Bolboschoenus (2)*

Bulbostylis

Cladium

Carex (>150)

Cyperus (13)

Dulichium

Eleocharis (14)

Eriophorum (6)

Fimbristylis autumnalis

Rhynchospora (4)

Schoenoplectus (8)

Scirpus (10)

Scleria (2)

Trichophorum (4)

*The numbers give the approximate number of species in the Northern Forest Region.

SEDGE LESSON 1: INTRODUCING THE SEDGES

Jerry Jenkins ◆ The Northern Forest Atlas Project ◆ MAY 2020

This is the first of eight sedge lessons I am preparing for the on-line class, June-August 2020. They are intended to introduce you to sedges and sedge ecology by looking at the commonest woodland and wetland sedges and using them as exemplars of species groups.

Lesson 1 explains what sedges are, how the genera are distinguished, and how *Carex,* the largest genus, is broken into subgroups. Because this lesson deals with large groups with wide ecological ranges, the focus here is on structure. Each group has diagnostic features; once you see them, you know the group. Later lessons will be more ecological, introducing the plants habitat by habitat.

To use these lessons you will need to know what a plant is and what a flower is and does. You will need a copy of our photographic guide, *Sedges of the Northern Forest* (Cornell University Press, *2019*); you may want copies of sour sedge charts or our digital atlas of sedges (very cool!), available as free downloads from the Northern Forest Atlas website, northernforestatlas.org.

Sedges are beautiful plants, worth studying and knowing. They are also, despite what you may have been told, relatively simple: varied and diverse certainly, but varying around a few core themes. One theme is the using of sheathing leaves, with or without blades; another is surrounding flowers with bristles or perigynia and enclosing them with bracts; and third is grouping flowers into spikelets and spikelets into inflorescences; and a fourth, restricted to *Carex*, is the grouping and separating of male and female flowers.

Take time to learn these themes and how they vary. Keep living plants in your house, in pots and jars; look at them, think about them, draw them, compare them to each other and to the images in these lessons. Appreciate their beauty, learn the architectural patterns beneath it. Once you do, everything else is easy.

NFAP

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Above, a rich fen in Pownal Vermont: *Carex aquatilis, chordorrhiza, lasiocarpa, Eleocharis elliptica, Trichophorum alpinum.* Below, the White Creek, White Creek, New York, tussocks of *Carex torta,* plus *Carex communis, hirsutella, laxiculmis, leptonervia, tenera,* etc.

The sedges, *Cyperaceae*, are a family of flowering plants with about 5,000 species worldwide. The *Flora of North America* has 27 genera and 843 species for North America and Greenland. I estimate at least 240 species in 14 genera* for the loosely defined area between Nova Scotia and the prairies I call the Northern Forest Region (NFR).

Sedges are found throughout the world, with the exception of Antarctica, which is largely ice, and the Antarctic Peninsula, which has only two vascular plants. In our area they are found in all terrestrial habitats, from the high-tide line to the alpine zone. They also grow as emergents in lakes and rivers and as submerged aquatics in shallow water.

Our sedges are herbs whose above-ground stems die back in the winter. They have parallel-veined leaves that are spirally arranged in three rows, each leaf a third of a turn from the leaf below. Their flowering stems may or may not be three angled. Their flowers have a single ovary with two or three styles and (usually) three stamens. There are no petals or sepals, but the ovary may be surrounded with bristles or a sack. The fruits are achenes. Two-style ovaries tend to produce compressed achenes, three-styled ovaries plump ones. The flowers are subtended by scale-like bracts, one scale per flower, and grouped into spikelets. The spikelets may be either solitary or grouped into spikes, racemes, condensed panicles, or umbels. Most of our genera can be recognized in the field by the arrangement of the spikelets.

The sedges and grasses are thought to have been separate since the early Cretaceous and are correspondingly different. Sedges are recognized in the field by their three-rowed leaves, flowers enclosed by a single bract, frequent presence of bristles or perigynia, and (except in a few genera) spirally arranged flowers. Sedges often have solitary spikelets or spikelets in umbels, which grasses never do. Grasses often have spikelets in open panicles, which sedges never do.

The rushes—Family *Juncaceae,* including *Juncus* and *Luzula*—are close to the sedges and are thought to have separated from them in the late *Cretaceous*. They differ from the sedges in having flowers surrounded by six sepals rather than a single scale and pods with three or more seeds rather than achenes. Their flowers are often clustered but never grouped in spikelets. The species with clustered flowers can resemble sedges, particularly *Rhynchospora* and *Cladium,* but the units in the cluster are single flowers rather than spikelets.

The 240 sedges we list for the Northern Forest Region include 168 species of *Carex* and 72 species in the other 12 genera. Upland floras are *Carex* dominated, with about 88 species of *Carex,* 9 species of *Cyperus,* and 1 species each of *Trichophorum* and *Bulbostylis.* Wetlands and shores have more equable floras, with about 89 species of *Carex* and 66 of other genera. Overall I estimate that the NFR has a wetland flora of 151 species of sedges and upland flora of 98, or roughly 3:2. This may surprise you if you think of sedges as principally a wetland group. The non-*Carex* genera mostly are; *Carex* is equally divided between wetland and upland species.

Beside being the biggest genus and the dominant group of upland sedges, *Carex* is important because it blooms early. If you are in the field in May, June, or June, most of the mature sedges you see will be *Carex*.

Because *Carex* is a big genus, it helps to divide it into smaller groups. Each species belongs to one of 43 sections. Each section belongs to one of 3 main groups. The groups and sections are introduced on page 21 here and described on pages 18-23 of the photo guide. In practice, because many of sections have only one or two species, what you really need to know are the three main groups and the 10 largest sections.

To learn the groups and sections, you need to tell the male flowers from the female. To start you off, recall that all sedge flowers are wind pollinated. The anthers, which look like hot dogs and the styles, which are coiled and furry, stick out. The ovaries, and, in *Carex*, the perigynia, are hidden behind the scales at flowering. Twelve of our genera are bisexual and have stamens and ovaries in the same flowers. *Carex* and *Scleria* are unisexual and have male flowers with anthers and female flowers with ovaries and styles.

To recognize the groups of *Carex,* you have to determine whether the male and female flowers are on separate plants, on separate spikelets within the same plant, or in separate parts of the same spikelet. The pictures will show you how to do this. It will be hard at first and then get easier. Once it is easy, *Carex* will be easy.

Try it and see. For orientation, and because most sedges have bisexual flowers, we start with *Eleocharis, Eriophorum,* and *Trichophorum*, the three bisexual genera that are in flower or fruit now.

* The photographic guide includes 13 of the genera. *Lipocarpha*, rare and southern, didn't get in. It is in the digital atlas.

