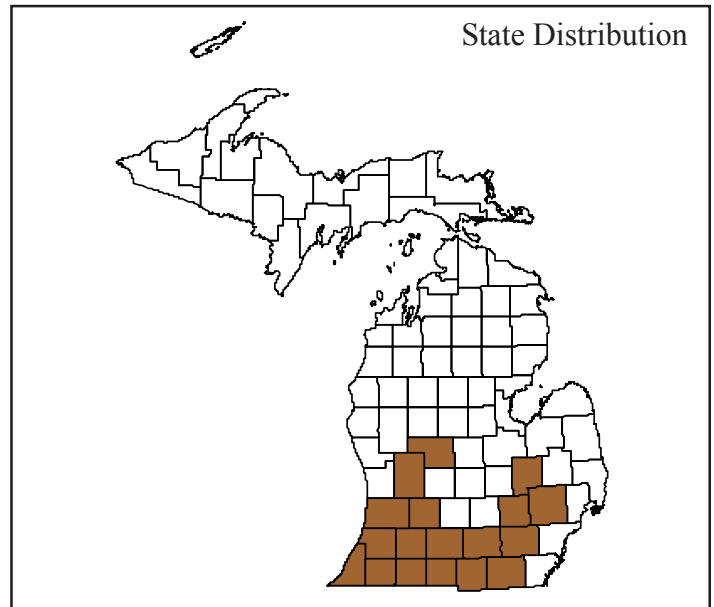




Photo by Dennis A. Albert



Best Survey Period



Global and state rank: G3/S3

Total range: Prairie fens are geologically and biologically unique wetlands found only in the glaciated Midwest. They are distinguished from other calcareous fens by a tallgrass prairie flora and fauna component. They currently are known in Illinois, Indiana, Iowa, Ohio, Michigan, Minnesota, North Dakota, Wisconsin and southern Ontario. Similar communities are also known in unglaciated Missouri (Orzell & Kurz 1984). In Michigan, prairie fens occur in the southern three to four tiers of counties, primarily in the glacial interlobate region (Kost et al. 2007).

Rank justification: With the exception of Missouri, prairie fens are restricted to glaciated portions of the Midwest with specific geologic features, and are a regionally common natural community. Prior to European settlement, prairie fens were undoubtedly more numerous than they are today. Agriculture and urban development in Michigan have disrupted groundwater flow and destroyed wetlands, including prairie fens. In addition, lack of fire has likely caused prairie fens to succeed into shrub-carr communities (Moran 1981). Currently, about 140 prairie fens are identified in Michigan totalling about 4,800 acres (1,940 hectares).

Landscape context: Prairie fens occur in the glacial interlobate region of Michigan’s southern Lower Peninsula. This region contains a broad outwash plain scattered with “islands” of coarse-textured end and ground moraine, and ice contact ridges (Albert 1995). Prairie fens are typically located along the junction of outwash plain and moraine or ice contact ridge. They occur on lower

slopes of the moraine or ridge, where coarse-textured glacial deposits provide high hydraulic conductivity, forcing groundwater to the surface (Moran 1981). Prairie fens are often associated with and drain into small lakes, headwater streams, or rivers. Sapric peat, one foot to greater than 36 feet (0.5 to >12 meters) deep (Moore et al. 1993), is typical prairie fen substrate, which is saturated with a constant supply of groundwater. Groundwater is calcareous, or rich in both calcium and magnesium bicarbonate, resulting from flow through limestone bedrock and/or coarse textured calcareous glacial deposits (Curtis 1959, Moran 1981, White & Chapman 1988). The high concentrations of bicarbonates often precipitate as marl at the soil surface. Soils are circumneutral with a typical pH range from 6.8 to 8.2. (White & Chapman 1988, Aaseng et al. 1993).

Natural processes: Hydrological processes are very important in prairie fen vegetative structure.

