Northern Wet Meadow — Community Abstract

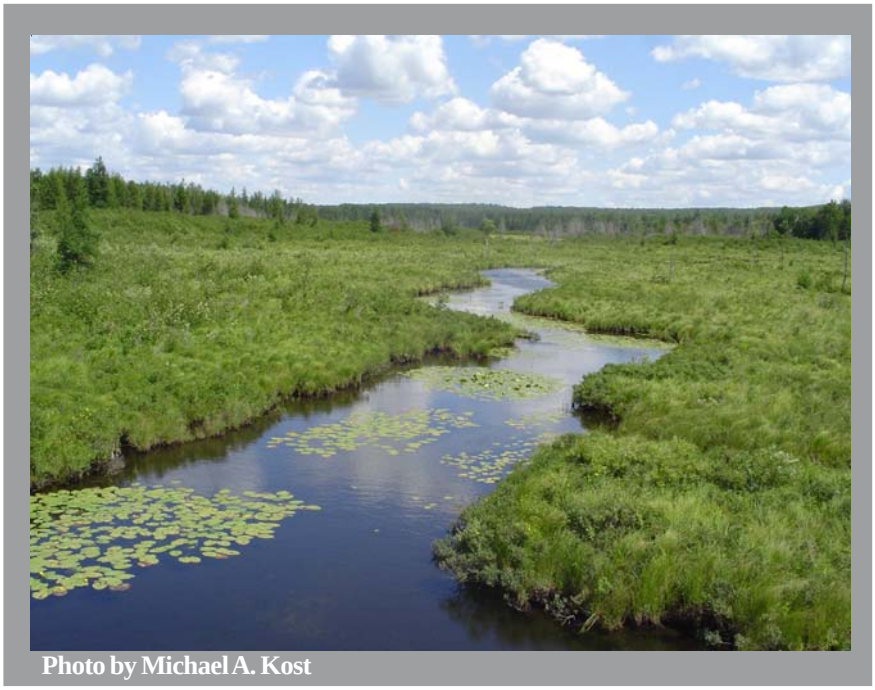
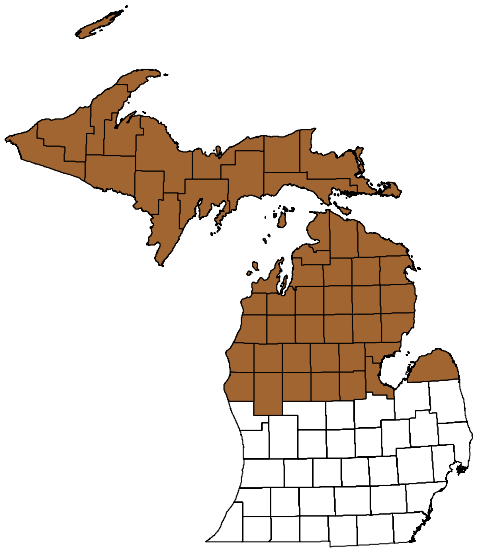


Photo by Michael A. Kost

State Distribution



Overview: Northern wet meadow is an open, groundwater-influenced, sedge- and grass-dominated wetland that occurs in the northern Lower and Upper Peninsulas and typically borders streams but is also found on pond and lake margins and above beaver dams. Soils are nearly always sapric peat and range from strongly acid to neutral pH. Open conditions are maintained by seasonal flooding, beaver-induced flooding, and fire.

Global and State Rank: G4G5/S4

Range: Northern wet meadow, which is commonly referred to as sedge meadow, occurs in Michigan, Minnesota, North Dakota, Wisconsin, and Ontario. In Michigan, northern wet meadow is thought to occur in the northern half of the Lower Peninsula above the climatic transition zone and throughout the Upper Peninsula and to differ from sedge meadows in southern Michigan (Kost 2001). However, no detailed study of the differences between northern and southern types has been undertaken in Michigan. Curtis (1959) studied sedge meadows in northern and southern Wisconsin and found them to be floristically similar but concluded that northern meadows had consistently lower soil pH values and were frequently wetter and smaller than many southern wet meadows. In Michigan, southern wet meadows are dominated primarily by *Carex stricta* (tussock sedge) while northern wet meadows can be dominated or codominated by several additional sedges and/or *Calamagrostis canadensis* (bluejoint grass) (Faber-Langendoen 2001, NatureServe 2006, Kost et al. 2007). Another sedge-dominated natural community, poor fen, also occurs in northern Michigan but differs markedly from sedge meadow because of its acidic, organic soils, and the prevalence of *Carex oligosperma* (few-seed sedge) and other open bog species (Kost and Cohen 2005, Kost et al. 2007).

