

A Photo Guide to
Some Outstanding
Mosses of the Morton
Arboretum







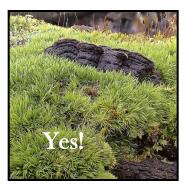
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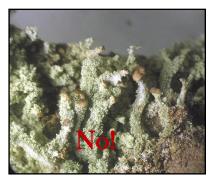


INTRODUCTION

Mosses? What are they and what do they do?



Many plants are called "moss"! Some of these are NOT mosses! Spanish Moss, Reindeer Moss, Moss Roses and others are not mosses but, "vascular" plants. Those plants have small tubes that transmit fluids to and from various parts of the plants. True mosses do not have these tubes. Fluids are moved through the plants by absorption directly into the cells of the plants, moving from one cell to another or across the surface of the plant. In addition, mosses do not have "roots". Mosses



have "rhizoids" that simply hold the plant to the surface and do not take anything from the substrate to which they are attached.

In the summer of 1981, Patricia K. Armstrong published an article in The Morton Arboretum Quarterly (Volume 17, Number 2) entitled *BRYOPHYTES Tiny Treasures of the Plant World*. This article details the structures, life cycles and habitats for many of the mosses and other bryophytes at the Morton Arboretum.

In the summer of 1983, Patricia K. Armstrong published another article in The Morton Arboretum Quarterly (Volume 19, Number 2) entitled *BRYOPHYTES OF THE MORTON ARBORETUM*. In it she outlined some of the more common bryophytes, including both mosses and liverworts, to be found on the grounds of the Arboretum. Her work constitutes the first ever done on bryophytes within the confines of the Arboretum.

The two publications above can be accessed at:

acorn.mortonarb.org/MultiSearch/index?search=bryophytes+armstrong

The first recorded sighting of a moss on the grounds of The Morton Arboretum was of the tiny *Fissidens bryoides* (Pixie Pocket Moss) by F.E. Drouet in 1922. Since that time, additional sightings and collections have produced a list of 209 species. Since the late 1800's, 257 mosses have been sighted for DuPage County (mainly from the DuPage County Forest Preserves). Between 1970 and the present, inventories of mosses conducted on the grounds of The Morton Arboretum, have collected or sighted 181 species.



Thus, about 70% of the county moss species can be found on just 1,700 acres of the Arboretum. Of these 181 species, only 21% (38) are considered to be common (20) to abundant (18) while 79% (143) are uncommon (61) to rare (82).

This guide includes the 56 moss species that are most commonly seen along trails. The majority of the included mosses can be found on trees, branches, stumps, logs, rocks, gravel, and soil as picture on the next page.











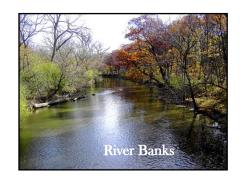


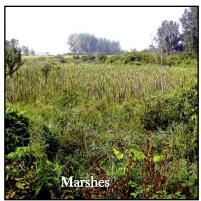


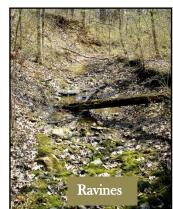
Where to look

















How to use this guide

PLEASE: do not remove any mosses from the place where they are growing at the Morton Arboretum or in local Forest Preserves! Examine them in place where you find them!

Mosses are <u>very</u> small plants. You will need a 10x or 20x hand lens (like the one shown below) or magnifier for a close up look to help you identify the mosses. These are available on line at places like Amazon or EBay or at the Arboretum Book Store.

In her article on "Tiny Treasures", Armstrong suggests the following:



"In order to find bryophytes, one must seek the environmental conditions that are conducive to their growth. The most important environmental factor is moisture, especially atmospheric humidity. Places that are near water, close to the ground and shady should offer good bryophytic hunting. Places such as tundra, bogs and swamps, vertical stream banks or cliffs. Bare rock and tree trunks or limbs that are free of composition from larger, faster growing plants are also good places to find bryophytes.... So the next time you go for a walk in a shady woods, bring your hand lens along and look for these small and exciting plants. Happy hunting"!

When you find one, search the photos in the guide to locate the moss that come the closest to the one you find. Then read the accompanying description to aid you in determining that you have the right one. The guide is divided into two sections to get you started. Section 1 is the mosses that occur in flat layers (forming mats) against the surface. These are known as "pleurocarpus" mosses. Section 2 contains mosses that stand erect or nearly so (creating tufts) from the surface, these are known as "acrocarpus" mosses. Because this guide includes only 1/3 of the 181 mosses that have been found on the grounds, you may encounter some of the rarer mosses not listed in this guide. To identify these species you will need a guide that includes a broader range of mosses. Several such guides are listed on page 32.