Saturated peat is maintained by a constant inflow of groundwater rich in calcium and magnesium from surrounding glacial deposits. Calcium and magnesium-rich groundwater often upwells through the peat and forms broad seeps or local springs. Once groundwater enters the prairie fen, drainage continues through the peat either in diffuse surface flow or in stream flow (Almendinger et al. 1994).

In the early 1800s, prairie fens were part of an ecosystem complex maintained by fire (Chapman 1988).

Prior to European settlement, dry, open upland communities



such as mixed oak barrens or white oak savannas were often adjacent to prairie fens (Comer et al. 1995). Native American or lightning strike fires burned uplands and likely spread into adjacent prairie fens (Vogl 1969). These fires burned surface vegetation, inhibited shrub invasion, and maintained the open prairie fen community structure (Curtis 1959).

Vegetation description: Historically, prairie fen vegetation was adapted to the natural processes described above. Fire is suppressed in most landscapes today, and therefore the vegetative structure in existing prairie fens is largely a result of the unique hydrology. Vegetation of this community consists of obligate wetland and calcicolous species mixed with tallgrass prairie and sedge meadow species.

Three (or four) vegetation zones are often present in prairie fens (Chapman 1988). Inundated flats or depressions are located around lake or stream margins. This zone can be expansive around lakes, or localized along small ponds, streams, or springs. It is the wettest portion of the prairie fen, with up to a foot (0.3 meters) of standing water in the spring and early summer. Dominant species include *Scirpus acutus* (hardstem bulrush), *Scirpus americanus* (three-square), *Cladium mariscoides* (twig-rush), *Juncus brachycephalus* (rush), *Eleocharis elliptica* (golden-seeded spike-rush), and *E. rostellata* (spike-rush).

Sedge meadow is the largest and most characteristic vegetative zone of a prairie fen. This zone is saturated but not inundated and slightly sloping with stable peat. Any number or combination of three general associations of dominance can be found in the sedge meadow zone. The sedge-shrub association is a combination of sedges and low growing shrubs, often dominated by *Potentilla fruticosa* (shrubby cinquefoil), *Carex stricta* (meadow sedge), and *C. aquatilis* (sedge). The sedge-composite association is often dominated by *C. stricta* (meadow sedge), *Eupatorium maculatum* (joe-pye weed), *E. perfoliatum* (common boneset), and *Aster* spp. (asters). The grass-sedge association is often dominated by *C. stricta*, *C. sterilis*, *C. aquatilis* (sedges), *Andropogon scoparius* (little bluestem), *A. gerardii* (big bluestem), and *Sorghastrum nutans* (Indian grass). Other species common in all associations of the sedge meadow zone include *Bromus ciliatus* (fringed brome), *Calamagrostis canadensis* (blue-joint grass), *Lysimachia quadriflora* (whorled loosestrife), *Muhlenbergia glomerata* (marsh wild-timothy), *Pycnanthemum virginianum* (Virginia mountain mint), *Rudbeckia hirta* (black-eyed Susan), *Solidago ohioensis* (Ohio goldenrod), and *Thelypteris palustris* (marsh fern). Other shrubs in this zone include *Betula pumila* (bog birch), and *Cornus* spp. (dogwoods). Lack of fire and disruptions in groundwater flow often result in the colonization of these and other shrub and tree species including *Salix* spp. (willows), *Populus tremuloides* (quaking aspen), *Rhamnus alnifolia* (alder-leaved buckthorn), and *Ulmus americana* (American elm). Diversity and herbaceous cover are greatest in the sedge

meadow zone, which distinguishes prairie fen from other calcareous fen communities in Michigan.

A wooded fen zone dominated by shrubs and trees is often located around upland edges of prairie fen. The zone usually occurs on higher and slightly sloping surfaces where upland grades to wetland. However, lower and wetter wooded fen zones also occur. *Larix laricina* (tamarack) is often a major component and sometimes dominant in the wooded fen zone. Occasionally, these zones resemble deciduous swamp dominated by *Acer rubrum* (red maple) and *Ulmus americana* (American elm). Shrub species, such as *Cornus stolonifera* (red-osier dogwood), *C. foemina* (gray dogwood), *Physocarpus opulifolius* (ninebark), *Salix candida* (sage willow), *Spiraea alba* (meadowsweet), and *Toxicodendron vernix* (poison sumac) are common in both types of wooded fen.

