

A Data Compilation and Assessment of Coastal Wetlands of Wisconsin's Great Lakes

Final Report

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PROJECT DESCRIPTION

The state of Wisconsin is bordered by Lake Superior to the northwest and Lake Michigan to the east. The 820 miles of combined shoreline make up a complex arrangement of ecosystems that contain a rich variety of natural features. Wetlands near the coasts of both lakes provide rich habitat for plants and animals and greatly influence the larger ecosystem processes of the Great Lakes Ecosystem. As transition zones (or ecotones) between land and water, coastal wetlands are often rich in species diversity and provide critical habitat for migratory and nesting birds, spawning fish, and rare plants. However, various types of development and recreation continue to impact coastal wetlands and limit their capacities to perform important ecosystem functions.

Numerous inventories and reports have been completed pertaining to coastal wetlands throughout Wisconsin. For example, the Bureau of Endangered Resources (BER) has completed a number of important inventory and data assessment projects over the last decade aimed at improving our understanding of coastal ecosystems and coastal wetland sites, in particular. However, at the time when this project was initiated (1999) a comprehensive synthesis of coastal wetland information for the Great Lakes had not been completed. Moreover, significant inventory gaps existed throughout the coastal zone in Wisconsin.

The focus of this project was to conduct an assessment of existing coastal wetland data to determine ecologically significant coastal wetland sites within the Lake Michigan and Lake Superior basins. The goals were to identify inventory gaps for guiding future inventory and planning efforts by the Bureau of Endangered Resources and others. The project was implemented in three phases, each one building incrementally upon the previous phase, as follows:

Phase 1: The first year of the project was, primarily, a survey of existing studies and resulted in the identification of 64 Primary Sites within the coastal zones of Lakes Michigan and Superior, including 28 sites near Lake Superior and 36 sites near Lake Michigan. The significance of the sites was determined based on the current level of information available. However, it was acknowledged that large data gaps existed, especially for Lake Michigan coastal wetlands. These gaps were identified focusing on NHI-related data (rare plants, animals, natural communities, and other natural features) and documented as part of the final report (Merryfield 2000) for this phase of the project. Phase I was completed in 2000.

Phase 2: Phase 2 was initiated in October, 2000 with the goal of filling some of the most critical data gaps and developing preliminary products intended, ultimately, to serve as the basis for public documents to be developed in subsequent phases. Several work items were completed including a “windshield survey” of 26 of 36 Lake Michigan Primary Sites (as defined in Phase 1). In addition, prioritization criteria for evaluating the “known ecological significance” of coastal wetland sites were developed and applied to all 64 sites to develop a “top 10” list of priority sites for both Lake Michigan and Lake Superior. Next, future inventory needs for all 64 coastal wetland sites were identified and a prioritized list of sites with large “data gaps” for both Lake Michigan and Lake Superior was developed. In addition, we initiated extensive data gathering

for missing bird and fish data. Two primary databases were procured, the Wisconsin Breeding Bird Atlas and the Wisconsin Fish Species database, in addition to a number of other important but smaller databases. Finally, we began efforts to make all of the above information available in draft format through a website and a prototype CD-ROM that would contain project reports, site descriptions for the 64 coastal wetland sites identified during Phase 1, and photographs of important ecological sites and features. The preliminary website contained the basic structure for a comprehensive overview of the information collected by BER throughout the course of the Coastal Wetland Assessment project. The website was made available through the Wisconsin Bureau of Endangered Resources website (<http://www.dnr.state.wi.us/org/land/er/>).

Phase 3: The current phase of the project was initiated in 2001 with the primary goals of 1) continuing to gather and incorporate coastal wetlands data into BER's Biological Conservation Database (BCD), 2) filling in data gaps as resources allowed through limited field inventory for high ranking sites identified during phase 2, and 3) developing the products that began in Phase 2 (coastal wetlands website, CD-ROM, and technical report including site descriptions). The ultimate intended outcome of the project (Phase IV) will be a publicly distributed product in an easy-to-read format, filled with pictures, maps and graphics that would help increase public awareness to the importance of coastal wetlands in Wisconsin. The basis for these products would be the ecologically significant sites, their site descriptions, and the regional and local ecological importance of each site.

COASTAL WETLANDS BACKGROUND AND SIGNIFICANCE

Wetlands found near the coasts of the Great Lakes include marshes, bogs, fens, sedge meadows, shrub swamps, hardwood swamps, coniferous swamps, spring seeps, and others. Wetlands specific to the Great Lakes coasts include freshwater estuaries, interdunal wetlands, ridge and swale systems, and lakeplain prairies. While there is no universally accepted definition of a coastal wetland, there are some significant characteristics distinguishing them from their inland counterparts and other wetlands found along the coast. Coastal wetlands exist because of their historic and present-day interactions with the Great Lakes. They serve as spawning grounds for fish, stopovers or staging grounds for migratory and breeding birds, and critical habitat for many rare plants and animals.

The importance of wetlands for performing various ecological services is well documented, and they have long been recognized as one of the most important ecosystems on Earth (Mitsch and Gosselink 1993). They are sometimes characterized as the “kidneys” of the landscape because of their functions in hydrological and chemical cycles and because they intercept wastes from both natural and human sources. Wetlands play an important role in cleansing polluted waters, preventing floods, protecting shorelines, and recharging groundwater aquifers. Wetlands are also important as carbon sinks on a global scale.

Wetlands throughout Wisconsin provide critical habitat for a diverse set of both aquatic and terrestrial plant and animal species. A number of coastal wetland sites host extremely rich assemblages of flora and fauna, including dwarf lake iris (*Iris lacustris*) and Piping Plover (*Charadrius melodus*), both of which are rare globally. Some rare plant species such as the coast sedge (*Carex exilis*), English sundew (*Drosera anglica*) and marsh bedstraw (*Galium palustre*), a Wisconsin special concern species, are found only in coastal wetlands. Long-term monitoring stations along the Great Lakes have documented high concentrations of migratory birds, over 100 of which are Neotropical Migrants or birds that winter in the Neotropics or southward (Finch 1991). The Great Lakes serve as migrant corridors and coastal wetlands offer critical food and shelter resources. In addition, some of the larger forested wetlands along Lake Michigan serve as ecological refuges for breeding bird species that are now more commonly found in northern Wisconsin. Table 1 lists many of the rare plants and animals tracked by NHI that have been documented within the Primary Sites for this project along with their state and federal status, where applicable.

Table 1. Rare animals and plants tracked by the Natural Heritage Inventory Program that have been documented within the Primary Sites.

Group	Common Name	Scientific Name	State Status	Federal Status
Beetle	Beach-Dune Tiger Beetle	<i>Cicindela hirticollis rhodensis</i>	SC/N	
	A Water Scavenger Beetle	<i>Cymbiodyta acuminata</i>	* SC/N	
Bird	Henslow's Sparrow	<i>Ammodramus henslowii</i>	THR	
	Long-Eared Owl	<i>Asio otus</i>	SC/M	
	Pine Siskin	<i>Carduelis pinus</i>	SC/M	
	Swainson's Thrush	<i>Catharus ustulatus</i>	SC/M	

Group	Common Name	Scientific Name	State Status	Federal Status
	Evening Grosbeak	<i>Coccothraustes vespertinus</i>	SC/M	
	Black-Throated Blue Warbler	<i>Dendroica caerulescens</i>	SC/M	
	Cape May Warbler	<i>Dendroica tigrina</i>	SC/M	
	Yellow-Bellied Flycatcher	<i>Empidonax flaviventris</i>	SC/M	
	Acadian Flycatcher	<i>Empidonax virescens</i>	THR	
	Merlin	<i>Falco columbarius</i>	SC/M	
	Connecticut Warbler	<i>Oporornis agilis</i>	SC/M	
	Gray Jay	<i>Perisoreus canadensis</i>	SC/M	
	Barn Owl	<i>Tyto alba</i>	END	
	Tennessee Warbler	<i>Vermivora peregrina</i>	SC/M	
	Great Egret	<i>Ardea alba</i>	* THR	
	Great Blue Heron	<i>Ardea herodias</i>	* SC/M	
	Lesser Scaup	<i>Aythya affinis</i>	* SC/M	
	Redhead	<i>Aythya americana</i>	* SC/M	
	American Bittern	<i>Botaurus lentiginosus</i>	* SC/M	
	Common Goldeneye	<i>Bucephala clangula</i>	* SC/M	
	Red-Shouldered Hawk	<i>Buteo lineatus</i>	* THR	
	Piping Plover	<i>Charadrius melodus</i>	* END	LE
	Black Tern	<i>Chlidonias niger</i>	* SC/M	
	Northern Harrier	<i>Circus cyaneus</i>	* SC/M	
	Yellow Rail	<i>Coturnicops noveboracensis</i>	* THR	
	Snowy Egret	<i>Egretta thula</i>	* END	
	Common Moorhen	<i>Gallinula chloropus</i>	* SC/M	
	Common Loon	<i>Gavia immer</i>	* SC/M	
	Bald Eagle	<i>Haliaeetus leucocephalus</i>	* SC/FL	LT,PD
	Least Bittern	<i>Ixobrychus exilis</i>	* SC/M	
	Common Merganser	<i>Mergus merganser</i>	* SC/M	
	Red-Breasted Merganser	<i>Mergus serrator</i>	* SC/M	
	Black-Crowned Night-Heron	<i>Nycticorax nycticorax</i>	* SC/M	
	Osprey	<i>Pandion haliaetus</i>	* THR	
	American White Pelican	<i>Pelecanus erythrorhynchos</i>	* SC/M	
	Red-Necked Grebe	<i>Podiceps grisegena</i>	* END	
	Louisiana Waterthrush	<i>Seiurus motacilla</i>	* SC/M	
	Caspian Tern	<i>Sterna caspia</i>	* END	
	Forster's Tern	<i>Sterna forsteri</i>	* END	
	Common Tern	<i>Sterna hirundo</i>	* END	
	Hooded Warbler	<i>Wilsonia citrina</i>	* THR	
Bug				
	A Water Measurer	<i>Hydrometra martini</i>	* SC/N	
Butterfly				
	Mottled Dusky Wing	<i>Erynnis martialis</i>	SC/N	
	Broad-Winged Skipper	<i>Poanes viator</i>	SC/N	
	Bog Fritillary	<i>Boloria eunomia</i>	* SC/N	
	Swamp Metalmark	<i>Calephelis muticum</i>	* END	
	Two-Spotted Skipper	<i>Euphyes bimacula</i>	* SC/N	
	Dion Skipper	<i>Euphyes dion</i>	* SC/N	
	Dorcas Copper	<i>Lycaena dorcas</i>	* SC/N	
	Bog Copper	<i>Lycaena epixanthe</i>	* SC/N	
	Mulberry Wing	<i>Poanes massasoit</i>	* SC/N	
Caddisfly				
	A Bizarre Caddisfly	<i>Lepidostoma libum</i>	* SC/N	
Dragonfly				
	Lake Darner	<i>Aeshna eremita</i>	* SC/N	

Group	Common Name	Scientific Name	State Status	Federal Status
	Green-Striped Darner	<i>Aeshna verticalis</i>	* SC/N	
	Arrowhead Spiketail	<i>Cordulegaster obliqua</i>	* SC/N	
	Swamp Darner	<i>Epiaeschna heros</i>	* SC/N	
	Amber-Winged Spreadwing	<i>Lestes eurinus</i>	* SC/N	
	Ski-Tailed Emerald	<i>Somatochlora elongata</i>	* SC/N	
	Forcipate Emerald	<i>Somatochlora forcipata</i>	* SC/N	
	Hine's Emerald	<i>Somatochlora hineana</i>	* END	LE
	Black Meadowhawk	<i>Sympetrum danae</i>	* SC/N	
	Violet-Masked Glider	<i>Tramea carolina</i>	* SC/N	
Fish				
	Lake Sturgeon	<i>Acipenser fulvescens</i>	* SC/H	
	American Eel	<i>Anguilla rostrata</i>	* SC/N	
	Bloater	<i>Coregonus hoyi</i>	* SC/H	
	Least Darter	<i>Etheostoma microperca</i>	* SC/N	
	Banded Killifish	<i>Fundulus diaphanus</i>	* SC/N	
	Longear Sunfish	<i>Lepomis megalotis</i>	* THR	
	Redfin Shiner	<i>Lythrurus umbratilis</i>	* THR	
	Greater Redhorse	<i>Moxostoma valenciennesi</i>	* THR	
Frog				
	Blanchard's Cricket Frog	<i>Acris crepitans blanchardi</i>	* END	
	Bullfrog	<i>Rana catesbeiana</i>	* SC/H	
Grasshopper				
	Blue-Legged Grasshopper	<i>Melanoplus flavidus</i>	SC/N	
	Lake Huron Locust	<i>Trimerotropis huroniana</i>	END	
	Seaside Grasshopper	<i>Trimerotropis maritima</i>	SC/N	
Leafhopper				
	Red-Tailed Prairie Leafhopper	<i>Aflexia rubranura</i>	END	
Mammal				
	Northern Myotis	<i>Myotis septentrionalis</i>	SC/N	
	Pigmy Shrew	<i>Sorex hoyi</i>	* SC/N	
Moth				
	Oithona Tiger Moth	<i>Grammia oithona</i>	SC/N	
	Phyllira Tiger Moth	<i>Grammia phyllira</i>	SC/N	
	An Owlet Moth	<i>Macrochilo bivittata</i>	SC/N	
	Liatris Borer Moth	<i>Papaipema beeriana</i>	* SC/N	
	Silphium Borer Moth	<i>Papaipema silphii</i>	* END	
Other				
	Bird Rookery		SC	
	Migratory Bird Concentration Site		SC	
Plant				
	Striped Maple	<i>Acer pensylvanicum</i>	SC	
	Climbing Fumitory	<i>Adlumia fungosa</i>	SC	
	Roundstem Foxglove	<i>Agalinis gattingeri</i>	THR	
	Pale False Foxglove	<i>Agalinis skinneriana</i>	END	
	Prairie Milkweed	<i>Asclepias sullivantii</i>	THR	
	Maidenhair Spleenwort	<i>Asplenium trichomanes</i>	SC	
	Cooper's Milkvetch	<i>Astragalus neglectus</i>	END	
	Prairie Dunewort	<i>Botrychium campestre</i>	END	
	Moonwort Grape-Fern	<i>Botrychium lunaria</i>	END	
	Mingan's Moonwort	<i>Botrychium minganense</i>	SC	
	Spoon-Leaf Moonwort	<i>Botrychium spathulatum</i>	SC	
	Prairie Indian Plantain	<i>Cacalia tuberosa</i>	THR	
	American Sea-Rocket	<i>Cakile edentula</i>	SC	

Group	Common Name	Scientific Name	State Status	Federal Status
	Low Calamint	<i>Calamintha arkansana</i>	SC	
	Sand Reed-Grass	<i>Calamovilfa longifolia</i> var <i>magna</i>	THR	
	Cuckooflower	<i>Cardamine pratensis</i>	SC	
	Beautiful Sedge	<i>Carex concinna</i>	THR	
	Handsome Sedge	<i>Carex formosa</i>	THR	
	Smooth Black Sedge	<i>Carex nigra</i>	SC	
	Richardson Sedge	<i>Carex richardsonii</i>	SC	
	Dune Thistle	<i>Cirsium pitcheri</i>	THR	LT
	Crinkled Hairgrass	<i>Deschampsia flexuosa</i>	SC	
	Thickspike	<i>Elymus lanceolatus</i> ssp <i>psammophilus</i>	THR	
	Seaside Spurge	<i>Euphorbia polygonifolia</i>	SC	
	Western Fescue	<i>Festuca occidentalis</i>	THR	
	Yellow Gentian	<i>Gentiana alba</i>	THR	
	Northern Comandra	<i>Geocaulon lividum</i>	END	
	Limestone Oak Fern	<i>Gymnocarpium robertianum</i>	SC	
	Dwarf Lake Iris	<i>Iris lacustris</i>	THR	LT
	Large-Flowered Ground-Cherry	<i>Leucophysalis grandiflora</i>	SC	
	Broad-Leaved Twayblade	<i>Listera convallarioides</i>	THR	
	American Gromwell	<i>Lithospermum latifolium</i>	SC	
	Fly Honeysuckle	<i>Lonicera involucrata</i>	END	
	Fir Clubmoss	<i>Lycopodium selago</i>	SC	
	Indian Cucumber-Root	<i>Medeola virginiana</i>	SC	
	Clustered Broomrape	<i>Orobanche fasciculata</i>	THR	
	One-Flowered Broomrape	<i>Orobanche uniflora</i>	SC	
	Chilean Sweet Cicely	<i>Osmorhiza chilensis</i>	SC	
	Small-Flower Grass-Of-Parnassus	<i>Parnassia parviflora</i>	END	
	Pale Beardtongue	<i>Penstemon pallidus</i>	SC	
	Pale Green Orchid	<i>Platanthera flava</i> var <i>herbiola</i>	THR	
	Hooker Orchis	<i>Platanthera hookeri</i>	SC	
	Large Roundleaf Orchid	<i>Platanthera orbiculata</i>	SC	
	Braun's Holly-Fern	<i>Polystichum braunii</i>	THR	
	Bird's-Eye Primrose	<i>Primula mistassinica</i>	SC	
	Giant Pinedrops	<i>Pterospora andromedea</i>	END	
	Small Yellow Water Crowfoot	<i>Ranunculus gmelinii</i>	END	
	Northern Black Currant	<i>Ribes hudsonianum</i>	SC	
	Canada Gooseberry	<i>Ribes oxycanthoides</i>	THR	
	Sand Dune Willow	<i>Salix cordata</i>	END	
	Tea-Leaved Willow	<i>Salix planifolia</i>	THR	
	Tufted Club-Rush	<i>Scirpus cespitosus</i>	THR	
	Torrey's Bulrush	<i>Scirpus torreyi</i>	SC	
	Heart-Leaved Skullcap	<i>Scutellaria ovata</i>	SC	
	Low Spike-Moss	<i>Selaginella selaginoides</i>	END	
	Bluestem Goldenrod	<i>Solidago caesia</i>	END	
	Sticky Goldenrod	<i>Solidago simplex</i> var <i>gillmanii</i>	THR	
	White Mandarin	<i>Streptopus amplexifolius</i>	SC	
	Small-Flowered Woolly Bean	<i>Strophostyles leiosperma</i>	SC	
	Lake Huron Tansy	<i>Tanacetum huronense</i>	END	
	Reflexed Trillium	<i>Trillium recurvatum</i>	SC	
	Purple False Oats	<i>Trisetum melicoides</i>	END	
	Narrow False Oats	<i>Trisetum spicatum</i>	THR	
	Northern Wild-Raisin	<i>Viburnum cassinoides</i>	SC	
	Smooth Black-Haw	<i>Viburnum prunifolium</i>	SC	

Group	Common Name	Scientific Name	State Status	Federal Status
	Long-Spur Violet	<i>Viola rostrata</i>	SC	
	Round-Leaved Orchis	<i>Amerorchis rotundifolia</i>	* THR	
	Swamp-Pink	<i>Arethusa bulbosa</i>	* SC	
	Lake-Cress	<i>Armoracia lacustris</i>	* END	
	Slim-Stem Small-Reedgrass	<i>Calamagrostis stricta</i>	* SC	
	Autumnal Water-Starwort	<i>Callitriche hermaphroditica</i>	* SC	
	Floating Marsh-Marigold	<i>Caltha natans</i>	* END	
	Fairy Slipper	<i>Calypto bulbosa</i>	* THR	
	Assiniboine Sedge	<i>Carex assiniboinensis</i>	* SC	
	Hair-Like Sedge	<i>Carex capillaris</i>	* SC	
	Crawe Sedge	<i>Carex crawei</i>	* SC	
	Coast Sedge	<i>Carex exilis</i>	* THR	
	Elk Sedge	<i>Carex garberi</i>	* THR	
	Northern Bog Sedge	<i>Carex gynocrates</i>	* SC	
	Shore Sedge	<i>Carex lenticularis</i>	* THR	
	Livid Sedge	<i>Carex livida</i> var <i>radicaulis</i>	* SC	
	False Hop Sedge	<i>Carex lupuliformis</i>	* END	
	Michaux Sedge	<i>Carex michauxiana</i>	* THR	
	Many-Headed Sedge	<i>Carex sychnocephala</i>	* SC	
	Sparse-Flowered Sedge	<i>Carex tenuiflora</i>	* SC	
	Sheathed Sedge	<i>Carex vaginata</i>	* SC	
	Ram's-Head Lady's-Slipper	<i>Cypripedium arietinum</i>	* THR	
	Small Yellow Lady's-Slipper	<i>Cypripedium parviflorum</i>	* SC	
	Showy Lady's-Slipper	<i>Cypripedium reginae</i>	* SC	
	Tufted Hairgrass	<i>Deschampsia cespitosa</i>	* SC	
	English Sundew	<i>Drosera anglica</i>	* THR	
	Slenderleaf Sundew	<i>Drosera linearis</i>	* THR	
	Flat-Stemmed Spike-Rush	<i>Eleocharis compressa</i>	* SC	
	Spike-Rush	<i>Eleocharis mamillata</i>	* SC	
	Slender Spike-Rush	<i>Eleocharis nitida</i>	* END	
	Capitate Spikerush	<i>Eleocharis olivacea</i>	* SC	
	Few-Flower Spikerush	<i>Eleocharis quinqueflora</i>	* SC	
	Robbins Spikerush	<i>Eleocharis robbinsii</i>	* SC	
	Marsh Willow-Herb	<i>Epilobium palustre</i>	* SC	
	Downy Willow-Herb	<i>Epilobium strictum</i>	* SC	
	Marsh Horsetail	<i>Equisetum palustre</i>	* SC	
	Variiegated Horsetail	<i>Equisetum variegatum</i>	* SC	
	Russet Cotton-Grass	<i>Eriophorum chamissonis</i>	* SC	
	Hairy Fimbristylis	<i>Fimbristylis puberula</i>	* END	
	Marsh Bedstraw	<i>Galium palustre</i>	* SC	
	Lesser Fringed Gentian	<i>Gentianopsis procera</i>	* SC	
	Vasey Rush	<i>Juncus vaseyi</i>	* SC	
	Marsh Blazing Star	<i>Liatris spicata</i>	* SC	
	Auricled Twayblade	<i>Listera auriculata</i>	* END	
	White Adder's-Mouth	<i>Malaxis brachypoda</i>	* SC	
	Adder's-Tongue	<i>Ophioglossum pusillum</i>	* SC	
	Marsh Grass-Of-Parnassus	<i>Parnassia palustris</i>	* THR	
	Arrow-Leaved Sweet-Coltsfoot	<i>Petasites sagittatus</i>	* THR	
	Smooth Phlox	<i>Phlox glaberrima</i> ssp <i>interior</i>	* END	
	Heart-Leaved Plantain	<i>Plantago cordata</i>	* END	
	Leafy White Orchis	<i>Platanthera dilatata</i>	* SC	
	Prairie White-Fringed Orchid	<i>Platanthera leucophaea</i>	* END	LT
	Pink Milkwort	<i>Polygala incarnata</i>	* END	

Group	Common Name	Scientific Name	State Status	Federal Status
	Seaside Crowfoot	<i>Ranunculus cymbalaria</i>	* THR	
	Brown Beakrush	<i>Rhynchospora fusca</i>	* SC	
	Whip Nutrush	<i>Scleria triglomerata</i>	* SC	
	Low Nutrush	<i>Scleria verticillata</i>	* SC	
	Marsh Ragwort	<i>Senecio congestus</i>	* SC	
	Ohio Goldenrod	<i>Solidago ohioensis</i>	* SC	
	Northern Bur-Reed	<i>Sparganium glomeratum</i>	* THR	
	Waxleaf Meadowrue	<i>Thalictrum revolutum</i>	* SC	
	Veined Meadowrue	<i>Thalictrum venulosum</i>	* SC	
	Sticky False-Asphodel	<i>Tofteldia glutinosa</i>	* THR	
	Common Bog Arrow-Grass	<i>Triglochin maritima</i>	* SC	
	Slender Bog Arrow-Grass	<i>Triglochin palustris</i>	* SC	
	Hidden-Fruited Bladderwort	<i>Utricularia geminiscapa</i>	* SC	
	Northeastern Bladderwort	<i>Utricularia resupinata</i>	* SC	
Salamander				
	Four-Toed Salamander	<i>Hemidactylium scutatum</i>	* SC/H	
Snail				
	Pleistocene Catinella	<i>Catinella exile</i>	SC/N	
	A Land Snail	<i>Catinella gelida</i>	SC/N	
	Sculpted Glyph	<i>Glyphyalinia rhoadsi</i>	SC/N	
	Brilliant Granule	<i>Guppya sterkii</i>	SC/N	
	Cherrystone Drop	<i>Hendersonia occulta</i>	THR	
	Dentate Supercoil	<i>Paravitrea multidentata</i>	SC/N	
	White-Lip Dagger	<i>Pupoides albilabris</i>	SC/N	
	Black Striate	<i>Striatura ferrea</i>	SC/N	
	Eightfold Pinecone	<i>Strobilops affinis</i>	SC/N	
	A Land Snail	<i>Succinea bakeri</i>	SC/N	
	Oval Vallonia	<i>Vallonia excentrica</i>	SC/N	
	Tapered Vertigo	<i>Vertigo elatior</i>	SC/N	
	Midwest Pleistocene Vertigo	<i>Vertigo hubrichti</i>	END	
	Iowa Pleistocene Vertigo	<i>Vertigo iowaensis</i>	SC/N	
	Six-Whorl Vertigo	<i>Vertigo morsei</i>	SC/N	
	Deep-Throated Vertigo	<i>Vertigo nylanderi</i>	SC/N	
	Boreal Top	<i>Zoogenetes harpa</i>	SC/N	
Snake				
	Northern Ringneck Snake	<i>Diadophis punctatus edwardsii</i>	SC/H	
	Butler's Garter Snake	<i>Thamnophis butleri</i>	THR	
Turtle				
	Wood Turtle	<i>Clemmys insculpta</i>	* THR	
	Blanding's Turtle	<i>Emydoidea blandingii</i>	* THR	

* Indicates an aquatic species. See Appendix C for an explanation of state and federal status.

Coastal wetlands near Wisconsin's Great Lakes include several important natural communities and other natural features such as Forested Ridge and Swale, Great Lakes Dunes, and Interdunal Wetlands. Many of the natural community types tracked by NHI that have been documented within the coastal study area for this project are listed below. Brief descriptions of these community types can be found in Appendix C.

Community Types documented within the Coastal Zone

- Alvar
- Boreal Forest
- Dry-Mesic Prairie
- Forested Ridge And Swale
- Great Lakes Barrens
- Great Lakes Beach
- Great Lakes Dune
- Moist Cliff
- Northern Dry Forest
- Northern Dry-Mesic Forest
- Northern Mesic Forest
- Oak Woodland
- Southern Mesic Forest
- Alder Thicket
- Black Spruce Swamp
- Boreal Rich Fen
- Calcareous Fen
- Emergent Aquatic
- Emergent Aquatic - Wild Rice
- Floodplain Forest
- Great Lakes Alkaline Rockshore
- Hardwood Swamp
- Interdunal Wetland
- Lake--Shallow, Hard, Drainage
- Lake--Shallow, Hard, Seepage
- Lake--Shallow, Very Hard, Drainage (Marl)
- Lake--Soft Bog
- Northern Sedge Meadow
- Northern Wet Forest
- Northern Wet-Mesic Forest
- Open Bog
- Poor Fen
- Shore Fen
- Shrub-Carr
- Southern Sedge Meadow
- Springs And Spring Runs, Hard
- Springs And Spring Runs, Soft
- Stream--Slow, Hard, Warm
- Submergent Aquatic
- Tamarack (Poor) Swamp
- Wet-Mesic Prairie

LAKE MICHIGAN COASTAL ZONE

The Lake Michigan shoreline is varied, ranging from gently sloping glacial lakeplain of Kenosha County in the southeastern corner of the state to the rocky cliffs of the Door Peninsula and Grand Traverse Islands in the northeast. The shoreline along the eastern side of Green Bay, including the Door Peninsula, features clay bluffs, sand and gravel beaches, and dolomite cliffs that reach a height of 150 feet above the bay (Anderson et al. 2002). The Lake Michigan shoreline of Door County consists of low dolomite cliffs and ledges, extensive horizontal exposures of dolomite “beach,” active beach and dune systems, shallow embayments with extensive marsh and meadow associations, and complex ridge and swale systems that harbor an intricate mosaics of wetland and upland plant communities. Red clay bluffs derived from glacio-lacustrine deposits, ranging from 10 to 70 feet in height, characterize the Lake Michigan shore of southern Door County, south to Milwaukee County. Sand beaches, active dunes, and forested ridge and swale systems interrupt the bluffs from Point Beach (Manitowoc County) south to Kohler-Andrae Dunes (Sheboygan County). Wetlands are scarce along this stretch of the lakeshore but a major dune complex situated south of Sheboygan contains interdunal wetlands and separates a large wetland bordering the Black River from the waters of Lake Michigan.

