BioBlitz Results

Eagle Marsh
May 31 and June 1
2014

RESULTS FROM THE 2014 EAGLE MARSH BIODIVERSITY SURVEY
ALLEN COUNTY, INDIANA

Compiled from the Science Team Reports
Assembled by Don Ruch (Indiana Academy of Science)

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Eagle Marsh, a 716 acre wetland nature preserve, is located on the southwest border of Fort Wayne, Indiana (see Map 1, p. 5).The wetland preserve has over 10 miles of trails (Map 2, p. 6) which allow hikers to access the preserve's variety of habitats which include permanent ponds, ephemeral open bodies of water, marsh, sedge meadow, wet to mesic prairie, shrubland, and a mature swamp woodland (Map 3, p. 7).

Eagle Marsh is one of the largest wetland restorations ever undertaken in Indiana. With the support of the federal Wetlands Reserve Program, the Indiana Heritage Trust of the Indiana Department of Natural Resources, The Nature Conservancy of Indiana, various foundations, and others, Little River Wetland Project (LRWP) acquired Eagle Marsh (then 676 acres) in 2005. The restoration included digging shallow areas deeper, breaking drain tiles, and removing pumps to increase the volume of water on the land, thus approximating its original hydrology. Over 500 acres were seeded with native rushes, grasses, and wildflowers and more than 45,000 native trees and shrubs planted. Between 2007 and 2010, the forty acre mature swamp woodland was added to the preserve, thus bringing the total acreage to the present day 716. The swamp woodland provided important habitat for many birds and animals that required large trees, sandy soil, or leaf litter to complete their life cycles.

The first biodiversity survey (known as a BioBlitz) of Eagle Marsh was conducted on May 31 and June 1, 2014. The 2014 Eagle Marsh BioBlitz will provide a better understanding the vast biological resources at the site. It will allow members of LRWP to evaluate the success of their efforts to restore the site back to its original condition. The information will also help determine future management strategies.

The BioBlitz attracted over 120 scientists, naturalists, students, and others volunteering their time and expertise to make the event an overwhelming success. Food and lodging for the participants were provided through the generous support of Little River Wetlands Project (LRWP) and The Indiana Academy of Science (IAS).

The 13 taxonomic teams and their leaders reported over 728 taxa. Here is a summary of the results.

Team	**Leader**	**Number of Taxa Found**
Birds	Don Gorney	88 species; 6 state listed species [3 endangered]
Fish	Brant Fisher	31 species; no state/federal listed species
Herpetofauna	Mark Jordan & Bruce Kingsbury	15 species; (1 state endangered species)
Mammals	John Whitaker Jr.	21 species; [6 small mammals, 15 other mammals]
Beetles (Coleoptera)	Jeff Holland	64 taxa; common species
Butterflies	Kirk Roth	18 species; common species
Dragonflies & Damselflies	Paul McMurray	12 taxa; 1 Allen County record

Team	Leader	Number of Taxa Found
Singing Insects	Carl Strang	13 species; 3 singing insects and 10 others
Snail-killing Flies	Bill Murphy	15 species; 12 Allen County records
Aquatic Macroinvertebrates	Ross Carlson	98 taxa; representing 16 classes, 43 families, and at least 67 genera
Freshwater Mussels	Brant Fisher	2 species; no state/federal listed species
Mushrooms/Fungi	Steve Russell	31 taxa [30 species]; all common in Indiana
Vascular Plants	Paul Rothrock	320 species; 243 native, but the non-native species have visual dominance

To obtain a complete picture of the biodiversity found at Eagle Marsh, long-term seasonal surveys are necessary. Even so, this two-day survey has provided a "snapshot in time" and has revealed the remarkable species richness and the inherent value of this nature preserve.

The participants express their appreciation to the Division of Nature Preserves, and especially Roger Hedge, for providing a permit allowing the event to occur.

Leopard frog
(Photo by Ben Hess)

Southern blue flag
(Photo by Paul McMurray)

Figure 1. Location of Allen County within Indiana (left) and Eagle Marsh within Allen County (right).

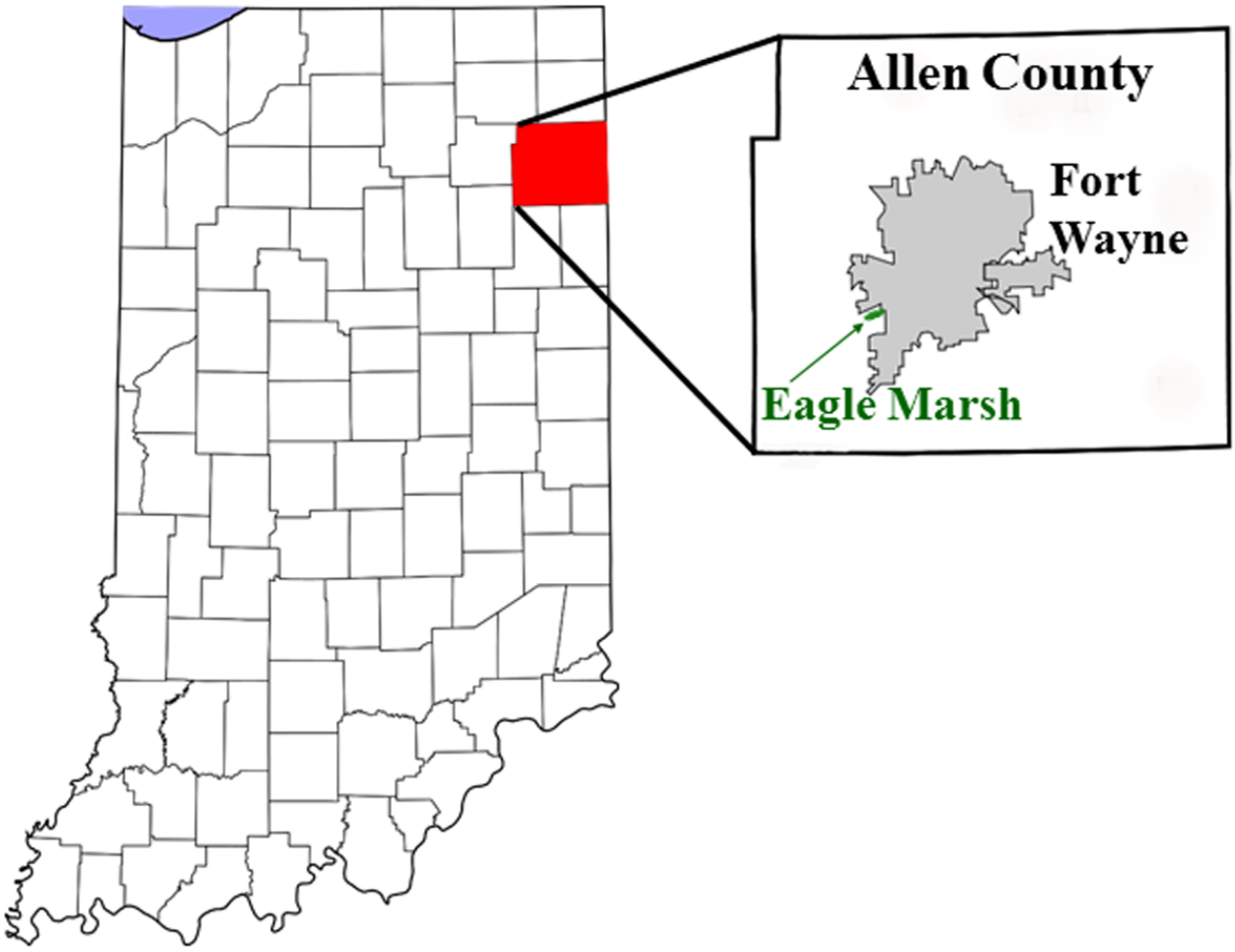
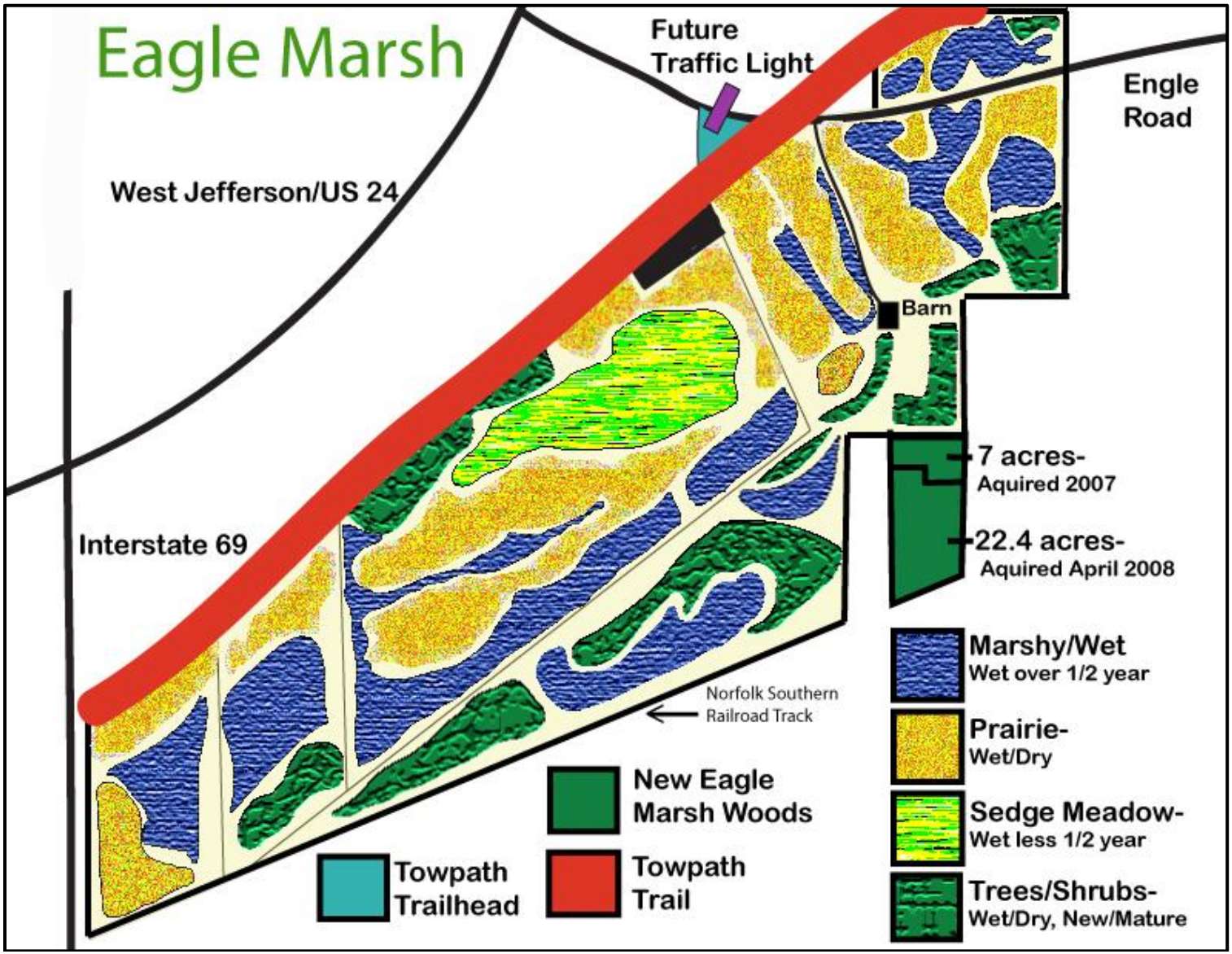


Figure 2: Eagle Marsh trails map.

Figure 3: Habitat map of Eagle Marsh.



LITTLE RIVER
WETLANDS PROJECT

The Story of Eagle Marsh
By Judy Nelsen

(with excerpt from Tony Fleming's geology page on LRWP's website, www.lrwp.org/page/geology)

Step back to early geologic history to understand how Eagle Marsh, a 716-acre restored wetland nature preserve located in southwest Fort Wayne, Indiana eventually came to be. Around 17,000 years ago, a huge lake formed between the melting Wisconsin glacier and a recently-deposited moraine, which acted like a dam to impound the lake. About 14,000 years ago, the lake overtopped the moraine near what is now downtown Fort Wayne and eroded a large outlet, unleashing a flood of unimaginable proportions, commonly called the "Maumee Torrent". In a matter of days or weeks, billions of gallons of water scoured out an existing river channel into a half-mile-wide valley. Related geologic events later changed the course of nearby waterways and location of a continental divide. The valley, stretching between present-day Huntington and Fort Wayne, developed into a fertile 25,000-acre wetland where wildlife thrived and Native Americans hunted.

When settlers arrived, this vast wetland became known as the "Great Marsh," and one of the streams traversing it was called the Little River. This river was of great strategic value because, in all but the driest times, one could canoe up it from the Wabash River to a place near present-day Fort Wayne where a shorter or longer portage (depending on the season) allowed passage to the St. Marys River and Lake Erie. A "golden gateway" between the Mississippi River and the Great Lakes had been found. The continental divide near the portage later became the high point along the Wabash & Erie Canal.

By the 1870's, Fort Wayne had grown from a small outpost to a respectable-sized town. Farmers and others began pushing for the Great Marsh to be drained. After several attempts, by the late 1880's the job was largely done, mostly by creating three main drainage ditches and many minor ones. One of the larger efforts was the Graham-McCulloch Ditch, which crosses what is now Eagle Marsh. Agriculture quickly expanded across the fertile soil of the old marsh, at first with crops such as onions, lettuce, and celery; then with the grain crop rotation of corn-soybeans-wheat following World War II. However, even extensive systems of closely spaced drainage tile, ditch laterals, and large pumps running 24 hours a day were sometimes not enough to prevent crops from being flooded out.

In 1990, Little River Wetlands Project (LRWP) was formed with the mission of restoring and protecting some of the lost wetlands of the Little River valley (later watershed). Between 2000 and 2004 the organization had acquired two restored wetlands a few miles southwest of Fort Wayne and was ready to find more. The owner of the land that was to become Eagle Marsh had enrolled it in the Wetlands

Reserve Program, a federal program that paid farmers to let the government restore wet agricultural land back to wetland and place it under a conservation easement in perpetuity. The original 676 acres consisting of farmed portions, a wooded fringe, barn and parking area were sold to LRWP in 2005. The Indiana Heritage Trust, The Nature Conservancy in Indiana, local foundations and generous donors helped fund the purchase, with the Indiana Department of Natural Resources (of which the Indiana Heritage Trust is part) retaining partial ownership.

After extensive planning by the Wetlands Reserve Program and LRWP, one of the largest contiguous wetland restorations ever undertaken in Indiana began at Eagle Marsh in late 2006. It was designed to emulate the original bottomland communities of the marsh, while adapting to a condition of relative water scarcity because hydrologic changes in the valley have limited the flow of water to the area. In addition to breaking tiles, plugging ditch laterals, and removing pumps to hold water on the land, earth was moved to enhance or recreate some of the old meander scrolls. These basins help retain water that might otherwise run off and serve as crucial habitat for wildlife ranging from the tiniest insect larva to large shorebirds. The restoration incorporated extensive prairie areas along with what could be considered true marsh. A highly diverse mix of plants was used to increase the probability of success given the land's variable hydrology. Virtually all the property was seeded with a combination of native grasses, sedges and wildflowers and approximately 45,000 native trees and shrubs were planted, with the initial restoration completed in 2009.

Over time the new native vegetation has become established to create a varied habitat of shallow water wetlands, wet and drier prairie, a sedge meadow, and areas of newly planted native trees. Forty more acres of mature forested wetland were added to the preserve between 2007 and 2010, bringing it to its present size. The mature wet woods provide important habitat for many birds and animals and is probably where remnant populations of native amphibians, reptiles and insects have survived from earlier times. Since the restoration, LRWP staff has worked hard to deal with invasive plant species inevitably to appear. Prescribed burns, mowing, hand-pulling, and use of herbicides where needed are part of the invasive management strategies carried out every year.

Today more than 11 miles of nature trails allow the preserve's many visitors to enjoy its varied habitats and the extensive free nature programming offered there. A total of 227 kinds of birds and numerous other wild creatures, many of them endangered or of special concern in Indiana, have been seen at Eagle Marsh. Bald eagles have nested for the past two years just outside the preserve boundary, and are often seen there with their young. With the adjacent Fox Island County Park and other privately owned natural properties, Eagle Marsh creates almost two square miles of natural habitat for native wildlife.

(Visit www.lrwp.org/page/geology [and below] for more on the history of the Little River valley, written by Tony Fleming, from which much of the above information was taken.)

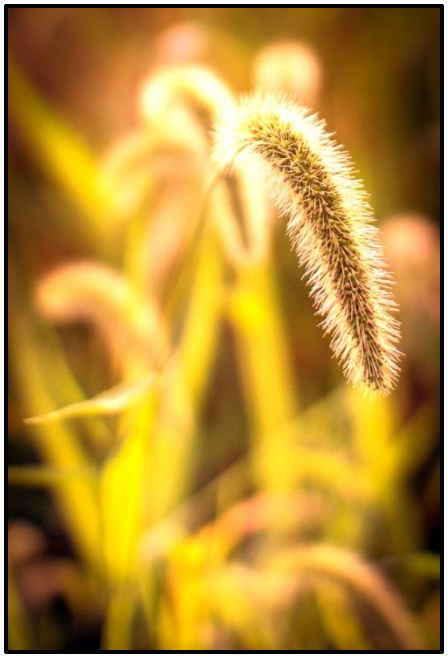


Photo by Jonah Westrick ₪

History and Physical Setting of Eagle Marsh
By Tony Fleming

Physiography

Eagle Marsh is situated within a broad, low-lying glacial drainage historically known as the Little River Valley. Despite its diminutive-sounding name, the Little River Valley is one of the most striking physiographic features in the region (Fig. 1). The valley extends about 24 miles from the west bank of the St. Marys River in Fort Wayne to the forks of the Wabash River, just west of the City of Huntington. Its name derives from the fact that the 'Little' River is the smaller of the two forks of the modern Wabash River, but from a geological perspective, this is rather misleading. Though the Little River is indeed a small stream, it occupies a deep, glacially-cut sluiceway known to geologists as the Wabash-Erie Channel, whose immense size dwarfs the valley occupied by the 'main' fork of the Wabash River many times over, and which is geologically continuous with the rest of the Wabash Valley below the forks.

From the air, the Wabash-Erie Channel resembles a deep scar on the landscape, extending southwestward for about 30 miles from the western apex of the Maumee Lake Plain, through downtown Fort Wayne and southwest Allen County, to the confluence with the main stem of the Wabash River at the forks. The eastern continental drainage divide, which separates the Great Lakes and Mississippi River drainages, crosses the channel just west of the St. Marys River. The Little River Valley occupies that portion of the Wabash-Erie Channel west of the divide. In historical times, the floor of the Little River Valley was dubbed "The Great Marsh" because it comprised a vast wetland complex covering some 25,000 acres. Eagle Marsh represents one small fragment of the former wetland complex.

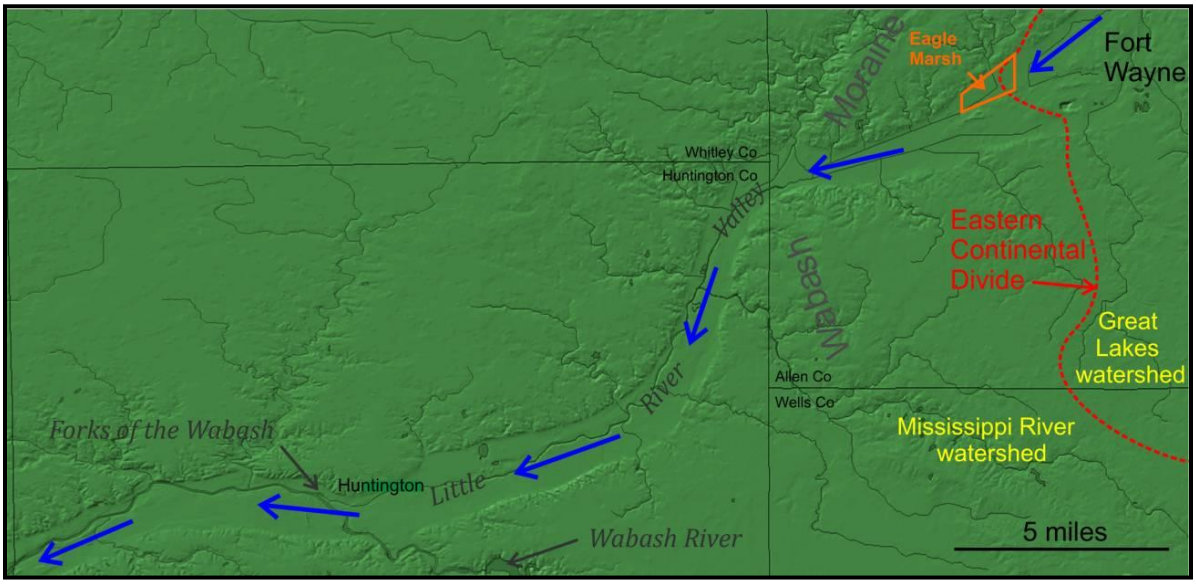


Figure 1. Regional physiography of the Little River Valley and vicinity. On this DEM, the Wabash-Erie Channel stands out as a deep, broad trough extending from Fort Wayne to Huntington. The blue arrows signify the final, massive outburst of glacial meltwater from Glacial Lake Maumee that carved the valley into its present form. Source: LRWP, 2014.

