

A COMPARATIVE STUDY OF THE
HABITAT REQUIREMENTS OF TWO SEDGES:
Carex limosa and *Carex paupercula*

Carex limosa - bog
Carex paupercula - bog
and *Carex paupercula* - bog

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Introduction

Carex limosa and *Carex paupercula* are two sedges with a circumboreal distribution which grow in similar habitats in northern Michigan and Ontario, Canada. *Carex limosa* is primarily found in peatlands. *Carex paupercula* can also be found in peatlands, as well as in coniferous swamps, and in rock crevices along Lake Superior. The purpose of this study is to attempt to compare and contrast these two species and to draw some conclusions about each one's habitat requirements through an analysis of field observations.

Morphology

Carex limosa and *Carex paupercula* are in the ^{section}subfamily Limosae. They both have nodding pistillate spikelets on slender peduncles. Other similarities between these two species include somewhat compressed perigynia, a staminate terminal spikelet, roots covered with a yellowish-brown felty tomentum, and a leafy bract subtending the lowest spikelet. Both are also wind pollinated and have a three angled achene (Gleason and Cronquist, 1991). Despite these similarities, the two sedges are easily separated by the shape of their pistillate scales. *Carex limosa* is characterized by having ovate or elliptic pistillate scales that are as wide and long as the perigynia. *Carex paupercula* is characterized by having lanceolate pistillate scales that are narrower and longer than the perigynia and may have a green midstripe. Another interesting difference between these two species is their growth form. *Carex limosa* stems arise singly or in a few together from long creeping rhizomes. *Carex paupercula* stems are loosely clumped and may have either

short or long rhizomes. The leaves of the two sedges are also different. *Carex limosa* leaves are thin, tend to be canaliculate, and are bluish green. *Carex paupercula* leaves are wider, flat, and are not bluish green.

Methods

At each site I visited where I found either *Carex limosa* or *Carex paupercula*, I recorded information about associated species, light level, and moisture. I considered a species to be an associate if it was growing intermingled with one of the sedges or nearby within approximately a meter of a plant. I also recorded overstory trees casting shade when present. I attempted to standardize my light and moisture observations through the use of terms. Full sun refers to an area without overstory trees and shrubs big enough to cast shade. Light shade refers to an area with either isolated trees or low shrubs which cast shade. Partial shade refers to an area with an open canopy of overstory trees. Complete shade refers to an area with a closed canopy of overstory trees. Very wet refers to an area where plants are partially under water. Wet refers to an area where the substrate is waterlogged. Moist refers to an area where the substrate contains water but is not saturated. Dry refers to an area where the substrate does not obviously contain water when squeezed. The field observations on which this paper is based were conducted from June 27 through August 4, 1994 in northern Michigan and Ontario, Canada.

Observations

I found *Carex limosa* at a total of 8 sites and *Carex paupercula* at a total of 6 sites. Table 1 presents an overview of the light availability, moisture conditions, and associated and indicator species present at each site.

Site #1: Bog adjacent to Barclay Lake; Luce County, MI (Upper Peninsula)

I observed *Carex limosa* growing here on *Sphagnum cuspidatum* and *Sphagnum papillosum* at the wet edge of the mat. I also saw it on islands of mat which had broken off and were floating in the open water. The *Carex limosa* was growing in full sun. *Eriophorum spissum*, *Drosera rotundifolia*, *Carex pauciflora*, *Carex oligosperma*, *Vaccinium macrocarpon*, *Vaccinium oxycoccos*, *Lycopodium inundatum*, and *Sarracenia purpurea* were growing with the *Carex limosa*. I revisited this site with the Bryology class and the pH we measured for the lake was 5.2.

Site #2: Troll Bog 1 Mile East of Barclay Lake; Luce County, MI (Upper Peninsula)

Carex limosa was growing here in full sun, on the very wet edge of the mat, among *Sphagnum*. *Drosera intermedia*, *Andromeda glaucophylla*, *Carex exilis*, and *Scheuchzeria palustris* were also growing with it.

