



Prairie Extremely Rich Fen

Open graminoid-dominated fens on permanently saturated peat sustained by mineral-rich groundwater discharge, with little influence from surface water inputs. Typically present on sloping sites; peat is sometimes mounded or domed. Small pools and sparsely vegetated marly peat areas are commonly present.

Vegetation Structure & Composition

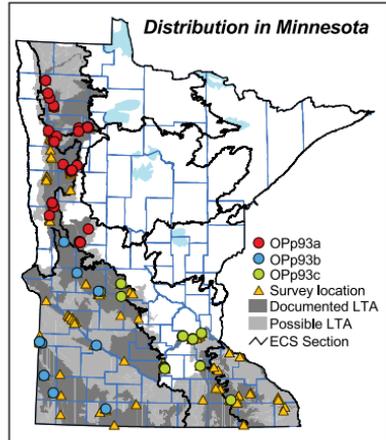
Description is based on summary of vegetation data from 78 plots (relevés) and moss data from 33 bryophyte plots. (Documented locations without plot data are shown on the distribution map as survey locations.)

- **Moss** cover is variable, composed only of brown mosses with *Sphagnum* absent. Characteristic species are *Bryum pseudotriquetrum*, *Campylopus stellatum*, *Drepanocladus aduncus*, and *Limprichtia cossonii*. *Limprichtia cossonii* is more common in northern and western Minnesota; the other three species are common throughout the state. The liverwort *Aneura pinguis* is also characteristic, occurring throughout the range of OPp93.

- **Graminoid** cover is patchy to continuous (50–100%), with sedges at least as important as grasses. Of the most distinctive species, prairie sedge (*Carex prairea*) is important throughout the range of OPp93; sterile sedge (*C. sterilis*) is typically a major component except in the far southwest; tufted bulrush (*Scirpus cespitosus*) is fairly common from central Minnesota northward; and hair-like beak rush (*Rhynchospora capillacea*) is often abundant (except in southeastern Minnesota), especially on the margins of marly pools. Two important species shared with wet prairies but absent from other meadow and fen communities are mat muhly grass (*Muhlenbergia richardsonis*) and big bluestem (*Andropogon gerardii*), although the latter is rare south of the Minnesota River valley. Other typically important species are more widely shared with other wetland classes, including clustered muhly grass (*Muhlenbergia glomerata*), narrow reed grass (*Calamagrostis stricta*), tussock sedge (*Carex stricta*), aquatic sedge (*C. aquatilis*), and hard-stemmed bulrush (*Scirpus acutus*).

- **Forb** cover is usually sparse (5–25%). Among the more common distinctive species are American grass-of-Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), seaside arrowgrass (*Triglochin maritima*), marsh arrowgrass (*T. palustris*), and lesser fringed gentian (*Gentianopsis procera*). Wet-meadow species common in OPp93 are spotted Joe pye weed (*Eupatorium maculatum*), common boneset (*Eupatorium perfoliatum*), and swamp thistle (*Cirsium muticum*). Several wet-prairie species are common in OPp93, including flat-topped aster (*Aster umbellatus*), swamp lousewort (*Pedicularis lanceolata*), northern bedstraw (*Galium boreale*), Riddell's goldenrod (*Solidago riddellii*), Virginia mountain mint (*Pycnanthemum virginianum*), prairie loosestrife (*Lysimachia quadriflora*), and golden alexanders (*Zizia aurea*). Other wet-prairie species such as tall meadow-rue (*Thalictrum dasycarpum*), northern plains blazing star (*Liatris ligulistylis*), and yellow stargrass (*Hypoxis hirsuta*) are often present at low densities.

- **Shrub layer** is absent to sparse (0–25% cover). Red-osier dogwood (*Cornus sericea*) is often present. Bog birch (*Betula pumila*) is often fairly common, except in southwestern Minnesota, and sage-leaved willow (*Salix candida*) is typically present. Shrubby cinquefoil (*Potentilla fruticosa*) is often common in northwestern Minnesota, although rare to absent elsewhere.