Near the St Marys River, the valley has 2 distinct, sub-parallel segments: 1) the wide, north channel, which includes Eagle Marsh, is sometimes referred to as the Fort Wayne Outlet, because it forms the head of the Wabash-Erie Channel at the Maumee Lake Plain; 2) the narrower southern segment

originates at the St Marys River near Waynedale. The two segments are separated by the rolling, sandy upland historically known as the Sand Point, and by a series of small dune fields just to the west of that, known historically as "islands". The two channel segments gradually coalesce in the vicinity of Fox Island, and continue downstream as one broad channel to Huntington.

The Little River Valley is a classic example of an underfit valley: the broad, flat valley bottom is more than 2 miles wide where the two segments converge, and lies between 75 and 125 feet below the adjacent uplands, while the modern stream within it (the Little River) is miniscule in comparison. This relationship implies that the valley bears little relation to the modern stream, and must have been cut by a vastly larger flow of water sometime in the geologic past. In fact, the valley experienced a complicated geologic history involving multiple outbursts of glacial meltwater, cycles of alluviation and exhumation of sediment, and frequently shifting drainages culminating in the piracy of the St. Joseph and St. Marys River by the Maumee River sometime in the mid Holocene. The latter event established the continental drainage divide across the valley and greatly diminished the discharge of the Little River by removing its two largest headwater streams. Regional physiography and the geologic history of the Wabash-Erie Channel are summarized in depth on the Little River Wetlands Project (LRWP) geology page (LRWP, 2014a), the Allen County Geology website (Indiana Geological Survey, 2014), and the Allen County Ground-Water Atlas (Fleming, 1994).

Geology

The Little River Valley owes its current form to geologic events that occurred within a several-thousand-year period spanning the close of the late Wisconsin Stage and the first half of the Holocene—in other words, it is a relatively recent feature. All of the sediments and landforms in and adjacent to the valley date from the latest substage of the late Wisconsin stage and from the early to mid-Holocene, whereas the modern hydrology evolved during the late Holocene and has been greatly modified since European settlement.

The part of the valley occupied by Eagle Marsh is floored by fine- and medium-grained sediments deposited in a low-gradient alluvial and palustrine environment (Fig. 2). These sediments consist chiefly of organic-rich silty clays deposited in marshes and small oxbow lakes, with scattered bodies of cross-bedded sands deposited on small point bars during floods. Numerous old meander scrolls crisscross the property and commonly contain moderately thick silty muck. Windblown sand covers the alluvial sediments in the far southeast part of the property, where it forms a series of low dunes and swales associated with Midway Island, one of several small dune fields in the Little River Valley. These post-glacial sediments range from a few feet to more than 25 feet thick and overlie an irregular, scoured surface on loam till and associated sand and gravel bodies of the late Wisconsin Trafalgar Formation (Fleming, 1994). The valley walls and adjacent uplands consist chiefly of clayey till of the Lagro Formation; however, sand and gravel bodies along the horizon between the two tills are commonly truncated along toe slopes, where they produce numerous springs and seeps.

The original soils at Eagle Marsh were chiefly very poorly drained argillic histosols and mollisols, represented by the Willette, Tawas, Lenawee, and Montgomery series, which collectively underlie the vast majority of bottomland on the property (Kirschner & Zachary, 1969). All of these soils formed under marsh or prairie conditions and are characterized by hydric, slightly acidic to circumneutral soil profiles. Today, however, it is probably more correct to characterize the soil below large parts of the bottomland as Udorthents—essentially fill and disturbed ground resulting from historical disturbance (e.g., drainage ditch construction) and extensive earthwork performed during restoration of the marsh.

Well-drained Chelsea fine sand underlies dunal parts of Eagle Marsh Woods in the southeast part of the property, and formed under forested conditions.

Hydrology

Historical accounts dating back to the early 1700's describe a vast marsh that covered virtually the entire floor of the Little River Valley between Huntington and Fort Wayne. The marshy expanse was broken only by a few, small wooded dunes, or "islands". In time, this wetland became known as the "Great Marsh", or "Marshy Prairie" (c.f., Atlas of Indiana, 1876; Helms, 1880; Kapler, 1904; LRWP, 2014b), and while it presented a major impediment to settlement, it also acted as a navigable waterway of great strategic value, not only to the early settlers and traders, but also to the Native Americans of the region. In all but the driest times, it was feasible to canoe up the river from the forks of the Wabash to a position just west of Eagle Marsh, and during wet seasons, all the way to the St. Marys River. These early accounts are among the best indications of both the widespread extent as well as the seasonal hydrology of the Great Marsh.

Figure 2 depicts the extent of the marsh and the positions of natural drainages in the vicinity of Eagle Marsh as they might have looked when the first Europeans arrived here. The locations of the actual channel of the Little River through the marsh, and of various small waterways tributary to it, are somewhat speculative at places due to the large number of meander scrolls and other features that crisscross the floor of the valley and mark multiple generations of geologically recent stream channels.

The ongoing migration of these small stream channels across the floor of the valley was one of the key geologic processes that continually shaped the ecosystem: the channels formed narrow ribbons of open water amidst a sea of grass, and probably supported riverine communities of aquatic plants, mussels, and fishes, along with a wide range of shore birds that fed on them. The adjacent areas included true marsh—that is, communities dominated by sedges and marsh grasses that were inundated on a continuous or semi-continuous basis—along with large expanses of wet prairie, which stood slightly higher and were inundated only seasonally. The distributions of these different natural communities were determined by subtle changes in elevation across the flat valley floor—a differential of mere inches probably determined whether a particular area was open channel, marsh, or wet prairie. In contrast, the sand dunes were islands that stood well above the prevailing water level of the marsh. They supported a completely different ecosystem—a diverse, mesic hardwood forest with a rich understory.

The water that fed the marsh came from several sources. Some came from precipitation that fell directly on the marsh, but a much larger share was derived from several tributaries that drained adjacent uplands. The main stem of the Little River, for example, originated in northern Wells County, just north of Ossian, and drained an upland area of 15 square miles. Already a fairly sizable creek by the time it entered the south channel, the Little River meandered for several miles across the flat valley bottom before entering Eagle Marsh near the east end of Fox Island.

Another sizable tributary was Cranberry Creek, which drained an upland area of comparable size on the north side of the valley and debouched into the valley on the north side of Eagle Marsh. Even larger influxes of surface water came from floods on the St. Marys River, which periodically overtopped the low divide at the heads of both the north and south channels and sent large sheets of water down the Little River Valley and into the Great Marsh (c.f., U.S. Army Corps of Engineers 1974).

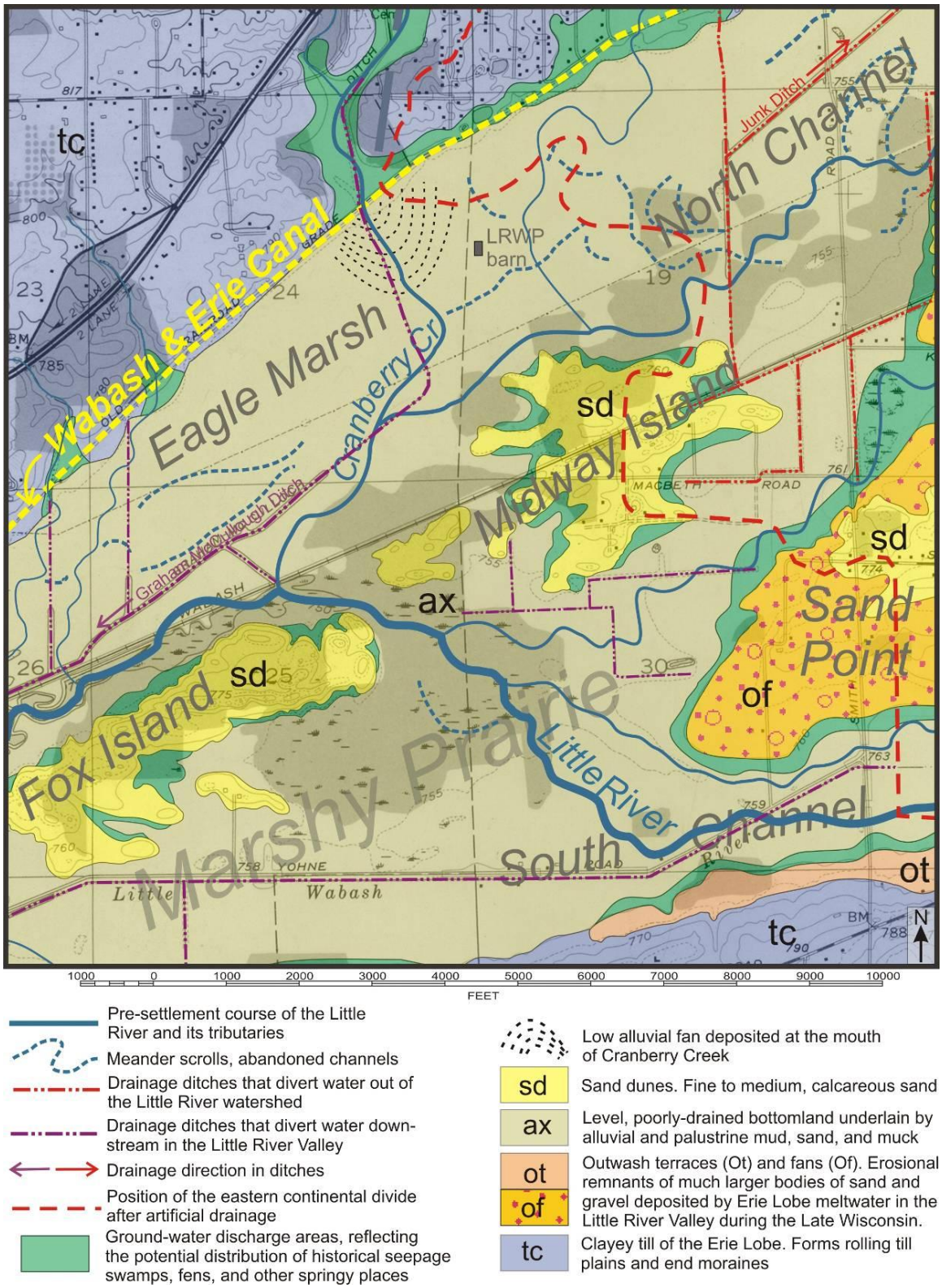


Figure 2. Geologic map of Eagle Marsh and vicinity, showing pre-settlement and current drainage, place names, and selected cultural features. Eagle Marsh lies within the area bounded by the Wabash & Erie Canal, the west edge of the map, the railroad embankment, and a north-south line through the center of section 19. Map adapted from Little River Wetlands Project, 2014a.

The Little River Valley occupies the lowest elevations found in the regional landscape, and thus acts as a regional ground-water discharge area for both bedrock and glacial aquifer systems (Fleming, 1994). In fact, much of the Little River Valley in Allen County is inferred to have been fringed by fens, seepage swamps, and other ecosystems supported by the discharge of ground water to the surface. The source of the much of the ground water is sand and gravel bodies of various sizes, including the dune fields, outwash terraces along the valley walls, and large artesian aquifers truncated along the valley walls (Fig. 3). There is ample evidence of upwelling ground-water from water-bearing strata at considerable depth below the valley floor, including the limestone bedrock. This is vividly illustrated by the well at Eagle Marsh barn, which flows freely when left uncapped, a condition known as a flowing artesian well. Although poorly quantified, the discharge of ground water into Eagle Marsh was undoubtedly substantial and helped to sustain the wetland hydrology in times of low surface water runoff.

The Draining of the Great Marsh

By the 1870's, the Great Marsh remained largely undeveloped, while Fort Wayne had grown from a small outpost to a sizable city. A variety of parties began pushing for the marsh to be drained, not least among them being local agricultural interests. Legislation to drain the Great Marsh cleared the state legislature and drainage work began in earnest in the late 1870's, and by the late 1880's, the Great Marsh was largely drained (Paul, 1969). Three major drainage projects irrevocably altered the hydrology of the valley in the vicinity of Eagle Marsh:

-Fairfield Ditch, completed in 1880, literally decapitated the Little River by diverting its headwaters out of the watershed and into the St. Marys River across the continental divide;
-Graham-McCullough Ditch likewise diverted Cranberry Creek out of Eagle Marsh. For thousands of years, this waterway had been providing the lion's share of the water budget to Eagle Marsh while also delivering a steady supply of sediment to the surface of the marsh.
-Junk Ditch probably had the most profound effect on Eagle Marsh by shifting the position of the continental divide westward by as much as 3 miles from its original location near the St. Marys River to its present position within Eagle Marsh. Some sections of the ditch utilize former courses of the Little River drainage, while others are simple, straight channels excavated across the former marsh. All told, the advent of Junk Ditch removed several square miles of former marshlands and adjacent uplands from the Little River watershed.

The net result of these and subsequent urban infrastructure projects is a dramatic reduction in the overall water budget of the marsh—possibly by as much as 75%. Table 1 estimates the pre-settlement water budget contributions of various water sources and compares them to what is available today. (Table 1 is on page 20.)

Agriculture quickly expanded across the fertile soil of the old marsh. The wet, mucky soil supported moisture-loving crops such as onions, lettuce, and celery. In fact, the valley became well known for its celery production around the turn of the century. Persistent wetness posed frequent challenges to cultivation, however, and these problems continued after vegetable production was abandoned and the fields were converted into grain crop production following WW II. Even extensive systems of closely-spaced drainage tile, ditch laterals, and large pumps running 24 hours a day were often not enough to keep the water at bay and prevent crops from being lost to inundation. Another unforeseen result of draining and cultivating the mucky soils of the Little River Valley is the loss of organic sediment from the land surface: when the soil surface dries out, the organic matter oxidizes and blows away, leading to a long-term reduction in soil fertility and tilth, and a gradual deflation, or lowering, of the land surface.

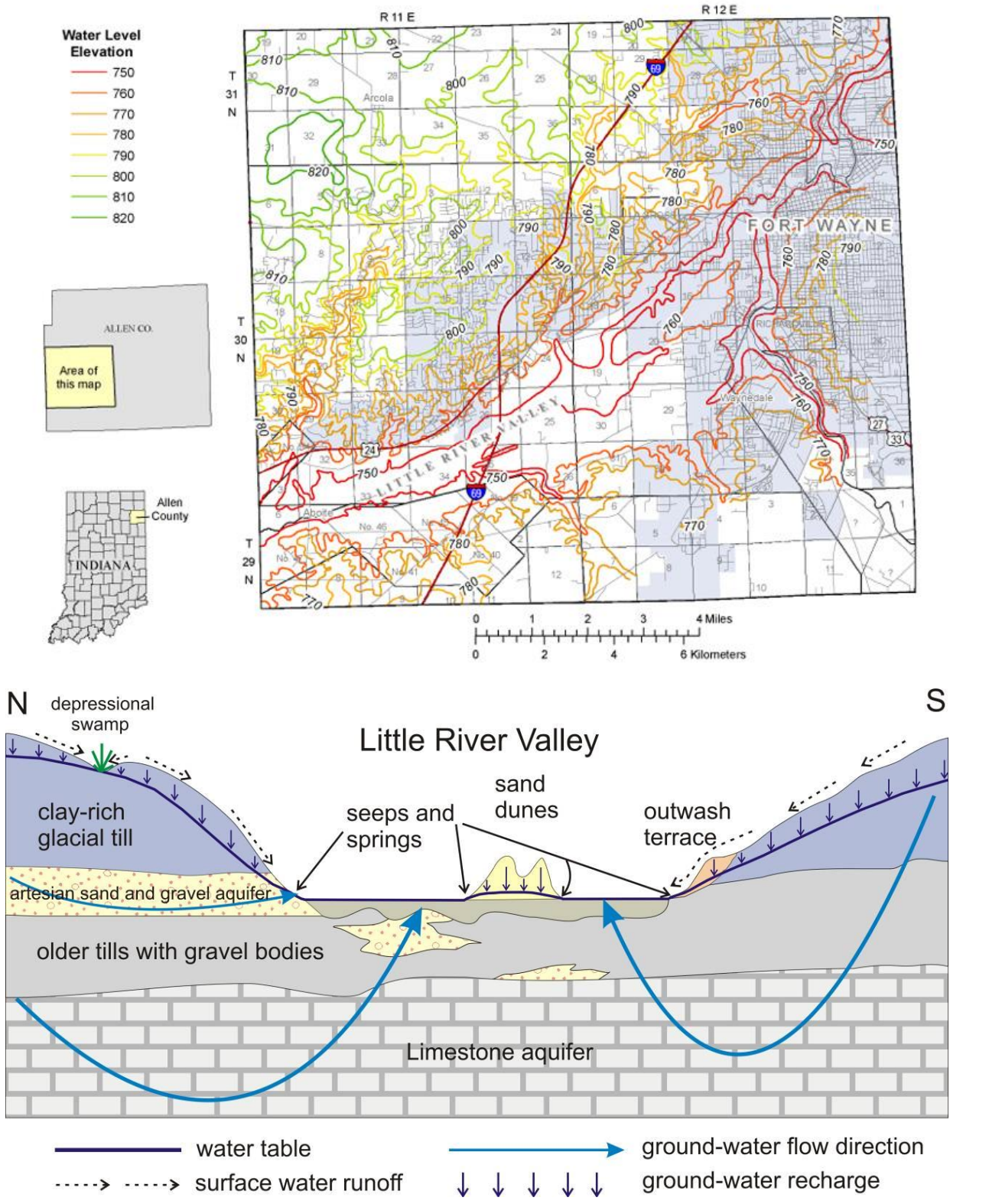


Figure 3. Regional ground-water flow map (top) and schematic cross section (bottom) illustrating the hydrology of the Little River watershed. The map contours represent lines of equal water-level elevations in the underlying aquifers, and show a strong inward gradient towards the valley. Upwelling of ground water from deep bedrock and gravel aquifers is well documented in the valley. Source of map: Indiana Geological Survey Special Report 57 (Fleming, 1994).

Restoration of Eagle Marsh

The ongoing challenges to successfully farming the valley bottom in an age of rock-bottom crop prices, coupled with increased local awareness of the many values of wetlands, form the backdrop for the restoration of portions of the Great Marsh. Both the challenges and the opportunities involved in a large-scale restoration are exemplified at Eagle Marsh, one of the largest contiguous wetland restorations ever undertaken in Indiana. The habitat map (Fig. 4), adapted from the restoration plan and distributed at the BioBlitz, shows the layout of natural communities and how they relate to the current hydrologic regime.

Visitors to Eagle Marsh are often surprised to learn that the property consisted of farm fields as recently as 2005. With the exception of Eagle Marsh Woods (acquired by LRWP in 2007, 2008, and 2010) and a few very small and isolated remnant populations around the fringes of the fields, there were few native plants on the property, much less any natural communities or functional wetland hydrology. Following extensive planning, restoration of the marsh began in earnest in 2007 with the first planting of native seeds and trees. Major seed and tree plantings were also made in 2008. From 2011-2013, 60 acres were treated and reseeded, while smaller plantings of both seeds and plants were made at various locations in nearly every year since 2008. In total, 50,000 trees and shrubs have been planted, along with more than 500 acres of native plant seeds. Since 2006, over 220 bird species have been recorded, which gives an indication of the return of native biodiversity.

The restoration is designed to emulate the original bottomland communities of the marsh, while adapting to a condition of relative water scarcity. One of the largest challenges is the lack of a regular source of surface water flowing into the marsh: ditching and channelization of the Little River and Cranberry Creek prevent these streams from interacting hydraulically with the surrounding valley bottom, whereas the various lateral ditches and berms for roadways that cross upstream portions of the valley inhibit the sheet flow of water to downstream portions. As a result, the water budget relies heavily on precipitation falling directly on the marsh, so retaining that water in the marsh is a top priority of the restoration. Ground-water discharge also assumes a larger role in the water budget, given the substantial reduction in historical surface water inflows.

In addition to decommissioning the extensive drainage infrastructure that existed on the property (e.g., breaking tiles, plugging ditch laterals, removing pumps), earth moving was undertaken to enhance or recreate some of the old meander scrolls (Fig. 5). Although these basins are mostly isolated in a hydraulic sense from other surface water sources, they help retain water that might otherwise run off; just as importantly, these small areas of open water serve as crucial habitat in the lifecycles of many marsh dwellers ranging from the tiniest insect larva to large shorebirds, and so form a key link in the marsh ecosystem.

