

## Appendix 9.4: Bay Shore Woods and Beach

Written by Erin Giese and Dr. James Horn

<b>Location</b> (centroid)	Lat. 44.533670°, Lon. -87.931459° <sup>1</sup> (NAD 1983, UTM Zone 16N)																		
<b>Total Area</b> (ha)	18.56 ha																		
<b>Area Public Land</b> (ha)	16.02 ha																		
<b>Area of Habitat Types Present (ha) and Percent of Each Habitat Type</b>	<p>Dominant Habitat Types: These habitat types were documented during a July 2015 habitat mapping effort led by the University of Wisconsin-Green Bay Cofrin Center for Biodiversity (CCB) across the Lower Green Bay and Fox River Area of Concern (LGB&amp;FR AOC)<sup>2</sup>. Habitat types within Bay Shore Woods and Beach are displayed as a static map at the bottom of this document. There is a total of 16.41 ha of natural habitat within Bay Shore Woods and Beach.</p> <table border="1"> <thead> <tr> <th>Habitat Type</th> <th>Area (ha)</th> <th>Percent</th> </tr> </thead> <tbody> <tr> <td>Emergent Marsh (High Energy Coastal)</td> <td>0.87</td> <td>5.29</td> </tr> <tr> <td>Emergent Marsh (Inland)</td> <td>0.21</td> <td>1.31</td> </tr> <tr> <td>Great Lakes Beach</td> <td>1.28</td> <td>7.80</td> </tr> <tr> <td>Hardwood Swamp</td> <td>14.00</td> <td>85.34</td> </tr> <tr> <td>Other Forest</td> <td>0.04</td> <td>0.26</td> </tr> </tbody> </table> <p><i>Disclaimer!</i> Because this priority area is located within the Great Lakes coastal zone, the amount of habitat types can vary drastically across years and even within years (or months) due to changing Great Lakes water levels, precipitation, and seiche. Within this priority area specifically, the extent of Great Lakes beach and emergent marsh (high energy coastal) habitats may fluctuate significantly from year to year and within years. The habitat types listed above and mapped below are based on a field effort conducted in July 2015. Plants recorded in the “Natural Habitat Communities and Significant Plants” section were primarily documented in July 2015 and August and September of 2016. Great Lakes water levels were much higher in 2016 than in July 2015.</p>	Habitat Type	Area (ha)	Percent	Emergent Marsh (High Energy Coastal)	0.87	5.29	Emergent Marsh (Inland)	0.21	1.31	Great Lakes Beach	1.28	7.80	Hardwood Swamp	14.00	85.34	Other Forest	0.04	0.26
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<b>General Description</b>	<p>Bay Shore Woods and Beach is a priority area located within the western corner of the University of Wisconsin-Green Bay campus and is a part of the Cofrin Memorial Arboretum. The property is owned and managed by the UW-Green Bay Cofrin Center for Biodiversity (CCB), though the City of Green Bay owns two small parcels. It primarily follows the bay of Green Bay shoreline and almost entirely consists of hardwood swamp, though emergent high energy marsh and Great Lakes beach are found along the shoreline<sup>2</sup>. Great Lakes beach is a relatively rare habitat within the LGB&amp;FR AOC as well as within the state of Wisconsin; nearly 0.7 km of beach traces the shoreline of this priority area<sup>2</sup>. The northeastern half of this priority area consists of Keowns silt loam soils, while the southwestern half is Allendale loamy fine sand along the shoreline and Poygan silty clay loam soils in the forested areas<sup>3</sup>. Although several invasive plant species frequent parts of the hardwood swamp and shoreline, it</p>																		

<sup>1</sup> File “AOC\_PriorityAreas.v09\_20171212.shp”.

<sup>2</sup> LGB&FR AOC 2015 habitat field mapping effort:

<http://uwgb.maps.arcgis.com/home/item.html?id=fd942b9dd224094b0841a08437f95f0>.

<sup>3</sup> Soil Survey Geographic (SSURGO) by the United States Department of Agriculture’s Natural Resources Conservation Service.

Published Dec 2010. Available: <http://uwgb.maps.arcgis.com/home/item.html?id=204d94c9b1374de9a21574c9efa31164>; accessed 14 October 2016.