Site #3: Bog on South Side of Galloway Lake; Emmet County, MI (Lower Peninsula)

Here I observed *Carex paupercula* growing in the light shade of *Ledum groenlandicum*, *Picea mariana*, *Thuja occidentalis*, and *Alnus rugosa*. It was growing in hollows between hummocks of *Sphagnum*. *Menyanthes trifoliata*, *Smilacina trifolia*, *Carex trisperma*, and seedlings of *Acer rubrum* were growing with the *Carex paupercula*.

Site #4: Unamed Fen on Bergstrom Rd. 2.5 Miles North of Hiawatha Trail;
Mackinac County, MI (Upper Peninsula)

In this small sedge fen surrounding an unnamed pond, I observed *Carex limosa* growing on and between *Sphagnum* hummocks at the edge of the mat and at the edge of pools. *Drosera rotundifolia*, *Sagittaria latifolia*, *Vaccinium oxycoccos*, *Potentilla palustris*, *Thelypteris palustris*, *Dulichium arundinaceum*, *Typha latifolia*, *Scirpus hudsonianus*, *Lysimachia thrysiflora*, *Campanula aparinoides*, *Calla palustris*, *Rhynchospora alba*, and *Carex diandra* were growing with it. Woody plants such as *Chamaedaphne calyculata*, *Larix laricina*, *Alnus rugosa*, *Salix pedicellaris*, and *Salix candida* were also associates but most were less than half a meter tall and did not cast shade on the *Carex limosa*.

Site #5 Bog adjacent to Little Dollar Lake; Mackinac County, MI (Upper Peninsula)

Carex limosa was growing here encircling the edge of the mat directly behind *Chamaedaphne calyculata* which was invading the water. *Carex limosa* was growing on higher *Sphagnum* hummocks, lower hummocks, and in wet depressions where the *Sphagnum* was submerged. This zone occurred in a band extending back from the water's edge approximately two meters. I also observed *Carex limosa* growing at the edge of pools or holes in the mat farther away from the open water. The light intensity in both locations was full sun. *Triadenum fraseri*, *Vaccinium oxycoccos*, *Sarracenia purpurea*, *Andromeda glaucophylla*, *Eriophorum virginicum*, *Rhynchospora alba*, and *Drosera rotundifolia* were growing with the *Carex limosa*. Farther back scattered, small individuals of *Larix laricina*, *Picea mariana*, and *Pinus*

strobis occurred with a large concentration of *Carex oligosperma*, and some *Scheuchzeria palustris*.

Site #6: Thuja Swamp adjacent to Mud Lake Bog; Cheboygan County, MI
(Lower Peninsula)

Here I observed *Carex paupercula* growing with *Sphagnum warnstorffii* under *Thuja occidentalis* in partial shade. *Carex trisperma*, *Smilacina trifolia*, *Larix laricina*, *Abies balsamea* and *Acer rubrum* seedlings were growing with it. I was unable to find *Carex limosa* at this site.

Site #7: Rock Shore of Terrace Bay on Lake Superior; Ontario, Canada

Carex paupercula was growing here in wet pools between rough alkaline rocks in nearly full sun. *Scirpus cespitosus*, *Chamaedaphne calyculata*, *Drosera rotundifolia*, *Myrica gale* and *Juncus alpinus* were growing with it.

Site #8: Shrubby Black Spruce Bog and Forest 0.5 Miles West of Prairie River; Ontario, Canada

Here *Carex paupercula* was growing with *Sphagnum* in nearly full sun. *Linnaea borealis*, *Myrica gale*, *Kalmia polifolia*, *Chamaedaphne calyculata*, *Juniperus horizontalis*, and *Ledum groenlandicum* were growing with it. I also found *Carex paupercula* growing on the disturbed roadside, in a mound above the water level, with *Equisetum arvense* and *Smilacina trifolia* in the very wet area adjacent to it. *Alnus rugosa* and *Picea mariana* were growing nearby.