A significant unknown involves the hydroperiods of different portions of the marsh. In simple terms, ‘hydroperiod’ refers to the length of time a particular wetland remains inundated during the course of a typical year: for example, a marsh is typically inundated for all, or almost all, of the year, whereas a wet meadow usually has water standing on the surface for only a portion of the year, while many wet prairies and forested wetlands may be inundated only briefly. In reality, there is much hydrologic variability both within a particular type of wetland and among different types, and factors such as the depth of water and the time of year inundation occurs (i.e., whether and when during the growing

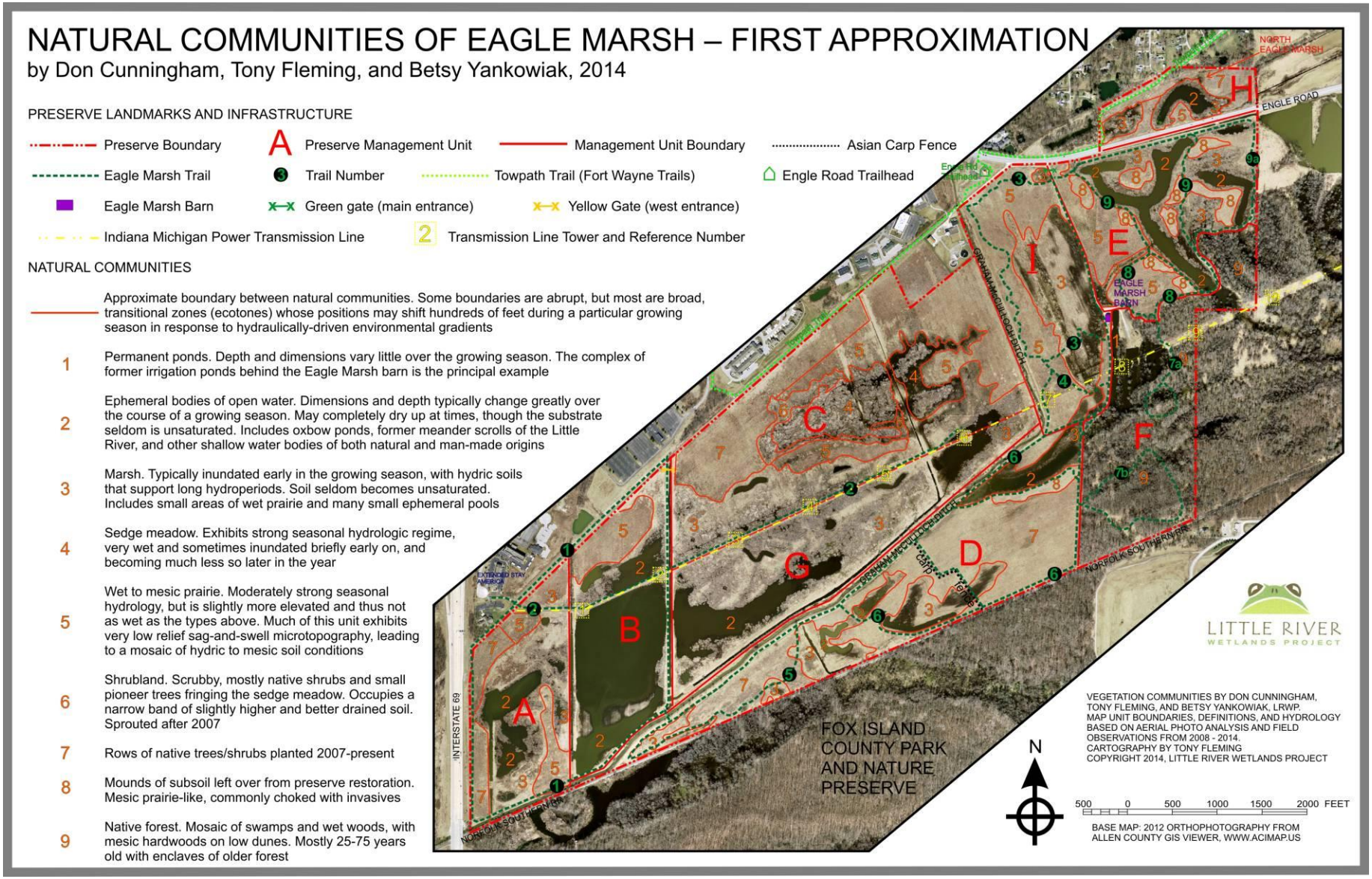


Figure 4. Map of Eagle Marsh showing preserve layout, cultural features, and the distribution of natural communities 7 years into the restoration.

season) have a tremendous influence on the type of natural community found in a given wetland. The lack of detailed historical records documenting this kind of information in the original marsh, coupled with the major hydrologic alterations in the valley, lead to considerable uncertainty and suggest that current hydrological conditions are likely to be quite different, and probably drier and more variable, than those that existed prior to European settlement. One way this uncertainty is being addressed in the restoration is by incorporating extensive prairie areas in the former marsh landscape, composed of plant species which are well adapted to large seasonal swings in moisture availability. Relative to the original landscape, the restored marsh undoubtedly has a greater proportion of wet prairie than true marsh, out of hydrologic necessity.

Another adaptation is the use of a highly diverse mix of species within each type of wetland, which increases the probability of success in a drier or more variable hydrologic system. If some areas turn out to be too dry for certain plants, their place in the ecosystem will be taken by other species better adapted to the prevailing conditions. One of the most interesting aspects of the restoration is seeing how the hydrology of the marsh plays out over the long term, and which species ultimately flourish in which environment—more or less like a grand ecology experiment on a scale seldom undertaken. The 2014 BioBlitz serves as the first major report of progress on that experiment.

Figure 5. Restored marsh and meander scroll, section G of Eagle Marsh. Fox Island is in the background. Photo by Tony Fleming.

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TABLE 1. EAGLE MARSH: ESTIMATED REGIONAL WATER BUDGET – PRE-SETTLEMENT VS. CURRENT

---------- **Pre-settlement Annual Volume** ----------

Water Source	**Total for Property**	**Per Acre[1]**	**% of Total**	**Current Status**
Direct precipitation (40"/yr)	752.5 million gal	3.3 acre-feet (~1,075,000 gal)	16 - 20	Available
Surface runoff-tributaries -Cranberry Creek[2] (@1,000 gpm) (@2,000 gpm) -all other tributary streams (incl. Little River headwaters, Portage Cr., etc.)	 525.6 million gal 1,051.2 million gal up to 1 billion gal	 2.30 acre-feet (~750,000 gal) 4.60 acre-feet (~1,500,00 gal) 4.38 acre-feet (~1,400,000 gal)	22 – 27 22 - 27	 Not available: ditch diverts from marsh Not available: diverted out of watershed
Discharge from edge fens and dune seeps @100 gpm/fen-seep Assumes 5 fens/seeps directly fed Eagle Marsh)	 52.5 million gal/fen 262.8 million gal total	 0.23 acre-feet (~75,000 gal) 1.15 acre-feet (~375,000 gal)	 5 - 7	50% or more is diverted or intercepted by urban infrastructure
Discharge from bedrock and deep sand & gravel aquifers[3]	236 – 1,027 million gal	1.03 – 4.5 acre-feet	6 - 23	Diminished 50% by dewatering of bedrock by nearby quarries
Shallow ground-water inflow from south and east[4] low WT gradient	280,000 gal	< 1 mm (400 gal)	<<<1	Insignificant: flat water table gradient and low permeability sediments
Surface water inflow from east (assume drainage area of 3 mi^2) -static (annual flood) -1913 flood (5,000 cfs^5)	 ~1.5 billion gal 3.23 billion gal/day	 6.6 acre-feet (2.2 million gal) 14.2 acre-feet/day	 33 - 40	Largely cut off by drainage ditches and flood control projects on St. Marys River

1 - assumes the total annual volume could be evenly spread out over the whole 700-acre property; in reality, most sources are irregularly distributed.
2 – these are conservative estimates of pre-settlement base flow for a largely forested watershed. The gaging station on Graham-McCullough Ditch (USGS, 2014) indicates modern base flow is greater than 2,000 gpm, but that reflects a heavily urbanized watershed. Historical base flow may have been greater.
3 - this calculation is extremely sensitive to assumptions about bulk vertical hydraulic conductivity of the till confining units (Kv), the vertical hydraulic gradient (I), and the extent of any sand and gravel bodies within the confining unit. The low number is based on Kv = 3.28×10^{-6} ft/s, I = 0.01, cross sectional area = 700 acres (30.5 million sq ft); high number is for comparative purposes only, and represents the discharge from an unbroken section of sand and gravel with Kv = 10^{-2} ft/s and extending from the surface to bedrock below an equivalent area of 1 acre.
4 - calculation based on bulk horizontal hydraulic conductivity = 10^{-5} ft/s, gradient = 0.001, cross sectional area of 15 ft thick x 1.5 miles wide.
5 – 1913 flood discharge estimated by U.S. Army Corps of Engineers, 1974; used as the extreme upper end of range.

Useful conversions: 1 acre = 43,560 sq ft; 1 acre-foot = 325,600 gallons; 1 cubic ft = 7.48 US gal; 1 cubic foot/sec = 646,000 gal/day

Results of the Biodiversity Survey

31 May through 1 June 2014

List of bird species (88 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Don Gorney

Team Members: Margit Codispoti, Alex Forsythe, Ben Hess, Shelley Jenkins, Barb Kampschmidt, Cathy Kelker, Gracie Kopple, Jeff Moore, Cynthia Powers, Ed Powers, Rodger Rang, Tim Rice, Kirk Roth, Andrew Slack, Carole Smith, Ryan Smith, Stephanie Wagner, John Winebrenner

Table 1: Birds

Family	Scientific Name	Common Name	Number
Order Anseriformes			
Anatidae	*Branta canadensis*	Canada Goose	165
	Cygnus olor	Mute Swan	4
	Aix sponsa	Wood Duck	24
	Anas platyrhynchos	Mallard	228
	Anas discors	Blue-winged Teal	1
	Anas crecca	Green-winged Teal	1
	Aythya americana	Redhead	2
	Lophodytes cucullatus	Hooded Merganser	3
Order Suliformes			
Phalacrocoracidae	*Phalacrocorax auritus*	Double-crested Cormorant	4
Order Pelecaniformes			
Ardeidae	*Ardea herodias*	Great Blue Heron	52
	Ardea alba #	Great Egret	8
	Butorides virescens	Green Heron	12
	*Nycticorax nycticorax**	Black-crowned Night Heron	1
Order Accipitriformes			
Cathartidae	*Cathartes aura*	Turkey Vulture	4
Accipitridae	*Haliaeetus leucocephalus* #	Bald Eagle	1
	Buteo jamaicensis	Red-tailed Hawk	4
Order Gruiformes			
Rallidae	*Fulica americana*	American Coot	1
Order Charadriiformes			
Charadriidae	*Charadrius semipalmatus*	Semipalmated Plover	1
	Charadrius vociferus	Killdeer	18
Scolopacidae	*Actitis macularius*	Spotted Sandpiper	4
	Calidris minutilla	Least Sandpiper	1
	Calidris pusilla	Semipalmated Sandpiper	10
	Gallinago delicata	Wilson's Snipe	1
	Scolopax minor	American Woodcock	5

Laridae	*Chlidonias niger**	Black Tern	1
Order Columbiformes			
Columbidae	*Zenaida macroura*	Mourning Dove	25
Order Cuculiformes			
Cuculidae	*Coccyzus americanus*	Yellow-billed Cuckoo	1
Order Strigiformes			
Strigidae	*Strix varia*	Barred Owl	1
Order Caprimulgiformes			
Caprimulgidae	*Chordeiles minor #*	Common Nighthawk	1
Order Apodiformes			
Apodidae	*Chaetura pelagica*	Chimney Swift	2
Trochilidae	*Archilochus colubris*	Ruby-throated Hummingbird	3
Order Coraciiformes			
Alcedinidae	*Megaceryle alcyon*	Belted Kingfisher	2
Order Piciformes			
Picidae	*Melanerpes carolinus*	Red-bellied Woodpecker	8
	Picoides pubescens	Downy Woodpecker	3
	Picoides villosus	Hairy Woodpecker	3
	Colaptes auratus	Northern Flicker	3
	Dryocopus pileatus	Pileated Woodpecker	1
Order Passeriformes			
Tyrannidae	*Contopus virens*	Eastern Wood-Pewee	4
	Empidonax virescens	Acadian Flycatcher	3
	Empidonax traillii	Willow Flycatcher	46
	Empidonax alnorum	Alder Flycatcher	1
	Myiarchus crinitus	Great Crested Flycatcher	12
	Tyrannus tyrannus	Eastern Kingbird	8
Vireonidae	*Vireo bellii*	Bell's Vireo	2
	Vireo gilvus	Warbling Vireo	14
	Vireo olivaceus	Red-eyed Vireo	3
Corvidae	*Cyanocitta cristata*	Blue Jay	5
	Corvus brachyrhynchos	American Crow	2
Hirundinidae	*Tachycineta bicolor*	Tree Swallow	41
	Stelgidopteryx serripennis	Northern Rough-winged Swallow	6
	Riparia riparia	Bank Swallow	90
	Hirundo rustica	Barn Swallow	28

Paridae	*Poecile carolinensis*	Carolina Chickadee	1
	Baeolophus bicolor	Tufted Titmouse	2
Sittidae	*Sitta carolinensis*	White-breasted Nuthatch	1
Troglodytidae	*Troglodytes aedon*	House Wren	9
	*Cistothorus palustris**	Marsh Wren	14
Polioptilidae	*Polioptila caerulea*	Blue-gray Gnatcatcher	1
Turdidae	*Sialia sialis*	Eastern Bluebird	3
	Catharus ustulatus	Swainson's Thrush	1
	Hylocichla mustelina	Wood Thrush	1
	Turdus migratorius	American Robin	48
Mimidae	*Dumetella carolinensis*	Gray Catbird	33
	Toxostoma rufum	Brown Thrasher	1
Sturnidae	*Sturnus vulgaris*	European Starling	13
Bombycillidae	*Bombycilla cedrorum*	Cedar Waxwing	16
Parulidae	*Protonotaria citrea*	Prothonotary Warbler	2
	Geothlypis trichas	Common Yellowthroat	59
	Setophaga petechia	Yellow Warbler	47
	Icteria virens	Yellow-breasted Chat	2
Emberizidae	*Pipilo erythrophthalmus*	Eastern Towhee	4
	Spizella passerina	Chipping Sparrow	1
	Spizella pusilla	Field Sparrow	3
	Melospiza melodia	Song Sparrow	69
	Melospiza georgiana	Swamp Sparrow	2
Cardinalidae	*Cardinalis cardinalis*	Northern Cardinal	21
	Pheucticus ludovicianus	Rose-breasted Grosbeak	5
	Passerina caerulea	Blue Grosbeak	1
	Passerina cyanea	Indigo Bunting	49
Icteridae	*Agelaius phoeniceus*	Red-winged Blackbird	219
	Sturnella magna	Eastern Meadowlark	1
	Quiscalus quiscula	Common Grackle	21
	Molothrus ater	Brown-headed Cowbird	15
	Icterus spurius	Orchard Oriole	7
	Icterus galbula	Baltimore Oriole	12
Fringillidae	*Haemorhous mexicanus*	House Finch	6
	Spinus tristis	American Goldfinch	54

Passeridae	*Passer domesticus*	House Sparrow	9

Total number of individuals at Eagle Marsh	**1627**
Total number of species	**88**

*** = state endangered species**

 # = state species of special concern

Surveying Methodology and Effort

The Eagle Marsh property was divided into four territories and a team was assigned to each. Teams maintained a tally of the species and the number of individuals encountered by sight or sound. On the first survey day, a few teams began before dawn and all teams finished by late afternoon. Thereafter, surveying during the evening of day one and on the morning of day two was primarily completed by the team leader who revisited locations that were productive. The focus of the team leader was to identify species new to the survey rather than counting additional individuals of species already detected. Reports of birds were also received from individuals who participated on other taxon teams. The multiple survey reports were reviewed and discussed by the team leader with team members to eliminate duplications. In those instances where individuals of a species tend to gather together at some point in the daily cycle (e.g., Great Blue Heron and Bank Swallow), the number of individuals listed in this report is the maximum number of that species seen at one time by one observer. The complete effort by the team was approximately 87 person-hours.

Summary Overview

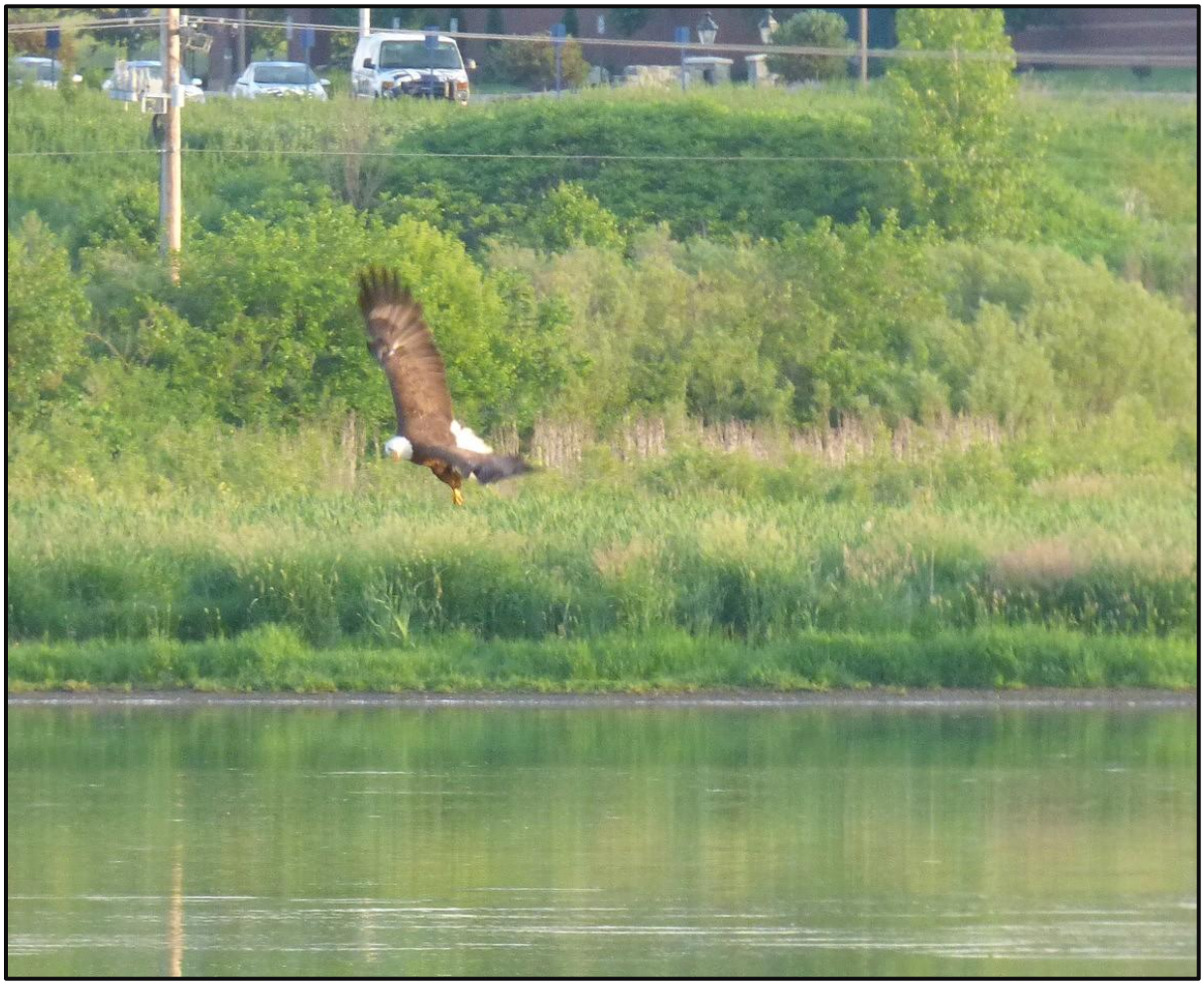
The late May - early June date for the Biodiversity Survey was ideal for detecting birds as it coincided with the beginning of peak breeding activity. Nevertheless, a noteworthy number of species found were birds still migrating, using the site only for foraging or resting, or non-breeding individuals. Birds were identified by sight or by song or call note. Consequently, the survey is not limited to territorial or singing males, but this demographic constitutes the majority of the records. In an attempt to capture as much baseline data as possible in this two-day survey, team members counted individual birds and noted any specific breeding activity by species. Bird diversity was found to be high with a total of 88 species observed on or flying over the property.

Birds at Eagle Marsh benefit from a mixture of habitats and the presence of additional suitable habitat at the adjacent Fox Island County Park. In particular, wetland- and shrubby field-dependent or associated species greatly benefit from restoration efforts and were found in robust numbers. These species include Wood Duck, Great Blue Heron, and Marsh Wren (wetland species) and Willow Flycatcher, Gray Catbird, Common Yellowthroat, Yellow Warbler, and Song Sparrow (grassland and shrubby field species). The Barred Owl heard calling is a new species for the property.

Of the 88 species detected, approximately 75 percent are presumed to be nesting at Eagle Marsh. The elevated percentage of nonbreeding species to total species is an indication that birds find the site attractive as a migratory stopover location and, for birds that nest near the site, as foraging grounds. A majority of the nonbreeding species found, including members of the duck, heron, and shorebird families, are wetland-associated species. The attractiveness of Eagle Marsh to migrating birds and individuals nesting off the property is presumed to be a lack of similar large palustrine wetland sites in northeast Indiana and northwest Ohio.

Six state listed species were detected. State listed endangered species were Black-crowned Night Heron, Black Tern, and Marsh Wren, while species of special concern were Great Egret, Bald Eagle, and Common Nighthawk. Of the six species, only Marsh Wren is believed to be breeding on the site, although a pair of Bald Eagles nests just off the property. Virtually all 14 Marsh Wrens detected were singing males, indicating that Eagle Marsh is an important breeding location for the species in Indiana.

For additional information reported by the Bird Team, see the Excel File named "Bird Team 2014 Eagle Marsh BioBlitz" on the Indiana Academy of Science Webpage [under Events, then BioBlitz Archive]. The IAS webpage can be reached at **http://www.indianaacademyofscience.org**.