	<p>still supports ~180 bird species annually (both migratory and breeding)<sup>4,5,7,10,11,12</sup>, 18 known odonate (dragonflies and damselflies) species<sup>17</sup>, &gt;30 fish species offshore, and several mammal and reptile species<sup>7</sup>. Because UW-Green Bay owns this priority area, it is extremely well-studied by university and agency scientists, particularly for plants, birds, and some arthropods<sup>6</sup>. CCB staff have also been actively managing invasive plant species, especially understory woody plants (e.g., glossy buckthorn [<i>Frangula alnus</i>]), to try and improve these important wildlife habitats.</p>
<p><b>Special Features</b></p>	<ul style="list-style-type: none"> <li>• Largely dominated by hardwood swamp but also includes ~0.7 km of Great Lakes beach, a habitat that is rare to both the state of WI and LGB&amp;FR AOC<sup>2</sup>.</li> <li>• Breeding and migratory stopover habitat for ~180 bird species<sup>4,5,7,10,11,12</sup>.</li> <li>• Provides habitat for odonates (dragonflies and damselflies) within Bay Shore Woods and Beach and neighboring parts of the Cofrin Memorial Arboretum<sup>17</sup>.</li> <li>• Forest habitat for &gt;20 mammal species, including several furbearers<sup>7</sup>.</li> </ul>
<p><b>Natural Habitat Communities and Significant Plants</b> (ordered in terms of ecological importance and size/amount)</p>	<p>The majority of Bay Shore Woods and Beach consists of <b>hardwood swamp</b>, which has a canopy dominated by green ash (<i>Fraxinus pennsylvanica</i>), cottonwood (<i>Populus deltoides</i>), and box elder (<i>Acer negundo</i>)<sup>2,8</sup>. In the understory are grape woodvine (<i>Parthenocissus inserta</i>), ostrich fern (<i>Matteuccia struthiopteris</i>), white avens (<i>Geum canadense</i>), American black currant (<i>Ribes americanum</i>), and little false Solomon's-seal (<i>Maianthemum stellatum</i>)<sup>2,8</sup>.</p> <p>A very small area to the southwest of the northern parking lot contains a high-quality <b>southern mesic forest</b> community. The canopy here is dominated by American basswood (<i>Tilia americana</i>), and the herbaceous understory includes a diverse assemblage of spring ephemerals, including wild ginger (<i>Asarum canadense</i>), red baneberry (<i>Actaea rubra</i>), Jack-in-the-pulpit (<i>Arisaema triphyllum</i>), May-apple (<i>Podophyllum peltatum</i>), and bloodroot (<i>Sanguinaria canadensis</i>)<sup>2,9</sup>. This area is not delineated on the habitat map below because it is very small and was therefore not found or mapped during the 2015 LGB&amp;FR AOC field effort.</p> <p>Along the shoreline of Bay Shore Woods and Beach are approximately 0.7 km of <b>Great Lakes beach</b> and <b>emergent high energy marsh</b>, both of which connect to these same two habitats located in the Mahon Woods and Creek priority area<sup>2</sup>. The beach consists of sand, shells (including zebra mussel [<i>Dreissena polymorpha</i>] shells), and rock (in some cases rip-rap) and is partially vegetated with cottonwood, sandbar willow (<i>Salix interior</i>), box elder, green ash, gray dogwood (<i>Cornus foemina</i>), and common cocklebur (<i>Xanthium strumarium</i>)<sup>2,8</sup>. Invasives present along the beach include common reed (<i>Phragmites australis</i>; hereafter referred to as <i>Phragmites</i>), glossy buckthorn, dame's rocket (<i>Hesperis matronalis</i>), and others<sup>2,8</sup>. The <b>emergent high energy marsh</b> is dominated by <i>Phragmites</i>, though several natives also occur here including bulrush (<i>Schoenoplectus</i> sp.), bulblet water-hemlock (<i>Cicuta bulbifera</i>), lesser duckweed (<i>Lemna minor</i>), and orange jewelweed (<i>Impatiens capensis</i>)<sup>2,8</sup>.</p> <p>In the southwestern corner of this priority area is a small <b>inland emergent marsh</b>, which was formerly a small pond that is now filled with a dense, clonal stand of <i>Phragmites</i>. There is also a moderate amount of small-spike false nettle (<i>Boehmeria cylindrica</i>)<sup>8</sup>.</p>

<sup>4</sup> eBird 2016: <http://ebird.org/ebird/hotspot/L159722> (as of 10 Nov 2016).

