Interdunal Wetland Community Abstract

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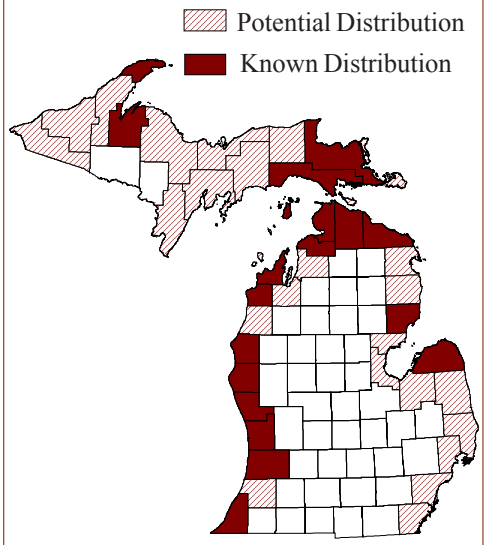

Global and State Rank: G2?/S2

Overview: Interdunal wetland is a rush, sedge, and shrub dominated wetland situated in depressions within open dunes or between beach ridges along the Great Lakes and possibly other large freshwater lakes, experiencing a fluctuating water table seasonally and yearly in synchrony with lake level changes.

Common Names: Interdunal Wetland. This community is called panne in Ontario, Illinois, and Indiana.

Range: Interdunal wetland is associated with portions of the shoreline of all of the Great Lakes, from eastern Lake Ontario to western Lake Superior and the south shore of Lake Michigan. Interdunal wetlands can occur wherever there are large coastal parabolic or perched dunes, or where narrow swales, pannes, or troughs occur behind a water- or wind-formed sand beach ridge. It is likely that interdunal wetlands also occur along the shoreline of large inland lakes throughout the glaciated northeastern U.S. and Canada, but there is little or no documentation of such occurrences. No systematic surveys of interdunal wetlands have been conducted on Michigan's Great Lakes shoreline, although small portions of over 50 interdunal wetlands were sampled as part of a state-wide inventory of wooded dune and swale complexes (Comer and Albert 1993, Albert 2006). Interdunal wetlands are most common along the eastern shore of Lake Michigan, among parabolic dunes, and along the north shores of Lakes Michigan and Huron, where low beach ridges and dune and swale complexes are prevalent.

Rank Justification: While there are only 27 survey records of interdunal wetland sites surveyed in Michigan, there are at least twice that many sites associated with coastal Great Lakes sand dunes or the shoreline portion of wooded dune and swale complexes (Comer and Albert 1993). Forty interdunal wetlands have been documented: 2 in Illinois, where the community is ranked S1 (White and Madany 1978), 6 in Indiana (S1) (Homoya et al. 1985), 27 in Michigan (S2), and 5 in Wisconsin (S1). No other occurrences have been documented, but the community also occurs in Ontario (S2,S1). It is found in 14 ecoregional subsections in Michigan (Albert 1995). Interdunal wetlands have been encountered by the author in Pennsylvania and New York as well. Because of the narrow, linear configuration of most interdunal wetlands, the average acreage in Michigan is approximately 50 acres (20 hectares), with 20 recorded sites ranging from 2 to 268 acres (1 to 108 hectares). Sizes of 29 occurrences across the Great Lakes range from 1 to 430 acres (1 to 172 hectares) (Faber-Langendoen 2001).

Landscape Context: Interdunal wetlands occur on sand in the open swales or pannes between beach ridges, in wind-formed depressions in dune fields, and in abandoned river channels that once flowed parallel to