Another vegetative zone is sometimes distinct in areas of calcareous groundwater seepage. These areas are either broad and flat or small and broken and sparsely vegetated with marl precipitate at the surface. The high concentration of calcium and magnesium in these areas results in vegetation dominated by calcicolous species including *Carex flava* (sedge), *Lobelia kalmii* (bog lobelia), *Parnassia glauca* (grass-of-parnassus), *Rhynchospora alba* (beak-rush), and *Triglochin maritimum* (bog arrow-grass). Carnivorous *Drosera rotundifolia* (round-leaved sundew), *Sarracenia purpurea* (pitcher plant), and *Utricularia intermedia* (flat-leaved bladderwort) are also found in this zone.

<u>Strata</u>	<u>Most abundant</u>
Tree canopy	<i>Larix laricina</i> (tamarack)
Short shrub	<i>Potentilla fruticosa</i> (shrubby cinquefoil) <i>Betula pumila</i> (bog birch)
Herbaceous	<i>Carex stricta</i> , <i>C. aquatilis</i> (sedges) <i>Eleocharis rostellata</i> (spike-rush) <i>Cladium mariscoides</i> (twig rush) <i>Scirpus acutus</i> (bulrush)

Michigan indicator species: *Larix laricina* (tamarack), *Toxicodendron vernix* (poison sumac), *Parnassia glauca* (grass-of-parnassus), *Potentilla fruticosa* (shrubby



Photo by William W. Brodowicz



cinquefoil), *Pycnanthemum virginianum* (Virginia mountain mint), *Solidago ohioensis* (Ohio goldenrod), *S. riddellii* (Riddell's goldenrod), and *Sorghastrum nutans* (Indian grass).

Other noteworthy species: Several rare animals are associated with prairie fen. *Oecanthus laricis* (tamarack tree cricket) utilizes tamarack for egg laying and is frequently found in the wooded fen zone fringing a prairie fen. *Neonympha mitchellii mitchellii* (Mitchell's satyr) is associated with more open edges of the wooded fen zone where tamarack trees and poison sumac are scattered within a meadow of tall sedges. *Oarisma poweshiek* (poweshiek skipper) is found associated with spike and bulrushes in the inundated flat/depression zone. Several rare turtles utilize prairie fen including *Emys blandingii* (Blanding's turtle), *Terrapene carolina carolina* (eastern box turtle), and *Clemmys guttata* (spotted turtle). *Clonophis kirtlandii* (Kirtland's snake) has been documented from several prairie fens in Michigan. Although not restricted to fens, *Sistrurus catenatus catenatus* (massasauga rattlesnake) is often found in the sedge meadow zone and in mid summer utilizes the inundated flat zone. *Celephelis muticum* (swamp metalmark) is found associated with its host plants *Cirsium muticum* (swamp thistle) primarily and *C. altissimum* (tall thistle), which are common in the sedge meadow zone. *Lepyronia angulifera* (angular spittlebug) has been collected from marly flats. Food plants for nymphs include *Sporobolus indicus* (smut-grass), *Cyperus schweinitzii* (umbrella sedge), and other sedges. In Michigan, adults of this species are generally found on *Eleocharis* spp.