<sup>5</sup> Wisconsin Breeding Bird Atlas II Project (2015-2019):

[http://ebird.org/ebird/atlaswi/block/4408758SE?atlasPeriod=EBIRD\\_ATL\\_WI\\_2015&rank=mrec&hs\\_sortBy=category&hs\\_o=desc](http://ebird.org/ebird/atlaswi/block/4408758SE?atlasPeriod=EBIRD_ATL_WI_2015&rank=mrec&hs_sortBy=category&hs_o=desc) (as of 10 Nov 2016).

<sup>6</sup> LGB&FR AOC Conservation Project Catalogue

<sup>7</sup> LGB&FR AOC comprehensive biota database: file "AOCBiota\_DB\_ShareableVersion\_20171210.accdb".

<sup>8</sup> LGB&FR AOC 2016 botanical surveys

<sup>9</sup> LGB&FR AOC 2016 botanical surveys

<p><b>Significant Animals</b></p>	<p>Significant animals that have been documented on the UW-Green Bay campus, unless otherwise noted:</p> <p><u>Birds:</u></p> <ul style="list-style-type: none"> <li>• ~180 bird species have been recorded across all seasons, including<sup>4,5,7,10,11,12</sup>: <ul style="list-style-type: none"> <li>○ Two federal species of concern (Common Tern [<i>Sterna hirundo</i>] and Black Tern [<i>Chlidonias niger</i>])</li> <li>○ Four state endangered species (Caspian Tern [<i>Hydroprogne caspia</i>], Forster's Tern [<i>Sterna forsteri</i>], Common Tern, Black Tern, and Peregrine Falcon [<i>Falco peregrinus</i>])</li> <li>○ One state threatened species (Great Egret [<i>Ardea alba</i>])</li> <li>○ Twenty-nine Wisconsin Wildlife Action Plan Species of Greatest Concern (e.g., waterbirds, raptors, songbirds, and shorebirds)</li> <li>○ Thirty-two state special concern species (e.g., Swainson's Thrush [<i>Catharus ustulatus</i>], Cape May Warbler [<i>Setophaga tigrina</i>])</li> <li>○ Six International Union for Conservation of Nature-listed species as near threatened (Chimney Swift [<i>Chaetura pelagica</i>], Red-headed Woodpecker [<i>Melanerpes erythrocephalus</i>], Olive-sided Flycatcher [<i>Contopus cooperi</i>], Semipalmated Sandpiper [<i>Calidris pusilla</i>]) or vulnerable (Long-tailed Duck [<i>Clangula hyemalis</i>], Rusty Blackbird [<i>Euphagus carolinus</i>])</li> <li>○ Although many bird species migrate through the UW-Green Bay Cofrin Memorial Arboretum, generalist bird species tend to use it as a migratory stopover site, typically in the late fall.<sup>10</sup> Migratory waterfowl (e.g., diving ducks, gulls) use the waters offshore from the Cofrin Memorial Arboretum as stopover habitat<sup>11</sup></li> <li>○ Over 40 bird species are known (or very likely) to breed within Bay Shore Woods and Beach and nearby vicinity<sup>5,12</sup>: <ul style="list-style-type: none"> <li>▪ Red-bellied Woodpecker (<i>Melanerpes carolinus</i>), Pileated Woodpecker (<i>Dryocopus pileatus</i>), White-breasted Nuthatch (<i>Sitta carolinensis</i>), House Wren (<i>Troglodytes aedon</i>), Red-eyed Vireo (<i>Vireo olivaceus</i>), American Robin (<i>Turdus migratorius</i>), Song Sparrow (<i>Melospiza melodia</i>), etc.</li> </ul> </li> <li>○ The UW-Green Bay campus is officially a "Migratory Bird Concentration Site" according to the Wisconsin Department of Natural Resources<sup>13</sup></li> </ul> </li> </ul> <p><u>Fish:</u></p> <ul style="list-style-type: none"> <li>• &gt;30 fish species have been reported offshore of Bay Shore Woods and Beach by the WDNR during their long-term trawling surveys in recent years, including<sup>14</sup>: <ul style="list-style-type: none"> <li>○ Emerald shiner (<i>Notropis atherinoides</i>)</li> <li>○ Spottail shiner (<i>Notropis hudsonius</i>)</li> <li>○ Channel catfish (<i>Ictalurus punctatus</i>)</li> <li>○ Black crappie (<i>Pomoxis nigromaculatus</i>)</li> <li>○ Yellow perch (<i>Perca flavescens</i>)</li> <li>○ Gizzard shad (<i>Dorosoma cepedianum</i>)</li> <li>○ Walleye (<i>Sander vitreus</i>)</li> </ul> </li> </ul> <p><u>Mammals:</u></p> <ul style="list-style-type: none"> <li>• Although more are likely found here, &gt;20 species have been officially documented<sup>7,15</sup>:</li> </ul>
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<sup>10</sup> Stephanie Beilke migratory landbird thesis project