• **Notes:** Several plant species are essentially restricted in Minnesota to OPp93, including sterile sedge (*Carex sterilis*), hair-like beak-rush (*Rhynchospora capillacea*), marsh arrowgrass, and whorled nutrush (*Scleria verticillata*). Beaked spikerush (*Eleocharis rostellata*) has been documented only in OPp93 and the closely related OPn93. Several species that occur in other classes in northwestern Minnesota are mostly confined to OPp93 farther south, including twig rush (*Cladium mariscoides*), tufted bulrush (*Scirpus cespitosus*), American grass-of-Parnassus, Kalm's lobelia, and shrubby cinquefoil. Occurrences of OPp93 are seldom homogeneous. Variation in groundwater flow paths and in topography can create noticeable variation in vegetation. Areas of open marly pools and low, tussocky graminoid "lawns" are most characteristic. These may grade into denser, taller, often shrubbier vegetation where the substrate is less saturated or mineral soil is closer to the surface, or into marshes where ponding occurs below the fen.

OPp93 is a refinement of "Calcareous Seepage Fen Prairie Subtype" in the DNR's previous native plant community classification for Minnesota (Minnesota Natural Heritage Program 1993). Communities in OPp93 are regulated as "calcareous fens" by the DNR under Minnesota Statutes, section 103G.223 and Minnesota Rules, part 8420.1020, and by the Minnesota Pollution Control Agency under Minnesota Rules, part 7050.0180. For regulatory purposes, each agency maintains an official list of recognized calcareous fens (available from the agency). Identification of a community as OPp93 by use of this field guide is not sufficient to bring it under regulatory authority.

Landscape Setting & Soils

OPp93 occurs where there is an uninterrupted, diffuse discharge of mineral-rich groundwater at the ground surface that is not ponded and where surface water inputs (from rainfall and runoff) are minor relative to groundwater input. Such conditions occur where gentle to moderate surface slopes intersect groundwater-bearing layers perched above less permeable layers; they also occur where permeable formations penetrate confining beds that overlie aquifers with above-surface heads. Fens of the first type are most commonly present along down-gradient slopes of Glacial Lake Agassiz beach ridges, on side slopes and terraces in the Minnesota and Mississippi River valleys, on side slopes of smaller glacial meltwater valleys in southwestern Minnesota, and on terraces in stream valleys in the dissected bedrock region of southeastern Minnesota. Fens of the second type are concentrated in southwestern Minnesota but occur sporadically northward. These are present in a variety of settings, but typically close to higher-elevation groundwater recharge areas. OPp93 is limited to regions of calcareous glacial drift or bedrock. Soils are histosols (more than half of the upper 32in [80cm] is organic material) or have a histic epipedon (at least approximately 15% of the upper 8–24in [20–60cm] is organic material).

Natural History

The groundwater that supplies OPp93 is alkaline (pH > 6.7) with a high calcium concentration (> 30mg/l) as a result of flowing through calcareous glacial drift or bedrock. The constantly upwelling cold, anoxic water creates ideal conditions for peat formation, provided water emerges as diffuse seepage and not as a concentrated spring flow. Peat formation over the area of seepage acts as a sponge to further diffuse the movement of the water and retain it longer on site, enhancing peat production. Peat shelves or domes are the frequent result. Conditions at the surface promote the precipitation of calcium carbonate as marl or tufa, which is incorporated into the accumulating peat. This material may give the peat a high mineral content. The elevated mineral concentrations and cold, anoxic substrate conditions exclude or suppress the growth of most wetland plants, allowing a few specialists to thrive. OPp93 does not occur in situations subject to flooding, as none of the characteristic dominants can survive prolonged inundation.