Rank Justification: Because northern wet meadow often occurs as a zone within large wetland complexes, information on its historical extent and present acreage is not readily available. However, in Wisconsin, where 459,000 hectares (1,130,000 acres) of sedge meadow are thought to have existed circa 1800 (Curtis 1959), it is estimated that less than one percent remain intact (Reuter 1986). It is likely that wet meadow acreage has declined similarly in other Midwest states, such as Michigan, where similar agricultural methods have been practiced. Northern wet meadows have fared slightly better than southern wet meadows because agriculture and development has been less extensive north of the climatic transition zone (Hoffman 2002).

Northern wet meadows have been extensively utilized for agriculture. Prior to the 1950s, mowing for marsh hay was widely practiced (Stout 1914, Curtis 1959, Eggers and Reed 1997). Wet meadows were frequently tiled, ditched, drained, and converted to pasture and row

Michigan Natural Features Inventory
P.O. Box 30444 - Lansing, MI 48909-7944
Phone: 517-373-1552

crops or mined for peat or muck (Costello 1936, Curtis 1959, Reuter 1986, Eggers and Reed 1997). The hydrology of these systems is currently threatened by the reduction and diversion of surface runoff, channelization of stream flow, lowering local groundwater discharge, and deterioration of water quality (Reuter 1986). Lowering of the water table has caused the conversion of many sedge meadows to shrub thickets (Curtis 1959, Reuter 1986, Eggers and Reed 1997). In addition, fire suppression has allowed shrub encroachment with many sedge meadows converting to shrub thicket within ten to twenty years (Curtis 1959, White 1965, Davis 1979, Reuter 1986, Jean and Bouchard 1991). This is especially evident where the water table has been lowered through tiling or ditching and where the practice of mowing for marsh hay has been abandoned (White 1965, Eggers and Reed 1997). Drastic reductions in beaver populations following the fur-trading era significantly altered the hydrologic regimes of wetland ecosystems across the Great Lakes. In the absence of periodic long-term flooding by beaver, many streamside northern wet meadows have gradually converted to northern shrub thickets. Alteration of the fire and hydrologic regimes has allowed for the invasion of sedge meadows by pernicious non-native species, especially *Lythrum salicaria* (purple loosestrife), *Rhamnus cathartica* (common buckthorn), and *Rhamnus frangula* (glossy buckthorn) (Reuter 1986).

Photo by Joshua G. Cohen

Lowering of the water table or fire suppression can result in the conversion of northern wet meadow to northern shrub thicket.

Landscape and Abiotic Context: Northern wet meadow occurs on glacial lakebeds, in channels of glacial outwash, and in depressions on glacial outwash and moraines (Curtis 1959, Reuter 1986, Faber-Langendoen 2001, Hoffman 2002, NatureServe 2005, NatureServe 2006). The community frequently occurs along the margins of lakes, ponds, and streams where seasonal flooding or beaver-induced flooding is common (Curtis 1959, Reuter 1986, Hoffman 2002).

Northern wet meadow typically occurs on organic soils such as well-decomposed sapric peat (Curtis 1959), but saturated mineral soil may also support the community (Costello 1936, Curtis 1959, Faber-Langendoen 2001, NatureServe 2006). Because of the calcareous nature of the glacial drift in many of the regions occupied by wet meadow, its wet soils can contain high levels of dissolved minerals such as calcium and magnesium and occasionally the soil profile may include a layer of marl, a whitish, calcium carbonate precipitate that forms in shallow water rich in calcium and magnesium carbonates. Northern wet meadow soils range from strongly acid to neutral (pH 5.1 to 7.3). However, the organic soils near the surface of northern wet meadow are typically more acidic than soils occurring in southern wet meadow, which is found on neutral to strongly alkaline soils (Costello 1939, Curtis 1959, Warners 1993).

Northern wet meadow is found adjacent to other wetland communities, often in large wetland complexes. Along streams, northern wet meadow typically borders northern shrub thicket and swamp forest (Curtis 1959).

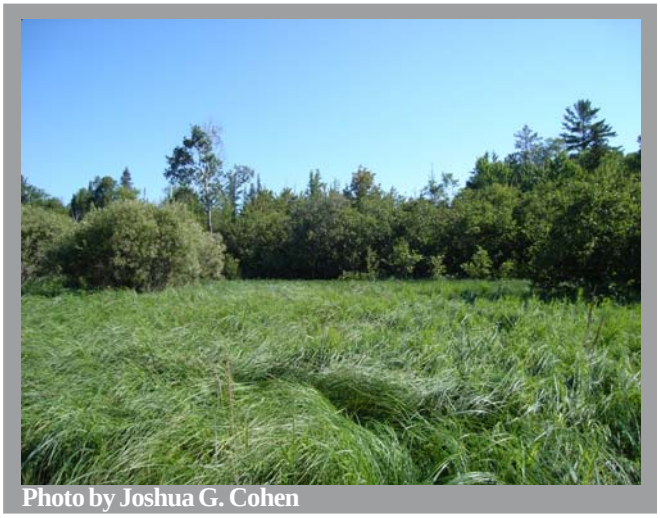


Photo by Joshua G. Cohen

Northern wet meadow often occurs in large wetland complexes and grades into northern shrub thicket.

