

Ecological Assessment of Averill Preserve, Forestview Natural Area, and Riverview Natural Area



**Prepared by: John J. Paskus, Peter J. Badra, Michael J. Monfils and
Bradford S. Slaughter**

**Michigan Natural Features Inventory
P.O. Box 13036
Lansing, MI 48909**

**Prepared for:
Little Forks Conservancy**

December, 2014

Report Number 2014-28

This document was prepared by the Michigan Natural Features Inventory, a program of Michigan State University Extension, on behalf of the Little Forks Conservancy.

Copyright 2014 Michigan State University Board of Trustees.

Michigan State University Extension programs and materials are open to all without regards to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, marital status, or family status.

Recommended citation:

Paskus, J.J., P.J. Badra, M.J. Monfils, and B. S. Slaughter. 2014. Ecological Assessment of Averill Preserve, Forestview Natural Area, and Riverview Natural Area. Report to the Little Forks Conservancy, Midland, MI. Report number MNFI 2014-28, 47 pp. + appendices.

Ecological Assessment of Averill Preserve, Forestview Natural Area, and Riverview Natural Area

**Prepared by: John J. Paskus, Peter J. Badra, Michael J. Monfils and
Bradford S. Slaughter**

**Michigan Natural Features Inventory
P.O. Box 13036
Lansing, MI 48909**

**Prepared for:
Little Forks Conservancy**

December, 2014

Report Number 2014-28

Table of Contents

Introduction.....	1
Plant and Natural Community Surveys.....	6
Site Ecological Summary: Averill Preserve	6
Site Ecological Summary: Forestview Natural Area	11
Site Ecological Summary: Riverview Natural Area	15
Bird Surveys.....	21
Mussel Surveys and River Habitat Assessment.....	29
Summary of Survey Results.....	39
Literature Cited	46
Appendix A: floristic quality assessment and plant list – Averill Preserve.....	48
Appendix B: floristic quality assessment and plant list – Forestview Natural Area	57
Appendix C: floristic quality assessment and plant list – Riverview Natural Area.....	67
Appendix D: floristic quality assessment and plant list – Summary of All Preserves	78
Appendix E: Qualitative Habitat Evaluation Index	92
Appendix F: Mussel species recorded from the Tittabawassee River watershed.....	95

Tables

Table 1. Bird species detected by survey station during point counts	24
Table 2. Bird species detected that have special status.....	27
Table 3. Latitude and longitude of aquatic survey sites, September 2014	31
Table 4. Numbers of unionid mussels recorded at each survey site	31
Table 5. Water chemistry measurements taken at aquatic survey sites	32
Table 6. Substrate particle size composition at each aquatic survey site.....	32
Table 7. Physical habitat characteristics at aquatic survey sites.....	33
Table 8. Qualitative Habitat Evaluation Index scores of each aquatic survey site	33
Table 9. General narrative ratings assigned to QHEI scores	36
Table 10. Floristic summary of all three preserves.....	42

Figures

Figure 1. Location of all three preserves	1
Figure 2. Saginaw Bay lake plain subsection	2
Figure 3. Tittabawassee River watershed	3
Figure 4. Valley Segment Ecological Communities in Tittabawassee River Watershed ...	4
Figure 5. 303d sections and dams in the Tittabawassee River Watershed	4
Figure 6. Natural Communities and Land Cover of Averill Preserve.	6
Figure 7. Open floodplain forest along Averill Creek	7
Figure 8. Patch of state threatened beak grass near the mouth of Averill Creek.....	9
Figure 9. Small colony of state threatened forked aster near the mouth L&B Drain.	9
Figure 10. Natural communities and land cover of Forestview Natural Area.....	11
Figure 11. Semi-open meander scar within the floodplain forest.....	12
Figure 12. Large colony of state threatened beak grass on sandy levee.....	13
Figure 13. Closeup view of state special concern American gromwell on sandy levee...	13
Figure 14. Natural communities and land cover of Riverview Natural Area	15
Figure 15. Small island of mesic northern forest on the large flat plateau	17
Figure 16. State threatened forked aster along eroding bank.....	18
Figure 17. Large patch of state threatened beak grass in floodplain forest	18
Figure 18. Locations of raptor and songbird surveys	22
Figure 19. Locations of aquatic survey sites, September 2014.....	30
Figure 20. Fatmucket (<i>Lampsilis siliquoidea</i>) at aquatic survey Site 4.....	34
Figure 21. Graph of flow (cfs) of the Tittabawassee River at Midland, MI.....	37
Figure 22. Graph of flow (cfs) of the Tittabawassee River at Midland, MI.....	38
Figure 23. Drain outlet located approximately 100m south of aquatic survey Site 5.....	38
Figure 24. Steep, eroded gully south of aquatic survey Site 5.....	39
Figure 25. Wood Thrush.....	40
Figure 26. Acadian Flycatcher	40

1. Introduction

The Little Forks Conservancy (LFC) owns one preserve located in Lincoln Township, Midland County: Averill Preserve (74 acres); and two preserves in Homer Township, Midland County: Forestview Natural Area (70 acres), and Riverview Natural Area (419 acres). The three sites are all located south of US 10 and just west of the city of Midland (Figure 1). All three preserves are adjacent to the Tittabawassee River and each one contains significant river frontage ranging from 3,000 ft. to 1.75 miles. The preserves, totaling 563 acres, were purchased by the LFC between 2003 and 2012.