Adult Bald Eagle at dawn on June 1, 2014. (Photo by Don Gorney)

Shallow wetland providing habitat for many different bird species. (Photo by Don Gorney)

Killdeer at its nest. (Photo by Don Gorney)

List of fish species (31 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Brant Fisher

Team Members: Doug Keller, JoAnne Davis, Bob Gillespie, Kathryn Sanders, Tyler Wood

Table 2A: Families listed by order, scientific name, and common name of fish species observed during the Eagle Marsh BioBlitz.

Family (listed by orders)	Scientific Name	Common Name
Order Amiiformes		
AMIIDAE	*Amia calva*	Bowfin
Order Cypriniformes		
CYPRINIDAE	*Campostoma anomalum*	Central Stoneroller
	*Carassius auratus**	Goldfish
	Cyprinella spiloptera	Spotfin Shiner
	*Cyprinus carpio**	Common Carp
	Luxilus cornutus	Common Shiner
	Lythrurus umbratilis	Redfin Shiner
	Notemigonus crysoleucas	Golden Shiner
	Notropis buccatus	Silverjaw Minnow
	Notropis stramineus	Sand Shiner
	Pimephales notatus	Bluntnose Minnow
	Pimephales promelas	Fathead Minnow
	Rhinichthys atratulus	Blacknose Dace
	Semotilus atromaculatus	Creek Chub
CATOSTOMIDAE	*Catostomus commersonii*	White Sucker
	Minytrema melanops	Spotted Sucker
Order Siluriformes		
ICTALURIDAE	*Ameiurus melas*	Black Bullhead
	Ameiurus natalis	Yellow Bullhead
	Noturus gyrinus	Tadpole Madtom
Order Esociformes		
ESOCIDAE	*Esox americanus*	Redfin Pickerel
	Umbra limi	Central Mudminnow
Order Cyprinodontiformes		
FUNDULIDAE	*Fundulus notatus*	Blackstripe Topminnow
Order Perciformes		
CENTRARCHIDAE	*Lepomis cyanellus*	Green Sunfish
	Lepomis gibbosus	Pumpkinseed
	Lepomis macrochirus	Bluegill

	Lepomis megalotis	Longear Sunfish
	Micropterus salmoides	Largemouth Bass
	Pomoxis nigromaculatus	Black Crappie
PERCIDAE	*Etheostoma blennioides*	Greenside Darter
	Etheostoma nigrum	Johnny Darter
	Etheostoma spectabile	Orangethroat Darter

*** = non-native**

Table 2B: List of the number of sites a fish species occurred (horizontal rows) and the number of fish species occurring at each site (vertical columns). All sampling occurred on 31 May 2014.

List of Sites/Locations:

1. Graham McCulloch Ditch: at the foot bridge, southeast Management Unit B.
2. Wetland: at southeast corner of Eagle Marsh Management Unit B.
3. Graham McCulloch Ditch: at Eagle Marsh Trail Bridge (northwest corner of Management Unit I).
4. Graham McCulloch Ditch: at bend between Eagle Marsh Management Units I and D.
5. Wetland: at northeast corner of Eagle Marsh Management Unit D.
6. Wetland: at northwest corner of Eagle Marsh Management Unit F.
7. Wetland: along Engle Road (north boundary eagle Marsh Management Unit E).

Scientific Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total Sites**
Amia calva						X	X	2
Campostoma anomalum			X					1
Carassius auratus	X	X			X			3
Cyprinella spiloptera	X		X	X				3
Cyprinus carpio	X			X			X	3
Luxilus cornutus			X	X				2
Lythrurus umbratilis	X		X	X				3
Notemigonus crysoleucas	X							1
Notropis buccatus			X					1
Notropis stramineus			X					1
Pimephales notatus	X		X	X				3
Pimephales promelas	X		X	X				3
Rhinichthys atratulus			X					1
Semotilus atromaculatus	X		X	X				3
Catostomus commersonii	X		X	X				3
Minytrema melanops	X							1
Ameiurus melas	X	X	X	X	X	X	X	7
Ameiurus natalis	X		X	X				3
Noturus gyrinus	X		X	X				3

Esox americanus							X	1
Umbra limi				X	X	X	X	4
Fundulus notatus	X		X	X				3
Lepomis cyanellus	X	X	X	X				4
Lepomis gibbosus				X				1
Lepomis macrochirus	X		X	X				3
Lepomis megalotis	X		X	X				3
Micropterus salmoides			X					1
Pomoxis nigromaculatus			X					1
Etheostoma blennioides			X					1
Etheostoma nigrum			X					1
Etheostoma spectabile			X					1
TOTAL SPECIES PER SITE =	**17**	**3**	**23**	**17**	**3**	**3**	**5**	

Collecting Methods, Effort, and Location

See Table 2B above for the list of sites/locations where sampling occurred. Sampling method for fish was as follows: Locations 2 and 7, seine net only; Locations 5 and 6; backpack electrofishing; Locations 1, 3, and 4, both electrofishing and seine net.

Summary Overview

Thirty-one species of fish representing eight families were recorded from the Eagle Marsh wetland preserve. Only three species, black bullhead (*Ameiurus melas*), central mudminnow (*Umbra limi*), and green sunfish (*Lepomis cyanellus*), were collected from more than three of the seven locations sampled. Two non-native species, goldfish (*Carassius auratus*) and common carp (*Cyprinus carpio*), were relatively common and reproducing, however, no Asian carp were collected. The three lotic sites sampled (in Graham McCulloch Ditch, sites 1, 3, and 4) were the most diverse with between 17 and 23 fish species found in each. Thirteen species were collected from all three lotic sites, i.e., spotfin shiner (*Cyprinella spiloptera*), redfin shiner (*Lythrurus umbratilis*), bluntnose minnow (*Pimephales notatus*), fathead minnow (*P. promelas*), creek chub (*Semotilus atromaculatus*), white sucker (*Catostomus commersonii*), black bullhead, yellow bullhead (*Ameiurus natalis*), blackstripe topminnow (*Fundulus notatus*), tadpole madtom (*Noturus gyrinus*), green sunfish, bluegill (*Lepomis macrochirus*), and longear sunfish (*L. megalotis*). These taxa are typical of small streams/ditches in northeast Indiana. The wetland sites sampled had low diversity (3-5 species) and were dominated by young-of-the-year individuals of the species found. Two species, bowfin (*Amia calva*) and redfin pickerel (*Esox americanus*), were only collected from the wetland sites, but also likely inhabit the lotic sites of Eagle Marsh. No state/federal endangered or special concern fish species were collected.

Bowfin (*Amia calva*). (Photo by Brant Fisher)

Goldfish (*Carassius auratus*), non-native. (Photo by Brant Fisher)

Green Sunfish (*Lepomis cyanellus*). (Photo by Brant Fisher)

Tadpole Madtom (*Noturus gyrinus*). (Photo by Brant Fisher)

Johnny Darter, female (*Etheostoma nigrum*). (Photo by Brant Fisher)

Spotfin Shiner (*Cyprinella spiloptera*). (Photo by Brant Fisher)

Central Mudminnow (*Umbra limi*). (Photo by Brant Fisher)

List of herpetofauna [amphibians and reptiles] (15 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Dr. Mark A. Jordan and Dr. Bruce A. Kingsbury

Team Members: Kevin Bonera, Bob Brodman, Mike Finkler, Anna Schultz-Finkler, Matt Schultz-Finkler, Jim Greer, Megan Gromhofer, Nathan Herbert, Liz Hincks, Joni Holde, Collin Holde, Dillon Holde, Tiffany Holmes, Anders Johnson, Payton Kellenburger, Grace Kepple, Jackie Kepple, Gia Martinez-Lopez, Jarrett Lortie, Vickie Lortie, Anastasia Marsh, Hanna Van Meter, DJ Mumaw, Tim Rice, Karen Nesius Roeger, Mike Roeger, Pete Roeger, Emily Stulik, Nancy Torkeo, Victoria Wesolowski, Andrew Wiedemier, Mike Wiedemier

Table 3: Herpetofauna.

Species	Larval/Metamorph #	Count	Management Unit
Reptiles			
Apalone spinifera	Not applicable	1	B
Chrysemys picta	Not applicable	3	B, C, F
*Emydoidea blandigii**	Not applicable	2	Site withheld
Nerodia sipedon	Not applicable	1	F
Thamnophis sirtalis	Not applicable	6	E, F, I
Amphibians			
Ambystoma texanum	2	0	F
Ambystoma tigrinum	4	0	F
Unisexual *Ambystoma*	7	0	F
Anaxyrus americanus	>50	2	A, B, C, E, F, I
Hyla veriscolor	1	0	F
Lithobates catesbeianus	2	3	B, D, E, F
Lithobates clamitans	1	2	D, F
Lithobates pipiens#	>50	9	A, B, C, E, F, I
Pseudacris crucifer	1	0	C
Pseudacris triseriata	1	0	F
TOTAL	**> 119**	**29**	**None in G, H**

*** = state endangered species**
 # = state species of special concern

Species List

All nomenclature for scientific and common names follows:

Crother et al. 2012. Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in our Understanding. Herpetological Circular No. 39 Society for the Study of Amphibians and Reptiles (http://www.ssarherps.org/pdf/HC_39_7thEd.pdf)

One taxonomic issue in the list is that there is a unisexual population of *Ambystoma* found at the site. Such populations most often contain polyploid genomes of at least two species, Blue-spotted Salamander (*A. laterale*) and Jefferson Salamander (*A. jeffersonianum*), and often others (*A. texanum* and *A. tigrinum*). Recent work has confirmed that the population at Eagle Marsh is polyploid, most frequently consisting of triploids with genomes of *A. laterale, A. jeffersonianum,* and *A. texanum* (Ryan Hunt and Mark Jordan, unpublished data). In the list we refer to these individuals as Unisexual *Ambystoma*.

Collecting Methods & Effort

A range of methods were used in the survey. Visual encounter was used in both terrestrial and wetland habitats primarily from 10:00 am – 12:00 pm on May 31 and June 1 resulting in approximately 48 person-hours involving 34 volunteers. Minnow traps (18 trap-nights) and dip nets were employed in ephemeral wetlands and the Graham McCulloch Ditch mainly to target larval amphibians. Calls made by anurans were also used to identify species presence. Baited hoop nets (12 trap-nights) were placed in selected wetland habitats to sample turtles. Finally, three drift fences with pitfall traps were opened in the forest to sample adult amphibians (6 trap-nights).

Voucher Specimens

No specimens were collected. Photo vouchers are available from Bob Brodman, St. Joseph College (bobb@saintjoe.edu), or Mark Jordan, IPFW (jordanma@ipfw.edu).

Special Interest Species

The most noteworthy observation was the capture of one male and one female Blanding's Turtle (*Emydoidea blandingii*). The species is state endangered in Indiana, in addition to being endangered or threatened throughout much of its geographic range. The last documented observation of this species in Allen County was made in the 1970s.

Additionally, we report two important observations of amphibian species with the designation of Special Concern. The Northern Leopard Frog (*Lithobates pipiens*) was abundant in our survey and was found in a wide range of habitats. In contrast, Blue-spotted Salamander (*Ambystoma laterale*) is likely to be absent based on the discussion above concerning unisexual, polyploid *Ambystoma*.

Summary Overview

The Herp Team, a group that included 34 volunteers, observed a total of 15 species and at least 119 individuals in a survey that encompassed aquatic and terrestrial habitats representative of Eagle Marsh. Amphibians were more

diverse (n = 10) than reptiles (n = 5), and the eastern side of the property appeared to have more species overall. A highlight of the survey was the capture of two Blanding's turtles (*Emydoidea blandingii*), a state endangered species that is also in decline across much of its geographic range. Further work will need to be done to determine whether these adults are part of a breeding population. Another important observation that reinforces knowledge of the site is that the Northern Leopard Frog (*Lithobates pipiens*), a species of special concern in Indiana, was very abundant and found in most habitats across the property.

Male and female Blanding's Turtle (*Emydoidea blandingii*) held by Betsy Yankowiak, LRWP.
The Blanding's Turtle is a state endangered species.

Spiny Softshell (*Apalone spinifera*). Photo by Bob Brodman.

Northern Leopard Frog (*Lithobates pipiens*). Photo by Bob Brodman.

List of mammal species (5 small mammals + 16 other mammal taxa) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: John Whitaker Jr.

Team Members: Angie Chamberlain

Table 4A: Small mammals.

Scientific Name	Common Name	Total
Microtus pennsylvanicus	Meadow vole	**16**
Peromyscus leucopus	White-footed mouse	**13**
Blarina brevicauda	Northern short-tailed shrew	**5**
Sorex cinereus	Masked shrew	**5**
Zapus hudsonius	Meadow jumping mouse	**2**
TOTAL =		**41**

Table 4B: Other mammals observed or on record - Eagle Marsh

Scientific Name	Common Name
Myotis sp.	Bats
Didelphis virginiana	Opossum
Tamias striatus	Eastern chipmunk
Marmota monax	Woodchuck
Sciurus niger	Fox Squirrel
Castor canadensis	Beaver
Ondatra zibethicus	Muskrat
Canis latrans	Coyote
Vulpes vulpes	Red fox
Procyon lotor	Raccoon
Mustela vison	Mink
Mephitis mephitis	Striped skunk
Odocoileus virginianus	White-tailed deer
Sylvilagus floridanus	Cottontail
Scalopus aquaticus	Eastern mole
Lutra canadensis	River otter

Collecting Methods, Effort, and Location

Snap-trap lines were set up - ~50 traps/line - over 20 locations with the Eagle Marsh property. Our survey consisted of approximately 100 hours of effort calculated based on two team members working five 10-hour days. We set trap lines within the following habitats: brushy field, weedy field, grassy field, marsh, wet prairie, pond edge, woods, and burned prairie.

Summary Overview

We concentrated on small mammals, but only five species (top table above) were taken during the biodiversity survey at Eagle Marsh; this was probably because up until ~2005 most of the land was farmland. There may be other species present that we did not capture but it is likely that the five species taken are the most common which occur on the property. It is likely that these five were present before Eagle Marsh was formed.

The meadow vole is most commonly found in lush grassy cover and was the most common species taken at Eagle Marsh. It was most abundant in burned prairie, followed by pond edge, wet prairie, and brushy field - all had goodly amounts of cover. The burned prairie would normally provide heavy cover but during this study the cover was much less due to a recent burn of the area.

The white-footed mouse is normally most abundant in woods and brushy field near woods. Only three were taken in woods, but there was only one trap line set out in a wooded area during the study, whereas there were six trap lines in brushy field habitat.

The short-tailed shrew is most common in woods, but is found in many habitat types. In this case three were found in woods and two were captured in other habitats.

Masked shrews are found in most areas. During this study three were captured in wet prairie and another along the edge of a pond.

Meadow jumping mice are found in grassy fields and in this case both were found in that habitat - one of them along a pond's edge.

List of beetle (Coleoptera) species (64 taxa) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Jeffrey D. Holland

Team Members: R. Michael Brattain, Gareth Powell, Ashley Kissick, and Julie Speelman

Table 5: Beetle (Coleoptera) species.

Species [Listed by Family]	Common Name	Non-native
ANTHICIDAE		
Malporus formicarius (Chandler)	an antlike flower beetle	
CANTHERIDAE		
Atalantycha neglecta (Fall)	a soldier beetle	
Podobrus tomentosus (Say)	a soldier beetle	
CARABIDAE		
Badister neopulchellus Lindroth	a ground beetle	
Poecilus chalcites (Say)	a ground beetle	
Scarites sp.	a ground beetle	
CERAMBYCIDAE		
Clytus ruricola (Olivier)	a longicorn beetle	
Neoclytus acuminatus acuminatus (Fabricius)	red-headed ash borer	
Phymatodes amoenus (Say)	a longicorn beetle	
Psenocerus supernotatus (Say)	currant-tip borer	
Saperda puncticollis Say	woodbine borer	
Stenocorus cinnamopterus (Randall)	a longicorn beetle	
Stenocorus cylindricollis (Say)	a longicorn beetle	
CHRYSOMELIDAE		
Cassida rubiginosa Muller	thistle tortoise beetle	
Disonycha procera Casey	a flea beetle	
Labidomera clivicollis (Kirby)	swamp milkweed beetle	
Paria sp.	a leaf beetle	
CLERIDAE		
Cymatodera bicolor (Say)	a checkered beetle	
Enoclerus n. nigripes (Say)	a checkered beetle	
Enoclerus rosmarus (Say)	a checkered beetle	
Zenodosus sanguineus (Say)	a checkered beetle	
COCCINELLIDAE		
Chilocorus stigma (Say)	twice-stabbed lady beetle	
Coleomegilla maculata DeGeer	spotted lady beetle	
Harmonia axyridis (Pallas)	Asian ladybird	Yes
Propylea quatuordecimpunctata (Linnaeus)	fourteen-spotted lady beetle	
Psyllobora vigintimaculata (Say)	twenty-spotted lady beetle	

CURCULIONIDAE

Corthylus columbianus Hopkins	Columbian timber beetle	
Euwallacea validus (Eichhoff)	a bark beetle	Yes
Hylastes tenuis Eichhoff	a bark beetle	
Lixus concavus Say	rhubarb curculio	
Rhyssomatus lineaticollis Say	milkweed stem weevil	
Sphenophorus australis Chittenden	a billbug	
Stenoscelis brevis (Boheman)	a bark beetle	
Xyleborinus saxeseni (Ratzeburg)	fruit-tree pinhole borer	Yes
Xylosandrus germanus (Blandford)	alnus ambrosia beetle	Yes
Xylosandrus crassiusculus (Motschulsky)	Asian ambrosia beetle	Yes

DERMESTIDAE

Dermestes caninus Germar	a carpet beetle

ELATRIDAE

Aeolus mellillus (Say)	a click beetle
Alaus oculatus (Linnaeus)	eyed click beetle
Ampedus nigricollis (Herbst)	a click beetle
Ampedus sellatus (Dejean)	a click beetle
Ampedus areolatus (Say)	a click beetle
Ampedus sanguinipennis (Say)	a click beetle
Melanotus sp.	a click beetle

EROTILIDAE

Dacne quadrimaculata (Say)	a pleasing fungus beetle
Languria mozardi Latrielle	clover stem borer
Triplax flavicollis Lacordaire	a pleasing fungus beetle

EUCNEMIDAE

Isorhipis obliqua (Say)	a false click beetle
Isorhipis ruficornis (Say)	a false click beetle

HISTERIDAE

Hololepta aequalis Say	a clown beetle
Platysoma leconti Marseul	a clown beetle
Platysoma aurelianum (Horn)	a clown beetle

LAMPYRIDAE

Ellychnia corrusca (Linnaeus)	diurnal firefly

MYCETOPHAGIDAE

Litagrus balteatus LeConte	stored grain fungus beetle
Mycetophagus flexuosus Say	a hairy fungus beetle

NITIDULIDAE

Carpophilus sayi Parsons	a sap beetle
Epuraea rufa (Say)	a sap beetle
Omosita colon (Linnaeus)	a sap beetle

PTINIDAE

Trichodesma gibbosa (Say)	a death-watch beetle

SCARABIDAE

Onthophagus hecate (Panzer)	scooped scarab
Phyllophaga sp.	a may beetle

STAPHYLINIDAE

Acidota subcarinata Erichson	an ocellate rove beetle

SYNCHROIDAE

Synchroa punctata Newman	a synchroa bark beetle

TETRATOMIDAE

Holostrophus bifasciatus (Say)	a polypore fungus beetle

Collecting Methods & Effort

Most of the collecting took place on-site during the BioBlitz event. To supplement this however, we set out several traps two weeks before the event and collected insects from these traps during the event. The traps consisted of: two multiple-funnel Lindgren traps, two Intercept panel traps, two window traps, 2 purple sticky traps, and two pitfall traps. The pitfall traps were baited with dung and placed at the periphery of the parking area, while the other traps were spaced along the main trails through the wooded areas. The Lindgren, Intercept, and window traps were baited with ethanol, while the purple sticky traps were left unbaited.

During the BioBlitz, we hand collected and used sweepnets to capture beetles from vegetation in all areas of Eagle Marsh. During one evening of the event we ran several lights to attract beetles and hand collected these from sheets placed under the lights. These lights were placed around the periphery of the pole barn that served as the base of operations for the BioBlitz. The lights consisted of two 1000 W metal halide lights, one 175 W mercury vapor light, and 4 UV lights. We operated these and collected around them for approximately 5 hours. The mercury vapor light ran continuously until dawn with a collecting bucket under it to capture beetles.

The sampling effort was approximately:

5 trap types x 2 traps/type x 2 weeks = 20 trap-weeks

20 person-hours of hand/sweepnet collecting

5–15 people x 5 hours of lighting = 50 person-hours of lighting

Special Interest Species

Most of the species collected were similar to what could be found in other semi-natural areas in the State of Indiana. The most charismatic species found was the beautiful eyed click beetle *Alaus oculatus*. This strikingly-marked black and white beetle can approach two inches long, and has large false eye spots on the prothorax.

Voucher Specimens

Representatives of all species collected, including some not yet identified as of this writing, have been accessioned into the Purdue Entomological Research Collection in the Department of Entomology, Purdue University, West Lafayette, Indiana.