Michigan Natural Features Inventory
P.O. Box 30444 - Lansing, MI 48909-7944
Phone: 517-373-1552

On the edges of inland lakes, northern wet meadow often borders emergent marsh and less frequently northern fen. It may also occur along the margins of patterned peatlands and within extensive areas of Great Lakes marsh along the Great Lakes shoreline.

The Michigan range of northern wet meadow falls within the area classified by Braun (1950) as the Northern Hardwood-Conifer Region (Hemlock/White Pine/Northern Hardwoods Region) and within the following regions classified by Albert et al. (1986) and Albert (1995): Region II, Northern Lower Michigan; Region III, Eastern Upper Michigan; and Region IV, Western Upper Michigan. The Northern Hardwood-Conifer Region has a cool snow-forest climate with short, warm summers, cold winters and a large number of cloudy days. The daily maximum temperature in July ranges from 24 to 29 °C (75 to 85 °F), the daily minimum temperature in January ranges from -21 to -9 °C (-5 to 15 °F) and the mean annual temperature is 7 °C (45 °F). The mean number of freeze-free days is between 90 and 160, and the average number of days per year with snow cover of 2.5 cm (1 in) or more is between 80 and 140. The normal annual total precipitation ranges from 740 to 900 mm (30 to 35 in) with a mean of 823 mm (32 in) (Albert et al. 1986, Barnes 1991, Albert 1995). Northern wet meadows are characterized by local climates with lower temperatures and evaporation rates and shorter growing seasons than the surrounding uplands (Curtis 1959).

Natural Processes: Northern wet meadow is a groundwater-dependent, graminoid-dominated, wetland community. Water levels in northern wet meadow fluctuate seasonally, reaching their peaks in spring and lows in late summer (Costello 1936, Warners 1993). However, water levels typically remain at or near the soil's surface throughout the year (Costello 1936, Curtis 1959, Warners 1993, Eggers and Reed 1997). The community's structure may depend on the maintenance of a consistently high water table. Costello (1936) stated that the *Carex stricta* tussocks disappeared within ten years from a meadow where the water levels were reduced to two to four feet below the surface as a result of tiling. In addition to seasonal flooding, beaver-induced flooding may also play an important role in maintaining the community by occasionally raising water levels and killing encroaching trees and shrubs. In addition, beaver can help create new northern wet meadows by flooding swamp forests and northern shrub thickets and thus creating suitable habitat for the growth of shade-intolerant wet meadow species.

Photo by Joshua G. Cohen

Beaver flooding along streams can create and maintain northern wet meadow.

Evidence from wetland peat cores and circa 1800 vegetation maps indicate that fire is also an important disturbance factor within northern wet meadows (Curtis 1959, Davis 1979). Analysis of wetland peat cores shows that charcoal fragments are consistently associated with sedge and grass pollen (Davis 1979). Conversely, charcoal fragments are lacking from sections of peat cores dominated by shrub pollen. Fires typically occur in sedge meadows during dry conditions of early spring or late fall (White 1965). By reducing leaf litter and allowing light to reach the soil surface and stimulate seed germination, fire can play an important role in maintaining wet meadow seed banks and species diversity (Warners 1997, Kost and De Steven 2000). Fire also plays a critical role in maintaining species richness in many community types by creating micro-niches for small species and temporarily reducing competition from robust perennials (Leach and Givnish 1996). In the absence of fire, a thick layer of leaf litter can develop that stifles seed germination and seedling establishment. Another critically important attribute of fire for maintaining open sedge meadow is its ability to temporarily reduce shrub cover (White 1965, Reuter

1986, Hoffman 2002). In the absence of fire or flooding, all but the wettest sedge meadows typically convert to shrub thicket and eventually swamp forest (Curtis 1959). Because many of the species that inhabit wet meadow are shade-intolerant, species richness usually declines following shrub and tree invasion (Curtis 1959, White 1965, Reuter 1986).

Vegetation Description: Northern wet meadow is a sedge-dominated wetland that typically has 100% vegetative cover in the ground layer (Curtis 1959, Eggers and Reed 1997) and is often dominated by *Carex stricta* (tussock sedge) (Stout 1914, Costello 1936, Curtis 1959, Warners 1997, Kost and De Steven 2000). Because the roots of *Carex stricta* form large hummocks or tussocks, the species is often responsible for the community's hummock and hollow structure. Individual culms of *Carex stricta* grow from the tussocks, which may reach more than one meter in height and half a meter in diameter and live for more than 50 years (Costello 1936). The *Carex stricta* tussocks can occur at very high densities (1 to 4 per m_2) and occupy more than 40% of a meadow's area (Costello 1936). Because the shaded areas between tussocks are often covered with standing water and leaf litter, many of the shorter species inhabiting sedge meadows grow almost exclusively from the sides or tops of *Carex stricta* tussocks.

