A Guide to Mosses and Liverworts of Alberta Peatlands

BOREAL RESEARCH INSTITUTE

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SPECIES OF RICH FENS

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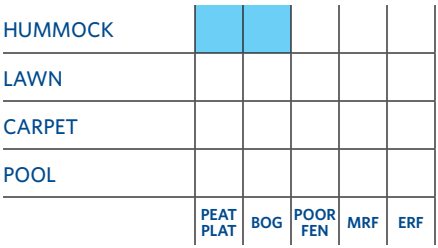
Introduction

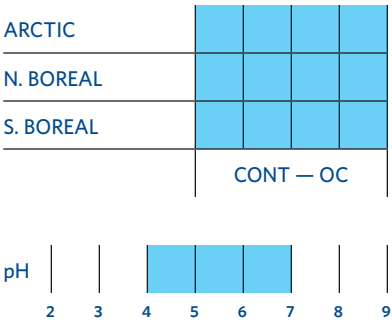
Bryophytes are important components of boreal peatland ecosystems. They serve a number of key ecosystem services and are critical indicators of ecosystem health. Also, individual species have habitats limited by important chemical and hydrological gradients and hence bryophytes can serve as indicators of various peatland site-types such as bogs, poor fens, and rich fens.

This guide treats 60 species of mosses and liverworts that comprise the flora of bogs and fens of Alberta (and western boreal Canada). The guide is designed to be used both in the field and in the laboratory. Photos were chosen to show the species as they occur in the field, accompanied by ecological and taxonomic comments useful for field recognition. For many characters a 10 or 14x handlens is required. Species are organized by the peatland site-type in which they are most common, but further information is shown on the ecological and phytogeographical diagrams that accompany each species. Ecological site-types include both permafrost dominated 'peat plateaus' and 'continental bogs' (without continuous permafrost). Fens, dominated by *Sphagnum*, are acid and here called poor fens. We use classical terminology for true moss-dominated rich fens and recognize two types - Fens with circumneutrral pH are equivalent to moderate-rich fens and alkaline fens with high alkalinity and high pH are equivalent to extreme-rich fens.

The text is derived from an article published in *Evansia* in 2014 by the first author (Vitt 2014) and used with permission of the editor, Scott LeGreca. The photographs are almost all taken by Michael Lüth and are copyrighted by him. Additional photographic details for most species can be found at 'Bildatlas der Moose Deutschlands'. Nomenclature follows *Bryophyte Flora of North America* for mosses (BFNA 2007, 2014) and Stotler and Crandall-Stotler (2017) for liverworts.

Hylocomium splendens (Hedw.) Schimp.





KEY FEATURES

The bipinnate branching, presence of paraphyllia, and distinctive frondose growth form are characters of this species (however, arctic-alpine forms may lack the frondose growth form). Microscopically, the broadly acuminate leaves, short and double costa, and prorulose leaf cells are key features.

IDENTIFICATION

Plants complex, forming bipinnately branched wefts. **Stems** form annual increments visible as annual fronds having a stair-step arrangement, paraphyllia abundant. **Leaves** stem leaves different from branch leaves, branch leaves with a short and double costa, ovate, abruptly acuminate often with tiny apiculus. **Leaf Cells** oblong to elongate, with small apical papillae on convex surface (prorulose). **Alar Cells** shorter and thicker-walled than upper cells.

HABITAT

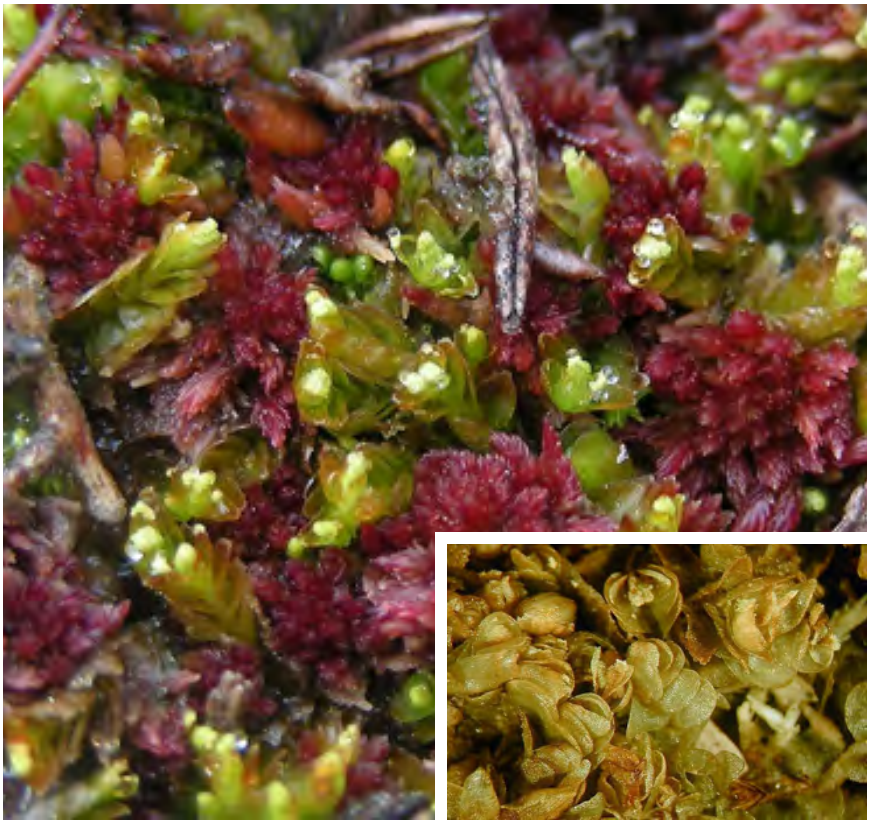
Very abundant in upland coniferous boreal forests; occasionally found in dry peatlands, especially in peat plateaus and dry bogs where it occupies the highest and driest hummocks.

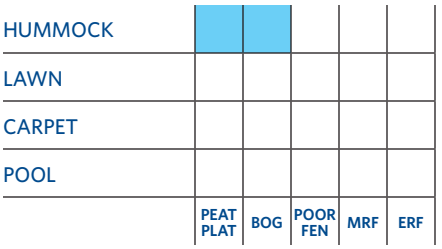
COMMON ASSOCIATES

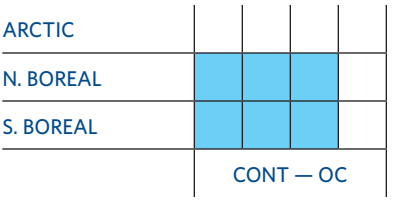
In dry oligotrophic peatlands associated with *Pleurozium schreberi* and hummock-forming Sphagna, especially *S. fuscum*. In mesic situations, *Ptilium crista-castrensis* (see below) may occur. This species is easily told by its densely pinnate stems with non-costate, falcate-secund, plicate leaves.

Ptilium crista-castrensis (Hedw.) DeNot.

Mylia anomala (Hook.) S.Gray







KEY FEATURES

This is the largest and most common species of liverwort in peatlands. In the field the conspicuous yellow gemmae, relatively large plants, and succubous entire leaves (see inset) are characteristic. *Odontoschisma sphagni* also has round, entire leaves. It is oceanic in bog pools and has a strong leaf border and obvious stolons. Other liverworts in peatlands have incubous leaves or leaves that are bilobed. The thalloid hepatic, *Marchantia polymorpha* occasionally occurs in disturbed fens, especially after fire.

IDENTIFICATION

Plants prostrate with ascending stem tips, mostly unbranched (to 1-2 times branched), medium-sized. **Stems** rather turgid, with sporadic hyaline rhizoids. **Leaves** succubous, circular to oblong-ovate, rounded, usually with very conspicuous yellow gemmae produced at upper margins, concave. **Leaf Cells** rounded to stellate due to thickened corners (trigones), similar throughout.

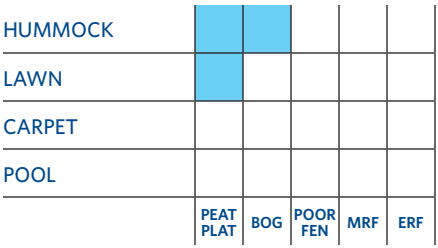
HABITAT

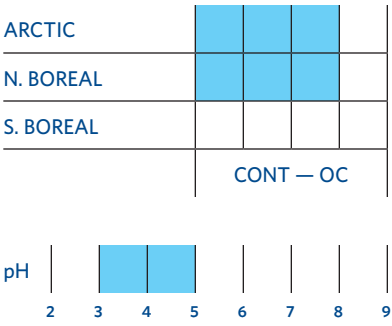
Growing intermixed and sometimes covering *Sphagnum fuscum*, rarely intermixed with other Sphagna.

COMMON ASSOCIATES

Sometimes with the mosses *Polytrichum strictum* and *Pohlia nutans*. Also occurring with less common leafy hepatics on *Sphagnum* hummocks, including species of *Calypogeia* (incubous leaves) *Fuscocephaloziopsis* (bifid leaves on tiny plants), and *Lophozia* (sensu lato; large plants with bifid leaves).

Sphagnum balticum (Russ.) C.Jens.





KEY FEATURES

This species resembles *S. angustifolium*, but is differentiated by larger, blunt, rounded, oblong, and more abundant stem leaves; also the spaces between capitulum arms have only one pendent branch evident. Microscopically, I find few differences between this species and *S. angustifolium* – perhaps the apical pore is better defined in the latter species, but I am not convinced these two species can be identified by branch leaf features.

IDENTIFICATION

Plants forming loose mounds, soft, yellow-brown, with one pendent branch visible between capitulum arms and no evident apical bud. **Stems** clear, with hyalodermis not well differentiated. **Leaves** ovate-lanceolate and narrowed to narrowly truncate apex, often undulate in capitulum; stem leaves relatively large, shortly oblong to triangular-oblong, blunt and concave – appearing triangular, usually numerous and bent downward along stem, with fibrillose, hyaline cells having partially resorbed pores in upper portion. **Leaf Cells** hyaline cells of convex surface of branch leaves with large apical pore and variable number of pores in cell corners, sometimes a few pores along cell edges, on concave surface with a few indistinct, unringed pores in cell corners, green cells triangular, and not reaching the concave surface, exposed only on convex surface.

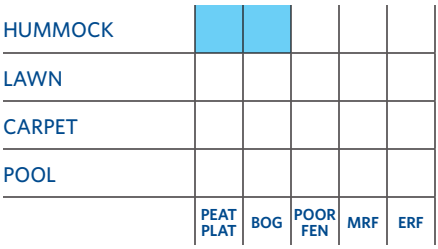
HABITAT

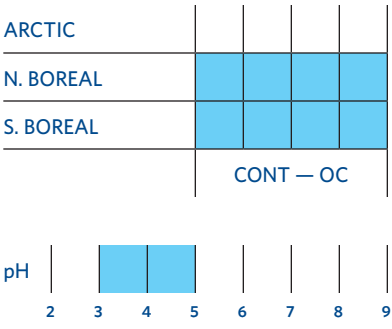
In northern North America this species is infrequent on hummocks on peat plateaus and rare southward, where it occurs intermixed with *S. fuscum* and *S. magellanicum*, and occurring in drier habitats than *S. angustifolium*; however, in Eurasia it also occurs in lawns in unfrozen peatlands.

Sphagnum capillifolium (Ehrh.) Hedw.

Photo: Jeremy Hartsock, Southern Illinois University

Photo: Dale H. Vitt, Southern Illinois University





KEY FEATURES

Sphagnum capillifolium (= *S. nemoreum* Scop.) forms high, pinkish-red hummocks in oligotrophic habitats. The dense, rounded capitula and ovate-lanceolate stem leaves with some pores and fibrils identifies this species. Branch leaf features cannot be used to differentiate this species from *S. fuscum*, but *S. capillifolium* has clear (pinkish) stems compared to dark brown in *S. fuscum*.

IDENTIFICATION

Plants small, green to pinkish-red plants with dense canopies, one pendent branch visible between capitulum arms; individual capitula hemispheric. **Stems** clear, with non-porose hyalodermis. **Leaves** ovate-lanceolate, minutely truncate at apex; stem leaves broadly lanceolate, with at least some fibrils and pores. **Leaf Cells** hyaline cells with large elliptic pores along sides of the cell on convex surface, somewhat smaller, less conspicuous rounded pores in central part of cell on concave surface; green cells triangular, exposed on concave surface.

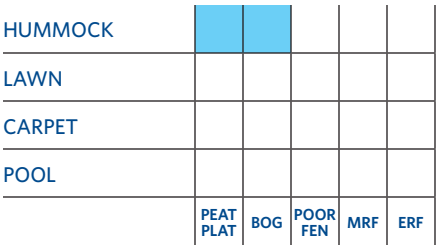
HABITAT

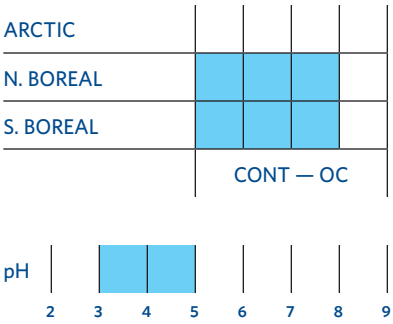
Forms hummocks in bogs and peat plateaus; rarely as isolated patches in both rich and poor fens. More abundant in eastern North America.

COMMON ASSOCIATES

Usually few species occur intermixed with this species, but like *S. fuscum* occasionally mixed with *Polytrichum strictum*; while *Pohlia nutans* and *Mylia anomala* occur as scattered individuals.

Sphagnum fuscum (Schimp.) Klinggr.





KEY FEATURES

Key features for the identification of *S. fuscum* include the lingulate, entire stem leaves, brown colour, and the dark (brown) stems. The branch leaves with large elliptic pores that are arranged along the sides of the cells on the convex surface is a pore pattern similar to that in *S. capillifolium* as well as a number of more woodland species (e.g., *S. girgensohnii*); however, the brown stems are a key feature of *S. fuscum* that are not found in any other *Sphagnum* in the section *Acutifolium*. See *S. angustifolium* for additional comments.

IDENTIFICATION

Plants small, brownish with dense canopies, one pendent branch visible between capitulum arms. **Stems** brown, with non-porose hyalodermis. **Leaves** ovate-lanceolate, minutely truncate at apex; stem leaves lingulate, without fibrils and pores. **Leaf Cells** with large elliptic pores along sides of cells on convex surface, somewhat smaller, less conspicuous, rounded pores in central part of cell on concave surface; green cells triangular, exposed on concave surface.

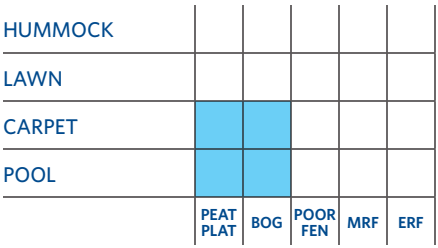
HABITAT

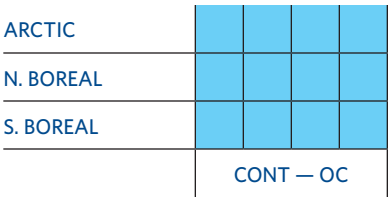
Forming hummocks in bogs and peat plateaus; occasionally on isolated hummocks in both rich and poor fens.

COMMON ASSOCIATES

Usually associated with *Polytrichum strictum*, *Pohlia nutans*, and *Mylia anomala*.

Warnstorfia fluitans (Hedw.) Loeske





KEY FEATURES

Differentiated from other species with costate, falcate-secund leaves by denticulate margins (best seen just below the apex), gradually differentiated alar cells that do not form conspicuous inflated groups, and a stem transverse section with a central strand. *Drepanocladus aduncus* has completely entire leaf margins; *Warnstorfia exannulata* has abruptly differentiated and inflated alar cells and a much stronger costa; while species of *Hamatocaulis* have no central strand in the stem. Species of *Scorpidium* have shorter leaves and a hyalodermis of enlarged cells. Also see comments under *W. exannulata*.

IDENTIFICATION

Plants floating to emergent, rather slender, green. **Stems** generally with few branches, occasionally with numerous branches, with central strand and no differentiated hyalodermis. **Leaves** narrowly lanceolate, gradually acuminate, falcate-secund; costa single, weak, ending about 1/2 to 2/3 up leaf, somewhat narrowed to insertion; margins denticulate in upper portion of leaves. **Leaf Cells** elongate-linear, with blunt ends, smooth. **Alar Cells** indistinct, gradually enlarged and forming small groups of hyaline, rectangular cells at leaf angles.

HABITAT

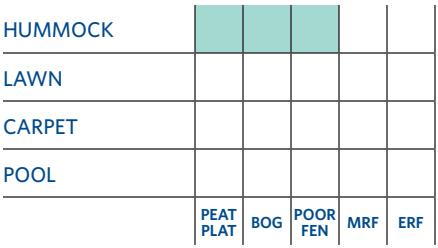
Found floating in shallow pools to emergent, and forming carpets in shallow water in oligotrophic habitats, and characteristic of bogs and extreme poor fens.

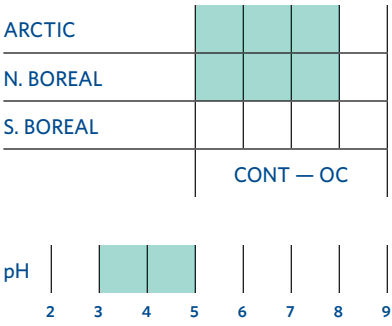
COMMON ASSOCIATES

In oceanic areas found with wet-growing species of *Sphagnum*, especially *S. cuspidatum*, while in continental areas associated with permafrost melt often found with *S. majus* and *S. jensenii*.

Calypogeia sphagnicola (H.Arnell et J.Perss.) Warnst. et Loeske

Photo: Jan-Peter Frahm, Moose Deutschland





KEY FEATURES

This small liverwort has incubous upper leaves along with bilobed underleaves. The upper leaves also have small apical notches in at least some leaves. The occurrence of individual stems within *Sphagnum* hummocks is shared with *C. suecica* - these two species differ in size of the leaf cells (25-30 µm in *suecica* and 30-35 µm in *sphagnicola*). All other *Calypogeia* species are rare in this habitat.

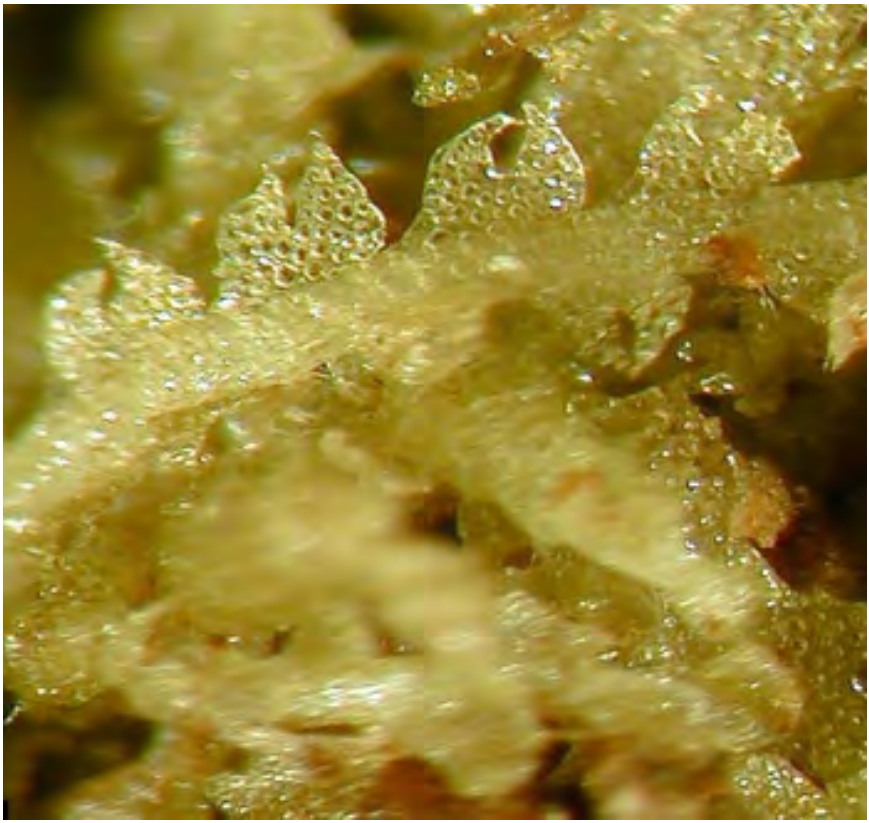
IDENTIFICATION

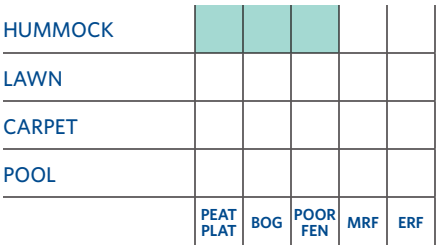
Plants slender, threadlike among *Sphagnum* plants. **Leaves** incubous, small and distant along stem, ovate, obtuse to notched, underleaves relatively large, bilobed, some with 1-2 obtuse, lateral teeth. **Leaf Cells** rounded, 30-35 µm across.