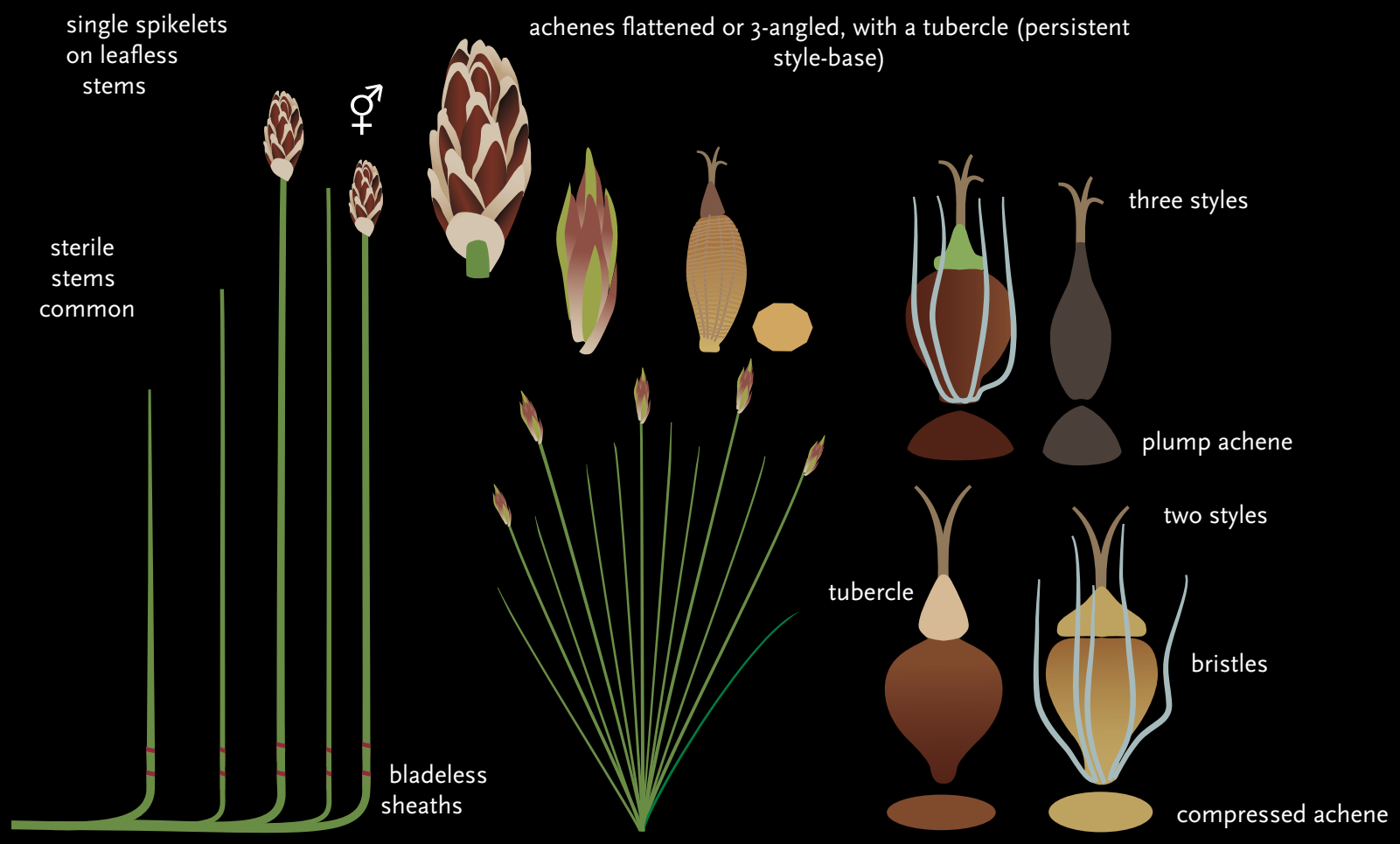
Peaty shores with limy seepage, Ottauquechee River, Woodstock, Vermont

In mid June, the early sedges—*Carex, Trichophorum, Eriophorum vaginatum*—have mostly flowered and are maturing fruit. The tall wetland dominants—*Bolboschoenus, Schoenoplectus, Scirpus*—are still growing vegetatively. The shoreline annuals —*Cyperus, Fimbristylis,* some *Eleocharis* and *Schoenoplectus*—are waiting to sprout when water levels drop. If you want to find a flowering sedge, a good strategy is to go to an open, fertile wetland—a fen, wet meadow, or shoreline seep—and look for a perennial *Eleocharis*. It will have creeping underground stems, sterile shoots with bladeless sheaths at their base, and fertile shoots with single spikelets at their tips. The spikelets have spirally arranged scales; each scale encloses a single bisexual flower; the anthers and styles stick out, the ovaries and some bristles are enclosed by the scales.* The flowers may have two or three styles; the achenes may be plump or flattened. *Elliptica* is the common, mid-sized species with three styles and plump yellow achenes.

We have 11 perennial species of *Eleocharis.* Six, or seven if you count *tenuis*, which I don't, have three styles. Besides *elliptica,* there are two tiny species, one deep-water emergent, one alvar species with flattened stems, and one uncommon species of fens and seeps with elongate scales. Thus, for field purposes, a common creeping *Eleocharis* with medium-sized stems and 3 styles is likely *elliptica.* It could also be *tenuis*, but there is no real difference.

*If these terms are unfamiliar, please see the visual glossary in the sedge book and any dictionary or botany text. I will use them repeatedly here.

ELEOCHARIS DIAGRAMMED



Eleocharis species may be annual or perennial and creeping or tufted; their flowers may have two or three styles, and their achenes may be compressed or plump. Sterile stems are abundant. The stems have bladeless sheath at their bases; the achenes are usually surrounded by bristles; the base of the style is often enlarged, forming a tubercle. Bristles are fairly common in our sedges; bristles plus tubercles also occur in *Rhynchospora*. Single spikelets also occur in *Carex*, *Eriophorum*, and *Trichophorum*. This gives an easy diagnosis: *a sedge with single spikelets and bladeless sheaths at the base is Eleocharis.* It will also have bisexual flowers (indicated by ⚥) and achenes with bristles and often tubercles. But so will other genera.

flowering, styles and anthers; June

post flowering, shriveled styles and filaments

achenes maturing scales spreading and beginning to drop: August, September

achenes mature scales dropping

mature achene; plump, yellow, pitted, low tubercle

Elliptica flowers in June and mature achenes in August and September. During flowering you see the feathery styles and stamens, consisting of a slender stalk (filament) and a pair of pollen sacks (anther). There are three styles per flower but they get tangled and you must count carefully. After flowering the anthers fall off and the styles shrivel and sometimes break off. You can still determine the number, but it takes a dissecting scope and care. Over the summer, the achenes mature, pushing the scales outwards. In some species the achenes fall and the scales remain. In *elliptica*, the scales eventually fall and you see a cluster of yellow achenes at the tip of an otherwise bare stem.