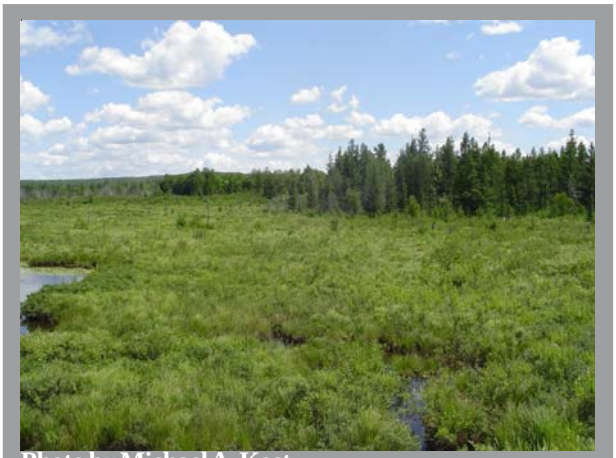


Photo by Michael A. Kost

Meandering streams, sedge tussocks, and scattered trees and shrubs are prevalent structural attributes of northern wet meadows that influence floristic and faunal composition.

Other sedges that commonly occur in northern wet meadow include *Carex aquatilis* (water sedge), *C. bebbii* (Bebb's sedge), *C. buxbaumii* (Buxbaum's sedge), *C. comosa* (long-hair sedge), *C. hystericina* (bottlebrush sedge), *C. lacustris* (lake or hairy sedge), *C. pellita* (woolly sedge), *C. lasiocarpa* (wiregrass sedge), *C. rostrata* (beaked sedge), *C. stipata* (saw-beak sedge), *C. vesicaria* (blister sedge), and *C. vulpinoidea* (fox sedge). Although most of the associated sedge species tend to be randomly interspersed, *Carex lacustris*, *C. lasiocarpa*, *C. rostrata*, and *C. vesicaria* can often occur as dominants or codominants.

The most dominant grass species in northern wet meadow is *Calamagrostis canadensis* (bluejoint grass) (Stout 1914, Kost and De Steven 2000). Other common grasses include *Bromus ciliatus* (fringed brome), *Glyceria canadensis* (rattlesnake grass), *G. striata* (fowl manna grass), *Muhlenbergia glomerata* (marsh wild timothy), *M. mexicana* (leafy satin grass), and *Poa palustris* (fowl meadow grass). *Eleocharis erythropoda* (bald spike-rush), *Typha latifolia* (broad-leaved cat-tail), *Cladium marisicoides* (twig-rush), and *Scirpus atrovirens* (green bulrush) are also common graminoids. Sedge meadows disturbed by agricultural use, grazing, drainage, and/or filling are frequently dominated by *Phalaris arundinaceae* (reed canary grass), an extremely aggressive grass that forms persistent, monotypic stands (Eggers and Reed 1997).

A wide variety of wetland forbs occur scattered in northern wet meadow. Due to the high moisture conditions during the spring, many of the forbs bloom in the summer and fall (Curtis 1959, Hoffman 2002). The following are some of the more common species: *Anemone canadensis* (Canada anemone), *Asclepias incarnata* (swamp milkweed), *Aster lanceolatus* (eastern-lined aster), *A. lateriflorus* (side-flowering aster), *A. puniceus* (swamp aster), *A. umbellatus* (flat-topped white aster), *Campanula aparinoides* (marsh bellflower), *Cicuta bulbifera* (water-hemlock), *C. maculata* (water-hemlock), *Cirsium muticum* (swamp thistle), *Epilobium strictum* (downy willowherb), *Eupatorium maculatum* (joe-pye-weed), *E. perfoliatum* (common boneset), *Euthamia graminifolia* (grass-leaved goldenrod), *Galium asprellum* (rough bedstraw), *G. trifidum* (small bedstraw), *Impatiens capensis* (jewelweed), *Iris versicolor* (wild blue flag), *Lathyrus palustris* (marsh pea), *Lycopus americanus* (American water-horehound), *L. uniflorus* (northern bugleweed), *Lysimachia thyrsifolia* (tufted loosestrife), *Mentha arvensis* (wild mint), *Polygonum amphibium* (water

smartweed), *Potentilla palustris* (marsh cinquefoil), *Rumex orbiculatus* (great water dock), *Sagittaria latifolia* (common arrowhead), *Scutellaria galericulata* (common skullcap), *Solidago canadensis* (Canada goldenrod), *S. gigantea* (late goldenrod), *S. patula* (swamp goldenrod), *Thalictrum dasycarpum* (purple meadow rue), *Triadenum fraseri* (marsh St. John's-wort), *Verbena hastata* (blue vervain), and *Viola cucullata* (marsh violet). Characteristic fern or fern allies include *Dryopteris cristata* (crested woodfern), *Equisetum arvense* (common horsetail), *E. fluviatile* (water horsetail), *Onoclea sensibilis* (sensitive fern), and *Thelypteris palustris* (marsh fern).