Summary Overview

The number of species of beetles collected at Eagle Marsh was lower than first predicted during the event, with many representatives of the same species. With most species collected at night with lights, this is not surprising in hindsight because the lighting area was effectively an island of dry ground surrounded by marsh. Therefore we collected from a small patch of dry ground, while the more abundant aquatic beetles were dominated by a few species. The wooded areas did contain a rich diversity of longicorn beetles (Col.: Cerambycidae; 7 spp.) and bark beetles (Col.: Scolytinae; 7 spp.) for a rapid survey, although these mostly came from the traps left for two weeks. As with any rapid survey however, these species will represent a small proportion of the total beetle fauna of Eagle Marsh. We did not find any rare species. Some very charismatic beetles are present at the marsh, including the eyed click beetle *Alaus oculatus* and a lizard beetle, the clover stem borer *Languria mozardi*. While we found five species of exotic beetles, one exotic lady beetle, and four exotic bark/ambrosia beetles, none of these were unusual or emerging threats.

The beetle team collecting specimens beneath one of the insect lights, the set closest to the barn door on the parking lot side. (Photo by Carl Strang)

Insects attracted to a mercury vapor light during the Eagle Marsh BioBlitz. (Photograph by Jason Kolenda)

Alaus oculatus, the eyed elater, a large and charismatic species of click beetle found during the Eagle Marsh BioBlitz. (Photograph by Jeff Holland)

Midnight collecting—beetles are attracted to a 1000 W metal halide light during the Eagle Marsh BioBlitz. (Photograph by Jason Kolenda)

List of adult butterfly species (18 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Kirk Roth

Team Member: Don Gorney

Table 6: Adult butterfly species.

Species	Common Name	Count	Management Unit
Epargyrius clarus	Silver-spotted Skipper	1	F
Ancyloxypha numitor	Least Skipper	15	B,C,D,E,G,I
Polites peckius	Peck's Skipper	13	A,B,C,D,E,F,G,H,I
Polites themistocles	Tawny-edged Skipper	9	B,C,E,F,I
Pompeius verna	Little Glassywing	1	G
Papilio polyxenes	Black Swallowtail	3	C,I
Papilio glaucous	Eastern Tiger Swallowtail	1	E
Papilio troilus	Spicebush Swallowtail	1	C
Colias philodice	Clouded Sulphur	3	C,E,I
Colias eurytheme	Orange Sulphur	1	B
Pieris rapae	Cabbage White	5	B,C,I
Lycaena hyllus	Bronze Copper	12	C,D,E,F,G,I
Danaus plexippus	Monarch	3	E,F
Limenitis archippus	Viceroy	4	A,C,E,I
Vanessa cardui	Painted Lady	2	D,I
Vanessa atalanta	Red Admiral	2	B,F
Polygonia comma	Eastern Comma	1	F
Phyciodes tharos	Pearl Crescent	3	E,I
TOTAL =		**279**	

Species List

A total of 80 butterflies of 18 species were detected during the BioBlitz. The most abundant species was the Least Skipper (*Ancyloxypha numitor*) with 15 individuals seen, followed by Peck's Skipper (*Polites peckius*) with 13 individuals seen. These species contributed heavily to the total number of grass skipper (subfamily *Hesperiinae*) species observed, which represented 47.5% of the adult butterfly observations.

Collecting Methods & Effort and Voucher Specimens

Approximately 12 person-hours of observation time were spent on May 31 and June 1, 2014 to document total number of individual butterflies detected. The time was sufficient to survey all Eagle Marsh Management Units, although more time was afforded to areas with blooming flowers and/or more butterfly activity. No specimens were collected, but photographs were taken when possible. When necessary, observations were made with 8x42 power binoculars and identifications confirmed in the field using Belth (2013).

Summary Overview

At the time of the BioBlitz, few high quality nectar sources, such as milkweeds (*Asclepias* spp.), Mountain-mint (*Pycnanthemum* spp.), Wild Bergamot (*Monarda fistulosa*), Purple Coneflower (*Echinacea purpurea*) and others, were noted to be in bloom, although some of these (especially milkweed) were common. When in bloom, these sorts of plants are attractive to larger species of butterfly. Instead, most nectaring butterflies were found feeding on Dame's Rocket (*Hesperis matronalis*) and Butterweed (*Packera glabra*), and those were almost exclusively grass skippers, with the exception of two Bronze Coppers (*Lycaena hyllus*). The types of nectar sources available during the dates of the BioBlitz may account for the relative abundance of skipper observations over other types of butterflies. Cabbage Whites (*Pieris rapae*) and some grass skippers were noted on White Clover (*Trifolium repens*) and a Red Admiral (*Vanessa atalanta*) was seen nectaring on willow (*Salix* sp.) blooms. Though Red Clover (*Trifolium pretense*) was blooming in several areas, the only butterfly species seen nectaring on it was Peck's Skipper.

Bronze Copper was the third most abundant species with 12 observations. In Indiana, this species is restricted to wetland habitats and uses dock (*Rumex* spp.) as a host plant (Belth 2013, Shull 1987). The Bronze Coppers were widely distributed throughout Eagle Marsh however, there were clusters of individuals in Management Unit I near the Engle Road Trailhead and in Unit F south of the barn adjacent to a long pond. Copulation was noted on the grasses bordering this same pond in Unit F at 5:35 p.m., May 31. Shull (1987) remarked that he had found three pairs *in copula* in Indiana in June, July, and September. All of Shull's records were in Wabash County among Blue Flag (*Iris versicolor*) during afternoon hours.

One Monarch (*Danaus plexippus*) egg was found on a milkweed. The single Eastern Tiger Swallowtail (*Papilio glaucous*) observation was of a dark form female. Observations of Peck's Skippers were scrutinized and photographed whenever possible for similar, rarer species, such as Indian Skipper (*Hesperia sassacus*), Leonard's Skipper (*Hesperia leonardus*), or Long Dash (*Polites mystic*), but none of these species were detected.

References

Belth, Jeffrey E., 2013. *Butterflies of Indiana – A Field Guide*. Bloomington and Indianapolis, IN: Indiana University Press, 323 pp.

Shull, Ernest M., 1987. *The Butterflies of Indiana*. Indianapolis, IN: Indiana Academy of Science, 262 pp.

Bronze Copper Male, *Lycaena hyllus*. (Photo by Kirk Roth)

Bronze Coppers copulating on Reed Canary Grass, *Phalaris arundinacea*. (Photo by Kirk Roth)

Tawny-edged Skipper, *Polites Themistocles*, nectaring on Dame's Rocket, *Hesperis matronalis*.
(Photo by Kirk Roth)

List of Dragonflies and Damselflies species (Odonata) (12 taxa) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Paul McMurray

Team Members: None

Table 7: Dragonfly and damselfly species (Odonata).

Family	Genus/Species	Common Name	Zone 1	Zone 2	Zone 3
Dragonflies (Order Anisoptera)					
Aeshnidae					
	Anax junius (Drury)	Common Green Darner	#	#	#
Libellulidae					
	Erythemis simplicicollis (Say)	Eastern Pondhawk		1f	
	Libellula pulchella Drury	12-Spotted Skimmer		1m, 2f	1f
	Pachydiplax longipennis (Burmeister)	Blue Dasher	2m	1m	1m
	Plathemis lyida (Drury)	Common Whitetail		#	#
	Tramea spp.	Saddlebag species		#	#
Damselflies (Order Zygoptera)					
Lestidae					
	Lestes dryas Kirby	Emerald Sweetflag			1m, 2f
	Lestes rectangularis Say	Slender Spreadwing	1m	3m, 1f	
Coenagrionidae					
	Enallagma exsulans (Hagen)	Stream Bluet	3f		
	Ischnura hastata (Say) *	Citrine Forktail		1m	
	Ischnura posita (Hagen)	Fragile Forktail	2m		
	Ischnura verticalis (Say)	Eastern Forktail	3m, 2f	1m, 1f	1m, 1f
TOTAL = 32 =			**13**	**12**	**7**

NOTE: Specimens were identified to lowest practical taxon by use of standard texts (see references below).

*** = New record for Allen County, Indiana**

 # = Voucher specimen not collected

m = male; f = female

Collecting Methods & Effort and Voucher Specimens

Adult Odonata (Dragonflies and Damselflies) were collected from within the boundaries of Eagle Marsh for about 5 hours on June 1, 2014. Odonates were collected with a large aerial net, placed into glassine envelopes and submerged in acetone for 24 hours, air dried and placed into clear polypropylene envelopes with a card listing

locality information. All specimens were identified using regional texts such as Curry (2001), Glotzhober and McShaffrey (2002) and Lam (2004). Representative voucher specimens of adult Odonata will be deposited with the Purdue Entomological Research Collections.

Three distinct zones within the boundaries of Eagle Marsh were sampled. Zone 1 consisted of lotic habitat within a stretch of Graham McCulloch Ditch extending from 200 meters downstream of the carp fence barrier to about 100 meters upstream of the carp fence barrier; substrate within the stream was mostly composed of sand and silt. Zone 2 was located from east of the carp fence barrier to the Eagle Marsh barn. This area consisted of sedge meadows with small trees and shrubs that transitioned into a marshy – open water with emergent vegetation such as cattails. Zone 3 was located northeast of the Eagle Marsh barn and consisted primarily of the margins of an open water marsh with thick stands of cattails and forested wetlands.

Summary Overview

Most of the 12 odonate species observed at Eagle March were common species with distributions across northern Indiana. However, the damselfly *Ischnura hastata* (Odonata Central Record # 428032) was a new record for Allen County in which 77 species are currently recorded (Abbot 2007). *Ischnura hastata* has been previously recorded in adjacent Wells County, Indiana and Paulding County, Ohio and is widely distributed across eastern North America (Abbot 2007).

References

Abbott, J. C. 2007. OdonataCentral: An online resource for the distribution and identification of Odonata. Texas Natural Science Center, The University of Texas at Austin. Available at http://www.odonatacentral.org. (Accessed: July 10, 2014).

Curry, J. R. 2001. Dragonflies of Indiana. Indiana Academy of Sciences, Indianapolis, Indiana. 303 pp.

Glotzhober, R. C. & D. McShaffrey. 2002. The Dragonflies and Damselflies of Ohio. Bulletin of the Ohio Biological Survey, New Series 14:1-364.

Lam, E. 2004. Damselflies of the Northeast. A Guide to the Species of Eastern Canada and the Northeastern United States. Biodiversity Books. 96 pp.

List of singing insect species (3 species) [plus other insects incidentally noticed (10 species)] observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Carl Strang

Team Members: Alyssa Heath, Beth Keuneke, Jason Kolenda, Glene Mynhardt, Maureen Reidenbach, Pat Reidenbach, Joe Schetter, Don Ruch

Table 8: Singing insects.

Scientific Name	Common Name	Habitat	Abundance
Singing Insects, Order Orthoptera			
Family Gryllidae			
Gryllus veletis	Spring Field Cricket	Dry Area	Common
Family Tettigoniidae			
Metrioptera roesellii	Roesel's Katydid	Dry Grassy Site	1 known Group
Family Acrididae			
Chortophaga viridifasciata	Green-winged Grasshopper	Dry Grassy Sites	Common
Other Insects Incidentally Observed, Order Odonata			
Family Aeshnidae			
Anax junius	Common Green Darner		
Family Coenagrionidae			
Ischnura verticalis	Eastern Forktail		
Family Corduliidae			
Epitheca cynosura	Common Baskettail		
Family Libellulidae			
Erythemis simplicicollis	Common Pondhawk		
Libellula pulchella	Twelve-spotted Skimmer		
Pachydiplax longipennis	Blue Dasher		
Plathemis lydia	Common Whitetail		
Tramea carolina	Carolina Saddlebags		
Tramea lacerata	Black Saddlebags		
Order Hymenoptera			
Family Apidae			
Apis mellifera	[European] Honeybee		

Methods

Team members walked the trails most likely to produce singing insects at this early point in the season. We listened, and also looked for immature stages of species approaching maturity but not yet singing. The total effort was 41 person-hours.

Voucher Specimen

No voucher specimens were taken.

Summary Overview

The BioBlitz date was early in the season for singing insects. We found all three of the common, widespread species that were likely to be found. Other possible species are much less common, and may or may not occur at the site. Green-striped grasshoppers (*Chortophaga vitripennis*) were common in all non-wetland grassy habitats. Spring field crickets (*Gryllus veletis*) were common in the railroad right-of-way and in drier habitats within easy dispersal distance from that right-of-way. The railroad bed is the likely oviposition site for this cricket, which avoids the wetlands and woodlands that dominate the Eagle Marsh site. The third species, Roesel's katydid (*Metrioptera roeselii*), was approaching maturity but not yet singing. We found one cluster of nymphs, but they probably are more widespread in the site's grasslands.

Members of the singing insect team searching along the carp fence. (Photo by Carl Strang)

Roesel's katydid nymph (*Metrioptera roeselii*). (Photo by Carl Strang)

List of Sciomyzidae (i.e., snail-killing flies) species (15 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: William L. Murphy

Team Members: None

Table 9: Snail-killing flies (Sciomyzidae).

Species	Count	Location	Abundance in Indiana
Atrichomelina pubera (Loew)*	1	shaded forest margin	common
Dictya borealis Curran*	7	marsh margin	common
Dictya expansa Steyskal*	17	marsh margin	abundant
Dictya pictipes (Loew)*	1	marsh margin	common
Ditaeniella parallela (Walker)*	1	marsh margin	common
Elgiva solicita (Harris) *	1	marsh margin	uncommon
Limnia boscii (Robineau-Desvoidy)*	2	grass near pond	abundant
Limnia conica Steyskal*	2	grass near pond	common
Pherbellia seticoxa Steyskal	4	wood edge	uncommon
Pherbellia similis Cresson*	4	wood edge	rare
Sepedon armipes Loew	36	marsh margins	abundant
Sepedon fuscipennis Loew	11	open marsh	abundant
Tetanocera plebeja Loew*	1	shaded forest margin	uncommon
Tetanocera plumosa Loew*	2	shaded forest margin	common
Tetanocera rotundicornis Loew*	1	shaded forest margin	rare
TOTAL	**91**		

*** = Allen County record**

Collecting Methods & Effort

Used a 12-inch-diameter sweep net. Spent about 10 hours in the field x 1 person.

Voucher Specimens

Specimens will be deposited in the National Insect Collection, Smithsonian Institution, Washington, DC

Summary Overview

Sciomyzid flies.—Ninety-one individuals of 15 species of Sciomyzidae (snail-killing flies) were found [See table above]. Eagle Marsh clearly is a paradise for snail-killing flies. It offers suitable habitat that ranges from open

freshwater marsh (perfect for non-operculate snails such as *Lymnaea* and *Physa*) to mature deciduous woodlands (ideal for *Succinea* snails and for slugs), with extensive edge and transitional areas dominated by sedges and cattail (*Typha* spp.). Sciomyzids were plentiful in the eastern (older) part of the marsh and quite scarce in the western (newer) part. Challenges to collecting included high daytime temperatures (sciomyzids in general are cold-adapted) and thick reed canarygrass (*Phalaris arundinacea*). Canarygrass slices the cloth rim of the net, destroying it within a single day of use if it is not protected by a covering of tough duck tape. The number of species found was among the highest for any site yet sampled in Indiana, higher in fact than the total number of species found so far in 76 of Indiana's 92 counties. Twelve of the species found were new for Allen County, from which 17 sciomyzid species are now known.

A male *Sepedon armipes* Loew. It was the most abundant sciomyzid collected during the BioBlitz. It's one of the easiest sciomyzids to identify – the male has a deep notch and some peg-like protuberances on the hind femur. The fly is about 5mm long.
(Photo by Steve Marshall, Guelph, Ontario)

List of aquatic macroinvertebrate taxa (98 taxa) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Ross Carlson

Team Members: Kevin Boner, Pam George, Liz Hincks, Justin Keefer, Cindy Nestel, John Niemeyer, Andrew Weidemeier, Mike Weidemeier

Table 10: Aquatic macroinvertebrate taxa.

Family (listed by orders)	Genus	Species	Number	Location(s)[1]
Order Amphipoda				
Hyalellidae	*Hyalella*	-----	14	4
Order Arhynchobdellida				
Erpobdellidae	-----	-----	6	1, 2, 5, 7
Order Bivalvia				
Pisidiidae	*Sphaerium*	*striatinum*	1	3
Order Coleoptera				
Dytiscidae	*Agabus*	-----	1	5
Dytiscidae	*Celina*	*hubbelli*	2	5
Dytiscidae	*Coptotomus*	*loticus*	1	4
Dytiscidae	*Celina*	-----	4	2, 7
Dytiscidae	*Hydroporus*	-----	5	1, 5
Dytiscidae	*Laccophilus*	*maculosus*	2	3
Dytiscidae	*Laccophilus*	-----	8	2, 3
Elmidae	*Dubiraphia*	*quadrinotata*	6	4
Elmidae	*Dubiraphia*	-----	1	4
Haliplidae	*Peltodytes*	*duodecimpuncata*	1	5
Haliplidae	*Peltodytes*	*edentulus*	7	2, 3, 5
Haliplidae	*Peltodytes*	*sexmaculatus*	1	4
Hydrophilidae	*Berosus*	*pantherinus*	1	3
Hydrophilidae	*Berosus*	*infuscatus*	7	2, 4, 7
Hydrophilidae	*Berosus*	-----	1	2
Hydrophilidae	*Cymbiodyta*	-----	1	4
Hydrophilidae	*Helocombus*	*bifidus*	1	5
Hydrophilidae	*Hydrochus*	*neosquamifer*	2	3
Hydrophilidae	*Hydrochus*	*pseudosquamifer*	6	4
Hydrophilidae	*Helocombus*	-----	2	1
Hydrophilidae	-----	-----	3	2
Hydrophilidae	*Hydrophilinae*	*paracymus*	3	3, 4
Hydrophilidae	*Tropisternus*	*glaber*	4	4
Hydrophilidae	*Tropisternus*	*mixtus*	3	2, 3
Hydrophilidae	*Tropisternus*	-----	30	1, 2, 3, 4, 5

Order Decapoda				
Cambaridae	*Cambarus*	-----	1	1
Cambaridae	*Orconectes*	-----	10	1, 4, 5, 6, 7
Order Diptera				
Ceratopogonidae	-----	-----	1	4
Chironomidae	-----	-----	1	
Chironomidae	*Dicrotendipes*	-----	1	
Chironomidae	*Endochironomus*	-----	23	
Chironomidae	*Kiefferulus*	-----	1	
Chironomidae	*Polypedilum*	*illinoense* Group	3	
Chironomidae	*Chironomus*	-----	3	
Chironomidae	*Tanytarsini*	-----	2	
Chironomidae	*Orthocladiinae*	-----	1	
Chironomidae	*Cricotopus*	*sylvestris* Group	4	
Chironomidae	*Psectrocladius*	-----	1	
Chironomidae	*Tanypodinae*	-----	1	
Chironomidae	*Ablabesmyia*	-----	2	
Chironomidae	-----	-----	12	
Chironomidae	-----	-----	3	
Dixidae	*Dixella*	-----	1	
Sciomyzoidae	*Sepadon*	-----	15	
Simuliidae	*Simulium*	-----	5	
Stratiomyidae	*Odontomyia*/*Hedriodiscus*	-----	3	1
Order Ephemeroptera				
Baetidae	*Pseudocloeon*	-----	2	5
Caenidae	*Caenis*	*latipennis*	2	4
Ephemeridae	*Hexagenia*	-----	1	6
Heptageniidae	*Stenacron*	*interpunctatum*	3	6
Order Gastropoda				
Lymnaeidae	Stagnicola	-----	7	1, 4, 7
Physidae	Physella	-----	21	1, 2, 3, 4, 5, 7
Planorbidae	Gyraulus	-----	4	2
Planorbidae	Planorbella	-----	7	1, 6, 7
Order Heteroptera				
Gerridae	*Aquarius*	*remegis*	4	1, 2, 4

Belostomatidae	*Belostoma*	*flumineum*	2	1
Belostomatidae	-----	-----	9	1, 5
Corixidae	-----	-----	1	2
Gerridae	*Gerris*	*argenticollis*	1	1
Gerridae	*Gerris*	*aquarius*	1	7
Gerridae	-----	-----	1	2
Mesovelidae	*Mesovelia*	*mulsanti*	13	2, 7
Notonectoidae	*Neoplea*	*striola*	27	2, 4, 7
Notonectoidae	*Notonecta*	*irrorata*	2	2, 7
Veliidae	*Microvelia*	*pulchella*	1	2
Veliidae	*Microvelia*	-----	3	2, 4
Order Isopoda				
Asellidae	*Caecidotea*	-----	4	4, 5, 7
Order Megaloptera				
Corydalidae	-----	-----	1	7
Order Odonata				
Aeshnidae	*Anax*	-----	1	5
Aeshnidae	*Aeshna*	*umbrosa*	2	6
Aeshnidae	*Boyeria*	*vinosa*	4	5, 6
Aeshnidae	*Anax*	*longipes*	1	1
Calopterygidae	*Calopteryx*	*maculata*	5	6
Coenagrionidae	*Argia*	*fumipennis*	1	5
Coenagrionidae	*Argia*	*tibialis*	1	4
Coenagrionidae	*Enallagma*	*basidens*	1	6
Coenagrionidae	*Enallagma*	*divigans*	7	5, 6
Coenagrionidae	*Enallagma*	*exsulans*	1	4
Coenagrionidae	*Ischnura*	*verticalis*	9	2, 3, 6
Corduliidae	*Somatochlora*	-----	1	5
Lestidae	*Lestes*	*congener*	1	4
Lestidae	*Lestes*	-----	30	1, 2, 3, 5
Libellulidae	*Libellula*	*quadrimaculata*	1	4
Libellulidae	*Plathemis*	*lydia*	2	3
Libellulidae	*Sympetrum*	*danae*	1	1
Libellulidae	*Sympetrum*	*janae*	3	1
Order Oligochaeta				
Lumbriculidae	-----	-----	1	
Naididae	-----	-----	1	

Naididae	*Nais*	-----	1	
Naididae	*Ophidonais*	*serpentia*	1	
Tubificidae	-----	-----	3	
Tubificidae	*Quistadrilus*	*multisetosus*	1	
Order Symphypleona				
Sminthuridae	-----	-----	1	2
Order Trombidiformes				
Hydrachnidiae	-----	-----	2	2, 4
Order Veneroida				
Sphaeriidae	*Musculium*	-----	1	4

NOTE: Collected specimens were identified to lowest practical taxon by use of standard (Merritt et al. 2008, Thorp & Covich 2001) and regional (Curry 2001, Glotzhober and McShaffrey 2002) texts.