The southern Wisconsin shore has areas of gently sloping, low sandbanks fronted by wide beaches. Between Port Washington and Milwaukee, bluffs composed of red till and assorted stratified deposits reach heights of 140 feet, decreasing to 25 feet near Kenosha. The bluff bases normally have narrow beaches of sand or cobbles and contain few wetlands. South of Kenosha there is an extensive but degraded dune system and the nationally significant Chiwaukee Prairie, an area of extremely high significance to many rare or declining native plants and animals.

The approximately 70-mile long Door Peninsula extends into Lake Michigan, separating the waters of the lake from those of Green Bay, and is one of the most sensitive areas on the Lake Michigan shoreline. The concentration of rare species and natural communities make it one of the highest conservation priorities in Wisconsin and the entire Great Lakes region. Many globally rare species are found within the Door Peninsula because of the unique interrelationships of its geographical position, climate, geology, glacial history, and soils. The Peninsula forms the western edge of the Niagara Escarpment, a dolomite bedrock feature of Silurian Age that arcs through Upper Lake Michigan and extends east to western New York State. The western shore of the peninsula features cliffs that reach heights of 150 feet above the surface of Green Bay. To the east the land slopes gently towards the Lake Michigan shore where low rocky ledges, sand dunes, embayments, estuaries, and ridge and swale systems have been formed by wind and wave action over time. Many of the lakes on the eastern side of the Door Peninsula were once bays of post-glacial Lake Nipissing but are now separated from Lake Michigan by shoreline sand deposition. Ridge and swale topography occurs at several places along the Lake Michigan coast of the Peninsula featuring complex vegetation patterns and supporting many rare species. In addition, the dolomite Niagara Escarpment forms the shoreline of portions of the Peninsula and creates unique communities such as cliffs, talus slopes, spring seepages, and alvar (Anderson et al. 2002) which in turn support rare, highly specialized plants and invertebrates.

The natural beauty and biological richness of the Door Peninsula have made it one of Wisconsin's most popular destinations, and the demand for tourism and second-home building warrants serious conservation concern. Major threats to the Door Peninsula coastal wetlands include habitat loss, fragmentation, and isolation, as well as chemical contamination and sedimentation. For example, loss or alteration of wetlands occurs through wetland filling, hydrologic disruption, road and utility corridor construction and maintenance, and forest clearing. Another major concern is groundwater contamination from failing septic systems and leaking underground storage tanks. In addition, surface waters may be contaminated by erosion due to development or agriculture. Groundwater contamination is a particular problem because of the shallow soils and fractured dolomite bedrock that underlies the Peninsula. Contaminants entering these soils are not adequately filtered and travel rapidly to groundwater aquifers (The Nature Conservancy, Grimm et. al., 1994 and Valvassori 1990)

LAKE SUPERIOR COASTAL ZONE

The Wisconsin shoreline of Lake Superior contains a diverse array of natural features. Among the most distinctive and noteworthy are the freshwater estuaries and sand spits that characterize the southwestern Lake Superior shoreline, the wave carved sandstone cliffs of the northern Bayfield Peninsula and Apostle Islands, and the floristically rich "red clay" wetlands that occupy ancient lacustrine deposits. Red clay wetlands are especially well developed near the City of Superior. Important wetland communities of the Lake Superior coastal region include marsh, fen, bog, sedge meadow, shrub swamp, lowland hardwood forest, and conifer swamp. Extensive beds of emergent, submergent, and floating-leaved aquatic plants occur in the shallower waters of the estuaries, partially protected from wind, wave and ice action by the sand spits situated at the mouths of streams entering the lake. The larger sand spits typically contain beach, dune, and pine forest communities, and where the dunes are active interdunal swales support unusual assemblages of wetland plants. The coastal wetland complexes receive heavy use by migratory birds, particularly in the spring. The larger coastal wetlands also host significant populations of nesting birds and spawning fish, as well as many resident herptiles and invertebrates. (For a fuller discussion of Wisconsin's Lake Superior wetlands see Epstein 1997 and Epstein et al. 1997).

ECOLOGICAL LANDSCAPES

The Wisconsin DNR has mapped Wisconsin into areas of similar ecological potential and geography into units known as Ecological Landscapes (Map 1). This classification is based on aggregations of subsections from the National Hierarchical Framework of Ecological Units (NHFEU) (Avers et al. 1994). The NHFEU and the Ecological Landscape systems delineate landscapes of similar ecological pattern and potential across the state in a way that is meaningful and useful to resource administrators, planners, and managers.

The areas adjacent to the Lake Michigan and Lake Superior coasts differ from inland portions of the state because the lakes influence temperature, humidity, and precipitation. In addition,

fluctuating water levels and disturbance patterns affect these landscapes. Each of the landscapes that occur in the two coastal zones is summarized below. Greatly expanded descriptions will be available soon in the “Wisconsin Ecological Landscapes Handbook”(DNR 2002).

Superior Coastal Plain

The Superior Coastal Plain is Wisconsin’s northernmost Ecological Landscape and comprises 93% of the Lake Superior coastal zone. This landscape is bordered on the north by southwestern Lake Superior and on the south by the Northwest Sands, the Northwest Lowlands, and the North Central Forest. The climate in this area is strongly influenced by Lake Superior, resulting in cooler summers, warmer winters, and greater precipitation compared to more inland locations. Exposed coastal areas are subject to significant disturbance from windstorms, waves, ice, currents, and periodic water level fluctuations. These disturbance regimes play a significant role in determining both the landform and vegetation characteristics of the shoreline ecosystems. The major landform in this Ecological Landscape is a nearly level plain of lacustrine clays that slopes gently northward toward Lake Superior. The comparatively rugged Bayfield Peninsula separates the clay plain into two disjunct segments. The present clay plain forest has been fragmented by agricultural use, and today approximately one-third of this landscape is non-forested. Most of the open land is in grass cover, having been cleared and then subsequently pastured or plowed. Aspen and birch forests occupy about 40% of the total land area, having increased in prominence over the boreal conifers. On the Bayfield Peninsula, second-growth northern hardwood forests are interspersed among extensive early successional aspen stands. Older forest successional stages are now rare throughout the Superior Clay Plain. An archipelago of sandstone-cored islands, the Apostles, occurs in Lake Superior just north and east of the Bayfield Peninsula. Wave carved sandstone cliffs bracket stretches of the Peninsula and also occur along the margins of several of the islands. Sand spits are a striking feature of the Lake Superior shoreline, typically separating the waters of the lake from inland lagoons and wetlands. The spits support rare and highly threatened natural communities such as beaches, dunes, interdunal wetlands, and pine barrens, and these in turn are inhabited by specially adapted plants and animals.

Northern Lake Michigan Coastal

This Ecological Landscape includes Green Bay, as well as the northern part of the Door Peninsula, comprising 22% of the Lake Michigan Coastal zone. Its landforms consist of the Niagara escarpment, a prominent dolomite outcropping along the east side of Green Bay, a lacustrine plain along the west side of Green Bay, and ground moraine elsewhere. The influence of Lake Michigan moderates extreme temperatures. Soils are very diverse; in some areas, lacustrine sands are found overlying clays or bedrock within only a few feet of the surface. In the Door Peninsula, soils are typically stony loamy sands to loams. Poorly drained sands are common in the lake plain or in depressions between dunes and beach ridges. On the western side of Green Bay, the ground moraine is composed mostly of moderately well drained, rocky sandy loams interspersed with lacustrine sands and clays, and peat and muck also common. Current vegetation consists of more than 60% non-forested land, most of which is in agricultural crops, with smaller amounts of grassland, wetland, shrubland, and urbanized areas. Forested lands are dominated by maple-basswood, with smaller amounts of lowland hardwoods, aspen-birch, and lowland conifers. High quality areas of exposed alkaline bedrock beach occur on the northern

Door Peninsula, providing habitat for many rare plants. In addition, several islands lie off the Door Peninsula and these also provide critical habitat for rare species and colonially nesting birds.

Central Lake Michigan Coastal

The Central Lake Michigan Coastal Ecological Landscape stretches from southern Door County west across Green Bay to the Wolf River drainage, then southward in a narrowing strip along the Lake Michigan shore to central Milwaukee County. This landscape comprises 58% of the Lake Michigan Coastal Zone. Summers are cooler, winters are warmer, and precipitation levels are greater in the eastern part of this landscape than at locations farther inland, owing to the influence of Lake Michigan. Dolomites and shales underlie the glacial deposits that blanket virtually all of the Central Lake Michigan Coastal Ecological Landscape. The dolomite Niagara Escarpment is the major bedrock feature, running across the entire landscape from northeast to southwest. Series of dolomite cliffs provide critical habitat for rare terrestrial snails, bats, and specialized plants. The primary glacial landforms are ground moraine, outwash, and lakeplain. The topography is generally rolling where the surface is underlain by ground moraine, variable over areas of outwash, and nearly level where lacustrine deposits are present. Important soils include clays, loams, sands, and gravels. Certain landforms, such as sand spits, clay bluffs, beach and dune complexes, and ridge and swale systems, are associated only with the shorelines of Lake Michigan and Green Bay. Today approximately 84% of this Ecological Landscape is non-forested. The remaining forest consists mainly of mesic maple-basswood or maple-beech types, or lowland hardwoods composed of soft maples, ashes, and elms.

Southern Lake Michigan Coastal

The Southern Lake Michigan Coastal Ecological Landscape is located in the southeastern corner of Wisconsin along Lake Michigan and comprises 18% of the Lake Michigan Coastal Zone. The landforms in this Ecological Landscape are characteristic of glacial lake influence, with ridge and swale topography, clay bluffs, and lake plain along Lake Michigan. Soils typically have a silt-loam surface overlying loamy and clayey tills. Maple-basswood-beech forests once dominated the northern portion of this landscape and oak forest, oak savanna and prairies were prevalent in the south. Also, wet, wet-mesic, and lake plain prairies were, historically, common in this landscape. Today, dairy and cash grain agriculture and intense urban development dominate most of the area. Only about 8% of the Ecological Landscape is forested and only 1% is public land. There are some areas of wet-mesic and wet prairie but only small preserves remain since the landscape is heavily disturbed and fragmented. Because of this isolation, fragmentation, and high level of disturbance, non-native plants are abundant.

Three other Ecological Landscapes, Northwest Sands, North Central Forest, and Southeast Glacial Plains overlap the coastal zone. Each of these landscapes represents only 2-4% of the area of the coastal zone for their respective coast, so they are not described here. See the Wisconsin Ecological Landscapes Handbook (DNR 2002) for descriptions of these and other Landscapes found in Wisconsin.

METHODS

STUDY AREA

The study area (Map 2) was established during Phase I of this project (Merryfield 2000) based on the following criteria:

- 1) **Ecological Landscapes¹.** Ecological Landscapes that are especially significant to Wisconsin's Great Lakes coasts and coastal wetlands include the Superior Coastal Plain, the Northern Lake Michigan Coastal, Central Lake Michigan Coastal, and the Southern Lake Michigan Coastal.
- 2) **Buffer area.** Wetlands that are within 6 miles of either the Lake Michigan or Lake Superior shoreline.

PRIMARY SITE SELECTION AND DATA ACQUISITION

Sixty-four primary coastal wetland sites were identified during the first phase of this project (WDNR 2000) using three main sources of information: a synthesis of over 40 reports found through a literature search, several other sources of data (including aerial photographs, Wisconsin Wetland Inventory GIS coverage, NHI Element Occurrence data, Ecological Landscapes of Wisconsin, Door Peninsula, Wisconsin Critical Habitat & Natural Areas Protection Plan, Manitowoc County Coastal Wetlands, as well as other GIS coverages), and evaluation and review by NHI staff. All 28 of the Lake Superior sites had been previously identified through a two-year study conducted by NHI (Epstein et al. 1997). Primary Lake Michigan sites were extracted from five additional sources of information (Herdendorf et al. 1981, WDNR 1980, Southeastern Wisconsin Regional Planning Commission 1997, Door County Land Use Forum 1999, and Water Resources Management Graduate Students 1998). Each of the information sources used to extract primary sites was summarized in a report prepared following phase one (Merryfield 2000). The sites resulting from Phase one had generalized site boundaries that included non-wetland areas in some cases. Site boundaries were digitized and delineated on a map included with the phase one report.

Because many of the Lake Michigan Primary sites were identified either from the literature or older DNR file information, "windshield surveys" were conducted on 26 of the 36 Lake Michigan sites during Phase 2. These reconnaissance surveys were designed to identify and prioritize areas for which more detailed future field surveys were needed. During the reconnaissance surveys, photographs were taken for the CD-ROM and web-based products associated with this project. Additional photographs were collected and limited plant surveys were conducted during Phase 3 for sites where the NHI database had insufficient or outdated data. NHI staff visited as many of these sites as project resources allowed.

¹ The boundaries for several of the Ecological Landscapes have changed since Phase 1 of the project. Map 1 contains the current Ecological Landscape boundaries.

Several existing sets of data were procured as part of this project in an attempt to fill data gaps and improve our understanding of the significance of the Primary Sites. Several large gaps in existing information were identified during Phase One, particularly for birds and fish. During the remaining phases of the project, active field ornithologists were contacted, and five major bird databases were procured. Efforts were made to contact the original data collectors for the Wisconsin Breeding Bird Atlas, one major data set that had not been incorporated into DNR files. A statewide fish database was procured from Don Fago, WDNR to address one of the other important information deficiencies. Finally, a methodology was developed for incorporating all of the useable data into NHI's Biological Conservation Database. Data for natural communities and rare species tracked by NHI are included in the individual site descriptions.

SITE PRIORITIZATION

Sites were ordered numerically during Phase Two of the project based on several attributes including site size, number and quality of element occurrences, development pressure, and whether the site had been surveyed for a number of different taxa or natural communities. This ranking was useful for determining which sites should be visited during Phase 3 to gain additional information. However, large disparities with respect to the amount of available data skewed several of the site rankings. Also, visits to several of the sites during 2001 revealed that rankings had been inflated due to a basic lack of information. For some of these sites, quality should have ranked lower due to poor size, quality, and/or condition.

Ordering was also difficult because of differences between Lake Superior and Lake Michigan sites in regard to the amount and quality of available information. BER was able to perform a comprehensive, detailed evaluation of the Lake Superior sites through a past major funding initiative; Lake Michigan has not received a comparable treatment. In addition, the Lake Superior sites are generally of higher quality, although some of this difference may be due to the initial pre-screening performed as part of the aforementioned study. Further, comparing sites that are quite different ecologically may be of limited use. A set of sites may contain very different natural community types. For example, lakeplain prairie occurs only at Chiwaukee and cannot be compared with other sites, and almost all of the freshwater estuary sites are on Lake Superior, with the notable exception of Mink River, and cannot be compared with Lake Michigan sites. Although these sites are not directly comparable, regional distribution and status of the communities and associated rare species (obtained from sources such as The Nature Conservancy's ecoregional planning initiative for the Great Lakes and other state's Heritage programs) does allow for a degree of prioritization, when combined with individual site size, context, and condition. Some sites are presently in poor condition but represent a potential opportunity for habitat restoration because of factors such as large size, remnant patches of good quality native vegetation, public ownership, and/or location. Several sites are relatively small and somewhat degraded, but contain rare species that are known only from a few populations in the entire state.

Because of these limitations, we did not order the sites numerically during Phase 3 of the project. Instead, important features of each of the sites are included in the description and a list of "exemplary sites" is included in this report.

PRIMARY SITE DESCRIPTIONS

The following sites were identified during the first phase of the project. Each site description provides site characteristics, size², special features, general location, and additional comments regarding significance based on the information available.

The website³ based on this report contains a table of Element Occurrences (EOs) for each site along with the site description, where applicable. The Element Occurrence tables consist of the rare animals, plants, or natural communities that are currently being tracked by the Natural Heritage Inventory program (Appendix A) and are documented within a given site. Note that certain sensitive species may have been removed from the tables. In addition, the tables summarize current NHI data for a given site and are not intended to be all-inclusive of elements that actually occur at any given site.

Each site is coded according to the coastal zone it falls within (M = Lake Michigan, S = Lake Superior), and given a unique number. Site numbers increase from south to north for Lake Michigan and west to east for Lake Superior⁴.

² Acreages are rough estimates based on GIS and aerial photographs and do not reflect ownership or management boundaries

³ The website can be accessed through the Bureau of Endangered Resource website at <http://www.dnr.state.wi.us/org/land/er/>

⁴ The following are exceptions to this: 1) site M-02 (Kenosha Sand Dunes) was combined with M-01 (Chiwaukee Prairie) and no longer exists as a site on its own and 2) S-22 (Mouth of the Brule River) was added as a Primary Site near the end of the project

M-01. Chiwaukee - Illinois Beach Shoreline

Ecological Landscape: Southern Lake
Michigan
County: Kenosha
Total acreage: 1760
Wetland acreage: 790



Chiwaukee - Illinois Beach Shore. Photograph by Thomas A. Meyer.

Site Description

The Chiwaukee-Illinois Beach Shoreline is located south of the City of Kenosha on the southeastern shoreline of Lake Michigan just north of the border with Illinois. Much of the site is protected by the state of Wisconsin and the Nature Conservancy. It is a large, partially fragmented, coastal lake plain prairie complex of both wetland and upland communities including prairies, fen, sedge meadow, savanna and dunes. The low, sandy beach ridges and interceding swales, created when the level of glacial Lake Michigan was lowered in stages, characterize the best parts of this site and provide many microhabitats that support an extremely rich flora (over 400 plants have been documented). Many species of rare plants and animals are found here.

This site is the most intact and floristically rich coastal wetland complex in southeastern Wisconsin. It is currently threatened by development, altered hydrology (wetland filling), fragmentation by roads and subdivisions, and non-native plant invasions. This site adjoins Illinois Beach State Park, which also contains exceptional ecological features. This site remains a high protection priority for the State of Wisconsin and The Nature Conservancy. Areas surrounding the site are still threatened by development, wetland filling and invasive species.

Kenosha Sand Dunes and Low Prairie

This site is located north of Chiwaukee Prairie on lake plain just north of Chiwaukee Prairie along the southeastern coastline of Kenosha County. An ancient hardwood forest lies buried beneath the dunes. At present this site includes one half-mile of Lake Michigan frontage containing semi-open dunes and dune succession patterns (fore dunes to swale to wet prairie). The large low “prairie” area behind the dunes is rich and diverse, including stands of cattail marsh, wet prairie, shrub-carr and sedge meadow. The dunes are weedy but still dominated by plants characteristic of this community type, including marram grass, sand-reed grass, Canada wild-rye and field wormwood. There are depressions within the dunes that support wetland plants, and scattered black and bur oaks occur with a few prairie grasses in the more stabilized sandy uplands. The site has been degraded by off-road vehicle use in the dune area, and by

riprapping of the shoreline. This is one of the few dune systems in southeastern Wisconsin, and rare plant species are present in both prairie and dune habitats.

Additional Comments

This site contains the only lakeplain prairie complex in Wisconsin, supports exceptional diversity and is large enough to provide suitable habitat for sensitive animals. The dune system to the north, though degraded, is the only dune remnant in southeastern Wisconsin and adjoins a rich wet prairie.

M-03. Root River Riverine Forest

Ecological Landscape: Southern Lake
Michigan
County: Milwaukee
Total acreage: 1330
Wetland acreage: 470



Root River Riverine Forest, 21 Oct. 2000. Southern mesic forest, City of Franklin. Photograph, E.J. Judziewicz.

Site Description

The Root River Riverine Forest is located within the six mile coastal zone in southern Milwaukee County just north of the Racine County border. It includes stands of mesic hardwoods and floodplain forest (composition is largely dependent upon the stand's microtopography) bordering the Root River and a gravel-bottomed tributary. The site was selectively logged in the past, and grazing may have occurred as well. Canopy species in the floodplain forest include silver maple, green ash and American elm; characteristic herbs include nettles, clearweed, sedges and waterleaf. The most intact stand of mesic forest has an extremely rich groundlayer and a good diversity of tree species including sugar maple, beech, basswood, red oak and white ash. As one of few remaining forest blocks in this region it provides habitat for many resident plant and animal species, including a number that are rare, and is used as a resting and feeding area by many migratory birds.

Additional Comments

The Root River Riverine Forest contains a diverse flora that includes several rare species and is a significant portion of the regionally important Root River corridor.

M-04. Warnimont Park Fens

Ecological Landscape: Southern Lake
Michigan
County: Milwaukee
Total acreage: 189
Wetland acreage: 0



Warnimont Park Fens, 21 Oct. 2000. White cedar on seeping, slumping clay bluffs of Lake Michigan. Photograph, E.J. Judziewicz.

Site Description

Warnimont Park Fens is a county owned site located on the south-central coastline of Lake Michigan in Milwaukee County. This site consists of semi-open clay bluffs with calcareous spring seepages, a narrow sand beach, a spring run, and maple-beech forest. Vegetation on the bluffs ranges from local stands of cedar and white birch to brush, and open areas are dominated by wetland plants and shrubs including many calciphilic species. Many uncommon or rare plants and animals also occur at this site. This site is threatened by the spread of invasive plants, altered hydrology and bluff erosion. While small in extent, these communities provide important habitat for plants and animals in an otherwise urbanized landscape.

Additional Comments

Partially protected within a county park, this series of seeping clay bluffs and the surrounding forest provide habitat for many rare species. Maintaining or restoring site integrity will be challenging owing to heavy recreational use and the heavily developed urban setting.

M-05. Harrington Beach Lacustrine Forest

Ecological Landscape: Central Lake
Michigan Coastal

County: Ozaukee

Total acreage: 270

Wetland acreage: 140



Harrington Beach Lacustrine Forest, 20 Oct. 2000. Hardwood swamp. Photograph, E.J. Judzewicz.

Site Description

Harrington Beach Lacustrine Forest is located on the shoreline of Lake Michigan in northeastern Ozaukee County. The lacustrine forest is located just west of the sandy shoreline beach and lies in a shallow depression underlain by sandy loam soils. It is a moderate- to good-quality mature second-growth northern wet-mesic forest, dominated by green and black ash, white cedar and basswood. This forest type is regionally rare and is heavily used by migratory birds.

This site is protected as part of Harrington Beach State Park. Other features in the park include a 23-acre lake occupying an abandoned dolomite quarry in the center of the park and a one mile long sandy beach. The beach receives heavy recreational use, limiting its potential as secure habitat for most beach inhabiting plants and animals. Abandoned agricultural lands nearby buffer the forest and currently provide habitat for grassland birds and other species that inhabit early successional vegetation. The entire park is heavily used by migratory birds, as are the adjoining waters of Lake Michigan.

Additional Comments

Threats include heavy recreational use, excessive deer browse, and rapidly increasing urbanization.

M-06. Kohler Andrae

Ecological Landscape: Central Lake
Michigan Coastal

County: Sheboygan

Total acreage: 3370

Wetland acreage: 1240



Kohler Andrae Area, 20 Oct. 2000. Dunes and swales. Dominant grasses are beachgrass and sand-reed.

Site Description

Lake Michigan Pine Hardwoods Dune Forest is a linear forest zone along Lake Michigan contiguous with the state park. It consists of many tracts of small ownerships with lakefront homes. White pine 12" - 20" is dominant with red oak, white birch, beech, sugar maple and others. Toward the Black River on the west are ash-white cedar swamps and alder thickets. There are some hemlocks in the area.. Many rare plants, including some endemic to the western Great Lakes, and a few rare animals are present.

Additional Comments

This is the largest dune complex on Wisconsin's western shore of Lake Michigan and provides habitat for many highly specialized plants, some of which are endemic to Great Lakes shorelines.

M-07. Cleveland Hardwood Swamp

Ecological Landscape: Central Lake
Michigan Coastal

County: Manitowoc,
Sheboygan

Total acreage: 710

Wetland acreage: 590



Cleveland Hardwood Swamp, April 2002. Black Ash Swamp temporarily flooded. Photograph, E. Spencer

Site Description

Cleveland Hardwood Swamp is an isolated depressional swamp with small upland forest inclusions located on top of a bluff overlooking Lake Michigan in southern Manitowoc and northern Sheboygan Counties. The swamp lies just west of Lake Michigan. A county road separates the wetland and the bluff top. The forest is mostly second growth and predominantly hardwood swamp (red maple, black and green ashes), though in the most intact portions of the site's interior white cedar is predominant. In areas where the canopy has been opened by recent logging, shrub swamp and open meadows, dominated by red-osier dogwood, speckled alder and blue joint grass, have developed. This swamp is one of few remaining large blocks of forest along Wisconsin's Lake Michigan coast and is important habitat for a diverse assemblage of plants and animals, including migratory songbirds.

Additional Comments

This stretch of the Lake Michigan coast is heavily developed and the vast majority of the former regional forest has been cleared. Use of coastal forests by migratory songbirds is very high, especially during spring.

M-08. Fischer-Centerville Creeks Area

Ecological Landscape: Central Lake
Michigan Coastal

County: Manitowoc

Total acreage: 1080

Wetland acreage: 80



Centerville Creeks Area. Common reed (*Phragmites australis*) on Lake Michigan bluffs, mouth of Fischer Creek, 20 Oct. 2000. Photograph, E.J. Judzewicz

Site Description

The Fischer-Centerville Creeks Area is located on the southeastern coast of Manitowoc County just north of the village of Cleveland. This site is a combination of several smaller sites, including a mixture of public (such as Fischer Creek County Park) and private ownerships (including one of the largest undeveloped properties in the county). Most of the sites within this area are less than five acres, but as a complex form a significant coastal wetland site. Glacial tills with sandy and silty lake deposits characterize the soil in the area. The unique geology of the area contributes to several interesting and uncommon wetland types.

At this site the seeping clay bluffs along Lake Michigan span a range of vegetation successional stages from open fen-like herbaceous dominated slope wetlands with cattails, gentians and other calcium-loving plants, to brushy alder and dogwood dominated slopes, and ultimately cedar dominated “stabilized” slopes along the northern-most stretch of bluff. Other wetlands, including sedge meadows and small shrub and forested wetlands, border Fischer Creek. A narrow but heavily used sand beach stretches between the two creeks; it lacks vegetation, most likely due to the intensive recreational use.

Both creeks are tributaries of Lake Michigan and flow through narrow steep-sided “canyons” down cut through the thick clay soils after the significant drop of lake levels in Glacial Lake Nipissing. Centerville Creek is a very fertile, moderate gradient creek that is impounded by an 11 ft dam, a relict from an old mill in the Town of Cleveland, just upstream from its mouth. Its bottom is composed predominantly of gravel, muck and sand.

Fischer Creek is a small stream with a bottom of muck and silt in the lower portions and clay, rubble and gravel predominating in the upper sections. Lake Michigan influences Fischer Creek at the outlet, and during high water periods, lake water can extend as far as one-quarter mile inland. As the lake level rises and falls due to the seiche, it continually changes the elevation of the creek outlet. When the outlet level rises, water flowing downstream backs up and low lying areas adjacent to the creek are inundated. Sucker and smelt spawn here. Sand blockage build up

at the mouth during low water periods, allowing only minimal flow. There are seven bridge crossings of the creeks within the site boundary.

Additional Comments

Conservation limitations include small size and various disturbances that have degraded the wetlands and creeks. The site does contain a diverse mosaic of wetland communities and also provides an interesting record of past geological events.

M-09. Point Creek

Ecological Landscape: Central Lake
Michigan Coastal

County: Manitowoc

Total acreage: 310

Wetland acreage: 20



Point Creek. Wooded portion of Point Creek upstream from the mouth. Photograph by E. Spencer.

Site Description

This wetland was identified as a high priority site for Manitowoc County (Water Resources Management Graduate Students, 1998). It is a combination of private lands and a sizable parcel known as "Kingfisher Farms," owned by the UW-Green Bay. It includes several small patches of "coastal canyon" wetlands. These coastal canyons feature bluff face seeps and gullies that were formed by the down cutting of their clay soils as Point Creek drained to Lake Michigan after the lake levels of Glacial Lake Nipissing dropped over 60 feet. The creek is clear, shallow, low gradient, and firm bottomed (gravel and sand). The stream has been used by rainbow trout and smelt as a spawning site.