Hints

Use the trail system through the East Woods and other wooded areas to find the most mosses. However they can be found anywhere and everywhere. Look for them at the base of trees, also on stumps, logs, rocks and bare soil (especially where soil is mounded or eroded). The best times of year to see them are fall and spring when they are still green and the wildflowers and grasses are dormant. At other times of the year, mosses stand out just after rain when their leaves are expanded with water (like a wet sponge). Where appropriate, the guide will show mosses in both dry and wet conditions.

A Photo Guide to Some Outstanding Mosses Of the Morton Arboretum

SECTION 1 - Plants that lay flat (or nearly so) on a surface (forming mats) - See examples below (If this is your moss, start on Page 3)



SECTION 2- Plants with stems or branches that are upright (forming tufts or cushions) - See examples below (If your moss looks like this, start on Page 20)



SECTION 1

FLAT GLAZE MOSS

Entodon cladorrhizans









This is a medium size, glossy, light colored moss; the stems are regularly branched, the branches are somewhat flattened, leaves are flattened and pointed, spores occur in fall.

<u>COMMON:</u> It grows in flat mats on tree bases and rotting logs.

LITTLE WORM MOSS

Entodon seductrix









This is a medium size and medium colored moss, the stems are short and sparsely branched and sometimes slightly flattened; the leaves are sharply pointed and flat; there is no midrib, spores occur in fall.

ABUNDANT: it grows in extensive mats on tree branches and bases, logs and soil in dry, shaded to open habitats.

ROUND SILK MOSS

Plagiothecium cavifolium









This is a medium size, glossy, light colored plant; stems and branches are long and crowded, worm like, leaves are spear shaped, pointed; costa medium, double, with spores in spring to summer.

<u>UNCOMMON</u>: growing in mats on rotting logs, soil and cliffs in shaded habitats

NECKLESS CHAIN MOSS

Leskea gracilescens









This is a small, dark colored moss that grows in dense mats of slender, rope-like branches that hang from trees, the leaves are, crowded, broadly lance shaped, pointed; the costa is long, with spores maturing in summer.

ABUNDANT: This moss grows on trees, logs, soil and rock in shaded habitats.

GOLDEN LOG **MOSS**

Leskea polycarpa









This is a medium size, dull, often yellowish moss that grows in mats, the branches are somewhat curved at the tips, leaves are abruptly pointed, capsules mature from summer into fall.

<u>UNCOMMON</u>: It grows at the base of trees and logs and horizontal branches in shaded areas; it is often vellowish to brown in color

GLAUCUS CEDAR MOSS

Brachythecium rotaeanum











This is a medium to large yellowish plant with creeping, cylindrical stems when dry, leaves are more open when wet, broadly lance shaped, leaf tip narrowed to a point, spore stalk cherry red when present.

UNCOMMON: growing in dense mats on trees, logs, soil and rock in woodlands.

LONG-LEAVED CEDAR MOSS

Brachythecium acuminatum









This moss is a small, slender, glossy, medium colored moss; the branches are short; the leaves are spreading when wet, closed when drey crowded, broadly lance shaped, abruptly pointed; spores mature in fall.

<u>COMMON</u>: this moss grows in extensive mats primarily on trees but also on soil in shaded habitats.

HOOKED SHINNING MOSS

Brachythecium campestre









This moss is a medium size plant growing in shiny, yellowish mats; the stems are flat or ascending, stem leaves are lance-shaped; branch leaves are spreading, hooked at the ends, slenderly tapered to a sharp point.

<u>UNCOMMON</u>: Grows on soil, limestone rocks and tree trunks in forests.

COMMON FOXTAIL MOSS

Brachythecium laetum









This is a robust, glossy, light colored moss, the leaves are slightly spreading, lance shaped, long tapered, seta is brownishorange, spores mature in winter. <u>ABUNDANT</u>: It grows in mats on trees, logs, soil (lawns) and rocks in dry, disturbed, habitats.

BEAKED COMB MOSS

Rhynchostegium serrulatum









This moss is a medium size, glossy, light green moss, the leaves are wide-spreading egg shaped, flattened when dry, slenderly pointed, with spores in fall.

<u>UNCOMMON</u>: It grows in flat mats on rotting logs and soil in shaded habitats.