Northern wet meadow can also contain numerous, scattered shrub and tree species. Shrub and tree encroachment is especially pronounced in sites that have altered flooding or fire regimes. Prevalent shrubs include *Alnus rugosa* (tag alder or speckled alder), *Betula pumila* (bog birch), *Cornus stolonifera* (red-osier dogwood), *Potentilla fruticosa* (shrubby cinquefoil), *Salix* spp. (willows), *Spiraea alba* (meadowsweet), and *S. tomentosa* (steeplebush). Scattered trees and tree saplings are often found invading northern wet meadow. Typical tree species include *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), *Larix laricina* (tamarack), *Populus balsamifera* (balsam poplar), *Populus tremuloides* (quaking aspen), and *Thuja occidentalis* (northern white-cedar). (Above species lists compiled from Michigan Natural Features Inventory database, Curtis 1959, Reuter 1986, Eggers and Reed 1997, Faber-Langendoen 2001, Hoffman 2002, NatureServe 2006).

Michigan Indicator Species: bluejoint grass, common boneset, great water dock, joe-pye-weed, lake sedge, marsh bellflower, northern bugleweed, swamp aster, tussock sedge, and tufted loosestrife.

Other Noteworthy Species: Several rare plants can be found in northern wet meadow and associated open wetlands including *Cacalia plantaginea* (Indian plantain, state special concern), *Carex wiegandii* (Wiegand's sedge, state threatened), *Gentiana linearis* (linear-leaved gentian, state threatened), *Parnassia palustris* (marsh-grass-of-Parnassus, state threatened), *Petasites sagittatus* (sweet coltsfoot, state threatened), and *Vaccinium cespitosum* (dwarf bilberry, state threatened), which is the host plant for *Lycaeides idas nabokovi* (northern blue butterfly, state threatened).

Northern wet meadow provides habitat for numerous herptiles such as *Clemmys guttata* (spotted turtle, state threatened), *Emydoidea blandingii* (Blanding's turtle, state special concern), *Glyptemys insculpta* (wood turtle, state special concern), *Pseudacris triseriata maculata* (boreal chorus frog, state special concern), and *Sistrurus catenatus catenatus* (eastern massasauga, federal candidate species and state special concern). The late-blooming composites found in sedge meadows supply an important food source for insects, which in turn support songbirds. The hummock-hollow microtopography provides excellent nesting habitat for wetlands birds (Eggers and Reed 1997). Rare birds that utilize these wetlands include *Asio flammeus* (short-eared owl, state endangered), *Botaurus lentiginosus* (American bittern, state special concern), *Chlidonias niger* (black tern, state special concern), *Circus cyaneus* (northern harrier, state special concern), *Cistothorus palustris* (marsh wren, state special concern), *Coturnicops noveboracensis* (yellow rail, state threatened), *Gallinula chloropus* (common moorhen, state special concern), *Ixobrychus exilis* (least bittern, state threatened), *Phalaropus tricolor* (Wilson's phalarope, state special concern), *Rallus elegans* (king rail, state endangered), and *Sterna forsteri* (Forster's tern, state special concern). *Alces alces* (moose, state threatened), *Canis lupus* (gray wolf, state threatened), and *Lynx canadensis* (lynx, state endangered) utilize sedge meadow habitat. *Oncocnemis piffardi* (three-striped oncocnemis, state special concern moth) utilizes northern wet meadows, especially where its host plant meadowsweet is prevalent.

Photo by Joshua G. Cohen

Northern wet meadows contribute significantly to the overall biodiversity of northern Michigan and also provide important ecosystem services.

Michigan Natural Features Inventory
P.O. Box 30444 - Lansing, MI 48909-7944
Phone: 517-373-1552

Conservation and Biodiversity Management: Northern wet meadows contribute significantly to the overall biodiversity of northern Michigan by providing habitat to a wide variety of plant and animal species including numerous rare species. In addition, sedge meadows provide ecosystem services, protecting water quality by assimilating nutrients, trapping sediment, and retaining storm and floodwaters (Eggers and Reed 1997). Protecting the hydrology of northern wet meadow is imperative for the community's continued existence and includes avoiding surface water inputs to meadows from drainage ditches, agricultural fields, road construction, and logging in the adjacent uplands, and protecting groundwater recharge areas by maintaining native vegetation types in the uplands surrounding the community. Resource managers operating in uplands adjacent to sedge meadows should take care to minimize the impacts of management to hydrologic regimes, especially increased surface flow. This can be accomplished by establishing no-cut buffers around wet meadows and avoiding road construction and complete canopy removal in stands immediately adjacent to wetlands.