ERIOPHORUM VAGINATUM, THE EARLY COTTON GRASS

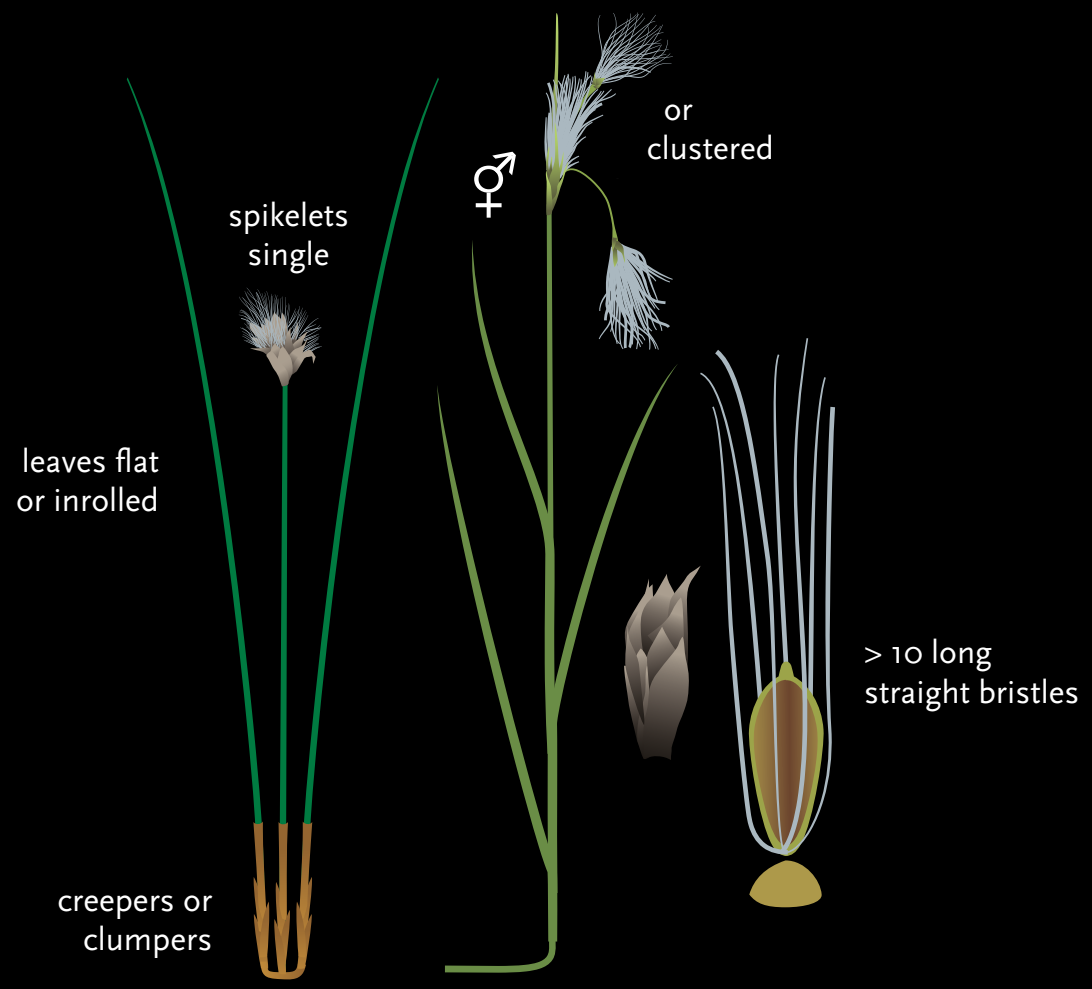
Sedge flowering begins in late April or early May and continues through late summer. The earliest genera are *Eriophorum* and *Trichophorum*, *which have bisexual flowers,* and *Carex,* which has unisexual flowers. We start with *Eriophorum*, the cotton grasses.* They are common peatland sedges recognized by the long silky bristles on the achenes. The hare's tail, *Eriophorum vaginatum*, is earliest wetland sedge to flower. It is a characteristic plant of northern bogs where it makes conspicuous mounds. The leaves are wiry and inrolled; the flowers are in a single spike at the tip of a leafless stalk and subtended by loose black scales with translucent edges. Here is an old picture from the Adirondacks with the anthers just emerging; Spring Pond Bog, 23 April 2008.

* Pedants object that they are not grasses, but no one cares.

Vaginata has leafless sheaths at the base of the stems, the upper ones expanded and loose. The outer scales are sterile and enlarged, surrounding the rest of the spikelet. The white bristles get much longer than this.

Eriophorum vaginatum is common and conspicuous in large bogs. Left, with black spruce and bog shrubs, Spring Pond Bog, 27 April, 2008. White heads of *vaginatum* with pink flowers of bog laurel. Right, old leaves and stems, with dwarf cranberry and *Sphagnum rubellum*.

ERIOPHORUM DIAGRAMMED



We have six species of *Eriophorum* in the Northern Forest Region. One, *chamissonis*, is a subarctic species that barely reaches Lake Superior. The others are widespread. Late spring is the time to start looking for them. You will find *vaginatum* and, northwards, *angustifolium* in acid bogs; *viridi-carinatum* and, much more rarely, *gracile*, in rich fens; *tenellum* in wet floating mats in July; and *virginicum* in all kinds of wetlands in late summer. You can see all five of the widespread species in Vermont, but you will have to know where to go.

The long silky bristles, more than 10 per flower, are diagnostic for *Eriophorum*. Other characters vary; they may be clumped or creeping; have flat or inrolled leaves; and have single or clustered spikelets.

A clump of *Trichophorum alpinum* in a rich fen in Pownal Vermont

Our second early sedge genus is *Trichophorum*. It is not as well known as it should be, partly because it looks like other things. To find it you need to go to fens, bogs, or rocky fertile woods, and you need to know what you are looking for: slender clumped plants with single spikelets resembling *Eleocharis* but with spikelet bracts, leaf blades (sometimes very short), and sometimes long bristles. *Eleocharis* never has long bristles or spikelet bracts, and has no leaf blades at all.

We have four species, two widespread, two quite rare. *Eriophorum alpinum*, a delicate fen species, is common in rich fens, and very showy in June. Its marks are the single spikelets with long white bristles. *Eriophorum vaginatum,* which also flowers in June and has single spikelets, has much larger spikelets with dark scales and many more bristles per flower.