BLANKET MOSS

Callicladium haldanianum









This is a medium size, glossy, light colored moss with somewhat flattened, branched and short stems, the leaves are crowded, long pointed and they curl upwards at the stem tips; seta is orange-red.

<u>COMMON</u>: It grows in extensive mats on logs and stumps in open woods and in the partial shade of thickets

SMALL CREEPING CEDAR MOSS

Amblystegium serpens









This moss is a mat forming moss of very small size with thin, branched stems; the leaves are narrowly lance shaped with a long slender point, small, widespreading, seta reddish, spores form in spring.

<u>COMMON</u>: It grows in spreading mats in lawns and on logs, soil and rock in moist to wet shaded and sunny habitats.

TANGLED THREAD MOSS

Hygroamblystegium varium varium









This is a small, dull, light colored moss that grows in rigid mats, the leaves are slightly spreading, lanceshaped, slenderly tapered; seta is dark red.

<u>ABUNDANT</u>: It grows on trees, logs, soil and rock in wet, shaded habitats. It is highly variable.

RIVER CEDAR MOSS

Leptodictyum riparium









This is a medium to large moss, dull, light to very dark green (even black) in color; growing in long trailing mats, the branches are horizontal and wide-spreading; the leaves wide-spreading, lance-shaped, gradually long tapered and somewhat two-ranked.

<u>ABUNDANT</u>: It grows on rotting vegetation, rotted logs, tree bases and soil in shaded (swampy) wetlands, also on rocks in streams

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PALE RUG MOSS

Oxyrrhynchium hians









This moss is a small, creeping, slender, often glossy, waxy-translucent, yellowish colored moss, the leaves are upright and spreading; it occurs in two forms (one with slender pointed leaves and another with rounded, egg-shaped leaves); spores occur in fall.

<u>ABUNDANT</u>: It grows in mats on soil (often lawns) in damp, shaded habitats.

LITTLE SWORD MOSS

Haplocladium microphyllum









This is a medium size, light colored moss that grows in thin, spreading mats; the stems have scattered hairs; the stem leaves are erect, broadly spear shaped, long-pointed; capsules mature year around.

<u>COMMON:</u> found growing primarily on rotting logs but also on soil in shaded habitat.

DELICATE FERN MOSS

Thuidium delicatulum delicatulum









This moss is a robust, dull, variously colored moss, usually branched two or three times, fuzz (paraphilia) covers the branches, leaves are erect or spreading, stem leaves triangular, pointed; branch leaves egg shaped and pointed; spores mature in fall to winter.

<u>ABUNDANT</u>: Grows in large mats on moist to dry soil and well rotted logs in shade.

FIELD FERN MOSS

Thuidium recognitum









This moss is a rather robust, light colored moss with stems that are often arched, divided twice with very abundant fuzz, the stem leaves are bowed away from the stems, wide spreading, egg shaped, abruptly pointed, with very small teeth; capsules mature in fall to winter.

<u>COMMON</u>: It grows in large mats on moist soil, rocks, logs and bases of trees in woods, and shrubby fields.

CYPRESS SLUMBER MOSS

Hypnum cupressiforme cupressiforme









This is a small, somewhat shiny, light colored, creeping moss, with red-brown stems; leaves are, sickle-shaped, slenderly long pointed, seta reddish, capsules mature in spring. COMMON: It grows in soft, flat mats on rotten logs, soil, or rock in wet, shaded to open habitats.

CURVED SLUMBER MOSS

Hypnum curvifolium









This moss is a large, glossy, medium colored moss with flat lying stems that are orange-brown to reddish and regularly divided; the branches are short; the leaves are crowded and overlapping, sickle shaped, triangular and gradually pointed; with spores in spring.

<u>COMMON:</u> The moss grows in extensive mats on logs and soil in shaded habitats

LINDBERG'S SLUMBER MOSS

Hypnum lindbergii









This is a large moss that grows in light colored, shiny, soft, loose mats, the stems are arched and irregularly branched; the leaves are spreading, strongly sickle shaped and pointed; with spores in summer.

<u>COMMON</u>: it grows on soil and rotted logs in open and shaded wetlands.

TONGUE APRON MOSS

Anomodon minor









This is a medium-sized, coarse, dull, dark green moss that grows in dense mats; the plants are generally flat; the leaves are upright and spreading, crowded, oblong (strap shaped) rounded at the end; capsules are urn shaped maturing in early fall.

<u>COMMON</u>: It grows on trees (especially at the base), logs, soil, and rock in shaded habitats.