Site #9: Orchis Fen; Emmet County, MI (Lower Peninsula)

I observed both *Carex limosa* and *Carex paupercula* growing at this site. *Carex limosa* was growing at the edge of the mat and on small islands separated from the main mat that were without trees. The *Carex limosa* was growing in full sun with *Typha latifolia*, *Calla palustris*, *Thelypteris palustris*, *Menyanthes trifoliata*, *Lobelia kalmii*, *Sarracenia purpurea*, *Potentilla palustris*, *Campanula aparinoides*, *Liparis loeselii*, *Drosera rotundifolia*, *Aronia melanocarpa*, and *Vaccinium oxycoccos*. Trees and shrubs were usually less than half a meter tall and included *Cornus stolonifera*, *Thuja occidentalis*, *Picea mariana*, and *Chamaedaphne calyculata*. At this site, I excavated two adjacent stems of *Carex limosa* growing on *Sphagnum* and found that they were connected by a long creeping rhizome that was located at the base of the hummock.

Approximately two meters from the edge of an inlet in the mat I saw *Carex paupercula* growing right behind *Carex limosa*. When I bent one stem of each together, they could just barely touch. The *Carex limosa* dropped out abruptly at this point and I could not find it any farther away from the open water. This location was in nearly full sun, but as I walked back away from the water, the area became partially shaded by scattered *Picea mariana*, *Larix laricina*, and *Thuja occidentalis*. *Carex paupercula* became more common in this treed area. The *Carex paupercula* was growing with *Menyanthes trifoliata*, *Dulichium arundinacium*, *Linnaea borealis*, *Thelypteris palustris*, *Smilacina trifolia*, *Rhamnus alnifolia*, *Sarracenia purpurea*, *Aronia melanocarpa*, *Chamaedaphne calyculata*, *Habenaria clavata*, *Drosera rotundifolia*, *Rhynchospora alba*, *Scirpus hudsonianus*, *Geum rivale*, and *Carex trisperma*. At this site, I also examined the roots of *Carex paupercula* and found the plants to be clumped.

Site #10 Fen adjacent to Ryerse Lake; Mackinac Cty., MI (Upper Peninsula)

I also found both *Carex limosa* and *Carex paupercula* growing at this site, but not as near to each other as at Orchis Fen. *Carex limosa* was rather sparse, occurring in isolated patches and not in a continuous ring surrounding the mat edge. *Carex limosa* was present on a very small floating island and growing off of the mat and partly submerged under water with *Sphagnum teres* at the very wet edge. *Nymphaea odorata* was only a meter and a half away. I also saw *Carex limosa* farther from the edge in full sun. *Triadenum fraseri*, *Cladium mariscoides*, *Rhyncospora fusca*, *Rhyncospora alba*, *Vaccinium macrocarpon*, *Vaccinium oxycoccos*, *Scutellaria galericulata*, *Scirpus hudsonianus*, *Scheuchzeria palustris*, *Sarracenia purpurea*, *Pyrola rotundifolia*, *Potentilla palustris*, *Menyanthes trifoliata*, *Lycopodium inundatum*, *Eriophorum virginicum*, *Epilobium palustre*, *Drosera rotundifolia*, and *Carex lasiocarpa* were growing with *Carex limosa* at this site. Trees and shrubs, usually less than half a meter tall, included *Rhamnus alnifolia*, *Alnus rugosa*, *Chamaedaphne calyculata*, *Picea mariana*, *Larix laricina*, and *Andromeda glaucophylla*. I revisited this site as part of a Bryology class field trip and the pH we recorded for the lake was 8.2.