The remaining vegetation on this site includes white cedar swamp, rich maple-basswood forest with a diverse groundlayer, and conifer-dominated forests that line most of the steep, narrow stream corridor. A narrow sand beach is present along the shoreline with localized development of dune and beach vegetation in low water years. Several rare plants and animals are known from this site. This block of forest is within a landscape that has been almost entirely converted to agricultural and residential uses. It provides important habitat for both migratory and resident species of animals and a number of plants that require specialized habitats.

Additional Comments

Although not large, this site includes good examples of several natural communities and one of the less isolated examples of a forested coastal canyon feature.

M-10. Silver-Calvin Creeks

Ecological Landscape: Central Lake
Michigan Coastal

County: Manitowoc

Total acreage: 640

Wetland acreage: 90



Silver - Calvin Creeks, 19 Oct. 2000. Mouth of Silver Creek. Photograph, E.J. Judziewicz.

Site Description

The Silver-Calvin Creeks site is located on the eastern coast of Manitowoc County a few miles south of the City of Manitowoc. This site combines four smaller wetland sites identified in the Coastal Wetlands of Manitowoc County report (Water Resources Management Graduate Students, 1998) and is under a mixture of public and private ownerships. Both Silver and Calvin creeks have down cut through bluffs of clayey reddish till to form 'coastal canyon' wetlands as the drainage network developed after the retreat from the former Lake Nipissing lake level.

At this site the canyons and stream corridors feature a mixture of wetland types including white cedar dominated bluff face seeps, hardwood swamps, emergent marshes, and shrub swamps. The wetlands have all suffered various degrees of disturbance. Upland forest with dominants that include both conifers and hardwoods cover the balance of the corridor.

Both Calvin and Silver creeks are moderate-gradient streams with gravel and rubble bottoms. Fish including smelt and suckers spawn here in the spring. The stream corridors are narrow and bordered by areas developed for residential or agricultural uses. The site does provide a diversity of habitats for native plants and animals, but many of these habitats are small. Even small patches of remnant forest can be quite significant as stopovers for migratory birds.

Additional Comments

Although small, this relatively undeveloped site is significant in this heavily developed stretch of Lake Michigan shoreline. However, conservation limitations include small size, isolation, past disturbances, and the impacts of surrounding land use.

M-11. Little Manistowoc River

Ecological Landscape:	Central Lake Michigan Coastal
County:	Manistowoc
Total acreage:	400
Wetland acreage:	70



Little Manistowoc River, 20 Oct. 2000. Estuary. Photograph, E.J. Judziewicz.

Site Description

The Little Manistowoc River wetlands are located in eastern Manistowoc County just north of the City of Manistowoc stretching from the river mouth upstream to County Highway Q. Similar to other coastal wetlands in the area, the site lies upon a clayey till plain. Wetland plant communities bordering the river include a small sedge meadow and a disturbed, open emergent marsh. Due to its proximity to Manistowoc, this site has suffered direct and secondary impacts of neighboring development and land-uses.

The estuarine sedge meadow's size and composition fluctuates depending upon both river flow and Lake Michigan water levels. It is still dominated by native sedges and grasses but remains vulnerable to infestation by reed canary grass and other invasive species. The disturbed emergent marsh is dominated by the invasive reed canary grass and cattails with other weedy species including nettles and burdock. A sizable block (approximately 80 acres) of hardwood forest is present in the northernmost portion of the site.

The Little Manistowoc river is a small tributary of Lake Michigan with a bottom of gravel and rubble. Smelt and suckers spawn here. Rainbow trout may spawn here if sufficient flow is present and appropriate habitat has not been degraded by siltation. Due to its the size and proximity to Lake Michigan, it is likely that this site provides important habitat for a variety of animal species. Additional inventory is needed to document more specific values.

Additional Comments

Small and somewhat degraded, the wetlands along the Little Manistowoc River provide habitat for native plants and animals and contain some of the more intact natural features in the local landscape.

M-12. Point Beach Area (Point Beach State Forest, Woodland Dunes, Rahr Memorial School Forest, West Twin River Marsh)

Ecological Landscape: Central Lake
Michigan Coastal

County: Manitowoc

Total acreage: 10570

Wetland acreage: 4430



Point Beach Area, 20 Oct. 2000. Lake Michigan beach
Photograph, E.J. Judziewicz.

Site Description

This site includes three disjunct areas adjoining the City of Two Rivers. These sites form a very important coastal wetland complex in Manitowoc County, with significant portions under state ownership and other areas managed for conservation values by private organizations. This site features well developed and extensive forested ridge and swale systems within Point Beach State Forest and Woodland Dunes.

Point Beach State Forest

This is a 1,800 acre area owned by the state and located just north of the City of Two Rivers. It includes two State Natural Areas, Point Beach Ridges and Wilderness Ridges. The state forest borders the Lake Michigan shore for six miles and is between 1/2 and 1 3/4 miles wide. It features many examples of Great Lakes coastal communities including some that are extensive and of high quality. These communities include Great Lakes beach and dune, interdunal wetland, forested ridge and swale, northern and southern sedge meadows, white cedar swamp and hardwood swamp.

The two most important community groups are the forested ridge and swale complex and the Great Lakes beach and dune. The ridges support several upland forest communities, with drier pine-oak-birch types near Lake Michigan, and mesic hemlock-hardwood forests farther inland. The swales vary from being forested with white cedar and tamarack to shrubby with alder dominant, to emergent marsh or northern sedge meadow communities. A large, mostly forested wetland lies west of the ridge and swale area and is drained by Molash Creek, a slow, hard, warm water stream. Quality and composition of the wetland is variable with areas of second growth black ash, green ash, trembling aspen, and white cedar; and black ash, tamarack, and white cedar swamp with alder, dogwood, cattail, and reed canary grass. There is also an area of higher quality white cedar-dominated swamp on the east side of the wetland. The lower section of Molash Creek flows southward out of the swamp, through a disturbed, open, green ash, alder,

and reed canary grass wetland, and then eastward to the lake through high quality alder thicket and southern sedge meadow.

Many rare plants and animals are known from the Point Beach area, including plants endemic to the Great Lake shorelines.

Some of the upland areas within the state forest also include old open fields with native and exotic plant species, as well as a few red pine plantations. A county highway passes through the state forest from north to south, and there are several paved and gravel access roads, three campgrounds, hiking and biking trails, parking lots, headquarters buildings, a lighthouse, a visitor center, and a few private inholdings. The trails, campground areas and portions of the beach and dunes receive heavy recreational use.

Woodland Dunes

Woodland Dunes is located just southwest of the City of Two Rivers. It is a privately owned nature preserve comprised of a 700 acre forested tract containing parallel sandy ridges representing former glacial lakes levels that lie 10-20 feet above Lake Michigan's present surface. The forested ridges support hardwoods, scattered hemlock, pine and aspen. Small elm, cedar, and lowland brush are present in the swales. This is an important stopping place for many migratory birds, and the site supports several rare plants and animals. Maintained trails and boardwalks provide access to a variety of habitats and facilitate local educational use and nature interpretation.

Rahr Memorial School Forest

The interior portion of this school forest is located just north of Point Beach State Forest, along the Lake Michigan shoreline. Privately owned cottages separate the state park from this property. This forest preserves a small portion of the same coastal wetland landscape as the park and includes hardwood swamp, shrub carr, and a 1/4-mile stretch of undeveloped Great Lakes beach. The upland vegetation includes northern dry mesic forest, as well as sandy old fields. The Great Lakes endemic beach plant, seaside spurge, has been seen here as recently as the mid 1990's.

Both on and off site land-uses have disturbed this area. Recreational use of the beach is particularly heavy, and a system of hiking trails traverses much of the site. Low-density residential development surrounds much of the school forest and a county highway separates the it from Point Beach State Forest to the south. Several areas to the west have undergone wetland restoration as part of local waterfowl management activities. Rahr Memorial School Forest should be considered in any management plan for Point Beach State Forest.

West Twin River Marsh

West Twin River Marsh is privately owned and one of the larger river marshes (roughly 80 acres) along Lake Michigan. The wetland borders the West Twin River west of the City of Two Rivers. Dominant plants are sedges and cattails with patches of willow and dogwood. Some infringements by the city and local farmers are taking place including dumping, filling, and draining of the river wetlands. This marsh is an excellent stopover for many species of birds.

Timber on the north edge has been completely cut, and grazing continues to be a significant land use.

Additional Comments

Point Beach contains significant examples of communities that are restricted to shorelines of the Great Lakes. Other parts of the site provide additional habitats and make the overall area valuable to many native species.

M-13. Kewaunee River Wetland Complex

Ecological Landscape: Central Lake
Michigan Coastal

County: Kewaunee

Total acreage: 1930

Wetland acreage: 810



Kewaunee River. River, emergent aquatics, and sedge meadow, 7 Nov. 2000. Photograph, E.J. Judziewicz.

Site Description

The Kewaunee River Wetland Complex is located in eastern Kewaunee County and is one of the largest wetland complexes bordering Lake Michigan. The wetland occupies both sides of the Kewaunee River where the river forms a large bend north of the city. The surrounding area has a gently rolling topography, but steep bluffs (60-80 feet high) define the boundaries of both the floodplain and the wetland. Most of the wetland is open sedge meadow and emergent marsh, and the dominant species include cattails, common reed grass and tussock and lake sedges. The remaining portions, mostly on slightly elevated and drier topography, are shrub and forested swamp. The river is fertile and generally turbid with a sheltered harbor, including two breakwalls, located at its mouth. The landscape surrounding this site is highly developed for agricultural and urban land-uses.

Historically, this area has been considered excellent wildlife habitat, particularly for songbirds, waterfowl, gulls, terns, herons, and shore birds. It supports a diversity of birdlife due to its proximity to Lake Michigan, the varied habitats present and the size and quality of the emergent marsh and meadow. This area is also migration corridor for many raptors and other birds.

Additional Comments

The largest marsh and wet meadow complex on the west shore of southern Lake Michigan. Overall quality and condition are good, and these wetlands are of high significance to nesting and migrating birds, and fish.

M-14. Black Ash Swamp Area

Ecological Landscape: Northern Lake
Michigan Coastal

County: Kewaunee, Door

Total acreage: 5660

Wetland acreage: 4600



Black Ash Swamp Area, border of Door and Kewaunee Counties, 7 Nov. 2000. Black ash and tag alder. Photograph, E.J. Judziewicz.

Site Description

Black Ash Swamp is located five miles west of the Lake Michigan coast, northwest of Algoma on the border of Kewaunee and Door Counties. This is a large inland swamp situated on an old glacial lake with poorly drained muck soils. The entire site is privately owned and surrounded by agricultural land with low-density rural development. Though some portions are degraded, Black Ash Swamp represents a large, diverse lowland forest within a highly fragmented landscape and may be host to a number of rare species.

Black Ash Swamp contains two extensive forest community types featuring both northern and southern species as well as an undeveloped stretch of Silver Creek, a major tributary of the Ahnapee River. The northern portion of the swamp supports second growth northern wet to wet-mesic forest of black ash, white cedar, and paper birch. In some areas the swamp grades into pure lowland conifer stands of cedar and tamarack. The small yellow lady's slipper, a species of special concern in Wisconsin, is abundant in the understory of this forest.

The southern portion supports a mixture of red maple, silver maple, green ash and black ash. Most areas contain a very open understory. Some portions are heavily dominated by silver maple and resemble a floodplain forest. High disturbance levels from logging and other uses have led to invasion by reed canary grass. Logging roads have altered the hydrology of the site and serve as an avenue for invasion by exotic species. Much of the understory, like other southern riparian forests, is heavily impacted by the spread of reed canary grass.

Private ownership of the site prohibited detailed floral and faunal surveys and limited field survey to those few tracts to which we had access. An updated and expanded survey is needed to determine the importance of this site to local and regional diversity. Due to the site's size and forest composition, it could harbor many species that are area sensitive including some that are found more commonly in northern Wisconsin. For example, surveys in 2001 discovered that this site harbors a small population of the federally endangered Hine's Emerald Dragonfly. Since access to private land was not granted, further work was not done to document breeding areas.

Additional Comments

Priority is difficult to determine at this time, but rank should be at least medium due to the site's size, landscape context, and presence of rare species.

M-15. Ahnapee River Wetlands

Ecological Landscape: Northern Lake
Michigan Coastal

County: Kewaunee

Total acreage: 890

Wetland acreage: 480



Ahnapee River Wetlands, 7 Nov. 2000. Photograph, E.J. Judziewicz

Site Description

The Ahnapee River Wetland is a five-mile, 1/4 to 1/2-mile wide corridor along the Ahnapee River between the Forestville dam and the City of Algoma. The lower stretch of the Ahnapee River corridor is a small freshwater estuarine system greatly influenced by Lake Michigan water levels. Situated on mucky wetland soils, the site supports isolated, small patches of white cedar, black ash swamp and tamarack swamp set in a matrix of wetlands including open wet meadows, emergent marshes and shrub swamp. The cedar swamps support a number of species at their southern range limits. The shrub and herb layer in these swamps vary with the stand's disturbance history. Relatively undisturbed sites have an intact herb layer and a fairly open native shrub layer, while disturbed sites have a less diverse herb layer and locally brushy shrub layer with tag alder or invasive species including Japanese barberry and autumn olive. Willows, dogwoods and bog birch are dominant in the patches of shrub swamp. Vegetation is dominated by native sedges and forbs in the intact, open meadows, while the invasive reed canary grass dominates disturbed or formerly tilled areas. Many areas within this site have been logged or grazed in the past, resulting in invasion by reed canary grass. The wetlands provide an excellent buffer for the river as adjoining lands have been cleared for agriculture.

Most of the area is privately owned, although a state trail passes through the site along an old railroad bed. Although they suffer from various high-impact uses, the Ahnapee River wetlands may be an important migratory corridor for various wetland species.

Additional Comments

Individual wetland patches are small and many have been degraded, but in aggregate they constitute an extensive corridor providing habitat for many native species and afford some protection to water quality in the river.

M-16. Shivering Sands Area (Whitefish Dunes, Kellner's Fen, Shivering Sands, Cave Point County Park)

Ecological Landscape: Northern Lake
Michigan Coastal

County: Door

Total acreage: 12020

Wetland acreage: 6590



Shivering Sands Area, Whitefish Bay Dunes State Park, foredune. Photograph, E.J. Epstein.

Site Description

The Shivering Sands Area is located along the eastern coast of Door County, north of Sturgeon Bay. It is a complex and important landscape with a great diversity of coastal wetland ecosystems. This site is composed of several smaller areas that include a mixture of state, county and private ownership. Each is described below.

Whitefish Dunes

Whitefish Dunes is a State Natural Area located within Whitefish Dunes State Park in Door County. The site contains all stages of succession from open unvegetated beach through mature stabilized dune forest. The primary coastal communities on this State Natural Area are active Great Lakes beach and open dunes, mature maple - beech - hemlock forest on stabilized dunes, and northern wet-mesic forest of white cedar, balsam fir, and hemlock. There is also a small lake with an associated sedge meadow and frontage on Clark Lake, a nearby baymouth bar lake. The beach and dune complex contains a unique flora with many species particularly adapted to this habitat and restricted to relatively undisturbed Great Lakes coastal areas. Many neotropical migrant bird species are known to nest in the park.

Shivering Sands

The Shivering Sands is a botanically-rich wetland complex that occurs along the northern coast of Lake Michigan. It is an exceptional site both in regards to its large size and natural community diversity. The vegetation is affected by the thermal balance of Lake Michigan, which has fostered a high degree of floristic diversity. The complex includes three undeveloped lakes and associated wetlands, including white cedar swamp and open fen communities. There is a conifer forest growing on thin humic soils over a dolomite limestone base and lowland conifer forest and wetlands on saturated peat soils over ancient beach ridges throughout the site. The large, central white cedar swamp surrounding the three undeveloped lakes forms a core rich in rare plant diversity; here many lilies, orchids and sedges flower amidst the mosses and downed trees. The open fen communities found on the lake edges harbor such rare species as tussock bulrush and coast sedge. Dwarf lake iris blooms in the dolomite - based upland conifer

forest east of the central cedar swamp. The site supports an impressive diversity of mammals including fisher, otter, black bear, snowshoe hare, porcupine, and mink. Breeding bird surveys have recorded 110 species of resident birds here.

This site is under significant residential development pressure and is threatened by fragmentation. Other threats include hydrologic disruption, detrimental logging practices, the spread of invasive species, construction of roads and other corridors, conversion of agricultural lands to subdivisions, and quarry operations. More minor threats include agricultural practices that diminish water quality and recreational overuse.

Kellner's Fen

Kellner's Fen is a 60 - 80 acre wetland complex. The area includes an open water lagoon, a large open fen, a transition zone of wet shrubs and small trees, coniferous swamps (of spruce, tamarack and white cedar), mixed hardwood-conifer swamps with black ash as an important canopy species, and forested ridge and swale topography. The fen is dominated by brown mosses and native sedges, including one rare species. This site is threatened by a serious infestation of the exotic shrub glossy buckthorn. Much of this site is unsuitable for development, but development of the adjacent uplands could alter the hydrology and have serious negative consequences for the wetlands.

The Shivering Sands area supports a great diversity of rare plants and animal species, including invertebrates.

Additional Comments

This large complex contains a diverse mosaic of natural communities and aquatic features that support a nearly intact biota with many rare species.

M-17. Northeast Coast Door County Area (North Bay, Ephraim Swamp, Bailey's Harbor Swamp, Moonlight Bay, Kangaroo Lake, Toft Point, Mud Lake Wildlife Area, The Ridges Sanctuary, Thorp Pond)

Ecological Landscape: Northern Lake
Michigan Coastal

County: Door

Total acreage: 20600

Wetland acreage: 8670



Northeast Coast Door County Area, Pickerel Pond, The Ridges, 20 July 2000. Wiregrass meadow, inundated in years of normal lake levels. Photograph, E.J. Judziewicz.

Site Description

This large area encompasses a series of high quality wetland sites and associated coastal features located on the northeastern coast of Door County, stretching from Bailey's Harbor north to the town of Rowley's Bay. Significant portions of this area are owned by state or private conservation organizations and are protected and managed for their natural values. The primary wetland natural communities include dolomite pavement shoreline and cobble beaches, old beach ridges stabilized by conifer-hardwood forest and swales containing a variety of wetland communities, Great Lakes marsh, rich fen and sedge meadow, rich conifer swamp and boreal forest.

Moonlight Bay Bedrock Beach State Natural Area

Moonlight Bay Bedrock Beach State Natural Area is located north of Bailey's Harbor. The primary shoreline feature is the dolomite bedrock pavement "beach," which is variously inundated or exposed, depending on Lake Michigan water levels. During low water periods the beach area is greatly expanded, facilitating colonization by many plants indicative of dynamic calcareous shorelines, including such rare species as small fringed gentian, bird's eye primrose, tufted hair grass and several sedges. Forested portions of the site overlie dolomitic ledges that are relicts of an ancient shoreline. These forests are typical of northeastern Door County boreal remnants, with white cedar, white spruce, paper birch, white pine, hemlock and balsam fir dominant. Thimbleberry and mountain maple are common understory plants, and the groundlayer, though sparse, supports many mosses and lichens and several rare plants.

Toft Point State Natural Area

Toft Point State Natural Area is located on a peninsula east of Bailey's Harbor. The cool microclimate along the eastern shoreline of this site is created by the effects of Lake Michigan,

and the plant cover includes a narrow strip of relict boreal forest dominated by balsam fir and white spruce. The remainder of the peninsula features a mesic forest of sugar maple, yellow birch, and hemlock, with scattered white pine. To the north, along Moonlight Bay, is an extensive marsh and sedge meadow complex that grades into shrub-carr and, finally, wet-mesic forest. This forest is dominated by white cedar, with occasional paper birch and black ash. The site, along with the adjacent Ridges Sanctuary, supports diverse resident birdlife including seventeen species of nesting warblers.

Mud Lake State Natural Area

Mud Lake State Natural Area is a 155-acre shallow, hard drainage lake surrounded by an extensive shrub and sedge fen and cedar and tamarack swamp with many standing snags. This area is located due north of Moonlight Bay, into which the outlet stream drains. The lake is predominantly marl-bottomed, although a dolomite bedrock bottom is found in some areas. Water levels fluctuate with seasonal precipitation and Lake Michigan levels. Reibolts Creek, the outlet stream, supports diverse beds of aquatic plants, which include bur-reed, coontail, pondweeds and wild rice. It has been stocked with trout and supports a trout-spawning run. The smaller aquatic plant beds in the lake support soft-stem bulrush, yellow water lily, common reed, and cattail. Sweet gale, dogwood, and willows dominate the shrub swamp. Waterfowl use of the site is occasionally heavy, and the site also supports a diverse assemblage of breeding marsh birds. Many rare plants and animals are known from this site, including two populations of the federally endangered Hine's emerald dragonfly.

The Ridges Sanctuary State Natural Area

The Ridges Sanctuary State Natural Area is located just north of Bailey's Harbor. It encompasses a variety of unusual habitats, and supports one of the greatest concentrations of rare plants in the Midwest. It features ridge and swale topography on a series of former Lake Michigan beach ridges. The ridges and swales vary from being open and wet with very rich calciphitic marsh and bog herbs dominating, to boreal conifer forest. Black and white spruce, balsam fir, and white pine are the most common canopy species. This boreal forest in northeastern Door County is far disjunct from the other boreal forest stands in Wisconsin, which occur mostly in the northwestern part of the state along Lake Superior. The climate is heavily influenced and moderated by Lake Michigan, with cooler springs and summers, warmer falls and winters. These conditions have resulted in reduced evaporation rates, lower growing season temperatures, and more precipitation, which allow northern species to thrive here. This site supports an outstanding assemblage of rare and endangered plants and animals, including the world's largest known population of the federally endangered Hine's emerald dragonfly.

Baileys Harbor Swamp and Ephraim Swamp

Baileys Harbor Swamp and Ephraim Swamp together form a wetland corridor, which almost completely crosses the upper Door Peninsula. The southern portions of the wetlands are adjacent to Baileys Harbor and consist of parallel, relict beach ridges remaining from the post-glacial time when Lake Michigan levels were higher. Some of the swales between the ridges are wet and open, while others are forested with swamp conifers. Development and fragmentation, caused by new roads and utility corridors, threaten this site.

North Bay

North Bay is a very large site covering approximately 4,700 acres, with approximately 8,500 feet of frontage along North Bay. It represents a significant stretch of undeveloped Lake Michigan shoreline and includes several high quality wetland communities associated with coastal processes. These wetland communities include emergent marsh, northern sedge meadow, and a large calcareous fen community. Further inland the site contains extensive tracts of northern wet to mesic forest intermixed with boreal components. Many shallow, cold hard water springs and spring runs originate within the site. The major spring fed stream, Three Springs Creek drains through the center of the site, emptying into Lake Michigan through a large emergent marsh at the north end of the bay. This marsh is dominated by soft- and hard-stemmed bulrush, cattail and bluejoint grass.

The North Bay area contains a significant breeding population of the federally endangered Hine's emerald dragonfly, as well as other rare dragonflies. Many other rare plant and animal species also occur here, and the bay is an important spawning site for many fish. Possible threats include ATV use, introduction or spread of invasive species, and development.

Thorp Pond and part of Kangaroo Lake are two ecologically important areas not within the primary Northeast Coast Door County site boundary (proper), but are adjacent to it.

Kangaroo Lake (including Meridian County Park on its south end) and Peil Creek

Kangaroo Lake is an embayment lake created by sand deposition and dune formation that followed the receding lake levels and regional post-glacial land rebound. It is a shallow, marl-bottomed basin with a high pH and calcium bicarbonate rich water. Set within a matrix of agricultural, residential and forestland, it has significant natural communities and rare species at both its north and south ends. At the north end is a wetland complex that includes a diverse mix of plant species characteristic of fen, sedge meadow, marsh, and shrub-carr. Plants such as shrubby cinquefoil, hoary and bog willow, twig-rush, and wire-leaved sedges are present and may be locally dominant. Several beds of common reed are also present. Several rare invertebrates occur in the wetlands and rare land snails occur on nearby dolomite outcrops.

The northernmost basin of the lake is shallow and filled with emergent marsh and floating-leaved macrophyte species including hard-stemmed bulrush, wild rice, and bullhead lily. Several rare plants are also present. A conifer swamp of white cedar and tamarack borders this complex of open wetlands.

The marshes of the north end of Kangaroo Lake are also important breeding and migration staging sites for diving and puddle ducks and shorebirds. Bald eagles, osprey, and Caspian terns often feed on the lake, and historically black terns have nested here. There is significant threat from the construction of single family units on the developable forest and lakeshore lands within the site. Residential unit construction with associated road and utility corridor construction is the major cause of habitat loss, habitat fragmentation and possible alteration to wetland hydrology. Inappropriate logging and recreational vehicle use are moderate threats.

On the south end of Kangaroo Lake is a complex of old beach ridges and dunes, now wooded with a 140-acre hemlock-sugar maple-yellow birch forest that is developing old-growth characteristics. Beech, red maple, white cedar and a few super-canopy white pines are also present. There is a dense shrub layer of Canada yew that exceeds 50% cover in parts of the older forest. Mountain maple is also locally common, but the herb layer is generally depauperate, composed of only a few species such as clubmosses, wood ferns, and Canada mayflower. This mesic forest type, located on a stabilized sand dune, is quite rare in Wisconsin.

Thorp Pond

Thorp Pond is a 312-acre, privately-owned complex of wetland communities in the interior of the Door Peninsula, set in a matrix of agricultural, residential, and recreational land, on thin soils over dolomite bedrock. At the center of the complex is a small seepage pond only a few acres in size. The pond is bordered by a narrow ring of tall shrubs, coarse sedges, and white cedar saplings surrounded, particularly on the north side, by a small (7-acre) but exceptionally floristically - significant boreal rich fen dominated by tussock sedges separated by muck pockets with pitcher plant, bladderworts, and buckbean.

A 248-acre northern wet-mesic forest dominated by medium-sized white cedar, tamarack, black spruce, and black ash encircles the fen and pond, with all but the tamarack reproducing. The understory includes alder-leaved buckthorn, red-osier dogwood, and herbs including goldthread and lady's-slipper orchids. The site has a history of logging and, perhaps, grazing, but the interior has recovered well. Also associated with this forest is a 57-acre hardwood swamp dominated by green ash and red (or hybrid red x silver) maple. The most mature patches have trees 9" - 15" in diameter. Characteristic understory herbs include marsh, cinnamon, and royal ferns, water-parsnip and sedges. A number of rare plants and at least one rare animal are present at this site.

Additional Comments

This area contains an exceptionally diverse mosaic of high quality natural communities and supports numerous rare plants and animals, some of which are of global significance and/or restricted to Great Lakes coastal environments.

M-18. Upper Door County Area (Mink River Estuary, Newport State Park, Europe Lake)

Ecological Landscape: Northern Lake
Michigan Coastal

County: Door

Total acreage: 9160

Wetland acreage: 1640 (not including pavement communities and open water)



Newport - Mink River. Emergents growing on exposed lakebed. Photograph by NHI staff.

Site Description

The Upper Door County Area site is located on the northernmost tip of Door County just east of the town of Ellison Bay. The area it encompasses is made up of several smaller sites, listed below. It is an important complex of upland and wetland community types dependent upon or formed by coastal processes. These include estuarine marsh, white cedar swamp, dolomitic bedrock pavement and cobble beach, Great Lakes beach and dune and former glacial lake shoreline now stabilized by hardwood and mixed boreal conifer-hardwood forest.

Mink River Estuary

The Mink River Estuary is owned primarily by The Nature Conservancy and is located in northeastern Door County just outside of Ellison Bay. The river originates in alkaline, spring fed headwaters and drains to the south into Lake Michigan. Between the lake and the headwaters is a dynamic estuarine system formed by the mixing and flushing of Lake Michigan and Mink River waters. During high water seiches the estuarine marshes are flooded; however, during low water the marshes are dry and many spring channels are evident. Bulrushes are the most common species in the deeper marshes, but wild rice, narrow-leaved cattail, and bur-reed dominate the intermediate depths. Shallower areas contain sedge meadow, with blue-joint grass, sedges and common reed grass. Surrounding the marsh is a narrow band of tall shrubs including willows, red osier dogwood, and alder which grades into a white cedar swamp that surrounds the Mink River corridor. This site also includes small areas of second growth northern hardwoods and a stretch of beach along Rowley's Bay. The river is an important fish spawning and bird migration area and the immediate landscape supports a variety of rare plant and animal species.