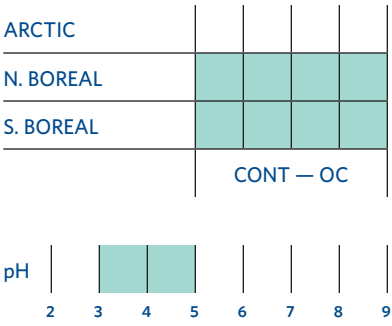
HABITAT

Occurring on bog hummocks among *Sphagnum* stems, often not evident on the capitulum surface. More common in disturbed situations and occurring with *Cephalozia* spp.

Fuscocephaloziopsis (Cephalozia) connivens (Dicks.) Váňa et Söderstr.







KEY FEATURES

This species and other boreal ones in the genus *Cephalozia* have recently been placed in a new genus – *Fuscocephaloziopsis*. The tiny, threadlike plants with sharply pointed, bilobed, obliquely succubous leaves are common on *Sphagnum* hummocks. This species, with relatively large leaf cells (45-60 µm across) and leaves with few cells (leaves 7-12 cells across), is frequent across the boreal. Although there are several other species of the genus that occur in this habitat, only *F. lunulifolia* is frequent. It differs by having leaf cells only 25-35 µm across. *Cladopodiella fluitans* and *Gymnocolea inflata* both occur in bog and poor fen pools – both of these species have blunt leaf lobes.

IDENTIFICATION

Plants threadlike, occurring singly among *Sphagnum* stems. **Leaves** round, bilobed to about half way, lobes incurved, tips often touching, sharply pointed, underleaves lacking. **Leaf Cells** 45-60 µm across.

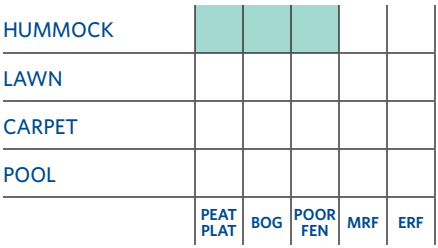
HABITAT

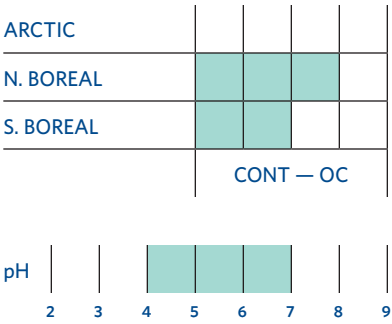
Scattered among *Sphagnum* stems in bog hummocks, more common in disturbed situations.

COMMON ASSOCIATES

Are *Calypogeia* species, sometimes among *Mylia anomala* stems.

Pleurozium schreberi (Brid.) Mitt.





KEY FEATURES

The pinnately branched, red stems without paraphyllia are characteristic. The leaves are relatively large, with a very short and double costa (or lacking), and well-differentiated alar cells. The very concave leaves with recurved leaf apices are useful characteristics. *Hylocomium splendens* has more acutely pointed leaves, is bipinnately branched, and has stems with paraphyllia.

IDENTIFICATION

Plants robust, coarse, sparsely to regularly pinnately branched, erect. **Stems** red, without hyalodermis or paraphyllia. **Leaves** ovate-oblong, with tiny, often recurved acute tip, concave; costa lacking; entire. **Leaf Cells** elongate-linear, smooth. **Alar Cells** composing a group of coloured, quadrate-rectangular, thick-walled cells forming a distinct angular group.

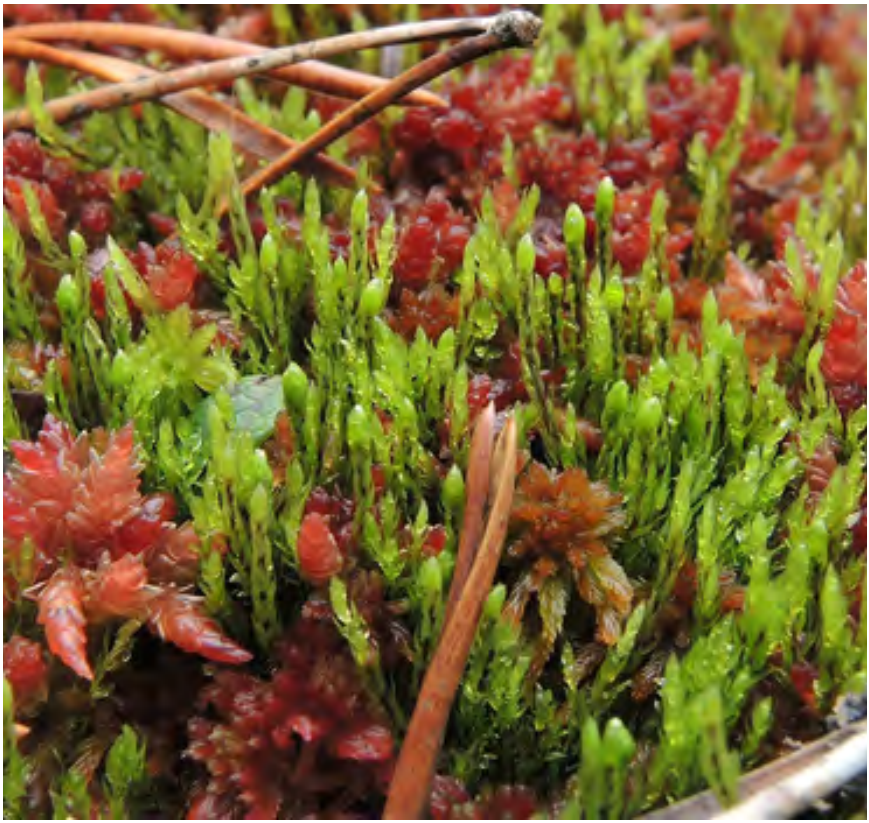
HABITAT

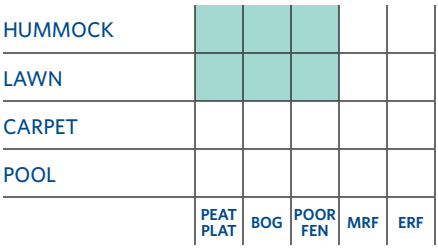
Growing on hummocks of oligotrophic peatlands and dominating acidic, nutrient poor upland boreal forests, less common coastward, rare in tundra.

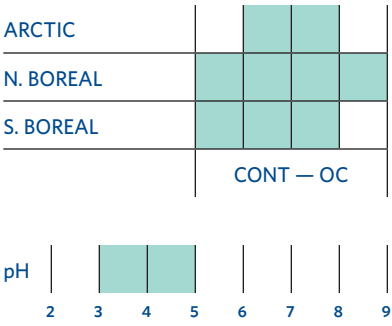
COMMON ASSOCIATES

Associated with *Hylocomium splendens* and *Ptilium crista-castrensis* in the continental boreal upland coniferous forest, and with species of *Rhytidiadelphus* in more mesic localities. Common in peat plateaus and continental bogs (or on hummocks in poor fens) in association with *Sphagnum fuscum*.

Pohlia nutans (Hedw.) Lindb.







KEY FEATURES

The very slender, unbranched stems; lanceolate leaves with serrulate margins; and rhombic cells are distinguishing features of this species. In rich fens, *Bryum pseudotriquetrum* is common – it is distinguished by decurrent leaves that are entire and bordered by elongate cells, and by shorter long-hexagonal leaf cells. The decurrencies easily differentiate this species from *Pohlia nutans*. *Pohlia wahlenbergii* is frequent in calcareous seeps, it is reddish in colour, and has long-decurrent leaves; *P. cruda* is very shiny and golden-green in colour with thin-walled leaf cells – it occurs on peaty calcareous ledges.

The photo is of *Pohlia sphagnicola*. Some authors treat *P. sphagnicola* as a species distinct from *P. nutans* based on its habitat, sexual condition, and spore size, however we follow BFNA and consider both of these morphotypes under the name *P. nutans*.

IDENTIFICATION

Plants slender, yellow- to light-green, unbranched, occurring intermingled with other mosses. **Stems** reddish, naked, shiny. Leaves lanceolate, acute, erect wet or dry; costa single, ending just beneath apex; margins distinctly serrulate in upper part of leaf. **Leaf Cells** long rectangular to long rhombic, rather thick-walled, smooth. **Alar Cells** not differentiated, leaves not decurrent.

HABITAT

Occurring on rotting wood, this is one of the most common species of upland boreal forest habitats. It is also commonly intermingled with *Sphagnum* (and sometimes called *P. sphagnicola*) in oligotrophic peatlands.

COMMON ASSOCIATES

Most commonly intermingled in *Sphagnum fuscum* along with *Polytrichum strictum* and *Mylia anomala*.

Polytrichum strictum Brid.

	PEAT PLAT	BOG	POOR FEN	MRF	ERF
HUMMOCK	■	■	■		
LAWN					
CARPET					
POOL					

	CONT — OC
ARCTIC	■
N. BOREAL	■
S. BOREAL	■

pH

KEY FEATURES

This is the only common species of the Polytrichaceae that occurs in bogs and poor fens. A less frequent species in swamps and paludified woodlands is *P. commune*. It is larger, has recurved leaves when moist, no stem tomentum, and the lamellae are not covered by the lamina. The apical cells of the lamellae are u-shaped in transverse section. *Polytichum juniperinum*, a species of mineral soils, is similar to *P. strictum* in leaf morphology, but lacks abundant whitish stem tomentum. The complex leaf structure of lamellae and complex costa along with hyaline leaf sheaths is unique to this group of mosses.

IDENTIFICATION

Plants erect, unbranched, with a bluish-green hue, occurring gregariously or in loose mats. **Stems** covered with whitish tomentum of rhizoids. **Leaves** erect when dry, spreading when moist, lanceolate from a hyaline, unistratose, expanded, sheathing base, acuminate, ending in a short, reddish, toothed awn; upper portion of leaves consisting of an expanded costa, from which numerous, vertical, green, lamellae arise that are encased in the inflexed leaf lamina. **Leaf Cells** has upper cells irregularly quadrate to isodiametric, smooth, cells of sheath hyaline, long-rectangular, smooth. Apical cells of lamellae rounded in transverse section of leaf, smooth. **Alar Cells** not differentiated.

HABITAT

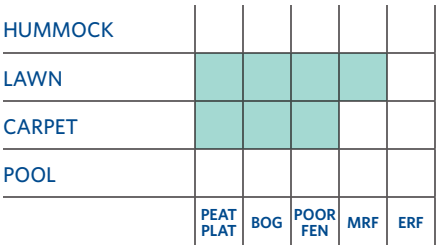
This species occurs intermixed with *Sphagnum* on high hummocks in oligotrophic habitats. The individual shoots are elevated 1 cm or so above the *Sphagnum* canopy. Also this species is one of the first bryophyte species to colonize disturbed bare peat surfaces, especially after fire where it forms large continuous mats.

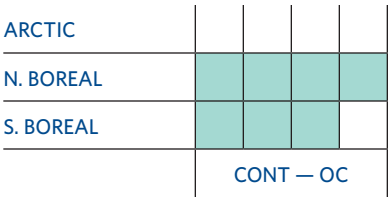
COMMON ASSOCIATES

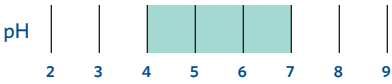
Most commonly associated with *Sphagnum fuscum*, but also with other hummock-forming species of *Sphagnum*; hummocks may also contain *Pohlia nutans* and *Mylia anomala*.

Sphagnum angustifolium (Russ.) C.Jens.

Photo: Jeremy Hartsock, Southern Illinois University







KEY FEATURES

Stems without a hyalodermis, small triangular non-porose stem leaves, and branch leaf hyaline cells having a prominent rounded apical pore, along with green cells exposed on the convex surface are key features. Without stem leaves, this species cannot be distinguished from *S. fallax* (which is rare in the continental boreal region), nor *S. balticum*, which is northern in distribution.

IDENTIFICATION

Plants yellow-green, fluffy, with loose canopies, two pendent branches visible between capitulum arms. **Stems** clear, without hyalodernis, non-porose. **Leaves** ovate-lanceolate, minutely truncate at apex; stem leaves small, triangular, blunt to slightly erose at apex, without pores and fibrils. **Leaf Cells** with hyaline cells that have an apical rounded-elliptic pore at cell apex on convex surface, occasionally a second pore just beneath; additional pores restricted to hyaline cell corners, on concave surface and several rounded rather inconspicuous pores in central part of cells; green cells triangular, exposed on convex surface.

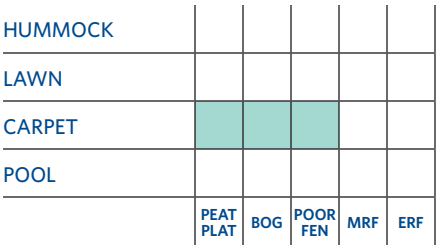
HABITAT

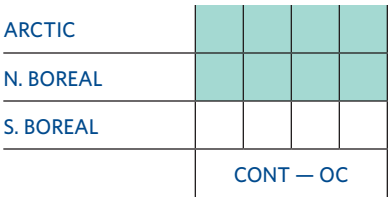
Perhaps the most common species across the continental boreal area, where it forms loose lawns in poor fens and bogs. It is also sometimes abundant in drier carpets in internal lawns and collapse scars. It is replaced in more mesotrophic situations and in less continental areas by *S. fallax*. Wetter oligotrophic carpets and pools have a number of other species including *S. jensenii*, and *S. majus*; more mesotrophic carpets have *S. riparium* or *S. obtusum*. *Sphagnum balticum* is more northern.

COMMON ASSOCIATES

In poor fens with *S. magellanicum* and occasionally associated with *Tomentypnum falcifolium*; in fens transitional to rich fens, sometimes with *S. teres* or *S. warnstorfii*.

Sphagnum lindbergii Lindb.





KEY FEATURES

This beautiful species is easily differentiated by brownish plants that have a dark brown stem core, a conspicuous apical bud, and stem leaves that are fan-shaped and lacerate over the entire upper portion. This species is relatively large in stature and occurs in carpets in very wet poor fens and bogs. At least in North America, it is only abundant in the northern boreal zone and along both coasts. In comparison, *S. lenense* that also has brown stems, is much smaller (*S. fuscum* in size), has stem leaves that are fan-shaped and lacerate but also have a broad resorbed tear that is evident in the upper half of the leaves. It occurs on high hummocks in the subarctic and alpine zones. From *S. fuscum*, which it superficially resembles, it is distinguished by having a wonderful copper colouration, young pendent branches in pairs, and the lacerate stem leaves (also it is a member of the section *Cuspidatum* with green cells exposed on the convex surface).

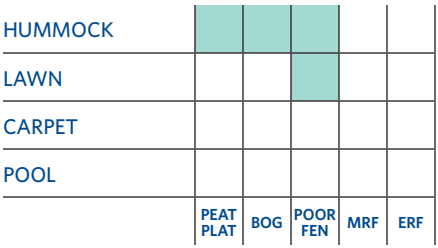
IDENTIFICATION

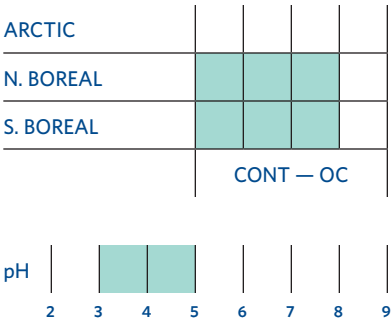
Plants dark brown in firm carpets with conspicuous apical bud and shiny, 5-ranked leaves that are especially noticeable when wet, capitulum-indentations with one visible pendent branch. **Stems** with dark brown core and well-developed hyalodermis. **Leaves** ovate-lanceolate, narrowed to narrowly truncate apex, stem leaves fan-shaped, coarsely lacerate across upper 1/2 of leaf, hyaline cells noticeably resorbed on upper part of leaf. **Leaf Cells** of branch leaves with few small ringed pores in cell corners, concave surface with few marginal unringed, indistinct pores, no medial pores on either surface present, green cells triangular, exposed on convex surface, and extending to concave surface.

HABITAT

Emergent from oligotrophic waters and forming wet carpets in poor fens and bogs (in oceanic areas). Largely northern and coastal in distribution.

Sphagnum magellanicum Brid.





KEY FEATURES

The reddish, robust, and turgid plants are key features of *S. magellanicum*. Characteristics include clear to pinkish stems with fibrose and porose cells composing the hyalodermis, and very concave, entire branch leaves that have numerous pores on relatively short hyaline cells and totally enclosed green cells without wall ornamentation. Other robust and turgid species of the section *Sphagnum* (all of these have hooded, entire branch leaves) are *S. palustre* and *S. henryense* with smooth, triangular green cells; *S. papillosum* with trapezoidal-triangular green cells with papillose adjacent walls; and *S. imbricatum* and *S. austinii* with broadly triangular green cells and adjacent walls with striations – none of these are reported from Alberta. Also, *S. centrale*, a species of margonal habotats, has elliptic green cells with thickened walls exposed on both leaf surfaces. *Sphagnum magellanicum* is the only northern species with red colour in the section *Sphagnum*; however, it is sometimes pure green under shaded conditions.

IDENTIFICATION

Plants large, turgid, reddish, forming dense canopies, 0-1 pendent branches visible between capitulum arms. **Stems** pink to clear, with porose and fibrose hyalodermis. **Leaves** ovate-elliptic, hooded, and entire at apex, convex surface just below apex with denticulations due to resorption of apical portions of hyaline cells; stem leaves lingulate, with hyaline cells not divided and mostly without fibrils or pores, resorbed on convex surface. **Leaf Cells** short, nearly plane or only slightly bulging on both surfaces, with numerous elliptic pores on convex surface and inconspicuous rounded pores on concave surface; green cells elliptic, completely enclosed by hyaline cells, adjoining hyaline cells walls smooth.

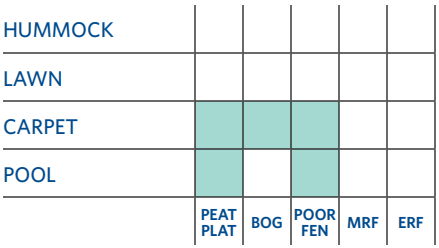
HABITAT

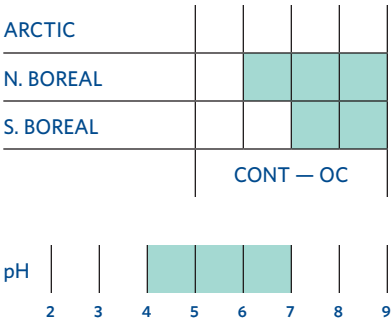
Forming small hummocks or occurring on the sides of high hummocks in bogs, sometimes on low hummocks and strings in poor fens.

COMMON ASSOCIATES

Found in oligotrophic habitats with *S. fuscum* and *S. angustifolium*, or *S. fallax*.

Sphagnum riparium Ångstr.





KEY FEATURES

The stem leaves with an obvious tear and the irregular to elliptic, large apical pore of the branch leaf hyaline cells are characteristics of this species. Living plants are easily identified by the large apical bud. Branch fascicles are usually sparsely positioned along the stem, thus the characteristic stem leaves are easily seen with a hand lens.

IDENTIFICATION

Plants large, yellow-green, forming loose canopies, apical bud very conspicuous, 1-2 pendent branches visible between capitulum arms. **Stems** clear, without hyalodernis. **Leaves** ovate-lanceolate, minutely truncate at apex; stem leaves large, broadly lanceolate, with single longitudinal resorption-tear to about mid leaf. **Leaf Cells** with conspicuous, oval, irregularly-shaped pore at apex on convex surface, additional pores either none, a second central pore just beneath apical one, or with some rounded pores only in cell corners, several very inconspicuous rounded central pores on concave surface; green cells triangular, exposed on convex surface.

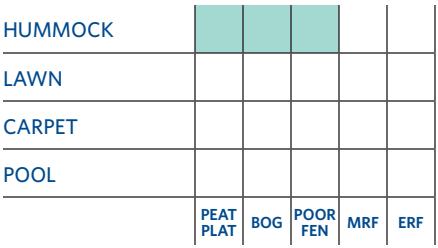
HABITAT

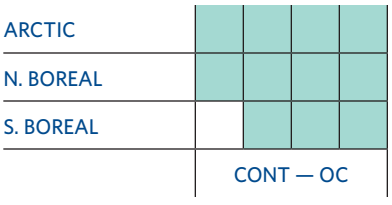
Forms carpets in mesotrophic pools, especially prevalent in internal lawns and recent collapse scars, and patterned poor fens where local nutrient inputs are evident. *Sphagnum riparium* is an early colonizer of wet, disturbed sites across the boreal, but becomes infrequent farther north.

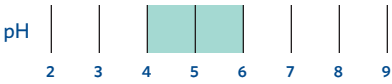
COMMON ASSOCIATES

Often found with *S. majus*, *S. jensenii*, *S. fallax*, and *S. angustifolium*.

Straminergon (Calliergon) stramineum (Brid.) Hedenäs







KEY FEATURES

The straw-coloured, slender, unbranched plants with oblong, obtuse, straight leaves distinguish this species. *Calliergon* and *Calliergonella* species (all with similar leaf cells) have inflated, hyaline alar cells and generally broader leaves. Formerly known as *Calliergon stramineum*.

IDENTIFICATION

Plants erect to ascending, yellow-green, slender, forming loose mats or occurring singly in Sphagnum mats. **Stems** mostly unbranched, without hyalodermis. **Leaves** narrowly oblong to oblong, ending in obtuse, cucullate apex, straight; costa single, ending about 2/3 up the leaf. **Leaf Cells** elongate to narrowly rhombic, with blunt ends, smooth and thin-walled. **Alar Cells** forming a conspicuous group of thick-walled, rectangular, coloured cells; somewhat decurrent.