At the edge of the fen in a shrubby area adjacent to upland forest, I observed *Carex paupercula* growing in light shade under an overstory tree of *Larix laricina* on a hummock of *Sphagnum recurvum*. *Carex trisperma*, *Carex oligosperma*, *Smilacina trifolia*, *Chamaedaphne calyculata*, *Ledum groenlandicum*, and *Nemopanthus mucronatus* were growing with it.

Site #11 Bog adjacent to Little Lake; Mackinac Cty, MI (Upper Peninsula)

I found *Carex limosa* here growing off of the mat and partly under water in an almost continuous ring around the edge of the lake in full sun. I visited this site as part of a Bryology class field trip and the pH we recorded for the lake was 4.7. *Xyris montana*, *Rhynchospora alba*, *Kalmia polifolia*, *Chamaedaphne calyculata*, *Drosera rotundifolia*, *Andromeda glaucophylla*, *Sarracenia purpurea*, *Vaccinium oxycoccos*, *Vaccinium macrocarpon*, *Ledum groenlandicum*, *Iris versicolor*, *Eriophorum virginicum*, *Carex oligosperma*, and seedling *Picea mariana* were growing associated with it on and near *Sphagnum papillosum*. This edge zone was very narrow and behind it *Carex oligosperma* become much more dense, scattered overstory *Picea mariana* were present and *Carex limosa* completely dropped out.

Site #12 Bog near Weber Lake; Cheboygan Cty., MI (Lower Peninsula)

The mat at this site had completely grown over the open water. I saw a small amount of *Carex limosa* growing with a relic *Nuphar variegata* and much *Dulichium arundinaceum* and *Rhynchospora alba* in an area of *Sphagnum recurvum* clearly differentiated from other parts of the mat. It was in full sun. There were no shrubs of any height in this area and relatively recently, in geological terms, it was probably open water. Other species growing with the *Carex limosa* included *Eriophorum virginicum*, *Scheuchzeria palustris*, seedling *Chamaedaphne calyculata*, *Sarracenia purpurea*, and *Carex oligosperma*.

Discussion

I found *Carex limosa* and *Carex paupercula* growing much more often separately than together. Only in a very narrow band at Orchis Fen could I

really describe these two species as growing together. This suggests that *Carex limosa* and *Carex paupercula* have different habitat requirements. In order to compare and contrast these species, I decided to look at several variables including microhabitat characteristics such as location, light, moisture, pH, and associated species, growth habit, and successional position.

One of the first things I noticed about *Carex limosa* is its location nearly always at the edge of mats and often partly submerged in water. I was quickly able to know where to look for this species. I found it growing in this kind of location at Barclay Lake, the Troll Bog, the Fen on Bergstrom Road, Little Dollar Lake, Orchis Fen, Ryerse Lake, and Little Lake. Two features which seem to characterize the *Carex limosa* sites I visited are full sun and very wet to wet moisture conditions. In contrast, *Carex paupercula* appeared in a larger variety of locations. I observed it at the most number of sites in laggs or swamps near peatlands. Crum (1988) defines the lagg as a mineral rich drainage area^s surrounding a peatland like a moat, which can be occupied by water, a sedgy fen or shrub growth. Crum states that these areas are not well marked in the Great Lakes area. I saw *Carex paupercula* growing in areas which may fit the definition of lagg or which may also be considered swamps at Galloway Lake, Mud Lake Bog, Orchis Fen, and Ryerse Lake. However, I also observed it on mats with *Sphagnum* at the Black Spruce Bog in Ontario and at Orchis Fen. At Terrace Bay on Lake Superior I saw it in wet pools in rock crevices. In general, I tended to find *Carex paupercula* in more shaded and drier conditions than *Carex limosa*..