Newport Beach State Park

Newport Beach State Park (including Newport Conifer Hardwoods State Natural Area) features an extensive northern hardwood forest of medium-age sugar maple and basswood, an old growth forest of white and red pines, hemlock maples and red oak, and patches of forest composed of balsam fir, white cedar, white spruce and various hardwoods. The Lake Michigan shoreline is

characterized by exposures of dolomite bedrock, both as low cliff and ledges and as horizontal bedrock beach, and with splash pools and crevices providing microsites for several rare plant species.

Europe Lake

Europe Lake is an embayment lake located on the eastern side of northern Door County, and a portion of the site is within Newport Beach State Park. At one time, this lake was a bay of Lake Michigan but the action of waves and currents has formed a bar of gravel and sand across the mouth of the embayment, forming the lake. There is a forest of old-growth red and white pine and beech, with sugar maple and hemlock on the stabilized dune between Europe Lake and Lake Michigan. Swampy pockets of boreal forest occur east of Europe Lake, and this habitat supports many rare plants. A narrow fringe of open active dunes and sand beach occurs on the Lake Michigan shoreline.

Additional Comments

This site contains the best developed freshwater estuary on the Wisconsin shore of Lake Michigan, an extensive block of upland hardwood and mixed conifer-hardwood forest, and over 6 miles of undeveloped shoreline of alkaline rockshore, and beach and dunes. Many rare or otherwise sensitive species have been documented here.

M-19. Washington Island Wetlands (including Coffee Swamp, Jackson Harbor Ridges, Big Marsh, and Little Marsh)

Ecological Landscape: Northern Lake
Michigan Coastal

County: Door

Total acreage: 2020

Wetland acreage: 350



Washington Island Wetlands, Plum Island, 22 July 1999. Brook lobelia (*Lobelia kalmii*) meadow surrounding lagoon (“Carp Lake”) periodically connected to Lake Michigan. Photograph, E.J. Judziewicz.

Site Description

Washington Island wetlands are in a mixture of state and private ownership and are located directly north of the Door Peninsula mainland. There are three important coastal wetland areas on Washington Island - each described separately below.

Big and Little Marsh.

This complex 250-acre site is located midway up the eastern coast of Washington Island and includes two primary components. First, there is a sandy barrier beach that has been mostly developed with a road and houses. At the south end of the beach there are small but good quality remnant Great Lakes Beach and Lake Dune communities, containing several rare plant species.

The barrier beach cuts off a second, larger component of the site: an extensive and undeveloped open wetland and wooded swamp (Big Marsh) located inland and west of the barrier beach. Immediately inland is a 38-acre Emergent Aquatic marsh on marl dominated by softstem bulrush. In some places there are patches of nearly bare marl with pavements of dolomite gravel and cobbles that are exposed at times of low water levels. Water depth ranges from two feet in the spring to dry by autumn and is seemingly dependent on the level of Lake Michigan, although the marsh is not directly connected to the Lake. Several rare plant species occur here.

West of the marsh are two additional communities of note. Rare plant species are present in both. To the southwest is a 60-acre Northern Wet-Mesic Forest (white cedar swamp) that is probably the highest quality representative of this community type on Wisconsin’s Lake Michigan islands. Northwest of the marsh is a 7-acre Boreal Rich Fen community dominated by wire-leaved sedges, sweet gale, shrubby cinquefoil, and alder-leaved buckthorn.

Northeast of Big Marsh is Little Marsh, with smaller and lower quality wetland communities, including Northern Hardwood Swamp (black ash dominant) and an ephemeral pond.

The landscape surrounding the Big-Little Marsh Area is mostly forested with second-growth hardwoods and conifers, and, farther away, abandoned agricultural fields. The potential for additional housing developments on adjacent uplands is a concern.

Except for Percy Johnson County Park, the entire site is divided among numerous private owners.

Coffee Swamp

This area is an approximately 300-acre wetland complex located midway along the northern coast of Washington Island. At the core of the complex and located about 0.5 miles south of Lake Michigan, is a small, very hard water, shallow seepage pond with a substrate of pure marl. It nearly dries up in late summer during years when Lake Michigan is low. North of the pond is a 9-acre Boreal Rich Fen dominated by wire-leaved sedges, sweet gale, bogbean, bog goldenrod, and hoary willow. This fen has several rare plant species but also contains the exotic glossy buckthorn and the aggressive common reed grass.

Surrounding the fen, on the south side of the pond, is a large (225 acre) white cedar swamp that has been severely impacted by deer browse. To the north of the cedar swamp there is a small (10 acres) but distinctive and high quality hardwood swamp dominated by black ash. There are also small patches of Northern Sedge Meadow in various places within the complex.

The coastline of Lake Michigan is mostly an upland white cedar forest (with some balsam fir) on very thin soil over dolomite gravel and cobbles. Interspersed in this forest are a few old abandoned agricultural fields and an old channel that was blasted through the dolomite bedrock in an attempt to drain the swamp. One portion of the Lake Michigan shoreline has a unique “cobble glade” community type with a scattering of cedars among heaps and windrows of large dolomite cobbles.

A 40-acre State Natural Area is at the core of Coffee Swamp. There are several private landowners to the south and west, and a very large landowner to the north and east along the Lake Michigan shoreline. Should this owner decide to sell, there will be very high development pressures on this shoreline.

Jackson Harbor Ridges

This State Natural Area is located on the northeast side of Washington Island which contains an excellent assemblage of rare and uncommon vascular plants. The beach undulates with numerous areas of dry to wet sand and interdunal swales. These swales, including a large one near the base of a point, contain an unusual community that prefers wet calcareous soils. Characteristic plants here are Kalm's lobelia, shrubby cinquefoil, arctic primrose, low calamint, slender bog arrow-grass, bladderworts, and many sedges. The beach gradually grades into drier dunes which are stabilized with drought tolerant species such as bearberry, horizontal juniper and sand coreopsis. Behind the dunes is a mixed conifer-hardwood forest of red and white pines, white cedar, balsam fir, and American beech. The entrance to Jackson Harbor is a sand spit which attracts gulls, terns, shorebirds and waterfowl.

Washington Island Wetlands support many rare plant and animal species including some which are Great Lakes Coastal endemics.

Additional Comments

This site consists of two designated State Natural Areas and a third location that is designated as a conservation project. Though none of the individual areas is large, overall quality is high, and many rare species are present.

M-20. Renard Swamp Area

Ecological Landscape: Central Lake
Michigan Coastal

County: Door

Total acreage: 300

Wetland acreage: 130



Renard Swamp. Northern mesic forest. Photograph by NHI staff.

Site Description

Renard Swamp Area is privately owned by a youth camp and is located in southwestern Door County, along the eastern shore of Green Bay just north of Shoemaker Point. This site lies on mucky, wet soils not commonly found along the western shore of the Door Peninsula. It features a significant stand of hardwood swamp, with an associated older growth maple-basswood forest occurring on gravelly former beach ridges.

The hardwood swamp is a large, pure stand of 12" - 27" silver maple resembling a riverine floodplain forest, with a weedy understory of wood and stinging nettles. The level flatlands both northwest and southeast of the beach ridge have mixtures of silver maple, green ash, and cottonwood (reaching 27" d.b.h.).

The maple-basswood forest has a diversity of tree species in its canopy and a mesic groundlayer. There is no clear canopy dominant, as sugar and red maples, white birch, hemlock, ashes, ironwood, red and bur (or swamp white) oaks, and basswood are all frequent. Yew is common, forming large patches on the bayside of the beach ridges. Deer browse levels appear low throughout the site.

The only current use of the site is recreational, with the hiking trails receiving rather heavy use from the camp. Logging has not taken place in the recent past, though large old stumps are present. Dame's rocket, an invasive exotic plant, is present and its further spread at this site is a threat. A mixture of private forest lands and a youth camp border the site, but agricultural and residential uses dominate the surrounding landscape.

There is a high diversity of species at this site. However, agriculture has had significant impacts on Renard Creek.

Additional Comments

Although small and isolated, this site supports relatively intact and potentially viable examples of native communities, one of which is quite rare along this stretch of the Lake Michigan coast. Use

by animals has not been documented, but virtually every patch of coastal forest provides important stopover habitat for migratory birds.

M-21. Duvall Swamp

Ecological Landscape: Central Lake
Michigan Coastal

County: Kewaunee, Door

Total acreage: 5290

Wetland acreage: 2800



Duvall Swamp, Little Mud Lake. Photograph by NHI staff.

Site Description

Duvall Swamp is a privately owned lacustrine swamp located 2 1/2 miles inland from the eastern Green Bay shore, in northwestern Kewaunee County. Much of area was logged in the past, and small areas are continuing to undergo harvest. Grazing has not occurred in the swamp. This extensive second-growth swamp is hardwood dominated, with black ash and white birch the most frequent species. Conifers are present but only as associates. Small patches are dominated by cedar and/or tamarack, with balsam fir, black spruce and white pine also present. The understory is locally brushy with alder, sapling black ash, willow, and dogwood, and the groundlayer indicates that some areas are quite nutrient rich. Populations of three rare plants were documented at this site.

This swamp and a small undeveloped lake embedded within it form the headwaters of the Red River. The lake is surrounded by an open, boggy, quaking sedge mat dominated by waterwillow, sedges, and ericaceous bog shrubs that grades into a zone of shrub-carr and then to cedar swamp. The shrub-carr area is primarily bog birch with dogwood and alder.

As a large block of forest in a predominantly agricultural landscape, this site provides important habitat for a variety of plant and animal species. Initial breeding bird surveys conducted along the site's perimeter indicate that this swamp is an important reserve for species formerly more common within this ecological landscape. Due to its size, location and habitat features this is undoubtedly an important site for migratory songbird stopovers. Additional survey work is needed here, as much of the site was not visited, and some element occurrence records are outdated.

Additional Comments

Though disturbed by extensive logging, this site represents one of the very few large blocks of remnant forest in this heavily developed landscape.

M-22. Red Banks Glades

Ecological Landscape: Central Lake
Michigan Coastal

County: Brown

Total acreage: 5300

Wetland acreage: 1610



Red Banks Glades. Cedar glade with rich understory.
Photograph by NHI staff.

Site Description

Red Banks Glades is a privately owned site located in northeastern Brown County. It contains an unusual and unique array of natural communities that owe their origins to glacial and Great Lakes processes. Red Banks supports Wisconsin's best example of an alvar community and unusual variants of the prairie-savanna and cedar forest communities. The glades comprise a linear area 2½ miles long by ¼ to ¾ of a mile wide that is perched on top and at the edge of the Niagara Escarpment, a bedrock feature composed of Silurian Age dolomite, extending from southeastern Wisconsin north and east to New York state. The site is characterized by areas of exposed bedrock and very thin soils. Moisture conditions vary widely throughout the year, ranging from inundated to extremely droughty.

Fire suppression and disrupted hydrology have allowed much of the vegetation to form an almost closed canopy dry forest of bur oak, shagbark hickory, red cedar, and aspen, with small scattered openings supporting plants characteristic of savanna or prairie communities such as big and little bluestem, Indiangrass, goldenrods, asters, and sedges. The exotics Kentucky bluegrass and smooth brome are common and sometimes dominant in the openings. The generally dense shrub layer includes the native New Jersey tea, common juniper, gray dogwood, ninebark, snowberry, and perfumed cherry, and the exotics common buckthorn and Tartarian honeysuckle. An interesting form of this community occupies abandoned pastures and consists of an open savanna of scattered red cedars, a scattering of native prairie species, and some herbaceous exotics such as Kentucky bluegrass.

A unique white cedar woodland community also occurs at this site, bordering Gilson Creek on the dolomite cobbles of the relict beach ridges left by Glacial Lake Oshkosh following its retreat. This community is dominated by white cedar, native sedges and the shrub, common juniper. The rare Great Lakes endemic, dwarf lake iris, is a local dominant in the groundlayer.

The western edge of the site is defined by the rocky bluffs of the Niagara Escarpment. Highly specialized, very rare land snails occupy cliffs, fissures, talus, and spring seepages associated

with the bedrock. Trees growing on the forested portions of this geologic feature include some of the oldest red and white cedars known from Wisconsin.

Major disturbance factors affecting this site include hydrologic disruption, quarrying, heavy grazing, invasive plants, encroachment by residential development, and fragmentation by roads and power line corridors. A long history of fire suppression, in concert with these other factors, has altered the composition and structure of the alvar community by increasing the dominance of woody species. That being said, portions of this large site are relatively intact or restorable. In addition, many rare plant and animal species occur here, including several endemic to this area or with highly specialized habitat needs. In particular, invertebrate diversity is high in both the insect and land snail groups, with many rare taxa represented.

Additional Comments

This site contains unique geologic features, natural communities and rare species. Threats remain very high, and Red Banks Glades is a priority for immediate conservation attention.

M-23. Point au Sable

Ecological Landscape: Central Lake
Michigan Coastal

County: Brown

Total acreage: 310

Wetland acreage: 200



Point au Sauble. Aerial view shot during high water period. Note the two inlets to the inner lagoon. The westernmost inlet is now no longer functioning. Photograph by UWGB Biodiversity Center staff.

Site Description

Point au Sable is a small peninsula owned by the University of Wisconsin - Green Bay, extending from the southeastern shoreline of Lower Green Bay in northeastern Brown County. This site lies at the zone of transition from sandy lakeplain in the lower bay to steep till bluff and bedrock escarpment along the eastern shore of Green Bay. This is one of very few wetlands on the eastern shoreline of Green Bay. The point's location and the dynamic nature of its estuarian wetland make this site a local hotspot for birds and other fauna. Wetland communities present here include hardwood swamp, shrub swamp, emergent marsh, open water lagoons, sedge meadow and beach. This site has been preserved from development owing to a private duck-hunting club purchasing the area in the late 1800's and then being acquired by UW - Green Bay.

The primary wetland community is an emergent marsh composed mostly of cattails and common reed bordering a lagoon in the interior of a hook-shaped peninsula. The wetland experiences alterations due to fluctuations in Green Bay water levels. A stream flows through the wetland, and there are many areas of open water. The extent of marsh vegetation varies with water level fluctuations that are an integral part of the wetland ecology of Green Bay.

Lower Green Bay has a history of being heavily polluted. The extent to which pollution affects Point au Sable is unknown, although dumping of industrial and other wastes formerly occurred offshore.

Regular surveys of the resident and migrant birds have documented a rich diversity of species including waterfowl, passerines, raptors and shorebirds. Many rare birds have been seen here, generally as migrants.

Additional Comments

This site is small and degraded by past uses of the lower bay but is one of the very few wetlands on the east side of Green Bay. Use by migratory birds is significant.

M-24. Whitney Slough

Ecological Landscape: Central Lake
Michigan Coastal

County: Brown

Total acreage: 550

Wetland acreage: 300



Whitney Slough, 8 Nov. 2000. On far northeast side, city of Green Bay. Sedge-dominated swales between forested beach ridges. Photograph, E.J. Judziewicz.

Site Description

Whitney Slough is located east of the mouth of the Fox River and adjacent to the city of Green Bay, 250 feet from the southern shoreline of lower Green Bay in Brown County. It is bounded on the south and east by steep slopes. Most of the wetlands are a rather simple lowland forest with little herbaceous ground cover. Cottonwood is generally the dominant species, though other tree species are present. There are also stands of emergent marsh dominated by cattails and shrub swamp. It is likely that the wetland was, at one time, contiguous with the waters of Green Bay, but a highway and residential development now separate them.

The Green Bay Wildlife Sanctuary lagoons are located in the western part of the site. These include a series of ponds and connecting channels which have been excavated to serve as a wildlife refuge. The water source is surface drainage, and a pump-supported drainage system regulates the water levels. High water levels have historically reduced the quality of the wetlands. There is little seiche movement above Whitney Slough in the Bay Beach area because of shoals between Point au Sable and Grassy Island. While lower Green Bay is heavily polluted, the extent and effect of these pollutants on Whitney Slough is unknown.

This wetland has been fragmented and degraded by residential and commercial development, landfill sites, roads, dikes, and drainage ditches found in the wetland. Portions of the wetland have been used as landfill sites. A dumping ground lies several miles offshore of the wetland within Green Bay. The northwestern portion of the wetland includes Bay Beach Park and Green Bay Wildlife Sanctuary; no other major areas of the wetland are publicly owned.

The site is an important migratory stop over point for songbirds. No rare species have been documented as breeding at this site.

Additional Comments

This site is primarily of local value due to its small size, the extensive development around it, and its isolation from the lower Green Bay ecosystem. Despite its disturbed nature, it should be considered a part of the highly significant complex of lower Green Bay wetlands.

M-25. Lower Green Bay

Ecological Landscape: Central Lake
Michigan Coastal

County: Brown

Total acreage: 4090 (includes
open water)

Wetland acreage: 490



Lower Green Bay, 31 Aug. 2000. Green Bay at end of Harbor Lights Road, Town of Suamico, Brown County. Photograph, E.J. Judzewicz.

Site Description

This area is made up of several smaller sites that combine both state and private ownership on the western shore of lower Green Bay. The sites begin just north of Peats Lake and continue south and east to the Bay Port Industrial Tract in the City of Green Bay just west of the mouth of the Fox River. These areas are located on poorly drained sandy lakebed and are heavily influenced by periodic water level fluctuations and seiche effects from Green Bay. Much of the area is managed as a wildlife area by the Wisconsin DNR.

Peats Lake & Duck Creek (also called Atkinson Marsh Complex) is located near the southern end of Green Bay, west of the mouth of the Fox River and on either side of the mouth of Duck Creek. These wetlands are situated in shallow water in lower Green Bay and are characterized by stands of emergent aquatic macrophytes. The exotic common reed grass has formed large monotypic clones here and dominates much of the area. Condition of this marsh is variable and many portions of it have been extensively diked and filled, degrading the site and reducing its acreage and functions.

Lake level fluctuations caused by seiches considerably alter the size of the wetlands in lower Green Bay. Fluctuations of the Fox River water levels allow nutrient- and silt-laden water to inundate the marsh. Pollution and siltation has degraded this wetland complex that was historically one of the finest and largest wetlands in the Midwest. Urbanization continues to threaten the site and the marsh is likely to suffer further degradation. Over 250 bird species have been recorded here, and this marsh continues to receive heavy use as a resting and staging area during migration. However, the simplification of the vegetative composition of the marsh has reduced the habitat diversity available thus reducing the numbers of birds of the using the area for breeding and foraging.

Bay Port Industrial Tract is a highly disturbed roughly 200-acre area along Green Bay just west of the Fox River. It is surrounded by industrial development but has historically provided nesting sites for colonial waterbirds and rare marsh birds.

Cat Island is located in Green Bay. Along with the surrounding islands it provides important nesting habitat for colonial birds.

The privately owned wetlands within lower Green Bay are subject to relatively high development pressure for conversion to agricultural or residential uses. The primary function of this site is providing breeding and migratory stopover areas for waterbirds, and it has also supported populations of rare plants and other animals, including invertebrates.

Additional Comments

This site ranks high due to the heavy use of the Lower Green Bay marshes by nesting and migrating birds and spawning fish. However, extensive remediation is needed to curb the loss and degradation of these wetlands.

M-26. Long Tail Point

Ecological Landscape:	Central Lake Michigan Coastal
County:	Brown
Total acreage:	1120
Wetland acreage:	300



Long Tail Point, aerial view. Photograph by Gary Fewless, UWGB

Site Description

Long Tail Point is located on the west shore of lower Green Bay, two miles east of Suamico in northern Brown County. It is a state-owned, narrow sand spit and associated embayment resting upon poorly drained sand lakeplain soils which stretch to the southeast for nearly four miles into lower Green Bay. The mouth of the Suamico River is just to the north of the point. The size and shape of the peninsula combined with the fluctuating water levels in lower Green Bay result in a very diverse assemblage of wetland flora and fauna. During high water level periods the point becomes a series of small islands.

The water table is at or near the surface throughout the entire site. Patches of black willow and cottonwood thicket occupy the highest ground, grading to the west into sizable monotypic clones of common reed grass and, finally, a large good quality emergent marsh dominated by cattails, softstem bulrush and three square bulrush. The portion of Dead Horse Bay that borders the point and the west shore of Green Bay support a somewhat intact, though relatively species poor, sedge meadow dominated by bluejoint grass and cattails. The invasive exotics common reed grass and purple loosestrife are common associates here and are a threat to displace the currently dominant native species. On the eastern side of the point there is sandy beach which is well developed at times of low water levels and provides habitat for at least one rare Great Lakes coastal endemic plant.

Fluctuations in Green Bay's water levels, caused by seiches and long-term water level changes, considerably alter the size of the wetlands over time. A change of several inches in water level can drastically alter the amount of wetland present and influence the type of vegetation and wildlife habitat available. Soil erosion from dredging activity and poor water quality in Green Bay has altered or destroyed many other former wetlands and aquatic plant beds in the lower Green Bay area.

This site provides very important habitat for shore birds, gulls and terns, which have historically included a rare species. This is an important migratory bird stopover point and is heavily used by waterfowl and shorebirds, as well as raptors and passerines.

Ownership by the state suggests that the wetlands will remain undeveloped in the future. However, heavy recreational use is a potential threat to this site. The area is used for many forms of recreation including hunting, fishing, trapping, boating, snowmobiling and skiing.

Additional Comments

Wetlands of lower Green Bay have been dramatically diminished and degraded by developments, wetland fills, hydrologic alterations, pollution, and the spread of aggressive invasive species. Remnants continue to provide significant habitat for migratory and resident birds and fish. This site is an important and integral component of the productive wetland remnants in lower Green Bay.

M-27. Sensiba Wildlife Area

Ecological Landscape: Central Lake
Michigan Coastal

County: Brown

Total acreage: 530

Wetland acreage: 450



Sensiba Wildlife Area. Man-made dike near Green Bay shoreline. Photograph by NHI staff.

Site Description

Sensiba Wildlife Area is state owned and lies on poorly-drained sandy lakeplain. It is located on the western shore of lower Green Bay in northern Brown County, directly north of Long Tail Point. The wetland communities here have been drastically altered by a system of dikes and ditches.

There are two main wetland types at this site: a large emergent marsh dominated by cattails and interlaced with open water channels, weedy areas and clones of giant reed; and a sizable but highly disturbed, open canopied, forested wetland lying between the emergent marsh and uplands to the west. This swamp is dominated by ash and other swamp hardwoods species, with a somewhat brushy understory of willow, dogwood and broad-leaved herbs.

This wetland remains an important breeding site for marsh birds and as a migratory stopover for both waterbirds and passerines. Both rare plants and animals have been documented at this site, but much of the habitat that previously supported these species has been destroyed or severely degraded.

Additional Comments

These wetlands are quite disturbed and the hydrology has been drastically altered by the construction of dikes and ditches.

M-28. Little Tail Point

Ecological Landscape: Central Lake
Michigan Coastal

County: Brown

Total acreage: 1600

Wetland acreage: 550



Little Tail Point, 31 Aug. 2000. Emergent aquatic community with duck potato (*Sagittaria latifolia*) and water-plantain (*Alisma triviale*). Photograph, E.J. Judzewicz.

Site Description

Little Tail Point is a sandy peninsula which extends 2.5 miles into the western lower Green Bay along the Oconto/Brown county border. Little Tail Point is a sand spit and associated embayment, lying entirely on poorly drained sand lakeplain. The wetland vegetation is best developed along on the western side of the point adjacent to the Green Bay shoreline. Recent low water levels have exposed a narrow sandy beach on eastern site of the point.

The water table is at or near the surface throughout the whole point. A thicket of black willow and cottonwood occupies the highest ground, grading into a lower, wetter reed canary grass and slender willow thicket, and finally into an emergent marsh dominated by cattail, softstem bulrush, nodding beggar's ticks and duck potato. The emergent marsh occupies the protected bay where the point meets the mainland and stretches the entire length of the point.

Fluctuations in Green Bay's water levels, caused by seiches and long-term water level changes, considerably alter the size of the wetlands over time. A change of several inches in water level can drastically alter the amount of wetland present and influence the type of vegetation and wildlife habitat available. The area is important breeding and migratory stop over habitat for many songbirds, waterfowl, gulls and terns, including several rare species.

This site is owned by a private hunting club and is largely protected from development and heavy recreational use.

Additional Comments

Wetlands of lower Green Bay have been dramatically diminished and degraded by developments, wetland fills, hydrologic alterations, pollution, and the spread of aggressive invasive species. Remnants continue to provide significant habitat for migratory and resident birds and fish. This site is an important and integral component of the productive wetland remnants in lower Green Bay.

M-29. Mud Creek Wetland

Ecological Landscape: Northern Lake
Michigan Coastal

County: Oconto

Total acreage: 1370

Wetland acreage: 800



Mud Creek Wetlands, 6 Sept. 2000. Narrow sandy beach at Lade Beach, south of Lade Beach Road. Photograph, E.J. Judzewicz.

Site Description

Mud Creek Wetlands are located along the western shore of lower Green Bay. This area is a large, although somewhat disturbed, complex of wetlands that includes emergent marsh along the shore which grades into large stands of shrub and hardwood swamp. Fluctuations in water level caused by seiches have both short- and long-term impact on coastal vegetation, influencing the composition of the marsh, as well as the extent and character of available wildlife habitat.

The western shore of lower Green Bay, although quite developed, still has a large amount of wetland acreage. Areas surrounding Mud Creek Wetlands has been developed for agricultural and residential uses. The area has historically received use as a migratory stopover for songbirds, waterfowl, gulls, terns, waders and shorebirds.

Additional Comments

Though somewhat degraded, the large wetland acreage here is important to many animals, especially migratory birds. Additional field inventory is needed to better determine the significance of this site.

M-30. Charles Pond

Ecological Landscape: Northern Lake
Michigan Coastal

County: Oconto

Total acreage: 440

Wetland acreage: 210



Charles Pond, 27 Aug. 2000. View across bay (formerly a “pond” cutoff by a baymouth bar). Photograph, E.J. Judziewicz.

Site Description

Charles Pond is a State Natural Area located along the west shore of Green Bay in southern Oconto County, south of the City of Pensaukee. Glaciolacustrine deposits of sand, silt and clay characterize the surficial geology of this site and the surrounding area. These lake sediments include associated deltas, low sand dunes, and organic deposits.

Charles Pond is a former bay-mouth bar lake. The site contains a swamp hardwood forest with a rich groundlayer, dominated by 6" - 12" trees (up to 24"d.b.h.) silver and sugar maples, green ash, basswood and swamp white oak. Patches of shrub swamp dominated by willow, alder, and red-osier dogwood are also present. A narrow strip of emergent marsh dominated by dense stands of soft-stem bulrush and broad-leaved cattail borders the bay. Closer to shore, the marsh grades into a narrow zone dominated by joe-pye weed, blue vervain and the invasive exotic plants purple loosestrife and common reed grass. The presence of these invasive plant species threatens the community integrity of the emergent marsh and shrub swamp.

This wetland is heavily influenced by water level changes in Green Bay and Lake Michigan. When Lake Michigan levels are low the pond is separated from the bay by a sand spit. During high water level periods the pond is reconnected to Green Bay. Inundation from the high water levels of the 1980's, and the accompanying disturbance, broke up much of the emergent marsh and shrub swamp and drowned low lying portions of the hardwood swamp. During low water years, exposed mud flats provide excellent migratory stopover habitat for many species of shorebirds and other waterfowl. Shrub swamps are common in many wetland areas on the West Shore of Green Bay, and serve as important migratory stopover areas for many migratory birds.

Additional Comments

This dynamic site changes dramatically over time. Curbing the spread of invasive species will require increased attention here. As with other wetlands on Green Bay's east shore Charles Pond is an important stopover area for migratory birds.

M-31. Pensaukee River Wetland Complex

Ecological Landscape: Northern Lake
Michigan Coastal

County: Oconto

Total acreage: 16290

Wetland acreage: 6390



Pensaukee River Wetland Complex. Pecore Point on Green Bay shore, 31 Aug. 2000. Emergent aquatic community dominated by softstem bulrush (*Schoenoplectus tabernaemontani*) and rush (*Juncus*) species. Photograph, E.J. Judziewicz.

Site Description

The Pensaukee River Wetland Complex is a mixture of state (Pensaukee Wildlife Area) and privately owned lands, located on a sandy lake plain near the mouth of the Pensaukee River on the western Green Bay shore of Oconto County. This site includes many wetland community types. Of greatest interest are the large emergent marshes along the shoreline, which are best developed south of the river. Dominants in these marshes include soft-stem bulrush, rushes and rice cutgrass. Water level fluctuations caused by seiches considerably alter the size and vegetative composition of the wetlands bordering the river and bay.

Many scattered, quite large complexes of second growth hardwood and shrub swamp also occur throughout this wetland. Some of these are concentrated on private lands in the interior of the site. Dominants include aspen, oak and white birch, or elm, ash, red maple and white pine in the more southern portions of the site. The shrub areas are a mixture of alder, dogwoods and willows.