In a medium-rich white-cedar fen near the Hudson River, Adirondacks, New York

Single spikelet with a bract, tan scales, long white bristles

Achenes elongate, pitted

Alpinum is found in open sedge fens, usually with other medium-fen or rich-fen sedges like *Carex aquatilis, Carex flava, Carex leptalea,* and *Eriophorum viridicarinatum*. The stems are delicate, the leaf blades only a few millimeters long. The bristles are bright white and showy but do not last very long.

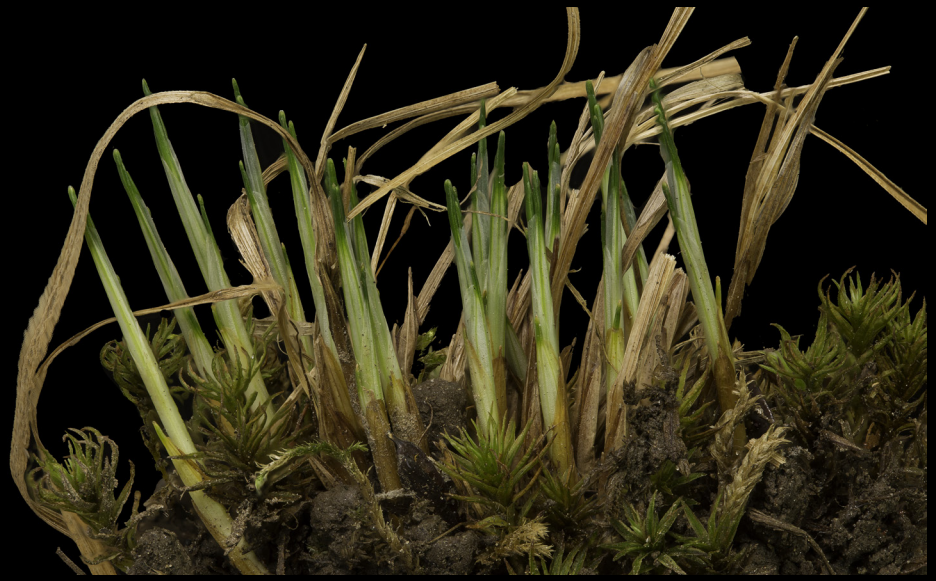
dense clump, in fall

Trichophorum cespitosum is a northern species of heaths and tundra, local in the alpine zones of New England, common in coastal bogs and blanket heaths from central Maine north and east. It is a major species along the north coast, and one you will see on almost every headland.

Cespitosum dominates on hummocks and raised parts of coastal heaths and blanket. It turns bright yellow in the fall, starting at the tips and working downward. After the yellow fades, it is a pale white tan. With black spruce, sheep laurel, and huckleberry in a coastal bog in eastern Maine, 8 October, 2015.

In a coastal bog with stunted tamarack and *Eriophorum,* L'Anse aux Meadows, Newfoundland, 24 September, 019. The *cespitosum* has just begun to turn yellow. With stunted tamarack, willows, mountain cranberry, dwarf cranberry, *Eriophorum, Sphagnum rubellum*.

old leaves persist



upper sheaths develop flat blades

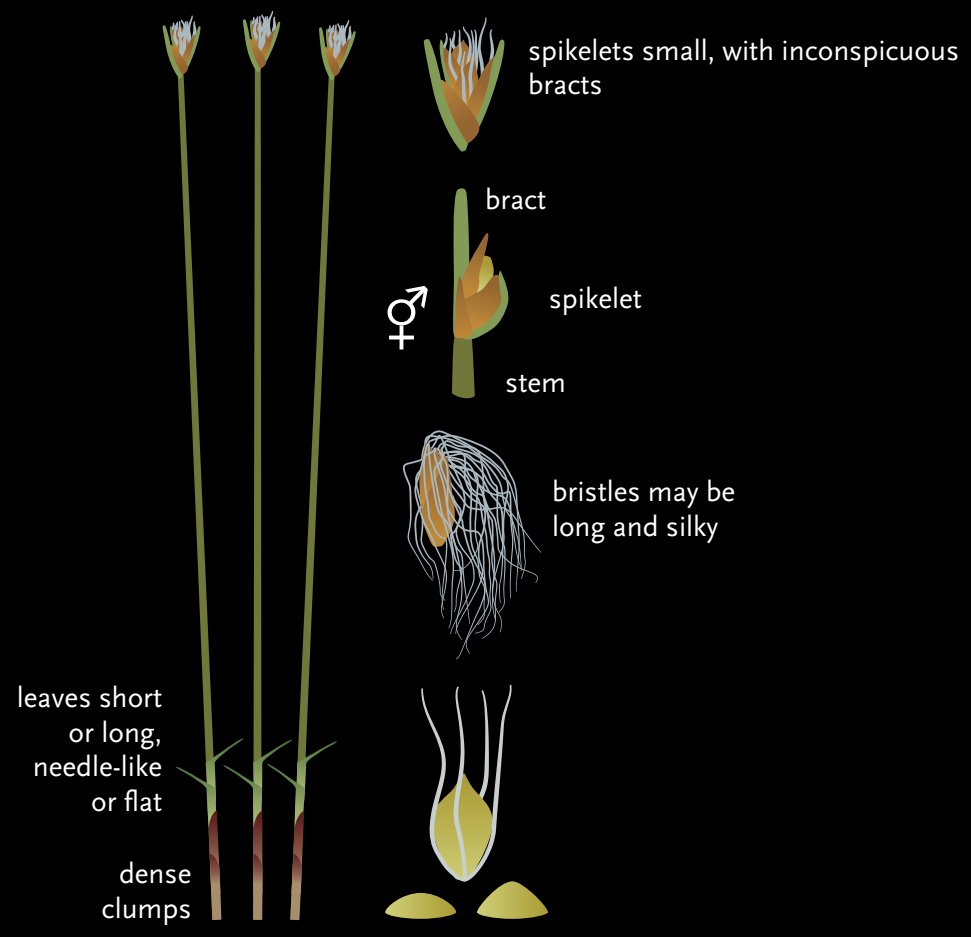
lower sheaths without blades

Trichophorum planifolium is a northeastern endemic, local on dry fertile rocky hills in southern New England, mostly south of the Northern Forest Region. It is also rare in western Vermont. It is a distinctive plant, but you have to know what you are looking for. Look for dense cushions of a slender-leaved sedges on south-facing and west-facing slopes. The new shoots appear in early April. The brown sheaths are distinctive. Plants from Bull Hill, Sunderland, Massachusetts.