In Table 1, I marked indicator species present at each site in order to attempt to determine pH and to help in characterizing each site. I hypothesized that pH might control where *Carex limosa* and *Carex paupercula* are found. Based on indicators, four sites, Barclay Lake, the Troll

Bog, Little Dollar Lake, and Little Lake, were acidic. All of these were sites where I found *Carex limosa* at the very wet edge and none were sites for *Carex pauperula*. Based on indicators, four sites, Orchis Fen, the Fen on Bergstrom Road, Terrace Bay, and the *Carex limosa* site at Ryerse Lake were calcareous. I found *Carex limosa* at all of the calcareous sites except Terrace Bay. This suggests that *Carex limosa* is not limited by either acidic or calcareous conditions.

One of my first hypotheses was that *Carex pauperula* is a calciphile. Of the calcareous sites I observed, *Carex pauperula* occurred at Orchis Fen and at Terrace Bay. I also thought that its absence from the acidic sites was significant. I then observed *Carex pauperula* growing at Ryerse Lake with *Carex oligosperma*, a plant characteristic of acid sites, in the lagg or swamp area surrounding the fen. I also saw *Ledum groenlandicum*, which tends to be found in acid sites, and *Carex trisperma* a plant commonly found in *Thuja* swamps, at this location but no other indicators were present. The indicators at Galloway Lake, Mud Lake Bog, the Black Spruce Bog in Ontario, and Weber Lake were also inconclusive in regards to pH. Three of these were *Carex pauperula* sites. Very often I found that indicators of both acidic and calcareous conditions appeared at the *Carex pauperula* sites. This may be due to microhabitat differences in rooting depth of plants, water circulation (oxygen and nutrient availability), *Sphagnum* species present, and successional changes taking place. I observed *Carex pauperula* to often be found associated with at least some calcareous species. However, it does not seem to be limited to strictly calcareous sites.

The moss species I observed growing with *Carex limosa* and *Carex pauperula* are good ecological indicators and also accentuate the microhabitat differences I have observed between these two species.

Sphagnum cuspidatum which grows underwater and *Sphagnum papillosum*, also a pioneer, are characteristic of the lawn zone at the edge of acid, mineral poor lakes (Crum, 1988). I identified *Carex limosa* growing on these species at Barclay Lake and at Little Lake. *Sphagnum teres* is the primary pioneer species at the margins of sedge mats on mineral rich alkaline lakes (Crum, 1988). I observed *Carex limosa* growing on *Sphagnum teres* at Ryerse Lake. In the area surrounding Mud Lake Bog, I identified *Carex paupercula* growing on *Sphagnum warnstorffii* which is a moss characteristic of *Thuja* swamps (Crum, 1988).

My observations suggest that *Carex limosa* and *Carex paupercula* are different in growth habit. At Orchis Fen, I excavated two connected plants of *Carex limosa* and observed its long creeping rhizome which was located at the base of a *Sphagnum* hummock. I have usually observed *Carex limosa* to be growing in a continuous band along the edge of mats. At several sites, the Troll Bog, Ryerse Lake, and at Little Lake, I have seen *Carex limosa* growing off of the mat and partly submerged in water. I hypothesize that *Carex limosa* is a mat former and that it is one of the species responsible for the expansion of the mat at the leading edge. At Orchis Fen, I also examined a plant of *Carex paupercula* and found its root system to be clumped and the stems easier to pull up. I have always observed *Carex paupercula* to be growing in isolated small clumps. Only at the Black Spruce Bog in Ontario and at Orchis Fen was it even growing on the mat.

Related to this difference in growth habit is another important difference between these two species. The only site where I did not find *Carex limosa* growing near open water was at Weber Lake. I saw very little of *Carex limosa* in the grown over pool there and none of it was in flower. It seems apparant that this site once had open water. I hypothesize that *Carex*