<sup>11</sup> LGB&FR AOC 2016 migratory waterfowl surveys

<sup>12</sup> LGB&FR AOC 2015 breeding bird surveys

<sup>13</sup> Wisconsin Department of Natural Resources. 2009. Wisconsin Natural Heritage Working List. <http://dnr.wi.gov/topic/NHI/WList.html>. (Accessed: 1 Nov 2014).

<sup>14</sup> Wisconsin Department of Natural Resources long-term fish trawling surveys

<sup>15</sup> Mahon Woods webpage from UW-Green Bay's Cofrin Center for Biodiversity: <http://www.uwgb.edu/biodiversity/natural-areas/arboretum/mahon.asp>.

	<ul style="list-style-type: none"> <li>○ Fur bearers: American mink (<i>Neovison vison</i>), red fox (<i>Vulpes vulpes</i>), short-tailed weasel or ermine (<i>Mustela erminea</i>), striped skunk (<i>Mephitis mephitis</i>), coyote (<i>Canis latrans</i>), etc.</li> <li>○ Rodents: groundhog (<i>Marmota monax</i>), meadow vole (<i>Microtus pennsylvanicus</i>), etc.</li> <li>○ Other: white-tailed deer (<i>Odocoileus virginianus</i>), masked shrew (<i>Sorex cinereus</i>), southern flying squirrel (<i>Glaucomys volans</i>), etc.</li> </ul> <p><u>Amphibians:</u></p> <ul style="list-style-type: none"> <li>● Two anuran (frog/toad) species were detected in April and June 2015 during surveys conducted by UW-Green Bay student researchers next to the small emergent inland wetland in the southwestern corner of Bay Shore Woods and Beach<sup>7</sup>: <ul style="list-style-type: none"> <li>○ Green frog (<i>Lithobates clamitans</i>) and wood frog (<i>Lithobates sylvaticus</i>)</li> </ul> </li> <li>● Red-backed salamander (<i>Plethodon cinereus</i>)<sup>15</sup></li> </ul> <p><u>Reptiles:</u></p> <ul style="list-style-type: none"> <li>● Five reptile species<sup>7,16</sup>: <ul style="list-style-type: none"> <li>○ Common garter snake (<i>Thamnophis sirtalis</i>), red-bellied snake (<i>Storeria occipitomaculata</i>), and milk snake (<i>Lampropeltis triangulum</i>)</li> <li>○ Snapping turtle (<i>Chelydra serpentina</i>) and painted turtle (<i>Chrysemys picta</i>)</li> </ul> </li> </ul> <p><u>Arthropods:</u></p> <ul style="list-style-type: none"> <li>● Within Bay Shore Woods and Beach priority area and neighboring land, 18 odonate species (dragonfly + damselfly) have been recorded here (commonality reported in relation to detections near this priority area)<sup>17</sup>: <ul style="list-style-type: none"> <li>○ Eastern forktail (<i>Ischnura verticalis</i>), relatively common</li> <li>○ Autumn meadowhawk (<i>Sympetrum vicinum</i>), relatively common</li> <li>○ Common green darner (<i>Anax junius</i>), relatively common</li> <li>○ Twelve-spotted skimmer (<i>Libellula pulchella</i>), relatively common</li> <li>○ Marsh bluet (<i>Enallagma ebrium</i>), relatively common</li> <li>○ Ebony jewelwing (<i>Calopteryx maculata</i>), relatively common</li> <li>○ Slender spreadwing (<i>Lestes rectangularis</i>), relatively uncommon</li> <li>○ Dot-tailed whiteface (<i>Leucorrhinia intacta</i>), relatively uncommon</li> <li>○ Sedge sprite (<i>Nehalennia irene</i>), rare</li> </ul> </li> </ul>
<b>Habitat Quality</b>	<p>The overall ecological quality of Bay Shore Woods and Beach is relatively good because native plants dominate much of this priority area. Although invasive plants species can be found here, the hardwood swamp and shoreline are not completely overrun with invasive understory shrubs (e.g., buckthorn) or <i>Phragmites</i>. In fact, several important native plants occur here, including American basswood, sandbar willow, green ash, shagbark hickory, ostrich fern, and bulrush; though, the Great Lakes beach perhaps needs the most work in terms of controlling invasive plant species since several besides <i>Phragmites</i> occur here. The CCB should continue its efforts to control the invasive plants that frequent this priority area in order to further improve fish and wildlife habitat.</p>
<b>Significant Invasive Species Issues</b>	<p>Significant invasive species that have been documented within Bay Shore Woods and Beach:</p> <p><u>Invasive Plant Species:</u> Each of these species outcompetes and crowds out native plants<sup>2,8</sup>:</p> <ul style="list-style-type: none"> <li>● European buckthorn (<i>Rhamnus cathartica</i>)</li> </ul>