Rare plants associated with prairie fen include *Berula erecta* (cut-leaved water-parsnip), *Cacalia plantaginea* (Indian plantain), *Calamagrostis stricta* (narrow-leaved reedgrass), *Carex richardsonii* (Richardson's sedge), *Cypripedium candidum* (white lady's-slipper), *Dodecatheon meadia* (shooting star), *Drosera anglica* (English sundew), *Eryngium yuccifolium* (rattlesnake-master), *Filipendula rubra* (queen-of-the-prairie), *Helianthus hirsutus* (whiskered sunflower), *Muhlenbergia richardsonis* (mat muhly), *Phlox maculata* (sweet William phlox), *Polemonium reptans* (Jacob's ladder), *Sanguisorba canadensis* (Canadian burnet), *Sporobolus heterolepis* (prairie dropseed), and *Valeriana ciliata* (common valerian).

Invasive, non-native species such as *Rhamnus frangula* (glossy buckthorn) establish monocultures along wooded fen edges and often extend into the sedge meadow zone. *Lythrum salicaria* (purple loosestrife) can also invade the inundated flat/depression and sedge meadow zones.

Conservation/management: Protecting hydrology is most important in the maintenance of vegetative structure in prairie fens. Groundwater flow into the prairie fen is altered by agricultural and residential drains and wells. The underlying groundwater table is lowered because of

groundwater extraction and lack of recharge due to drained surface water. A lower groundwater table cannot supply the calcareous seepage which underlies prairie fen communities. Land use planning to protect the aquifer recharge area to the prairie fen is necessary to retain the unique hydrology. Many of the existing prairie fens already have disrupted aquifer recharge areas and portions of these communities are slowly changing to shrub-carr.

Healthy woodlands, savanna, and prairies in uplands adjacent to fens allow infiltration of precipitation into the groundwater. On the other hand, lawns, agricultural fields, and impervious surfaces contribute warm, nutrient and sediment-laden surface water runoff into fens.

Nutrient addition from leaking septic tanks and drain fields is suspected of contributing to the dominance of invasives such as *Typha angustifolia* (narrow-leaved cat-tail), and *Phragmites australis* (giant reed grass) and purple loosestrife in portions of several prairie fens (Panno et al. 1999).

Control of invasive and woody species invasion is necessary in these prairie fens to restore natural vegetative patterns of diversity. Fire and manual removal have proven effective in controlling exotics and native woody invasives (Kohring 1982, Zimmerman 1983). Bowles et al. (1996) determined that although fire did not significantly decrease woody species frequency, it increased graminoid dominance.

Research needs: Quantify vegetational differences of structure and species diversity in prairie fens across the regional distribution. Investigate historical fire frequency within prairie fens. Determine how varying degrees of hydrological disruption affect patterns of prairie fen vegetative structure. Investigate the association of rare species (e.g., Mitchell's satyr) with prairie fens. Identify the most effective management techniques in restoring native prairie fen flora and fauna.

Similar communities: wet prairie, wet-mesic prairie, lakeplain wet prairie, lakeplain wet-mesic prairie, southern wet meadow, southern shrub-carr, northern fen, coastal fen, poor fen, interdunal wetland, rich tamarack swamp, bog.

Other classifications

Michigan Natural Features Inventory (MNFI) Presettlement Vegetation: not specifically noted, likely associated with 6227-wet prairie, 6122-marsh.

Michigan Department of Natural Resources (MDNR): L-lowland brush, N-marsh, T-tamarack.

Michigan Resource Information Systems (MIRIS): 612-shrub/scrub, 623-non-forested flats.

National Wetland Inventory (NWI): not specifically mentioned.



The Nature Conservancy National Classification: CODE: (V.A.7.N.p).

Alliance: *Potentilla fruticosa/Carex (flava, interior, sterilis, lasiocarpa)* (saturated shrub herbaceous).

Association: *Potentilla fruticosa/Carex sterilis-Carex flava-Eleocharis rostellata-Cacalia plantaginea* (shrub herbaceous vegetation).

Related abstracts: southern wet meadow, rich tamarack swamp, lakeplain wet prairie, lakeplain wet-mesic prairie, interdunal wetland, oak barrens, Mitchell's satyr, poweshiek skipper, Indian plantain, Richardson's sedge, white lady's-slipper, English sundew, mat muhly, and prairie dropseed.