In fire-prone landscapes, management for wet meadow should include the use of prescribed fire (Curtis 1959, White 1965). Prescribed fire can help reduce litter, stimulate seed germination, promote seedling establishment, and bolster grass, sedge, and perennial and annual forb cover (Bowles et al. 1996, Warners 1997, Kost and De Steven 2000). While prescribed fire can be an important tool for rejuvenating wet meadow seed banks, it can also help ensure that the community remains in an open condition by temporarily setting back invading woody species (Reuter 1986). Using prescribed fire to control shrub invasion in sedge meadows has also been shown to be 85% less expensive to implement than manual cutting (Reuter 1986). Prescribed fire should not be utilized during periods of drought to avoid igniting the community's organic soils (Curtis 1959, Vogl 1969). Burning in the early spring while the soil moisture is high reduces the chances of destroying the organic soils (Reuter 1986), however, growing season burns can be more effective at reducing aggressive woody vegetation (Bowles et al. 1996). If prescribed burning is not feasible, mowing can be used to temporarily reduce woody plant cover but should be restricted to the winter, when ground frost will reduce disturbance to soils, herbaceous plants, and hydrology, or late summer and fall when the meadows are dry (White 1965, Reuter 1986). In situations where shrub encroachment is severe, resource managers may need to cut invading shrubs and herbicide the cut stumps, especially for shrub species that are capable of resprouting, like *Alnus rugosa* (tag alder or speckled alder) or *Rhamnus frangula* (glossy buckthorn) (Heidorn 1991).

Invasive species that can occur in northern wet meadow include glossy buckthorn, common buckthorn, purple loosestrife, reed canary grass, *Typha angustifolia* (narrow-leaved cat-tail), *Typha* x*glauca* (hybrid cat-tail), *Rosa multiflora* (multiflora rose), and *Phragmites australis* (reed). Each of these species is capable of significantly altering northern wet meadow community structure and dramatically reducing species richness. Management should strive to prevent the establishment and spread of these invasive species. Establishment of invasive species can be prevented by maintaining the hydrologic and fire disturbance regimes and avoiding grazing (Reuter 1986).

Restoration of degraded northern wet meadows depends on the occurrence of water-saturated peat and muck soils, maintenance of waters levels very near the soil surface throughout the year, protection from shrub encroachment and invasive species, and the availability of appropriate seed stock (Reuter 1986). Finding viable seed for sedges, the plant group responsible for the overall structure of wet meadow, may be a difficult task. Costello (1936) reports that in more than six years of studying *Carex stricta*–dominated sedge meadows, he did not find a single seedling of the species. Because of the difficulty of restoring wet meadow in the absence of favorable hydrology and intact organic soils, conservation efforts should focus on protecting and managing the remaining community occurrences (Reuter 1986).

Research Needs: Further work on community classification is needed to elucidate differences among sedge meadow types both within and among ecoregions (Reuter 1986). More studies need to focus on the flooding and fire regimes of northern wet meadow and the interaction of disturbance factors. As noted by Hammerson (1994), beavers significantly alter the ecosystems they occupy. An important research question to examine is how the wetland ecosystems of the Great Lakes have been and continue to be affected by the fluctuating beaver population. Experimentation is

needed to determine how best to prevent shrub encroachment of open wetlands that are threatened by conversion to northern shrub thicket (Reuter 1986). The examination of non-native plant establishment in northern wet meadows and means of controlling invasive species is especially critical. In addition, scientists should gain an understanding of plant and animal community responses to the frequency and seasonal timing of prescribed burning and anthropogenic flooding. Effects of management within northern wet meadow need to be monitored to allow for assessment and refinement of management techniques. Conservation and management of northern wet meadow will be stimulated by research on the importance of the community for maintaining rare species and regional biodiversity.