<sup>16</sup> UW-Green Bay Cofrin Student Research Grant Project by Lindsey Bender and Gary Wauters 2010

<sup>17</sup> LGB&FR AOC Odonata Surveys 2016 by Willson Gaul

	<ul style="list-style-type: none"> <li>○ Common and continuing problem; found in understory of hardwood swamp; currently being managed</li> <li>• Glossy buckthorn (<i>Frangula alnus</i>) <ul style="list-style-type: none"> <li>○ Common and continuing problem; found in understory of hardwood swamp; currently being managed</li> </ul> </li> <li>• Common reed (<i>Phragmites australis</i>) <ul style="list-style-type: none"> <li>○ Common and continuing problem; occurs along shoreline in emergent marsh and Great Lakes beach</li> </ul> </li> <li>• Showy bush honeysuckle (<i>Lonicera x bella</i>) <ul style="list-style-type: none"> <li>○ Common and continuing problem; occurs in hardwood swamp; currently being managed</li> </ul> </li> <li>• Crack willow (<i>Salix x fragilis</i>) <ul style="list-style-type: none"> <li>○ Occurs in hardwood swamp; not currently being managed</li> </ul> </li> <li>• Japanese barberry (<i>Berberis thunbergii</i>) <ul style="list-style-type: none"> <li>○ Occurs in hardwood swamp; not currently being managed</li> </ul> </li> <li>• Dame's rocket (<i>Hesperis matronalis</i>) <ul style="list-style-type: none"> <li>○ Occurs in hardwood swamp; not currently being managed</li> </ul> </li> <li>• European lily-of-the-valley (<i>Convallaria majalis</i>) <ul style="list-style-type: none"> <li>○ Occurs in hardwood swamp; not currently being managed</li> </ul> </li> </ul> <p><u>Exotic Plant Species:</u><sup>8</sup></p> <ul style="list-style-type: none"> <li>• White mulberry (<i>Morus alba</i>) <ul style="list-style-type: none"> <li>○ Occurs in hardwood swamp; not currently being managed</li> </ul> </li> <li>• European cranberry-bush (<i>Viburnum opulus</i>) <ul style="list-style-type: none"> <li>○ Occurs in hardwood swamp; not currently being managed</li> </ul> </li> </ul> <p><u>Invasive Animal Species:</u><sup>7</sup></p> <ul style="list-style-type: none"> <li>• <u>Arthropods:</u> <ul style="list-style-type: none"> <li>○ Documented within or near UW-Green Bay campus (none are being managed): <ul style="list-style-type: none"> <li>▪ Cobweb weaver (<i>Enoplognatha ovata</i>)</li> <li>▪ Common harvestman (<i>Phalangium opilio</i>)</li> <li>▪ Grey field slug (<i>Deroceras reticulatum</i>); considered to be an exotic species; effects on forest understories are not well known<sup>18</sup></li> </ul> </li> <li>○ Japanese beetle (<i>Popilla japonica</i>) was documented using the Great Lakes beach habitat of Bay Shore Woods and Beach in July 2016<sup>8</sup></li> </ul> </li> <li>• <u>Birds:</u> Documented within or near UW-Green Bay campus: <ul style="list-style-type: none"> <li>○ European Starling (<i>Sturnus vulgaris</i>) <ul style="list-style-type: none"> <li>▪ Poses some threat to native species, particularly cavity nesters (e.g., Tree Swallow), by outcompeting them and occupying potential nest sites; not currently being managed</li> </ul> </li> <li>○ Other exotic or invasive bird species: House Sparrow (<i>Passer domesticus</i>) and Rock Pigeon (<i>Columba livia</i>); however, these species generally do not significantly affect native birds because they tend to inhabit human areas (e.g., developed or agricultural areas)</li> </ul> </li> <li>• <u>Fish:</u> Documented within or near UW-Green Bay campus: <ul style="list-style-type: none"> <li>○ Alewife (<i>Alosa pseudoharengus</i>)</li> </ul> </li> </ul>
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<sup>18</sup> Andrew LaPlant exotic slug abundance study in northeastern WI