Overall the area provides diverse habitat for a wide range of songbirds, gulls, terns, shorebirds, mammals, reptiles, invertebrates and plants. This site is also an important spawning ground for many fish species in Green Bay, including northern pike (Schuette and Rost, 1998).

Because of the site's mosaic of upland and wetland conditions, residential developments, roads and agricultural developments lie within its boundaries. Occasional overflow of nearby waste containment structures and heavy runoff in the Pensaukee River drainage basin may cause significant amounts of suspended solids to enter the River; the effect on this wetland complex have not been studied. The state wildlife area is used for many kinds of recreation including hunting, fishing, trapping, boating, snowmobiling, and cross-country skiing.

Additional Comments

Somewhat degraded and fragmented, the Pensaukee wetlands provide important habitat for many native animals and contain good quality marsh and shrub swamp communities.

M-32. Oconto Marsh

Ecological Landscape: Northern Lake
Michigan Coastal

County: Oconto

Total acreage: 3700

Wetland acreage: 2340



Oconto Marsh. South Marsh, 17 Aug. 2000. Sedge meadow.
Photograph, E.J. Judziewicz.

Site Description

Oconto Marsh is one of the largest wetlands along the western shoreline of lower Green Bay, surrounding the Oconto River mouth and stretching several miles to the north and south. Most of the site is owned by the state (as part of the Green Bay Shores State Wildlife Area), but there are some private inholdings. Most of the wetland, particularly around the delta, is a complex of sedge meadow and emergent marsh, though shrub swamp is also present in association with these communities. Patches of swamp hardwood forest are also present further inland and on small islands in the river channel.

The main marsh area features low beach ridges and swales and abandoned oxbows and meanders of the Oconto River near the river's delta at Green Bay. Fluctuations in water levels caused by seiches and long term water level changes are large enough to have an impact on vegetation composition and extent and type of wildlife habitat

The marsh is an important breeding area for birds and receives significant use from migrating waterfowl and shore birds. It is important to many species that have been forced to abandon former habitat in the southern part of the bay because of high water levels, wetland filling and pollutants. A number of rare animals inhabit this site.

Water quality remains a problem in Green Bay. Point pollution and nonpoint discharges into the Oconto River may adversely affect the marsh. There is development pressure on the marsh's western edge and in the areas bordering the city. The primary use of the site is recreation.

Additional Comments

Significance of this site is high owing to the size of the marsh and its values to rare animals. Continued work is needed on water quality and invasive species control.

M-33. County Line Swamp

Ecological Landscape: Northern Lake
Michigan Coastal

County: Oconto

Total acreage: 15730

Wetland acreage: 10630



County Line Swamp, 8 Nov. 2000. Black ash (*Fraxinus nigra*) on border of Marinette and Oconto Counties. Photograph, E.J. Judziewicz.

Site Description

County Line Swamp is located on the border of Marinette and Oconto counties along the western shore of Green Bay. It is a large lacustrine swamp of considerable diversity. Topography is a controlling factor in determining natural community composition. Before heavy logging and extensive ditching took place, this swamp was dominated by cedar and tamarack. These disturbances and changes in the site's hydrology have facilitated the invasion of large areas by reed canary grass, glossy buckthorn and purple loosestrife.

Currently, most of the site is a mosaic of open-canopied wetlands dominated by various trees depending on the local conditions and historical disturbance. Dominants include small diameter black ash, alder, lake sedge and reed canary grass. There are hundreds of small "islands" of upland hardwoods (white birch, red maple, red oak and trembling aspen) in the swamp, presumably where sand is close to the surface and elevations are slightly higher than in the adjoining lowland forest. In the southernmost portion there are areas of more intact, maturing (4" - 10") hardwood swamp dominated by black ash with cedar as a canopy associate and a brushy understory dominated by alder.

Given its large size and pivotal location, this site provides important habitat for a variety of species (especially birds) even though much of it has been highly disturbed. Despite limited inventory efforts, many rare animal and plant species are known from this site.

Additional Comments

Despite continued negative impacts from past disturbance, this site encompasses the largest stand of swamp hardwoods on either of Wisconsin's Great Lakes shorelines. Size, strategic location and the diverse biota present also contribute to its significance. County Line Swamp is a high priority for increased protection, restoration of diminished features, and more detailed inventory attention.

M-34. Lower Peshtigo River

Ecological Landscape: Northern Lake
Michigan Coastal

County: Marinette

Total acreage: 11480

Wetland acreage: 6890



Lower Peshtigo River, East Bay, Peshtigo Harbor, 18 Aug. 2000. Dunes, interdunal wetlands, and emergent aquatic communities on outer barrier beach.

Site Description

The Lower Peshtigo River site is a very large wetland situated on poorly drained sand lakeplain located along the northwest shore of Green Bay approximately three miles southeast of the city of Peshtigo. The wetland extends upstream along the Peshtigo River for two miles from the mouth. Some smaller sites treated separately in previous phases of this project have now been included within one large site, linked by the Peshtigo River. Ownership is a mixture of state and private holdings. The private lands are primarily concentrated around the periphery of the wetlands.

A number of different natural communities and habitat features occur here, including emergent marsh, sedge meadow, shrub-carr, floodplain forest, abandoned oxbow lakes, beach, sand bar, and channels within the river delta. The lower two miles of the river form an extensive delta, with river channels winding through large stands of good quality emergent marsh and sedge meadow. Dense colonies of the submergent aquatics, coontail and pondweeds, are present. Seiches and long term water level fluctuations are significant enough to have an impact on the wetlands, leading to changes in natural community composition, location and structure over time. These changes affect the types and extent of available wildlife habitat.

According to a report from the early 1980's (Herendorf et. al. 1981), the Peshtigo River was either polluted or adversely affected by pollution from upstream discharges of sludge deposits, leading to algae growths that limited dissolved oxygen levels. The current effects on the wetlands from this pollution are unclear.

This wetland provides large, varied and high quality habitat for waterfowl, herons, gulls and tern, and shorebirds. The habitat is also desirable for furbearers, and trapping is an important recreational activity in the wetlands. A number of rare animals and plants are known from this site.

Currently development pressure is fairly low and overall disturbance levels are lower than those experienced at many other wetlands along Green Bay's west shoreline. The area receives a multiplicity of recreation uses such as hunting, fishing, trapping, and boating. Logging has occurred periodically in much of the silver maple-green ash floodplain forest bordering the river above the marsh and meadow complex, but several older, intact stands have recently been acquired by the state and are now protected.

Additional Comments

Site significance is high due to its size, the diverse mosaic of wetland communities present, the overall good condition of the vegetation, and the many rare resident and migratory species known to use the Lower Peshtigo. This site, arguably, contains the most diverse and least disturbed wetland complex on the west shore of Green Bay.

M-35. Ansul Patterned Dunes

Ecological Landscape: Northern Lake
Michigan Coastal

County: Marinette

Total acreage: 120

Wetland acreage: 10



Ansul Patterned Dunes, city of Marinette. 8 Nov. 2000.
Photograph, E.J. Judziewicz

Site Description

Ansul Patterned Dunes is an isolated, privately owned site located just outside of the City of Marinette in the southeastern Marinette County. The site's main features are the relict dune ridges that remain from the former shoreline of Glacial Lake Nipissing. The dunes are now stabilized by Hill's oak and jack pine forest (with white birch and red maple). Low dry sandy ridges, ephemeral ponds and sloughs are found between the dunes. Wetland plants including cattails, grasses, sedges and scattered shrubs occur in the open ephemeral ponds, which show as patterned vegetation on aerial photos. Disturbance by off-road vehicles may be a problem, and residential development has encroached on the site's natural features.

Additional Comments

This site is now quite isolated by development, fragmented by roads, and has been subject to disturbances such as logging and fire suppression, thereby reducing its integrity.

M-36. Seagull Bar

Ecological Landscape: Northern Lake
Michigan Coastal

County: Marinette

Total acreage: 270

Wetland acreage: 50



Seagull Bar, 19 Aug. 2000. Emergent aquatic community (dominated by softstem bulrush, *Schoenoplectus tabernaemontani*) to open mud flats along Green Bay. Photograph, E.J. Judziewicz..

Site Description

Seagull Bar is a sand spit and accompanying embayment marsh at the mouth of the Menominee River on the margin of Green Bay, lying just east of the City of Marinette. The embayment is a large area of shallow water with emergent marsh vegetation that expands or recedes, depending on lake levels. In lower water years the bare mud substrate is exposed, and the lagoon is nearly enclosed by the sand bar. The eastern edge of Seagull Bar is a system of sand beach ridges and low dunes resulting from wave action and sand deposition.

During suitable water levels the margins of the lagoon support a broad emergent marsh dominated by softstem bulrush, and associates include other bulrush and rush species. On slightly drier ground the dominants shift to boneset, beggar-ticks, a wool grass species and the invasive purple loosestrife. Acreage of the emergent beds changes often due to the bay's seiches and long-term water level fluctuations. The dunes support a diverse and characteristic flora including marram grass, Canada rye, beach pea, and several rush species in low, wetter areas. The sand beach is currently broad and supports a representative flora of the community that includes at least one plant endemic to the Great Lakes coast.

When appropriate substrates are exposed during spring and fall migration periods, shorebirds by the thousands congregate here. The lagoon area is particularly attractive to waterfowl. Small passerines are "trapped" occasionally by suddenly unfavorable weather conditions and are then seen in large numbers searching for insects and seeds washed onto the shores. Several rare bird species have nested here historically.

This site is threatened by recreational overuse and the potential spread of invasive species.

Additional Comments

Seagull Bar is a small site within an urban setting but supports a dynamic, good quality marsh and provides habitat for large numbers of migratory water birds.

S-01. Red River Breaks-St. Louis River Marshes

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 6960
Wetland acreage: 1300



Red River Breaks - St. Louis River Marshes. Aerial view of St. Louis River (flowing left to right); Wisconsin and mouth of Red River on near bank, 15 Oct. 1996. Photograph, E.J. Epstein.

Site Description

Significant wetlands lie within the upper St. Louis River Estuary; the neighboring Wisconsin shoreline is almost entirely undeveloped and includes a large block of rough, forested, roadless terrain. The area is a mixture of state and private ownership. The Minnesota side of the St. Louis River also harbors valuable wetlands, including remnant patches of wire-leaved sedge fen at the Oliver Bridge and downstream at Grassy Point.

St. Louis River Marshes

Upper portions of the St. Louis River Estuary from Fond du Lac downstream to Oliver feature extensive emergent marshes. These are typically located inside the main channel's meanders, but also occur in protected, shallow bays along the upland shore. Important emergent aquatics include species typical of other Lake Superior stands (arrowheads, bulrushes, bur-reed, lake sedge, and cattails). Wild rice and sweet flag are locally common. Deeper waters of the marsh complexes support submergent and floating-leaved macrophytes.

The patches of marsh associated with the main channel are often bordered by a natural levee adjoining the flowing river. Where well-developed, the levees are vegetated with tall wetland shrubs and lowland hardwoods, especially speckled alder, red-osier dogwood, meadowsweet, willows, black and green ash, and box elder.

Red River Breaks

This site borders the Red River and associated Wisconsin tributaries of the lower St. Louis River and contains an extensive block of undeveloped and unroaded forest dominated by pole-size trembling aspen. The canopy is sparse, with a dense understory of speckled alder in many stands. Conifers, which were formerly dominant here, occur as scattered individuals or in small stands, and white spruce, white pine, and white cedar are the most important species. In poorly drained 'flats,' on the level ridges between ravines, there are patches of black ash-dominated hardwood swamp and thickets of speckled alder and other tall wetland shrubs. Areas of standing water are

infrequent but, where present, support small emergent marshes and broad-leaved sedge meadows.

The lower slopes of the steep-sided ravines are often springy, sometimes supporting remnant stands of white cedar and unusual herbs. Several springs were flowing with brightly-colored orange water, the result of the presence of iron bacteria. Some of the small terraces a few meters above the streams in the ravine bottoms contain mature stands of large white spruce, black ash, and balsam poplar. Along the St. Louis River channel there are stands of emergent macrophytes, shrub swamp, and small patches of black ash swamp.

At least 10 species of rare plants have been documented on the site. The area supports a representative diversity of the region's birds, including large populations of many neotropical migrants (e.g. wood warblers, vireos, flycatchers, and thrushes).

Additional Comments

The St. Louis River Marshes/Red River Breaks are an integral part of one of the largest freshwater estuaries on the western Great Lakes, and the lower St. Louis River offers unique large scale protection and restoration opportunities in an urban setting. It is considered a high priority owing to its large size, recent state acquisition of lands within the area, and its significance to water quality in the estuary.

S-02. Oliver Marsh

Ecological Landscape: Superior Coastal
Plain
County: Douglas
Total acreage: 330
Wetland acreage: 120



Oliver Marsh. St. Louis River below town, 8 Aug. 1996.
Photograph, E.J. Epstein.

Site Description

This large marsh occupies part of the St. Louis River Estuary between the Village of Oliver and the City of Superior Municipal Forest. A narrow, natural levee has developed on the outside bend of a channel meander and is partially vegetated with shrubs and small lowland hardwoods. The levee separates the northern portion of the marsh from the main channel. The emergent beds are typical of Lake Superior stands and include bulrushes, bur-reeds, lake sedge, cattails, sweetflag, and arrowheads. Pockets of wild rice occur in several protected bays fed by tiny streams draining the uplands to the east. A deep central lagoon between the natural levee and the emergent beds (that lie adjacent to the upland shore) harbors significant stands of floating-leaved and submergent macrophytes.

Most of the Wisconsin portion of the shoreline of this site is undeveloped and forested with the early successional species paper birch and trembling aspen. Remnant stands of conifers, mostly white spruce and white pine, are scattered along the clay bluffs. Where homes and docks have been constructed (as is the case near the Village of Oliver) erosion is often noticeable. Small patches of the invasive exotic purple loosestrife are often associated with the natural levees or disturbed shoreline areas. Slumps occur on many of the clay bluffs exposed to the direct action of water and ice, especially when they are unprotected by stands of aquatic vegetation. The Minnesota side of the river has more residential and industrial development but also has extensive marshes.

Additional Comments

One of several high quality marshes within the St. Louis River Estuary. Adjoining uplands are a protection priority to preserve the marsh.

S-03. Superior Municipal Forest

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 2050
Wetland acreage: 610



Superior Municipal Forest. Aerial view of lower part of Little Pokegama River, 15 Oct. 1996. Photograph, E.J. Epstein.

Site Description

The City of Superior Municipal Forest contains a wealth of natural features unusual in the context of an urban-industrial center. Among the most significant of these are stands of mature coniferous forest, extensive emergent marsh, and wet clay flats supporting a mixture of shrub swamp and wet meadow. The site borders the St. Louis River Estuary, which dissects the uplands into a series of narrow, steep-sided ridges.

The extensive emergent marsh borders both sides of the Pokegama River (which is really an arm of the St. Louis River Estuary). Marsh composition is very similar to that of stands found along the lower stretches of the St. Louis. Dominants include bur-reed, bulrushes, arrowheads, and cattail. Deeper waters support submergent and floating-leaved macrophyte species. The invasive exotic purple loosestrife is uncommon but widespread in the marsh. Efforts to control it should begin as soon as possible.

The shrub swamp and meadow complex provides habitat for several rare plants. The dominant plants are typical of Lake Superior region stands on red clay and include speckled alder, willows, lake sedge, and bluejoint grass. This wetland is the southwesternmost portion of a former large and contiguous wetland that was partially destroyed and greatly disrupted by growth of the City of Superior. Rare animals such as Forster's Tern, Bald Eagle, and Merlin forage here.

The coniferous forests are composed primarily of species often associated with the boreal regions. Throughout the Lake Superior Clay Plain Ecoregional Subsection, this forest type has been greatly fragmented and often replaced by more monotypic stands of aspen. Thus the stands within this site have regional conservation significance. They could also provide a template for restoration actions considered elsewhere.

Additional Comments

The Superior Municipal Forest is a large natural community complex connected to a major fresh water estuary. A significant portion of this site was designated as a State Natural Area in 1996.

This designation encompassed much of the mature forest and marsh, and also included a part of the wet red clay flats where rare plants occur.

S-04. Pokegama-Carnegie Wetlands

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 2770
Wetland acreage: 2270



Pokegama - Carnegie Wetlands, 1995. Willow carr - broad-leaved sedge meadow. Photograph, E.J. Judziewicz.

Site Description

The extensive and poorly drained red clay flats in the headwaters of the Pokegama and Little Pokegama rivers support a large wetland mosaic of shrub swamp, sedge meadow, emergent marsh, and small ponds. This site is characterized by a large complex of shrub wetlands composed mostly of speckled alder and willows, as well as more open wet meadows that are dominated by coarse leaved sedges and bluejoint grass. Widely scattered small pools support a variety of emergent and submergent aquatic macrophytes. Tiny, upland "islets" of white spruce, white pine and red pine, balsam poplar, and trembling aspen punctuate the flats.

Of special significance are the many populations of rare plants occurring in the site's wetlands. Many of the rarities are represented by large and/or multiple populations. It is important to recognize that some of these species are not widespread in the Lake Superior region but are concentrated in the vicinity of the City of Superior. The large size of the site as well as the quality and diversity of open and shrub wetland types also support a diverse assemblage of amphibians and birds.

Additional Comments

Pokegama-Carnegie is the largest and most intact of the red clay wetlands in northwest Wisconsin. It has the greatest floristic diversity, supports some of the largest populations of rare species, and may be less likely in the short-term to suffer destruction or fragmentation owing to expanded development, disrupted hydrology, or incursions of aggressive species. Appropriate management and protection of this site is critically important.

S-05. Superior Airport-Hill Avenue Wetlands-South Superior Triangle

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 720
Wetland acreage: 600



Superior Red Clay Wetlands, 10 Nov. 1999. Photograph, E.J. Epstein

Site Description

This site is composed of several discontinuous wetlands separated by roads, railroad tracks, and other urban developments. These disconnected patches are among the largest remnants of a formerly contiguous wetland within the City of Superior. The wetlands are mosaics of shrub swamp and open meadow, with a few small patches of emergent marsh. Dominant shrubs are speckled alder and willows. Open meadows are typically dominated by broad-leaved sedges, such as lake sedge, and characteristic associates include flat-topped white aster, joe-pye weed, late goldenrod, bedstraw, bellflower, and marsh fern. Trembling aspen typically occupies drier portions of the sites. Despite severe disturbances that have altered their composition, structure, function, size, and configuration, these wetlands harbor significant populations of rare plants, some of which do not occur in other parts of Wisconsin. They also provide habitat for many native animals.

Because of habitat fragmentation and isolation, as well as disrupted hydrology, these wetlands are highly vulnerable to damage even in the absence of future developments. There is presently high interest at state and local levels in protecting the most biologically valuable and viable remnants. Management needs could be partially met by a combination of techniques such as brushing, prescribed burning, and scarification to create and perpetuate the microhabitats used by many of the rare species.

Additional Comments

Though far from pristine and in need of active management attention, the red clay wetlands of the Superior area constitute a unique resource that warrants high conservation priority.

S-07. Lower Nemadji River Marshes

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 210
Wetland acreage: 160



Nemadji River Marshes. Aerial view of lower Nemadji River marshes near Superior Tank Farm. Note cut-off oxbow with pond surrounded by sedge meadow / shrub swamp, 15 Oct. 1996. Photograph, E.J. Epstein

Site Description

The lower stretches of the Nemadji River flow in a narrow steep-sided valley through a heavily industrialized and urbanized portion of the City of Superior before emptying into Allouez Bay. A series of emergent marshes occurs along the inside of the well-developed meanders that are characteristic of this river. These marshes are separated from the main channel by weedy natural levees, which support a mixture of tall wetland shrubs and small lowland hardwoods. The steep clay bluffs confining the valley are generally undeveloped, sometimes forested, and buffer the river system somewhat from the neighboring urban areas.

Important marsh plants include bur-reed, arrowheads, soft-stemmed bulrush, broad-leaved cattail, lake sedge, marsh cinquefoil, water horsetail, and water parsnip. Locally deep, slowly flowing sloughs support stands of wild rice and beds of pondweeds. Drier portions of the wetlands contain patches of sedge meadow dominated by tussock sedge and bluejoint grass, alder thicket, and black ash-dominated hardwood swamp.

Additional Comments

Though the lower Nemadji system has suffered many abuses, it has retained significant natural features and should be a prime candidate for remedial attention. The marshes are representatively diverse, dominated by native species, appear reasonably functional, and support uncommon resident birds. Exotic plants are still quite localized, associated mostly with the disturbed levees and formerly dredged areas near U.S. Highway 2.

S-08. Allouez Bay-Wisconsin Point

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 670
Wetland acreage: 350



Wisconsin Point - Allouez Bay Marshes. 15 Oct. 1996. Aerial view of south side of eastern end of Allouez Bay, showing inflow of Bear Creek (lower right). Photograph, E.J. Epstein

Site Description

Wisconsin Point.

Wisconsin Point is the eastern portion of a long coastal barrier spit separating the waters of Lake Superior from Allouez Bay a portion of the St.Louis River Estuary. Major site features include several miles of open sand beach and dunes, small interdunal wetlands, and a xeric forest of white and red pines. The point and adjacent Allouez Bay receive heavy visitation by migrating birds in the spring. Developments include roads, vehicle turnouts, a Coast Guard station, and breakwater.

A small, open interdunal swale near the western tip of the point supports a marsh community dominated by low graminoid plants, especially sedges and rushes. Several rare plants are present. The swale is surrounded by dense thickets of tall shrubs - mostly speckled alder, willows, and red-osier dogwood. These shrubs are encroaching on the openings and should be monitored and controlled if necessary. The shrubs do provide a measure of security for this fragile site by screening it from most passersby. During 1996 this swale was very wet, with standing water reaching a depth of over 30-cm in July and August. This site will require both vigilance and active management to maintain and protect the many valuable natural features present.

A similar community was unintentionally created east of the Coast guard station when an area was cleared of vegetation and then fenced in the hope the Federally endangered Pipe Plover would nest here. The center of this sand area was excavated to a depth slightly below the water table, providing suitable conditions for colonization by some of the interdunal swale plants, including several rare species

Allouez Bay

Allouez Bay is situated between the City of Superior's east-side neighborhood of Allouez and Wisconsin Point. The eastern end of the bay is shallow and contains a large marsh with patches of sedge meadow and a drowned tamarack swamp present near the base of Wisconsin Point.

Several streams, Bear Creek, Bluff Creek and the Nemadji River empty into the bay. A portion of the wetland at the head of the bay, but now cut off by the access road to Wisconsin Point, was filled in the past.

The marsh is dominated by tall native graminoids, such as bur-reeds, bulrushes, spikerush, sedges, and cattails. Broad-leaved arrowhead is also among the dominants. Deep areas within and on the margins of the emergent marsh support floating-leaved and submergent aquatic macrophytes. The portions of the wetland nearest the shore are dominated by sedges. Tamarack snags are scattered throughout parts of this area.

It is possible that this wetland formerly contained extensive mats of wire-leaved sedges, but eutrophication, sedimentation, and other disturbances led to changed conditions which aided the spread and eventual dominance of the coarser, more nutrient tolerant emergents. Nevertheless, this wetland is composed mostly of native species, and plant diversity and wildlife values are quite high. In the early spring, substantial numbers of waterbirds of many kinds congregate here. This site may be especially significant in years when the break-up of ice on Lake Superior is late, and little open water is available inland. The marsh also supports many nesting birds, including uncommon marsh species and a few rare invertebrates.

Additional Comments

This site is a critical part of the regionally-significant lower St. Louis River Estuary, containing good, though disturbed examples of natural communities endemic to the Great Lakes. This area supports many rare species and hosts major concentrations of migratory birds in the spring.

S-09. Port Wing

Ecological Landscape: Superior Coastal Plain
County: Bayfield
Total acreage: 830
Wetland acreage: 530



Port Wing - Bibon Lake. Aerial view of Bibon Lake (including sewage treatment pond); note older growth tamarack (*Larix laricina*) stands, 15 Oct. 1996. Photograph, E.J. Epstein

Site Description

This large complex of wetlands, forested sand ridges, beach, and open dune occurs at the mouth of the Flag River adjacent to the Village of Port Wing. A large slough, Bibon Lake, is situated within the southwestern portion of the site. Significant communities include coastal fen, coastal bog, Great Lakes dune, tamarack swamp, and several stands of dry pine forest with a strong boreal flavor. Overall quality of the natural communities is good to excellent. At least twelve species of rare plants and animals have been documented here including Wisconsin's only known population of the plant, fly honeysuckle.

The fen community consists of a floating mat of sedges, dominated by woolly sedge. Important associates are twig rush, sweet gale, and buckbean. The coastal bog fringes the margins of the uplands, with a mat of *Sphagnum* mosses, ericaceous shrubs, and sedges. This community contains species not typically found in truly ombrotrophic bogs. Small tamarack are scattered unevenly through this community. The tamarack swamp consists of three stands, each with an even-aged canopy of mature tamarack, a dense tall shrub layer of speckled alder, and a diverse low shrub/herb/bryophyte flora. The biota includes many rare species.

Additional Comments

Partially protected via a State Natural Area designation, management and protection of the site's natural features will present many challenges. Potential problems include: spread of narrow-leaved cattail and the aggressive common reed grass; diminished water quality due to discharge of effluent from the village sewage ponds into Bibon Lake; encroachment of developments into sensitive areas; disruption of coastal processes including longshore sediment transport by the jetties at the mouth of the river; and successional changes to the fire-dependent pine forests. A more comprehensive management and monitoring plan is needed, with participation from appropriate agency personnel, local governments, conservation organizations, and private citizens.

S-10. Bark Bay

Ecological Landscape: Superior Coastal Plain
County: Bayfield
Total acreage: 770
Wetland acreage: 700



Aerial photo of Bark Bay site. (Eric Epstein)

Site Description

This large complex of coastal barrier spit, lagoon, springs, and wetlands occupies an embayment between two rocky headlands. The wetlands are extensive and include two major types: coastal fen and coastal bog. The fen dominants are typical of Lake Superior stands (i.e. woolly sedge, twig rush, sweet gale, water horsetail and buckbean). The coastal bog is composed of a mat of sphagnum mosses, ericaceous shrubs, sedges, and scattered small tamarack trees. Both communities are floristically diverse, in excellent condition, and support many rare species that include plants, birds and butterflies. A large lagoon occupies the center of the site and supports submergent and floating-leaved aquatic macrophytes. A forested interior spit parallel to the outer spit breaks the wetlands into two major sections. Communities are similar on both sides of the interior spit but the interior wetlands lack a central lagoon. Other significant features include a narrow strip of dry pine forest on the coastal spit, springs associated with the mouth of the Bark River on the eastern edge of the site, and small stands of tamarack and tall shrubs. The unnamed inlet stream on the west side of the site is bordered by several large clones of the invasive common reed grass.

Additional Comments

This site is a protection priority as its wetlands are extensive, in excellent condition, and support many rare, uncommon, and representative species. The common reed grass clone should be monitored and controlled, if necessary. A portion of the site is designated as a State Natural Area, but the boundary is not adequate to prevent negative impacts associated with increased development in the area. A broader view of the local watershed and the land uses therein is desirable to assess and better anticipate/address threats and protection needs.

S-11. Lost Creek

Ecological Landscape: Superior Coastal Plain
County: Bayfield
Total acreage: 320
Wetland acreage: 290



Lost Creek. Aerial view of Lost Creek, 15 Oct. 1996. Note houses (with trails leading to Lake Superior beach) on barrier beach, Photograph, E.J. Epstein

Site Description

This estuarine complex is located at the drowned mouths of three small creeks, just south of Lake Superior. A forested coastal barrier spit separates the wetlands from the lake. Sandstone headlands flank the sandspit and estuary on the east and west. The major communities within the site are coastal fen, coastal bog, and shrub swamp. The lagoon at the junction of the creeks contains significant stands of emergent, submergent, and floating-leaved aquatic macrophytes. The eastern end of the complex is forested with a shrubby second-growth stand of white cedar and black ash. A mature dry forest of pine and spruce occurs on the sandspit, upon which a number of cabins and an access road have been built.

The fen community is well-developed on the west and north sides of the central lagoon. The mat is composed of woolly sedge, livid sedge, buckbean, sweet gale, and alpine cotton grass. Boggier areas with firmly grounded moss peat are composed of *Sphagnum* spp., ericaceous shrubs, and sedges. Community boundaries are quite indistinct between these types. The emergent marsh is composed of lake sedge, water arum, marsh cinquefoil, and broad-leaved cattail. Characteristic submergent and floating-leaved species are floating-leaved bur-reed, water-milfoils, yellow water lily, common bladderwort, water-marigold, and pondweeds.

