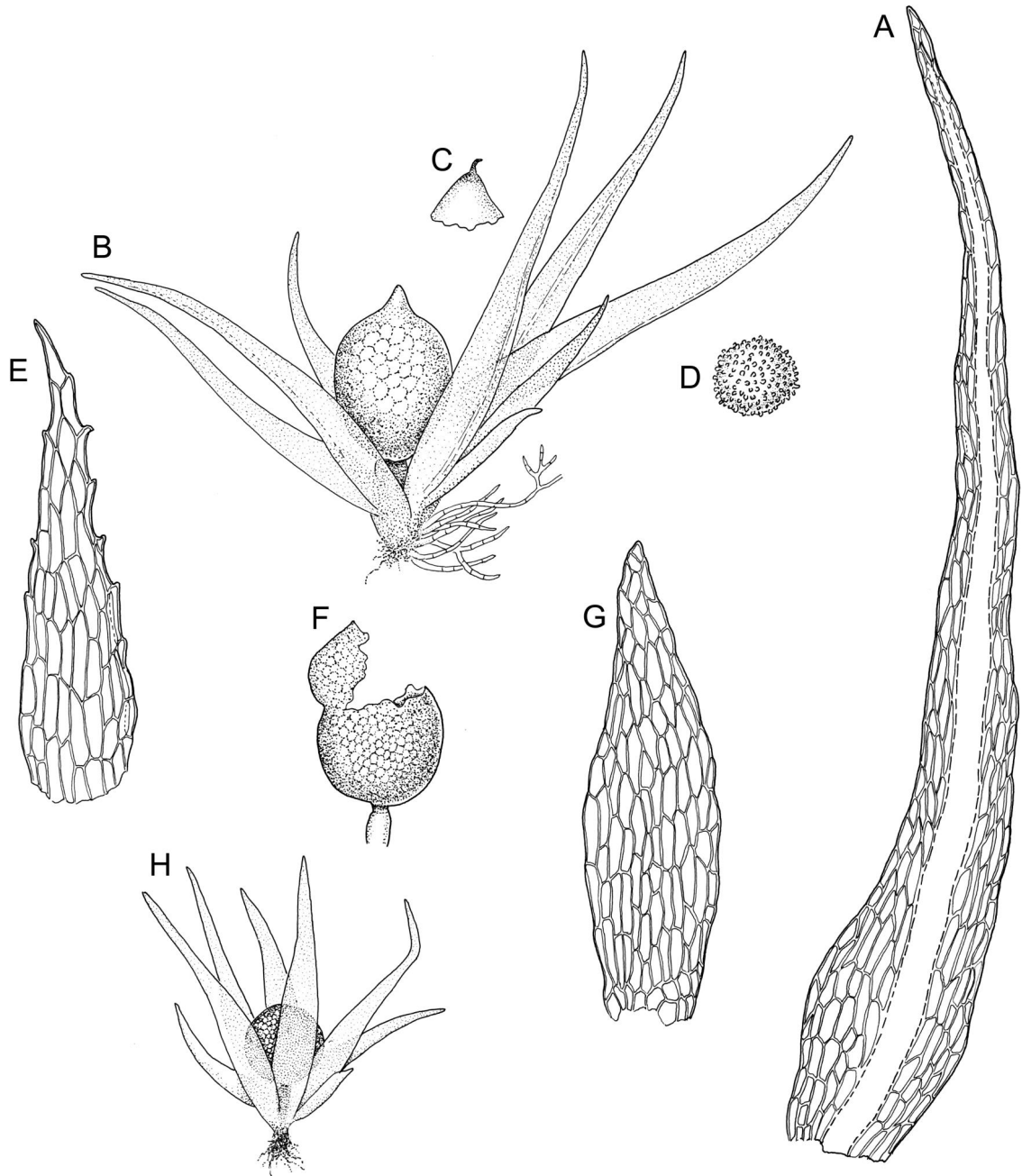
Abbreviations for Herbaria follow the standard abbreviations listed in *Index Herbariorum*.