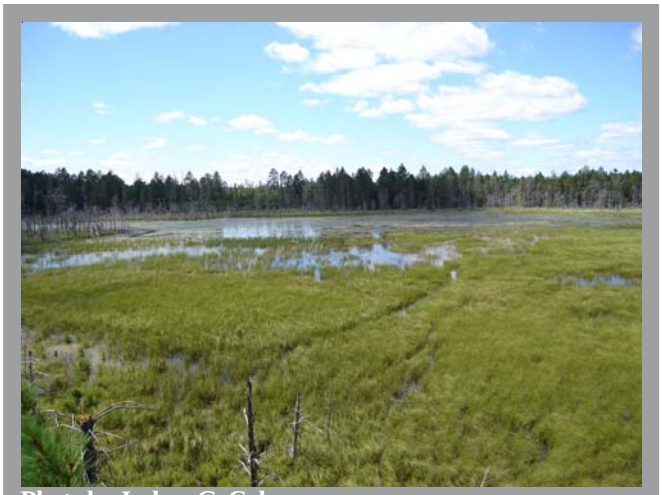


Photo by Joshua G. Cohen

Important research needs include ascertaining how flooding and fire interact at both the landscape and local scales to influence northern wet meadows and associated wetlands.

Similar Communities: emergent marsh, Great Lakes marsh, intermittent wetland, southern wet meadow, northern fen, northern shrub thicket, patterned fen, poor fen, wet-mesic sand prairie, and wet prairie.

Other Classifications:

Michigan Natural Feature Inventory (MNFI) Circa 1800 Vegetation: Wet Meadow (6224), Emergent Marsh or Shrub Swamp (6221)

Michigan Department of Natural Resources (MDNR): L-lowland brush, N-marsh, V-bog

Michigan Resource Information Systems (MIRIS): 622 (emergent wetland)

Integrated Forest Monitoring, Assessment, and Prescription (IFMAP): Emergent Wetland (623), Mixed Non-Forest Wetland (629)

The Nature Conservancy National Classification: CODE; ALLIANCE; ASSOCIATION; COMMON NAME

V.A.5.N.k; *Calamagrostis canadensis* Seasonally Flooded Herbaceous Alliance; *Calamagrostis canadensis – Phalaris arundinacea* Herbaceous Vegetation; Bluejoint – Reed Canary Grass Herbaceous Vegetation; Bluejoint Wet Meadow.

V.A.5.N.k; *Carex aquatilis* Seasonally Flooded Herbaceous Alliance; *Carex aquatilis – Carex* spp. Herbaceous Vegetation; Aquatic Sedge – Sedge Species Herbaceous Vegetation; Water Sedge Wet Meadow.

V.A.5.N.k; *Carex lacustris* Seasonally Flooded Herbaceous Alliance; *Carex lacustris* Herbaceous Vegetation; Lake Sedge Herbaceous Vegetation; Lake Sedge Wet Meadow.

V.A.5.N.k; *Carex* (*rostrata, urticulata*) Seasonally Flooded Herbaceous Alliance; *Carex rostrata – Carex lacustris* – (*Carex vesicaria*) Herbaceous Vegetation; Swollen-Beak Sedge – Lake Sedge – (Inflated Sedge) Herbaceous Vegetation; Northern Sedge Wet Meadow.

V.A.5.N.k; *Carex stricta* Seasonally Flooded Herbaceous Alliance; *Carex stricta – Carex* spp. Herbaceous Vegetation; Tussock Sedge – Sedge Species Herbaceous Vegetation; Tussock Sedge Wet Meadow.

NatureServe Ecological Systems Classification:

CES201.582: Laurentian-Acadian Wet Meadow Shrub Swamp

CES202.701: North-Central Interior Wet Meadow-Shrub Swamp

Related Abstracts: American bittern, black tern, Blanding's turtle, dwarf bilberry, eastern massasauga, floodplain forest, Forster's tern, Great Lakes marsh, Indian plantain, intermittent wetland, king rail, least bittern, marsh-grass-of-Parnassus, northern blue butterfly, northern fen, northern harrier, northern shrub thicket, poor fen, short-eared owl, southern wet meadow, spotted turtle, sweet coltsfoot, wood turtle, and yellow rail.

References:

Albert, D.A. 1995. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: A working map and classification. Gen. Tech. Rep. NC-178. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/habitat/rlandscp/index.htm (Version 03JUN1998)

Albert, D.A., S.R. Denton, and B.V. Barnes. 1986. Regional landscape ecosystems of Michigan. University of Michigan, School of Natural Resources, Ann Arbor, MI. 32 pp. & map.

Barnes, B.V. 1991. Deciduous forest of North America. Pp 219-344 in Temperate deciduous forests ed. E. Röhrig and B. Ulrich. Elsevier, Amsterdam. 635 pp.

Braun, E.L. 1950. Deciduous forests of eastern North America. Hafner Press, New York, NY. 596 pp.

Bowles, M., J. McBride, N. Stynoff, and K. Johnson. 1996. Temporal changes in vegetation composition and structure in a fire-managed prairie fen. Natural Areas Journal 16: 275-278.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A working classification of U.S. Terrestrial Systems. NatureServe, Arlington, VA.

Costello, D.F. 1936. Tussock meadows in southeastern Wisconsin. Botanical Gazette 97: 610-48.