	<ul style="list-style-type: none"> <li>▪ Poses a threat to native fish species by consuming a lot of zooplankton and disturbing the natural food web; not currently being managed<sup>19</sup></li> <li>○ Common carp (<i>Cyprinus carpio</i>) <ul style="list-style-type: none"> <li>▪ Destroy vegetation by uprooting plants and increasing cloudiness of water; not currently being managed<sup>20</sup></li> </ul> </li> <li>○ Round goby (<i>Neogobius melanostomus</i>) <ul style="list-style-type: none"> <li>▪ Prey on small native fish and eggs (e.g., darters) and outcompete similarly sized native fish; not currently being managed<sup>21</sup></li> </ul> </li> </ul>
<b>Management and Restoration Recommendations</b>	<ul style="list-style-type: none"> <li>• Control woody successional and invasive plant species, remove accumulated zebra/quagga mussel shells, and restore native vegetation at undeveloped east shore beaches.</li> <li>• Conduct biotic inventories along AOC shoreline and if necessary re-establish populations of native turtle species and other beach specialists.</li> <li>• Identify critical buffer habitats and shorelines with potential den sites for mink, otter, and other shoreline wildlife species.</li> <li>• Develop or restore important fish spawning and nursery habitats, such as rocky reefs, gravel, cobble, woody debris, and sandy areas for shoreline fish.</li> <li>• Continue current invasive plant species management efforts to control invasives noted above (e.g., buckthorn, showy bush honeysuckle). Restore and expand habitats with native fruiting shrubs to improve stopover habitat for migratory land birds.</li> <li>• Control <i>Phragmites</i> along the Great Lakes beach shoreline, including at the neighboring priority area, Mahon Woods and Creek, which will improve shorebird and other wildlife habitat.</li> <li>• Enhance small inland emergent marsh located in the southwestern corner of this priority area by controlling the <i>Phragmites</i> and restoring with native herbaceous vegetation.</li> </ul>
<b>Reference Links and Documents</b>	<p><b>Links:</b></p> <ul style="list-style-type: none"> <li>• UW-Green Bay's Cofrin Memorial Arboretum: <a href="http://www.uwgb.edu/biodiversity/natural-areas/arboretum/">http://www.uwgb.edu/biodiversity/natural-areas/arboretum/</a></li> </ul> <p><b>Reference Documents:</b></p> <ul style="list-style-type: none"> <li>• Dorney, J.R. 1975 The vegetation pattern around Green Bay in the 1840s as related to geology, soils, and land use by Indians with a detailed look at the Townships of Scott, Green Bay, and Suamico. Book available through the UW-Green Bay Cofrin Library Archives and Area Research Center.</li> </ul>
<b>Site History</b> (e.g., original vegetation, past conservation projects)	<p>In the early 1630s, Frenchman Jean Nicolet first arrived in lower Green Bay when it was primarily inhabited by Native American tribes<sup>22</sup>. Lower Green Bay consisted of large beds of wild rice (<i>Zizania</i> sp.) and wild celery (<i>Vallisneria americana</i>), extensive emergent marsh (<i>Schoenoplectus</i> sp., cattail), sedge meadows (<i>Calamagrostis canadensis</i>), shrub carr (e.g., <i>Cornus</i> spp., <i>Salix</i> spp.), swamps, and wet conifer forest</p>

<sup>19</sup> Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2016. *Alosa pseudoharengus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=490> Revision Date: 9/25/2015. Accessed 17 Oct 2016.

<sup>20</sup> Nico, L., E. Maynard, P.J. Schofield, M. Cannister, J. Larson, A. Fusaro, and M. Neilson. 2016. *Cyprinus carpio*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=4> Revision Date: 7/15/2015. Accessed 17 Oct 2016.

<sup>21</sup> Fuller, P., A. Benson, E. Maynard, M. Neilson, J. Larson, and A. Fusaro. 2016. *Neogobius melanostomus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=713> Revision Date: 1/7/2016. Accessed on 17 Oct 2016.