limosa is a pioneer species which is responsible for the expansion of mats and that at Weber Lake, like the *Nuphar variegata* growing nearby, it is a relic which may be dying out due to competition from species of the grounded mat such as *Carex oligosperma*. At Weber Lake, there were calcareous indicators including *Rhynchospora alba* and *Dulichium arundinaceum* growing in the former pool which may reflect the relatively recent presence of open moving water. As succession takes place these will likely be replaced by more acidic species. At the Black Spruce Bog in Ontario, at which there was no open water, I failed to find *Carex limosa*. However, I did find *Carex paupercula* at this site. Most of my observations suggest that *Carex paupercula* is a later successional species. At Terrace Bay, I was surprised to find *Carex paupercula* growing in the wet rock crevices. However, it was growing up in the higher rocks almost at the edge of the forest and is probably not subject to frequent disturbance. In general, I found *Carex paupercula* growing in lags and swamps near peatlands with trees and shrubs which indicate that at least some level of succession (mat or substrate development) has already occurred in these areas. Succession is, of course, still occurring.

In my review of the literature, I found several sources whose conclusions about *Carex limosa* and *Carex paupercula* seem to conflict with what I have observed. Hulten (1962) lists *Carex limosa* as a calcifuge meaning, intolerant of calcium. Vitt and Slack (1975) working in northern Michigan, grouped *Carex limosa* and *Carex paupercula* together with *Sphagnum cuspidatum* and *Sphagnum papillosum* as being characteristic of the acidic lake edge zone and absent from the alkaline lake edge zone. Jeglum & Boissonneau (1974), working in Ontario, also group *Carex limosa* and *Carex paupercula* together as being characteristic of graminoid bogs and

associated with acidic species such as *Carex exilis*, *Carex oligosperma*, *Carex pauciflora*, *Eriophorum spissum*, and *Scheuchzeria palustris*. In contrast to these authors, I only found *Carex paupercula* growing near the edge with *Carex limosa* at one location, Orchis Fen. This is an alkaline site, judging from the indicator species present, and is not a typical lakefill peatland. At three sites, I have pH readings taken by the Bryology class from lakes where *Carex limosa* was growing near the edge and where its roots were presumably in contact with the lake water. Although Barclay Lake and Little Lake were acidic (pH = 5.2 and 4.7), Ryerse Lake was alkaline (pH = 8.2). My observations suggest that *Carex limosa* and *Carex paupercula* are not confined to acidic habitats and that *Carex limosa* and *Carex paupercula* each have distinct microhabitats and do not generally grow together.

Conclusions

1. *Carex limosa* is characteristic of the mat edge in lakefill peatlands and often grows partly submerged in water. *Carex paupercula* is generally found in the lagg or in coniferous swamps surrounding peatlands but does also occur on the open mat and in rock crevices on Lake Superior.
2. *Carex limosa* grows in full sun and wet conditions. *Carex paupercula* grows in somewhat more shaded and drier conditions.
3. *Carex limosa* and *Carex paupercula* are tolerant of both acid and calcareous conditions.

4. *Carex limosa* is a rhizomatous mat former. *Carex paupercula* grows in isolated clumps.

5. *Carex limosa* is a pioneer species at the leading edge of mats and is replaced when the mat closes over. *Carex paupercula* is present in areas already colonized by other plants.

Table 1

Indicators

A = Acid

C = calcareous

T = Tundra

SITE	<i>Carex limosa</i>	<i>Carex paupercula</i>
#1 Bog adjacent to Barclay Lake; Luce Co., MI (Upper Peninsula)	full sun; wet; associates: <i>Carex oligosperma</i> A <i>Carex pauciflora</i> A <i>Drosera rotundifolia</i> <i>Eriophorum spissum</i> A <i>Lycopodium inundatum</i> <i>Sarracenia purpurea</i> <i>Vaccinium macrocarpon</i> <i>Vaccinium oxycoccos</i> A	
#2 Troll Bog 1 mi East of Barclay Lake; Luce Co., MI (Upper Peninsula)	full sun; very wet; associates: <i>Andromeda glaucophylla</i> <i>Carex exilis</i> A <i>Drosera intermedia</i> <i>Scheuchzeria palustris</i> A	
#3 Bog/Fen/Swamp on South Side of Galloway Lake; Emmet Co., MI (Lower Peninsula)		partial shade; wet; associates: <i>Acer rubrum</i> <i>Alnus rugosa</i> <i>Carex trisperma</i> T <i>Ledum groenlandicum</i> A <i>Menyanthes trifoliata</i> C <i>Picea mariana</i> <i>Smilacina trifolia</i> <i>Thuja occidentalis</i> T