[1] Locations: Macroinvertebrates were collected from seven (7) distinct sites on the property. **Site 1**, reserve management unit E, lentic, was on trail 8 in the northeast pond along grassy and wooded riparian areas. **Site 2**, reserve management unit I &D, lentic, was split with a sample just west of the Eagle Marsh barn in the wetland to the north of the access drive, and a zone past the barn in the wetland along trail 6. **Site 3**, reserve management unit B, lentic, was in the big pond off trail 2. **Site 4**, Graham McCulloch Ditch, reserve management unit G, lentic, was collected from the streambed approximately 100 meters up and downstream from the footbridge on trail 1. **Site 5**, Graham McCulloch Ditch, reserve management unit I, lotic, was collected just upstream from the bridge as the stream enters the park on the north end. **Site 6**, Graham McCulloch Ditch, lotic, reserve management unit I, was collected just downstream of site 5, while still above the out fall of the waste water treatment plant. **Site 7**, reserve management unit I, lentic, was collected just west of the Eagle Marsh barn in the wetland on the south of the access drive.

Methods of Collection and Voucher Specimens

All macroinvertebrates recorded for the Eagle Marsh BioBlitz were collected within park boundaries on May 31st and June 1st of 2014. Collections were made at seven sites using a D Frame dip net with a mesh size of 500 micrometers. Sites represented both lotic and lentic systems and comprised a variety of habitats (i.e. pools, riffles, emergent vegetation, open water). Specimens were placed into jars of 70% isopropanol for storage. Representative voucher specimens of aquatic macroinvertebrates and will be deposited in the Purdue Entomological Research Collections.

Summary Overview

Aquatic Macroinvertebrates recorded for the Eagle Marsh BioBlitz were collected at seven sites within Eagle Marsh park boundaries using a D Frame dip net with a mesh size of 500 micrometers.

Collected specimens were identified to lowest practical taxon by use of standard texts (Merritt et al. 2008, Thorp & Covich 2001). In total 99 taxa were recorded, representing 16 classes, 43 families, and at least 67 genera. Taxa found were characteristic of aquatic wetland systems with no new or surprising species found.

References

Merritt, R. W., K. W. Cummins & M. B. Berg (eds.). 2008. An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa. xvi + 1158 pp.

Thorp, J. H. & A. P. Covich (eds). 2001. Ecology and Classification of North American Freshwater Invertebrates, second edition. Academic Press, San Diego, CA. xvi + 1056 pp.

List of freshwater mussel species (2 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Brant Fisher

Team Members: Doug Keller, JoAnne Davis, Bob Gillespie, Kathryn Sanders, Tyler Wood

Table 11A: Orders, families, scientific name, and common name of freshwater mussel species observed during the Eagle Marsh BioBlitz.

Order	Family	Scientific Name	Common Name
UNIONOIDA	UNIONIDAE	*Anodontoides ferussacianus*	Cylindrical Papershell
VENEROIDA	CORBICULIDAE	*Corbicula fluminea**	Asian Clam

* = non-native

Table 11B: List of the number of sites a freshwater mussel species occurred (horizontal rows) and the number of freshwater mussel species occurring at each site (vertical columns). WD = weathered dead shell material; FD = fresh dead shell material. All sampling occurred on 31 May 2014.

List of Sites:

1. Graham McCulloch Ditch: at the foot bridge, southeast Management Unit B.
2. Wetland: at southeast corner of Eagle Marsh Management Unit B.
3. Graham McCulloch Ditch: at Eagle Marsh Trail Bridge (northwest corner of Management Unit I).
4. Graham McCulloch Ditch: at bend between Eagle Marsh Management Units I and D.
5. Wetland: at northeast corner of Eagle Marsh Management Unit D.
6. Wetland: at northwest corner of Eagle Marsh Management Unit F.
7. Wetland: along Engle Road (north boundary eagle Marsh Management Unit E).

	Sites						
Scientific Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Anodontoides ferussacianus	--	--	WD	--	--	--	--
Corbicula fluminea	FD	--	--	--	--	--	--

Collecting Methods, Effort, and Location

Sampling method for freshwater mussels was by physical search. The seven locations are listed in Table 11B above.

Summary Overview

We found evidence of only two species of freshwater mussels from the seven locations sampled. No state/federal endangered or special concern freshwater mussel species were collected. Neither of the two species collected were found live, although the non-native Asian clam (*Corbicula fluminea*) is likely live on the property as fresh dead shell material was collected. Only weathered dead shell material was found for cylindrical papershell (*Anodontoides ferussacianus*) and it is not likely still living on the property. The low freshwater mussel diversity found on Eagle Marsh is not a surprise considering the ephemeral nature of many of the wetland habitats and the limited mussel habitat available in the lotic habitats.

List of fungal/mushroom species (31 taxa, 30 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Stephen Russell, The Hoosier Mushroom Society

Team Members: Don Ruch

Table 12: List of fungi and fungal allies.

Artomyces pyxidatus
Bjerkandera adusta
Callistosporum luteo-olivaceum
Ceratiomyxa sp.
Coprinellus dissimenatus
Coprinellus domesticus
Coprinopsis variegate
Crepidotus applanatum
Ductifera pulupuluhauna
Flammulaster erinacella
Ganoderma applanatum
Gymnoconia nitens
Irpex lacteus
Lycogala epidendrum
Lycoperdon pyriforme
Mycena haematopus
Mycena leaiana
Pleurotus pulmonarius
Pluteus cervinus
Pluteus petasatus
Polyporus arcularis
Polyporus squamosus
Polyporus badius
Rhodotus palmatus
Rhytisma acerinum
Ricknella fibula
Schizophyllum commune
Scutellinia scutellata
Trametes versicolor
Xylaria hypoxylon
Xylobolus frustulatus

Summary Overview

Early June is nearing the end of a lull in the fungal world. The spring mushrooms are coming to an end, but the summer mushrooms have yet to fruit in abundance. That being said, Management Unit F, the woodland at Eagle Marsh, provided a good species diversity for the time period. Most of the fungi reported are lignicolous, that is, wood rot fungi. Two collectors spent a total of about 6 hours on the property collecting the listed species. The majority of the species we encountered can be found commonly throughout much of the state. No specific genera were over-represented in numbers on the grounds.

Rhytisma acerinum, Tar-spot of Maple, especially *Acer saccharinum* (Sugar Maple).

Gymnoconia nitens, Orange Rust of Blackberry. (Photo by OMAFRA Staff, ag.info.omafra@ontario.ca).

Artomyces pyxidatus, Crown-tipped Coral Mushroom. (Photo by Laurent Francini at http://www.francini-mycologie.fr/MYCOLOGIE/LES_AUTRES_CHAMPIGNONS/Artomyces_pyxidatus.html)

Xylobolus frustulatus, Ceramic Parchment fungus. (Source unknown)

List of vascular plant species (320 species) observed during the Eagle Marsh Biodiversity Survey, May 31 through June 1, 2014.

Team Leader: Paul Rothrock

Team Members: Curt Burnett, Ben Blocher, Willy De Smet, Brett Fisher, Tony Fleming, Deb Guibard, Nick Harby, Alice Heikens, Ben Hess, Collin Hobbs, Ellen Jacquart, Amber Kimmel, Abigail Lima, Jordan Marshall, Scott Namestnik, Don Ruch, Cheryl Shearer, John Taylor, Adam Thada, Sandra Vance, Louise Weber.

List of Tables:

Table 13A: List of plant species and their common name for all species reported in Management Units A, B, C, D, E, G, H, I. Management Units are based upon the map entitled: "Natural Communities of Eagle Marsh - First Approximation" by Don Cunningham, Tony Fleming, and Betsy Yankowiak 2014 [see maps section]. Non-native vascular plant species are indicated by all CAPITAL letters.

Scientific Name	Common Name
ABUTILON THEOPHRASTI	Velvet Leaf
Acalypha rhomboidea	Three-seed Mercury
Acer negundo	Boxelder
Acer rubrum var. *rubrum*	Red Maple
Acer saccharinum	Silver Maple
Achillea millefolium	Common Milfoil
Alisma subcordatum	Common Water Plantain
ALLIARIA PETIOLATA	Garlic Mustard
ALLIUM VINEALE	Field Garlic
Alopecurus carolinianus	Annual Foxtail
AMARANTHUS RETROFLEXUS	Rough Pigweed
Amaranthus tuberculatus	Tall Water Hemp
Ambrosia artemisiifolia var. *elatior*	Common Ragweed
Ambrosia trifida	Giant Ragweed
Amorpha fruticosa	False Indigo Bush
Andropogon gerardii	Big Bluestem Grass
Apocynum cannabinum	Dogbane
ARCTIUM MINUS	Common Burdock
Asclepias incarnata	Swamp Milkweed

Asclepias syriaca	Common Milkweed
ATRIPLEX PATULA	Fat-hen Saltbush
BARBAREA VULGARIS	Yellow Rocket
Bidens cernua	Nodding Bur Marigold
Bidens comosa	Swamp Tickseed
Bidens frondosa	Common Beggar's Ticks
Boehmeria cylindrica	False Nettle
Bolboschoenus fluviatilis	River Bulrush
BRASSICA NIGRA	Black Mustard
BROMUS COMMUTATUS	Hairy Brome
BROMUS INERMIS	Smooth Brome
BROMUS JAPONICUS	Japanese Chess
BROMUS TECTORUM	Cheat Grass
Calystegia sepium	American Bindweed
CAPSELLA BURSA-PASTORIS	Shepherd's Purse
Carex comosa	Bristly Sedge
Carex crinita	Fringed Sedge
Carex cristatella	Crested Oval Sedge
Carex frankii	Bristly Cattail Sedge
Carex lacustris	Common Lake Sedge
Carex lupulina	Common Hop Sedge
Carex lurida	Bottlebrush Sedge
Carex molesta	Field Oval Sedge
Carex normalis	Spreading Oval Sedge
Carex scoparia	Lance-fruited Oval Sedge
Carex shortiana	Short's Sedge
Carex stipata var. *stipata*	Common Fox Sedge
Carex tribuloides var. *tribuloides*	Broad-leaved Oval Sedge
Carex vulpinoidea	Brown Fox Sedge
Carya cordiformis	Bitternut Hickory
Catalpa speciosa	Cigar Tree
Celtis occidentalis	Hackberry
Cephalanthus occidentalis	Buttonbush
Cerastium nutans var. *nutans*	Nodding Chickweed
Cercis canadensis	Eastern Redbud
CHENOPODIUM ALBUM	Lamb's Quarters
Cicuta maculata	Water Hemlock
CIRSIUM ARVENSE	Field Thistle
Clematis virginiana	Virgin’s Bower
CONIUM MACULATUM	Poison Hemlock
Conyza canadensis	Horseweed
Coreopsis tripteris	Tall Coreopsis
Cornus drummondii	Rough-leaved Dogwood
Cornus obliqua	Pale Dogwood
Cornus racemosa	Gray Dogwood
CORONILLA VARIA	Crown Vetch

Corylus americana	American Filbert
Crataegus mollis	Downy Hawthorn
CRATAEGUS PHAENOPYRUM	Washington Hawthorn
Crataegus punctata	Dotted Hawthorn
Cuscuta gronovii	Common Dodder
DACTYLIS GLOMERATA	Orchard Grass
DAUCUS CAROTA	Queen Anne's Lace
Decodon verticillatus	Swamp Loosestrife
DIPSACUS FULLONUM	Common Teasel
DIPSACUS LACINIATUS	Cut-leaved Teasel
Echinacea purpurea	Broad-leaved Purple Coneflower
Echinocystis lobata	Wild Cucumber
ECHINOCHLOA CRUS-GALLI	Barnyard Grass
ELAEAGNUS UMBELLATA	Autumn Olive
Eleocharis acicularis	Needle Spike Rush
Eleocharis erythropoda	Red-rooted Spike Rush
Eleocharis obtusa	Blunt Spike Rush
Eleocharis palustris	Great Spike Rush
Elymus canadensis	Canada Wild Rye
Elymus virginicus	Virginia Wild Rye
Epilobium coloratum	Cinnamon Willow Herb
Equisetum arvense	Common Horsetail
Erechtites hieracifolia	Fireweed
Erigeron annuus	Annual Fleabane
Erigeron philadelphicus	Marsh Fleabane
ERYSIMUM CHEIRANTHOIDES	Wormseed Mustard
Eupatoriadelphus maculatus	Spotted Joe Pye Weed
Eupatorium perfoliatum	Common Boneset
Eupatorium serotinum	Late Boneset
Euthamia graminifolia	Grass-leaved Goldenrod
Fallopia scandens var. *scandens*	Climbing False Buckwheat
Fragaria virginiana	Wild Strawberry
Fraxinus americana	White Ash
Fraxinus pennsylvanica var. *lanceolata*	Green Ash
Galium aparine	Annual Bedstraw
Geum canadense	White Avens
Galium obtusum	Wild Madder
Geum laciniatum	Rough Avens
Geum vernum	Spring Avens
Gleditsia triacanthos	Honey Locust
Gymnocladus dioica	Kentucky Coffee Tree
Glyceria striata	Fowl Manna Grass
Hackelia virginiana	Stickseed
Helenium autumnale	Common Sneezeweed
Helianthus grosseserratus	Sawtooth Sunflower
Helianthus mollis	Downy Sunflower

Heliopsis helianthoides	False Sunflower
HESPERIS MATRONALIS	Dame's Rocket
Hibiscus moscheutos var. *moscheutos*	Swamp Rose Mallow
HORDEUM JUBATUM	Squirrel-tail Grass
HUMULUS LUPULUS var. *LUPULUS*	Common Hops
IPOMOEA PURPUREA	Common Morning Glory
Iris virginica	Southern Blue Flag
Juglans nigra	Black Walnut
Juncus dudleyi	Dudley's Rush
Juncus effusus	Common Rush
Juncus tenuis	Path Rush
Juncus torreyi	Torrey's Rush
Juniperus virginiana	Eastern Red Cedar
LACTUCA SERRIOLA	Prickly Lettuce
LAMIUM AMPLEXICAULE	Henbit
LAMIUM PURPUREUM	Purple Dead Nettle
Laportea canadensis	Canada Wood Nettle
Leersia oryzoides	Rice Cut Grass
Lemna minor	Small Duckweed
Lemna trisulca	Forked Duckweed
LEPIDIUM CAMPESTRE	Field Cress
Liatris spicata	Marsh Blazing Star
Liriodendron tulipifera	Tulip Poplar
Lobelia cardinalis	Cardinal Flower
LONICERA MAACKII	Amur Honeysuckle
LONICERA MORROWII	Morrow's Honeysuckle
LOTUS CORNICULATUS	Birdsfoot Trefoil
Ludwigia palustris	Marsh Purslane
Lycopus americanus	Common Water Horehound
Lysimachia ciliata	Fringed Loosestrife
LYSIMACHIA NUMMULARIA	Moneywort
LYTHRUM SALICARIA	Purple Loosestrife
Malus coronaria	Wild Sweet Crab
MATRICARIA DISCOIDEA	Pineapple Weed
MEDICAGO LUPULINA	Black Medick
MELILOTUS ALBA	White Sweet Clover
Mentha arvensis var. *villosa*	Wild Mint
Mimulus ringens	Monkey Flower
Monarda fistulosa	Wild Bergamot
MORUS ALBA	White Mulberry
NEPETA CATARIA	Catnip
Nymphaea odorata ssp. *tuberosa*	Fragrant Water Lily
Oenothera biennis	Common Evening Primrose
Oxalis stricta	Tall Wood Sorrel
Packera glabella	Butterweed
Panicum virgatum	Prairie Switch Grass

Parthenocissus quinquefolia	Virginia Creeper
PASTINACA SATIVA	Parsnip
Peltandra virginica	Arrow Arum
Penstemon calycosus	Smooth Beard Tongue
Penstemon digitalis	Foxglove Beard Tongue
Penthorum sedoides	Ditch Stonecrop
Persicaria amphibia var. *emersa*	Water Heartsease
Persicaria lapathifolia	Curytop Lady's Thumb
Persicaria pensylvanica	Pinkweed
Persicaria sagittata	Arrow-leaf Tearthumb
PERSICARIA VULGARIS	Lady's Thumb
PHALARIS ARUNDINACEA	Reed Canary Grass
Phragmites australis	Common Reed
Phyla lanceolata	Fog Fruit
Phytolacca americana	Pokeweed
Pilea pumila	Canada Clearweed
PLANTAGO LANCEOLATA	English Plantain
Plantago rugelii	Red-stalked Plantain
Platanus occidentalis	Sycamore
POA ANNUA	Annual Blue Grass
POA PRATENSIS	Kentucky Blue Grass
Polygonatum biflorum	Small Solomon's Seal
POLYGONUM AVICULARE var. *AVICULARE*	Common Knotweed
Populus deltoides	Eastern Cottonwood
Potamogeton foliosus	Leafy Pondweed
Potamogeton gramineus	Grass-leaved Pondweed
Potentilla norvegica	Rough Cinquefoil
Prunus americana	American Plum
Prunus serotina	Wild Black Cherry
Pycnanthemum virginianum	Common Mountain Mint
PYRUS CALLERYANA	Bradford Pear
Quercus alba	White Oak
Quercus bicolor	Swamp White Oak
Quercus macrocarpa	Burr Oak
Quercus muhlenbergii	Chinkapin Oak
Quercus palustris	Burr Oak
Quercus rubra	Northern Red Oak
Quercus shumardii var. *shumardii*	Shumard's Oak
Ranunculus abortivus	Little-leaf Buttercup
Ranunculus sceleratus	Cursed Crowfoot
Ratibida pinnata	Yellow Coneflower
RHAMNUS CATHARTICA	Common Buckthorn
Ribes americanum	Wild Black Current
Rorippa palustris ssp. *fernaldiana*	Marsh Yellow Cress
ROSA MULTIFLORA	Japanese Rose
Rosa setigera	Illinois Rose

Rubus abactus	Yankee Blackberry
Rubus allegheniensis	Common Blackberry
Rubus flagellaris	Common Dewberry
Rubus occidentalis	Black Raspberry
Rudbeckia hirta var. *hirta*	Black-eyed Susan
Rudbeckia laciniata	Wild Golden Glow
Rudbeckia subtomentosa	Sweet Black-eyed Susan
RUMEX CRISPUS	Curly Dock
RUMEX OBTUSIFOLIUS	Bitter Dock
Rumex verticillatus	Swamp Dock
Sagittaria latifolia	Common Arrowhead
Salix amygdaloides	Peach-leaved Willow
Salix discolor	Pussy Willow
Salix eriocephala	Heart-leaved Willow
Salix interior	Sandbar Willow
Salix nigra	Black Willow
Sambucus nigra ssp. *canadensis*	Common Elderberry
Sanicula odorata	Clustered Black Snakeroot
SAPONARIA OFFICINALIS	Bouncing Bet
SCHEDONORUS ARUNDINACEUS	Tall Fescue
Schoenoplectus tabernaemontani	Great Bulrush
Scirpus atrovirens	Dark-green Bulrush
Scirpus cyperinus	Wool Grass
Scirpus pendulus	Red Bulrush
Scutellaria lateriflora	Mad-dog Skullcap
Senna hebecarpa	Wild Senna
SETARIA FABERI	Giant Foxtail Grass
Silphium integrifolium var. *integrifolium*	Rosin Weed
Silphium laciniatum	Compass Plant
Silphium perfoliatum	Cup Plant
Silphium terebinthinaceum var. *terebinthinaceum*	Prairie Dock
Sium suave	Water Parsnip
Solanum carolinense	Horse Nettle
SOLANUM DULCAMARA	Bittersweet Nightshade
SOLANUM ELAEAGNIFOLIUM	Silver-leaved Nightshade
Solidago altissima	Tall Goldenrod
Solidago canadensis	Canada Goldenrod
Solidago gigantea	Late Goldenrod
Solidago rigida	Rigid Goldenrod
SONCHUS ASPER	Prickly Sow Thistle
Sorghastrum nutans	Indian Grass
Sparganium eurycarpum	Common Bur Reed
Spartina pectinata	Prairie Cord Grass
Spirodela polyrhiza	Great Duckweed
STELLARIA MEDIA ssp. *MEDIA*	Common Chickweed
Symphyotrichum firmum	Shining Aster

Symphyotrichum lanceolatum	Panicled Aster
Symphyotrichum lateriflorum	Side-flowering Aster
Symphyotrichum novae-angliae	New England Aster
Symphyotrichum pilosum var. *pilosum*	Hairy Aster
TARAXACUM OFFICINALE	Common Dandelion
Thalictrum revolutum	Waxy Meadow Rue
THLASPI ARVENSE	Field Penny Cress
Tovara virginiana	Virginia Knotweed
Toxicodendron radicans ssp. *radicans*	Poison Ivy
Tradescantia ohiensis	Common Spiderwort
TRAGOPOGON PRATENSIS	Common Goat's Beard
TRIFOLIUM HYBRIDUM	Alsike Clover
TRIFOLIUM PRATENSE	Red Clover
TRIFOLIUM REPENS	White Clover
Triosteum aurantiacum	Early Horse Gentian
TYPHA ANGUSTIFOLIA	Narrow-leaved Cattail
TYPHA x *GLAUCA*	Hybrid Cattail
Ulmus americana	American Elm
Urtica dioica ssp. *gracilis*	Tall Stinging Nettle
Valerianella umbilicata	Corn Salad
VERBASCUM THAPSUS	Woolly Mullein
Verbena hastata	Blue Vervain
Verbena urticifolia var. *urticifolia*	White Vervian
Verbesina alternifolia	Wingstem
Vernonia fasciculata	Common Ironweed
Vernonia gigantea	Tall Ironweed
VERONICA ARVENSIS	Corn Speedwell
Veronica peregrina ssp. *peregrina*	Smooth Purslane Speedwell
Viburnum lentago	Nannyberry
VIBURNUM OPULUS var. *OPULUS*	European High-bush Cranberry
Viburnum prunifolium	Black Haw
Vitis riparia	Riverbank Grape
Vitis vulpina	Frost Grape
Wolffia columbiana	Globose Water Meal
Xanthium strumarium	Cocklebur
Zizia aurea	Golden Alexanders

END OF TABLE 13A.