<sup>22</sup> Jean Nicolet: French Explorer. By The Editors of Encyclopaedia Britannica. Available: <https://www.britannica.com/biography/Jean-Nicolet> (accessed on 24 Oct 2016).



	<p>(black spruce [<i>Picea mariana</i>], balsam fir [<i>Abies balsamea</i>])<sup>23,24,25,26,27</sup>. Between the late 1600s through the 1800s, European fur trade, hunting, fishing, logging, shipping, and agriculture were important early industries in lower Green Bay<sup>28,29,30</sup>.</p> <p>In the early 1800s, there were a few small settlements and farms consisting of Europeans and Native Americans in the lower bay<sup>29,30</sup>. In the early 1840s, Native American campsites and burial mounds were located within the present day UW-Green Bay campus<sup>31</sup>. Vegetation at present day UW-Green Bay in 1840 largely consisted of oak openings dominated by red and white oaks and burr oak (<i>Quercus macrocarpa</i>) with early successional, recently disturbed areas consisting of aspen (<i>Populus</i> spp.) and birch (<i>Betula</i> spp.)<sup>31</sup>. According to surveyors in June 1834, there was a house located within agricultural fields as well as open meadows in the southwestern part of Bay Shore Woods and Beach<sup>32</sup>.</p> <p>According to 1875 and 1889 Plat Books of Brown County, most of present day Bay Shore Woods and Beach was privately owned by John Woodruff<sup>33,34</sup>. Sometime before the mid-1930s, this same land was broken up into really small parcels that were privately owned<sup>35</sup>. It was almost entirely forested with emergent marsh along the shoreline and largely remained that way until present time<sup>36</sup>. Present day Lambeau Cottage was built along Bay Shore Woods and Beach in 1941 by Curly Lambeau, who helped found, coach, and play for the Green Bay Packers national football team<sup>37</sup>. Lambeau built this cottage primarily for recreational and entertainment purposes for the Green Bay Packers<sup>37</sup>. In 1950, he sold the property, which was eventually bought by UW-Green Bay in 1978. Today, the cottage is a part of the existing Cofrin Memorial Arboretum and is still used for many different entertainment functions<sup>37</sup>.</p> <p>In the 1960s, the state of Wisconsin owned the land known as Bay Shore Woods and Beach, and in 1965, UW-Green Bay was founded and established as a four-year college<sup>38</sup>. Although agricultural fields still dominated most of the campus property, there were still many important natural features, including Mahon Creek, forests, and the Niagara Escarpment<sup>39</sup>. In 1971, former Chancellor Edward Weidner and a small committee recommended that UW-Green Bay create a system of trails and an</p>
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<sup>23</sup> Arthur C. Neville's Map of Historic Sites on Green Bay, Wisconsin 1669-1689. Available: <http://s3.amazonaws.com/labaye/data/Bay%20Settlement%20Map%20WI%20Historical%20Bulletin%201926.pdf> (accessed on 24 Oct 2016).

<sup>24</sup> Survey of the N.W. Lakes: East Shore of Green Bay 1843. Available: <http://s3.amazonaws.com/labaye/data/1843%20East%20Shore%20of%20Green%20Bay.jpg> (accessed on 24 Oct 2016).

<sup>25</sup> 1845 Chart of Green Bay. Available <http://s3.amazonaws.com/labaye/data/1845%20Chart%20of%20Green%20Bay.pdf> (accessed on 24 Oct 2016).

<sup>26</sup> 1820s Fox River Military Road Map to Ft. Crawford. Available: <http://s3.amazonaws.com/labaye/data/1820s%20Fox%20River%20Military%20Road%20Map%20to%20Ft.%20Crawford.pdf> (accessed on 24 Oct 2016).

<sup>27</sup> Personal communication with Thomas Erdman.

<sup>28</sup> City of Green Bay's History Webpage: <http://www.ci.green-bay.wi.us/history/1800s.html> (accessed on 20 Oct 2016).

<sup>29</sup> Excerpt from "Recollections of Green Bay in 1816-17" by James W. Biddle. Available: <http://s3.amazonaws.com/labaye/data/Recollections%20of%20Green%20Bay%20in%201816-1817.pdf> (accessed on 24 Oct 2016).