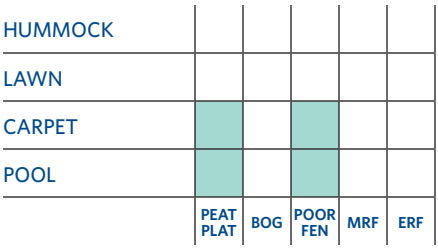
HABITAT

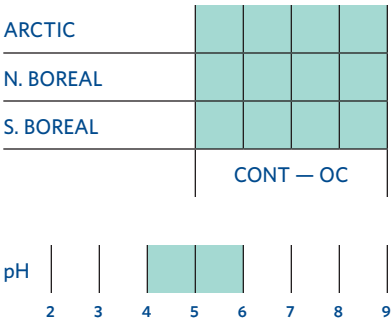
Mostly occurring on a variety of organic substrates, most common in oligotrophic habitats where it is found intermingled with *Sphagnum*, but also occurring in carpets and lawns of rich fens.

COMMON ASSOCIATES

Intermingled with peat-forming Sphagna such as *S. fuscum*, *S. angustifolium*, and *S. magellancium*, but also with carpet/lawn species of *Drepanocladus (sensu lato)*.

Warnstorfia exannulata (Schimp.) Loeske





KEY FEATURES

Distinguished from *W. fluitans* by having a stronger costa, reddish colouration, and abruptly inflated groups of hyaline alar cells. In general, the plants are larger and more robust then those of *W. fluitans*. The denticulate leaf margins, often seen best in the apical tufts of young leaves, distinguish this species and *W. fluitans* from species in the *Drepanocladus aduncus* group. *Scorpidium* species have shorter leaves and enlarged epidermal cells of the stem, while *Hamatocaulis* species have no central strand of the stem, and lack differentiated alar cells. Somewhat similar species include *W. trichophylla* with a long excurrent costa and *W.* (Calliergidium or *Sarmentypnum*) *tundrae* with 5-angled stem and long decurrent leaves.

IDENTIFICATION

Plants slender to large, reddish-green. **Stems** sporadically to irregularly pinnately branched, in transverse section with central strand and no enlarged epidermal cells. **Leaves** narrowly lanceolate, gradually acuminate; costa strong, ending 2/3 up leaf to just below apex, excurrent in closely related aquatic species. **Leaf Cells** elongate-linear with rather blunt ends, smooth; with denticulate margins, sometimes with teeth only near apex and sometimes teeth continuing to mid leaf and conspicuous on lower shoulders. **Alar Cells** abruptly inflated and hyaline, forming conspicuous groups of one row of enlarged, rectangular cells along with a few smaller, hyaline cells.

HABITAT

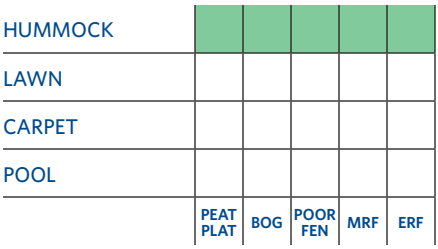
Floating in water or forming emergent mats in pools or on unconsolidated peat. Characteristic of poor fens and peat plateaus with wet collapse scars.

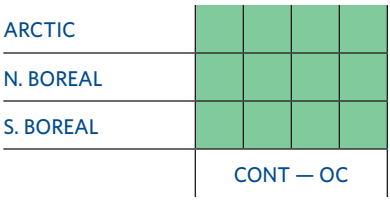
COMMON ASSOCIATES

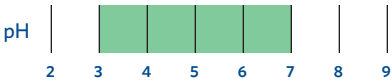
In boreal regions found with *Sphagnum majus*, *S. fallax*, and *S. jensenii*, occasionally with the rare *S. lindbergii* and farther north with *S. balticum*.

Aulacomnium palustre (Hedw.) Schwaegr.

Photo: Bin Xu, NAIT Boreal Research Institute







KEY FEATURES

Aulacomnium palustre is one of the very few peatland moss species with isodiametric, papillose leaf cells. The yellow-green leaf apices contrasted to the reddish stems, twisted leaves, and when present the gemmiferous shoots, also characterize this species. In arctic-alpine areas, *A. turgidum* and *A. acuminatum* occur – both are larger, more robust species without the covering of reddish tomentum of the stems. *Tomentypnum nitens* has reddish tomentum, but is distinguished by plicate leaves and pinnately branched stems.

IDENTIFICATION

Plants erect, unbranched, reddish below owing to dense tomentum of reddish rhizoids, yellow-green above. **Stems** covered with rhizoids, sometimes ending in attenuate shoots covered with triangular, red-brown brood-bodies that occur along upper portion of shoot. **Leaves** twisted and curled when dry, erect-spreading when moist, lanceolate to oblong-lanceolate, acute, serrate above; costa strong, ending just below apex; entire and recurved below. **Leaf Cells** isodiametric to rounded, thick-walled, with a single large papilla on each surface. **Alar Cells** not differentiated.

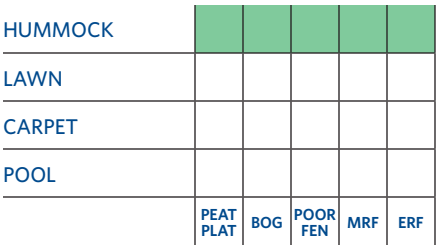
HABITAT

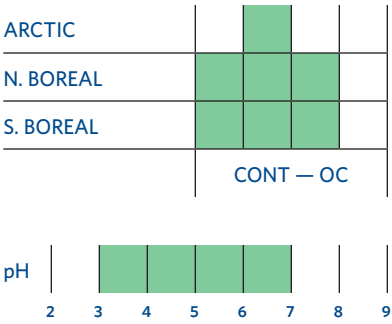
Growing on hummocks and on disturbed peat in all peatlands - limited by calcareous ground water in rich fens. This is a pioneer species in early succession of both fens and bogs.

COMMON ASSOCIATES

Dicranum undulatum, *Polytrichum strictum*, and *Tomentypnum nitens*; this is one of the most common peatland species.

Dicranum undulatum Brid.





KEY FEATURES

The short, irregular leaf cells, strongly differentiated alar cells, and undulate, rather blunt leaves characterize this species. Two other species with undulate leaves are *Dicranum polysetum* that has strongly nodose, elongate upper leaf cells and *D. acutifolium* with slender, acute leaf ápices – both occur in upland habitats and are rare in peatlands. *Aulacomnium palustre* has leaf cells each with one well-developed, blunt, conical papilla.

IDENTIFICATION

Plants erect, unbranched, often with single sporophytes. **Stems** colourless, covered with orange-brown tomentum of rhizoids. **Leaves** lanceolate, obtuse to bluntly acute; with strong single costa; entire except just below apex where several course serrations are present, irregularly undulate above, loosely erect wet or dry. **Leaf Cells** irregularly isodiametric to oblong or quadrate, somewhat longer below, smooth or with an inconspicuous, low, single, papilla per cell. **Alar Cells** of well-differentiated groups of reddish, thick-walled, quadrate, enlarged cells.

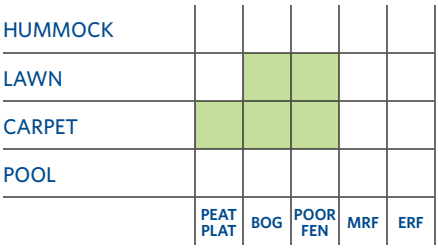
HABITAT

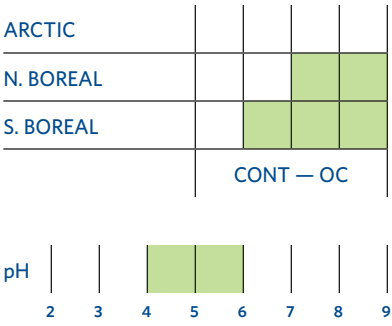
Occurs as small clumps interspersed on hummocks in both bogs and fens, more common in bogs. This is one of the most commonly collected plants from boreal peatlands, but is less common in oceanic areas and northward.

COMMON ASSOCIATES

Sphagnum fuscum, *Tomentypnum nitens*, *Aulacomnium palustre*, and *Pleurozium schreberi*.

Sphagnum fallax (Klinggr.) Klinggr.





KEY FEATURES

The apiculate, entire stem leaves define this species. The branch leaf pore pattern is similar to that of *S. angustifolium* and *S. balticum* (the latter differentiated by green cell transverse section). *Sphagnum fallax* is subcontinental and temperate in distribution, and becomes rare in continental, boreal areas. Historically, and especially in North America, the name *S. recurvum* has been applied in a broad sense to include *S. angustifolium*, *S. fallax*, and *S. flexuosum* (as well as *S. recurvum sensu stricto*) – all differentiated by stem leaf features.

IDENTIFICATION

Plants large, but slender in yellow-green to green-brown, loose lawns, with small apical bud and two pendent branches visible between capitulum arms. **Stems** without enlarged hyalodermis, central core clear to green. **Leaves** ovate-lanceolate and narrowed to acuminate, narrowly truncate apex, often undulate when dry; stem leaves oblong-triangular and apiculate, not erose at tip, without fibrils and pores. **Leaf Cells** of convex surface of branch leaves few, consisting of one rather large rounded to elliptic apical pore and sometimes a few smaller pores restricted to cell corners, on concave surface several indistinct, unringed pores along cell edges, green cells triangular and reaching concave surface, exposed broadly on convex surface.

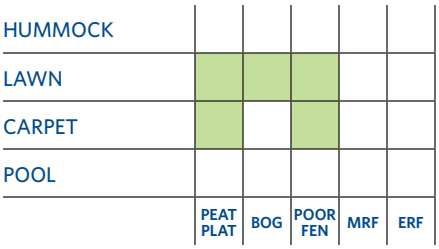
HABITAT

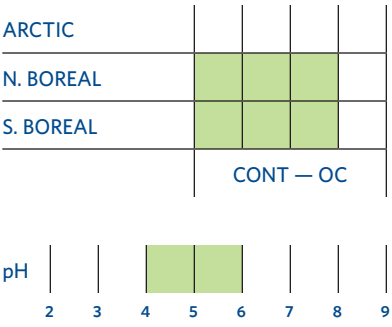
Found in wet lawns and carpets in poor fens and found in oceanic areas in bog hollows. This species appears to tolerate high nutrient levels and occupies more nutrient rich sites than others of the group. In Alberta, reported only from the eastern part of the province; there occurring in large patterned poor fens.

Sphagnum jensenii H.Lindb.

Photo: Tomas Hallingbäck, Swedish University of Agricultural Sciences

Photo: Dale H. Vitt, Southern Illinois University





KEY FEATURES

Similar to *S. majus* in the field. When the two grow together, *S. jensenii* is slightly darker and a little larger - both differentiated from other species by dark colour. The distinctive pore pattern (see below) of the branch leaf hyaline cells is the best identifying feature.

IDENTIFICATION

Plants forming loose mats, dark brown to reddish-green, with a moderate apical bud and one pendent branch visible between capitulum arms. **Stems** with clear core and poorly differentiated hyalodermis. **Leaves** ovate-lanceolate and gradually narrowed to narrowly truncate apex; stem leaves oblong and concave in upper portion – thus leaves appearing triangular, hyaline cells without pores and with few fibrils in upper part. **Leaf Cells** long, with numerous pores on both surfaces – convex surface with 7-20 small elliptic to rounded, ringed and unringed pores, usually in two medial rows and concave surface with 4-15 medium-sized, round, unringed pores, some near cell corners and most in 1-2 medial rows, green cells isosceles-triangular, exposed on convex surface.

HABITAT

Found in pools and emergent in poor fens and in permafrost collapse features.

COMMON ASSOCIATES

Often with *S. majus*, *S. obtusum*, and *S. fallax*.

Sphagnum majus (Russ.) C.Jens.

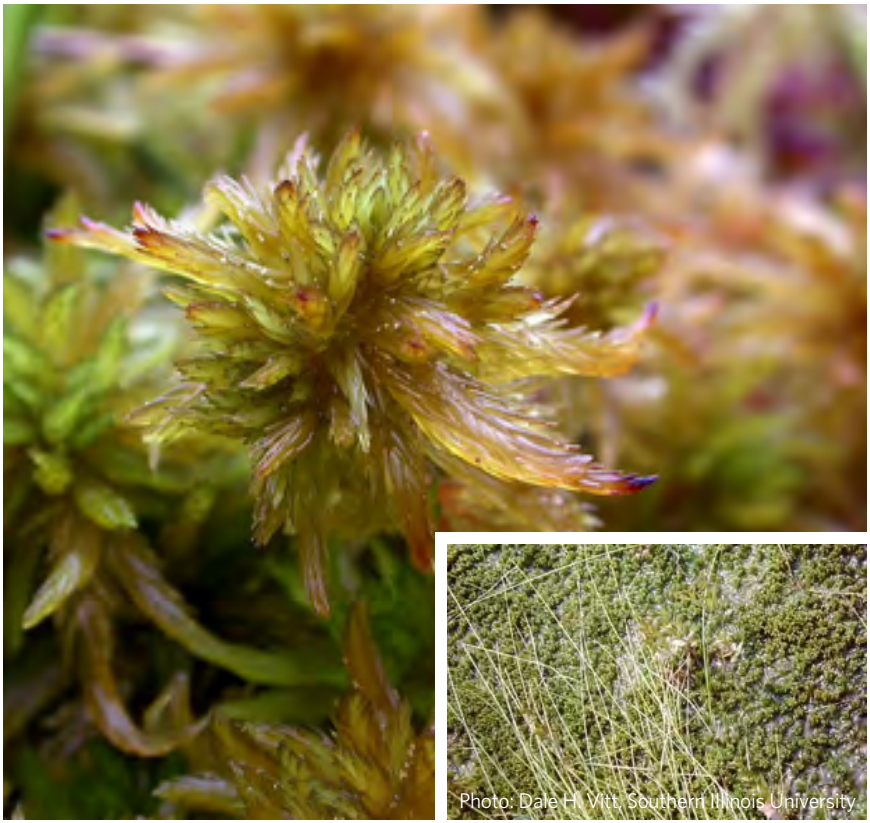
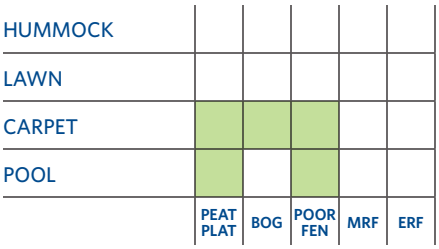
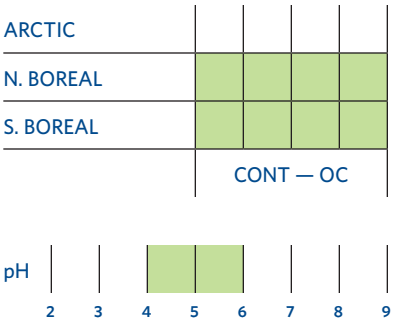


Photo: Dale H. Vitt, Southern Illinois University





KEY FEATURES

The lack of pores on the concave surface of branch leaf hyaline cells coupled with numerous, rather large medial pores on the convex surface and blunt, oblong stem leaves are identifying features. In the field, the dark colour and habitat are helpful characters.

IDENTIFICATION

Plants medium-sized, floating or in loose carpets, dark brown to mottled reddish-green, with small apical bud and 1-(2) pendent branches visible between capitulum arms. **Stems** without dark core, hyalodermis not or poorly developed. **Leaves** ovate-lanceolate, gradually acuminate and narrowly truncate at apex; stem leaves oblong, concave and inflexed, with leaves appearing triangular, blunt and rounded, hyaline cells with few fibrils in upper part, without pores. **Leaf Cells** long, with many unringed, large pores in 1-2 medial rows (not in contact with cell edges), without pores on concave surface (or occasionally with 1-3 small faint, pores at cell corners), green cells isosceles triangular, exposed on convex surface.

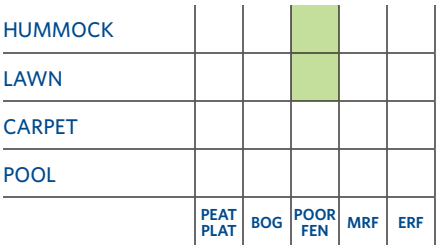
HABITAT

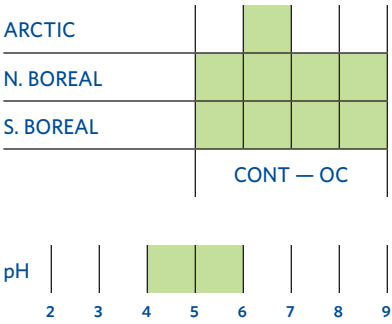
Floating and emergent in poor fens, in collapse scars, and in internal lawns. *Sphagnum majus* occurs in more minerotrophic habitats then does *S. cuspidatum*, a species not reported from Alberta.

COMMON ASSOCIATES

Often found with *S. jensenii*; also sometimes with *S. balticum* and *S. obtusum*.

Sphagnum russowii Warnst.





KEY FEATURES

The reddish colouration; oblong, blunt stem leaves with a resorbed apical notch; and porose stem hyalodermis are the key characters of this species. The branch leaves are quite similar to those of other section *Acutifolium* species; however, the ringed, elliptic, rather small pores in the upper part of young leaves are about half way in size between those of *S. warnstorfii* and those of *S. capillifolium* and *S. fuscum*.

IDENTIFICATION

Plants slender reddish-green with loose canopies, capitulum flat and clearly star-shaped, sometimes mottled in red to greenish bands, one pendent branch visible between capitulum arms. **Stems** with pale-reddish core and 2-3 layered, well-developed hyalodermis; some cells of outermost stem layer with pores. **Leaves** ovate-lanceolate and gradually tapered to truncate acuminate apex; stem leaves oblong, obtuse, flat, with small resorbed notch at apex, without fibrils and pores. **Leaf Cells** with 6-10 elliptic, ringed, medium-sized pores arranged along sides of bulging hyaline cells, concave surface flat, with several larger, unringed pores positioned medially; green cells triangular, exposed on concave surface.

HABITAT

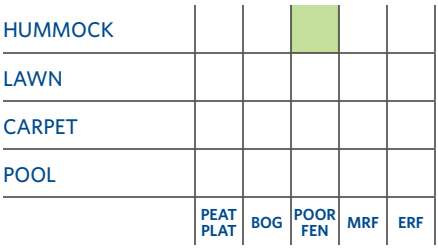
Found on low hummocks and drier lawns at the edges of oligotrophic habitats and in marginal swampy woods.

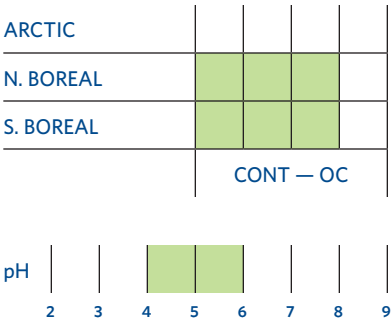
COMMON ASSOCIATES

Sometimes with *S. girgensohnii* and other woodland mosses or with *S. fallax* in marginal habitats.

Tomentypnum falcifolium (Nichols.) Tuom.

Photo: Peter Whitehead, Cape Ecology, Ltd.





KEY FEATURES

This species differs from *Tomentypnum nitens* in having falcate-secund leaves with tomentum restricted to one side of the stem. The falcate-secund, plicate leaves are reminiscent of *Sanionia uncinata*, but differs in having abundant tomentum.

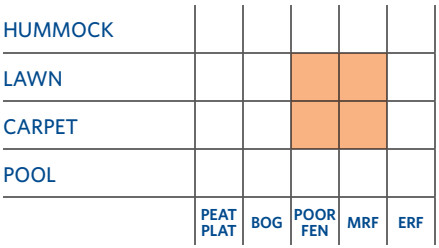
IDENTIFICATION

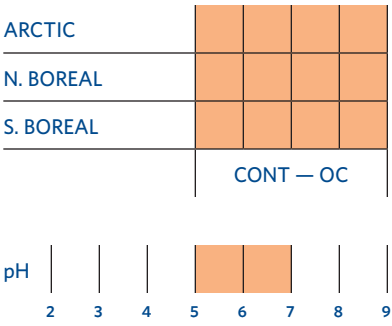
Plants erect to ascending, pinnately branched. **Stems** covered on one side with tomentum of reddish rhizoids. **Leaves** long lanceolate, falcate-secund, acuminate to narrowly acute, strongly plicate; costa strong and single, ending just below apex; margins entire. **Leaf Cells** elongate-linear, thin-walled, smooth. **Alar Cells** not much different, shorter, with thicker nodose walls.

HABITAT

A species of hummocks and drier habitats in poor fens, often associated with *Sphagnum angustifolium*.

Sphagnum subsecundum Sturm





KEY FEATURES

This species has subsecund capitulum branches, often a dirty orange tint; one-layered hyalodermis; and branch leaf hyaline cell pores arranged as strings of beads along both sides of the cell - the pores large and covering the distance between the fibrils. Several closely related species have been recognized and form a difficult complex of seemingly intergrading taxa. Two are key northern species worth mentioning. *Sphagnum contortum* has a 2-3 layered hyalodermis and small pores that are less than 1/2 the distance between the fibrils. *Sphagnum orientale*, a truly arctic species has tiny pores in 2-3 rows, the medial row is sometimes not well-organized, but there is at least 1-3 tiny medial pores in some upper leaf cells. It is shiny blackish purple colour calling to mind 'Darth Vadar'.