Table 13B: List of plant species occurring in Management Units A, B, C, D, E, G, H, I. Management Units are based upon the map entitled: "Natural Communities of Eagle Marsh - First Approximation" by Don Cunningham, Tony Fleming, and Betsy Yankowiak 2014 [see maps section]. Non-native vascular plant species are indicated by all CAPITAL letters.

Dominant species are marked with D, while other species simply with x. Numbers following D indicate which community type [see below] the species was dominant.

Community Types are:

1. **Permanent pond**
2. **Ephemeral body of open water**
3. **Marsh**
4. **Sedge meadow**
5. **Wet to mesic prairie**
6. **Shrubland**
7. **Rows of native trees/shrubs planted 2007-2014**
8. **Mounds of subsoil**
9. **Native forest**

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
ABUTILON THEOPHRASTI			x					
Acalypha rhomboidea			x					
Acer negundo	x	x	x		x		x	x
Acer rubrum var. *rubrum*	x				x			x
Acer saccharinum	x			x	x			x
Achillea millefolium							x	
Alisma subcordatum	x	x	x	D3	x	x	x	x
ALLIARIA PETIOLATA	x	x	x	x	x		D7	x
ALLIUM VINEALE	x	x						
Alopecurus carolinianus				x	x			
AMARANTHUS RETROFLEXUS	x		x	x				
Amaranthus tuberculatus					x			
Ambrosia artemisiifolia var. *elatior*	x		x	x	x		x	x
Ambrosia trifida	x		x	x	x		x	x
Amorpha fruticosa	x							
Andropogon gerardii	x		D5		D5			x
Apocynum cannabinum	x	x	x	x	x	x		x
ARCTIUM MINUS	x	x	x	x	x			x
Asclepias incarnata	x	x	x	x	x		x	x
Asclepias syriaca	x	x	x	x	D8	x	x	x
ATRIPLEX PATULA	x							
BARBAREA VULGARIS	x	x			x	x		x
Bidens cernua			x					
Bidens comosa	x			x	x		x	D3
Bidens frondosa	x	x	x	x	x		x	x
Boehmeria cylindrica					x			
Bolboschoenus fluviatilis	x		x	x	x		x	x
BRASSICA NIGRA			x				x	x
BROMUS COMMUTATUS	x	x			x	x	x	x
BROMUS INERMIS	x	x	x	D8	x			x
BROMUS JAPONICUS	x				x			x
BROMUS TECTORUM					D8			
Calystegia sepium	x	x	x	x	x			x
CAPSELLA BURSA-PASTORIS	x	x	x		x		x	x
Carex comosa							x	
Carex crinita			x					
Carex cristatella	x		x		x			x

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
Carex frankii			x	x			x	
Carex lacustris		x						
Carex lupulina							x	
Carex lurida			x		x		x	
Carex molesta		x	x	x	x	x	x	
Carex normalis				x	x			
Carex scoparia				x	x	x	x	
Carex shortiana				x				
Carex stipata var. *stipata*	x		D3,D5	x	D3	x		x
Carex tribuloides var. *tribuloides*			x	x	x		x	x
Carex vulpinoidea	x	D	D3	x	D3	x	D2	x
Carya cordiformis	x							
Catalpa speciosa				x				x
Celtis occidentalis	x	x						
Cephalanthus occidentalis	x	x		D2			D2	
Cerastium nutans var. *nutans*					x			
Cercis canadensis	x							
CHENOPODIUM ALBUM	x	x	x	x	x		x	x
Cicuta maculata						x		
CIRSIUM ARVENSE	D5	x	D5	x	D8	x	x	D5
Clematis virginiana			x					
CONIUM MACULATUM	x			x				
Conyza canadensis					x			
Coreopsis tripteris	x	x			D5			x
Cornus drummondii	D7	x			x	x		x
Cornus obliqua			D7	x			D2	x
Cornus racemosa			D7					
CORONILLA VARIA	x							
Corylus americana	x							
Crataegus mollis	x							
CRATAEGUS PHAENOPYRUM				x			x	
Crataegus punctata			x					
Cuscuta gronovii		x						
DACTYLIS GLOMERATA	x	x			x			x
DAUCUS CAROTA	x	x	x		x	x	x	x
Decodon verticillatus							x	
DIPSACUS FULLONUM	D7	x	x	x	x		x	D5
DIPSACUS LACINIATUS	x	x						
Echinacea purpurea		x						
Echinocystis lobata		x		x				
ECHINOCHLOA CRUS-GALLI	D3		x		x			D3
ELAEAGNUS UMBELLATA				x		x		
Eleocharis acicularis				x	x			

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
Eleocharis erythropoda			x	x	x			x
Eleocharis obtusa			x	x	x		x	x
Eleocharis palustris			x	x				
Elymus canadensis	x				x			x
Elymus virginicus			x	D7	x		x	x
Epilobium coloratum	x		x		x		x	
Equisetum arvense				x				
Erechtites hieracifolia			x		x			
Erigeron annuus	x	x	x	x	x	x	x	x
Erigeron philadelphicus	x		x		x	x	x	x
ERYSIMUM CHEIRANTHOIDES				x	x			x
Eupatoriadelphus maculatus					x			
Eupatorium perfoliatum			x		x		x	
Eupatorium serotinum	x	x		x	x	x		x
Euthamia graminifolia	x		x		x			x
Fallopia scandens var. *scandens*	x		x	x	x		x	x
Fragaria virginiana		x	x					
Fraxinus americana	x				x			x
Fraxinus pennsylvanica var. *lanceolata*	x	x	x	x	x	x		x
Galium aparine	x	x	x	x	D8	x	x	x
Geum canadense	x				x			x
Galium obtusum					x			
Geum laciniatum	x		x	x	x		x	x
Geum vernum			x		x			
Gleditsia triacanthos	x		x	x	x		x	
Gymnocladus dioica	x							
Glyceria striata				x	x			
Hackelia virginiana			x		x			
Helenium autumnale	x				x			x
Helianthus grosseserratus		x	D5		D5,D8	x		x
Helianthus mollis	x				x			x
Heliopsis helianthoides	D5			x	D8	x		x
HESPERIS MATRONALIS	x	x		x		x		x
Hibiscus moscheutos var. *moscheutos*						x		
HORDEUM JUBATUM		x	x	x	x			x
HUMULUS LUPULUS var. *LUPULUS*				x				x
IPOMOEA PURPUREA			x					
Iris virginica			x	x				
Juglans nigra	x		x		x			x
Juncus dudleyi		D	x		x			
Juncus effusus	x	x	x	D3	D3	x		x
Juncus tenuis	x	D		x	x			x
Juncus torreyi								x

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
Juniperus virginiana	x			x	x			
LACTUCA SERRIOLA	x	x			x	x		x
LAMIUM AMPLEXICAULE					x			
LAMIUM PURPUREUM	x	x	x		x	x	x	x
Laportea canadensis				x				
Leersia oryzoides	x		D5	D3	D3		D2	x
Lemna minor	D2	x	x	x	x	x	x	x
Lemna trisulca	D2							
LEPIDIUM CAMPESTRE		x			x			
Liatris spicata							x	
Liriodendron tulipifera	x							
Lobelia cardinalis			x					
LONICERA MAACKII	x	x			x			
LONICERA MORROWII	x		x	x			x	x
LOTUS CORNICULATUS				x				
Ludwigia palustris	x		x		x			x
Lycopus americanus	x		x	x	x			x
Lysimachia ciliata				x				
LYSIMACHIA NUMMULARIA				x				
LYTHRUM SALICARIA			x	x				
Malus coronaria	x		x	x				x
MATRICARIA DISCOIDEA					x			
MEDICAGO LUPULINA	x			x	x			x
MELILOTUS ALBA	x	x	x	x	D8		x	
Mentha arvensis var. *villosa*			x		x			
Mimulus ringens								x
Monarda fistulosa	D5,D7	x	x		x	x	x	D5
MORUS ALBA	D5	x	x	x	x			x
NEPETA CATARIA				x			x	
Nymphaea odorata ssp. *tuberosa*		x						
Oenothera biennis	x	x	x	x	x	x	x	x
Oxalis stricta	x		x		x			x
Packera glabella	x	x	x	x	x	x	x	x
Panicum virgatum	x	x			D3,D5			x
Parthenocissus quinquefolia	x			x	x		x	x
PASTINACA SATIVA								x
Peltandra virginica							x	
Penstemon calycosus		x						
Penstemon digitalis	x	x	x	x	x		x	x
Penthorum sedoides	x		x	x	x		x	x
Persicaria amphibia var. *emersa*	x		x	x	x	x	x	x
Persicaria lapathifolia	x	x			x	x	x	x
Persicaria pensylvanica	D3		x	x	D3			D3

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
Persicaria sagittata			x		x			x
PERSICARIA VULGARIS		x	x			x		
PHALARIS ARUNDINACEA	D7	D	D7	x	x	x	x	D3,D5
Phragmites australis	x	x	x		x			x
Phyla lanceolata		D	x			x	x	
Phytolacca americana	x		x	x	x			x
Pilea pumila					x			
PLANTAGO LANCEOLATA		x						
Plantago rugelii		x		x	x			x
Platanus occidentalis	x		x	x	x		x	
POA ANNUA					x			x
POA PRATENSIS	x	x	x	x	x	x		x
Polygonatum biflorum				x				
POLYGONUM AVICULARE var. *AVICULARE*						x		x
Populus deltoides	x	x	x	x	x	x		x
Potamogeton foliosus			x					
Potamogeton gramineus		x						
Potentilla norvegica	x	x	x	x	x		x	x
Prunus americana				x				
Prunus serotina	x		x		x			x
Pycnanthemum virginianum			x		x			
PYRUS CALLERYANA	x	D	x	x	x			x
Quercus alba	x							
Quercus bicolor	x		x	D7	x			
Quercus macrocarpa	x		x	D7	x		x	
Quercus muhlenbergii	x						x	
Quercus palustris			x	D7	x			
Quercus rubra	x							
Quercus shumardii var. *shumardii*	x			x				
Ranunculus abortivus	x	x	x		x		x	x
Ranunculus sceleratus	x	x	x	x	x	x	x	x
Ratibida pinnata	x	x			x			x
RHAMNUS CATHARTICA	x			x				
Ribes americanum					x		x	
Rorippa palustris ssp. *fernaldiana*	x	D	D5	x	x	x	x	x
ROSA MULTIFLORA			x	x	x			x
Rosa setigera	x				x			
Rubus abactus					x			
Rubus allegheniensis			x	x	x		D7	
Rubus flagellaris		x	x					
Rubus occidentalis			x					
Rudbeckia hirta var. *hirta*			x					
Rudbeckia laciniata				x				

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
Rudbeckia subtomentosa					x			
RUMEX CRISPUS	x	x	x	x	x	x	x	x
RUMEX OBTUSIFOLIUS		x						
Rumex verticillatus				x				
Sagittaria latifolia	x	x		x		x		
Salix amygdaloides						x	x	
Salix discolor			x	x	x			
Salix eriocephala	x							
Salix interior	x	x	x	x		x	x	
Salix nigra	x		x		x	x	x	x
Sambucus nigra ssp. *canadensis*	x	x	x	x	x		x	
Sanicula odorata			x					
SAPONARIA OFFICINALIS				x				
SCHEDONORUS ARUNDINACEUS	x	x		D8	x	x	x	x
Schoenoplectus tabernaemontani			x		x		x	x
Scirpus atrovirens	x		D3	x	D3		x	x
Scirpus cyperinus	x		D3	x	D3		D2	x
Scirpus pendulus				x				
Scutellaria lateriflora					x			
Senna hebecarpa	x	x	x	x	x	x		x
SETARIA FABERI	x		x		x			x
Silphium integrifolium var. *integrifolium*	x				x			x
Silphium laciniatum	x	x			x			x
Silphium perfoliatum		x	x		x		x	x
Silphium terebinthinaceum. var. *terebinthinaceum*		x	x		x	x	x	x
Sium suave				x				
Solanum carolinense	x		x			x		
SOLANUM DULCAMARA	x		x	x	x			x
SOLANUM ELAEAGNIFOLIUM						x		
Solidago altissima	D4,D7	x	D3		D5	x	x	D5
Solidago canadensis		x	x					
Solidago gigantea					x			
Solidago rigida	x	x	x		x	x		D5
SONCHUS ASPER			x					
Sorghastrum nutans	x				x			D5
Sparganium eurycarpum	x			D2,D3	D3	x	D2	x
Spartina pectinata			x					
Spirodela polyrhiza	x		x		x			x
STELLARIA MEDIA ssp. *MEDIA*					x		x	
Symphyotrichum firmum			x				x	
Symphyotrichum lanceolatum	D3		D3	D3	D3		D2	x
Symphyotrichum lateriflorum		x					x	

	MANAGEMENT UNITS							
Scientific Name	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
Symphyotrichum novae-angliae	x	x		x	x			x
Symphyotrichum pilosum var. *pilosum*	x			x	x		x	x
TARAXACUM OFFICINALE	x	x	x	x	x			x
Thalictrum revolutum				x				
THLASPI ARVENSE	D5	D	x	x	D8		x	x
Tovara virginiana			x					
Toxicodendron radicans ssp. *radicans*	x		x	x	x			
Tradescantia ohiensis				x			x	
TRAGOPOGON PRATENSIS		x						
TRIFOLIUM HYBRIDUM	x	x		x		x		
TRIFOLIUM PRATENSE		x			x			
TRIFOLIUM REPENS		x	x		x	x		
Triosteum aurantiacum	x							
TYPHA ANGUSTIFOLIA	x	x	x	x	x	x		x
TYPHA x GLAUCA	D3	D	D4	D2	D3	x	x	x
Ulmus americana	x			x	x			x
Urtica dioica ssp. *gracilis*	x	x	x	x	D8	x	D7	x
Valerianella umbilicata							x	
VERBASCUM THAPSUS	x	x		x	x			x
Verbena hastata		x	x		x		x	x
Verbena urticifolia var. *urticifolia*				x	x			x
Verbesina alternifolia	x	x	x	x	x			x
Vernonia fasciculata					x			
Vernonia gigantea	x	x	x		x	x	x	x
VERONICA ARVENSIS		x				x	x	
Veronica peregrina ssp. *peregrina*	x	x	x	x	x	x	x	x
Viburnum lentago						x		
VIBURNUM OPULUS var. *OPULUS*		x						
Viburnum prunifolium			x					
Vitis riparia	x	x	x	x	x	x	x	x
Vitis vulpina	x	x						
Wolffia columbiana	D2				x			x
Xanthium strumarium								x
Zizia aurea			x		x			

END OF TABLE 13B.

Table 13C: Floristic Quality Summary by Unit.

	Management Units							
MATRIX	**A**	**B**	**C**	**D**	**E**	**G**	**H**	**I**
NATIVE SPECIES	112	65	111	94	134	42	79	99
Total Species	153	105	144	131	179	61	101	139
NATIVE MEAN C	2.8	2.6	2.6	2.5	2.8	2.2	2.8	2.7
W/Adventives	2.1	1.6	2.0	1.8	2.1	1.5	2.2	1.9
NATIVE FQI	29.9	20.6	27.8	24.1	32.0	14.4	25.0	26.2
W/Adventives	25.5	16.2	24.4	20.4	27.7	11.9	22.1	22.1
NATIVE MEAN W	-0.9	-1.1	-1.9	-2.0	-1.6	-1.8	-2.2	-1.4
W/Adventives	-0.2	0	-1.1	-1.1	-0.7	-0.9	-1.2	-0.5

Table 13D: Floristic Quality Summary for Restoration Areas (Units A, B, C, D, E, G, H, I).

MATRIX	**Value**
NATIVE SPECIES	213
Total Species	286
NATIVE MEAN C	3.1
W/Adventives	2.3
NATIVE FQI	45.0
W/Adventives	38.7
NATIVE MEAN W	-1.4
W/Adventives	-0.5

Table 13E: List of plant species and their common name for all species reported in Management Unit F. Management Units are based upon the map entitled: "Natural Communities of Eagle Marsh - First Approximation" by Don Cunningham, Tony Fleming, and Betsy Yankowiak 2014 [see maps section]. Non-native vascular plant species are indicated by all CAPITAL letters. The dominant species are designated with a D in the first column.

Dominant Species	**Scientific Name**	**Common Name**
D	*Acer negundo*	Boxelder
D	*Acer saccharinum*	Silver Maple
	Acer saccharum ssp. *saccharum*	Sugar Maple
	Actaea pachypoda	Doll's-eyes
	Agastache nepetoides	Yellow Giant Hyssop

	Ageratina altissima	White Snakeroot
	Agrimonia parviflora	Swamp Agrimony
	Alisma subcordatum	Common Water Plantain
	ALLIARIA PETIOLATA	Garlic Mustard
	Allium canadense	Wild Garlic
	Ambrosia artemisiifolia var. *elatior*	Common Ragweed
	Ambrosia trifida	Giant Ragweed
	Amphicarpaea bracteata var. *bracteata*	Hog Peanut
	Anemone canadensis	Meadow Anemone
	Apocynum cannabinum	Dogbane
	Arisaema dracontium	Green Dragon
	Arisaema triphyllum	Indian Turnip
	Bidens vulgata	Tall Beggar's Ticks
	Bolboschoenus fluviatilis	River Bulrush
	Carex conjuncta	Green-headed Fox Sedge
	Carex grisea	Wood Gray Sedge
	Carya cordiformis	Bitternut Hickory
	Cephalanthus occidentalis	Buttonbush
	Chaerophyllum procumbens var. *procumbens*	Common Streambank Chervil
	Cicuta maculata	Water Hemlock
D	*Cinna arundinacea*	Common Wood Reed
	Circaea lutetiana ssp. *canadensis*	Enchanter's Nightshade
	CIRSIUM ARVENSE	Field Thistle
	Cornus obliqua	Pale Dogwood
	Cornus drummondii	Rough-leaved Dogwood
	Cornus racemosa	Gray Dogwood
	Cryptotaenia canadensis	Honewort
	Dryopteris carthusiana	Spinulose Wood Fern
	Echinocystis lobata	Wild Cucumber
	Elymus canadensis	Canada Wild Rye
	Elymus virginicus	Virginia Wild Rye
	Erigeron philadelphicus	Marsh Fleabane
	Eupatorium perfoliatum	Common Boneset
	Euthamia graminifolia	Grass-leaved Goldenrod
	Festuca subverticillata	Nodding Fescue
	Fraxinus pennsylvanica var. *lanceolata*	Green Ash
	Galium aparine	Annual Bedstraw
	Galium triflorum	Sweet-scented Bedstraw
	Geum canadense	White Avens
D	*Geum vernum*	Spring Avens
	GLECHOMA HEDERACEA	Ground Ivy
	Gleditsia triacanthos	Honey Locust
	Glyceria striata	Fowl Manna Grass
	HESPERIS MATRONALIS	Dame's Rocket
	Impatiens capensis	Spotted Touch-Me-Not
	Impatiens pallida	Pale Touch-Me-Not