<sup>30</sup> The Early Outposts of Wisconsin: Green Bay for Two-Hundred Years, 1639-1839. Available: <http://labaye.org/item/70/2810> (accessed on 25 Oct 2016).

<sup>31</sup> The vegetation pattern around Green Bay in the 1840s as related to geology, soils, and land use by Indians with a detailed look at the Townships of Scott, Green Bay, and Suamico by John Dorney, 1975. File "Dorney1975\_VegetationPatternGreenBay1840s.pdf".

<sup>32</sup> Wisconsin Public Land Survey System (1834) from file "PLSS\_SurveyData.shp".

<sup>33</sup> 1875 Brown County plat map. Available through the UW-Green Bay Cofrin Library Archives and Area Research Center.

<sup>34</sup> 1889 Brown County plat map. Available through the UW-Green Bay Cofrin Library Archives and Area Research Center.

<sup>35</sup> 1934-1936 Brown County plat map for the Town of Scott. Available through the UW-Green Bay Cofrin Library Archives and Area Research Center.

<sup>36</sup> Brown County's Multi-purpose GIS map and 1938 aerial photograph. Available:

[http://www.co.brown.wi.us/departments/page\\_7f0c2f6b6bc6/?department=85713eda4cdc&subdepartment=89ce08984445](http://www.co.brown.wi.us/departments/page_7f0c2f6b6bc6/?department=85713eda4cdc&subdepartment=89ce08984445) (accessed on 29 Nov 2016).

<sup>37</sup> UW-Green Bay History with the Green Bay Packers: <https://www.uwgb.edu/packers/history/> (accessed on 29 Nov 2016).

<sup>38</sup> UW-Green Bay: From the Beginning by Betty D. Brown webpage: <http://www.uwgb.edu/univcomm/from-the-beginning/> (accessed on 15 Nov 2016).

<sup>39</sup> History of the Arboretum: <http://www.uwgb.edu/biodiversity/natural-areas/arboretum/History.asp> (accessed on 15 Nov 2016).

arboretum that circled the campus in an effort to prevent future development on campus and to keep it natural<sup>39</sup>. Thanks to the family of John Cofrin, an endowment was established to pay for the building of these hiking trails, enhance the natural communities, and purchase additional adjacent property to develop what is today called the Cofrin Memorial Arboretum<sup>39</sup>. The present day Bay Shore Woods and Beach priority area is just one small section of the larger arboretum, which also includes the Keith White Prairie, Mahon Woods, northern barrens, Niagara Escarpment, oak savanna, Paul Sager tract, succession plots, and Les Raduenz Woods<sup>39</sup>. After the UW-Green Bay Cofrin Center for Biodiversity (CCB) was established in 1999, one of its responsibilities was to manage the campus natural areas (e.g., Point au Sable Nature Preserve), which included the Cofrin Memorial Arboretum. Today, the CCB manages the Cofrin Memorial Arboretum by controlling invasives, preserving the natural communities found there, and maintaining trails.

Although this priority area is relatively well studied (at least for plants, fish, birds, and some arthropods) by the University and agencies, additional studies are needed for mammals, reptiles (e.g., turtles), and amphibians (e.g., salamanders). It provides critical habitat for both plants and many wildlife, particularly migratory and breeding birds, odonates, and others. To improve existing wildlife habitat, CCB staff have been actively trying to control invasive plant species, such as understory woody plants (e.g., buckthorn), in the hardwood swamp forest. They are also working to control the *Phragmites* found along the Great Lakes beach shoreline of this priority area, which is important because it is part of a longer stretch of beach habitat, which is rare to both the state of WI and the LGB&FR AOC. Because this priority area is protected and almost entirely publicly owned by the University, there is great potential to enhance this property for fish and wildlife habitat. It is also one of the few relatively undeveloped areas along the east shore of lower Green Bay. Therefore, efforts should be made to continue protecting and preserving this property in order to sustain fish and wildlife populations within the LGB&FR AOC.



Map of Bay Shore Woods and Beach plant communities, which are delineated based on the UW-Green Bay 2015 habitat mapping effort. Map made by UW-Green Bay's Jon Schutte.



Land ownership boundaries at Bay Shore Woods and Beach. Map made by UW-Green Bay's Jon Schubbe.





Photograph of Bay Shore Woods and Beach facing southeast. Photograph taken by Erin Giese on 2 December 2016.



Photograph of Bay Shore Woods and Beach facing southeast. Photograph taken by Erin Giese on 2 December 2016.