Similar Native Plant Community Classes

• OPn93 Northern Extremely Rich Fen

OPn93 and OPp93 have similar hydrology and water chemistry. OPn93 occurs within patterned peatlands or other settings in the northern forest region of Minnesota and has northern species that are absent from OPp93. Conversely, OPp93 has a number of species from the prairie region that are absent from OPn93.

OPp93 Indicator Species	(freq%)		OPn93 Indicator Species	(freq%)	
	OPp93	OPn93		OPp93	OPn93
Spotted Joe yew weed (<i>Eupatorium maculatum</i>)	71	-	Bog rosemary (<i>Andromeda glaucophylla</i>)	-	88
Mat muhly grass (<i>Muhlenbergia richardsonis</i>)	69	-	White cedar (U)	-	75
Flat-topped aster (<i>Aster umbellatus</i>)	67	-	White beak rush (<i>Rhynchospora alba</i>)	-	50
Narrow reed grass (<i>Calamagrostis stricta</i>)	54	-	Bladderworts*	4	88
Big bluestem (<i>Andropogon gerardii</i>)	49	-	Twig rush (<i>Cladium mariscoides</i>)	4	75
Northern bedstraw (<i>Galium boreale</i>)	47	-	Sundews**	3	50
Riddell's goldenrod (<i>Solidago riddellii</i>)	45	-	Buckbean (<i>Menyanthes trifoliata</i>)	6	75
Marsh arrowgrass (<i>Triglochin palustris</i>)	38	-	Pitcher plant (<i>Sarracenia purpurea</i>)	9	88

*Bladderworts (*Utricularia intermedia*, *U. cornuta*, and *U. minor*) **Sundews (*Drosera anglica*, *D. rotundifolia*, and *D. intermedia*)

• OPp91 Prairie Rich Fen

Both OPp91 and OPp93 occur on saturated peat substrates, but while there may be some lateral flow in OPp91, there is no artesian pressure as in OPp93. OPp91 occupies depressional sites where the water table is persistently at or close to the surface. Shallow flooding is a regular event in OPp91, and the dominant species of this class have adaptations to conduct oxygen to roots from emergent leaves. Fen wiregrass sedge (*Carex lasiocarpa*), almost always a dominant in OPp91, is occasionally common in OPp93.

OPp93 Indicator Species	(freq%)		OPp91 Indicator Species	(freq%)	
	OPp93	OPp91		OPp93	OPp91
Sterile sedge (<i>Carex sterilis</i>)	76	-	Marsh St. John's wort (<i>Triadenum fraseri</i>)	-	31
Hair-like beak rush (<i>Rhynchospora capillacea</i>)	28	-	Common mint (<i>Mentha arvensis</i>)	-	29
Big bluestem (<i>Andropogon gerardii</i>)	49	2	Marsh cinquefoil (<i>Potentilla palustris</i>)	-	27
Riddell's goldenrod (<i>Solidago riddellii</i>)	45	2	Bog willow (<i>Salix pedicularis</i>)	-	23
American grass-of-Parnassus (<i>Parnassia glauca</i>)	58	2	Silverweed (<i>Potentilla anserina</i>)	-	19
Mat muhly grass (<i>Muhlenbergia richardsonis</i>)	69	3	Northern blue flag (<i>Iris versicolor</i>)	-	19
Marsh arrowgrass (<i>Triglochin palustris</i>)	38	2	Tufted loosestrife (<i>Lysimachia thyrsiflora</i>)	1	48
Prairie sedge (<i>Carex prairea</i>)	45	3	Water smartweed (<i>Polygonum amphibium</i>)	1	35

• WPn53 Northern Wet Prairie

WPn53 is similar enough to OPp93 to give rise to classification uncertainty only when WPn53 is influenced by groundwater seepage (WPn53a). The influence of groundwater seepage is more subtle in WPn53 than in OPp93. The substrate is moist but not saturated, marly pools are absent, and there is no flow of water out of the community. Soils in WPn53 are organically enriched mineral soil, not peat. The vegetation is lush and dominated by taller species than those that compose the distinctive low tussocky lawns of OPp93.