Acid

Acid

SITE	<i>Carex limosa</i>	<i>Carex paupercula</i>
#4 Unamed Fen on Bergstrom Rd. 2.5 Miles North of Hiawatha Trail; Mackinac Co., MI (Upper Peninsula)	full sun; wet; associates: <i>Alnus rugosa</i> <i>Calla palustris</i> <i>Campanula aparinoides</i> C <i>Carex diandra</i> <i>Carex lasiocarpa</i> C <i>Chamaedaphne calyculata</i> <i>Dulichium arundinaceum</i> C <i>Drosera rotundifolia</i> <i>Larix laricina</i> <i>Lysimachia thyrsiflora</i> <i>Potentilla palustris</i> <i>Rhynchospora alba</i> C <i>Sagittaria latifolia</i> <i>Salix candida</i> <i>Salix pedicellaris</i> <i>Scirpus hudsonianus</i> C <i>Thelypteris palustris</i> <i>Typha latifolia</i> <i>Vaccinium oxycoccos</i> A	
#5 Bog adjacent to Little Dollar Lake; Mackinac Co., MI (Upper Peninsula)	full sun; wet; associates: <i>Andromeda glaucophylla</i> <i>Carex oligosperma</i> A <i>Drosera rotundifolia</i> <i>Eriophorum virginicum</i> <i>Larix laricina</i> <i>Picea mariana</i> <i>Pinus strobus</i> <i>Rhynchospora alba</i> C <i>Sarracenia purpurea</i> <i>Scheuchzeria palustris</i> A <i>Triadenum fraseri</i> <i>Vaccinium oxycoccos</i> A	
#6 <i>Thuja</i> Swamp adjacent to Mud Lake Bog; Cheboygan Co., MI (Lower Peninsula)		partial shade; moist; associates: <i>Abies balsamea</i> <i>Acer rubrum</i> <i>Carex trisperma</i> T <i>Larix laricina</i> <i>Smilacina trifolia</i> <i>Thuja occidentalis</i> T

Calla

Acid

SITE	<i>Carex limosa</i>	<i>Carex paupercula</i>
#7 Rock Shore of Terrace Bay on Lake Superior; Ontario, Canada		full sun; wet; associates: <i>Chamaedaphne calyculata</i> <i>Drosera rotundifolia</i> <i>Juncus alpinus</i> <i>Myrica gale</i> ☹ <i>Scirpus cespitosus</i> ☹
#8 Shrubby Black Spruce Bog and Forest 0.5 mi. West of Prairie River; Ontario, Canada		full sun; wet; associates: <i>Alnus rugosa</i> <i>Chamaedaphne calyculata</i> <i>Equisetum arvense</i> <i>Juniperus horizontalis</i> <i>Kalmia polifolia</i> <i>Ledum groenlandicum</i> A <i>Linnaea borealis</i> <i>Myrica gale</i> ☹ <i>Picea mariana</i> <i>Smilacina trifolia</i>
#9 Orchis Fen; Emmet Co., MI (Lower Peninsula)	full sun; wet; associates: <i>Aronia prunifolia</i> <i>Calla palustris</i> <i>Campanula aparinoides</i> ☹ <i>Chamaedaphne calyculata</i> <i>Cornus stolonifera</i> <i>Drosera rotundifolia</i> <i>Liparis loeselii</i> ☹ <i>Lobelia kalmii</i> ☹ <i>Menyanthes trifoliata</i> ☹ <i>Picea mariana</i> <i>Potentilla palustris</i> <i>Sarracenia purpurea</i> <i>Thelypteris palustris</i> <i>Thuja occidentalis</i> <i>Typha latifolia</i> T <i>Vaccinium oxycoccos</i> A	light shade and partial shade; wet to moist; associates: <i>Aronia prunifolia</i> <i>Carex trisperma</i> T <i>Chamaedaphne calyculata</i> <i>Dulichium arundinacium</i> ☹ <i>Geum rivale</i> <i>Habenaria clavellata</i> <i>Linnaea borealis</i> <i>Larix laricina</i> <i>Menyanthes trifoliata</i> ☹ <i>Picea mariana</i> <i>Rhamnus alnifolia</i> ☹ <i>Rhynchospora alba</i> ☹ <i>Sarracenia purpurea</i> <i>Scirpus hudsonianus</i> ☹ <i>Smilacina trifolia</i> <i>Thelypteris palustris</i> <i>Thuja occidentalis</i> T