Additional Comments

Though Lost Creek is not a large site, at least fourteen rare species of plants, birds, and butterflies were documented here by NHI during a previous study (Epstein et al 1997). Among the rarities is one of only three established Wisconsin populations of the regionally rare plant, lake cress. A portion of this site is designated as a State Natural Area, but increasing developments on the sandspit adjacent to the wetlands could threaten water quality and make the area unsuitable for sensitive species. Increased powerboat traffic in the lagoon could damage the aquatic beds and lead to the inadvertent introduction of invasive species. Promoting awareness of this site's values with local residents should be a priority for those with stewardship responsibilities and interests.

S-12. Sand Bay

Ecological Landscape: Superior Coastal Plain
County: Bayfield
Total acreage: 240
Wetland acreage: 200



Sand Bay. Sand River estuary, aerial view showing lagoon and native red pine stand on barrier beach, 15 Oct. 1995. Photograph, E.J. Epstein.

Site Description

The drowned mouth of the Sand River is situated in a complex of wetlands separated from Lake Superior by a forested sandspit. The lower portions of the Sand River are bordered by northern sedge meadow and alder thicket. West of the lagoon at the stream's outlet are several spring runs. East of the lagoon is a peatland with coastal fen, coastal bog, and tamarack swamp. Rocky headlands with significant outcroppings of sandstone cliffs occur on either side of Sand Bay. Most of the watershed is forested and undeveloped. The National Park Service owns most of the land in this site, though the Red Cliff Band of Lake Superior Chippewa hold title to the forested spit west of the river mouth. Overall the site supports a diverse assemblage of plants, animals and communities including many rare species. The Sand River, which enters Lake Superior at Sand Bay, supports regionally significant diversity among its aquatic macroinvertebrates

Additional Comments

This site features one of the least disturbed of the coastal estuaries. Many rare species occur here.

S-13. Raspberry Bay

Ecological Landscape: Superior Coastal Plain
County: Bayfield
Total acreage: 1370
Wetland acreage: 170



Red Cliff Reservation. Aerial view of Raspberry Bay barrier beach pine forest and open wetland (coastal fen, northern poor fen), 15 Oct. 1995. Photograph, E.J. Epstein.

Site Description

The Reservation of the Red Cliff Band of Lake Superior Chippewa occupies the northeastern margin of the Bayfield Peninsula. These are not public lands, and all requests for visitation or additional information must go through the tribal offices at Red Cliff, Wisconsin.

The outstanding feature is an undisturbed wetland complex at the mouth of the Raspberry River containing coastal fen, coastal bog, northern sedge meadow, lagoon, and dry pine forest. Each of these communities harbors a diverse flora and some support significant populations of rare plants. We also obtained records of rare birds and butterflies while conducting vegetation survey work at these sites. Small but undisturbed stands of sedge meadow, alder thicket and marsh occurs along the lower stretches of the Raspberry River, which enters Lake Superior at Raspberry Bay.

Wave-carved sandstone cliffs and ledges are prominent and characteristic features of the northern Bayfield Peninsula. Some of the most extensive and ecologically significant outcroppings occur within the Reservation, but others occur within the boundary of the adjacent mainland unit of the Apostle Islands National Lakeshore. The cliffs support rare plants, most of them specialists that do not occur in other habitats.

Additional Comments

The site contains an exceptional wetland complex with excellent examples of communities restricted to estuarine environments and is flanked by rocky headlands that also have very high ecological values.

S-14. Sultz Swamp

Ecological Landscape: Superior Coastal
Plain
County: Bayfield
Total acreage: 280
Wetland acreage: 250



Sultz Swamp, July 1996. Black spruce - tamarack - ericad muskeg. Photograph, E.J. Epstein.

Site Description

This acid peatland occupies a depression high on the Bayfield Peninsula approximately six miles inland from the Lake Superior coast. Although there are other similar wetlands in this part of the basin, Sultz Swamp is the largest and is embedded within vast stretches of county-owned forest. The major features of this insular peatland include a mature swamp forest of black spruce, an extensive muskeg/open bog, and large populations of several rare species. Disturbances to the interior of the site have been minimal, with the exception of a maintained power line corridor, which crosses the area east-west. White cedar logs were removed from the more minerotrophic margins of the wetland in the distant past.

Underneath its closed canopy, the black spruce swamp is very open and park-like. The understory plants are typical of this community type and include ericaceous shrubs, and a few herbs: three-leaved false Solomon's-seal, moccasin flower, and native sedges (poor and three-sedge sedge). A level carpet of Sphagnum mosses covers the surface. Canopy gaps are filled with thickets of young black spruce or tamarack.

Where sphagnum has accumulated and formed deep, hummocky layers of peat, the spruce and tamarack become scattered and stunted, resulting in a more open community type called "muskeg." The understory is dominated by ericaceous shrubs such as leatherleaf, bog laurel, bog rosemary, and small cranberry. The presence of dense patches of blueberries and gnarly jack pine hint at a history of fire. Common graminoids of the open bog and muskeg include the tussock sedge and tawny cotton grasses, plus few-seeded and poor sedges. Boreal birds and butterflies were noted at this site, and rare plants occur here.

Additional Comments

Acid peatlands are uncommon in the coastal zone, and this site supports one of the better developed and least disturbed complexes of the type in the southwestern Lake Superior coastal region.

S-15. Outer Island Sand Spit and Lagoon

Ecological Landscape: Superior Coastal Plain
County: Ashland
Total acreage: 250
Wetland acreage: 110



Outer Island Sand Spit and Lagoon. Sand spit dunes at sunset. Photograph by E.J. Epstein.

Site Description

The attenuated southern tip of remote 8,000-acre Outer Island, part of the Apostle Islands National Lakeshore, forms a long sandspit, enclosing a large lagoon and wetland. The spit features extensive non-vegetated beach, lake dunes and a xeric pine forest. The open peatlands surrounding the lagoon are sedge-dominated to the south and more boggy to the north. Thickets of tall shrubs and small, open, scattered stands of conifers add diversity to the community mosaic.

The open mat around the southern end of the lagoon is composed primarily of sedges, buckbean and sweet gale. To the north, the mat is boggier, with *Sphagnum* mosses dominant, and ericaceous shrubs, wire leaved sedges, and pitcher plant are prominent.

Of the terrestrial communities, the open dunes are vegetated with marram grass, beach-pea and sand cherry. The xeric forest dominants are red and white pines and paper birch, and the groundlayer includes bracken fern, bunchberry, cow-wheat, wintergreen, early low blueberry, and clubmosses.

The islands hosts notable concentrations of migratory birds in the fall, especially among the passerines and raptors. Loons, grebes and cormorants congregate in the waters off of the spit, and there are frequent visits from southbound shorebirds. Outer Island has been designated as a State Natural Area. There are no immediate threats to this site, but it should be monitored periodically for invasive species, changes in abundance of rare species, and human use (currently light).

Additional Comments

Excellent undisturbed sandscape with a beach, dune, Great Lakes barrens, and large enclosed lagoon with floristically rich fen community. Use by migratory birds particularly raptors, passerines and shorebirds is very high especially in the fall.

S-16. Stockton Island Tombolo

Ecological Landscape: Superior Coastal Plain
County: Ashland
Total acreage: 680
Wetland acreage: 290



Stockton Island Tombolo. Aerial view of tombolo, October 15, 1996 Eric Epstein

Site Description

The tombolo is an exceptionally diverse and complex association of rare landforms and natural communities on the southeast end of 10,000 acre Stockton Island. Two sandspits have connected Presque Isle Point, historically an islet, with the main body of the island. The spits enclose a large wetland and lagoon which are traversed by a series of narrow, parallel, sand ridges. The swales between the ridges support a variety of wetland types including submergent aquatic, emergent aquatic, coastal fen, coastal bog, alder thicket, and tamarack swamp communities.

Communities associated with the sandspits include Great Lakes beach, Great Lakes dune, Great Lakes barrens, boreal forest, northern dry-mesic forest, and interdunal wetland. Several small streams drain the island's interior and reach Lake Superior via an outlet through the eastern sandspit into Julian Bay.

The open mat is dominated by sedges, including twigrush, beak-rush, sweet gale, and buckbean. A boggy mat of Sphagnum mosses, ericaceous shrubs, sedges, and scattered small tamarack trees occur in the drier swales and along the wetland margins. An interdunal pond supports an unusual flora that includes many rare plants. An isolated portion of the wetland in the northwestern sector of the site is quite acidic, dominated by ericaceous shrubs, few-seeded sedge, and beaked sedge.

Additional Comments

A high concentration of rare species (mostly plants and birds) has been documented here. Apart from the many rare species, the diversity, extent, and quality of the natural communities are reflected in the very high overall species diversity at this site. Stockton Island Tombolo is a designated State Natural Area within the Apostle Islands National Lakeshore.

S-17. Big Bay Wetlands

Ecological Landscape:	Superior Coastal Plain
County:	Ashland
Total acreage:	970
Wetland acreage:	730



Aerial view of Big Bay, Madeline Island, 15 Oct. 1996. Looking perpendicular to beach ridges. Photograph, E.J. Epstein.

Site Description

Big Bay is a large east-facing embayment on Lake Superior along the eastern coast of Madeline Island, the largest of the Apostle Islands. The embayment contains a coastal barrier spit, beach and dunes, xeric pine forest, lagoon, and a diverse array of peatlands. The lagoon is bordered by coastal fen, coastal bog, shrub swamp, and tamarack swamp. An abandoned sandspit, now three-quarters of a mile inland from Lake Superior, separates a distinctive, much more acid complex of peatland types (that include open bog, muskeg, and black spruce swamp) from the more minerotrophic types to the east.

The floating mat around the lagoon is composed of native wire-leaved sedges (wooly and coastal sedge and twig-rush), sweet gale, and buckbean. Away from the lagoon the more firmly grounded coastal bog mat consists of Sphagnum mosses, ericaceous shrubs, and a different complement of sedges. Small tamarack form a nearly closed forest of 4'-11' d.b.h. trees near the interior spit.

To the west of the interior spit, which supports a boreal conifer-hardwood forest, is diverse highly patterned acidic peatland. The interior is quite open, with deep, hummocky Sphagnum mosses, ericads, and a depauperate vascular flora representative of a truly ombrotrophic community. Among the few herbs present are the wire leaved (few-seeded, few-flowered and poor) sedges, tussock cotton-grass, and round-leaved sundew. Stunted black spruce are abundant. To the east there is a closed stand of mature black spruce with a nearly level sphagnum carpet. Large tamarack ring the bog and spruce swamp, and a wet moat-like zone of alder, black ash, and lake sedge occurs at the upland margins. This may be the only coastal wetland on Lake Superior where fens adjoin a true ombrotrophic bog.

Additional Comments

This site is rich in rare and uncommon species and contains undisturbed, sometimes large examples of many natural communities. As within Big Bay State Park and a designated State Natural Area, the major tasks are to ensure that inappropriate use does not occur and to monitor periodically for invasive species.

S-18. Bayview Beach-Sioux River Slough

Ecological Landscape: Superior Coastal Plain
County: Bayfield
Total acreage: 310
Wetland acreage: 200



Bayview Beach - Sioux River Slough. Sedge fen (with some common reed, *Phragmites australis*) near outlet of Sioux River, Sept. 1996. Photograph, E.J. Epstein.

Site Description

The wetland complex at the Sioux River mouth includes emergent marsh and alder thicket communities adjoining a narrow, mile-long open peaty swale between two parallel sandspits. Major swale communities are an acid, weakly minerotrophic coastal bog and a wet coastal fen. The beach ridges are forested with white and red pines, balsam fir, and paper birch.

The open peatlands of the swale are composed of Sphagnum mosses, ericaceous shrubs, and sedges, with scattered small tamarack. Wetter areas support a mat of woolly sedge, with buckbean, sweet gale and water horsetail. The dominant species of the marsh at the Sioux River mouth are typical of Lake Superior stands and include bur-reeds, soft-stemmed bulrush, cattails, lake sedge, and water arum.

Threats include the spread of common reed grass and purple loosestrife, disruption of hydrology and water chemistry, recreational overuse, and maintenance activities on State Trunk Highway 13. Recommendations include development of a management and protection plan with the Township, DNR Bureaus of Fish Management and Endangered Resources, and the Wisconsin Department of Transportation. The plan should provide for periodic monitoring of water quality and both rare and invasive plant species. Currently, monitoring is being conducted of phragmites and narrow-leaved cattail by Northland College.

Many rare plants and animals occur at the site. Use by migratory birds can be significant, especially in the spring

Additional Comments

Partially developed to accommodate a state highway and public beach, this site contains significant marsh and fen communities and supports many rare species.

S-19. Fish Creek Slough

Ecological Landscape: Superior Coastal Plain
County: Ashland
Total acreage: 510
Wetland acreage: 340



Emergent aquatic community with bulrush (*Schoenoplectus* sp.), bur-reed (*Sparganium* sp.), duck-potato (*Sagittaria latifolia*), and cat-tail (*Typha latifolia*). Photograph, E.J. Epstein.

Site Description

The drowned mouth of Fish Creek and its associated wetlands occupy the head of Chequamegon Bay. Located on the outskirts of the City of Ashland and crossed by busy U.S. Highway 2, this site has been subjected to many disturbances in the past and remains vulnerable to further deterioration unless efforts to address problems are maintained. This wetland is particularly dynamic, owing to the funnel shape of Chequamegon Bay and the seiche activity that causes frequent and sometimes substantial short-term water level changes.

The primary wetland communities are emergent marsh, shrub swamp, and hardwood swamp. The open waters of the "sloughs" also constitute an important feature. The emergent marsh occupies several hundred acres close to the creek mouth. Dominants include bur-reeds, bulrushes, lake sedge, arrowhead and water sedge. Beds of submergent and floating-leaved aquatic macrophytes occur in the open waters of the sloughs and intermingle with the emergents where conditions are suitable. The marsh grades into a shrub swamp of speckled alder and willows, eventually giving way to an extensive forest of swamp hardwoods, containing mostly ashes.

Near the mouth of Fish Creek, flats of sand and mud exposed when the water level is low are used heavily by waterfowl, gulls, terns, and shorebirds as loafing or feeding sites. Efforts to maintain the functional values of this site should continue, as Fish Creek Sloughs are important wildlife and fish habitat. Purple loosestrife control is a critical management need.

Additional Comments

Though somewhat compromised by the location of Highway 2, the wetland communities are extensive, in generally good condition, and provide significant habitat for many wildlife species, including several that are rare.

S-20. Long Island-Chequamegon Point

Ecological Landscape:	Superior Coastal Plain
County:	Ashland
Total acreage:	640
Wetland acreage:	150



Chequamegon Point. Aerial view of Long Island and Chequamegon Point, 15 October 1996. Photograph by E.J. Epstein.

Site Description

Western Lake Superior's most extensive and least disturbed coastal barrier spit separates the waters of Chequamegon Bay from Lake Superior. The natural dynamics of erosion and deposition are expressed in the changing size and shape of the spit over time. An especially vivid example of this occurred following a severe November storm in the late 1970s when Long Island and Chequamegon Point were joined.

Important communities at the site include Great Lakes beach and dune, xeric forest, interdunal wetland, open bog, shrub swamp, and wet sand flats. While wetlands cover only a very small percentage of the site, the interdunal ponds located near the western end of Long Island are a very rare community statewide and also provide habitat for several rare plants. The bogs of the ridge and swale system on the Chequamegon Bay side of the island generally contain a subset of the common bog ericads and sedges.

Wet sand flats occur along Chequamegon Bay at the former gap between the point and the island. The flora is an interesting mix of plants from many wetland communities. This area attracts significant numbers of migrating shorebirds when water levels are favorable.

The beach and dune system is best developed where active deposition of sand is occurring. Owing to wind, wave, and ice exposure the beaches are unvegetated. The dune vegetation is composed mostly of marram grass and beach-pea. The island continues to attract large numbers of gulls, terns, and sometimes shorebirds and raptors. Rare dune insects, absent from other dune systems on western Lake Superior, occur here.

Most of Long Island is forested with mature stands of jack, red and white pine, as well as Hill's oak. During the spring, large numbers of passerines and raptors migrate through this area.

Additional Comments

This site comprises the most intact coastal barrier spit system on western Lake Superior. Included are excellent examples of both rare and widespread natural communities. A number of rare species are resident here, some of them specialized to dune environments. The site is used heavily by migratory birds. Of great added significance is the role this coastal barrier spit plays in protecting the vast wetlands of the Bad and Kakagon river systems just to the south.

S-21. Bad River-Kakagon Sloughs

Ecological Landscape: Superior Coastal Plain
County: Iron
Total acreage: 56180
Wetland acreage: 17310



Bad River Sloughs. Honest John Lake; sedge mat and pools, 16 June 1996. Photograph by E.J. Epstein.

Site Description

This site is a very large estuarine wetland complex located in northern Ashland County on the Lake Superior coast. It lies on a lacustrine clay plain deposited during the last glaciation. It is a very rich, dynamic and intact mosaic of many natural communities bordering the lower Bad and Kakagon rivers.

The major wetland communities at this site include emergent marsh, coastal fen, coastal bog, tamarack swamp, and shrub swamp. A series of coastal lagoons support beds of submergent and floating-leaved aquatic plants and provides critical habitat for many aquatic animals. These communities are the most extensive and among the least disturbed of their respective types on Western Lake Superior and rank among the most significant in the Great Lakes. Many rare plants and animals have been documented here.

A long coastal barrier spit (see "Long Island-Chequamegon Point") borders the Bad and Kakagon wetlands on the north. South of U.S. Highway 2, the course of the Bad River is confined between steep clay banks. Communities include rich mesic hardwood forests of sugar maple-basswood, floodplain forest of silver maple-green ash, black ash swamp, shrub swamp, hemlock-hardwood forest, and oxbow lakes. A large complex of tamarack swamp, white cedar swamp, black ash swamp, and fen occurs where the river exits the deep clay "canyons" to spread out over the lake plain to the north.

Most of the site is within the Reservation of the Bad River Band of Lake Superior Chippewa. These are not public lands and all requests for additional information or visitation must go through the tribal government offices at Odanah, Wisconsin.

Additional Comments

This site may be the largest freshwater estuarine system of this size, type and quality in the world. It supports a great diversity of high quality natural communities and rare plant and animal species.

S-22. Mouth of the Brule River

Ecological Landscape: Superior Coastal Plain
County: Douglas
Total acreage: 440
Wetland acreage: 80



Aerial of small embayment at Brule River Mouth. A recent storm has stirred up clay sediments in Lake Superior, hence the lake's "coffee with cream" appearance. The Brule is running clear. Photograph by Eric J. Epstein, 1996.

Site Description

On the west side of the mouth of the Brule River there is an emergent marsh of approximately 80 acres separated from the river and Lake Superior by a natural levee and sand spit. Several distinct plant species associations occur in the marsh. A small lagoon supports dense beds of pond lilies, pondweeds and common bladderwort. Around the lagoon there are stands of emergent aquatic macrophytes composed of bur-reed, soft-stem bulrush, cattail, and arrowhead. Near the margins of the marsh sedges are dominant, with lake sedge and tussock sedge the most important species. The natural levee between the marsh and the Brule River is vegetated with speckled alder, dogwoods, willows, and small ash trees. A very small beach and dune complex between the marsh and Lake Superior supports a sparse growth of marram grass and beach pea.

Upstream, low terraces along the river support additional wetland communities, including black ash-dominated hardwood swamp, alder thicket and wet meadow. Steep clay bluffs flanking the Brule are forested with a boreal mixture of white pine, white spruce, balsam fir, balsam poplar, trembling aspen, and paper birch. Seepages and short spring runs are frequent on the clay slopes.

Rare animals and plants are resident on this site, and several rare birds, including Common and Caspian Terns, use the mouth of the Brule as a resting and foraging area.

Additional Comments

Though this is a relatively small site, it contains a good quality marsh located at the mouth of one of Wisconsin's most fabled trout streams.

EXEMPLARY SITES

These Primary Coastal Wetland Sites are among the best coastal wetlands near Wisconsin's Great Lakes and would be good candidates for use in a publicly distributed document showcasing Wisconsin's coastal wetland "jewels." This list is not intended to exclude any of the other Primary Sites as being less important. See the site descriptions for more information.

- Chiwaukee Prairie
- Kohler-Andrae Dunes
- Point Beach
- Northeast Coast – Door Peninsula
- Newport State Park – Mink River
- Shivering Sands
- Red Banks Glades
- West Shore of Green Bay (collectively of high significance or Peshtigo Harbor could be highlighted, followed by Oconto Marsh and Great Lakes marsh)
- St. Louis River Estuary (collectively of high significance).
- Stockton Island
- Big Bay
- Outer Island
- Raspberry Bay
- Sand Bay
- Lost Creek
- Bark Bay
- Port Wing
- Bad River
- Allouez Bay – Wisconsin Point
- Red River Breaks – St. Louis River Marshes
- Pokegama - Carnegie Wetlands

INFORMATION GAPS AND FUTURE INVENTORY NEEDS

The Lake Superior coastal wetland sites described in this report were identified through an inventory and assessment conducted by NHI staff. A detailed description of this evaluation was provided in a report (Epstein et al. 1997). Due to the comprehensive nature of this inventory effort, Lake Superior's coastal zone is fairly well understood in terms of the presence of rare or otherwise significant elements. However, several interior bogs on the Apostle Islands were not surveyed as part of this study and should be inventoried in the future. The red clay wetlands, especially those in northwestern Douglas County near the city of Superior, warrant additional attention for taxa other than plants.

Future inventory efforts would benefit our understanding of Lake Michigan coastal wetlands. A good deal of effort was spent throughout this project incorporating existing data sources for the primary sites, and several sites were visited as part of this project. In addition, portions of some of the sites have been surveyed through various other efforts (e.g. several of the state parks on the Door Peninsula, recently completed surveys for rare plants and natural communities of the Niagara Escarpment and Grand Traverse Islands, and detailed surveys conducted to support conservation projects initiated on the Door Peninsula shoreline by private conservation organizations). Nonetheless, the collective level of detailed information known about the sites is unbalanced. For example, the extensive marshes and lowland forests along the west shore of Green Bay are a high priority for additional survey work in the future, especially for birds and wetland communities. These wetlands are extensive and at least some of them have potential for rare species; unfortunately, they also face threats due to the high amount of development pressure, hydrologic disruption, and the spread of invasive plants and animals. Also, several features and sites along Wisconsin's central Lake Michigan shoreline need additional survey work, such as the extensive ridge and swale system at Point Beach (Manitowoc County) and the little studied white cedar forests of the "coastal canyons."

Specific inventories for the Federally Endangered Hine's emerald dragonfly in Eastern Wisconsin have been funded by the U.S. Fish and Wildlife Service over the past few years and a new three-year project was recently funded. This project will result in a fairly complete inventory for this very rare species in Wisconsin.

GLOSSARY OF TERMS USED IN THE REPORT

*Please note the definitions for wetlands given here are generalized based on definitions found in wetland publications used for this report. The natural community definitions used to describe and classify some Lake Michigan primary sites and all of the Lake Superior primary sites can be found in **Appendix C**.*

BCD. The Natural Heritage Inventory Biological Conservation Database, a relational database management application containing 36 database files and more than 2,000 information fields regarding tracked plants, animals, and natural communities.

Bog. A wetland receiving water and nutrients only from atmospheric inputs, dominated by sphagnum mosses and ericaceous shrubs, and characterized by low nutrient and oxygen availability, high acidity, and peat accumulation.

Bottomland. Lowlands along streams and rivers, usually on alluvial floodplains that are periodically flooded.

Calciphilic/Calciphilous A term applied to an organism that prefers to grow in, or can only grow in habitats rich in calcium.

Element Occurrence (or EO). A record or series of records of rare, endangered, threatened, and special concern plant and animal species, and natural communities, tracked by the Natural Heritage Inventory program.

Ericaceous shrubs or ericads. Shrubby, often evergreen plants in the "heath" (Ericaceae) family that typically grow on open to semi-open canopied, acidic soil or peat. Labrador tea, leatherleaf, cranberries, blueberries and huckleberry are examples.

Fen. A peat-accumulating wetland that receives mineral enriched, aerated water from the surrounding landscape. "Rich" fens are differentiated from "poor" fens by the levels of groundwater-borne calcium available to plants, floristic indicators, and, in some cases, special landforms associated with peatland complexes. Dominant plants include sedges, grasses, and mosses, but shrubs and trees may also be important components of fen communities.

Freshwater (Coastal) Estuary In Wisconsin, estuaries occur only on the Great Lakes shorelines where various geological and hydrological processes have created drowned river mouths

GIS (Geographic Information System). A system of computer hardware, software, procedures, standards, geographical data, and personnel for the capture, storage, maintenance, manipulation, analysis and display of all forms of geographically referenced (spatial) information. A GIS can be thought of as having three essential components: a graphical (or pictorial) interface, a database, and a capacity to perform spatial analysis (i.e. how many lakes are in a particular county and what proportion of land do they cover) from that database in a graphical way.

Interdunal Wetland. A type of coastal wetland that occurs between dunes adjacent to the Great Lake coasts (and follow no specific pattern). They generally occur where the water table is close to or exposed at the surface, and are dynamic features formed by wind, wave, and storm action.

Lake Dune System or Barrier Lagoon Wetlands. Wetlands or lagoons which were once part of the Great Lakes but are now separated from the lake by an unbroken natural barrier sand dune or ridge. They generally have very little flow.

Macrophyte A large plant, especially a large aquatic flowering plant. Examples include water-lilies, cattails and pondweeds.

Marsh. A frequently or continually inundated wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Muskeg. Acidic peatlands characterized by sphagnum mosses, sedges, ericaceous shrubs, and a scattered growth of stunted black spruce or tamarack. Floristically and functionally, “muskeg” is very similar to “bog”, but differs structurally owing to the sparse growth of coniferous trees.

Natural Heritage Inventory (or NHI). A program was established by the Wisconsin Legislature in 1985 and is maintained by the Wisconsin DNR's Bureau of Endangered Resources. The NHI program is responsible for maintaining data on the locations and status of rare species, natural communities, and natural features in Wisconsin.

Peatland. Any wetland characterized by the accumulation of partially decomposed plant matter.

Pothole. A shallow, small pond that may hold water throughout the year.

Red Clay Complex Wetlands. Wetlands found in northwestern Wisconsin that occur on old lake plains adjoining Lake Superior and develop on heavy red clay soils. The red clay wetlands may occupy topographic high points in the local landscape, creating “perched” wetlands.

Reedswamp. Marsh dominated by *Phragmites* (common reed)

Ridge and Swale Wetland. A complex and distinctive coastal landform composed of sandy ridges running parallel to the shore, and low areas (swales) between the ridges. Ridge and swale systems were created as post-glacial Great Lakes levels receded. The swales are generally saturated or inundated and create a unique and complex mosaic of wetland vegetation.

Seiche. This is a natural process generated when wind blows in a constant direction and piles water up on a downwind shore. When the wind drops, the water is released and flows back to the opposite shore. For example, when a seiche moves towards the western shore of Lake Michigan or Green Bay, it acts as a dam, slowing the discharge of rivers and creeks into the lake or even forcing water to reverse course and move upstream (adopted from Manitowoc report, 1998). Seiches can be especially dramatic in funnel-shaped bays where great volumes of water are pushed into increasingly smaller areas. This phenomenon is particularly important at sites

such as Green Bay, Chequamegon Bay, and in the estuaries associated with the St. Louis and Mink rivers.

Slough. A swamp or shallow lake system with standing water.

Swamp. A wetland dominated by trees or shrubs.

Vernal pond. A small, shallow, intermittently flooded wetland, generally dry for most of the summer and fall. Vernal ponds provide critical habitat for breeding amphibians, and are also important for certain invertebrates and plants.

Wave-splashed Cliff/Rock Ledge. Exposed bedrock along the Great Lakes shorelines that receive high levels of moisture from wave spray. Such sites can support rare plants.

Wet Meadow. A grass or sedge dominated wetland with saturated soil, but without standing water for most of the year.

Wet Prairie. Rare wetlands dominated by native prairie plants that occur only in the southeastern portion of the project area. Moisture levels are intermediate between those of a marsh and a wet (or sedge) meadow.

SPECIES LIST

List of plant and animal species referred to by common name in the text of the report.