IDENTIFICATION

Plants orange-green to yellow-brown in soft cushions and lawns; branches slightly curved (subsecund); and one pendent branch somewhat visible between capitulum arms. **Stems** with brownish central core and 1-layered, well-developed hyalodermis. **Leaves** 1.0-1.2 mm long, curved, ovate, acute and narrowly truncate, very concave; stem leaves small 0.5-0.8 mm long, oblong to ovate-oblong, blunt, concave, with some fibrils in upper portion and also few irregular areas of resorption present. **Leaf Cells** on convex surface with two rows of numerous, rounded to elliptic pores arranged along green cell contact, pores about width of fibril spacing; on concave surface with few small pores at ends and corners; green cells trapezoidal, exposed more broadly on convex surface

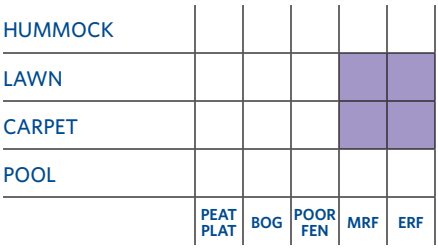
HABITAT

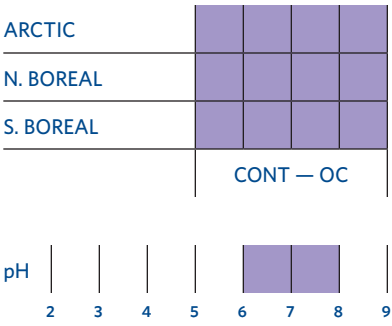
In wet minerotrophic habitats, sometimes in transitional rich/poor fens.

COMMON ASSOCIATES

S. teres, *S. warnstorfii*, *S. fimbriatum*, and *S. obtusum* can all occur in similar habitats.

Aneura pinguis (L.) Dum.





KEY FEATURES

The only thalloid liverwort that commonly occurs in rich fens, *Aneura pinguis* is characterized by small (about 4-8 mm wide) thalli that appear oily and fleshy, often with wavy margins. No midrib is obvious and rarely are sporophytes present. *Marchantia polymorpha* occurs on organic soils after disturbance – it has clear rhomboidal markings on the upper surface and the rare *Moerkia flotoviana* (and *Pellia endiviifolia* that does not occur in peatlands) have a distinct midrib and thin, delicate strap-shaped thalli. Species of *Riccardia* are much smaller (1-2 mm wide) and branched – and occur on rotting logs and organic debris (usually not in peatlands).

IDENTIFICATION

Plants thalloid, prostrate to ascending, growing singly or in tangled groups of thalli, with few branches, thalli 5-15 cells thick in the middle with marginal areas 1-3 cells thick, without a distinct midrib.

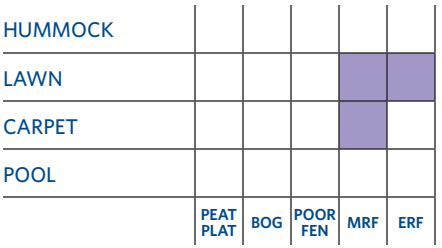
HABITAT

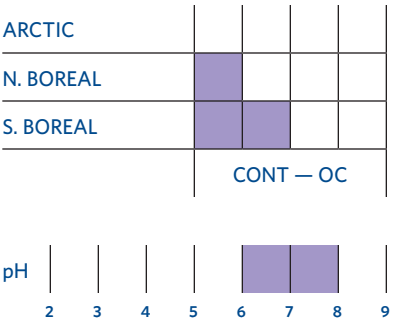
Aneura occurs in wetter areas of rich fens mixed in with other bryophytes - sometimes the thalli are quite small in Alberta, but the oily, unbranched thalli are distinctive.

COMMON ASSOCIATES

Occurs with species of *Drepanocladus*, *Scorpidium*, and *Hamatocaulis*; most common in extreme rich fens.

Brachythecium acutum (Mitt.) Sull.





KEY FEATURES

This species is the only common *Brachythecium* that regularly occurs in boreal rich fens. *Brachythecium turgidum*, more common northward, is larger and mostly unbranched. The straight (non-falcate-secund), leaves with no plications, shortly acuminate leaf apices, lack of inflated alar cells, and presence of a single costa distinguish this species from all other mosses growing in fens. In general, other more upland species of the genus have narrower leaves, more branched plants, and most species have serrulate leaf margins. When these upland species occur in peatlands, they are found on rotting wood and tree bases, and do not occur directly in lawn habitats. *Drepanocladus polygamus* is somewhat similar, but has a u-shaped leaf insertion and more acuminate, somewhat channeled leaf apices - it occurs in more eutrophic habitats.

The species of *Brachythecium* that is commonly found in rich fens across boreal Alberta has in the past been called *B. mildeanum*. Recently BFNA has considered the correct name for this species in North America to be *B. acutum*. Here we follow this treatment - this photo is *B. mildeanum* from Europe.

IDENTIFICATION

Plants rather large, erect to ascending, mostly with a few branches, light- to lime-green, sometimes with yellow-green tips. **Stems** naked, without enlarged epidermal cells. **Leaves** erect, sometimes loosely so, straight, broadly lanceolate to oblong-lanceolate, shortly acuminate, not plicate; costa weak, single, ending about 3/4 up leaf; margins entire. **Leaf Cells** elongate-linear, mostly with sharp ends, smooth, shorter below. **Alar Cells** gradually shorter and rectangular, rather dense and firm-walled, forming indistinct, angular groups.

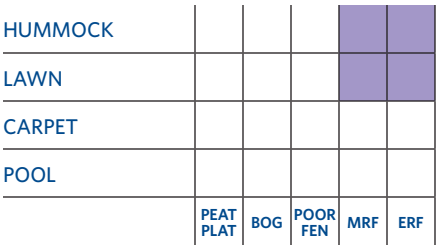
HABITAT

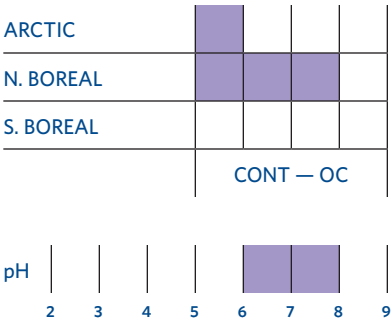
Growing among other mosses in carpets and lawns of moderate-rich fens, occasionally found in pure patches.

COMMON ASSOCIATES

Hamatocaulis vernicosus and *Scorpidium revolvens*.

Brachythecium turgidum (Hartm.) Kindb.





KEY FEATURES

The large, yellow-green, mostly unbranched plants growing erect in rich fens distinguish this species from *Brachythecium acutum*. Whereas *B. acutum* is common across the boreal zone, *B. turgidum* is more frequent in arctic and subarctic fens and meadows.

IDENTIFICATION

Plants robust, erect to ascending, mostly unbranched or with a few scattered branches. **Leaves** erect to spreading, straight, broadly lanceolate, acute; costa single, ending in upper portion; entire. **Leaf Cells** elongate, thin-walled, smooth. **Alar Cells** somewhat larger, rectangular-rounded, thin-walled and clear, forming a poorly defined group.

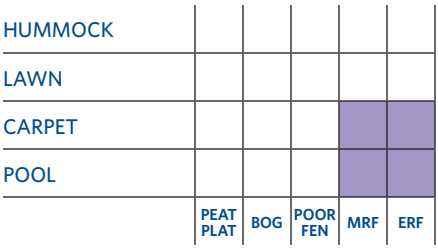
HABITAT

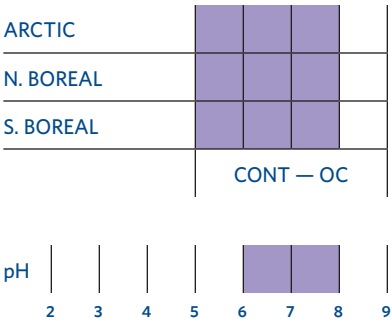
Growing intermixed with other mosses in rich fens and arctic meadows, not common in the boreal zone.

COMMON ASSOCIATES

Species of *Campylium* and *Drepanocladus* (*sensu lato*).

Calliergon giganteum (Schimp.) Kindb.





KEY FEATURES

Obtuse leaves with a very strong, single costa that continues to the leaf apex are key features of this species. Branch leaves are often much narrower and inrolled making them appear even more narrow than the stem leaves, but all of these leaves have the strong costa. All leaves also have abruptly differentiated alar cell groups. *Calliergon richardsonii* is similar, but has a short double costa; *Stramiergon stramineum* has oblong leaves and alar cells with thickened walls; and *C. cordifolium* has gradually inflated alar cells and undifferentiated branch and stem leaves. *Calliergon cordifolium* is more common in eastern North America and occurs in more eutrophic habitats; *C. richardsonii* is more common in the northern boreal forest, often in shaded hollows, and *S. stramineum* is a species of bogs and poor fens, usually associated with *Sphagnum*.

IDENTIFICATION

Plants large, unbranched to regularly pinnately branched, brownish. **Stems** colourless, without tomentum. **Leaves** ovate, ovate-oblong to lanceolate-ovate, obtuse; with strong single costa ending at leaf apex; entire. **Leaf Cells** elongate-linear, smooth, most leaves having a few, clear, differentiated cells just below apex. **Alar Cells** inflated, hyaline, isodiametric to oval, cells forming abruptly differentiated, decurrent, concave auricles at leaf bases.

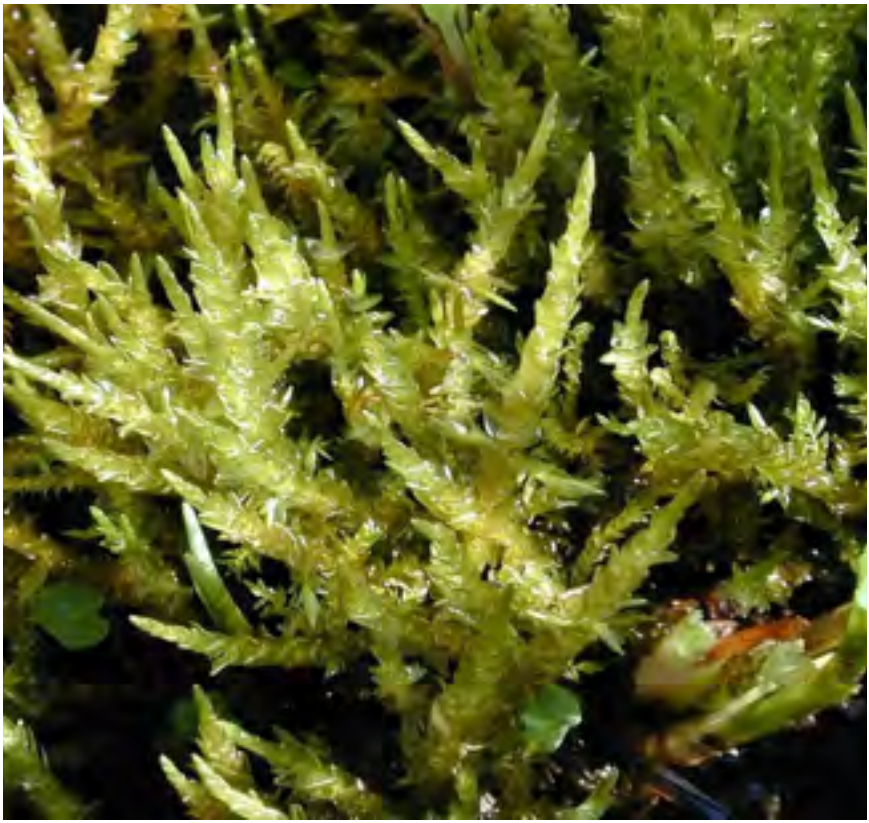
HABITAT

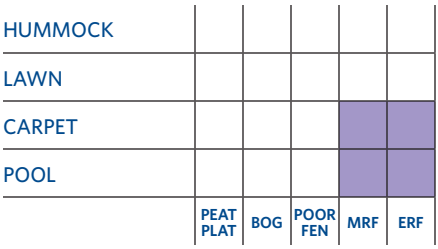
Emergent in pools, forming carpets, and intermixed with other brown mosses on lawns in rich fens.

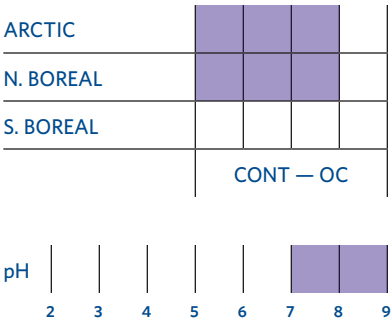
COMMON ASSOCIATES

Scorpidium cossonii, *S. scorpioides*, and *H. vernicosus* are frequently found intermixed with this species.

Calliergon richardsonii (Mitt.) Kindb.







KEY FEATURES

This is a species of the northern boreal forest. It is not completely clear how its habitat preferences differ from those of *C. giganteum*. These two species are similar in alar cell characters, but differ in strength of the costa and leaf shape. Both of these species differ from the eastern *C. cordifolium*, by the sharply differentiated alar cells, as compared to gradually differentiated ones of the latter species. *Calliergon richardsonii* has leaves that are shorter (1-2:1) and more ovate in shape then *C. giganteum*, wherein the stem leaves are oblong to oblong-ovate and are about 2-3 times as long as wide. Also, *C. giganteum* is dioicous and seldom fruits, while *C. richardsonii* is autoicous and often has capsules.

IDENTIFICATION

Plants erect to ascending, lime-green, with few to rather numerous side branches. **Stems** flaccid and clear, without hyalodermis. **Leaves** ovate to ovate-oblong, obtuse, concave; with short, usually double costa ending 1/3 and 1/2 distance up leaf; margins erect, entire. **Leaf Cells** elongate to long rhombic, with blunt ends. **Alar Cells** hyaline, inflated, and forming an abruptly differentiated decurrent group.

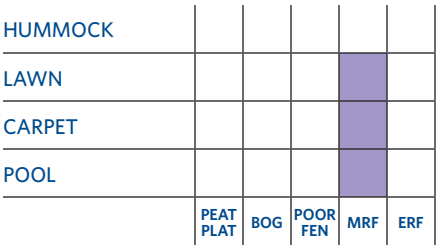
HABITAT

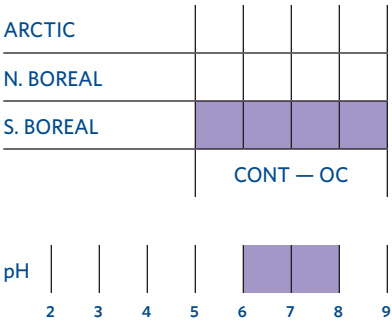
Emergent from pools in rich fens, especially in wooded fens and forested swamps.

COMMON ASSOCIATES

Species that also occur in wooded fen depressions are a variety of species of *Drepanocladus sensu lato*.

Calliergonella cuspidata (Hedw.) Loeske





KEY FEATURES

This large moss has erect to ascending, flattened stems that look like spear-heads. Whereas in Europe and along the western coast of North America the species is a common weed of ditches and yards, in continental Canada it occurs almost exclusively in moderate-rich fens. The leaves are complanate (flattened) and not at all secund, this feature separates this species from *Hypnum pratense* that has flattened leaves with secund tips and only a few moderate-sized alar cells. *Hypnum lindbergii* has inflated alar cells and a stem hyalodermis much like *C. cuspidata*, but has distinctly falcate-secund leaves. Both *H. pratense* and *H. lindbergii* occur characteristically in shrubby and wooded rich fens and forested swamps.

IDENTIFICATION

Plants robust, erect to ascending, shiny, yellow-green, occurring in mats or singly among other mosses. **Stems** irregularly to subpinnately branched, with a distinct hyalodermis and central strand. **Leaves** oblong to oblong-ovate, rounded and obtuse, concave; costa none or short and double; margins entire. **Leaf Cells** elongate and flexuose, smooth, those near insertion thicker-walled. **Alar Cells** oblong to oval, inflated, thin-walled, hyaline, forming conspicuous auricles.

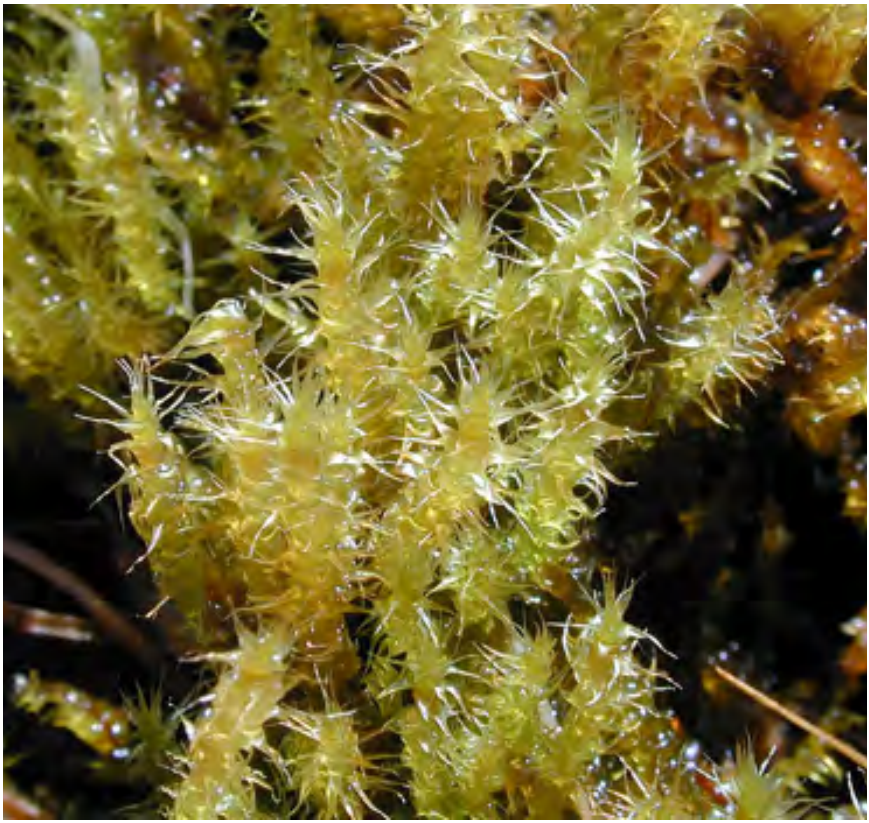
HABITAT

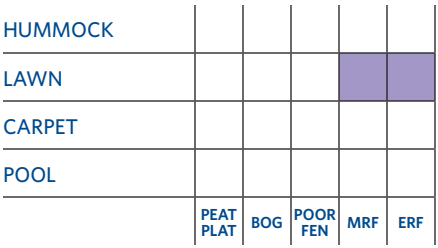
Growing in fen lawns and carpets, floating mats, and wet meadows.

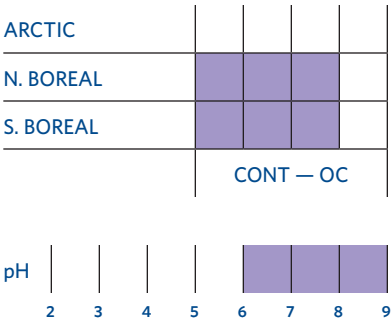
COMMON ASSOCIATES

When in peatlands, sometimes associated with *Brachythecium acutum*, *Sphagnum subsecundum*, *S. teres*, *Drepanocladus polygamus*, and *Hypnum pratense*.

Campylium stellatum (Hedw.) C.Jens.







KEY FEATURES

The widely-spreading stiff leaves are key field characters. The leaves have a concave, ovate base that quickly narrows to a long, channeled, acuminate apex. The channeled acumen is a key character. In the arctic, *C. arcticum* has even more concave leaves and a v-shaped insertion (compared to a more open u-shaped one for *C. stellatum*). *Drepanocladus polygamus* is a species that occurs in eutrophic marshes and fens, in carpets, and has less spreading and less concave leaves that have a stronger, usually single costa. Other *Campylium* species are smaller and more prostrate.

IDENTIFICATION

Plants golden-green, bristling, with erect to ascending, infrequently branched stems. **Leaves** wide-spreading to almost squarrose wet or dry, ovate-lanceolate, and sharply narrowed to a long acuminate, channeled apex; costa short and double; entire. **Leaf Cells** elongate to long rhombic with blunt ends, smooth. **Alar Cells** hyaline and enlarged, forming a well-marked angular group.

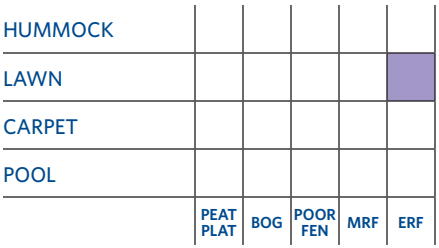
HABITAT

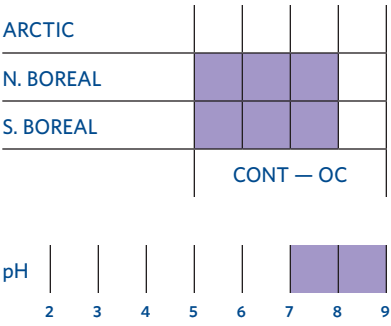
Found in lawns of rich fens, occurring above *Scorpidium revolvens* and *S. cossonii*, and below *Sphagnum warnstorfii* and *Tomentypnum nitens*.