COMMON APRON MOSS

Anomodon attenuatus









This is a small, dull, medium colored moss; the leaves are upright and spreading, when wet; bottle-shaped, pointed, and flattened; compressed when dry; branches ends are often wiry with tiny or no leaves leaves; spores occur in fall. <u>ABUNDANT</u>: It grows in thick mats on trees, logs, soil and rock in shaded habitats.

VELVET APRON MOSS

Anomodon rostratus









This is a small, dull, yellow-green moss, with stems that are profusely branched, crowded, erect, short and cylindrical, leaves are sharply pointed, erect-spreading when wet, closed when dry, somewhat egg shaped, with a colorless point; capsules mature in fall. <u>UNCOMMON</u>: Grows in dense mats on the bases of trees, soil and rock in moist, shaded habitats.

MEDUSA MOSS

Hedwigia ciliata









This is a coarse, dull, medium colored moss that grows in mats; the leaves are spreading when wet but closed when dry; tipped with a whitish fringe and awn (especially when dry), they are crowded, toothless, pointed, seta is reddish-brown with spores in spring.

<u>UNCOMMON</u>: It usually grows on rock, (even asphalt) as well as trees and logs in shaded habitats.

FOREST STAR MOSS

Plagiomnium ciliare









This is a robust, medium colored moss that grows in mats and tufts, the plants are mostly flat (upright, fertile stems may occur the leaves have teeth covering the entire margins; they are egg-shaped, wide spreading and contorted (curled) when dry, with spores in spring.

<u>COMMON</u>: Grows on soil, especially (banks and mounds), and rotted logs in moist, shaded habitats.

WOODSIE MNIUM

Plagiomnium cuspidatum









This is a medium sized, medium colored moss that grows in tufts and or mats; the stems are fuzzy, the leaves are spreading, spatulate to oval, contorted when dry, pointed with sharp teeth on the upper half only, with spores in late spring.

<u>ABUNDANT</u>: grows on logs and soil in moist, shaded, often very weedy habitats.

PLAIN FOREST STAR MOSS

Plagiomnium ellipticum









This is a small to robust, medium colored moss that grows in mats; the leaves are wide spreading, with no or only a couple of teeth, egg shaped, the end of the leaf is rounded with a sharp point; capsules mature in late spring.

<u>UNCOMMON</u>: found growing on wet soil, rotten logs, and rocks in shade.

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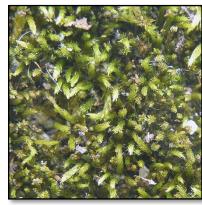
OLIVE-COLORED LOG MOSS

Platygyrium repens









This is a small, dark colored moss with clusters of gemmae (tiny plantlets) at the ends of erect branches, the branches are ascending and short, the leaves are spreading, ovate, pointed; with spores in fall.

<u>ABUNDANT</u>: This moss grows in flat mats on trees, logs, and stumps in dry woods and brushy (sayanna) habitats

PAINTBRUSH MOSS

Pylaisia salwynii









This is a small, light-colored, shiny moss, it grows in curly mats; the branches are crowded and curled when dry (looking like small paint brushes), the branch leaves are crowded, lance-like, narrowly pointed; with spores in fall.

<u>UNCOMMON</u>: It grows in wide mats on the trunks and branches of hardwoods.

SECTION 2

SILVERY BRYUM

Bryum argentium argentium









This is a small, light colored wormlike moss with red stems; leaves have silvery appearance, especially when dry, the branch leaves are oval, long pointed, spores are produced in summer.

ABUNDANT: Grows on (including concrete), exposed, rocky soil, gravel (driveways and parking lots), shingle roofs and cracks in the sidewalk

PURPLE HORN-**TOOTHED MOSS**

Ceratodon purpureus purpureus









This is a small, dull, yellow to reddish colored moss with broadly tapered leaves that are sharply pointed, they are rolled inward, contorted when dry; the seta red, capsules with spores in spring.

ABUNDANT: It grows in dense (often very large) colonies in dry, sterile or very disturbed habitats (lawns, roadsides and old roofs).

SPINY PINCUSHION MOSS

Ptychostomum creberrimum









This is a small densely tufted, light colored moss; the srems are red below, yellowish at apex which is sharply pointed, the leaves are somewhat crowded, lance shaped, rolled inward, gradually long-pointed; capsules mature in summer.

<u>COMMON</u>: It grows on soil in sun or shade and appears whitish due to the awn.