Common name	Scientific name	Vegetation type
alder	<i>Alnus spp.</i>	Shrub
alder-leaved buckthorn	<i>Rhamnus alnifolia</i>	Shrub
alpine cotton grass	<i>Scirpus hudsonianus</i>	Herbaceous
American beech	<i>Fagus grandifolia</i>	Tree
American elm	<i>Ulmus americana</i>	Tree
arrowheads	<i>Sagittaria spp.</i>	Aquatic macrophyte
aspen	<i>Populus spp.</i>	Tree
autumn olive	<i>Elaeagnus angustifolia</i>	Exotic tree/shrub
balsam fir	<i>Abies balsamea</i>	Tree
balsam poplar	<i>Populus balsamifera</i>	Tree
basswood	<i>Tilia americana</i>	Tree
beach-pea	<i>Lathyrus japonicus</i>	Herbaceous
bedstraw bellflower	<i>Campanula aparinoides</i>	Herbaceous
beech	<i>Fagus grandifolia</i>	Tree
beggar-ticks	<i>Bidens spp.</i>	Herbaceous
big bluestem	<i>Andropogon gerardi</i>	Herbaceous
bird's eye primrose	<i>Primula mistassinica</i>	Herbaceous
black ash	<i>Fraxinus nigra</i>	Tree
black oak	<i>Quercus velutina</i>	Tree
black willow	<i>Salix nigra</i>	Tree
bladderworts	<i>Urtricularia spp.</i>	Herbaceous
blue vervain	<i>Verbena hastata</i>	Herbaceous
blueberries	<i>Vaccinium angustifolium, V.</i>	Shrub
bluejoint grass	<i>Calamagrostis canadensis</i>	Herbaceous
bog birch	<i>Betula pumila</i>	Shrub
bog goldenrod	<i>Solidago uliginosa</i>	Herbaceous
bog laurel	<i>Kalmia polifolia</i>	Shrub
bog rosemary	<i>Andromeda glaucophylla</i>	Shrub
bogbean	<i>Menyanthes trifoliata</i>	Herbaceous
boneset	<i>Eupatorium perfoliatum</i>	Herbaceous
box elder	<i>Acer negundo</i>	Tree
bracken fern	<i>Pteridium aquilinum</i>	Herbaceous
broad-leaved cattail	<i>Typha latifolia</i>	Herbaceous
buckbean	<i>Menyanthes trifoliata</i>	Herbaceous

Common name	Scientific name	Vegetation type
bullhead lily	<i>Nuphar variegata</i>	Aquatic macrophyte
bulrush	<i>Scirpus spp.</i>	Herbaceous
bunchberry	<i>Cornus canadensis</i>	Shrub
bur oak	<i>Quercus macrocarpa</i>	Tree
burdock	<i>Arctium spp.</i>	Herbaceous
bur-reed	<i>Sparganium eurycarpum</i>	Herbaceous
Canada wild-rye	<i>Elymus canadensis</i>	Herbaceous
cattails	<i>Typha spp.</i>	Herbaceous
clearweed	<i>Pilea pumila</i>	Herbaceous
club mosses	<i>Lycopodium spp.</i>	Bryophyte
common bladderwort	<i>Utricularia macrorhiza</i>	Aquatic macrophyte
common buckthorn	<i>Rhamnus cathartica</i>	Shrub
common juniper	<i>Juniperus communis</i>	Shrub
common reed	<i>Phragmites australis</i>	Herbaceous
cottonwood	<i>Populus deltoides</i>	Tree
cow-wheat	<i>Melampyrum lineare</i>	Herbaceous
dame's rocket	<i>Hesperis matronalis</i>	Herbaceous
dogwoods	<i>Cornus spp.</i>	Shrub
duck-potato	<i>Sagittaria latifolia</i>	Herbaceous
dwarf lake iris	<i>Iris lacustris</i>	Herbaceous
early blueberry	<i>Vaccinium angustifolium</i>	Shrub
few-seeded sedge	<i>Carex oligosperma</i>	Herbaceous
field wormwood	<i>Artemisia campestris</i>	Herbaceous
flat-topped white aster	<i>Aster umbellatus</i>	Herbaceous
fly honeysuckle	<i>Lonicera involucrata</i>	Shrub
glossy buckthorn	<i>Rhamnus frangula</i>	Shrub
gray dogwood	<i>Cornus racemosa</i>	Shrub
green ash	<i>Fraxinus pennsylvanica</i>	Tree
hemlock	<i>Tsuga canadensis</i>	Tree
Hill's oak	<i>Quercus ellipsoidalis</i>	Tree
Hines emerald dragonfly	<i>Somatochlora hineana</i>	Dragonfly
hoary willow	<i>Salix candida</i>	Shrub
Indiangrass	<i>Sorghastrum nutans</i>	Herbaceous
ironwood	<i>Ostrya virginiana</i>	Herbaceous
jack pine	<i>Pinus banksiana</i>	Tree
Japanese barberry	<i>Berberis thunbergii</i>	Shrub
joe-pye weed	<i>Eupatorium maculatum</i>	Herbaceous
kentucky bluegrass	<i>Poa pratensis</i>	Herbaceous

Common name	Scientific name	Vegetation type
lake cress	<i>Armoracia lacustris</i>	Aquatic macrophyte
lake sedge	<i>Carex lacustris</i>	Herbaceous
late goldenrod	<i>Solidago gigantea</i>	Herbaceous
leatherleaf	<i>Chamaedaphne calyculata</i>	Shrub
little bluestem	<i>Schizachyrium scoparium</i>	Herbaceous
livid sedge	<i>Carex livida</i>	Herbaceous
marram grass	<i>Ammophila breviligulata</i>	Herbaceous
marsh cinquefoil	<i>Potentilla palustris</i>	Herbaceous
marsh fern	<i>Thelypteris palustris</i>	Herbaceous
mayflower	<i>Maianthemum canadense</i>	Herbaceous
meadowsweet	<i>Spiraea alba</i>	Shrub
moccasin flower	<i>Cypripedium acaule</i>	Herbaceous
mountain maple	<i>Acer spicatum</i>	Tree
narrow-leaved cattail	<i>Typha angustifolia</i>	Herbaceous
nettles	<i>Laportea or Urtica spp.</i>	Herbaceous
New Jersey tea	<i>Ceanothus americanus</i>	Shrub
ninebark	<i>Physocarpus opulifolius</i>	Shrub
nodding beggar's ticks	<i>Bidens cernuus</i>	Herbaceous
paper birch	<i>Betula papyrifera</i>	Tree
perfumed cherry	<i>Prunus mahaleb</i>	Shrub
pine	<i>Pinus spp.</i>	Tree
pitcher plant	<i>Sarracenia purpurea</i>	Herbaceous
poor sedge	<i>Carex paupercula</i>	Herbaceous
purple loosestrife	<i>Lythrum salicaria</i>	Herbaceous (invasive exotic)
red maple	<i>Acer rubrum</i>	Tree
red oak	<i>Quercus rubra</i>	Tree
red pine	<i>Pinus resinosa</i>	Tree
red-osier dogwood	<i>Cornus stolonifera</i>	Shrub
reed canary grass	<i>Phalaris arundinacea</i>	Herbaceous
round-leaved sundew	<i>Drosera rotundifolia</i>	Herbaceous
sand cherry	<i>Prunus pumila</i>	Shrub
sand-reed grass	<i>Calamovilfa longifolia var magna</i>	Herbaceous
shrubby cinquefoil	<i>Potentilla fruticosa</i>	Shrub
silver maple	<i>Acer saccharinum</i>	Tree
slender willow	<i>Salix gracilis</i>	Shrub
small cranberry	<i>Vaccinium oxycoccos</i>	Shrub
small fringed gentian	<i>Gentianopsis procera</i>	Herbaceous

Common name	Scientific name	Vegetation type
small yellow lady's slipper	<i>Cypripedium parvifolium</i>	Herbaceous
smooth brome	<i>Bromus inermis</i>	Herbaceous
snowberry	<i>Gaultheria hispidula</i>	Shrub
soft-stemmed bulrush	<i>Scirpus validus</i>	Herbaceous
speckled alder	<i>Alnus incana</i>	Shrub
spike-rushes	<i>Eleocharis spp.</i>	Herbaceous
stinging nettles	<i>Urtica dioica</i>	Herbaceous
sugar maple	<i>Acer saccharum</i>	Tree
swamp white oak	<i>Quercus bicolor</i>	Tree
sweet gale	<i>Myrica gale</i>	Shrub
tamarack	<i>Larix laricina</i>	Tree
tartarian honeysuckle	<i>Lonicera tartarica</i>	Shrub
tawny cotton-grass	<i>Eriophorum virginicum</i>	Herbaceous
thimbleberry	<i>Rubus parviflorus</i>	Shrub
three square bulrush	<i>scirpus americana</i>	Herbaceous
three-leaved false Solomon's-	<i>Smilacina trifolia</i>	Herbaceous
three-sedged sedge	<i>Carex trisperma</i>	Herbaceous
trembling aspen	<i>Populus tremuloides</i>	Tree
tufted hair grass	<i>Deschampsia cespitosa</i>	Herbaceous
tussock cotton-grass	<i>Eriophorum vaginatum</i>	Herbaceous
tussock sedge	<i>Carex stricta</i>	Herbaceous
twig-rush	<i>Cladium mariscoides</i>	Herbaceous
water arum	<i>Calla Palustris</i>	Herbaceous
water horsetail	<i>Equisetum fluviatile</i>	Herbaceous
water parsnip	<i>Sium suave</i>	Herbaceous
water-marigold	<i>Megalodonta beckii</i>	Aquatic macrophyte
water-milfoils	<i>Myriophyllum spp.</i>	Aquatic macrophyte
white birch	<i>Betula papyrifera</i>	Tree
white cedar	<i>Thuja occidentalis</i>	Tree
white pine	<i>Pinus strobus</i>	Tree
white spruce	<i>Picea glauca</i>	Tree
wild rice	<i>Zizania aquatica</i>	Aquatic macrophyte/Herb
willows	<i>Salix spp.</i>	Shrub
Wintergreen	<i>Gaultheria procumbens</i>	Shrub
wire leaved sedges	<i>Carex oligosperma, C. lasiocarpa,</i>	Herbaceous
wood ferns	<i>Dryopteris spp.</i>	Herbaceous
wood nettle	<i>Laportea canadensis</i>	Herbaceous
wool grass	<i>Scirpus cyperinus</i>	Herbaceous

Common name	Scientific name	Vegetation type
woolly sedge	<i>Carex lasiocarpa</i>	Herbaceous
yellow water lily	<i>Nuphar variegatum</i>	Aquatic macrophyte
yew	<i>Taxus canadensis</i>	Shrub

REFERENCES

- Albert, D. 1994. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification. U.S. Forest Service. St. Paul, MN. 250 pp.
- Alden, W.C. 1918. The quaternary geology of southeastern Wisconsin, with a chapter on the older rock formations. US Geological Survey. 356 pp.
- Bay-Lake Regional Planning Commission. 1980. Green Bay West Shore Study - Summary Report. Green Bay, WI.
- Brazner, J.C. and E.W. Beals. 1997. Patterns in Fish Assemblages from Coastal Wetland and Beach Habitats in Green Bay, Lake Michigan: A Multivariate Analysis of Abiotic and Biotic Forcing Factors. U.S. Environmental Protection Agency, National Health and Environmental Effects Laboratory, Duluth, MN and Unity College, ME. 16 pp.
- Brazner, J.C. 1997. Regional, Habitat, and Human Development Influences on Coastal Wetland and Beach Fish Assemblages in Green Bay, Lake Michigan. University of Wisconsin-Madison. Madison, WI. 15 pp.
- Burton, T., 1985. The Effects of Water Level Fluctuations on Great Lakes Coastal Marshes. Departments of Zoology, Fisheries, and Wildlife - Michigan State University. East Lansing, MI. 13 pp.
- Curtis, John T. 1959. The Vegetation of Wisconsin. The University of Wisconsin Press. Madison, WI. 657 pp.
- Department of Natural Resources Regional Ecology Team. 1999. Wisconsin's Northern State Forest Assessments. Bureau of Forestry. Madison, WI. 90 pp.
- Epstein, E., W. Smith, J. Dobberpuhl, and A. Galvin. 1999. Biotic Inventory and Analysis of the Brule River State Forest. Wisconsin Department of Natural Resources - Bureau of Endangered Resources. Madison, WI. 169 pp.
- Epstein, E. 1997. Biotic Inventory of the St. Louis River Estuary and Associated Lands. Wisconsin Department of Natural Resources - Bureau of Endangered Resources. Madison, WI. 42 pp.
- Epstein, E., W. Smith, and E. Judziewicz. 1997. Wisconsin Lake Superior Coastal Wetlands Evaluation. Wisconsin Department of Natural Resources - Bureau of Endangered Resources. Madison, WI. 330 pp.
- Epstein, E., W. Smith, and E. Judziewicz. 1997. Priority Wetland Sites of Wisconsin's Lake Superior Basin. Wisconsin Department of Natural Resources - Bureau of Endangered Resources. Madison, WI. 66 pp.

- Finch, D.M. 1991. Population ecology, habitat requirements, and conservation of neotropical migratory birds. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report 205. 26 pp.
- Grimm, M. 1994. The Door Peninsula Conservation Initiative: A Resource Guide for Local Conservation Partners with Site Reports. The Nature Conservancy. Madison, WI.
- Harris, H.J. 1993. The State of the Bay - A Watershed Perspective. Institute for Land and Water Studies, University of Wisconsin-Green Bay. Green Bay, WI. 24 pp.
- Herdendorf, C.E., S.M. Hartley and M.D. Barnes, eds. 1981. Fish and Wildlife Resources of the Great Lakes Coastal Wetlands within the United States. Volumes 1-6. U.S. Fish and Wildlife Service. Washington D.C. FWS/OBS-81/02.
- Judzewicz, E. and David Kopitzke. 1998. Wisconsin Lake Michigan Island Plant Survey. Wisconsin Department of Natural Resources, Bureau of Endangered Resources. Madison, WI.
- Krieger, K., D. Klarer, R. Heath, and C. Herdendorf. 1992. Journal of Great Lakes Research, Special Issue on Coastal Wetlands of the Laurentian Great Lakes. Volume 18, Number 4. Ohio. 290 pp.
- McNab, W. Henry, and Avers, Peter E., comps. 1994. Ecological subregions of the United States: Section descriptions. Administrative Publication WO-WSA-5. Washington, DC: U.S. Department of Agriculture, Forest Service. 267 pp.
- Merryfield, N. 2000. A data compilation and assessment of coastal wetlands of Wisconsin's Great Lakes. Wisconsin Department of Natural Resources. Madison, WI
- Milwaukee Public Museum. Bryophytes in Wisconsin's Coastal Wetlands - Final Report. Milwaukee, WI. 8 pp.
- Minc, L.D. 1997. Vegetative Response in Michigan's Coastal Wetlands to Great Lakes Water-Level Fluctuations. Michigan Natural Features Inventory. Lansing, MI. 135 pp.
- Minc, L.D. 1997. Great Lakes Coastal Wetlands: An Overview of Controlling Abiotic Factors, Regional Distribution, and Species Composition (In 3 Parts). Michigan Natural Features Inventory. Lansing, MI. 307 pp.
- Mitsch, W. and J. Gosselink. 1993. Wetlands. New York, NY.
- Schuette, P.A. and R.A. Rost. 1998. Wetlands used by Spawning Northern Pike in the Pensaukee River Watershed. Wisconsin Department of Natural Resources. Peshtigo, WI. 41 pp.

- Shideler, G. 1992. Critical Coastal Wetland Problem Areas along the Michigan-Wisconsin Shoreline of Lake Michigan, and Their Prioritization for Further Study. U.S. Geological Survey. Denver, CO. 10 pp.
- Southeastern Wisconsin Regional Planning Commission. 1997. A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin. Waukesha, WI. 531 pp.
- Spotts, R. 1994. Preliminary Analysis of Conservation Issues in the Kakagon/Bad River Sloughs Watershed. The Nature Conservancy, Northland College. Ashland, WI. 82 pp.
- Stearns, F., and P. Salamun. 1978. The Vegetation of the Lake Michigan Shoreline in Wisconsin. Department of Botany, University of Wisconsin-Milwaukee. 42 pp.
- Tans, W., and R. Dawson. 1980. Natural Area Inventory - Wisconsin's Great Lakes Coast. Office of Coastal Management, Wisconsin Department of Administration and Scientific Areas Section, Wisconsin Department of Natural Resources. Madison, WI. 53 pp.
- The Door County Land Use Forum, Inc. 1999. Door Peninsula, Wisconsin Critical Habitat and Natural Areas Land Protection Plan - Project Prospectus. Sturgeon Bay, WI. 18 pp.
- The Nature Conservancy. 1999. Terrestrial Vegetation of the Midwestern United States, Wisconsin Portion (Draft). Minneapolis, MN.
- The Nature Conservancy. 1992. Preliminary analysis of the conservation issues in the Kagaon / Bad River Sloughs Watershed. Ashland, WI.
- Thorp, S., R. Rivers, V. Pebbles. 1996. Impacts of Changing Land Use. Background Paper - State of the Lakes Ecosystem Conference. 119 pp.
- Thwaites, F.T. 1943. Pleistocene of part of northeastern Wisconsin. Bulletin of the Geological Society of America. pp. 87-144.
- Thwaites, F.T and Bertrand, K. 1957. Pleistocene geology of the Door Peninsula, Wisconsin. Bulletin of the Geological Society of America. pp. 831-879.
- U.S. Fish and Wildlife Service. Special Wetlands Inventory Study (SWIS) Data Base and Manual. Green Bay, WI.
- U.S. Fish and Wildlife Service. 1979. Green Bay Estuary Study. Twin Cities, MN.
- Valvassori, D. 1990. Door County Basin Water Quality Management Plan. Wisconsin Dept. Natural Res., Madison, WI. [PUBL-WR-205-90-REV]

Water Resources Management Graduate Students. 1998. The Coastal Wetlands of Manitowoc County. Institute for Environmental Studies, University of Wisconsin-Madison. Madison, WI. 190 pp.

Wisconsin Department of Transportation. 1999. Draft State Environmental Impact Statement Federal Environmental Assessment (Project ID 1154-01-00) for USH 41, Oconto and Marinette Counties. Green Bay, WI.

Wisconsin Coastal Management Program. 1996. Wisconsin Coastal Zone Management Profile - Protection of Estuaries and Coastal Wetlands. Wisconsin Department of Administration. 17 pp.

Wisconsin Department of Natural Resources. 1993. Guide to Wisconsin's Endangered and Threatened Plants. Bureau of Endangered Resources. Madison, WI. 128 pp.

Wisconsin Department of Natural Resources. 1972. Erosion and Sedimentation in the Lake Superior Basin. 81 pp.

APPENDIX A: NATURAL HERITAGE INVENTORY METHODS OVERVIEW

The Wisconsin Natural Heritage Inventory program is part of an international network of NHI programs. The defining characteristic of this network, and the feature that unites the programs, is the use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity. This network of data centers was established, and is currently coordinated by, The Nature Conservancy, an international non-profit organization.

Natural Heritage Inventory programs focus on rare species, natural communities, and other rare elements of nature. When NHI programs are established, one of the first tasks facing the staff is to consolidate existing information on the status and location of rare elements. Before proceeding, the NHI program must determine what elements warrant "tracking" and which are more common. Similar to most states, Wisconsin biologists had a general idea of which species in the better-studied taxonomic groups (e.g., mammals, birds, and vascular plants) were rare or declining. For less-studied groups such as macroinvertebrates, the process of assembling the list of species to track and gathering the data were quite dynamic. Initially, NHI staff cast a wide net, collecting data on many species from existing sources (e.g., scientific literature, field guides, books, maps, and museum collections) as well as from direct contact with experts throughout the state. As more data were gathered, it was clear that some species were more common than originally thought and the NHI program stopped collecting data on them. Thus, the list of which elements are tracked, the NHI Working List, changes over time as species' populations change (both up and down) and as our knowledge about their status and distribution increases. This evolution continues today, with the NHI Working List typically going through several revisions a year. The most current Wisconsin Natural Heritage Working List for the State of Wisconsin as of this writing (dated December 2001) is available through the NHI office.

In general, there are two approaches to surveying biodiversity: (1) those focused on locating occurrences of particular elements, and (2) those focused on assessing the components of a particular area. The latter approach employs a "top down" analysis that begins with an assessment of the natural communities and aquatic features present, their relative quality and condition, the surrounding landscape pattern, and current land use and results in the identification of future species-oriented surveys. This approach, commonly referred to as "coarse filter-fine filter," concentrates inventory efforts on those sites most likely to contain target species. It also allows sites to be placed in a larger, landscape context for more broad applications of ecosystem management principles.

The NHI methodology for organizing and storing data is actually a system of three inter-related data storage techniques: structured manual information files, topographic map files, and a computer database that integrates the various information. The computer component, known as the Biological & Conservation Data System (BCD), was developed by The Nature Conservancy for use by the Heritage Network. It is a sophisticated relational database management application built upon the Advanced Revelation application environment. Owing to the diversity and complexity of the information managed--from species taxonomy and ecosystem classification to real estate transactions--the system contains 36 database files and more than 2,000 information

fields. The data in the Biological & Conservation Data System populate the NHI Geographic Information System.

Methods of Inventory

The following is a description of standard NHI methods for conducting NHI inventories. Any step may be modified, dropped, or repeated as appropriate to the project.

File Compilation: Involves obtaining existing records of natural communities, rare plants and animals, and aquatic features for the study area and surrounding lands and waters from the Biological & Conservation Data system, housed within DNR's Natural Heritage Inventory. Other databases with potentially useful information may also be queried, such as: forest stand/compartments reconnaissance, which is available for many public agency owned lands; the DNR Surface Water Resources series for summaries of the physical, chemical, and biological characteristics of lakes and streams (statewide, by county); the Milwaukee Public Museum's statewide Herp Atlas; museum/herbarium collections for various target taxa; soil surveys; and the fish distribution database (by watershed, WDNR-Research).

Additional data sources are sought out as warranted by the location and character of the site, and the purpose of the project. Manual files maintained within the Bureau of Endangered Resources contain information on a variety of subjects relevant to the inventory of natural features and are frequently useful.

Literature Review: Field biologists involved with a given project consult basic references on the natural history and ecology of the region within which the study area is situated. This can both broaden and sharpen the focus of the investigator.

Target Elements: Lists of target elements including natural communities, rare plants and animals, and aquatic features are developed for the study area. Field inventory is then scheduled for the times when these elements are most identifiable or active.

Map Compilation: USGS 7.5 minute topographic quadrangles serve as the base maps for field survey and often yield useful clues regarding access, extent of area to be surveyed, developments, and the presence and location of special features.

WDNR wetland maps consist of aerial photographs upon which all wetlands down to a scale of 2 or 5 acres have been delineated. Each wetland polygon is classified based on characteristics of vegetation, soils, and water depth.

Ecoregion maps are useful for comprehensive projects covering large geographic areas such as counties, national and state forests, and major watersheds. These maps integrate basic ecological information on climate, landforms, geology, soils, and vegetation. As these maps evolve, they should become increasingly useful, even for relatively small, localized projects.

Geographic Information Systems (GIS) are increasing our ability to integrate spatial information on lands and waters of the state and are becoming a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

Aerial photographs: These provide information on a study area not available from maps, paper files, or computer printouts. Examination of both current and historical photos, taken over a period of decades, can be especially useful in revealing changes in the environment over time.

Original Land Survey Records: The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. These notes also record general impressions of vegetation, soil fertility, and topography, and note aquatic features, wetlands, and recent disturbances such as windthrow and fire. As these surveys typically occurred prior to extensive settlement of the state by Europeans, they constitute a valuable record of conditions prior to extensive modification of the landscape by European technologies and settlement patterns.

Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield information not available in other formats.

Analysis of Compiled Information: The compiled information is analyzed to identify inventory priorities, determine needed expertise, and develop budgets.

Meetings: Planning and coordination meetings are held with all participants to provide an overview of the project, share information, identify special equipment needs, coordinate schedules, and assign landowner contact responsibilities. Team development may be a part of this step.

Aerial Reconnaissance: Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are scheduled for those times when significant features of the study area are most easily identified and differentiated. They are also useful for observing the general lay of the land, vegetation patterns and patch sizes, aquatic features, infrastructure, and disturbances within and around the site.

APPENDIX B: ECOLOGICAL COMMUNITY SETTINGS FOR COASTAL COMMUNITIES

Coastal Peatlands. Wetland complexes characterized by the accumulation of sedge and moss peat that have developed in association with sandspits at the inundated mouths of several streams entering Lake Superior on the margins of the Bayfield peninsula, several of the Apostle Islands, and at the mouths of the Bad and Kakagon rivers. For this evaluation, priority peatland communities consisted of coastal fen, coastal bog, and tamarack swamp. Other important associated communities were interdunal wetland, alder thicket, beach, lake dune, dry boreal pine forest, and Great Lakes pine barrens. The priority sites surveyed were Port Wing, Bark Bay, Lost Creek, Sand Bay, Big Bay, Stockton Island Tombolo, Outer Island Sandspit and Lagoon, Long Island-Chequamegon Point, Bayview Beach-Sioux River Slough, Red Cliff Reservation, and Bad River Reservation.

Threats to these communities include invasive species, diminished water quality, increased development, and suppression of natural disturbance regimes.

With a few exceptions, these communities and associated landforms are unique to the coastal zone. Many rare species are restricted to the coastal peatlands and their associated features. Outer Island Sandspit and Lagoon and Long Island-Chequamegon Point are especially important migratory bird concentration areas. Bad River Reservation contains aquatic biota of high regional significance.

Estuarine Marsh. Wetlands composed of stands of emergent, submergent, and floating-leaved aquatic macrophytes, occurring at the mouths of drowned rivers along the Lake Superior shore. Peat accumulation is minimal or absent. For this evaluation, priority communities consisted of emergent aquatic, submergent aquatic, northern sedge meadow, and boreal forest.

Threats to these communities include invasive species, diminished water quality, and increased development pressure.

Coastal Cliffs and Ledges. Exposures of sandstone bedrock are frequent shoreline features of the northern Bayfield peninsula and also occur on some of the Apostle Islands. Cold currents, fogs, and wave spray create conditions suitable for the maintenance of populations of many specialized vascular plants, which are not present in similar rocky habitats away from the coast. For this evaluation, priority communities consisted of moist cliff, dry cliff, Great Lakes rocky shore, hemlock-hardwood forest, and pine forest. The priority sites surveyed were Red Cliff Reservation, Stockton Island Tombolo, and Sand Bay.

Threats to these communities include quarrying, shoreline development, and rock climbing.

These natural communities are critical habitat for many rare plants, most of them habitat specialists and restricted to coastal environments. Many additional sites occur on the Apostle Islands and on the northern Bayfield Peninsula.

Red Clay Flats. Though red clay soils blanket much of Wisconsin's portion of the basin, in the vicinity of the City of Superior there is a concentration of shrub- and sedge-dominated wetlands on the nearly level, poorly drained clays. For this evaluation, priority communities consisted of alder thicket, shrub-carr, northern sedge meadow, and emergent aquatic. The priority sites surveyed were Pokegama-Carnegie Wetlands, Red River Breaks, and Superior Airport/Hill Avenue Wetlands/South Superior Triangle.

Threats to these communities include disruption of hydrology, increased development, invasive species, pollution, and suppression of natural disturbance regimes.

While within the rather arbitrarily defined coastal zone, the poorly drained red clay flats are not directly affected by coastal processes and so are placed here. All of the sites are in the vicinity of the City of Superior and vulnerable to a variety of disturbances. These sites are most notable for their concentrations of rare plants, some of which occur nowhere else in the drainage basin or state.

Stream Corridors. For this evaluation, priority communities consisted of white cedar swamp, hardwood swamp, floodplain forest, mesic hardwood bottoms, alder thicket, emergent aquatic, boreal forest, and northern dry-mesic forest. The priority sites surveyed include Bad River Reservation, Brule Spillway, and Nemadji River Bottoms.

Threats to these communities include disruption of hydrology, logging, increased development, and invasive species.

Several of the large streams deeply entrenched in the region's red clays possess unique attributes, especially the Bad and Nemadji rivers. The entire length of the Brule River contains unique features.

Bedrock-influenced Shoreline: Bedrock has created special conditions for wetland species assemblages at several locations on the Great Lakes coast. Lake Michigan's Door Peninsula is underlain by Silurian Age dolomite, which is exposed as a steep cliff-forming escarpment (the Niagara Escarpment) on the west side of the Peninsula along Green Bay, and as flat alkaline rock "beach" on the east side of the Peninsula north of Bailey's Harbor. Both the Escarpment and the dolomite beaches provide habitat for highly specialized organisms, including many that are rare or otherwise sensitive. Cliffs, talus slopes, seepages, alvar, rock beaches, and splash pools are among the special habitats owing their origin to the bedrock.