COMMON ASSOCIATES

In extreme rich fens, rare associates may include *Catoscopium nigritum*.

Catoscopium nigritum (Hedw.) Brid.





KEY FEATURES

When sterile, this moss has little character and except for the habitat could be mistaken for the ubiquitous *Ceratodon purpureus* – the latter has a few marginal notches just below the leaf apices - however, *Ceratodon* never occurs in rich fen lawns. *Catoscopium* leaves are small (about 1.0-1.3 mm) and have smooth, quadrate cells. *Catoscopium* is usually fertile, with black, globose, nodding capsules that looks like golf clubs. These are distinctive and no other species has capsules like these.

IDENTIFICATION

Plants small, erect, forming dense, dark-green to reddish cushions. **Stems** unbranched, reddish, with scattered dark rhizoids. **Leaves** lanceolate, acute. **Leaf Cells** erect, quadrate, smooth, longer below. **Alar Cells** not differentiated.

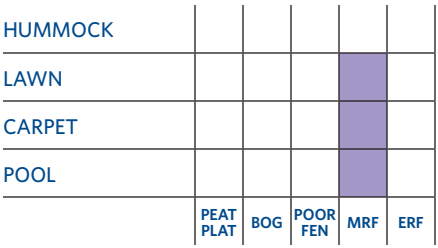
HABITAT

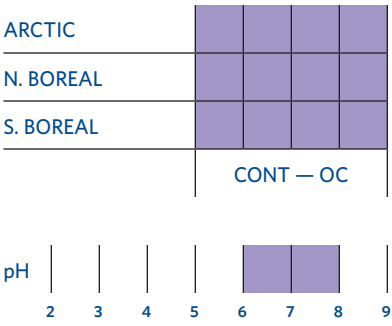
Grows along the edges of flarks and carpets where it forms darkish cushions, sometimes in lawns with a variety of extreme rich fen species.

COMMON ASSOCIATES

Often with *Scorpidium revolvens*.

Drepanocladus aduncus (Hedw.) Warnst.





KEY FEATURES

Drepanocladus aduncus, in a broad sense, consists of plants that have stems with a central strand, but no enlarged epidermis; entire leaf margins; and a few enlarged and inflated alar cells. There is considerable morphological variation and several taxa have been recognized and occur in somewhat different habitats. These include the truly aquatic *Drepanocladus capillifolius* with a stout, long-excurrent costa; *D. polycarpus* with short leaf cells, branched erect-growing plants with short leaves; and *D. kneiffii*, a form with long leaf cells and slender, flaccid leaves. All of these variations appear to occur in mesotrophic to eutrophic fens and marshes. *Drepanocladus sordidus* has a strong costa, thick-walled and nodose lower leaf cells, and the alar cells are strongly porose, thick-walled, and brownish.

IDENTIFICATION

Plants highly variable, usually slender and irregularly branched. **Stems** naked, with a central strand, but without a hyalodermis or enlarged epidermis. **Leaves** falcate-secund, narrowly lanceolate, and gradually narrowed to a long acuminate apex, sometimes shorter; costa single, slender, ending 1/2 to 3/4 up the leaf; margins entire. **Leaf Cells** elongate to long-rhombic, smooth, not decurrent. **Alar Cells** consisting of a few enlarged hyaline cells that merge gradually with the basal leaf cells.

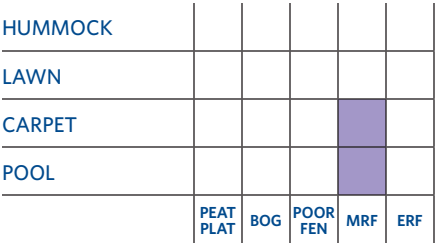
HABITAT

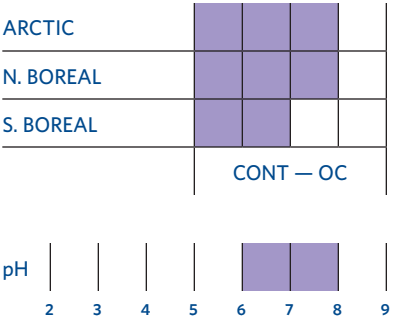
Grows floating and stranded in water, emergent from fen pools, or forming dense carpets just above the water table.

COMMON ASSOCIATES

Hamatocaulis vernicosus sometimes occurs with this species, but is more common in less eutrophic habitats; *D. polygamus* co-occurs in more eutrophic situations.

Drepanocladus (Campylium) polygamus (Schimp.) Hedenäs





KEY FEATURES

The erect-spreading, broadly concave leaves are key features of this species. *Drepancladus aduncus*, which occurs in similar habitats, differs by having falcate-secund leaves (at least at the branch tips). *Campylium stellatum* differs by having no (or short and double) costa, and *Brachythecium acutum* has non-channelled leaves, less-differentiated alar cells, and by habitat. In the past literature, this species has been placed in *Campylium*, close to *C. Stellatum*. This species has more similarity to *Drepanocladus*; however, it lacks the traditional falcate-secund leaves of species in that genus.

IDENTIFICATION

Plants simple to irregularly branched, usually ascending to erect, forming loose mats. **Stems** naked. **Leaves** lanceolate, shortly acuminate; costa single, ending in upper one-third of leaf, insertion u-shaped; entire, somewhat channelled below. **Leaf Cells** elongate, smooth. **Alar Cells** oblong, somewhat inflated, darker and thick-walled with age.

HABITAT

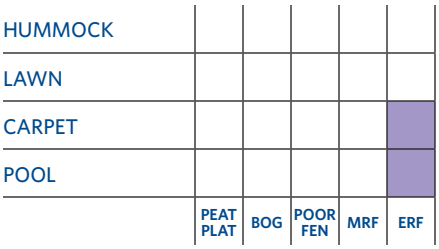
Occuring in marshes and other eutrophic, open (sedge-dominated) fens.

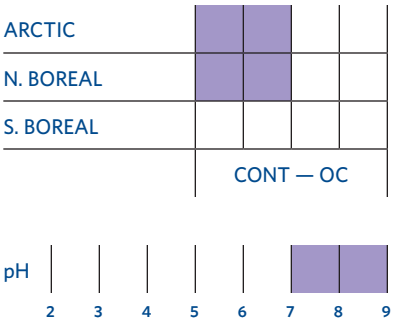
COMMON ASSOCIATES

Drepanocladus aduncus. Although quite similar superficially to *Brachythecium acutum*, this latter species occurs in more mesotrophic habitats such as moderate-rich fens.

Drepanocladus sordidus (C.Muell.) Hedenäs

NO AVAILABLE PHOTO





KEY FEATURES

This rather rare species is robust, with long-acuminate, strongly falcate-secund leaves. The key feature that differentiates it from other species of *Drepancladus* (*sensu lato*) are the enlarged, oblong, coloured, thick-walled (often nodose) alar cells. It shares entire leaf margins and stem transverse section features (central strand, no hyalodermis) with *Drepancladus aduncus*. Previously in North American literature, plants belonging to this species have been named *Drepanocladus sendtneri* (C.Muell.) Warnst, but this species does not occur in North America.

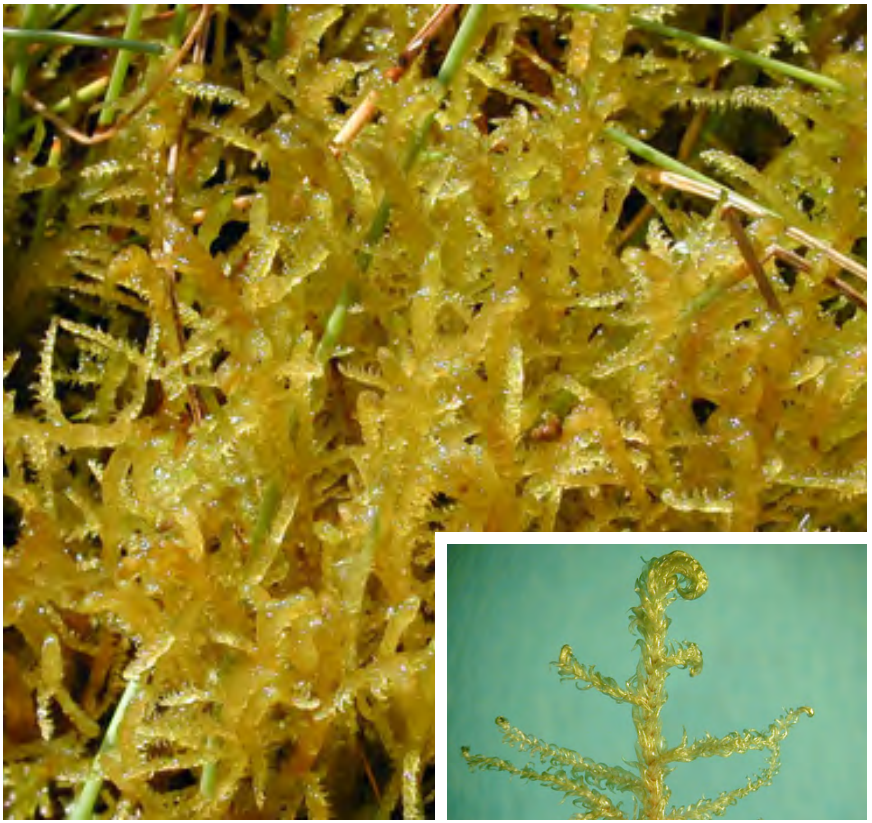
IDENTIFICATION

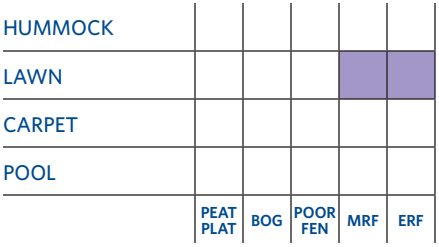
Plants dark- to brownish-green, erect to ascending, simple to irregularly branched. **Leaves** strongly falcate-secund, lanceolate, acuminate; costa strong, ending in upper portion of leaf; entire. **Leaf Cells** elongate, with somewhat thickened walls in lower portion of leaf. **Alar Cells**, oblong, coloured, thick-walled and nodose, forming well-differentiated groups.

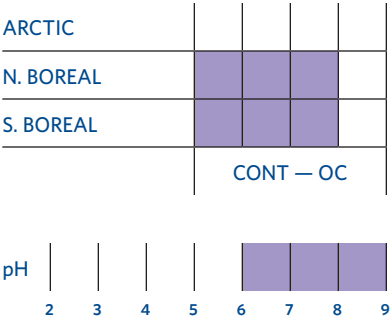
HABITAT

A species of rich fen pools and carpets.

Hamatocaulis vernicosus (Mitt.) Hedenäs







KEY FEATURES

This is a characteristic species of moderate- and sometimes extreme-rich fens. The hooked and falcate leaves (see inset) are good field characters, while under the microscope the lack of a central strand in the stem transverse section is definitive for the genus. Also, the faintly striate leaves with no differentiated alar cells and branched stems are helpful features. The stem apices have a characteristic fish-hook appearance that once recognized is useful for field identification.

IDENTIFICATION

Plants yellow-green to dirty-green in colour, mostly ascending to erect, usually with numerous branches. **Stems** naked, with pronounced hooked upper portion, with no central strand and no enlarged epidermis cells in transverse section. **Leaves** falcate-secund, somewhat striate, especially when dry; costa single, ending about 2/3 up leaf; margins entire. **Leaf Cells** elongate with blunt ends, smooth. **Alar Cells** not much different from basal cells.

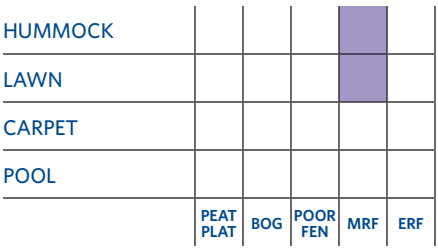
HABITAT

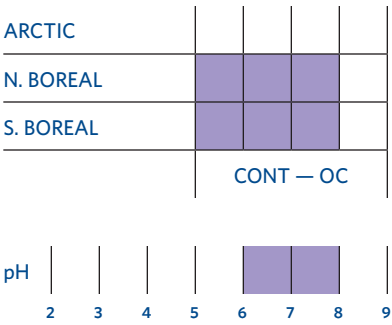
Forms lawns and small hummocks in rich fens, sometimes dominating areas and occurring in depressions and at the bases of shrubs.

COMMON ASSOCIATES

In more eutrophic habitats occurring with *Drepanocladus aduncus*, while in mesotrophic situations, occurring with *Scorpidium revolvens* and *S. cossonii*, but generally found in more nutrient rich places than are these two species. *Hamatocaulis lapponicus* is less branched, larger, has better developed alar cells, and occurs in depressions in similar habitats.

Helodium blandowii (F.Weber et D.Mohr) Warnst.





KEY FEATURES

The densely pinnate fronds, stem leaves different from branch leaves, and abundant filamentous paraphyllia composed of long, smooth cells are key characters. *Thuidium* species are bipinnate, while *Haplocladium* occurs in uplands.

IDENTIFICATION

Plants robust, erect, regularly pinnately branched, in light-green, loose mats. **Stems** covered in filamentous, branched, green paraphyllia. **Leaves** - stem leaves ovate, shortly acuminate, serrulate, costa strong, single and ending below apex; branch leaves narrower, smaller; all leaves with ciliate basal margins due to presence of paraphyllia. **Leaf Cells** oblong-rhombic, uni-papillose on ventral surface. **Alar Cells** not differentiated, but basal cells somewhat enlarged.

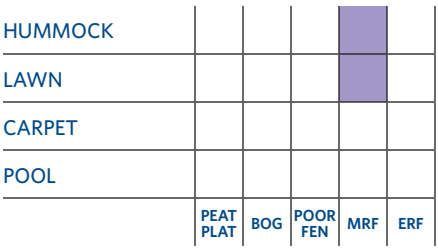
HABITAT

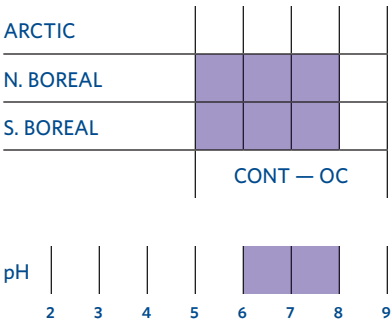
A species of wooded and shrubby, moderate-rich fens.

COMMON ASSOCIATES

Often with *Scapania paludicola*, *Hypnum pratense*, and *Hamatocaulis vernicosus*.

Hypnum lindbergii Mitt.





KEY FEATURES

The regularly falcate-secund, yellow-green leaves without a costa are distinctive features of this species. Although superficially similar to species of *Drepanocladus* (*sensu lato*) the lack of a costa readily differentiates this species.

IDENTIFICATION

Plants irregularly branched, yellow-to lime-green, forming loose mats. **Stems** naked, with unistratose outer layer of enlarged cells. **Leaves** falcate-second; costa lacking to short and double; margins entire. **Leaf Cells** smooth, elongate. **Alar Cells** hyaline, enlarged, forming distinctive inflated groups at insertion.

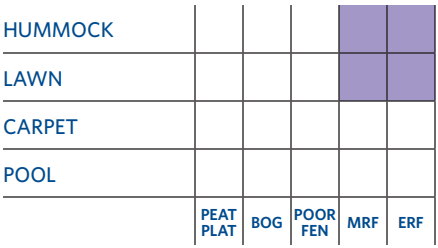
HABITAT

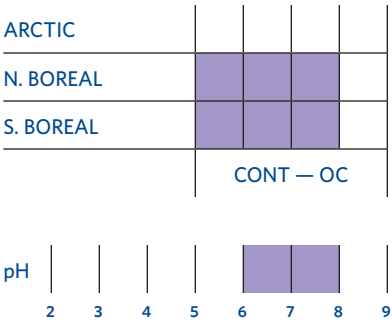
A species of wooded rich fens and swamps, but also common on mineral soils along stream banks, and occasionally forming mats in shrubby and drier open fens.

COMMON ASSOCIATES

Include *Plagiomnium elipticum*, *Ptychostomum pseudotriquetrum*, and *Tomentypnum nitens*.

Hypnum pratense (Rabenh.) Spruce





KEY FEATURES

Although seemingly similar to H. *lindbergii*, this species is easily distinguished by having complanate-secund leaves and a lack of inflated hyaline alar cells. The complanate-secund leaves that lack a costa differentiate this species from other species with falcate-secund leaves.

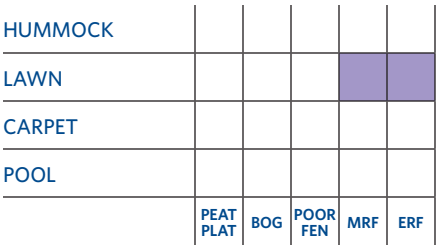
IDENTIFICATION

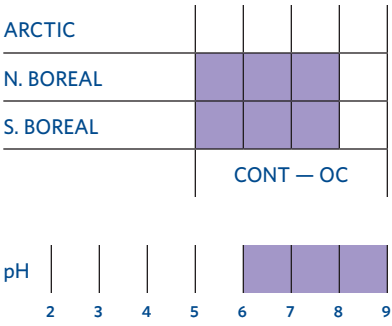
Plants simple to irregularly branched, yellow- to lime-green, forming loose mats or occurring as single stems. **Stems** naked with a unistratose outer later of enlarged cells. **Leaves** complanate-secund, entire or slightly serrulate at apex, contracted to insertion; costa lacking or short and double. **Leaf Cells** smooth, elongate. **Alar Cells** somewhat thin-walled, quadrate to oblong, enlarged but not forming an inflated distinctive group.

HABITAT

A species of swamps and moderate-rich fens, usually occurring scattered among other mosses on low hummocks and lawns. Not uncommon in sedge-dominated, shrubby, and wooded fens - more frequent in fens than *H. lindbergii*.

Meesia triquetra (Richt.) Ångstr.





KEY FEATURES

The ovate-lanceolate leaves, with serrulate margins that occur in three spirals along the stem identify this species. *Meesia longiseta* is quite similar, but is differentiated by entire margins. In addition, *Meesia longiseta* is autoicous and frequently with capsules, while *M. triquetra* is dioicous and rarely has capsules.

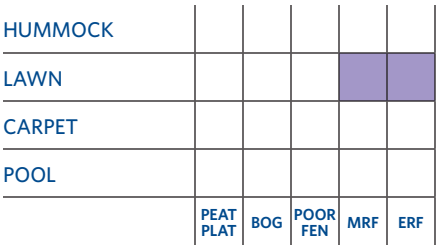
IDENTIFICATION

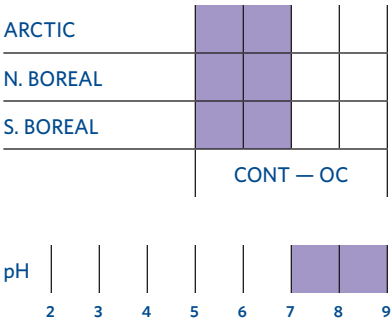
Plants erect, unbranched, lime- to dark-green. **Stems** colourless and smooth. **Leaves** spreading when moist, twisted when dry, spirally three-ranked, ovate-lanceolate, acute; costa strong, single, ending in apex, decurrent; margins serrulate above. **Leaf Cells** rhombic, rectangular to quadrate, smooth, longer below. **Alar Cells** not differentiated.

HABITAT

Occurring singly or in small patches in rich fen lawns, often with species of *Scorpidium*.

Meesia uliginosa Hedw.





KEY FEATURES

The strap-shaped leaves with strongly recurved margins, nearly the whole length of the leaves, are characteristic of this species. The short, smooth leaf cells and complete lack of differentiated alar cells are also features of this species. No other peatland species has such ligulate leaves. In addition, *M. uliginosa* is commonly found with sporophytes and the capsules with a long neck abruptly bent about 1/2 way up are characteristic of the genus *Meesia*. This species is one of several that inhabits wooded rich fen and swamp depressions, one of the richest habitats for uncommon bryophyte species. This species also occurs in peaty calcareous wet tundra and montane stream-side habitats.

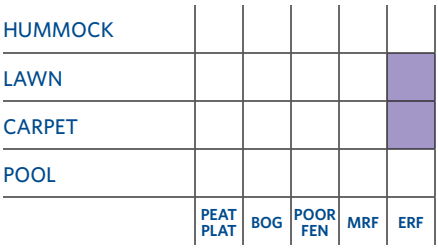
IDENTIFICATION

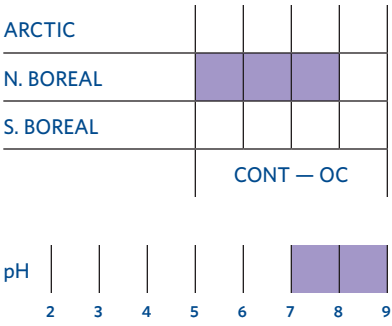
Plants erect, unbranched. **Stems** short, naked. **Leaves** erect, ligulate, obtuse; costa very strong ending in apex; entire. **Leaf Cells** rounded, smooth. **Alar Cells** not differentiated.