	Iris virginica	Southern Blue Flag
	Juglans nigra	Black Walnut
	Juncus tenuis	Path Rush
	Lactuca floridana	Blue Lettuce
	LAMIUM PURPUREUM	Purple Dead Nettle
	Laportea canadensis	Canada Wood Nettle
	Lemna minor	Small Duckweed
	LIGUSTRUM OBTUSIFOLIUM	Border Privet
	Lindera benzoin	Hairy Spicebush
	LONICERA MORROWII	Morrow's Honeysuckle
	Lycopus americanus	Common Water Horehound
	LYSIMACHIA NUMMULARIA	Moneywort
	LYTHRUM SALICARIA	Purple Loosestrife
	Menispermum canadense	Moonseed
	MORUS ALBA	White Mulberry
	Osmorhiza longistylis	Anise Root
	Packera glabella	Butterweed
	Parthenocissus quinquefolia	Virginia Creeper
	Parthenocissus vitacea	Thicket Creeper
	Penstemon digitalis	Foxglove Beard Tongue
	Penthorum sedoides	Ditch Stonecrop
	Persicaria amphibia var. *emersa*	Water Heartsease
	Persicaria arifolia	Halbred-leaved Tear-thumb
	PERSICARIA VULGARIS	Lady's Thumb
	PHALARIS ARUNDINACEA	Reed Canary Grass
	Phytolacca americana	Pokeweed
D	*Pilea pumila*	Canada Clearweed
	Plantago rugelii	Red-stalked Plantain
	Platanus occidentalis	Sycamore
	Podophyllum peltatum	May Apple
	Populus deltoides	Eastern Cottonwood
	Populus tremuloides	Quaking Aspen
	Potentilla norvegica	Rough Cinquefoil
	Prunus serotina	Wild Black Cherry
	PYRUS CALLERYANA	Bradford Pear
	Quercus muhlenbergii	Chinkapin Oak
	Quercus palustris	Pin Oak
	Quercus rubra	Northern Red Oak
	Ranunculus abortivus	Little-leaf Buttercup
	Ranunculus sceleratus	Cursed Crowfoot
	RHAMNUS CATHARTICA	Common Buckthorn
	RHAMNUS DAVURICA ssp. *NIPPONICA*	Dahurian Buckthorn
	Ribes americanum	Wild Black Current
	Rorippa palustris ssp. *fernaldiana*	Marsh Yellow Cress
	ROSA MULTIFLORA	Japanese Rose
	Rubus allegheniensis	Common Blackberry

	Rubus flagellaris	Common Dewberry
	Rubus occidentalis	Black Raspberry
	RUMEX CRISPUS	Curly Dock
	Salix amygdaloides	Peach-leaved Willow
	Salix nigra	Black Willow
	Sambucus nigra ssp. *canadensis*	Common Elderberry
	Sanguinaria canadensis	Bloodroot
	Sanicula odorata	Clustered Black Snakeroot
	Scirpus atrovirens	Dark-green Bulrush
	Scutellaria lateriflora	Mad-dog Skullcap
	Senna hebecarpa	Wild Senna
	Sium suave	Water Parsnip
	Smilax hispida	Bristly Green Brier
	Smilax lasioneura	Common Carrion Flower
	SOLANUM DULCAMARA	Bittersweet Nightshade
	Solidago altissima	Tall Goldenrod
	Solidago gigantea	Late Goldenrod
	Sparganium eurycarpum	Common Bur Reed
	Symphyotrichum lanceolatum	Panicled Aster
D	*Symphyotrichum lateriflorum*	Side-flowering Aster
	Symphyotrichum prenanthoides	Crooked Aster
	Symplocarpus foetidus	Skunk Cabbage
	TARAXACUM OFFICINALE	Common Dandelion
	Thalictrum revolutum	Waxy Meadow Rue
	Tovara virginiana	Virginia Knotweed
	Toxicodendron radicans ssp. *negundo*	Eastern Poison Vy
	Ulmus americana	American Elm
	Urtica dioica ssp. *gracilis*	Tall Stinging Nettle
	Verbesina alternifolia	Wingstem
	Vernonia gigantea	Tall Ironweed
	Veronica peregrina ssp. *peregrina*	Smooth Purslane Speedwell
	Viburnum lentago	Nannyberry
	VIBURNUM OPULUS var. *OPULUS*	European High-bush Cranberry
	Viola sororia	Woolly Blue Violet
	Vitis riparia	Riverbank Grape
	Vitis vulpina	Frost Grape
	Wolffia columbiana	Globose Water Meal
	Zanthoxylum americanum	Prickly Ash

END OF TABLE 13E.

Table 13F: Floristic Quality Summary for Unit F.

MATRIX	Value
NATIVE SPECIES	115
Total Species	135
NATIVE MEAN C	3.1
W/Adventives	2.6
NATIVE FQI	32.7
W/Adventives	30.2
NATIVE MEAN W	-1.0
W/Adventives	-0.6

Table 13G: Floristic Quality Summary for all Units Combined.

MATRIX	Value
NATIVE SPECIES	243
Total Species	320
NATIVE MEAN C	3.3
W/Adventives	2.5
NATIVE FQI	50.7
W/Adventives	44.2
NATIVE MEAN W	-1.1
W/Adventives	-0.4

Collecting Effort and Voucher Specimens

The Plant BioBlitz team visited each unit of the Eagle Marsh property over the period of May 31 to June 1, 2014, i.e., three subteams on 31 May and one subteam on 1 June. The plant survey effort expended in excess of 160 man-hours and involved over 20 botanists. No voucher specimens were taken, but a limited number of unknowns were keyed using fresh material.

Floristic Quality Index

The Floristic Quality Indices (FQI) report in this report was determined using the program developed by the Conservation Design Forum in conjunction with Rothrock (2004). This program also calculates the mean Coefficient of Conservatism (mean C), and the mean Wetland Indicator Status (mean W). For a detailed description of how the FQI is determined and an explanation of C-values, see Swink & Wilhelm

(1994), Rothrock (2004), and Rothrock & Homoya (2005). Briefly, C-values, which range from zero to ten, are an index of the fidelity of an individual species to undisturbed plant communities characteristic of the region prior to European settlement. The higher the C-value the more conserved the species is to an undisturbed habitat. All exotics are given a C value of 0. The FQI is determined by multiplying the mean C for all species present by the square root of the total number of species. [For native FQI and mean C, only the native species are used.] A FQI greater than 35 suggests that a site has remnant natural quality and contains some noteworthy remnants of natural heritage of the region (Rothrock & Homoya 2005, Swink & Wilhelm 1994).

Summary Overview

Overall, 320 species were recorded with 243 being native to Indiana. Since most units of Eagle Marsh were restored from agricultural use during the past decade, it is of interest to note that collectively these areas had about 210 native species and three of the eight units had in excess of 100 native species. Not surprisingly, though, there still remains an abundance of non-native species, especially in the western units where *Phalaris arundinacea* and *Typha* × *glauca* were among the dominant species. A Floristic Quality Assessment of the restoration units (Units A, B, C, D, E, G, H, and I) generated a mean C for native species of 3.1, a value in keeping with the early to mid-successional status of the property. When non-native species were included in the analysis the mean C dropped to 2.3. This difference in mean C values indicates that non-natives have a meaningful impact on plant community structure and function at Eagle Marsh.

Several native graminoids were frequent in wetter habitats. These included *Carex tribuloides, C. vulpinoidea, Leersia oryzoides, Scirpus cyperinus,* and *Sparganium eurycarpum.* The composite family member *Symphyotrichum lanceolatum* was also abundant and the sedge *Carex stipata* locally abundant. Common native species of drier habitats were *Solidago altissima* and, in eastern units, *Helianthus grosseserratus*. Native shrubs, *Cornus obliqua* and *C. racemosa,* were abundant in Unit C, a mix of oak species (*Quercus*) and *Cephalanthus occidentalis* in Unit D, and the shrubs *C. occidentalis* and *C. obliqua* in Unit H.

Within Eagle Marsh, one unit (designated as Unit F) supports a swamp woodland. The overstory was dominated by soft maples, *Acer negundo and A. saccharinum.* Dominant herbaceous species included *Cinna arundinacea, Geum vernum, Pilea pumila,* and *Symphyotrichum lateriflorum.* In this unit 115 native species were observed along with 20 non-native species. However, due to the presence of restoration habitat within this unit, its mean C for native species was only 3.1, somewhat below a level typically associated with remnant natural quality. On the plus side the presence of non-native species was clearly more constrained since total mean C only dropped to 2.6. Among the more conservative species present in this unit, that were lacking elsewhere at Eagle Marsh, were *Actaea pachypoda, Carex conjuncta, Dryopteris carthusiana,* and *Persicaria arifolia* as well as *Amphicarpaea bracteata, Arisaema dracontium, Galium triflorum,* and *Lindera benzoin.*

Overall Eagle Marsh now supports a remarkable diversity of plant life and habitats given its recent intensive use as agricultural land. Many hardwoods, shrub plantings, wetland restoration species, and tall grass prairie species have been successfully established.

References

Rothrock, P.E. 2004. Floristic quality assessment in Indiana: The concept, use and development of coefficients of conservatism. Final Report for ARN A305 4 53, EPA Wetland Program Development Grant CD975586 01. 96 pp. At: http://www.in.gov/idem/water/planbr/401/publications.html.

Rothrock, P.E. & M.A. Homoya. 2005. An evaluation of Indiana's Floristic Quality Assessment. Proceedings of the Indiana Academy of Science 114:9-18.

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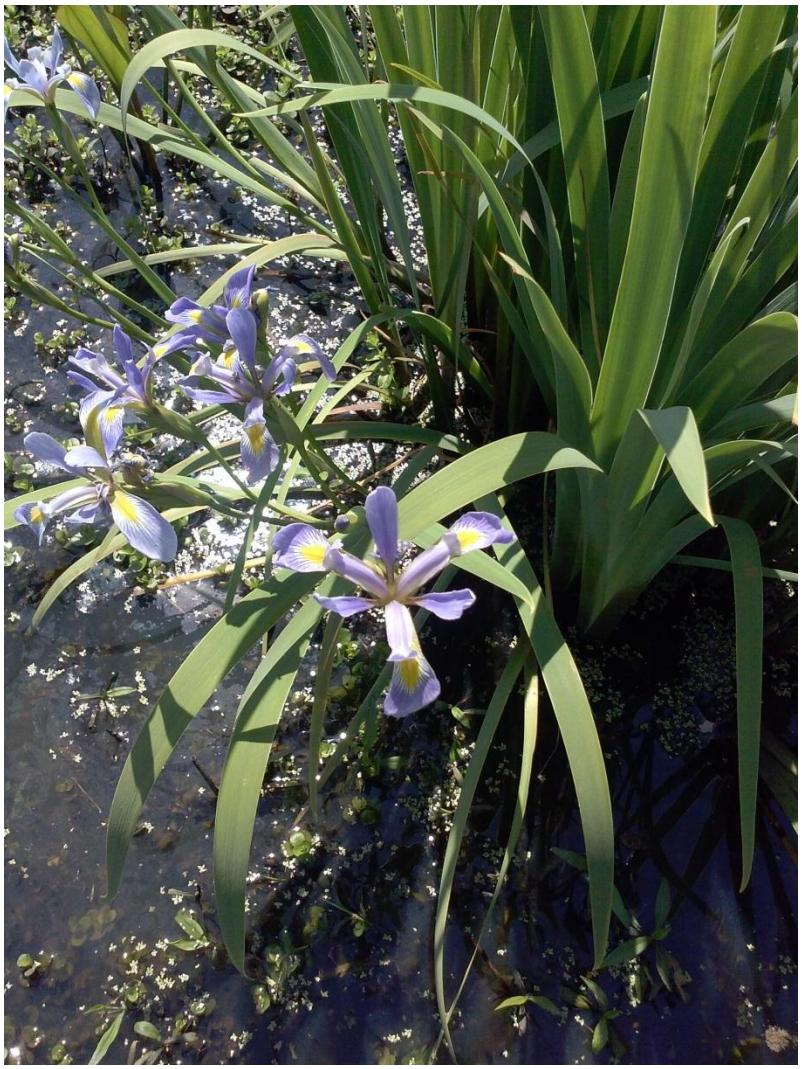
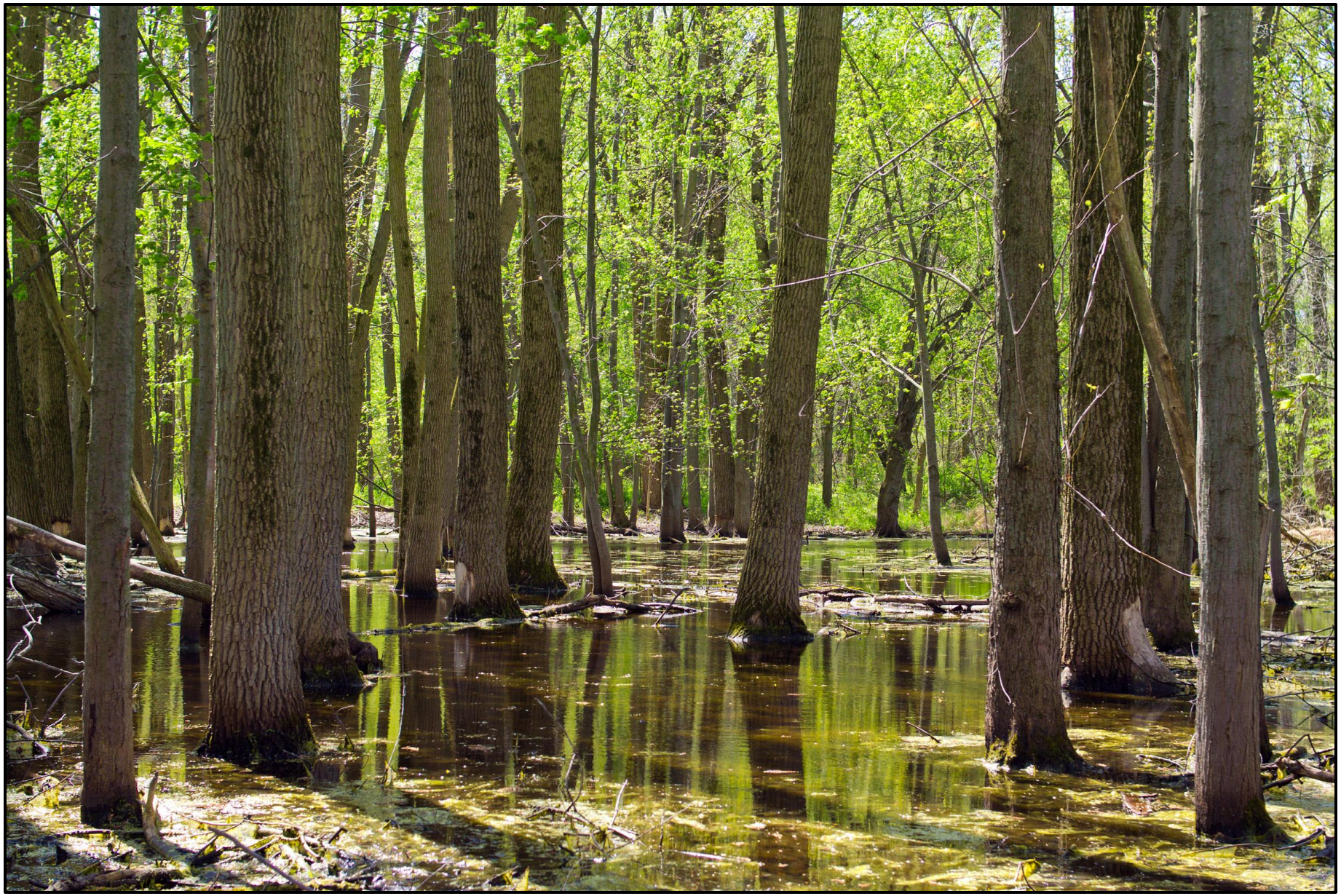


Iris virginica var. *shrevei* (Blue flag). (Photo by Paul McMurray)

Members of the plant team. (Photo by Ben Hess)

Members of the plant team. (Photo by Ben Hess)



Swamp woodland (Photo by Jonah Westrick)

Oxbow panorama (Photo by Lyle McDermott)

Members of the plant team (Photo by Ben Hess)

Members of the plant team (Photo by Ben Hess)

Eagle Marsh Biodiversity Survey 2014
Scientists, Naturalists, Students, Staff and Community Volunteers (126)

Arata, Nathan	General
Bandor, Michelle	General
Blocher, Ben	Vascular Plants
Boner, Kevin	Aquatic Macroinvertebrates
Bonera, Kevin	Amphibians & Reptiles
Bradtmiller, Danielle	General
Brattain, R. Michael	Beetles (Coleoptera)
Brodman, Robert (Bob)	Amphibians & Reptiles
Bruck, Roger	Invasive Plants
Burnett, Curt	Vascular Plants
Byerly, Wayne	General
Carlson, Ross *	Aquatic Macroinvertebrates
Chamberlain, Angie	Mammals
Codispati, Margit	Birds
Cunningham, Don	General
Davis, JoAnne	Fish & Freshwater Mussels
De Smet, Willy	Vascular Plants
Donnelly, Deb	General
Finkler, Michael S.	Amphibians & Reptiles
Fisher, Brant *	Fish & Freshwater Mussels
Fisher, Brett	Vascular Plants
Fleming, Tony	Geology
Forsythe, Alex	Birds
George, Pam	Aquatic Macroinvertebrates
Gillespie, Bob	Fish & Freshwater Mussels
Golani, Lee	Butterflies
Gorney, Don *	Birds, Butterflies
Greer, Jim	Amphibians & Reptiles
Gromhofer, Megan	Amphibians & Reptiles
Guebard, Deb	Vascular Plants
Harby, Nick	Vascular Plants
Heath, Alyssa	Singing Insects
Heikens, Alice	Vascular Plants

Herbert, Nathan	Amphibians & Reptiles
Hess, Ben	Vascular Plants, Birds
Hincks, Liz	Aquatic Macroinvertebrates, Amphibians & Reptiles
Hobbs, F. Collin	Vascular Plants
Holde, Collin	Amphibians & Reptiles
Holde, Dillon	Amphibians & Reptiles
Holde, Honi	Amphibians & Reptiles
Holland, Jeffrey D *	Beetles (Coleoptera)
Hollenberg, Aaron	General
Holmes, Tiffany	Amphibians & Reptiles
Hutter, Mary Lou	General
Jacquart, Ellen	Vascular Plants
Jenkins, Shelley	Birds
Johnson, Anders	Amphibians & Reptiles
Jordan, Mark *	Amphibians & Reptiles
Kampschmidt, Barb	Birds
Keefer, Justin	Aquatic Macroinvertebrates
Kelker, Cathy	Birds
Kellenburger, Payton	Amphibians & Reptiles
Keller, Doug	Fish & Freshwater Mussels
Kepple, Grace	Amphibians & Reptiles
Kepple, Jackie	Amphibians & Reptiles
Keuneke, Beth	Singing Insects
Kimmel, Amber	Vascular Plants
Kimmel, Kris	General
Kingsbury, Bruce *	Amphibians & Reptiles
Kissick, Ashley	Beetles (Coleoptera)
Kolenda, Jason	Singing Insects
Koppler, Gracie	Birds
Koppler, Jackie	Birds
LaRocque, Mary	General
Lima, Abigail	Vascular Plants
Lortie, Jarrett	Amphibians & Reptiles
Lortie, Vickie	Amphibians & Reptiles
Marsh, Anastasia	Amphibians & Reptiles

Marshall, Jordan	Vascular Plants
Martinez-Lopez, Gia	Amphibians & Reptiles
McGinley, Julie	General
McGinley, Steve	General
McMurray, Paul *	Damselflies & Dragonflies
Moore, Jeff	Birds
Morris, Carly	Beetles (Coleoptera)
Mumaw, D.J.	Amphibians & Reptiles
Murphy, Bill *	Snail Killing Flies
Mynhardt, Glené	Singing Insects
Namestnik, Scott	Vascular Plants
Nestel, Cindy	Aquatic Macroinvertebrates
Niemeyer, John	Aquatic Macroinvertebrates
Powell, Gareth	Beetles (Coleoptera)
Powers, Cynthia	Birds
Powers, Ed	Birds
Pryor, Warren	Fish & Freshwater Mussels
Quinn, Polly	General
Rang, Rodger	Birds
Reidenbach, Maureen	Singing Insects
Reidenbach, Pat	Singing Insects
Rice, Tim	Birds, Amphibians & Reptiles
Ricketts, Beth	General
Roeger, Karen	Amphibians & Reptiles
Roeger, Mike	Amphibians & Reptiles
Roeger, Pete	Amphibians & Reptiles
Roth, Kirk *	Butterflies, Birds
Rothrock, Paul *	Vascular Plants
Ruch, Don	Vascular Plants, Fungi
Samek, Julie	General
Sanders, Kathryn	Fish & Freshwater Mussels
Schetter, Joe	Singing Insects
Schultz-Finkler, Anna	Amphibians & Reptiles
Schultz-Finkler, Matt	Amphibians & Reptiles
Schwartz, Sam	Vascular Plants

Schwelger, Jackie	General
Shearer, Cheryl	Vascular Plants
Silva, Amy	Coordinator
Simpson, Barb	General
Slack, Andrew	Birds
Smith, Carole	Birds
Smith, Ryan	Birds
Strang, Carl *	Singing Insects
Stulik, Emily	Amphibians & Reptiles
Swicegood, Carl	General
Taylor, John	Vascular Plants
Thada, Adam	Vascular Plants
Torkeo, Gary	Amphibians & Reptiles
Torkeo, Nancy	Amphibians & Reptiles
Van Meter, Hanna	Amphibians & Reptiles
Vance, Sandra	General, Vascular Plants
Wagner, Stephanie	Birds
Weber, Lou	Vascular Plants
Weidemeier, Andrew	Aquatic Macroinvertebrates, Amphibians, Reptiles
Weidemeier, Mike	Aquatic Macroinvertebrates, Amphibians, Reptiles
Wesolowski, Victoria	Amphibians & Reptiles
Whitaker, John *	Mammals
Wiedman, Larry	General
Winebrenner, John	Birds
Wood, Tyler	Fish & Freshwater Mussels
Yankowiak, Betsy	Coordinator

* Denotes a team leader

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End of Report – March 25, 2015