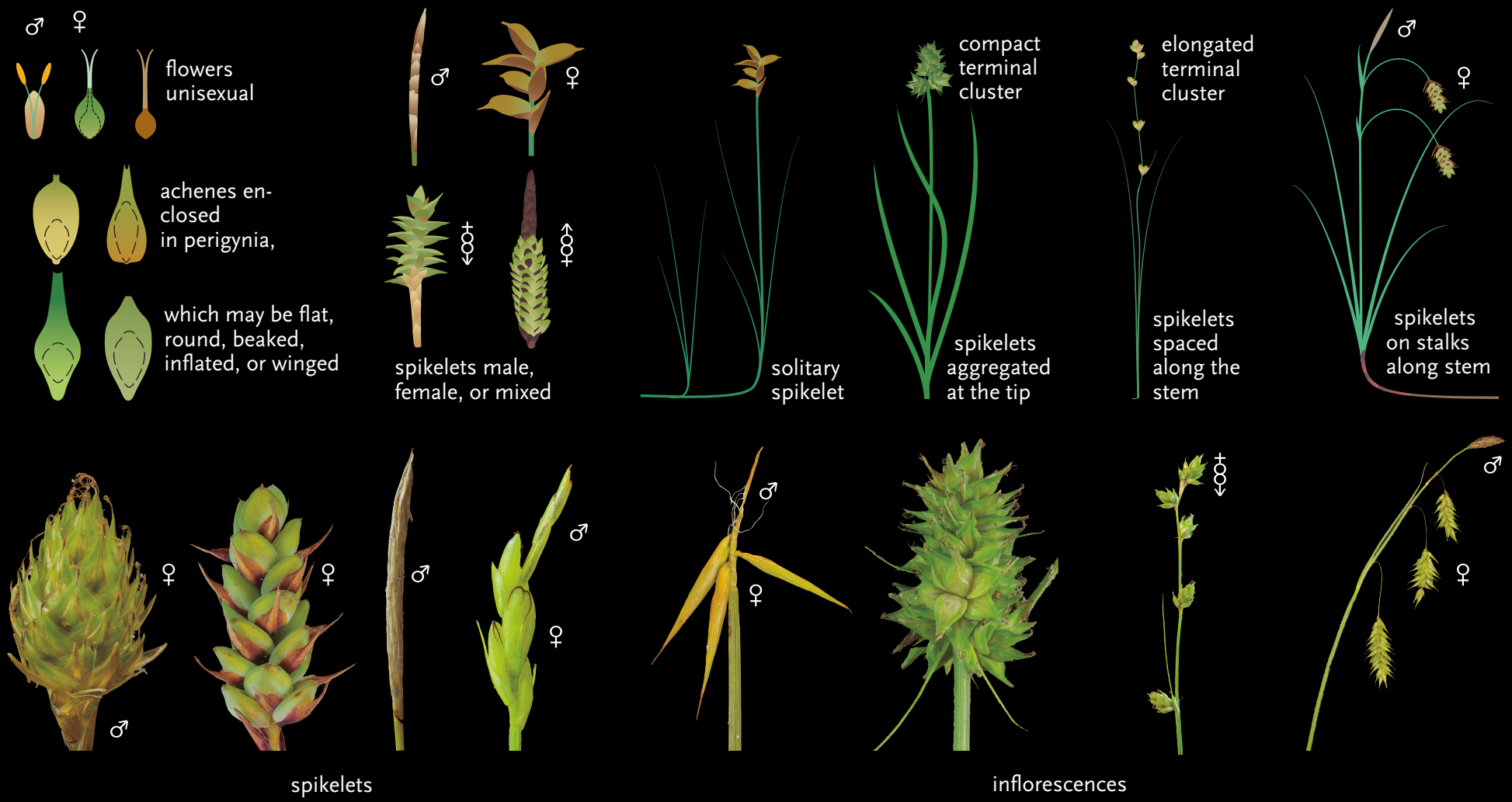
The flowering stems are delicate, with small spikelets and spikelet bracts. The spikelets look something like an *Eleocharis*, but there are no *Eleocharis* in rocky woods. The flowering stems don't last long; once they are gone you have to recognize the leaves and bracts. Plants from Schoolhouse Hill, North Pownal, VT.

Trichophorum clintonii is another rare species, found on open limy soil, dry or wet. It is a wide-ranging northern species, very rare in our area, commoner in Maine ranging west across the Canadian prairies to Alberta. In the east it grows on limy ledges and shores; in the west, in limy prairies. The picture shows it on peaty soil between stones in the Hudson River Ice Meadows, south of the Glen. The spikelets are small, the leaves are needlelike and look like the stems. It looks much like an *Eleocharis*; you have to see the inflorescence bracts or show that the leaves are really leaves to know that it is not.

Upper leaf sheaths with slender blades, under 1 mm wide; stems triangular, rough on the edges; spikelets small, usually shorter than their bracts. *Trichophorum cespitosum* has short blades only a few millimeters long; *Trichophorum planifolium* is a woodland species, also on limy soils; it has long flat leaves, over a millimeter wide.



All our Trichophorums have single spikelets with bracts, basal leaf sheaths with short or long blades, bisexual flowers, and achenes with 6 to 8 bristles. The leaf blades, which may only be a few millimeters long, and spikelet bracts separate them from *Eleocharis*. The small spikelets with few bristles per flower separate them from *Eriophorum*.



Carex is our largest and most diverse genus. Almost all woodland sedges and early-blooming wetland sedges are *Carex*. Studying sedges in spring and early summer means studying *Carex*.

All *Carex* share two features; the flowers are unisexual, and the ovaries and lower parts of the styles are surrounded by perigynia. One other genus in our flora, *Scleria*, has unisexual flowers; no other genus has perigynia.

The arrangement of the sexes within the spikelets, and of the spikelets on the stem, vary from species to species. Spikelets may be all male, all female, or male plus female; if the latter, the females may be at the top or the bottom. A single stem may have a single spikelet or multiple spikelets. If multiple, the spikelets may be aggregated into a cluster, spaced out along the stem and stalkless, or spaced out along the stem and stalked.

To identify *Carex*, we divide it into subgroups based on the arrangement of the flowers and spikelets. At first this will be hard and require concentration and practice. After a while it will be automatic.