HABITAT

This species is one of several that inhabit wooded rich fen and swamp depressions, one of the richest habitats for uncommon bryophyte species. This species also occurs in peaty calcareous wet tundra and montane stream-side habitats.

Mesoptychia (Lophozia) rutheana (Limpr.) L.Söderst. et Váňa





KEY FEATURES

This large, beautiful species is always a pleasure to find. The decurrent, succubous, bilobed leaves with broadly reflexed margins cannot be confused with any other boreal species. Historically this species has been placed in either the genus *Leiocolea* or *Lophozia*.

IDENTIFICATION

Plants robust, purple to copper-coloured. **Stems** 4-5 mm across, prostrate to ascending. **Leaves** oblong-ovate, convex, bilobed, lobes acuminate; postical margin long-decurrent, underleaves large, bifid, and ciliate.

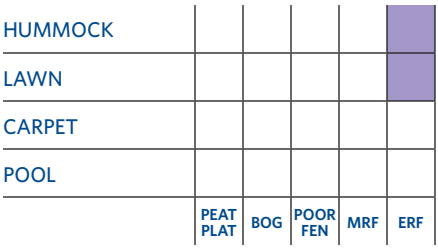
HABITAT

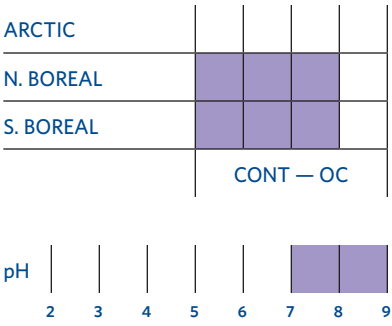
This infrequent indicator species of extreme-rich fens is the largest of the peatland liverwort species. It appears to occur on lawns and along the sides of small hummocks in open rich fens.

COMMON ASSOCIATES

Occurs with species of *Meesia*, *Paludella squarrosa* and other rich fen 'brown mosses'.

Paludella squarrosa (Hedw.) Brid





KEY FEATURES

Perhaps the most distinctive moss found in peatlands. The erect plants, stiff, 5-ranked, strongly squarrose-recurved leaves, dense tomentum on the stems, and golden-green colour are definitive. The strongly papillose upper leaf cells are also quite different from those of other species. When sporophytes are present, the capsules with long necks show its relationships with *Meesia*.

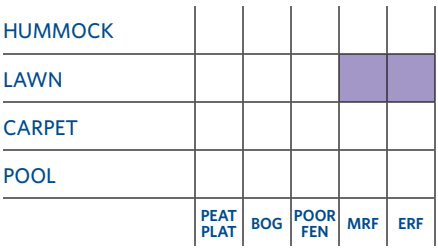
IDENTIFICATION

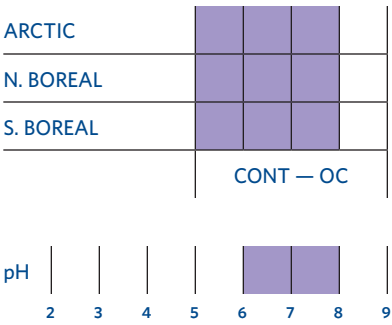
Plants erect, golden-green, with closely set leaves. **Stems** with dense orange tomentum of rhiziods. **Leaves** stiffly squarrose-recurved; costa strong, ending near apex; with margins reflexed. **Leaf Cells** oblong-rounded, strongly unipapillose. **Alar Cells** not differentiated.

HABITAT

A rare species of extreme-rich fens, where it occurs on open lawns and low hummocks.

Plagiomnium ellipticum (Brid.) T.Kop.





KEY FEATURES

Plagiomnium ellipticum could be confused with a number of species: a summary of these for peatland habitats follows with differentiating features noted (compared to those listed below for *P. ellipticum*). *Plagiomnium medium* has decurrent leaves on the fertile stems, is larger and darker in colour, and is an upland and margin species; *Rhizomnium pseudopunctatum* (also *R. gracile*) has entire leaves; *Pseudobryum cinclidioides* has irregular leaf cells longer than wide with nodose walls and a very few inconspicuous marginal teeth – this is sometimes a common species of rich fen carpets in the northern boreal zone. *Plagiomnium cuspidatum* and *Mnium spinulosum* are upland species.

IDENTIFICATION

Plants prostrate to sometimes ascending, lime-green; when fertile with erect fertile branches and arching, spreading sterile runners. **Stems** naked or with a few rhizoids. **Leaves** obovate to ovate-rounded, blunt or with small apiculus, bordered by elongate cells; costa strong, ending just below or in apex; upper margins with a few to numerous small denticulations; leaves not or only very slightly decurrent. **Leaf Cells** hexagonal, somewhat longer near the costa, evenly thin-walled, marginal cells longer. **Alar Cells** not differentiated.

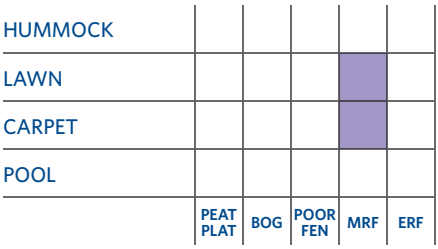
HABITAT

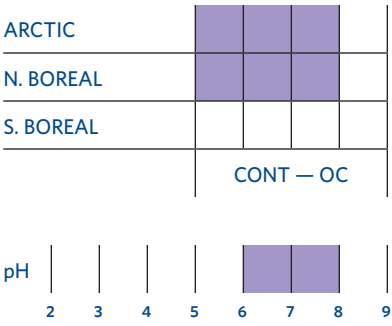
Occurring commonly in lawns and depressions in wooded fens, rich fens, and forested swamps; also in depressions in open fens.

COMMON ASSOCIATES

In open fens associated with species of *Hamatocaulis* and *Drepanocladus aduncus*.

Pseudobryum cinclidioides (Hueb.) T.Kop.





KEY FEATURES

This species has a mysterious sheen to it that helps in identification. The sheen is due to the rather elongate, nodose leaf cells arranged in oblique rows. Also, the oblong, obtuse leaves with a poorly developed margin of longer cells and lack of a strong apiculus are key features. *Plagiomnium ellipticum* and *Rhizomnium pseudopunctatum* both have stronger leaf borders and thin-walled isodiametric leaf cells.

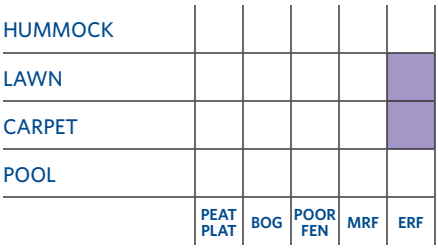
IDENTIFICATION

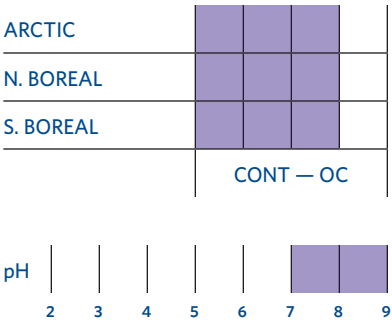
Plants robust, erect, with loosely arranged large leaves. **Stems** naked, but often with some rhizoids. **Leaves** oblong, obtuse, with satin luster, leaf border poorly developed, of 1-2 rows of unistratose, elongate cells; entire or with a few small teeth. **Leaf Cells** rhombic to oblong, about 2-4 times as long as wide, with irregularly thickened walls, smooth. **Alar Cells** not differentiated.

HABITAT

This uncommon species is found in swamps and eutrophic fens, usually in somewhat shaded or protected habitats, at the edges of small pools, or in wet lawns.

Pseudocalliergon (Calliergon) trifarium (F.Weber et D.Mohr) Loeske





KEY FEATURES

The slender string-like stems, ovate, imbricate, spirally seriate leaves that are not much longer than wide; indistinct, single costa; and gradually differentiated, but enlarged alar cells characterize this species. *Calliergon* species have longer leaves, *Scorpidium* species have falcate-secund leaves, and *Calliergonella* has abruptly differentiated, inflated alar cells. *Pseudocalliergon* (*Scorpidium*) *turgescens* is more robust, has more loosely arranged, imbricate leaves each with a tiny apiculus. Formerly known as *Calliergon trifarium*.

IDENTIFICATION

Plants single, mostly unbranched, terete, string-like, growing among other species. **Stems** without enlarged epidermis. **Leaves** ovate to oblong-ovate, obtuse, concave, imbricate and spirally seriate; costa single, extending 1/2 to 2/3 leaf length; margins entire. **Leaf Cells** long-rhombic to elongate-oblong, with blunt ends, smooth. **Alar Cells** enlarged, hyaline to orange, forming large, decurrent, and gradually differentiated groups.

HABITAT

Usually found as individual stems among other mosses in extreme-rich fen carpets. Rarely found in pure patches in carpets of rich fens.

COMMON ASSOCIATES

Usually found with *Scorpidium* species, especially *S. scorpioides* and *S. revolvens*, and in similar habitats as *Meesia triquetra*.

Ptychostomum (Bryum) pseudotriquetrum (Hedw.) D.T.Holyoak et N.Pedersen

	PEAT PLAT	BOG	POOR FEN	MRF	ERF
HUMMOCK				■	■
LAWN				■	■
CARPET				■	■
POOL					

	CONT — OC
ARCTIC	■
N. BOREAL	■
S. BOREAL	■

pH: 2 3 4 5 6 7 8 9 (■ 6–9)

KEY FEATURES

The slender, erect plants with reddish stems and contrasting greenish decurrencies are key characters. The leaf cells are short (3-4:1) and the upper leaf margins entire and bordered by long cells – these two features differentiate it from *Pohlia nutans*, a species of similar size, but having longer leaf cells (5-6:1) and serrulate upper leaf margins. The *Pohlia* occurs in bogs and poor fens within *Sphagnum*-dominated habitats whereas the *Ptychostomum* occurs in rich fens in true moss-dominated habitats. Historically this species has been placed in the genus *Bryum*.

IDENTIFICATION

Plants small, erect, reddish with dark, naked, unbranched stems. **Leaves** lanceolate, occasionally broadly so, acute to shortly acuminate; costa single, strong, ending at or just below leaf apex, occasionally shortly excurrent, distinctly decurrent; entire. **Leaf Cells** shortly hexagonal, longer at margin and there forming a border of long cells, longer below, smooth. **Alar Cells** not differentiated.

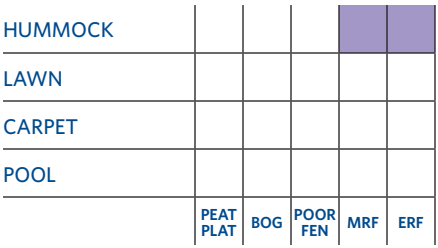
HABITAT

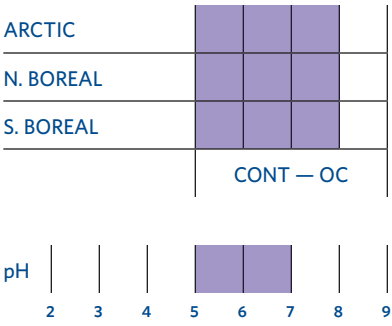
Growing intermixed among other mosses in rich fens, occurring not uncommonly in wooded fens and swamps as well as in open rich fens. Although this species is extremely common and variable in a number of non-peatland habitats (and hard to differentiate from numerous other *Bryum* (sensu lato) species), the form that occurs in rich fens is easily recognized by the decurrent leaf bases.

COMMON ASSOCIATES

A large number of typical rich fen species are often co-mingled with this species. Some examples are *Hamatocaulis vernicosus*, *Meesia triquetra*, *Scorpidium cossonii*, and *Plagiomnium ellipticum*.

Sanionia uncinata (Hedw.) Loeske





KEY FEATURES

The plicate, circinate, very long-acuminate, denticulate leaves are key features of this species. The presence of a costa (hard to see owing to the strong plications) and irregular branching differentiates it from *Ptilium crista-castrensis*, while the lack of tomentum separates it from *Tomentypnum falcifolium.*

IDENTIFICATION

Plants prostrate to ascending, irregularly branched, yellow-green, forming mats or sometimes as individuals among other mosses. **Stems** naked, with a large, hyaline outer layer of cells forming a hyolodermis and well-developed central strand. **Leaves** lanceolate, long-acuminate, circinate to falcate-secund, plicate; margins denticulate above; costa single ending in the upper part of leaf. **Leaf Cells** elongate, with blunt ends, smooth. **Alar Cells** small rectangular, hyaline and thin-walled, in small group.

HABITAT

Although generally considered an upland species, it can be frequent in wooded fens and swamps, usually occurring on logs and leaf litter.

Sarmenthypnum (Warnstorfia) tundrae (Arn.) Hedenäs

	PEAT PLAT	BOG	POOR FEN	MRF	ERF
HUMMOCK					
LAWN					
CARPET					■
POOL					■

	CONT — OC
ARCTIC	
N. BOREAL	■
S. BOREAL	

pH	2	3	4	5	6	7	8	9
						■	■	

KEY FEATURES

This species has been placed variously in a number of genera, including *Calliergidium*, *Drepanocladus*, and *Warnstorfia*. Two features make it quite distinctive: The very long-decurrent leaves that are so decurrent that the stem becomes 5-angled; and the stem leaves that are erect with down-turned apices that contrast to the falcate-secund, smaller branch leaves. The stem leaves are rather short with acute apices while the branch leaves are longer and acuminate.

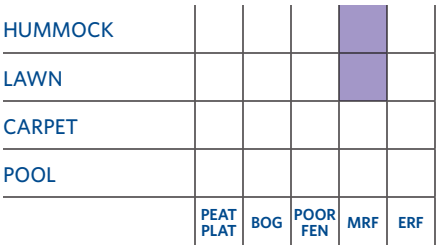
IDENTIFICATION

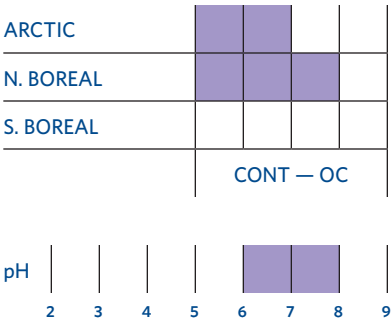
Plants large, erect, branched. **Stems** 5-angled, dark. **Leaves** stem leaves loosely erect to somewhat curved, lanceolate, acute to shortly acuminate, apices bent, long decurrent; branch leaves falcate-secund, lanceolate, acuminate. **Leaf Cells** elongate, smooth. **Alar Cells** oblong, coloured, arranged as long decurrencies.

HABITAT

A rare species of pools and carpets of rich fens.

Scapania paludicola Loeske et K.Muell.





KEY FEATURES

One of two large species of *Scapania* that occurs in fens. *Scapania* is differentiated by the rounded, complicate-bilobed, succubous leaves, with the lower lobe larger than the upper lobe and with no underleaves. *Scapania paludicola* is a large showy species. Along with *S. paludosa*, it is distinguished by arched postical margins (where the two lobes are joined). *Scapania paludicola* has the dorsal lobe (smaller) not decurrent and the ventral (larger) lobe strongly decurrent, whereas *S. paludosa* has both the ventral and dorsal lobes long decurrent.

IDENTIFICATION

Plants large, erect to ascending, light-green, generally without gemmae. **Leaves** complicate-bilobed, entire, succubous, lobes heart-shaped, often acute, ventral lobe long decurrent.

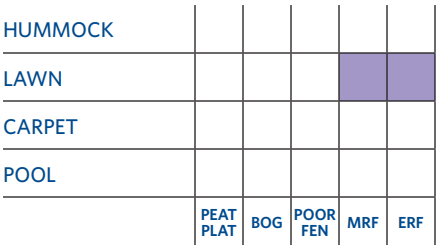
HABITAT

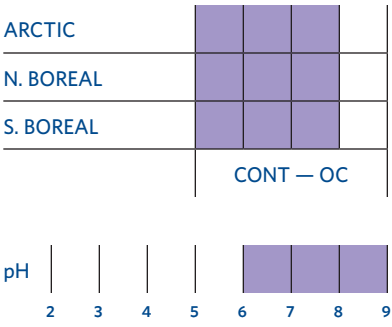
A species of moderate-rich fens, usually along the sides of hollows in hummocky wooded or shrubby fens.

COMMON ASSOCIATES

Often with *Hypnum pratense* and *Helodium blandowii*.

Scorpidium cossonii (Schimp.) Hedenäs





KEY FEATURES

Historically, this species has been known by a number of names, most commonly as *Drepanocladus revolvens* var. *Intermedius*. It is identified by green, profusely branched plants with rather short leaves and shorter leaf cells and occurs in somewhat drier habitats than the type variety. This relationship is similar to that found in *Drepanocladus aduncus* and *D. polycarpus*. A recent review of the morphology by L. Hedenäs of *D. revolvens* and *D. intermedius* concluded that indeed *intermedius* was worthy of recognition as a species; however, the correct name for this species is not *intermedius*, but rather *cossonii* when placed in *Scorpidium*. He placed both '*revolvens*' and '*cossonii*' in the genus *Scorpidium*. *Scorpidium cossonii* differs from *S. revolvens* by brownish-green (not red) plant colouration, more profuse branching, smaller plants, and especially leaf cell shape and size (oblong 14-95 µm) with blunt ends in *S. cossonii* versus elongate (61-140 µm) with sharp ends in *S. revolvens*.

IDENTIFICATION

Plants ascending to erect, pinnately to irregularly branched, brownish-green. **Stems** in transverse section with a weak central strand and enlarged epidermal cells. **Leaves** concave, falcate-secund with spirally twisted, long acuminate apices; costa ending in upper 2/3 of leaf; margins sparsely denticulate. **Leaf Cells** oblong-elongate, 14-95 µm long, with blunt ends, smooth. **Alar Cells** 2-10, hyaline and inflated, forming groups in leaf angles.

HABITAT

Found on dry lawns and low hummocks in open rich fens.

COMMON ASSOCIATES

Campylium stellatum, *Tomentypnum nitens*, and *Scorpidium revolvens*.

Scorpidium revolvens (Sw.) Rubers

	PEAT PLAT	BOG	POOR FEN	MRF	ERF
HUMMOCK					
LAWN					■
CARPET					■
POOL					

	CONT — OC
ARCTIC	■
N. BOREAL	■
S. BOREAL	■

pH

2 3 4 5 6 7 8 9

KEY FEATURES

The reddish plants with dark costa, precisely spirally twisted leaf apices, and differentiated alar cells serve to identify this species. *Scorpidium scorpioides* has broader and shorter leaves and a shorter, narrower costa; *Hamatocaulis vernicosus* has characteristically hooked leaves, a green colour and no alar cells; while *S. cossonii* is brownish to green in colour, shorter, more blunt leaf cells, and is usually more richly branched. In the arctic *Pseudocalliergon* (*Drepanocladus*) *brevifolius* can be superficially similar, but has shorter leaves and no enlarged stem cortex. Microscopically, the three species of *Scorpidium* all have enlarged stem epidermal cells and a central strand.

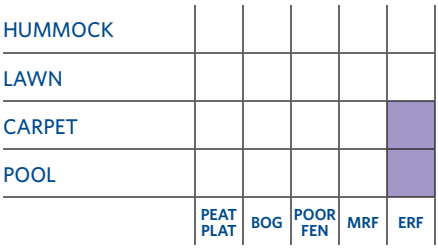
IDENTIFICATION

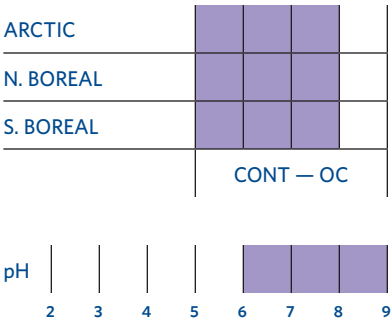
Plants prostrate to ascending, reddish to purplish. **Stems** irregularly to sparsely branched, in transverse section with enlarged epidermis and well-developed central strand. **Leaves** densely packed, strongly falcate-secund, with spirally twisted, long acuminate apices; costa single, ending in upper 2/3 of leaf, usually with some reddish colour or at least darker then lâmina; margins faintly denticulate. **Leaf Cells** elongate-linear (14-95 µm long – Hedenäs 1989), with pointed ends, smooth. **Alar Cells** 5-20, hyaline, inflated, forming non-decurrent, angular groups.

HABITAT

Usually forming dense lawns and carpets in rich fens, especially characteristically occurring above *Scorpidium scorpioides* and below *Campylium stellatum* in extreme-rich fens.

Scorpidium scorpioides (Hedw.) Limpr.





KEY FEATURES

The large, turgid plants and blunt falcate-secund leaves that lack a costa are key features. All *Drepanocladus* (*sensu lato*) species have a strong single costa as do both *S. cossonii* and *S. revolvens*.

IDENTIFICATION

Plants large, turgid, black to reddish-green, floating in water or growing upright in loose carpets, mostly with a few irregular branches. **Stems** naked, without a hyalodermis. **Leaves** ovate-lanceolate to ovate, broadly acute to narrowly obtuse, falcate-secund, rather short and blunt overall; costa short and double; margins entire. **Leaf Cells** elongate to linear, with blunt ends, smooth. **Alar Cells** consisting of a few enlarged and hyaline cells at insertion.

