Appendix 4: Botanical Survey Methodology of Plant Biodiversity Hotspots (2016)

Purpose

Although the 2015 habitat mapping effort generated a lot of information on plant communities throughout the LGB&FR AOC (Appendix 3), most field visits were short and only the major habitat type and dominant plant species were recorded at each location. Therefore, we launched a second field effort in July 2016, in which they commissioned UW-Green Bay's Gary A. Fewless Herbarium Curator, James Horn, to conduct more detailed plant surveys in high quality areas. Horn and his team explored and described "plant biodiversity hotspots" that are generally of high quality (i.e., high native plant diversity) and also recorded comprehensive lists of plants that were present in the hotspot area(s) at each site. We deemed 28 of the 55 "priority areas" to be of sufficient botanical interest to warrant a survey. Sites of small area often consisted wholly of a single "plant biodiversity hotspot," whereas larger sites consisting of a mosaic of several plant community types sometimes contained several "plant biodiversity hotspots." Especially within several of the more poorly explored larger sites, Horn searched for additional "plant biodiversity hotspots" that were expected to be present or not well characterized based on existing information. Information collected from both the 2015 habitat mapping and 2016 detailed plant surveys provided greatly needed, baseline information on available fish and wildlife habitat within the LGB&FR AOC that will ultimately assist with restoration efforts in the future.

Field Work Planning

After visiting nearly all available habitat in the LGB&FR AOC in 2015, Howe, Wolf, and Giese gained a general sense of which areas contain (or potentially contain) high quality habitat that are worth protecting and restoring. To organize this 2016 field effort, they first identified 55 "priority areas" throughout the study area (LGB&FR AOC boundary plus 1 km of shoreline at Lake Michigan/Green Bay high water level of 177.2 m AMSL), in which a "priority area" is defined as an area of importance that contains available fish and wildlife habitat and that may serve as a type of "management unit" or "focus area" for future restoration planning. Most of these "priority areas" were already previously known to be of particularly high caliber (e.g., west and east shores of the Bay), while others were known to be of lower quality (e.g., sites along the Fox River). They looked across the study area and delineated 55 such areas that were later digitized into an ArcGIS shapefile by UW-Green Bay undergraduate student, Jordan Marty. Horn and two UW-Green Bay students (undergraduate student, Emily Vandersteen, and graduate student, Vanessa Brotske) visited and catalogued 28 of the higher quality "priority areas," for which we wanted more detailed plant information (Table 1, Appendix 4). A few sites along the west and east shores were not visited in 2016 because the crew was either unable to access the site (e.g., St. Francis Tributary) or because the site was already well known (e.g., Keith White Prairie). Nearly all of the Fox River sites were not visited in 2016 because adequate information was already collected in 2015; the 2015 field crew, led by Giese, requested that Horn revisit three Fox River sites to ensure all possible botanical data were recorded, particularly herbaceous plants (e.g., submergent and emergent plants, grasses, etc.). Botanist Kathryn Corio also helped with this 2016 field effort during the early stages of its development and described plant diversity at a few localities.

Table 1. Original “priority areas” (n = 55) within the Lower Green Bay and Fox River Area of Concern in Wisconsin that we identified as areas that contain available fish and wildlife habitat, including some sites that are of particularly high quality. A field crew conducted detailed plant surveys at 28 of these sites in July-September 2016.