Curtis, J.T. 1959. The vegetation of Wisconsin: An ordination of plant communities. University of Wisconsin Press, Madison, WI. 657 pp.

Davis, A.M. 1979. Wetland succession, fire and the pollen record: A Midwestern example. American Midland Naturalist 102: 86-94.

Eggers, S.D., and D.M. Reed. 1997. Wetland plants and plant communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St Paul, MN. 263 pp.

Faber-Langendoen, D., ed. 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA. 61 pp. + appendix (705 pp.).

Hammerson, G. 1994. Beaver (*Castor canadensis*): Ecosystem alterations, management, and monitoring. Natural Areas Journal 14(1): 44-57.

Heidorn, R. 1991. Vegetation management guideline: Exotic buckthorn – common buckthorn (*Rhamnus cathartica* L.), glossy buckthorn (*Rhamnus frangula* L.), Dahurian buckthorn (*Rhamnus davurica* Pall.). Natural Areas Journal 11(4): 216-217.

Hoffman, R. 2002. Wisconsin's natural communities. How to recognize them, where to find them. University of Wisconsin Press, Madison, WI. 375 pp.

Leach, M.K., and T.J. Givnish. 1996. Ecological determinants of species loss in remnant prairies. Science 273: 1555-1558.

Jean, M., and A. Bouchard. 1991. Temporal changes in wetland landscapes of a section of the St. Lawrence River, Canada. Environmental Management 15(2): 241-250.

Kost, M.A. 2001. Natural community abstract for southern wet meadow. Michigan Natural Features Inventory, Lansing, MI. 5 pp.

Kost, M.A., and D. De Steven. 2000. Plant community responses to prescribed burning in Wisconsin sedge meadows. Natural Areas Journal 20: 36-49.

Kost, M.A., and J.G. Cohen. 2005. A reassessment of high quality natural communities on Camp Grayling. Report for Michigan Department of Military and Veterans Affairs, Camp Grayling, MI. Michigan Natural Features Inventory, Lansing, MI. 124 pp.

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.

NatureServe. 2005. International ecological classification standard: Terrestrial ecological classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of January 13, 2005.

NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [Web application]. Version 4.2. NatureServe, Arlington, VA. Available http://www.natureserve.org/explorer. (Accessed: March 03, 2005.)

Reuter, D.D. 1986. Sedge meadows of the upper Midwest: A stewardship summary. Natural Areas Journal 6(4): 27-34.

Stout, A.B. 1914. A biological and statistical analysis of the vegetation of a typical wild hay meadow.

Transactions of the Wisconsin Academy of Sciences, Arts, and Letters 17: 405-57.
Vogl, R.J. 1969. One hundred and thirty years of plant succession in a Southeastern Wisconsin lowland. Ecology 50: 248-55.
Warners, D.P. 1993. Species diversity in southern Michigan sedge meadows. Unpublished report to The Nature Conservancy, Michigan Chapter, East Lansing, MI 35 pp.
Warners, D.P. 1997. Plant diversity in sedge meadows: Effects of groundwater and fire. Ph.D. dissertation, University of Michigan, Ann Arbor, MI. 231 pp.
White, K.L. 1965. Shrub-carrs of southeastern Wisconsin. Ecology 46: 286-304.

Abstract Citation:

Cohen, J.G., and M.A. Kost. 2007. Natural community abstract for northern wet meadow. Michigan Natural Features Inventory, Lansing, MI. 9 pp.

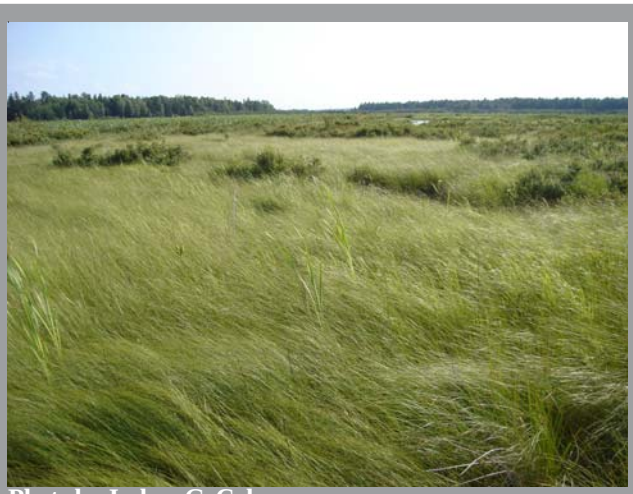


Photo by Joshua G. Cohen

Sedges dominate this northern wet meadow in Marquette County, Upper Michigan.

Funding for abstract provided by Michigan Department of Military and Veterans Affairs.

Michigan Natural Features Inventory
P.O. Box 30444 - Lansing, MI 48909-7944
Phone: 517-373-1552