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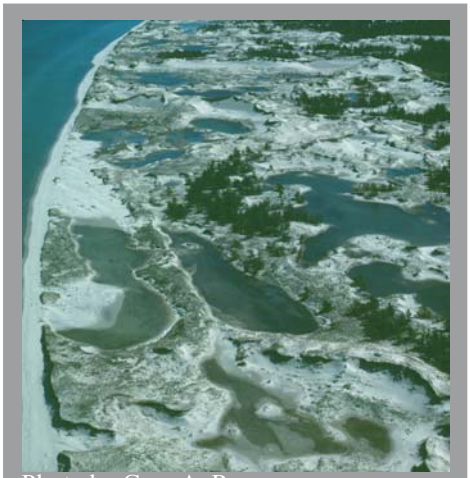
the lakeshore behind the foredune (Kost et al. 2007). Interdunal wetlands occur near the shoreline of all of the Laurentian Great Lakes. Proximity to the Great Lakes results in moderated climate and high precipitation. Some of Michigan's larger freshwater lakes may be large enough that storm waves maintain an open beach and adjacent wet swales, but no surveys have been conducted on any inland lakes. Many of Michigan's larger lakes in northern Lower Michigan and eastern Upper Michigan have abundant sand to maintain a shoreline beach with swales. Similar large lakes of glacial origin are common throughout Canada and the Great Lakes and northeastern states, on a variety of glacial landforms. Interdunal wetlands occur adjacent to sand and gravel beaches, and within wooded dune and swale complexes, open dunes, and Great Lakes barrens.

Photo by Joshua G. Cohen

Interdunal wetland within open dunes along the northern Lake Michigan shoreline.

Natural Processes: Water-level fluctuations of the adjacent Great Lakes are important for maintaining open interdunal wetlands. Interdunal wetlands are formed when water levels of the Great Lakes drop, creating a swale or linear depression between an existing, more inland foredune (beach ridge) and the newly formed foredune along the water's edge. Rising Great Lakes water levels or storm waves can result in interdunal wetlands being partially or completely buried by sand (Hiebert et al. 1986, Albert 2004). Water level fluctuations are similarly important for destabilizing parabolic or perched dunes, producing interdunal wetlands at the bases of blowouts. Studies by several researchers have documented the long-term water level changes and dynamics of both the parallel coastal beach ridges and the parabolic and perched dune fields with their associated interdunal wetlands (Dorr and Eschman 1984, Thompson 1992, Lichtner 1998, Loope and Arbogast 2000). Interdunal wetlands close to the Great Lakes shoreline are typically open, supporting herbaceous vegetation, while shrubs and wetland trees become more common in most swales farther inland.



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Water-level fluctuations of the adjacent Great Lakes generate and maintain interdunal wetlands.

The sand in most interdunal wetlands is similar in composition to that of the surrounding beach ridges or dunes, consisting largely of quartz with lesser amounts of feldspar, magnetite, and traces of other minerals, such as calcite, garnet, and hornblende (Albert 2006). Both the saturated sand and the pondwater of interdunal wetlands along the lower Great Lakes are neutral to moderately alkaline because of traces of calcareous minerals in the lake-edge sands and because of carbonate-rich groundwater flowing off uplands of limestone bedrock or limestone-rich till. In the Straits of Mackinac region, the underlying soil in the interdunal wetlands is often fine-textured loams or clays, with pH ranging from neutral to moderately alkaline (pH 6.6 to 8.4). When these wetlands are inundated for extended periods, the carbonate-rich groundwater provides the nutrients for rapid growth of stonewort (*Chara* spp.) and other algae. The metabolism of these algae produces calcium carbonate, which precipitates as a fine, white mud-like substance called marl. As marl accumulates, it helps maintain moderately alkaline conditions and it facilitates a change in species composition toward dominance by calciphiles and a northern fen natural community. Warm summer temperatures and evaporation can result in warm,

shallow water that accelerates algal metabolism and marl production, and thus the change from interdunal wetland to northern fen. Because of the alkaline conditions, marl-covered portions of interdunal wetlands typically have low plant and animal diversity. On Lake Superior, there is little or no calcite or limestone; as a result alkalinity is lower than in the other Great Lakes and marl is not deposited within interdunal wetlands.
Springs occasionally occur within interdunal wetland complexes, probably resulting from hydrological heads developed within adjacent dunes or limestone bedrock uplands. In the Lake Michigan dunes of Indiana, these springs help maintain open, herbaceous conditions within the wetland (Hiebert et al. 1986).

Interdunal wetlands located farther inland in dune fields are less subject to water-level fluctuations linked to the Great Lakes, and also much less subject to being filled by moving sand during storms. The stable conditions allow for the development of organic soils, as well as greater dominance by shrubs and occasionally small trees, both of which facilitate the succession of herb-dominated interdunal wetlands to other wetland community types.