OPp93 Indicator Species	(freq%)		WPn53 Indicator Species	(freq%)	
	OPp93	WPn53		OPp93	WPn53
Sterile sedge (<i>Carex sterilis</i>)	86	-	Prairie dropseed (<i>Sporobolus heterolepis</i>)	-	80
Aquatic sedge (<i>Carex aquatilis</i>)	46	-	Purple prairie clover (<i>Dalea purpurea</i>)	-	60
Hardstem and Slender bulrush*	41	-	Little bluestem (<i>Schizachyrium scoparium</i>)	-	30
Tufted bulrush (<i>Scirpus cespitosus</i>)	30	-	Indian grass (<i>Sorghastrum nutans</i>)	-	30
Hair-like beak rush (<i>Rhynchospora capillacea</i>)	27	-	Heath aster (<i>Aster ericoides</i>)	5	70
Lead-colored sedge (<i>Carex livida</i>)	24	-	Prairie cordgrass (<i>Spartina pectinata</i>)	5	70
Sage-leaved willow (<i>Salix candida</i>)	78	10	Autumn sneezeweed (<i>Helenium autumnale</i>)	3	40
Marsh arrowgrass (<i>Triglochin palustris</i>)	59	10	Maximilian's sunflower (<i>Helianthus maximiliani</i>)	3	30

*Hardstem and Slender bulrush (*Scirpus acutus* and *S. heterochaetus*)

• WPs54 Southern Wet Prairie

As with WPn53, WPs54 is similar enough to OPp93 to give rise to classification uncertainty only when WPs54 is influenced by groundwater seepage (WPs54a). Vegetation data for WPs54a are available from only one plot, making tabular summary of differences largely meaningless. The differences described above between WPn53 and OPp93 should also differentiate WPs54a from OPp93 reasonably well.

• WMs83 Southern Seepage Meadow/Carr

WMs83 appears somewhat similar to OPp93 but usually lacks the small, shallow marly pools and areas of visibly upwelling groundwater typical of OPp93. The low tussocky



lawns characteristic of OPp93 are not present in WMs83, which is dominated instead by taller sedges and forbs. The shrub component of WMs83 is also typically much taller. WMs83 sometimes occurs on the outer margins of OPp93.

OPp93 Indicator Species	(freq%)		WMs83 Indicator Species	(freq%)	
	OPp93	WMs83		OPp93	WMs83
Sterile sedge (<i>Carex sterilis</i>)	76	-	Common mint (<i>Mentha arvensis</i>)	-	28
American grass-of-Parnassus (<i>Parnassia glauca</i>)	58	-	Fowl bluegrass (<i>Poa palustris</i>)	1	35
Kalm's lobelia (<i>Lobelia kalmii</i>)	58	-	Lake sedge (<i>Carex lacustris</i>)	1	32
Marsh arrowgrass (<i>Triglochin palustris</i>)	38	-	Tufted loosestrife (<i>Lysimachia thyrsoiflora</i>)	1	31
Hair-like beak rush (<i>Rhynchospora capillacea</i>)	28	-	Water smartweed (<i>Polygonum amphibium</i>)	1	22
Mat muhly grass (<i>Muhlenbergia richardsonis</i>)	69	2	Great water dock (<i>Rumex orbiculatus</i>)	5	58
Riddell's goldenrod (<i>Solidago riddellii</i>)	45	2	Touch-me-not (<i>Impatiens</i> spp.)	6	43
Seaside arrowgrass (<i>Triglochin maritima</i>)	49	3	Bluejoint (<i>Calamagrostis canadensis</i>)	9	45

Native Plant Community Types in Class

• OPp93a Calcareous Fen (Northwestern)