Carex Group 1

perigynia flattened, spikelets mostly bisexual, short and stalkless

Section *Phaestoglochin*
Carex radiata

Section *Chordorrhiza*
Carex chordorrhiza

Carex Group 2

perigynia flattened; some spikelets stalked or elongate

Section *Phacocystis*
Carex torta

Carex group 3

perigynia plump; some spikelets unisexual, often stalked or elongate

Section *Careyanae*
Carex plantaginea

Section *Acrocystis*
Carex communis

Section *Laxiflorae*
Carex leptonervia

The species of *Carex* are grouped into 43 sections. These are formal taxonomic units, thought to reflect evolutionary lineages. For convenience I divide the sections among three major groups, based on the shape of the perigynia and the distribution of male and female flowers. The diagram shows the three groups and the section and species discussed in this lesson. For diagrams of all the groups and sections, see pages 18-23 in the Photo Guide or scroll through the Digital Atlas. More sections will be introduced in subsequent lessons.

Overwintering leaves: long, pleated and rippled, not whitened, with new shoots

We start in middle spring when the woodland sedges begin to put up flowering shoots. The earliest species belong to five sections in two of the major croups: *Phaestoglochin* in Group 1, and *Acrocystis* and the *Careyanae, Digitatae,* and *Laxiflorae* in Group 3. *Acrocystis* and the *Careyanae* and *Digitatae* are the earliest, *Phaestoglochin* and the *Laxiflorae* several weeks later. I save the *Digitatae* for Lesson 2, and discuss the others here.

At my house, Taconic Mountains, near Shaftsbury, Vermont, the sedge season begins in the second half of April, when the forest floor is still pretty bare. Most of the early species have overwintering leaves and can be recognized before the flowers appear. I go to the south sides of rocky fertile hills and watch the clumps for the first shoots, which expand before or with the new leaves. *Carex plantaginea*, with long pleated leaves with red bases and deep red new shoots, is always one of the first.

Depending on the year, the new shoots of *plantaginea* may remain short for some time or elongate immediately; when they do, they look like barber poles, alternating deep red bracts with green internodes. The male spikelet is large, the female spikelets slender; each female flower has three styles, suggesting that the achenes will be plump rather then compressed. The separate male and female spikes and three styles per flower make this a Group 3 species.

By the time the perigynia mature, in early May, the forest floor is much greener. The fruit stems have elongated and bent down to the ground, and the new leaves are expanding. The perigynia are rounded triangular with flat sides, fine nerves, bent beaks, and rounded angles. They are probably ant dispersed. The slender flowering stems, without leafy bracts, and flat-sided perigynia make this a member of Section *Careyanae*. We have three other member of the *Careyanae* in the northern forest, *digitalis, laxiculmis,* and *platyphylla*. I will have more to say about them in the next lesson.

Carex communis is in fact one of our commonest sedges, found in both fertile and average woods. The leaves are 2-4 mm wide, dark green, minutely roughened on the upper surface, with red, shreddy bases. They overwinter and are conspicuous in early spring. They can be recognized vegetatively, once you know what to look for and how to tell them from *Carex pedunculata* and *Carex backii*.

male spikelet

anthers emerging

female spikelets, styles emerging

three styles per flower

Third week in April

perigynia emerging

plump beaked perigynia

Early June

In White Creek, the flowering shoots emerge in late April. The pattern is standard Group 3: terminal male spike, lateral female spikes, 3 styles per flower,j plump perigynia and achenes. The red bases, stalkless or short-stalked spikes, needle-like spikelet bracts, and beaked furry perigynia are diagnostic for Section *Acrocystis.*

We have nine species of *Acrocystis* in the northern forest. *Pensylvanica,* also early, is a common creeper; *albicans* and *peckii* are associated with dry fertile woods, *novae-angliae* with the mountains, *deflexa* with cool swamps; *tonsa* and *umbellata* are species of barrens and ledgetops. More about them all in the next lesson.

furry perigynia,
with relatively wide
bodies broadening
above

Diagnostic characters for *Communis* are its relatively wide mature leaves, 3 mm or more, obovoid perigynium bodies, and the expanded lobes at the base of the spikelet bract of the middle spikelets. Being early and one of the commonest sedges in the woods help too. *Pensylvanica,* which often grows with it, is a creeper with narrower leaves and lacks the broad lobes at the base of the spikelet bract.

The *Laxiflorae* are some of our commonest woodland sedges, and *leptonervia* is one of the commonest species. It is found in both fertile and average woods, and, for that matter, in shade at the edges of my lawn. It loves trails and moist bottoms near brooks. The leaves shiny, long, often evergreen, and up to about a centimeter wide; their bases are white or brownish, never red. They are M-folded in cross section, with the intermediate nerves a bit higher than the mid nerve. Many other common woodland sedges have red bases; when you see one with relatively wide M-folded leaves and a pale base, start in the *Laxiflorae*.

The architecture of the *Laxiflorae* is classic group 2: a small terminal male spike, female lateral spikes, flowers with three styles, plump perigynia. The plump oboval perigynia that with short beaks that taper to their bases, and the large leafy spikelet bracts are diagnostic for Section Laxiflorae. We have five *Laxiflorae* in the nortern forest. *Laxiflora, leptonervia,* and *albursina* are the commonest around me. *Leptonervia* is separated from all the others by the few-nerved perigynia.

THE EARLY WOODLAND CAREX: *CAREX RADIATA* (GROUP 1, SECTION *PHAESTOGLOCHIN*)

I HAVE, OR HAVE HAD, over twenty species of *Carex* in my yard and the young woods between it and the White Creek. *Carex radiata* is one of the commonest. It is semi-evergreen, grows in dense clumps, and has long slender leaves and slender, widely spreading perigynia it small clusters along the stem. It loves the lawn and trail, and seems to thrive on mowing.

Middle to late May

Middle to late June

THE FLOWERS APPEAR IN LATE MAY, when the spikelets are still very small. They are down among the leaves, and you have to look hard to see them at all. There is no separate male spikelet; the male flowers are near the tips of the spikelets, the females at the base. There are two styles per flower. The mature perigynia are beaked and compressed—plano-convex— and spread widely. The scales that contained the male flowers remain erect at the tip of the spikelets. The stalkless spikelets with both male and female flowers, two styles per flower, and compressed perigynia make this a Group 1 species. The males at the tips of the spikelets, upland habitat, and spongy-based perigynia with sharp edges make it a member of Section *Phaestoglochin*.

We have seven species of *Phaestoglochin* in the northern forest. *Radiata* is a member of a three-species complex called the *Rosea* group. The others, also common, are *appalachica* and *rosea*. The species lines are and they were formerly considered varieties of a broadly defined *rosea*. Within that group it is distinguished by the relatively slender leaves and widely spreading perigynia with slender styles that are not tightly coiled. None of these distinctions is all that convincing; I recognize the three species, but don't go out of my way to defend them. If you look sharply, for example, you will see that the styles are thicker and more coiled at their bases than at their tips. The tips often break off and, when they do, what you have is a *radiata* perigynium that looks a lot like some other species.