SITE	<i>Carex limosa</i>	<i>Carex paupercula</i>
#10 Fen adjacent to Ryerse Lake; Mackinac Cty., MI (Upper Peninsula)	full sun; very wet and wet; associates: <i>Alnus rugosa</i> <i>Andromeda glaucophylla</i> <i>Carex lasiocarpa</i> C <i>Chamaedaphne calyculata</i> <i>Cladium mariscoides</i> C <i>Drosera rotundifolia</i> <i>Epilobium palustre</i> C <i>Eriophorum virginicum</i> <i>Larix laricina</i> <i>Lycopodium inundatum</i> <i>Menyanthes trifoliata</i> C <i>Nymphaea odorata</i> <i>Picea mariana</i> <i>Potentilla palustris</i> <i>Pyrola rotundifolia</i> A <i>Rhamnus alnifolia</i> C <i>Rhynchospora alba</i> C <i>Rhynchospora fusca</i> C <i>Sarracenia purpurea</i> <i>Scheuchzeria palustris</i> A <i>Scirpus hudsonianus</i> C <i>Scutellaria galericulata</i> <i>Triadenum fraseri</i> <i>Vaccinium macrocarpon</i> <i>Vaccinium oxycoccos</i> A	light shade; wet; associates: <i>Carex oligosperma</i> A <i>Carex trisperma</i> T <i>Chamaedaphne calyculata</i> <i>Larix laricina</i> <i>Ledum groenlandicum</i> A <i>Nemopanthus mucronatus</i> <i>Picea mariana</i> <i>Smilacina trifolia</i>

Calcifer

SITE	<i>Carex limosa</i>	<i>Carex paupercula</i>
#11 Bog adjacent to Little Lake; Mackinac Cty., MI (Upper Peninsula)	full sun; very wet; associates: <i>Andromeda glaucophylla</i> <i>Carex oligosperma</i> A <i>Drosera rotundifolia</i> <i>Chamaedaphne calyculata</i> <i>Eriophorum virginicum</i> <i>Iris versicolor</i> <i>Kalmia polifolia</i> <i>Ledum groenlandicum</i> A <i>Picea mariana</i> <i>Rhynchospora alba</i> C <i>Sarracenia purpurea</i> <i>Vaccinium macrocarpon</i> <i>Vaccinium oxycoccus</i> A <i>Xyris montana</i>	
#12 Bog near Weber Lake; Cheboygan Cty., MI (Lower Peninsula)	full sun; wet; associates: <i>Carex oligosperma</i> A <i>Chamaedaphne calyculata</i> <i>Dulichium arundinaceum</i> C <i>Eriophorum virginicum</i> <i>Nuphar variegata</i> <i>Rhynchospora alba</i> C <i>Sarracenia purpurea</i> <i>Scheuchzeria palustris</i> A	

Acid

It is not necessary to repeat in the text as most of the information is in the table.

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