SOUTHERN TREE MOSS

Climacium americanum









This is a large, dark colored moss that resembles minature trees; the plants are dull and dirty-green when dry, the leaves are broadly lance-like, toothed; capsules mature in fall.

<u>COMMON</u>: Usually found growing in tufts on wet ground (occasionally on well rotted logs) in shallow depressions, around ponds and other moist to wet areas in woodlands.

COMMON PLUME MOSS

Fissidens taxifolius









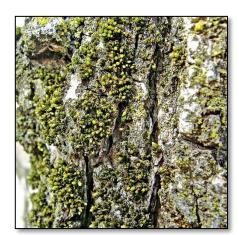
This is a small, medium to dark colored moss, the leaves are oblong and grow on either side of the stem, they are crowded; they end in a sharp point; with spores in fall.

<u>ABUNDANT</u>: Grows on soil (even in lawns and gardens) and rocks in shaded habitats

STRAIGHT HAIR MOSS

Orthotrichum pumilum









This is a small, greenish black plant, the leaves are erect, soft, broadly lanceolate, pointed, the margins are rolled inward, capsules (usually present after winter) extend above the leaves, dark brown, strongly eight ribbed spores produced in spring.

<u>ABUNDANT</u>: growing in tufts on trees and rotting wood.

SMALL STRAIGHT HAIR MOSS

Orthotrichum pusillum









This is a tiny, dark green moss; the leaves are erect, broadly lance-like, bluntly pointed, rolled inward, capsules are not ribbed, immersed within the plant, with spores in spring.

<u>COMMON</u>: It grows in tufts on trunks of trees in open dry woodlands and roadsides. Look for characteristic straw-colored capsules that are present much of the year.

STARRY HAIR MOSS

Orthotrichum stellatum









This is a small moss, leaves erect closed when dry open when wet, broadly lance-shaped apex is pointed, capsules are strongly vase-shaped and emerge from plant, they have eight ribs.

<u>UNCOMMON</u>: it grows mainly on trunks and branches of hardwood trees in moist areas.

KANNIKIN MOSS

Schistidium crassithecium









This moss grows in compact cushions that are blackish-olive colored, the leaves are erect, broadly lance-like, keeled (like a boat), apex pointed with a white awn, capsules light brown, maturing in spring to summer.

<u>UNCOMMON</u>: it grows only on limestone rock in both open and wooded areas.

TINY TORNADO MOSS

Tortella humilis









This is a small, medium green colored moss with leaves that are broadly lance shaped and contorted when dry, pointed with a short awn; capsules mature in spring

<u>COMMON</u>: It grows in small tufts on trees, logs, soil and rock in dry, shaded to open habitats.

COMMON ROCK MOSS

Tortula obtusifolia









This is a tiny, dull, green to yellowish colored plant, growing in dense tufts, leaves upright and spreading, oblong to lance-like, end of the leaf is blunt, often fuzzy (especially above), incurved contorted when dry, capsules mature in summer.

<u>COMMON</u>: it grows on soil, limestone rock and rock walls, in open to shaded areas.

GREEN PINCUSHION MOSS

Bryum argentium majus









This is a dark green, 'pincushion' moss; it is a small, worm-like plant with wiry leaves that are translucent at the tips with a long whitish awn, sporophytes unknown.

<u>UNCOMMON</u>: it grows in small, dense cushions in disturbed, open, places such as gravel parking lots and patios.

PINCUSHON MOSS

Gemmabryum caespiticium









Tthis is a small pincushion looking moss, it is somewhat shiny, and light colored; leaves spread out like rose petals; the stems are fuzzy; leaves are lance-shaped and gradually pointed, capsules mature summer.

<u>ABUNDANT</u>: This moss grows in tufts on disturbed soil in open habitats.

URN MOSS

Physcomitrium pyriforme









This is a small, light green colored moss growing in small tufts; the leaves point upward, they are oblong, narrowing to the tip, awned capsules green turning brown with age, urn shaped.

<u>COMMON</u>: It grows on wet, disturbed soil (gardens and lawns) in open habitats in spring (a spring ephemeral).

LARGE CLUSTER MOSS

Rosulabryum laevifilum









This is a small to medium, bright green moss, leaves spread out like rose pedals and are egg shaped, apex pointed, costa long (with an awn), spores maturing in summer.

<u>UNCOMMON</u>: growing on bark, rotten wood, rock and soil in open woods.