Priority Area	General Area	Field Survey in 2016?
Sensiba South	west shore	Yes
Long Tail Point	west shore	Yes
Long Tail Beach Road Hardwood Swamp	west shore	Yes
Dead Horse Bay	west shore	Yes
Barkhausen Waterfowl Preserve	west shore	Yes
Cat Island	west shore	Yes
Fort Howard Wildlife Area	west shore	Yes
Malchow/Olson Tract	west shore	Yes
Peters Marsh	west shore	Yes
Cottage Grove Complex	west shore	Yes
Lakeview Road Hardwood Swamp	west shore	No
Duck Creek Estuary North	west shore	Yes
Duck Creek Estuary South	west shore	Yes
Ken Euers Nature Area	west shore	Yes
Upper Duck Creek North	west shore	Yes
Upper Duck Creek South	west shore	Yes
Railroad Complex	west shore	Yes
WPS/City of Green Bay Complex	west shore	No access
Point Sable	east shore	Yes
Wequiock Creek East	east shore	Yes
St. Francis Tributary	east shore	No access
Barina Parkway	east shore	Yes
Scottwood Creek	east shore	Yes
Mahon Woods and Creek	east shore	Yes
Bay Shore Woods and Beach	east shore	Yes
Keith White Prairie	east shore	No
UWGB Oak Savanna	east shore	No
Bay Beach Wildlife Sanctuary East	east shore	Yes
Bay Beach Wildlife Sanctuary West	east shore	Yes
Bay Beach Amusement Park Shoreline	east shore	Yes
Frigo Bridge Inlet	east shore	No access
Fox River Trail	Fox River	No
Saint Francis Park	Fox River	No
Optimist Point	Fox River	No
Allouez Riverside Park	Fox River	No
Jones Point	Fox River	Yes
Village of Allouez Shoreline Park	Fox River	No
Nicolet Bank Forest	Fox River	No

Priority Site	General Area	Field Survey in 2016?
Abbey Pond	Fox River	Yes
Voyager Park	Fox River	No
Expera Inlet	Fox River	No
Ashwaubomay Park	Fox River	No
Brown County Fairgrounds	Fox River	No
Ashwaubenon Creek	Fox River	No
Bay Harbor Wetland on Fox River	Fox River	Yes
Dutchman Creek	Fox River	No
Frying Pan Shoal/Point Sable Bar	open water	No access
Duck Creek	open water	No
East River	open water	No
Fox River Mouth	open water	No
Fox River	open water	No
Lone Tree and Grassy Island	open water	No
Green Bay Open Water East	open water	No
Green Bay Open Water West	open water	No
Renard Island	open water	No

Field Work Logistics

Horn conducted detailed plant surveys with the assistance of one or two UW-Green Bay students (Vandersteen and Brotske). The students helped by assisting with navigating and marking waypoints (documenting their location). Additionally, the crew carried reference maps and previously filled out data forms and maps from the 2015 habitat mapping effort (Appendix 3) to facilitate the 2016 fieldwork.

Upon arriving at one of the 28 sites that were assigned to him, Horn quickly started investigating the site on foot looking for high quality areas in terms of native plant diversity. Once he located such a place, he and his assistants filled out a field data form (Figure 1, Appendix 4). They immediately recorded a reference waypoint and associated geospatial coordinates (saved on a GPS unit and recorded on paper data form) in order to geotag their current location. Each waypoint was named using shortened versions of the general site name and habitat type imbedded in it as abbreviations. For example, Horn visited an emergent marsh at Duck Creek at the Deerfield Docks boat landing at the end of West Deerfield Avenue. He named the reference waypoint as “DCEM01,” in which “DC” stands for “Duck Creek” and “EM” stands for “emergent marsh” at point 01. If additional points were recorded nearby in the same sites and habitat, he used the same site-related naming information but incremented the waypoint numerically (e.g., “DCEM02”).

They recorded basic information like the calendar date, observer(s), site name, and dominant habitat type as well as a general description of the area (e.g., dominant plants, landmarks, disturbance, water features, or shape). The crew also filled out three “habitat ranks,” which describe the habitat quality of the site: a) topography/drainage (describes how the site’s overall landscape drains, whether it drains naturally or artificially through landscape modification), b) native biodiversity (describes the diversity of plants in terms of how many native and/or non-native plants are present), and c) invasive species (quantitative estimate [%] of any invasive

species present, unlike the 2015 habitat mapping effort which focused on a small set of target invasives [see “Field Work Logistics” from Appendix 3 for list of target invasives]).

Most importantly, Horn recorded a detailed, comprehensive list of all plants found at any given location, including both native and invasive plants (Figure 1, Appendix 4). For each species recorded, he described how common it was by using an extent code: a) *C*, common (>20% cover), *M*, moderately common (5-20% cover), and *R*, rare (<5% cover). As Horn searched for and documented plant species, his field assistant(s) took additional “trailing waypoints” using the GPS unit’s default waypoint name that is assigned automatically when one marks a waypoint. By looking at the first reference waypoint (e.g., DCEM01) and the “trailing waypoints” (e.g., 165), one can quickly see where the field crew went in terms of documenting plants at a particular site. Horn also collected >500 plant specimens to document the plants he found and recorded specimen-related information into a separate notebook. All plant specimens were subsequently archived at the UW-Green Bay Gary A. Fewless Herbarium.