Rich fen, Pownal, Vermont

I AM NOT SURE what the earliest wetland *Carex* is. One candidate might be *Carex leptalea*. Another might be *Carex chordorrhiza,* shown here. It is an unusual species, rare and often hard to find in this area. The leaves few and short, down low in wet sedge-shrub meadows or medium fens; the spikelets are aggregated into a small head, often about 5 mm wide, on a slender stem. Leafy stems develop after flowering; at the end of the season they flop over, leaves and all, forming a sort of thatch. The new vertical stems arise from the axils of the horizontal ones, and then flop over in their turn. The flopped-over stems are, by definition, leafy stolons. Instead of creeping, as most stolons do, they grow erect and then flop and sprout. Mosses do this all the time; it is odd for a sedge.

Taxonomically, the bisexual spikelets and compressed achenes make *chordorrhiza* a Group 1 plant. It is in its own section, the *Chordorrhizae*, which is easy to remember but not particularly informative. Ecologically it likes wet marshes and fens, either neutral or limy, where it can make loose floating mats, often mixed with mosses and other sedges. Geographically it is a transcontinental northern species found from Greenland to Alaska, at its southern limits here.

Carex Group 2 is intermediate. It includes species with compressed perigynia like Group 1, but stalked unisexual spikelet like Group 3. Most of our species are members of Section *Phacocystis,* a large and common wetland group with 11 northern forest species. The first of these to appear, and one of the most common, is *Carex torta*, which makes large clumps on cobble bars along high-gradient streams. This is what it looks like in June, along the banks of the White Creek near my trail. It was here when the stream was in open pastures in the 1970s, and has remained, though somewhat diminished, as the banks have become wooded.

Torta has long leaves, up to 70 cm long and 5 mm wide. The old leaves form a dense overwintering thatch. The new shoots appear in early April, not that long after snowmelt. They are some of the earliest new growth along the creek. Note the red-brown bladeless sheaths at the base. The moss hitch-hikihng on the top may be *Brachythecium rivulare*, which is common on the cobble bars.

Torta is the first shoreline sedge to flower. The flowers appear in early May, several weeks after the first woodland sedges flower. The males and females re in separate spikelets. The female spikelets are long and slender and taper to a loosely flowered base. They are erect when they first flower and then elongate and arch.

The female flowers have two styles, like Group 1, but the male and female spikelets are separate and stalked, like Group 3. This puts it in Group 2, an intermediate group.

The perigynia and achenes are compressed. The perigynia are veinless and taper to a beaks, which is often twisted at maturity. The perigynia place it in Section Phacocystis, which also includes, among others, important wetland species like *Carex stricta* and *gynandra,* the fen species *Carex aquatilis,* the alpine species *Carex bigelowii,* and the river-shore species *Carex lenticularis.* The large clumps, slender arching spikelets that are loosely flowered at their bases, and broad-beak perigynia without nerves are diagnostic for *torta*.

1 There are 11 widely distributed genera of sedges in the Northern Forest Region. Three others, *Fimbristylis, Lipocarpha,* and *Scleria*, are restricted to the southern edge of the NFR. Four widely distributed genera, *Carex, Eleocharis, Eriophorum,* and *Trichophorum,* are in flower or fruit by mid June and are introduced in this lesson. The other seven flower and fruit from July to September.

2 All our sedges have a common plan: small flowers, without petals or sepals, enclosed by a single scale each, and aggregated into spikelets. The genera differ in sexuality—*Carex* and *Scleria* have unisexual flowers, the rest bisexual flowers—and in the shape and size of spikelets and how they are grouped. The differences are usually conspicuous in the field. Once you are familiar with them, all the genera can be identified on sight.

3 The four genera included in this lesson are identified by spikelets and sex.

> *Eleocharis* has single spikelets without spikelet bracts, bisexual flowers, and no leaf blades at all.
>
> *Eriophorum* has bisexual flowers and single spikelets or multiple spikelets with lots of long silky bristles.
>
> *Trichophorum* has bisexual flowers, single spikelets with spikelet bracts, and leaf sheaths with short or long blades. If it has long silky bristles, there are only about 6 per flower.
>
> *Carex* always has unisexual flowers, and may have unisexual (all male or female) spikes. The achenes are enclosed in perigynia; stems may have a single spikelet or a group. Many species have single spikelets from axils of bracts; no other genera do.

4 *Eleocharis* and *Eriophorum* are restricted to wetlands; *Carex* and *Trichophorum* are found in both wetlands and uplands.

5 The species of *Carex* are divided into 43 sections by growth form, position of the male and female flowers, and the shape of the spikelets, scales, and perigynia. Many of the sections are small, and it is easier to learn the species then the sections. Ten have five or more species and are must-know groups. The spring *Carex* of woodlands belong to sections *Acrocystis, Careyanae, Digitatae, Laxiflorae,* and *Phaestoglochin,* all must-know groups.

6 For convenience, I place the 43 sections in 3 main groups:

> Group 1 has male and female flowers in the same spikelets, flowers with two styles, and compressed perigynia. The spikelets are never stalked.
>
> Group 2 has some spikelets all male or all female, flowers with two or three styles, and compressed perigynia. The spikelets are often stalked.
>
> Group 3 has some spikelets all male or all female, flowers three styles, and plump perigynia. The spikelets are often stalked.

The main groups are important because they can be recognized in the field and simplify identification. Learn them well, and use them daily.

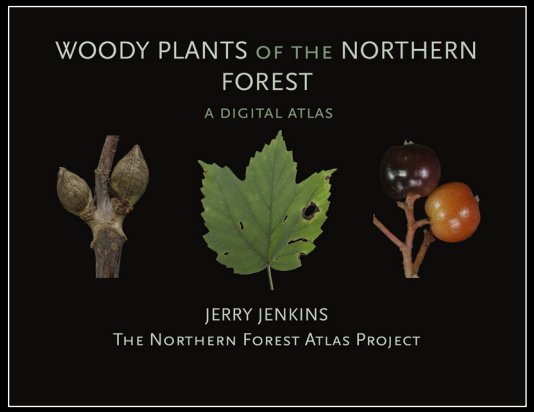
7 With practice, many or most sedges can be identified in flower as well as fruit. This is fun, bur neither easy nor safe. It requires, as a minimum, that you know what species are possible in your area and have followed them through the season. It is definitely not something you should try when starting out. Flowering *Eleocharis,* in particular, are somewhere between hard and insolvable; I generally let all but the most distinctive ones go until I have fruit.