On Lake Superior sandstone is exposed along the northern Bayfield Peninsula and on the shores of several of the Apostle Islands. Cliffs and level rocky ledges support populations of many rare plants, including several, such as the carnivorous butterwort (*Pinguicula vulgaris*), that occur in Wisconsin only on wet cliffs in the Apostle Islands.

Coastal Canyons: These features occur primarily along the central stretches of the Lake Michigan coast where small streams have cut through glacio-lacustrine deposits creating short,

steep-walled valleys perpendicular to the shoreline. The vegetation is typically forest, with white cedar dominant, and a mixture of other “northern” conifers and various hardwoods the major associates. The slopes often harbor seepages that can provide habitat for rare plants. Similar features also occur in the red clay regions of southwestern Lake Superior in Douglas county.

Lacustrine Plain: Nearly level lakeplain occurs in a wide band along the west shore of Green Bay. The uplands have generally been developed for agricultural and residential purposes, and some of the wetlands have been drained or pastured, but significant amounts of emergent marsh, sedge meadow, and lowland hardwood forest have persisted in certain areas. Large open wetland complexes occur at the mouths of the Oconto and Peshtigo Rivers, and some extensive remnants of marsh occur in Lower Green Bay.

The west shore wetlands provide critical habitat for many animals, especially nesting and migrating birds, and fish. Development threats remain significant and there are significant problems with invasive species at virtually all of the wetland sites.

Ridge and Swale Systems: As the water levels of Lake Michigan dropped following the last glacial retreat, long narrow ridges separated by wet swales were created by shoreline processes leaving unique landforms at several locations. These ridge and swale systems are best developed on the east side of the Door Peninsula and in the Point Beach area on the central Lake Michigan coast. The vegetation mosaic is even more complex than the landform, and often includes a high diversity of plant associations, including marsh, fen, bog, meadow, shrub swamp, hardwood swamp, and conifer swamp. The sandy ridges are typically forested with mixtures of conifers and hardwoods, and moisture conditions vary from mesic (moist) to very dry depending on local soil conditions and depth to water table.

Several of these ridge and swale features are quite large, reaching sizes of several thousand acres. These provide critical habitat for many native plants and animals, including some that are area sensitive, or habitat specialists.

Appendix C: NHI NATURAL COMMUNITY DESCRIPTIONS FOR COMMUNITIES FOUND WITHIN THE COASTAL ZONE

(January 14, 2002 Revision) Prepared by Eric Epstein, Emmet Judziewicz and Elizabeth Spencer

Specific palustrine community types found in either the coastal zone or the Lake Superior Basin interior are described below.

Alder Thicket. This tall shrub wetland community is dominated by speckled alder (*Alnus incana*). Common sites include stream and lake margins, the interface between open and forested wetland communities, the interface between open wetlands and upland communities, and depressions where there is movement of groundwater through the soil. Common associates include marsh marigold (*Caltha palustris*), black currant (*Ribes americanum*), crested shield fern (*Dryopteris cristata*), spotted touch-me-not (*Impatiens biflora*), rough bedstraw (*Galium asprellum*), sensitive fern (*Onoclea sensibilis*), horsetails (*Equisetum* spp.), and arrow-leaved tearthumb (*Polygonum sagittatum*). Rare species occurring in alder thickets include auricled twayblade (*Listera auriculata*), sweet coltsfoot (*Petasites sagittatus*), small shinleaf (*Pyrola minor*), and the wood turtle (*Clemmys insculpta*).

Alvar. This rare community consists of areas of thin discontinuous soil overlying horizontal beds of limestone or dolomite in the vicinity of Great Lakes shorelines. They are characterized by relatively low tree cover and a distinctive biota, which includes elements of rock pavement, prairie, savanna and boreal forest communities. Among these are regional endemics, some very rare. This community type is much more common and better-developed in Michigan and Ontario than in Wisconsin. Small coniferous and deciduous trees (cedar, fir, pine, oak, aspen, birch) are scattered among an assemblage of species that can include big bluestem (Andropogon gerardii), little bluestem (Schizachyrium scoparium), Indian-grass (Sorghastrum nutans), and wood lily (Lilium philadelphicum), as well as shoreline plants such as silverweed (Potentilla anserina) and dwarf lake iris (Iris lacustris).

Bedrock Shore. Wave-splashed bedrock shoreline ledges are best developed on sandstone in the Apostle Islands of Lake Superior. Stunted trees of white cedar (Thuja occidentalis), white birch (Betula papyrifera), showy mountain-ash (Sorbus decora) and green alder (Alnus crispa) are often present in crevices. Common herbs are ticklegrass (Agrostis hyemalis), fireweed (Epilobium angustifolium), and Canada goldenrod (Solidago canadensis), but the flora often includes unusual plants such as bird's-eye primrose (Primula mistassinica), brook lobelia (Lobelia kalmii), and three-toothed cinquefoil (Potentilla tridentata).

Black Spruce Swamp. This forest wetland community occurs primarily in acid peatlands of insular basins. Black Spruce (*Picea mariana*) is the dominant tree. Canopy associates include tamarack (*Larix laricina*) and occasionally balsam fir (*Abies balsamea*). A level mat of *Sphagnum* mosses covers the surface and provides a substrate upon which a characteristic set of understory plants grows. Among these are Labrador tea (*Ledum groenlandicum*), three-leaved false Solomon's seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), three-

seeded sedge (*Carex trisperma*), and moccasin flower (*Cypripedium acaule*). Windthrow gaps are often common in mature stands, and these contain thickets of spruce or tamarack saplings. As the sphagnum peat accumulates, the canopy may break up and a very acid muskeg will result.

Black spruce swamp and tamarack swamp have previously been treated as “northern wet forest”, as described by Curtis (1959). We have recognized two types based on compositional differences and the diverging successional pathways demonstrated by these communities. Rare species include many boreal birds and lepidoptera.

Boreal Rich Fen. Neutral to alkaline cold open peatlands of northern Wisconsin through which carbonate-rich groundwater percolates. Sphagnum mosses are absent or of relatively minor importance, as calciphilic species (especially the “brown” mosses) predominate. Dominant/characteristic plants include woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), beaked bladderwort (*Utricularia cornuta*), rushes (*Juncus* spp.), and Hudsons Bay cotton-grass (*Scirpus hudsonianus*). Shrubby phases also occur, with bog birch (*Betula pumila*), sage willow (*Salix candida*), and speckled alder (*Alnus incana*) ~~also~~ present in significant amounts.

Calcareous Fen. An open wetland found in southern Wisconsin, often underlain by a calcareous substrate-marl, through which ~~percolates~~ carbonate-rich groundwater percolates. The flora is typically diverse, with many calciphiles. Common species are several sedges (*Carex sterilis* and *C. lanuginosa*), marsh fern (*Thelypteris palustris*), shrubby cinquefoil (*Potentilla fruticosa*), shrubby St. John's-wort (*Hypericum kalmianum*), Ohio goldenrod (*Solidago ohioensis*), grass-of-parnassus (*Parnassia glauca*), twig-rush (*Cladium mariscoides*), brook lobelia (*Lobelia kalmii*), boneset (*Eupatorium perfoliatum*), swamp thistle (*Cirsium muticum*), and asters (*Aster* spp.). Some fens have significant prairie or sedge meadow components, and ~~appear to~~ intergrade with those communities.

Clay Seepage Bluff (formerly called Alkaline Clay Bluff). Steep, ~~red~~ clay bluffs occur along some stretches of the Great Lakes shorelines and less commonly inland on streams draining into Lake Superior and Lake Michigan. Vegetative cover ranges from forested with pines (*Pinus resinosa* and *P. strobus*), white cedar (*Thuja occidentalis*) and white birch (*Betula papyrifera*), to bare clay with only a few herbs present. Buffaloberry (*Shepherdia canadensis*) is a characteristic shrub, but more typically, alders (*Alnus incana* and *A. crispa*), as well as herbs such as Canada goldenrod (*Solidago canadensis*) and pearly everlasting (*Anaphalis margaritacea*) are dominant. Both native and exotic pioneers such as fireweed (*Epilobium angustifolium*) and Canada thistle (*Cirsium arvense*) are common, especially on unstable sites. But it is the semi-stabilized “weeping” bluffs that are of the greatest biological interest. Golden sedge (*Carex aurea*), orchids and calciphilic fen species may colonize such sites, which can be local repositories of rare or otherwise noteworthy species.

Coastal Bog (Poor Fen). The coastal bog is also considered an herbaceous wetland community. The surface layer of this weakly minerotrophic open peatland community, which occurs as a part of the coastal sandspit-lagoon complexes, is comprised of *Sphagnum* mosses. The mats are

typically quite firm and may be "grounded" along the margins of the uplands adjoining the wetland complexes. At larger sites, the coastal bogs grade into a sedge fen community toward the open lagoon waters and to tamarack swamp toward the uplands. Characteristic plants associated with the sphagnum mats are a number of ericaceous shrubs and sedges, particularly leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), large cranberry (*Vaccinium macrocarpon*), woolly sedge (*Carex lasiocarpa*), few-seeded sedge (*C. oligosperma*), mud sedge (*C. limosa*), a sedge (*C. chordorrhiza*), white beak-rush (*Rhynchospora alba*), and tawny cotton-grass (*Eriophorum virginicum*). Shrub components of this type often include bog birch (*Betula pumila*), speckled alder (*Alnus incana*), and bog willow (*Salix pedicellaris*).

Other typical species include pitcher plant (*Sarracenia purpurea*), buck bean (*Menyanthes trifoliata*), scheuchzeria (*Scheuchzeria palustris*), sweet gale (*Myrica gale*), rose pogonia (*Pogonia ophioglossoides*), grass pink (*Calopogon tuberosus*), and club-spur orchid (*Platanthera clavellata*). Floristically, the coastal bogs closely resemble the "poor fens" and "sphagnum lawns" of the upper Great Lakes region, and they should perhaps be treated as a subtype of that community.

Among the rare plants found in the coastal bogs are dragon's mouth orchid (*Arethusa bulbosa*), Michaux's sedge (*Carex michauxiana*), sooty beak-rush (*Rhynchospora fusca*), *Carex tenuiflora*, and yellow star grass (*Xyris montana*). Rare animals include birds, such as northern harrier and American bittern, and a number of boreal lepidoptera.

Coastal Fen (Sedge Fen). This herbaceous (sedge-dominated) wetland community occurs in coastal areas on the margins of shallow lagoons, which are protected from wind, wave, and ice action on Lake Superior by sandspits. Woolly sedge (*Carex lasiocarpa*) is usually the primary mat component. Typical associates are twig rush (*Cladium mariscoides*), buck bean (*Menyanthes trifoliata*), sweet gale (*Myrica gale*), pitcher plant (*Sarracenia purpurea*), bladderworts (*Utricularia cornuta*, *U. intermedia*, *U. minor*), cotton-grass (*Scirpus hudsonianus*), intermediate sundew (*Drosera intermedia*), water horsetail (*Equisetum fluviatile*), marsh muhly (*Muhlenbergia glomerata*), and white beak-rush (*Rhynchospora alba*).

Floristically, these communities appear intermediate to rich and poor fens as described in both Michigan (Crum 1988) and Minnesota (Wright et al. 1992). The rich fen indicators of the Minnesota peatlands and eastern Wisconsin such as grass-of-Parnassus (*Parnassia glauca*), false asphodel (*Tofieldia glutinosa*), linear-leaved sundew (*Drosera linearis*), beaked spike rush (*Eleocharis rostellata*), and the sedge *Carex sterilis*, are absent from these coastal fens.

Rare and uncommon plants of coastal fens include coast sedge (*Carex exilis*), livid sedge (*C. livida*), Michaux's sedge (*C. michauxiana*), bog arrow grass (*Triglochin maritimum*), English sundew (*Drosera anglica*), tall white bog orchid (*Platanthera dilatata*), and sooty beak-rush (*Rhynchospora fusca*). Several rare birds also occur in the sedge mats, including yellow rail and LeConte's sparrow.

Emergent Aquatic. The aquatic plant community is best developed in shallow, protected, usually permanent waters. Most of the dominant plants are tall and erect with narrow leaves. Frequently a single species will form a zone within an emergent marsh, often correlated with water depth. Cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), bur-reeds (*Sparganium* spp.), arrowheads (*Sagittaria* spp.), spike rushes (*Eleocharis* spp.) and water plantain (*Alisma plantago-aquatica*) are important members of this community. Unrooted floating-leaved species such as the duckweeds (*Lemna minor*, *L. trisulca*, *Spirodela polyrhiza*), and several submergent aquatic macrophytes may occur among the stems of the emergents. Emergent marshes are important to many nesting and migratory waterbirds, mammals, invertebrates, and fish.

Floodplain Forest. Confined to the floodplains of large streams, this forest wetland community is rare in the Lake Superior Basin. Canopy trees include silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), box elder (*A. negundo*), and occasionally bur oak (*Quercus macrocarpa*). The primary disturbance dynamic affecting this community is flooding, which occurs in the spring after the ice goes out and the snow melts, and after heavy rains. The understories are often quite open, supporting ostrich fern (*Matteucia struthiopteris*), wood nettle (*Laportea canadensis*), green-headed coneflower (*Rudbeckia laciniata*), swollen sedge (*Carex intumescens*), Gray's sedge (*C. grayii*), and Tuckerman's sedge (*C. tuckermanii*).

Great Lakes Alkaline Rockshore. These are creviced, wave-splashed, nearly horizontal dolomite ledges [along Lake Michigan on the Door Peninsula. County along Lake Michigan](#) Depending on lake levels, large expanses of this habitat may be either inundated or exposed during a given year. Common members of this community are the shrubs ninebark (*Physocarpus opulifolius*), shrubby cinquefoil (*Potentilla fruticosa*), and the herbs silverweed (*Potentilla anserina*), goldenrods (especially *Solidago hispida*), brook lobelia (*Lobelia kalmii*), gentians (*Gentiana* spp.), grasses-of Parnassus (*Parnassia* spp.), Indian paint-brush (*Castilleja coccinea*), low calamint (*Calamintha arkansana*) and many other calciphiles. [Plants endemic to the Great Lakes shores are significant components of some stands.](#)

Hardwood Swamp. The hardwood swamp can also be considered a forest wetland community. These deciduous lowland forests situated on wet to wet-mesic mineral or muck substrates outside of active floodplains are often dominated by black ash (*Fraxinus nigra*). Canopy associates may include red maple (*Acer rubrum*), green ash (*F. pennsylvanica*), American elm (*Ulmus americana*), white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and yellow birch (*Betula alleghaniensis*). However, black ash not infrequently occurs in almost pure stands, and is often well represented as a sapling or small tree. A dense tall shrub layer of speckled alder (*Alnus incana*) and winterberry (*Ilex verticillata*) is commonly present. Seasonal pools are features of many stands.

Among the characteristic groundlayer plants are marsh marigold (*Caltha palustris*), swamp saxifrage (*Saxifraga pensylvanica*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern

(*Onoclea sensibilis*), water horehound (*Lycopus uniflorus*), skunk cabbage (*Symplocarpus foetidus*), mint (*Mentha arvensis*), fowl manna grass (*Glyceria striata*), and many sedges.

Interdunal Wetland. This herbaceous wetland community is extremely rare, occurring only within dune systems of the Great Lakes. As there are fewer than five occurrences known in the western Lake Superior Basin, and they are quite a distance from one another, it is difficult to characterize them floristically. Graminoids are prominent at all sites, including shore rush (*Juncus balticus*) and the sedge *Carex viridula*. Other species found at some, but not all sites, are woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), and nodding ladies' tresses (*Spiranthes cernua*).

At some sites, this community may be ephemeral. At least one site has been known for many decades, and is being encroached on by woody species and invaded by exotics. A great number of rare species were documented in the interdunal wetlands, including marsh grass-of-Parnassus (*Parnassia palustris*), small purple bladderwort (*Utricularia resupinata*), Robbins spike rush (*Eleocharis robbinsii*), sooty beak-rush (*Rhynchospora fusca*), shore sedge (*Carex lenticularis*), and variegated horsetail (*Equisetum variegatum*). An old borrow pit on one of the coastal barrier spits has been colonized by several of these rare plants and also held the first Wisconsin record for juniper clubmoss (*Lycopodium sabinaefolium*).

Moist Cliff (Shaded Cliff of the Curtis community classification). This "micro-community" occurs on shaded (by trees or the cliff itself because of aspect), moist to seeping mossy, vertical exposures of various rock types, most commonly sandstone and dolomite. Common species are columbine (*Aquilegia canadensis*), the fragile ferns (*Cystopteris bulbifera* and *C. fragilis*), wood ferns (*Dryopteris* spp.), ~~polypody (*Polypodium vulgare*)~~, rattlesnake-root (*Prenanthes alba*), and wild sarsaparilla (*Aralia nudicaulis*). The rare flora of these cliffs vary markedly in different parts of the state; Driftless Area cliffs might have northern monkshood (*Aconitum noveboracense*), those on Lake Superior, butterwort (*Pinguicula vulgaris*), or those in Door County, green spleenwort (*Asplenium viride*).

Northern Sedge Meadow. Two distinct types of sedge meadow, another herbaceous wetland community, are currently recognized within the Lake Superior Basin. The first is found along the margins of low gradient streams and drainage lakes. Dominants are often tussock sedge (*Carex stricta*) and bluejoint grass (*Calamagrostis canadensis*). Associates include swamp milkweed (*Asclepias incarnata*), spotted joe-pye-weed (*Eupatorium maculatum*), blue flag (*Iris versicolor*), yellow loosestrife (*Lysimachia terrestris*), marsh St. Johnswort (*Triadenum fraseri*), marsh bellwort (*Campanula aparinoides*), water horehound (*Lycopus uniflorus*), panicked aster (*Aster simplex*), purple meadow rue (*Thalictrum dasycarpum*) and the sedges *Carex comosa*, *C. diandra*, and *C. canescens*. This type is found throughout most of the project area, though the stands are often small.

The other type tends to occur more in insular depressions, especially in the vicinity of northwestern Douglas County. The usual dominants are broad-leaved sedges, usually lake sedge

(*Carex lacustris*), sometimes with beaked sedge (*Carex rostrata*). Associates include bluejoint grass (*Calamagrostis canadensis*), fringed brome (*Bromus ciliatus*), flat-topped aster (*Aster umbellatus*), rough bedstraw (*Galium asprellum*), spotted touch-me-not (*Impatiens biflora*), spotted joe-pye-weed (*Eupatorium maculatum*), water horehound (*Lycopus uniflorus*), blue flag (*Iris versicolor*), late goldenrod (*Solidago gigantea*), and other sedges. Several rare plants were found in this community, including sweet coltsfoot (*Petasites sagittatus*), Vasey's rush (*Juncus vaseyi*), and New England violet (*Viola novae-angliae*). Encroachment by woody shrubs appears to be occurring at many locations, especially for the broad-leaved type.

Open Bog. This peatland type herbaceous wetland community is dominated by deep layers of *Sphagnum* mosses which isolate the other members of the community from the influence of nutrient-rich groundwater or runoff. There is often a pronounced hummock-hollow microtopography. Ericaceous shrubs, sedges, and stunted, scattered black spruce (*Picea mariana*) are the most characteristic vascular plants. Among the ericads the most important species are typically leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*). Sedges with a tolerance for these ombrotrophic peatlands include the carices *Carex oligosperma*, *C. pauciflora*, and *C. paupercula*, and the cotton-grasses *Eriophorum angustifolium*, *E. spissum*, and *E. virginicum*. Round-leaved sundew (*Drosera rotundifolia*) is among the few other vascular plants frequently found in the open bogs. In the "muskeg" phase, the community structurally resembles a savanna owing to the scattered, often stunted, black spruce and tamarack.

Bogs occur mostly in poorly drained depressions in glacial till and in isolated kettles within end moraines or outwash. Scale and landscape context of this community often differs markedly within different landforms. Within the project area, the largest bogs occur in the Mille Lacs Uplands and Winegar Moraines subsections. Rare species found in the bogs include a number of birds and butterflies of boreal affinity.

Shrub-carr. Willows (*Salix* spp.) are the dominant plants in this tall shrub wetland community. Important species include slender willow (*Salix gracilis*), pussy willow (*S. discolor*), balsam willow (*S. pyrifolia*), and autumn willow (*S. serissima*). Other common shrubs, which may be co-dominant in some stands, are meadowsweet (*Spiraea alba*), red-osier dogwood (*Cornus stolonifera*), nannyberry (*Viburnum lentago*), and speckled alder (*Alnus incana*). Representative herbs are bluejoint grass (*Calamagrostis canadensis*), spotted touch-me-not (*Impatiens biflora*), sensitive fern (*Onoclea sensibilis*), water horehound (*Lycopus uniflorus*), and purple meadow rue (*Thalictrum dasycarpum*).

Southern Sedge Meadow. Widespread in southern Wisconsin, this open wetland community is most typically a tussock marsh dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*). Common associates are water-horehound (*Lycopus uniflorus*), paniced aster (*Aster simplex*), blue flag (*Iris virginica*), Canada goldenrod (*Solidago canadensis*), spotted joe-pye-weed (*Eupatorium maculatum*), broad-leaved commoncat-tail (*Typha latifolia*), and swamp milkweed (*Asclepias incarnata*). Reed canary grass (*Phalaris arundinacea*) may be dominant in grazed and/or ditched stands. Ditched stands can succeed quickly to Shrub-Carr.

Submergent Aquatic. This aquatic plant community occurs in bodies of permanent water, usually where there is some protection from excessive wave action and strong currents. Characteristic species include waterweed (*Elodea canadensis*), coontail (*Ceratophyllum demersum*), water milfoils (*Myriophyllum exalbescens*, and *M. verticillatum*), wild celery (*Vallisneria americana*), water marigold (*Megalodonta beckii*), naiad (*Najas flexilis*), mare's-tail (*Hippuris vulgaris*), common bladderwort (*Utricularia macrorhiza*), and many pondweeds, especially *Potamogeton amplifolius*, *P. epihydrus*, *P. natans*, *P. richardsonii*, and *P. zosteriformis*. Rooted, floating-leaved, aquatic macrophytes often occur with this group in shallower waters. Most common among these are water shield (*Brasenia schreberi*), yellow water lily (*Nuphar variegatum*), and white water lily (*Nymphaea tuberosa*). Some members of the bur-reed genus *Sparganium* also form beds of floating leaves. Some biologists separate the floating from the submerged beds, but there is often considerable spatial overlap between them so they have been treated together here.

Rare and uncommon species of submergent aquatic communities are lake cress (*Armoracia lacustris*), a water milfoil (*Myriophyllum alterniflorum*), and small yellow water lily (*Nuphar microphyllum*).

Tamarack Swamp. This forest wetland community, a weakly minerotrophic conifer swamp, is dominated by tamarack (*Larix laricina*). The shrub/sapling layer is often well-developed, composed of black ash (*Fraxinus nigra*), speckled alder (*Alnus incana*), and other tall shrubs. The groundlayer is often mossy, though genera other than *Sphagnum* may be most important. Characteristic low shrubs and herbs include smooth white violet (*Viola pallens*), Labrador tea (*Ledum groenlandicum*), goldthread (*Coptis trifolia*), three-leaved false Solomon's seal (*Smilacina trifolia*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), sensitive fern (*Onoclea sensibilis*), twinflower (*Linnaea borealis*), small bishop's cap (*Mitella nuda*), and many sedges such as *Carex crinita*, *C. disperma*, *C. leptalea*, and *C. stipata*.

This is a one-generation forest type, as the tamarack (*Larix laricina*) cannot reproduce under its own shade. It is also the most common forested wetland in the coastal zone. Rare species found in tamarack swamps include the sedges *Carex tenuiflora* and *C. vaginata*, fly honeysuckle (*Lonicera involucrata*), showy lady's slipper (*Cypripedium reginae*), and yellow-bellied flycatcher.

Wet-Mesic Prairie. This herbaceous grassland community is dominated by tall grasses including big bluestem (*Andropogon gerardii*), Canada bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), and Canada wild-rye (*Elymus canadensis*). The forb component is diverse and includes azure aster (*Aster oolentangiensis*), shooting-star (*Dodecatheon meadia*), sawtooth sunflower (*Helianthus grosseserratus*), prairie blazing-star (*Liatis pycnostachya*), prairie phlox (*Phlox pilosa*), prairie coneflower (*Ratibida pinnata*), prairie docks (*Silphium integrifolium* and *S. terebinthinaceum*), late and stiff goldenrods (*Solidago gigantea* and *S. rigida*), and culver's-root (*Veronicastrum virginicum*).

Wet Prairie. This is a rather heterogeneous tall grassland community that shares characteristics of prairies, Southern Sedge Meadow, Calcareous Fen and even Emergent Aquatic communities. The Wet Prairie's more wetland-like character can mean that sometimes very few true prairie species are present. Many of the stands assigned to this type by Curtis are currently classified as Wet-Mesic Prairies. The dominant graminoids are Canada bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), and prairie muhly (*Muhlenbergia glomerata*), plus several sedge (*Carex*) species including lake sedge (*C. lacustris*), water sedge (*C. aquatilis*), and woolly sedge (*C. lanuginosa*). Many of the herb species are shared with Wet-Mesic Prairies, but the following species are often prevalent: New England aster (*Aster novae-angliae*), swamp thistle (*Cirsium muticum*), northern bedstraw (*Galium boreale*), yellow stargrass (*Hypoxis hirsuta*), cowbane (*Oxypolis rigidior*), tall meadow-rue (*Thalictrum dasycarpum*), golden alexander (*Zizia aurea*), and mountain-mint (*Pycnanthemum virginianum*).

Wet Sand Flats. Found only on the Chequamegon Bay side of the former gap between Long Island and Chequamegon Point, this herbaceous wetland community has developed within the past two decades. The wetter, more open areas are dominated by short sedges (*Carex* spp., *Scirpus* spp.) and rushes (*Juncus* spp.). Slightly drier sands support thickets of willows (*Salix exigua*, *Salix* spp.) and speckled alder (*Alnus incana*), and many sapling green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), balsam poplar (*P. balsamifera*), and box elder (*Acer negundo*).

Because of its short tenure and rapidly changing structure and composition, it's difficult to make any recommendations except to continue efforts to control the serious infestation of purple loosestrife (*Lythrum salicaria*) now established. The stand should also be visited periodically by skilled biologists as unusual numbers of interesting waifs have appeared here.

White Cedar Swamp (Northern Wet-mesic Forest). This forest wetland community (wet-mesic conifer forest) is dominated by white cedar (*Thuja occidentalis*), often in association with balsam fir (*Abies balsamea*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), and black ash (*Fraxinus nigra*). White cedar mixed with hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*) is not treated as "white cedar swamp". Canopy gaps are frequently occupied by fir or ash saplings. Young cedar seldom reach the sapling stage. The tall shrub layer is typically well-developed, composed primarily of mountain maple (*Acer spicatum*), speckled alder (*Alnus incana*), and elder buckthorn (*Rhamnus alnifolia*). Common herbs/low shrubs include bluebead lily (*Clintonia borealis*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), dwarf raspberry (*Rubus pubescens*), small bishop's cap (*Mitella nuda*), many sedges, and a lush cover of bryophytes. Orchids may be especially well-represented in this forest community.

Springs and spring runs are present in many cedar forests, often containing spotted touch-me-not (*Impatiens biflora*), golden saxifrage (*Chrysosplenium americanum*), and swamp saxifrage

(*Saxifraga pensylvanica*), as well as aquatic mosses. The presence of mineral-rich groundwater is a given in this community.

Concern for the cedar swamps is warranted as reproduction of cedar is severely suppressed in the presence of high deer densities. Silvicultural experiments have not succeeded in addressing this issue. Among the many rare inhabitants of this type are fairy slipper (*Calypso bulbosa*), Lapland buttercup (*Ranunculus lapponicus*), northern black currant (*Ribes hudsonianum*), and sheathed sedge (*Carex vaginata*).

Appendix D: Explanation of the NHI Working List Species Status

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked, and we encourage data submissions on these species. This list is meant to be dynamic - it is updated as often as new information regarding the biological status of species becomes available. The Natural Heritage Program welcomes your input on any aspect of this list. Wisconsin's extirpated species list is at the end. The most recent list of species and natural communities can be obtained by writing the Bureau of Endangered Resources.

US Status refers to the Federal protection status in Wisconsin designated by the Office of Endangered Species, U.S. Fish and Wildlife Service through the U.S. Endangered Species Act. LE = listed endangered; LT = listed threatened; XN = non-essential experimental population(s); LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.

WI Status is a protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.