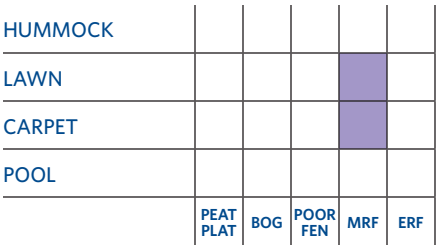
HABITAT

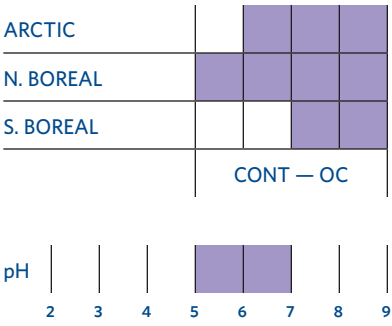
Floats in pools of water, emergent from water, or forming dense, coarse carpets at the edges of pools.

COMMON ASSOCIATES

Often intermingled with *Pseudocalliergon trifarium* and *Meesia triquetra*. *Scorpidium scorpioides* grows in the wettest areas of extreme-rich fens, with *Scorpidium cossonii* and *S. revolvens* occurring in somewhat drier habitats.

Sphagnum contortum Schultz





KEY FEATURES

A species similar to *S. subsecundum*, *S. contortum* differs in having the stem hyalodermis in 2-3 layers and small branch leaf pores - the pores of *S. contortum* are less than half the distance between the fibrils, whereas in *S. subsecundum* the pores occupy about the entire distance between the fibrils.

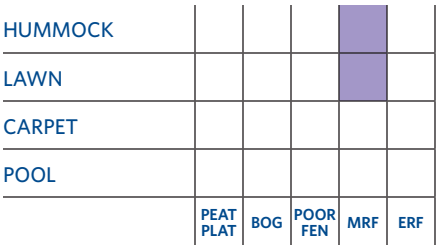
IDENTIFICATION

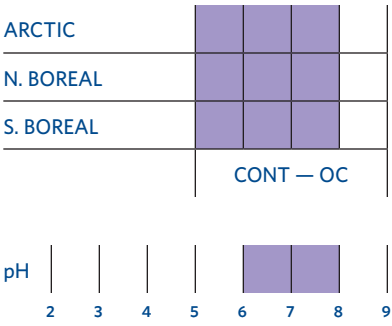
Plants medium sized, in dense mounds on lawns, orange-green, with a dense capitulum and curved branches. **Stems** with a 2-3 layered hyalodermis. **Leaves** 1.2-2.0 mm long, ovate-lanceolate, tapering to truncate acute apex; stem leaves 0.7-1.4 mm long, triangular-lingulate. **Leaf Cells** with numerous small pores arranged along sides of hyaline cells (as a string of beads), green cells trapezoidal, exposed more broadly on convex surface.

HABITAT

On wet lawns in site types transitional between rich and poor fens. More common in subcontinental and oceanic areas; rare in Alberta.

Sphagnum fimbriatum Wils.





KEY FEATURES

This species has slender plants, capitula with a large apical bud, a pallid-green colouration, and stem leaves that are rounded and fimbriate along most of the margin. As a species of section *Acutifolium*, it has one-pendent branch shown between capitulum arms. *Sphagnum girgensohnii* is larger and has stem leaves fimbriate along a truncate apex. Two species in section *Cuspidatum* have lacerate stem leaf margins: *S. lenense* and *S. lindbergii* - both have dark brown stems.

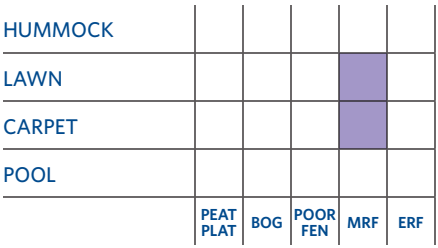
IDENTIFICATION

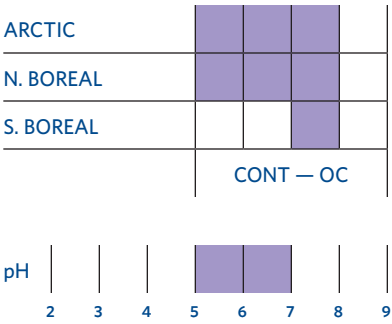
Plants slender, dirty to pallid green, with dense canopies, one pendent branch visible between capitulum arms. **Stems** clear, with porose hyalodermis. **Leaves** ovate-lanceolate, minutely truncate at apex; stem leaves broadly obovate, obtuse, fimbriate across margin, without fibrils and pores. **Leaf Cells** with large elliptic pores along sides of cells on convex surface, somewhat smaller, less conspicuous, rounded pores in central part of cell on concave surface; green cells triangular, exposed on concave surface.

HABITAT

Forming hummocks in transitional areas and in shrubby moderate-rich fens. The mesotrophic habitats often associated with marginal and transititonal areas are characteristic of this species. Also it sometimes forms quite large hummocks in rich fens.

Sphagnum obtusum Warnst.





KEY FEATURES

This species is troublesome, mainly because the definitive characters are hard to recognize. My approach is that when I have plants with rather large, blunt stem leaves (*i.e.*, not *S. fallax* or *S. angustifolium*) and when I can find nearly no pores in the upper part of the leaves, then I heavily stain and look for the very small pseudopores in the lower part of the leaves, especially noticeable along the lower marginal areas. The other key character is the long (linear-elongate) lower hyaline cells. Additionally *S. obtusum* is a species of mesotrophic and rich fen habitats, rare in oligotrophic poor fens.

IDENTIFICATION

Plants brownish-green to shiny-green, robust and stout, branch ends obtuse, 1-2 pendent branches visible between capitulum arms. **Stems** hyalodermis not or only slightly enlarged, stem core colourless. **Leaves** ovate-lanceolate and gradually narrowed to a narrowly truncate apex, margins somewhat wavy; stem leaves oblong-triangular, obtuse and erose at apex, rather flat, without fibrils and pores. **Leaf Cells** very long, especially in basal leaf area, with almost no true pores or each with a small apical pore and 1-3 corner pores on both surfaces in upper portion of leaf, lower portion of leaves with numerous very small, pseudopores (membrane thinnings) in medial portion of cell and in 1-2 irregular rows - seen only with heavy staining.

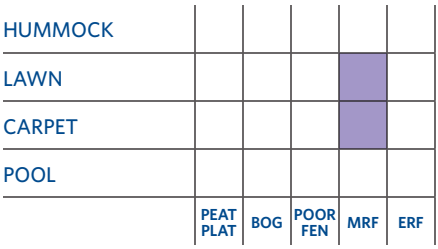
HABITAT

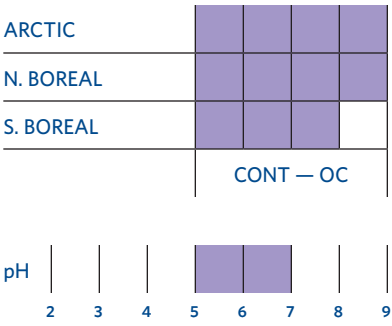
This a species of mesotrophic habitats, seemingly present in transitional rich fens and the most minerotrophic poor fens.

COMMON ASSOCIATES

In wet fens with *S. teres* and *S. subsecundum*, along with true mosses.

Sphagnum teres (Schimp.) C.Hartm.





KEY FEATURES

The distinctive stem leaves (see description below), are dark, often dirty stems with a hyalodermis, and faintly papillose walls between the hyaline and green cells of the branch leaves are differentiating characters. Also the large apical bud and minerotrophic habitat are field characters. This species is usually quite distinct from its sister species, *S. squarrosum*, but occasionally *S. teres* can have squarrose leaves similar to the larger *S. squarrosum* (see photo below).

IDENTIFICATION

Plants forming loose mats, greenish to brownish, rather slender, with large apical bud and one pendent branch visible between capitulum arms. **Stems** with 2-3 layered hyalodermis, without fibrils and pores, usually with dark core. **Leaves** ovate-lanceolate, apex narrowly truncate, erect or sometimes with recurved apices; stem leaves long-lingulate; hyaline cells in body of leaf undivided and without pores, in upper part leaf, marginal hyaline cells divided and resorbed, forming delicate marginal fringe. **Leaf Cells** with 1-3, large, irregular pores or gaps on convex surface, with distinct elliptic pores on concave surface; green cells oval-trapezoidal to triangular, exposed more so on convex surface, adjacent walls to hyaline cells very finely papillose.

HABITAT

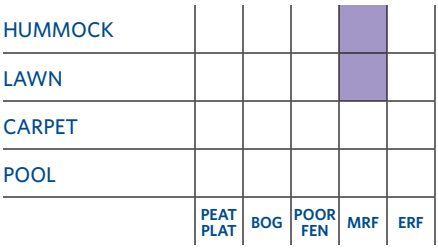
Found in minerotrophic habitats such as floating mats around lakes, carpets, and lawns of rich fens, and marginal fen laggs.

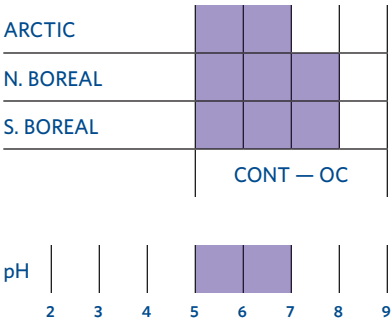
COMMON ASSOCIATES

Sometimes intermixed with *S. angustifolium* in transitional poor fens. It occurs in wetter habitats than does *S. warnstorfii*; however, in similar chemical conditions.

Sphagnum squarrosum Crome

Sphagnum warnstorfii Russ.





KEY FEATURES

Branch leaves of *Sphagnum warnstorfii* are distinguished by the very small, strongly ringed pores on the convex surface of the upper hyaline cells of the branch leaves. This character is best seen in branches of the capitulum; however, hanging branches lower down the stem may not have these small pores, and thus are not distinguishable from those of other species of the section *Acutifolium*. Association with *Tomentypnum nitens* can be used to suggest the identity of this species.

IDENTIFICATION

Plants slender, green to purplish-red, usually with flat-topped capitulum, and one conspicuous pendent branch visible between capitulum arms. **Stems** with non-porose hyalodermis, uncoloured to pinkish. **Leaves** branch leaves ovate-acuminate, fimbriate at apex, clearly ranked and seriate; stem leaves long-lingulate, without pores or fibrils. **Leaf Cells** green cells triangular, exposed on convex surface, pores on convex surface along sides of cells, small and strongly ringed in upper 1/3, larger below; on concave surface with few, large, indistinct pores in center of cell.

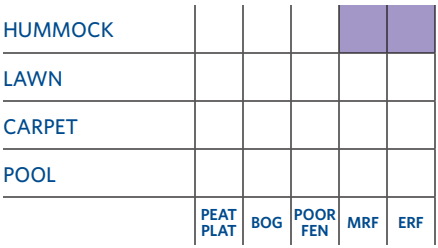
HABITAT

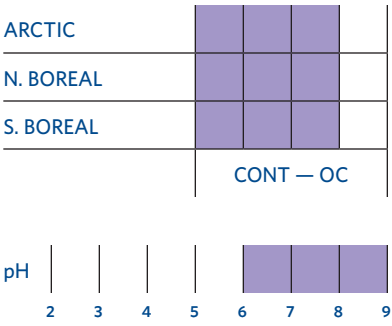
Occurring in lawns and on low hummocks in rich fens of the boreal forest, becoming less frequent northward and coastward.

COMMON ASSOCIATES

Often associated with *Tomentypnum nitens* and *Aulacomnium palustre*. In rich fens, as pH decreases above the water table, low hummocks and hummock sides are often dominated by *S. warnstorfii*; however, high hummocks may have *S. fuscum*.

Tomentypnum nitens (Hedw.) Loeske





KEY FEATURES

The costate, plicate, straight leaves with linear cells are diagnostic for this common species of rich fens. *Tomentypnum falcifolium* is similar, but has falcate-secund leaves; it occurs in poor fens. In arctic meadows *Orthothecium chryseum* occurs, but is distinguished by ecostate leaves.

IDENTIFICATION

Plants erect, pinnately branched. **Stems** covered with tomentum of reddish rhizoids. Leaves long-lanceolate, straight, acuminate to narrowly acute, strongly plicate; costa strong and single, ending just below apex; margins entire. **Leaf Cells** elongate-linear, thin-walled, smooth. **Alar Cells** not much different, shorter, with thicker, nodose walls.

HABITAT

Grows on hummocks and raised areas in wooded to open rich fens and calcareous tundra.

COMMON ASSOCIATES

Sphagnum warnstorfii, *Aulacomnium palustre*, and *Campylium stellatum*. Occasionally associated with less frequent species such as *Paludella squarrosa* and *Helodium blandowii*.

Key to Species

1. Plants thalloid, without leaves ..... ***Aneura pinguis* (p. 54)**
1. Plants with leaves 2
   2. Leaves with upper cells similar in size and shape, sometimes different from lower cells, but cells never having a reticulate network of alternating cell types; branches single or not branched 3
   2. Leaves with alternating large, clear cells and small dense cells, forming a reticulate network; branches in fascicle ..... (***Sphagnum***) 44
3. Leaves circular in outline, as wide as long, arranged in 2 or 3 ranks along stem 4
3. Leaves elliptic to lanceolate-ligulate, much longer than wide or with a border of elongate cells, not in ranks along stem ..... (True mosses) 8
   4. Leaves folded along postical edge to form two lobes, the upper smaller than the lower ..... ***Scapania paludicola* (p. 104)**
   4. Leaves simple, not folded 5
5. Leaves incubous (lower margins hidden by upper margins of the leaf above) ..... ***Calypogeia sphagnicola* (p. 16)**
5. Leaves overlapping and succubous (the upper margins hidden by lower margins of the leaf above) or not overlapping and obliquely inserted 6
   6. Leaves rounded at apex; cells with distinct corner thickenings (trigones) ..... ***Mylia anomala* (p. 6)**
   6. Leaves bilobed with two sharp points; cells thin-walled without trigones 7
7. Plants large; leaves with reflexed margins; occurring in rich fens ..... ***Mesoptychia (Lophozia) rutheana* (p. 88)**
7. Plants tiny; leaves with erect margins; occurring among *Sphagnum* plants ..... ***Fuscocephaloziopsis (Cephalozia) connivens* (p. 18)**
   8. Leaves with longitudinal folds 9
   8. Leaves without longitudinal folds 11
9. Leaves straight, erect ..... ***Tomentypnum nitens* (p. 122)**
9. Leaves curved (falcate) 10
   10. Stems with reddish tomentum along one side ..... ***Tomentypnum falcifolium* (p. 50)**
   10. Stems naked, without tomentum ..... ***Sanionia uncinata* (p. 100)**
11. Leaves multi-stratose, consisting of broad costa, overlapping laminae encasing vertical lamellae; lower cells forming a clear, unistratose sheath ..... ***Polytrichum strictum* (p. 24)**
11. Leaves unistratose, without lamellae; lower cells not forming clear sheath 12
   12. Leaves stiffly squarrose-recurved, margins broadly reflexed ..... ***Paludella squarrosa* (p. 90)**
   12. Leaves erect to wide-spreading, margins erect to narrowly reflexed 13
13. Leaves erect, recurved, or wide-spreading 24
13. Leaves curved (falcate) - all in one direction 14
   14. Costa very short and double, never extending beyond one-third of leaf length; leaves ending in short, blunt point 15
   14. Costa long and single, extending at least to mid-leaf; leaves long-acuminate ..... (***Drepanocladus sensu lato***) 17
15. Leaves complanate-secund ..... ***Hypnum pratense* (p. 82)**
15. Leaves falcate-secund 16
   16. Leaves lanceolate, acuminate; alar cells numerous, forming an inflated group of cells ..... ***Hypnum lindbergii* (p. 80)**

16. Leaves broadly ovate-lanceolate, broadly acute to narrowly obtuse ····· ***Scorpidium scorpioides* (p. 110)**
17. Upper leaf margins entire ····· 18
17. Upper leaf margins serrulate, sometimes minutely so with only 1-3 apical teeth ····· 22
    18. Alar cells forming distinct marginal groups; stems with central strand and small epidermal cells ····· 19
    18. Alar cells not much different from basal cells, not forming distinct groups, at most 1-3 hyaline, inflated, fragile cells at basal margin; stems either without central strand or with epidermis of larger cells compared to outer cortical cells ····· 20
19. Alar cells thin-walled, hyaline, inflated ····· ***Drepanocladus aduncus* (p. 70)**
19. Alar cells thick-walled, coloured, enlarged ····· ***Drepanocladus sordidus*** (***Drepanocladus sendtneri*** in previous literature)
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Glossary

abaxial: of the side or surface of an organ, facing away from the axis.

acrocarpous: with the gametophore producing the sporophyte at the end of the stem or main branch. Most acrocarpous mosses grow erect in tufts, and they are not or only sparsely branched.

acumen: a slender, tapering point with concave sides. adj. **acuminate**.

acute: terminating in a distinct but not protracted point, the converging edges separated by an angle of 45–90°and with straight sides.

adaxial: of the side or surface of an organ, facing towards the axis.

air-pores: openings in the upper surface of complex thalloid liverworts composed of several concentric rings of cells.

alar cells: specialized cells at the basal angles of a moss leaf, often distinctive in their size, shape, colour, or ornamentation.

annual: a plant that completes its life history within one year.

annular: shaped like a ring; leaves or branches arranged in a circle.

annulus: one or more rings of specialized cells between the mouth of the capsule and operculum, aiding in dehiscence.

antheridium (pl. **antheridia**): the male gametangium; a multicellular, stalked structure with a jacket of sterile cells and producing large numbers of antherozoids (male gametes); globose to broadly cylindric in shape.

anticlinal: oriented perpendicular (rather than parallel) to the surface.

apical cell: a single cell at the apex of a shoot, leaf, or other organ that divides repeatedly to produce new leaves, stems or other organs.

apiculus: a short, abrupt point; adj. **apiculate**.

appendiculate: having short, thin transverse projections, e.g. on the endostomial cilia of the peristome.

appressed: leaves lying close to or flat against the stem.

archegonium (pl. **archegonia**): the female gametangium; a multicellular, flask-shaped structure consisting of a stalk, a swollen base (venter) containing the egg, and a neck through which the antherozoid swims to fertilize the egg.

arcuate: curved like a bow.

areolate: with small angular areas forming a network; the cellular pattern of the moss leaf is often termed areolation.

arista: the hard awn or bristle at the tip of a leaf, usually formed by an excurrent costa. adj. **aristate**.

arthrodontous: *of a peristome*, of triangular or linear teeth/segments consisting of differentially thickened wall-pairs. The teeth/segments are formed of part cells, in contrast to a nematodontous peristome in which they are formed of whole cells.

ascending: sloping or curved upwards.

attenuate: tapering gradually.

auricle: a small bulge or ear-like lobe at the basal margin of a leaf: adj. **auriculate**.

autoicous: with male and female gametoecia on separate stems or separate branches of the same plant.

awn: an arista or hairpoint, usually hyaline and formed of a projecting costa.

axil: the angle between the stem and any organ originating from it, e.g. a leaf or branch. adj. **axillary**.

axillary hair: a hair originating in a leaf axil, usually inconspicuous and often concealed by the leaf base.

axis: the main stem; the conceptual line around which leaves, branches and other organs develop.

basal membrane: a delicate or robust membrane at the base of the endostome, often bearing segments and cilia.

bilobed: forked into ±equal parts.

bistratose: consisting of two cell layers, e.g. a leaf lamina two cells thick.

border: of leaves a margin that is differentiated in shape, size, colour or thickness.

bract: one of the specialized leaves surrounding and protecting archegonia and/or antheridia, especially used for leafy liverworts.

bryophyte: a green plant with a gametophyte generation that is free-living with a sporophyte permanently attached; a collective name for mosses, liverworts, and hornworts.

bulbil: a small deciduous, bulb-shaped, axillary, vegetative propagule or rhizoidal gemma; often with rudimentary leaves.

bulbiform: bulb-shaped.

caducous: falling readily or early.

caespitose: tufted, growing in dense cushions or turfs.

calcicolous: a plant that grows best in habitats or on substrata with high levels of calcium.

calyptra (pl. **calyptrae**): a membranous or hairy hood or covering that protects the maturing sporophyte; derived largely from the archegonial venter.

campanulate: shaped like a bell; here referring to a calyptra that is elongated and some-what cylindric; a campanulate-cucullate calyptra is split on one side only, whereas a campanulate-mitrate calyptra is undivided or equally lobed at the base.

capitulum (pl. **capitula**): a head-like mass of crowded branches at the apex of the stem in *Sphagnum*.

capsule: the terminal, spore-producing part of a moss sporophyte.

carinate: folded along the middle, like the keel of a boat; V-shaped in transverse-section.

caulonema: a secondary, bud-generating part of the filamentous moss protonema, typically reddish-brown with few chloroplasts and consisting of long cells with oblique end walls.

central strand: the column of elongated cells, sometimes with thicker walls, in the center of a stem.

cernuous: nodding or drooping.

channelled: *of a leaf*, hollowed out like a gutter and semicircular in transverse-section.

chloronema: the filamentous part of the protonema that contains chloroplasts.

cilia (sing. **cilium**): a delicate, hair-like or thread-like structure, usually one cell thick; adj. **ciliate**.

cladocarpous: having perichaetia terminal on lateral branches with juvenile leaf development similar to that on vegetative branches.

clavate: club-shaped.