Vegetation Description: The data used for this section is almost exclusively from narrow interdunal wetlands along the Great Lakes shoreline, with little data from hollows or depressions in dune fields and no data from large inland lakes. Most of the common and characteristic plant species of the interdunal wetland tolerate or require the carbonate-rich conditions of the Great Lakes shoreline. The majority of plants are perennial herbs with strongly-developed rhizomes. Dominant plants include Baltic rush (*Juncus balticus*) and twig rush (*Cladium mariscoides*), both species able to survive sand burial and water level fluctuations. Some other common plants are bog lobelia (*Lobelia kalmii*), horned bladderwort (*Utricularia cornuta*), common bog arrow-grass (*Triglochin maritimum*), Kalm's St. John's-wort (*Hypericum kalmianum*), false asphodel (*Tofieldia glutinosa*), golden-seeded spike-rush (*Eleocharis elliptica*), grass-leaved goldenrod (*Euthamia graminifolia*), shrubby cinquefoil (*Potentilla fruticosa*), three square (*Schoenoplectus pungens*), northern white-cedar (*Thuja occidentalis*), blue joint grass (*Calamagrostis canadensis*), and beak-rush (*Rhynchospora capillacea*).


Photo by Joshua G. Cohen
Interdunal wetlands are typically dominated by graminoids with shrubs occurring along their margins

Characteristic Plants: Other typical species include several sedges (*Carex aquatilis*, *C. garberi*, *C. viridula*, *C. lasiocarpa*, *C. stricta*), small-fringed gentian (*Gentianopsis procera*), blue-leaf willow (*Salix myricoides*), geocaulon (*Geocaulon lividum*), purple gerardia (*Agalinis purpurea*), balsam ragwort (*Senecio pauperculus*), Houghton's goldenrod (*Solidago houghtonii*), Ohio goldenrod (*Solidago ohioensis*), silverweed (*Potentilla anserina*), grass-of-Parnassus (*Parnassia glauca*), scouring rush (*Equisetum variegatum*), sweet gale (*Myrica gale*), tamarack (*Larix laricina*), spike rush (*Eleocharis quinqueflora*), hardstem bulrush (*Schoenoplectus acutus*), pitcher-plant (*Sarracenia purpurea*), sand dune willow (*Salix cordata*), Indian paintbrush (*Castilleja coccinea*), swamp candles (*Lysimachia terrestris*), dwarf Canada primrose (*Primula mistassinica*), smooth scouring rush (*Equisetum laevigatum*), red osier dogwood (*Cornus stolonifera*), low calamint (*Calamintha arkansana*), tag alder (*Alnus rugosa*), ticklegrass (*Agrostis hyemalis*), marsh cinquefoil (*Potentilla palustris*), rose pogonia (*Pogonia ophioglossoides*), jack pine (*Pinus banksiana*), marsh pea (*Lathyrus palustris*), hair grass (*Deschampsia cespitosa*), slender bog arrow-grass (*Triglochin palustris*), panic grass (*Panicum lindheimeri*), and marsh bellflower (*Campanula aparinoides*).

Unlike the interdunal wetlands of the lower Great Lakes, those along the shores of Lake Superior are not buffered by calcium carbonate, and as a result they often become acidic and support a flora with more acid-tolerant shrubs and small trees, including leatherleaf (*Chamaedaphne*

calyculata), black chokeberry (*Aronia prunifolia*), bog rosemary (*Andromeda glaucophylla*), Labrador tea (*Ledum groenlandicum*), and black spruce (*Picea mariana*), along with more acid-tolerant sedges, like *Carex paupercula*. *Sphagnum* mosses are a major component in some Lake Superior interdunal wetlands. In the interdunal swales that are continuously inundated along Lake Superior, an organic substrate can develop and facilitate the development of a bog natural community. In Wisconsin's interdunal wetlands along Lake Superior, other characteristic plants include pipewort (*Eriocaulon septangulare*) and small purple bladderwort (*Utricularia resupinata*) (Epstein et al. 2002). Along Lake Superior, interdunal wetlands also form between irregularly formed sand spits, as at Whitefish Point, where hundreds of small interdunal wetlands have formed. The flora of the Whitefish Point wetlands shares many of the more acid-tolerant shrubs already described for Lake Superior, but no data have been collected on this large wetland complex.