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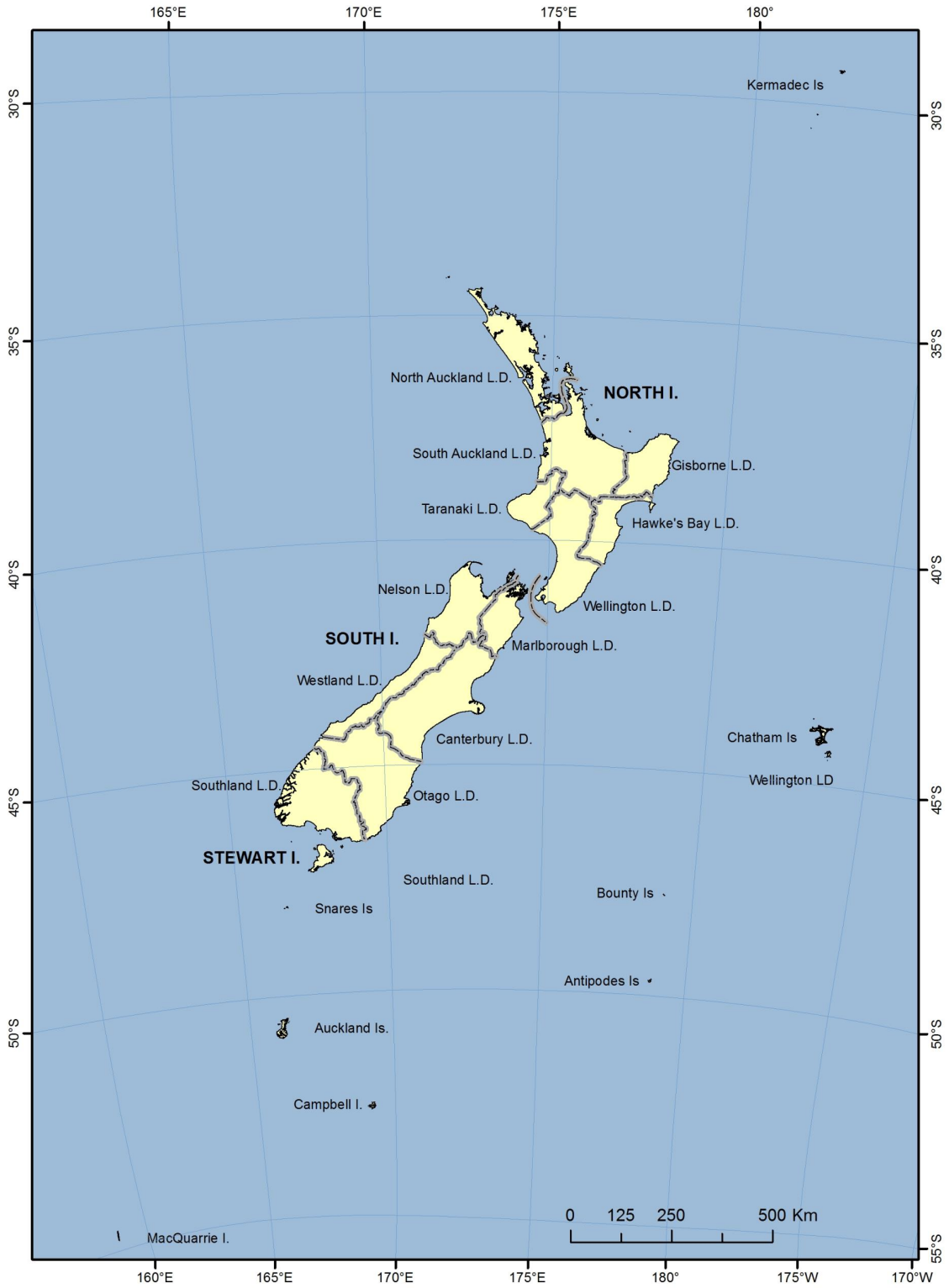
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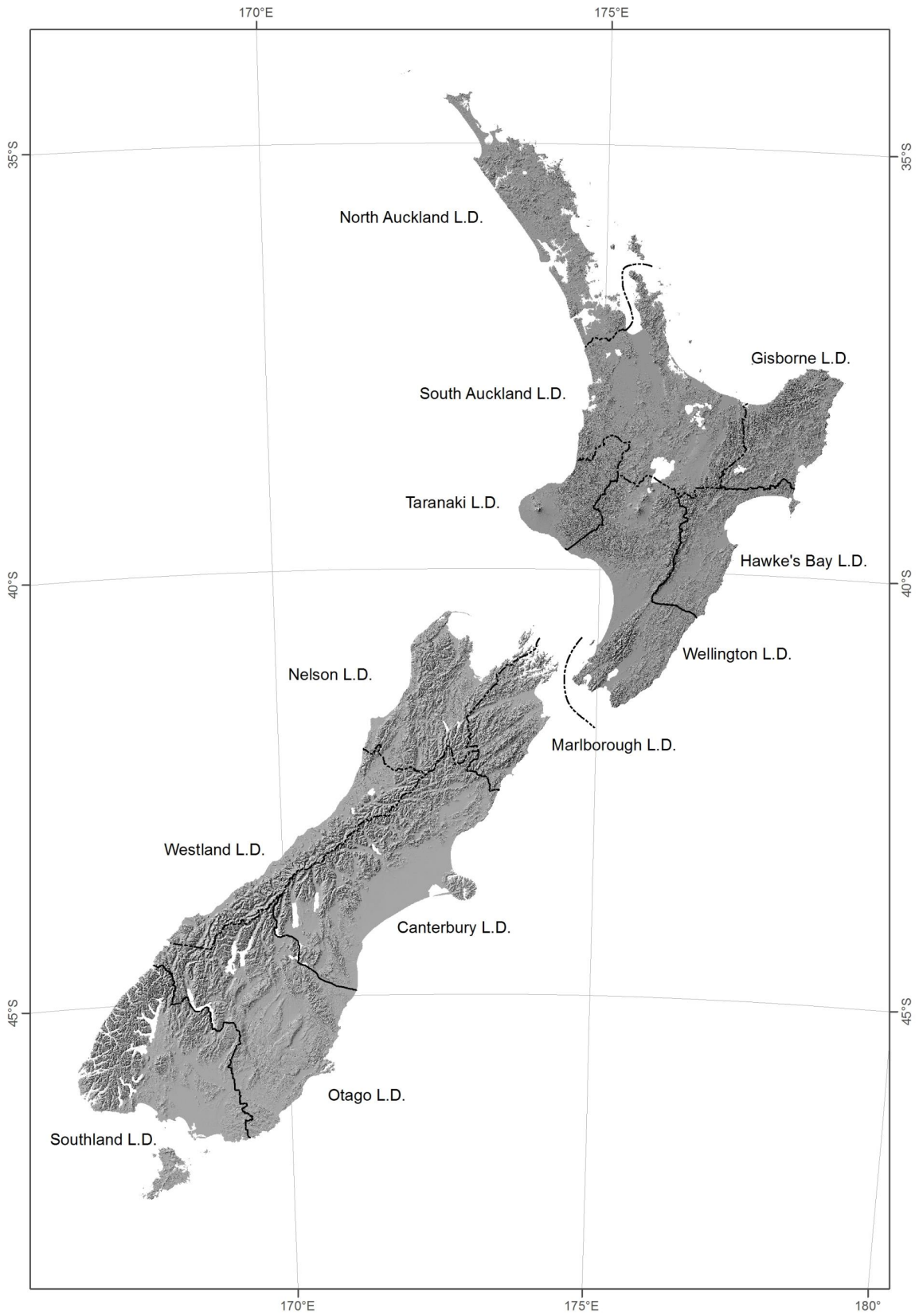
I also thank the participants, over many years, of the John Child Bryological and Lichenological Workshops. The preparation of this revision was supported by Core funding for Crown Research Institutes from the Ministry of Business, Innovation and Employment's Science and Innovation Group.



**Plate 1: *Ephemera* and *Micromitrium*. A–D: *E. sessile*. A, leaf. B, habit with capsule and protonema. C, calyptra. D, spore. E: *E. serratum*. E, leaf. F–H: *M. tenerum*. F, capsule. G, leaf. H, habit with capsule. *E. sessile* drawn from J.K. Bartlett 19830, CHR 405918. *E. serratum* drawn from A.J. Fife 5879, CHR 104194. *M. tenerum* drawn from J.K. Bartlett s.n., Mar. 1980, CHR 266331.**



**Map 1:** Map of New Zealand and offshore islands showing Land District boundaries



**Map 2:** Map of main islands of New Zealand showing Land District boundaries

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## Image Information

**Image**  
Plate 1  
Map 1  
Map 2

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