Selected references

Aaseng, N.E., J.C. Almendinger, R.P. Dana, B.C. Delaney, H.L. Dunevitz, K.A. Rusterholz, N.P. Sather, and D.S. Worcha. 1993. Minnesota's native vegetation: A Key to natural communities. Minn. DNR Natural Heritage Program. Biological Report No. 20.

Albert, D.A. 1995. Regional landscape ecosystems of MI, MN, and WI: A Working map and classification. USFS - North Central Forest Experiment Station.

Almendinger, J., J. Anderson, J. Bell, E. Berglund, R. Dana, S. Eggers, E. Gorham, J. Janssens, S. Komor, G. Larson, J. Leete, N. Sather, and S. Verry. 1994. Technical criteria for identifying and delineating calcareous fens in Minnesota. Minn. DNR.

Bowles, M., J. McBride, N. Stoyhoff, and K. Johnson. 1996. Temporal change in vegetation structure in a fire-managed prairie fen. *Nat. Areas J.* Oct. v16, N4. pp. 275-288.

Chapman K.A. 1986. Natural community description: fen. Michigan Natural Features Inventory, Lansing, MI. 2 pp.

Comer, P.J., D.A. Albert, H.A. Wells, B.L. Hart, J.B. Raab, D.L. Price, D.M. Kashian, R.A. Corner, and D.W. Schuen. 1995. Michigan's Presettlement Vegetation, as Interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. Digital map.

Curtis, J.T. 1959. Vegetation of Wisconsin: An Ordination of Plant Communities. U. of Wis. Press, Madison, WI. 657 pp.

Kohring, M.A. 1982. Effect of a fall burn on Bakertown Fen, Berrien Co., Michigan. Master's Thesis. Mich. State Univ., East Lansing, MI.

Kost, M.A., D.A. Albert, J.G. Cohen, B.S. Slaughter, R.K. Schillo, C.R. Weber, and K.A. Chapman. 2007. Natural communities of Michigan: Classification and description. Michigan Natural Features Inventory, Report Number 2007-21, Lansing, MI. 314 pp.

Moore (Spieles), J.B., M.S. Hugan, and L.P. Bruederle. 1993. Comparison of three prairie fens in southern Michigan. Report to MNFI. U. of Mich. - Flint Biology Dept., Flint, Michigan. 42 pp.

Moran, R.C. 1981. Prairie fens in northeastern Illinois: Floristic composition and disturbance. In, Proceedings Sixth North American Prairie Conference. R.L. Stuckey and K.J. Reese (eds.). Ohio State U., Columbus, OH. Ohio Bio. Survey Notes No. 15.

Orzell, S.L. and D.R. Kurz. 1984. Floristic analysis of prairie fens in the southeastern Missouri Ozarks. In, Proceedings of the 9th North American Prairie Conference. Tri-College Univ. Center for Environ. Studies, Fargo, ND. pp. 50-58.

Panno, S.V., V.A. Nuzzo, K. Cartwright, B.R. Hensel, and I.G. Krapac. 1999. Impact of urban development on the chemical composition of groundwater in a fen-wetland complex. *Wetlands* 19:1.

White, M.A. and K.A. Chapman. 1988. Element stewardship abstract for alkaline shrub/herb fen, lower Great Lakes type. TNC - Midwest Heritage Task Force. 14 pp.

Zimmerman, J.H. 1983. The Revegetation of a small Yahara Valley prairie fen. *WI Acad. of Science, Arts, and Letters* 71. pp. 87-102.

Abstract citation

Spieles, J.B., P.J. Comer, D.A. Albert, and M.A. Kost. 1999. Natural community abstract for prairie fen. Michigan Natural Features Inventory, Lansing, MI. 4 pp.

Updated January 2008.

Copyright 2006 Michigan State University Board of Trustees.

Michigan State University Extension is an affirmative-action, equal-opportunity organization.

Funding for abstract provided by Michigan Department of Natural Resources - Wildlife Division.