cleistocarpous: of a capsule, lacking an operculum and, therefore, opening irregularly.

cochleariform: round and deeply concave, like the bowl of a spoon.

collenchymatous: cells with walls that are thickened at the corners.

columella: the sterile, central tissues of a moss capsule.

commissure: the margin of a hyaline cell which adjoins that of a chlorophyllose cell in the leaves of *Sphagnum*.

comose: stems tips with leaves that are larger and crowded into tufts.

complanate: a leafy shoot that is more-or-less flattened into one plane.

complicate: folded lengthwise.

complicate-bilobed: in liverworts leaves that are two-lobed due to being folded sharply at the keel.

concave: curving inward, in *Sphagnum* leaves the dorsal surface of leaf.

concolorous: having the same colour.

conduplicate: folded lengthwise along the middle.

constricted: abruptly narrowed.

contracted: abruptly narrowed or shortened.

convex: curving outward, in *Sphagnum* the ventral surface of the leaf.

convolute: of leaves or bracts, rolled together to form a sheath.

cordate: heart-shaped, as in leaves attached at the broad end.

cortex: the outermost layer or layers of cells in a stem, often differentiated from the central strand.

corticolous: growing on bark.

costa (pl. **costae**): the thickened midrib or nerve of a leaf; when present, can be single or double. adj. **costate**.

crenate: of a leaf margin, having rounded teeth.

crenulate: of a leaf margin, having minute, rounded teeth formed from bulging cell walls.

crisped (or **crispate**): wavy; often used loosely to include curled, twisted, and contorted.

cucullate: hooded or in the shape of a hood; applied to leaves that are concave at the tips and to calyptrae that are conic and split up one side.

cushion: a more-or-less hemispheric or rounded moss colony, with stems generally erect and tightly clustered but radiating somewhat to form a tuft.

cuspidate: ending in a stout, rigid point, like a tooth.

cygneous: curved downards in the upper part like the neck of a swan.

cymbiform: concave and boat-shaped.

decurrent: applied to the margins of leaves which extend down the stem, as ridges or narrow wings, below the insertion of the leaf.

decurved: curved downward.

deflexed: bent downward.

dehiscent: of capsules, splitting open by means of an annulus, operculum or valves.

dendroid: with the habit of a tree, branching from a main stem.

dentate: with teeth directed outward.

denticulate: with fine teeth.

descending: directed gradually downward.

diaspore: an agent of dispersal; any structure that becomes detached from the parent plant and gives rise to a new individual.

dichotomous: with two equal forks or branches.

dioicous: with archegonia and antheridia borne on separate plants.

diplolepideous: a form of arthrodontous peristome having two concentric rings of teeth, with the outer ring (exostome) derived from thickening of the contiguous walls of the outer and primary peristomial layers and the inner ring (endostome) derived from the thickening of the contiguous walls of the primary and inner peristomial layers. One or both rings may be absent or reduced.

distal: away from the base or point of attachment.

distant: widely spaced, e.g. leaves with space between adjacent leaves.

distichous: leaves alternating in two opposite rows on a stem, as in *Fissidens*.

divergent: spreading in opposite directions.

dorsal lamina: part of the leaf blade opposite the sheathing base, at the back of the costa and below the apical lamina in *Fissidens*.

dorsiventral: flattened with distinct upper and lower surfaces.

ecostate: lacking a costa.

ectohydric: having water transport essentially external by surface flow, including capillary motion between leaves or through surface papillae.

efibrillose: without fibrils.

elaters: sterile cells interspersed among spores in a liverwort capsule.

elliptical: having the shape of an ellipse, oblong but convex at the sides and ends.

emarginate: broad at the apex with a shallow notch

emergent: partly exposed, as a capsule only partly protruding from among the perichaetial leaves.

endostome: the inner ring of a diplolepideous peristome, formed from contiguous periclinal wall-pairs of the primary and and inner peristomial layers; typically a weak membranous structure consisting of a basal membrane with cilia and segments; homologous with the single peristome of haplolepideous mosses.

entire: with a smooth outline, not toothed or lobed.

ephemeral: short-lived.

epidermis: the outer layer of cells at the surface of an organ.

epiphragm: a circular membrane, positioned horizontally over the capsule mouth of some mosses, attached to the tips of the peristome teeth and partially closing the mouth of an inoperculate capsule.

epiphyte: a plant that grows on the surface of another plant.

equidistant: regularly separated or spaced.

erect: of leaves, almost or quite parallel to the stem, but not appressed; of branches or stems, in a ±vertical position with respect to stem or substratum; *of capsules*, upright.

erect-patent: spreading at an angle of less than 45°.

exannulate: lacking an annulus.

excavate: hollowed out.

excurrent: of a costa, extending beyond the leaf apex.

exostome: the outer circle of the diplolepideous peristome, consisting of teeth formed from contiguous periclinal wall-pairs of the outer and primary peristomial layers; absent or rudimentary in the haplolepideous peristome.

exothecium: the epidermis or superficial layer of cells (exothecial cells) of the capsule wall.

exserted: exposed, as in a capsule protruding beyond the perichaetial leaves.

falcate: curved like a sickle.

falcate-secund: strongly curved and turned to one side.

fascicle: a group, bunch, or tuft of branches, e.g. in *Sphagnum*.

fenestrate: pierced with broad openings resembling windows.

fibril: a fine, fiber-like wall thickening. adj. **fibrillose**.

filamentous: thread-like.

filiform: slender and elongate, thread-like.

fimbriate: fringed, generally eroded with radiating cell walls of partly eroded marginal cells.

flaccid: soft and limp.

flagelliform: whip-like; a branch with a gradual attenuation from ordinary leaves at the branch base to vestigial-branched tip.

flexuose: slightly bent, wavy, or twisted.

foliose: leafy or leaflike; covered with leaves.

fringed: with a short-ciliate margin or edge.

frond: the branched or leafy part of an erect stem, including branches of a dendroid moss. adj. **frondose**.

fugacious: quickly or readily falling or vanishing.

fusiform: narrow and tapering at each end, spindle-shaped.

gametoecium: a gametangium together with its surrounding bracts.

gametophore: the leafy moss gametophyte plant developed from a protonema.

gametophyte: the haploid, sexual generation; in bryophytes the free-living, dominant generation.

gemma (pl. **gemmae**): uni- or multi-cellular, globose, clavate, filiform, cylindric, or discoid structures, borne on the aerial part of the plant and functioning in vegetative reproduction.

gemmiferous: bearing gemmae.

geniculate: bent abruptly, as at the knee.

gibbous: swollen or bulging at one side.

glabrous: smooth, not papillose, rough, or hairy.

glaucous: bluish green in colour or with a grayish or whitish bloom.

green cells: the small, linear, living cells of *Sphagnum* leaves that alternate with large dead hyaline cells.

guard cells: specialized photosynthetic cells bordering the stoma on the capsule wall of mosses an hornworts.

guide cells: large, rather thin-walled cells in the center of the costa, usually best seen in transverse-section.

gymnostomous: without a peristome, so that the mouth of the urn is naked.

habit: general appearance.

hairpoint: the hair-like and often colourless leaf tip, formed from an excurrent costa or a tapering of the leaf lamina.

haplolepideous: a form of arthrodontous peristome having only one circle of teeth derived from thickening of the contiguous walls of the primary and inner peristomial layers.

Hepatic (=liverwort): a member of the Division Hepaticophyta.

hoary: grayish or whitish, appearing frosted from numerous massed hairpoints.

homomallous: pointing in the same direction.

hornwort: a member of Division Anthocerotophyta.

hyaline: colourless and transparent; commonly used with reference to cells that lack chloroplasts.

hyaline cells: The large dead cells of *Sphagnum* leaves and stems.

hyalocyst: a large, hyaline, water-storage cell in Sphagnum.

hyalodermis: with the outer most cells of the stem cortex of large, empty, colourless cells.

hypnoid: having a complete peristome.

hypothysis (=apophysis): a differentiated sterile neck at base of the capsule, between the seta and urn; sometimes swollen or expanded.

imbricate: closely appressed and overlapping.

immersed: submerged below the surface; immersed capsules occur below the tips of the perichaetial leaves; immersed stomata have guard cells that are sunken below the surrounding exothecial cells.

inclined: applied to a capsule that is tilted between the vertical and horizontal.

incrassate: thickened, or cells with thick walls.

incubous: in liverworts with leaves inserted obliquely on the stem and when viewed from the dorsal surface the distal leaf edges are visible and the proximal edges hidden beneath the leaf below.

incurved: curved upward and inward; applied to leaf margins and tips.

inflated: swollen, puffed up.

inflexed: bent upward (adaxially) and inward; applied to leaves, leaf margins and peristome teeth.

innovation: a new shoot; in acrocarpous mosses a subfloral branch formed after differentiation of the sex organs, usually from the gynoecium base.

inoperculate: lacking an operculum.

insertion: a line or point of attachment of a leaf, branch or peristome etc.

intricate: tangled, interwoven.

involute: strongly rolled upward (adaxially) and tightly inward; applied to leaf margins.

isodiametric: about as long as broad and having the same dimensions in all directions; applied to square, rounded, or hexagonal cells.

julaceous: smoothly cylindric; applied to shoots with crowded, imbricate leaves.

juxtacostal: the part of a leaf lamina adjacent to the costa.

lacerate: deeply and irregularly cut or torn.

laciniate: dissected into fine, deep, often irregular divisions (**laciniae**); fringed with cilia.

lamella (pl. **lamellae**): a longitudinal chlorophyllose ridge or plate on the leaf blade of some mosses (e.g. Polytrichaceae); adj.

lamina (pl. **laminae**): the blade of a leaf excluding the costa and leaf margin or border.

laminal cell: any cell of the lamina.

lanceolate: shaped like the blade of a spear, narrow and evenly tapered from near the broader base.

lax: soft or loose, commonly referring to a tissue of large, thin-walled cells as well as the spacing of leaves.

lid: operculum.

ligulate: strap-shaped, with parallel sides and an abruptly tapered apex.

limb: the upper part of the leaf, the lower part being the base.

limbidium: a leaf border or differentiated margin in e.g. *Fissidens*.

linear: very narrow and elongate, with the sides nearly parallel; narrower than ligulate.

lingulate: tongue-shaped; broad with the sides ±parallel.

lumen (pl. **lumina**): the cavity of a cell.

mammilla (pl. **mammillae**): a bulge on the surface of cell with a nipple-like tip. adj. **mammillose**.

mat: a densely interwoven, horizontal growth form.

median: central, in the middle; **median leaf cells** are those in the upper middle of the leaf or, in leaves with a costa, those located between the margin and costa about two-thirds of the way up the leaf.

merophyte: A primordal segment of a stem that is produced by one of the cutting faces of a apical cell -in liverworts all of the structures along one of three ranks of leaves are produced from one merophyte.

mitrate: of a calyptra, conic, and undivided or regularly lobed at the base.

monoicous: bisexual, having antheridia and archegonia on the same plant; includes autoicous, synoicous, and paroicous.

monopodial: with the main stem having unlimited growth, and giving rise to numerous, secondary, lateral shoots or stems.

mucro: a short, abrupt point at the apex of a leaf (adj. **mucronate**), as in a leaf with a short-excurrent costa; apiculate is somewhat longer.

naked: lacking covering structures or ornamentation; e.g. without hairs or papillae, referring to smooth, glabrous calyptra.

neck: the sterile basal part of moss capsule; also the cylindric upper part of an archegonium.

nematodontous: of a peristome, consisting of whole dead cells with ±evenly thickened walls, e.g. as in Polytrichaceae.

nodose: knotted, with small knob-like thickenings.

ob-: a prefix indicating inversion, as in obovate.

oblate: wider than long.

oblong: rectangular but, when applied to leaves, usually rounded at the corners.

obovate: with the profile of an egg, the broad end distal.

obtuse: broadly pointed, at an angle of greater than 90°; sometimes used loosely to indicate blunt.

oil-bodies: Oil-containing structures in the cells of most leafy liverworts.

operculum (pl. **opercula**): the lid covering the mouth of most moss capsules, becoming detached at maturity; usually separated from the mouth by an annulus.

ovate: with the profile of an egg, the base broader than the apex and about twice as long as wide.

papilla (pl. **papillae**): a minute, protuberance from the surface of a cell (especially of leaves and spores) of various forms, commonly domed or spinous, simple or branched.

paraphyllium (pl. **paraphyllia**): a small, green, filiform, lanceolate or leaf-like scale borne superficially on the stems between branches of many pleurocarpous mosses.

paraphyses (sing. **paraphysis**): sterile hairs composed of uniseriate cells, coloured or hyaline, associated with antheridia and sometimes archegonia.

parenchyma: tissue of undifferentiated cells, usually isodiametric and thin-walled, usually not overlapping.

paroicous: with antheridia and archegonia in the same gametoecium but not mixed, the antheridia immediately below the perichaetium in the axils of leaves.

patent: used for leaves spreading at an angle of about 45°.

pellucid: clear, transparent, or translucent.

pendant: drooping or hanging down.

percurrent: of a costa, extending up to, but ceasing at the apex of a leaf.

perfect: a complete peristome; applied to diplolepideous peristomes with an endostome having both segments and cilia.

perianth: in leafy liverworts the tube-like structure formed by the fusion of the uppermost 2-3 leaves and protects the developing sporophyte.

perichaetial leaf: a modified leaf surrounding the archegonia.

perichaetium: the female gametoecium, consisting of the sex organs and the perichaetial leaves surrounding them.

periclinal: oriented parallel (rather than perpendicular) to the surface.

perigonial leaf: a modified leaf associated with and surrounding the antheridia.

perigonium: the male gametoecium, consisting of the sex organs and the perigonial leaves associated with them.

peristome: a circular structure generally divided into 4, 8, 16 or 32 teeth arranged in single or double (rarely multiple) rows around the mouth of the capsule and visible after dehiscence of the operculum.

piliferous: with a long hairpoint.

pinnate: with spreading branches on either side of a stem, rather like a feather, bipinnate is when the branches are also branched.

pitted: of a cell wall, having small depressions or pores.

plane: flat, not curved or wavy, as in leaf margins.

pleurocarpous: having sporophytes produced laterally on short, usually specialized branches rather than from the apex of the main stem; mosses with stems usually prostrate, creeping and freely branched, growing in mats rather than tufts.

plica: a lengthwise fold or pleat. adj. **plicate**.

plumose: closely and regularly pinnate and feathery in appearance.

polysety: having more than one sporophyte produced from a single gametoecium, each from a separate archegonium with its own calyptra.

pore: a pit or opening in a cell wall. adj. **porose**.

process: the main divisions of a diplolepideous peristome (also called segments).

procumbent: prostrate, spreading.

propagule: a reduced bud, branch, or leaf functioning in vegetative reproduction.

prorate: having a mammillose projection formed by protusion of the end of a prosenchymatous cell.

prosenchyma: a tissue consisting of narrow, elongate cells with overlapping ends. adj. **prosenchymatous**.

prostrate: lying flat on ground; creeping.

protonema (pl. **protonemata**): a filamentous, globose, or thallose structure resulting from spore germination and including all stages up to production of one or more gametophores.

proximal: the end or part nearest to the base or place of origin.

pseudoparaphyllium (pl. **pseudoparaphyllia**): green structures resembling paraphyllia, but restricted to the bases of branches and branch buds in some pleurocarpous mosses.

pseudopodium: the hyaline, haploid stalk that raises the sporophyte of *Sphagnum* and a few other mosses above the gametophore.

pseudopore: a pore-like structure with a thin membrane that is revealed by staining; e.g. in the hyalocysts of *Sphagnum* leaves

pulvinate: cushion-like.

pyriform: pear-shaped.

quadrate: usually of cells, appearing square or approximately so in two dimensions. frond.

radiculose: covered with rhizoids.

recurved: curved down (abaxially) and inward; in leaves referring to margins, apices, or marginal teeth; in the peristome, teeth curved outward and ±downward.

reflexed: bent down (abaxially) and inward; generally referring to leaf margins or leaves of a stem.

reniform: kidney-shaped.

resorption: the digestion or erosion of cell walls in the leaves of some species of *Sphagnum*.

reticulate: forming a network.

retort cells: cortical cells in some species of *Sphagnum*, with a downwardly projecting neck ending in a pore.

retuse: a slight indentation or notch in a broad, rounded apex.

revolute: of leaf margins, rolled downward (abaxially) and backward.

rhizoid: a hair-like structure that anchors a moss to the substratum; multicellular with oblique cross walls, without chlorophyll, often pigmented, and sometimes clothing the stem.

rhombic: diamond-shaped.

rhomboidal: longer and narrower than rhombic, oblong–hexagonal.

rostrate: of an operculum, with an apical beak that is narrowed to a slender tip or point.

rosulate: resembling a rosette, with leaves enlarged and crowded at the tips of stems.

rugose: with irregular, roughly transverse wrinkles or undulations; e.g. the leaves of *Neckera*.

saxicolous: growing on rock.

scabrous: rough.

scale: in complex thalloid liverworts the membranous, coloured or hyaline appendage on the ventral surface.

secund: bent or turned to one side.

segment: of a peristome, a single, tooth-like component of the endostome.

seriate: in rows (uni-, bi-, tri- or multiseriate); applied either to adjacent rows of leaf cells, or to ranks of leaves on a stem.

serrate: regularly toothed like a saw; leaves with marginal teeth pointing forward.

serrulate: minutely serrate.

sessile: without a stalk, e.g. of sporophytes with greatly reduced setae.

setaceous: bristle-like.

sheathing: surrounding or clasping a stem, seta, or capsule.

shoulder: the distal part of the leaf base where it is abruptly narrowed to the upper lamina or limb.

sigmoid: S-shaped.

sinuose: having a wavy wall or margin.

sinus: a gap between two lobes of a leaf.

spathulate: having the shape of a spatula, narrow below and gradually broadening above.

spinose: having sharply pointed teeth.

spinulose: with minutely sharply pointed teeth.

spore: a minute, usually spheric, haploid cell produced in the capsule as a result of meiosis; its germination gives rise to the protonema.

sporophyte: the spore-bearing generation; initiated by the fertilization of an ovum; consists of foot, seta, and capsule; attached to and partially dependent on the gametophyte.

spreading: of leaves inserted at 46–90° to the stem; said to be widely spreading when close to 90°.

squarrose: of leaves, spreading at right angles to the stem.

squarrose-recurved: spreading at right angles, with the tips curved downwards.

stegocarpous: a capsule with a differentiated, dehiscent operculum.

stereid: a slender, elongate cell with very thick walls present in groups (**stereid bands**) in the costa and stem of many mosses.

stolon: a slender, elongate branch with leaves that are often smaller and have a different shape to those of the main stem. adj. **stoloniferous**.

stoma (pl. **stomata**): a pore surrounded by two guard cells; in mosses restricted to the neck of the capsule.

stratose: in layers; denoting the thickness of leaves, i.e. uni-,bi- or multistratose.

stria (pl. **striae**): a fine line or ridge. adj. **striate**.

striolate: very finely ridged.

struma: a cushion-like swelling at one side of the base of a capsule. adj. **strumose**.

subula: a long, slender, needle-like point.

succubous: in liverworts with leaves inserted obliquely on the stem and appearing as shingles on a roof – when viewed from the dorsal surface the proximal leaf edges are visible and the distal edges hidden beneath the leaf above.

superficial: *of stomata*, having the guard cells in the same plane as the adjacent exothecial cells.

sympodial: having a main stem of determinate growth, and further growth by innovations or lateral branches.

synoicous: having antheridia and archegonia mixed in the same gametoecium.

systylious: of a capsule, the operculum remains attached to the tip of the columella after the capsule has opened.

terete: smoothly cylindric, round in transverse-section.

tetrahedral: a four-faced cell or spore.

theca (pl. **thecae**): the spore-bearing part of a moss-capsule.

tomentum: a felt-like or woolly covering composed of abundant rhizoids or paraphyllia on some stems, rarely on leaves. adj. **tomentose**.

trabecula (pl. **trabeculae**): projecting cross-bars formed from the horizontal walls on either face of arthrodontous exostome teeth; also strands of cells bridging spaces within some capsules.

transerve: across the main axis of an object, with leaf insertion 90° to the stem.

trigone: triangular intracellular wall thickenings found in the corners of three adjacent cells.

truncate: cut off abruptly or squarely at the apex.

tuber: a gemma borne on rhizoids, usually underground.

tuft: a growth form with stems erect but radiating at the edges and forming small cushions.

tumid: swollen or inflated.

turf: a growth form with stems erect, parallel and close together and forming rather extensive patches.

turgid: swollen or plump.

uncinate: hooked; with the tip bent to form a hook.

underleaf: leaves on the ventral surface of a stem in liverworts and some mosses, usually in rows and modified in size and shape leaf compared to other leaves.

underlobe: in liverworts the ventral portion of a leaf in complicate-bilobed species.

undulate: wavy.

urn: the spore-bearing part of the capsule.

vaginant: one of two clasping leaf laminae in *Fissidens* spp.; the adaxial part of the leaf that sheathes the stem and encloses the base of the leaf above it.

vermicular: worm-like; long narrow and curving.

verticillate: whorled.

weft: a loosely interwoven growth, often somewhat ascending.

whorled: arranged in a ring or circle.

Wide-spreading: of leaves, spreading from the stem at a wide angle (less than 90°).

xerophyte: a plant that is adapted for survival in arid places. adj. **xerophytic**.

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