Open graminoid-dominated fens, primarily near the bases of Glacial Lake Agassiz beach ridges on their down-gradient sides with some examples present in areas of local upwelling from confined aquifers. A number of occurrences are large (> 40 acres), and most are > 10 acres. OPp93a is the most species-rich community type in this class. Characteristic species in OPp93a that are rare or absent in OPp93b and OPp93c are tufted bulrush (*Scirpus cespitosus*), candle-lantern sedge (*Carex limosa*), lead-colored sedge (*C. livida*), marsh grass-of-Parnassus (*Parnassia palustris*), and sticky false asphodel (*Tofieldia glutinosa*). Bog birch, sage-leaved willow, and shrubby cinquefoil are much more common in this type than in the other two. OPp93a has been documented in the northern third of the MIM, in the LAP, and on the east margin of the RRV. Description is based on summary of vegetation data from 44 plots.

• OPp93b Calcareous Fen (Southwestern)

Open graminoid-dominated fens on local upwellings from confined aquifers and on side slopes of erosional features. OPp93b is the most species-poor community type in the class, and most occurrences are < 5 acres. Sterile sedge (*Carex sterilis*) is mostly absent from OPp93b; the areas where this species is dominant in OPp93a are typically dominated instead by hair-like beak rush (*Rhynchospora capillacea*), three-square bulrush (*Scirpus pungens*), and seaside arrowgrass. Shrubs are nearly absent from OPp93b, with only stunted red-osier dogwood likely. OPp93b has been documented at scattered locations in the CGP. Description is based on summary of vegetation data from 12 plots.

• OPp93c Calcareous Fen (Southeastern)

Open graminoid-dominated fens present mostly on side slopes of erosional features and sometimes on terraces within valleys. Most occurrences are small, although larger occurrences have been documented, especially in the Minnesota River valley. OPp93c is intermediate between OPp93a and OPp93b in species diversity; sterile sedge (*Carex sterilis*) is usually present, but other calcareous fen indicators are rare or absent southeast of the Minnesota River valley. Several species in OPp93c that are rare or absent in other types in OPp93 are spring cress (*Cardamine bulbosa*), cowbane (*Oxypolis rigidior*), and edible valerian (*Valeriana edulis*). Bog birch and sage-leaved willow are sometimes present, and red-osier dogwood is common. OPp93c has been documented in the southern two-thirds of the MIM, mainly along the Minnesota River valley, and in the CGP from a few locations close to the MIM. Description is based on summary of vegetation data from 21 plots.