Zonation: The coastal swales often show little zonation, although the larger, deeper swales can have shrubs and herbs along their edges, with emergent bulrushes, spike-rushes, and cat-tails in the shallow water, and submergent and floating plants in the deepest water at the center of the swale. In dry years the entire wetland may be dry or only moist, in which case many plants from the adjacent beach ridges can establish. Wetlands among parabolic dunes are often drier, supporting a greater percentage of shrubs and sometimes trees. When trees become dominant, the plant community is no longer considered interdunal wetland, but instead either part of a wooded dune and swale complex along large sandy embayments, or a Great Lakes barren within a parabolic or perched dune field.

Associated Species: Interdunal wetland supports many of the plants found growing on adjacent sand beach or carbonate-rich shorelines. Most of the plants growing on limestone cobble shore or coastal fen are also found growing within interdunal wetlands (Kost et al. 2007).

Invasive Plants: Among the invasive plant species are linear leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha* X *glauca*), redtop (*Agrostis gigantea*), mullein (*Verbascum thapsus*), Canada thistle (*Cirsium arvense*), marsh thistle (*Cirsium palustre*), Russian thistle (*Salsola kali*), dog mustard (*Erucastrum gallicum*), Canada bluegrass (*Poa compressa*), lawn prunella (*Prunella vulgaris*), and sheep sorrel (*Rumex acetosella*).

Michigan Indicator Species: Baltic rush (*Juncus balticus*), twig rush (*Cladium mariscoides*), bog lobelia (*Lobelia kalmii*), horned bladderwort (*Utricularia cornuta*), common bog arrow-grass (*Triglochin maritimum*), Kalm's St. John's-wort (*Hypericum kalmianum*), false asphodel (*Tofieldia glutinosa*), golden-seeded spike-rush (*Eleocharis elliptica*), grass-leaved goldenrod (*Euthamia graminifolia*), shrubby cinquefoil (*Potentilla fruticosa*), three square (*Schoenoplectus pungens*), beak-rush (*Rhynchospora capillacea*), and seedlings of northern white-cedar (*Thuja occidentalis*).

Other Noteworthy Species: These quickly warming wetlands provide important feeding areas for migrating shorebirds, waterfowl, and songbirds in the spring. They are also important foraging areas for waterfowl in the fall. Spotted sandpipers (*Actitis macularia*) breed along the margins of the wetlands and piping plovers (*Charadrius melodus*, state and federally endangered) forage at their edges. Great blue herons (*Ardea herodias*) regularly feed on invertebrates in the swales. Among the invertebrates occupying interdunal wetlands are dragonflies (Suborder *Anisoptera*), damselflies (Suborder *Zygoptera*), midges (Family *Chionomidae*), and probably many others. Leeches (Family *Hirundinae*) are commonly observed invertebrates in the warm, shallow waters of interdunal swales along Lakes Michigan and Huron.

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Interdunal wetlands provide important foraging areas for migrating shorebirds, waterfowl, and songbirds.

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Special Animals: Marly interdunal wetlands in the Straits area of Lakes Michigan and Huron support Hine's emerald dragonfly (*Somatochlora hineana*, state endangered) (Soluk et al. 1998, Zercher 1999). Other rare animals include Blanchard's cricket frog (*Acris crepitans blanchardi*, state special concern), spotted turtle (*Clemmys guttata*, state threatened), Blanding's turtle (*Emys blandingii*, state special concern), two land snails (*Catinella exile*, state special concern, and *Vallonia albula*, state special concern), and three other insects, three-striped oncocnemi (*Oncocnemis piffardi*, state special concern), delicate meadow katydid (*Orchelimum delicatum*, state special concern), and aweme borer (*Papaipema aweme*, state special concern).