Some data fields on the paper data form (Figure 1, Appendix 4) were not used throughout the field season because they were later determined to have little added value (e.g., *Map #*, *Time*, *Direction*). They were included in earlier versions of the data form but not regularly used throughout the field season. Although general fieldwork photographs were taken, photographs were not always geotagged at the point-specific level as noted on the data form. Throughout the field season, Horn consulted with Howe, Wolf, and Giese regularly to discuss and resolve any issues or questions that arose.

AOC Habitat / Plant Community Analysis

University of Wisconsin-Green Bay

Site Name	Date			Time	Observer(s)
			2016	:	

Describe the point from where assessment was made (may be outside of habitat):

Longitude	Latitude	GPS Waypoint ID	Direction (Point to Habitat)	Habitat Type
44._____	-8 ._____			

Map # _____ **Map Polygon ID** (reference number on map) _____

Description: (*landmarks, disturbance, water features, shape*)

Extent: **C** = common (> 20% cover); **M** = moderately common (5-20% cover); **R** = rare (1-5% cover); **P** = present

Dominant Species (large site)	Extent		Invasive Species (large site)	Extent

Other species (< 1% cover) (*use back of page if necessary)*:

Habitat Rank (circle one):

	Topography/Drainage		Native Biodiversity		Invasive Species
0	Severely modified	0	No native species; monotype	0	100% invasive species
1		1	A few weedy species, none native	1	
2		2	Moderately diverse but non-native	2	
3		3	Mostly non-native, but some native	3	
4		4	Mostly non-native, but many native	4	
5	Partly modified/disturbed	5	Mixed non-native and low quality native	5	50% invasive species
6		6	Mostly native but low diversity and quality	6	
7		7	Low diversity native, some high quality	7	
8		8	Mostly quality native species; some weeds	8	
9		9	Mostly quality native species; few weeds	9	
10	Natural topography/drainage	10	High diversity, all native species	10	<1% invasive species

Photographs:

Camera	Start Frame	End Frame	Data Folder (in computer)

Figure 1. Sample field data form designed by Robert Howe and Amy Wolf that was used for the 2016 detailed botanical survey effort in the Lower Green Bay and Fox River Area of Concern in Wisconsin. Note that some fields were not regularly used in the field (see text in section “Field Work Logistics” of Appendix 4).

Photo Documentation and Processing

General photographs were taken at some of the sites that the field crew visited, though they were not always geotagged at a point-specific level. The photos were digitally organized into folders based on the photographer's name.

Field Crew and Training

After Wolf and Howe designed the first version of the data form, Wolf went into the field with Kathryn Corio to test the field methods and data form and determine if they should be modified. Then, Corio conducted these detailed botanical surveys at a few sites with Wolf and students early in the field season, which served as a basic training; afterwards, Horn conducted the remaining plant surveys with the student assistants, visiting over half of the "priority areas." Each person collecting field data was either trained individually or as a member of a team.

Field Data Management and Archiving

Giese designed a data management system for organizing and backing up incoming field data, including field data forms, maps, and geospatial data (from GPS unit). At the end of each field day, Vandersteen scanned newly filled out field data forms and filed them into folders labeled using that field day's calendar date. She also scanned and filed maps that contained newly recorded data on them, though maps were only used during the first few field days. She saved geospatial coordinates as .gpx files after each field day and named the files with imbedded metadata like the botanist's four-letter name code (e.g., "JAHO" = "James Horn"), the GPS unit's Cofrin Center for Biodiversity inventory number, and the date the data were downloaded. Implementing these strict data back-up procedures ensured no data were lost.

Data Entry

After the field season, Vandersteen entered the detailed botanical survey data into a MS Excel spreadsheet created by Giese that employed data validation techniques to minimize data entry error. Horn spent significant time editing, auditing, and correcting additional errors and issues with the data set, and Giese compiled and compared the collected waypoints saved as .gpx files against the list of waypoints entered from the plant field data sheets. Corrections were made as needed. Giese wrote accompanying metadata and produced a final, high quality data set.