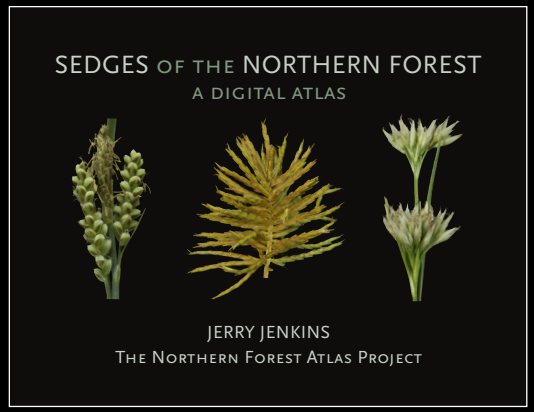
8 The woodland sedge season begins here in April. The first common sedges to bloom are usually *Carex pedunculata* in the *Digitatae*; *Carex communis* and *pensylvanica* in *Acrocystis;* and *Carex plantaginea* and *platyphylla* in the *Careyanae*. The *Laxiflorae* (*albursina, laxiflora, leptonervia*) and the *rosea* group in *Phaestoglochin* (*appalachica, rosea, radiata*) come a few weeks later. The rare *Trichophorum planifolium,* a southern species, is also very early. Many others follow.

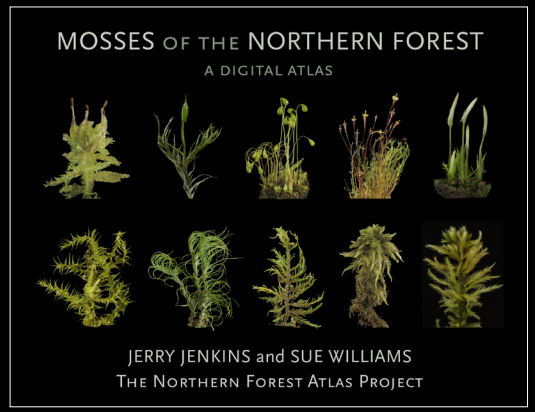
9 The first wetland sedge to bloom is the hare's tail, *Eriophorum spissum,* in middle or late April. *Trichophorum alpinum* and *cespitosum* and *Carex leptalea, aquatilis,* and *chordorrhiza* are also early. I haven't done enough work in wetlands in May, and don't have a good idea of the sequence.

PUBLICATIONS OF THE NORTHERN FOREST ATLAS PROJECT

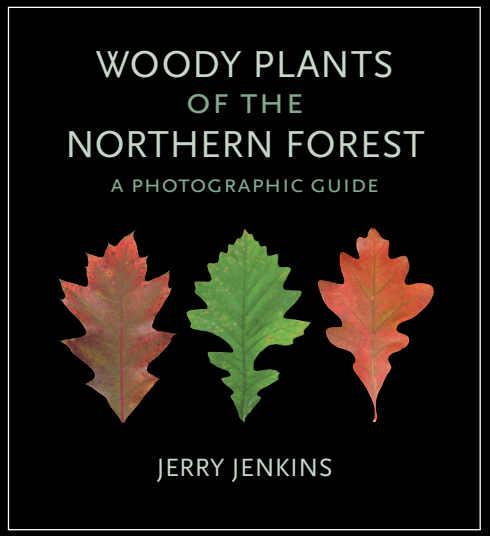
DIGITAL ATLASES

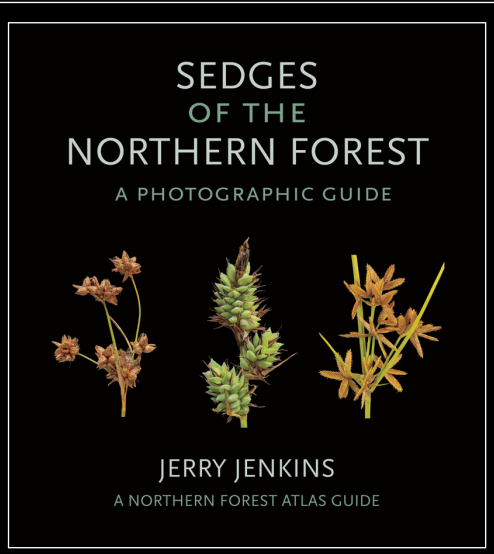


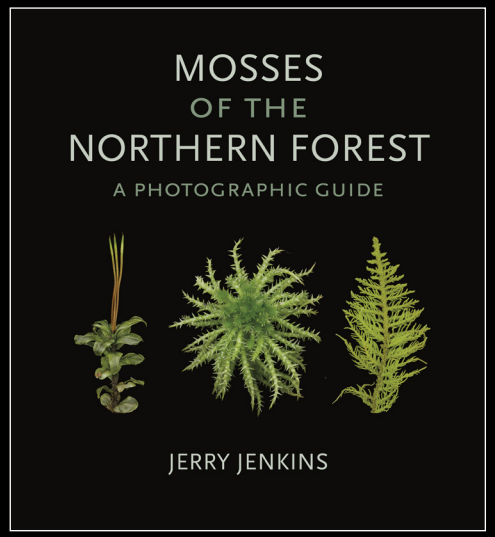




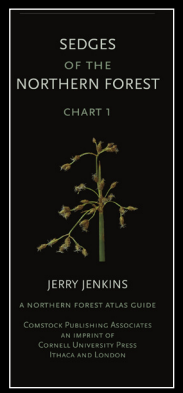
PHOTOGRAPHIC GUIDES

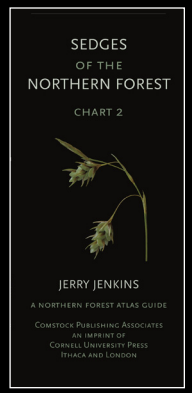


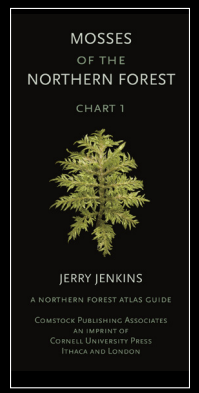


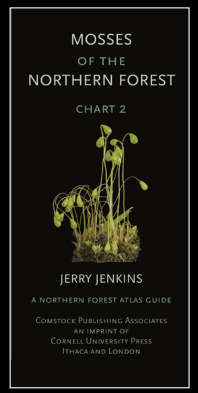


WATERPROOF FOLDING CHARTS









As of Spring, 2020, the Atlas Project has produced digital atlases, paper photographic guides, and folding charts to woody plants, sedges, and mosses. The digital atlases are available for download from our website, northernforestatlas.org; the photographic guides and charts from Cornell University Press, cornellpress.cornell.edu. Photographic guides to grasses, a digital atlas of grasses, and a book-length field guide to woody plants will be published in 2022.