PIGTAIL MOSS

Weissia controversa









This is a tiny, dull, pale green colored moss, the leaves are larger above, spreading, long, pointed, tightly rolled inward, they are also strongly curled when dry, the capsules mature frequently.

<u>COMMON</u>: It grows in small cushions on disturbed soil in open and partly shaded habitats.

SAFFRON MOSS

Ditrichum pallidum









This is a small, medium colored moss that grows in pincushion mounds, with leaves that are slightly curved, hair-like and erect, with seta that are light yellow, spores occur in fall.

<u>UNCOMMON</u>: It grows in tufts on disturbed soil (along trails) and mounds (wind throws), particularly at the bases of trees, in shaded habitats.

MOUNTAIN FORK MOSS

Dicranum montanum









This is a small, dense, medium colored moss found in dull tufts, the leaves are strongly curled when dry, hair-like, pointed, capsules mature in spring

<u>UNCOMMON</u>: This moss grows in small, dense patches on trees, logs, stumps and humus in wooded habitats.

WAVY CATHARINEA

Atrichum altecristatum









This is a relatively robust, dull, dark green moss; the leaves have teeth on the lower surface and are keeled (like a boat), surface is wavy, narrow and pointed with double-toothed margins, they are strongly curen wet; it has spores that mature from spring to fall.

<u>ABUNDANT</u>: It grows in large tufts on dry exposed soil in shaded habitats (common name honors Catherine the Great, Empress of all Russia).

PIDGEON WHEAT

Atrichum angustatum









This is a small, dull, dark green moss; the leaves are long and wavy because of the teeth on the lower surface, narrow, pointed and have double-toothed margins; leaves are strongly curled when wet; it has spores that mature in spring and summer.

<u>UNCOMMON</u>: It grows in large tufts on light, silty soil banks in dry, open to shaded habitats. 29

SMOOTH CATHARINEA

Atrichum tennellum









Plants are mediun sized and delicate; leaves are long and narrow, not wavy, tapered to a rather blunt, but sharp pointed tip, they are strongly curled when dry with few or no teeth on the underside, marginal teeth mostly double, capsules mature in late summer.

<u>UNCOMMON:</u> growing in tufts on sandy or clayey soil in a variety of habitats.

FOREST STAR MOSS

Plagiomnium ciliare









This is a is a large, dark green moss that grows in tufts, the plants are mostly prostrate (erect, fertile stems also occur), the leaves have teeth covering the entire margin of the leaf which is oblong, wide spreading and contorted when dry, seta brownish with spores in spring.

COMMON: Grows on soil, especially banks, and rotted logs in moist, shaded habitats.

WOODSIE MNIUM

Plagiomnium cuspidatum









This is a large, green moss that grows in tufts and or mats, the stems are fuzzy, the leaves are spreading, spatulate shaped on upright, fertile plants, contorted when dry, pointed with sharp teeth on the upper half only; seta is brown, with spores in late spring.

<u>ABUNDANT</u>: grows on logs and soil in moist, shaded, often very weedy habitats like lawns and gardens.

PLAIN FOREST STAR MOSS

Plagiomnium ellipticum









This is a medium sized, medium colored moss that grows in tufts; the leaves are wide spreading, with no or only a couple of teeth, egg shaped, apex rounded and pointed, seta reddish brown, capsules mature in late spring.

<u>UNCOMMON</u>: Found growing on wet soil, rotten logs, and rocks

in shade.

CINDER ELLA

Funaria hygrometrica hygrometrica









This is a small light green colored moss; with leaves that are oblong, pointed, crowded and without teeth; capsules are pear-shaped, spores produced in fall.

<u>ABUNDANT</u>: It grows in large patches on wet soil and lawns. It is especially common in the ash of burned areas (even old camp fire pits) in woodlands.

Some Helpful Guides to Mosses and Other Bryophytes

Conrad, Henry S., and Redfearn, Paul L., Jr., *How to Know the Mosses and Liverworts,* WCB McGraw-Hill, 1979

Lincoln, Mary S. G., *Liverworts of New England (A Guide for the Amateur Naturalist)*, The New York Botanical Gardens Press, 2008

McKnight, Karl B., et.al. *Common Mosses of the Northeast and Appalachians*, Princeton University Press, 2013

Munch, Susan, Outstanding Mosses and Liverworts of Pennsylvania & Nearby States, Susan Munch, 2006

Pope, Ralph, *Mosses, Liverworts and Hornworts (A Field Guide to Common Bryophytes of the Northeast)*, Comstock Publishing Associates, Cornell University Press, 2016