photo by F.S. Harris MN DNR



Yellow Medicine County, MN



OPp93 Prairie Extremely Rich Fen — Species Frequency & Cover

	freq % cover	freq % cover
Forbs, Ferns & Fern Allies		
Spotted Joe pye weed (<i>Eupatorium maculatum</i>)	71	•
Northern bog violet (<i>Viola nephrophylla</i>)	71	•
Bog aster (<i>Aster borealis</i>)	67	•
Flat-topped aster (<i>Aster umbellatus</i>)	67	•
Swamp loosewort (<i>Pedicularis lanceolata</i>)	65	•
American grass-of-Parnassus (<i>Parnassia glauca</i>)	58	•
Kalm's lobelia (<i>Lobelia kalmii</i>)	58	•
Giant, Sawtooth, or Nuttall's sunflower*	54	••
Seaside arrowgrass (<i>Triglochin maritima</i>)	49	••
Northern bedstraw (<i>Galium boreale</i>)	47	•
Riddell's goldenrod (<i>Solidago riddellii</i>)	45	•
Swamp thistle (<i>Chrysium muticum</i>)	41	•
Marsh arrowgrass (<i>Triglochin palustris</i>)	38	•
Virginia mountain mint (<i>Pycnanthemum virginianum</i>)	32	•
Lesser fringed gentian (<i>Gentianopsis procera</i>)	32	•
Common boneset (<i>Eupatorium perfoliatum</i>)	31	•
Grass-leaved goldenrod (<i>Euthamia graminifolia</i>)	29	•
Broad-leaf cattail (<i>Typha latifolia</i>)	28	••
Canada goldenrod (<i>Solidago canadensis</i>)	28	•
Prairie loosestrife (<i>Lysimachia quadriflora</i>)	28	•
Northern bugleweed (<i>Lycopus uniflorus</i>)	28	•
Red-stemmed aster (<i>Aster purpureus</i> and <i>A. firmus</i>)	23	•
Giant goldenrod (<i>Solidago gigantea</i>)	23	•
Dwarf raspberrry (<i>Fubus pubescens</i>)	22	••
Golden alexanders (<i>Zizia aurea</i>)	22	•
Sticky false aspidodel (<i>Toffieldia glutinosa</i>)	22	•
New England aster (<i>Aster novae-angliae</i>)	21	•
Labrador bedstraw (<i>Galium labradoricum</i>)	21	•
Swamp milkweed (<i>Asclepias incarnata</i>)	21	•
Tall meadow-rue (<i>Thalictrum dasycarpum</i>)	19	•
Marsh bellflower (<i>Campanula aparinoides</i>)	18	•
Marsh grass-of-Parnassus (<i>Parnassia palustris</i>)	17	•
Cut-leaved bugleweed (<i>Lycopus americanus</i>)	17	•
Grasses & Sedges		
Golden or False golden ragwort (<i>Senecio aureus</i> or <i>S. pseudaururus</i>)	15	•
Clustered mucky grass (<i>Muhlenbergia glomerata</i>)	86	••
Stentle sedge (<i>Carex sterilis</i>)	76	•••
Mat mucky grass (<i>Muhlenbergia richardsonii</i>)	69	•••
Rigid sedge (<i>Carex tetanica</i>)	55	•
Narrow reed grass (<i>Calamagrostis stricta</i>)	54	•
Big bluestem (<i>Andropogon gerardii</i>)	49	••
Prairie sedge (<i>Carex prairiea</i>)	45	•••
Tall cottongrass (<i>Eriophorum polystachion</i>)	45	•
Hardstem and Slender bulrush (<i>Scirpus acutus</i> and <i>S. heterochaetus</i>)	42	•••
Fringed brome (<i>Bromus ciliatus</i>)	41	•
Aquatic sedge (<i>Carex aquatilis</i>)	36	•
Tussock sedge (<i>Carex stricta</i>)	35	•••
Flattened spikerush (<i>Eleocharis compressa</i>)	35	••
Hair-like beak rush (<i>Rhynchospora capillacea</i>)	28	•••
Fen wiregrass sedge (<i>Carex lasiocarpa</i>)	28	•••
Interior sedge (<i>Carex interior</i>)	28	•
Fowl manna grass (<i>Glyceria striata</i>)	27	•
Tufted hair grass (<i>Deschampsia cespitosa</i>)	24	••
Tufted bulrush (<i>Scirpus cespitosus</i>)	22	••
Three-square bulrush (<i>Scirpus pungens</i>)	21	••••
Red-stalked spikerush (<i>Eleocharis palustris</i>)	21	•
Sartwell's sedge (<i>Carex sartwellii</i>)	19	••
Lead-colored sedge (<i>Carex livida</i>)	19	•
Shrubs		
Red-osier dogwood (<i>Cornus sericea</i>)	55	•
Bog birch (<i>Betula pumila</i>)	54	•••
Sage-leaved willow (<i>Salix candida</i>)	50	•
Shrubby cinquefoil (<i>Potentilla fruticosa</i>)	42	•••
Pussy willow (<i>Salix discolor</i>)	33	••
Bebb's willow (<i>Salix bebbiana</i>)	29	•
Autumn willow (<i>Salix serotina</i>)	28	•
Slender willow (<i>Salix petiolaris</i>)	22	•

*Giant, Sawtooth, or Nuttall's sunflower (*Helianthus giganteus*, *H. grosseserratus*, or *H. nuttallii*)