Special Plants: Rare plants found in alkaline interdunal wetlands include butterwort (*Pinguicula vulgaris*, state special concern), floating bladderwort (*Utricularia inflata*, state endangered), Houghton's goldenrod (*Solidago houghtonii*, state threatened), northern appressed clubmoss (*Lycopodiella subappressa*, state special concern), waterthread pondweed (*Potamogeton bicupulatus*), yellow pitcher-plant (*Sarracenia purpurea* ssp. *heterophylla*, state threatened), and zigzag bladderwort (*Utricularia subulata*, state threatened). No rare plants are known from acidic Lake Superior wetlands.

Conservation and Management: Off-road vehicles can damage or destroy the vegetation and habitat of interdunal wetlands, as documented at several sites along the northern Lake Michigan and Lake Huron shorelines. Heavy human usage of the adjacent beach can also threaten associated fauna, such as piping plover and other shorebirds.

Research Needs: A systematic survey of interdunal wetlands is needed across the Great Lakes to allow for further refinement of its classification and description of regional variants. In addition, pilot surveys should be conducted on the large, glaciated lakes of northeastern U.S. and Canada, especially those located in areas of sandy glacial sediments. Studying the dynamics of interdunal swales over multiple years would also be a significant contribution to understanding their ecology. Documenting the response of the rare species to water fluctuations may be important, as the relatively small size of the individual interdunal wetlands may increase the susceptibility of populations of rare species to local extinction. Houghton's goldenrod populations have been observed to increase greatly when water levels are low and decrease greatly with high water levels.

Similar Communities: In Michigan, similar natural communities include limestone cobble shore, coastal fen, northern fen, prairie fen, and wooded dune and swale complex. Illinois and Indiana recognize a panne community with a very similar species composition that occurs along the southern Lake Michigan shorelines. New York identifies a maritime freshwater interdunal swale, which shares twig-rush and beak-rush with the Great Lakes interdunal wetlands, and a maritime brackish interdunal swale, which shares only three square (*Schoenoplectus pungens*) (Reschke 1990, Edinger et al. 2002). While New York has sand dunes along the east shore of Lake Ontario, they identify no interdunal wetland community, although they do identify a marl fen and a marl pond shore from inland ponds and wetlands; both communities share many Great Lakes interdunal wetland species. New Hampshire has a coastal interdunal marsh/swale, which occurs along the Atlantic and is dominated largely by shrubs, with few plants shared with the Laurentian Great Lakes flora (Sperduto and Nichols 2004). Ontario recognizes a Great Lakes Meadow Marsh Ecosite with shoreline fens or pannes (Bakowsky 1996). Wisconsin recognizes a Lake Superior interdunal wetland and shore fen, both of which are similar to Michigan's Lake Superior sites, which contain many less carbonate-dependent plants (Epstein et al. 2002). Wisconsin also recognizes two additional plant communities, boreal rich fen and calcareous fen, which are floristically very similar to our interdunal swales on the southern, calcareous Great Lakes shoreline. NatureServe (2006) recognizes interdunal wetlands, but considers it a plant community of the southern Great Lakes; it identifies two associations, "Bluejoint - Hairy Sedge - Twig-rush - Ontario Lobelia Herbaceous Vegetation Great Lakes Sedge Rich Shore Fen" and "Shrubby-cinquefoil – Sweet Gale Rich Shore Fen Shrubland" as possible northern Great Lakes equivalent of interdunal swale (Faber-Langendoen 2001, NatureServe 2006). However, data from Michigan seems to indicate that the northern Lake Huron and Lake Michigan interdunal wetlands share the species of the southern Great Lakes, and that there is an additional northern, more acid type found only on Lake Superior.

Other Classifications:

The Nature Conservancy National Vegetation Classification: (Faber-Langendoen 2001, NatureServe 2006): CODE, ALLIANCE; ASSOCIATION; COMMON NAME

V.A.5.N.k: Cladium marisicoides Seasonally Flooded Herbaceous Alliance; *Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides* - *Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation; Shrubby-cinquefoil / Twig-rush - Baltic Rush - (Limestone Beaksedge) Herbaceous Vegetation; Interdunal Wetland

Related Abstracts: Hine's emerald dragonfly, Blanchard's cricket frog, spotted turtle, Blanding's turtle, dwarf lake iris, Houghton's goldenrod, northern appressed clubmoss, yellow pitcher-plant, zigzag bladderwort, open dune, wooded dune and swale complex, prairie fen, limestone cobble shore.

References:

Albert, D.A. 1995. Region Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification. North Central Forest Experiment Station. Forest Service - U.S. Department of Agriculture. 250 pp. + maps.

Albert, D.A. 2000. Borne of the Wind: An introduction to the Ecology of Michigan Sand Dunes. University of Michigan Press. Ann Arbor, Michigan. 63 pp.

Albert, D.A. 2004. Between Land and Lake: Michigan's Great Lake Coastal Wetlands. MSUE bulletin E2902, Michigan Natural Features Inventory, Lansing, MI.

Bakowsky, W.D. 1996. Natural Heritage Resources of Ontario: Vegetation Communities of Southern Ontario. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, Ontario, 21 pp.

Comer, P.J., and D.A. Albert. 1993. A Survey of Wooded Dune and Swale Complexes in Michigan. MNFI report to Michigan Department of Natural Resources, Land and Water Management Division, Coastal Zone Management Program.159 pp.

Dorr, J.A., Jr., and D.F. Eschman. 1984. Geology of Michigan. University of Michigan Press, Ann Arbor, MI. 470 pp.

Edinger, G.J., D.J. Evans, S. Gebauer, T.G. Howard, D.M. Hunt, and A.M. Olivero (editors). 2002. Ecological Communities of New York State. Second Edition. A revised and expanded edition of Carol Reschke's Ecological Communities of New York State. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY.

Epstein, E., E. Judziewitz, and E. Spencer. 2002. Recognized Natural Communities – Working Document. Wisconsin Natural Heritage Inventory.15 pp.

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

Hiebert, R.D., D.A. Wilcox, and N.B. Pavlovic. 1986. Vegetation patterns in and among pannes (calcareous intradunal ponds) at the Indiana Dunes National Lakeshore, Indiana. American Midland Naturalist 116: 276-281.

Homoya, M.A., D.B. Abrell, J.R. Aldrich, and T.W. Post. 1985. The natural regions of Indiana. Proceedings of the Indiana Academy of Science 94: 245-268.

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.

Lichtner, J. 1998. Primary succession and forest development on coastal Lake Michigan sand dunes. Ecological Monographs 68: 487-510.

Loope, W.L., and A.F. Arbogast. 2000. Dominance of an 150-year cycle of sand-supply change in Lake Holocene dune-building along the eastern shore of Lake Michgan. Quaternary Research 54: 414-422.

NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe, Arlington, Virginia. Available: http://www.natureserve.org/explorer. (Accessed: September 27, 2006.)

Reschke, C. 1990. Ecological Communities of New York. New York Natural Heritage Program, New York State Department of Environmental Conservation, Latham, NY. 96 pp.

Soluk, D.A., B.J. Swisher, D.S. Zercher, J.D. Miller, and A.B. Hults. 1998. The ecology of Hine's emerald dragonfly (*Somatochlora hineana*): Monitoring populations and determining patterns of habitat use. Activity summary and report of findings (September 1996-August 1997). IL Nat. History Survey, Champaign, IL. 111 pp.

Sperduto, D.D., and W. F. Nichols. 2004. Natural Communities of New Hampshire. New Hampshire Natural Heritage Bureau, Concord, New Hampshire, University of New Hampshire Cooperative Extension, Durham, NH.

Thompson, T.A. 1992. Beach-ridge development and lake-level variation in southern Lake Michigan. Sedimentary Geology 80: 305-318.

White, J., and M. Madany. 1978. Classification of natural communities in Illinois. Pages 311-405 in: Natural Areas Inventory technical report. Volume I. Survey methods and results. Illinois Natural Areas Inventory, Urbana, IL.

Zercher, D. 1999. Hine's emerald dragonfly (*Somatochlora hineana*) draft recovery plan. Report to USFWS, Fort Snelling, MN. 110 pp.

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Photo by Vicki L. Dunevitz

Interdunal wetland in Ludington State Park.

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