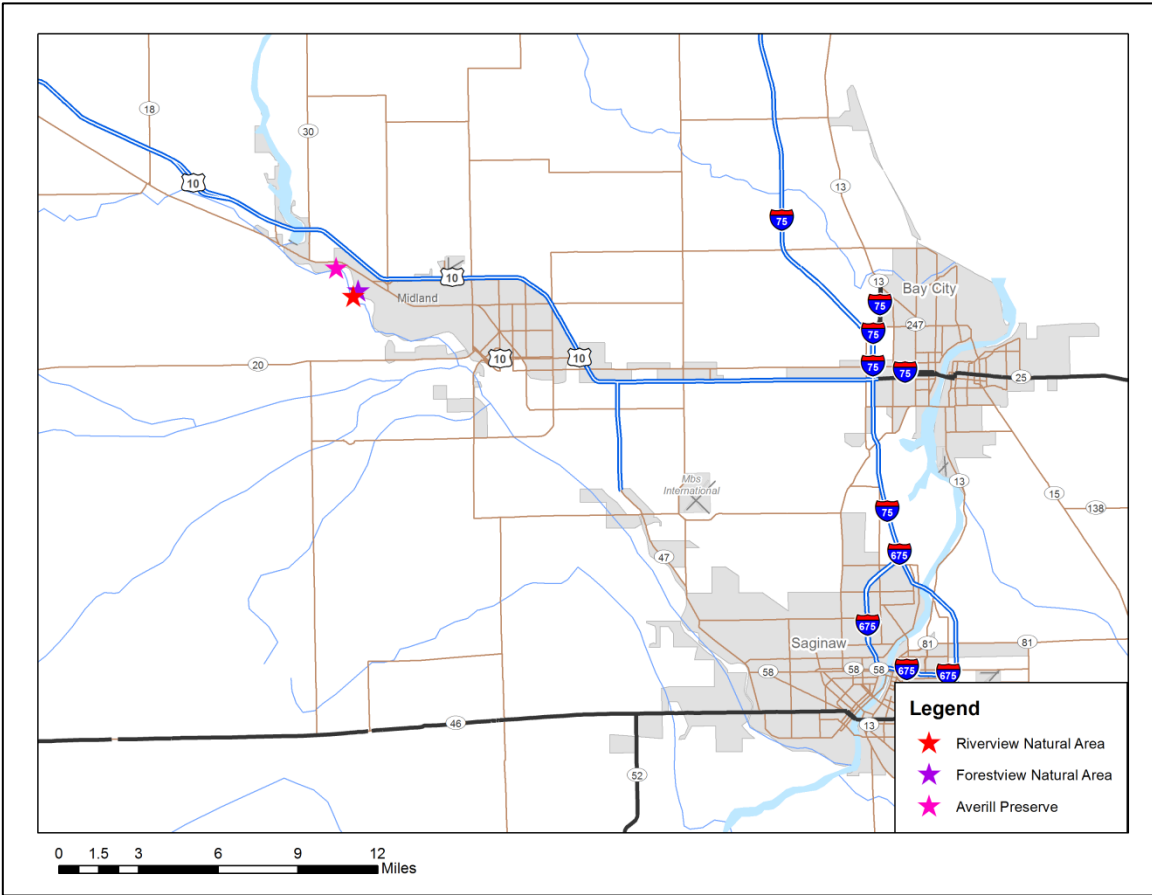


Figure 1. Location of Averill Preserve, Forestview Natural Area, and Riverview Natural Area.

The properties between Midland and Sanford along the Tittabawassee River corridor were identified as a priority area for conservation since the inception of the LFC. The LFC’s founding board was primarily focused on protecting the local river corridors of the Tittabawassee, Chippewa and Pine Rivers which together form the Tittabawassee River Watershed (Lipchitz 2014). These sites also serve the conservancy’s key goals of protecting important biodiversity areas and providing recreation opportunities for residents in and around Midland County.

Although it was assumed each of these sites harbored important ecological values, none of the preserves had been systematically surveyed to document the plants, birds, and natural communities occurring on these lands. In addition, no aquatic surveys have been conducted in the

stretch of Tittabawassee River adjacent to these preserves. To fill these data gaps and help the LFC better understand the ecological assets they have on their lands, The Michigan Natural Features Inventory (MNFI) was contracted in 2014 to conduct ecological surveys at each of these Little Forks Conservancy owned preserves as well as the adjacent stretch of the Tittabawassee River during the 2014 field season.

Ecoregion and Watershed Context

The three preserves are all located within the Saginaw Bay Lake Plain (subsection VI.6), which consists primarily of flat glacial clay lake plain that is broken up by several extensive sandy channels (Figure 2). Lacustrine deposits of clay are generally quite thick and range from 300 ft. at the farthest inland portion of the lake plain to 50 ft. or less near Saginaw Bay. American elm, basswood and red ash dominated large expanses of the flat lake plain and were often associated with northern white cedar, hemlock, white pine, burr oak, swamp white oak, and tamarack. Beech and sugar maple were more common in the better drained areas such as inland sandy beach ridges (Albert 1995) formed during the previous glacial period when the Saginaw Bay region was experiencing much higher water levels. This region was historically and still is important for agriculture, evaporates and brines for the chemical industry, as well as oil and gas production. During the logging era of the 1800s, the northern portion of the Saginaw Bay watershed was one of the largest pineries in Michigan, producing approximately one billion board feet of lumber.

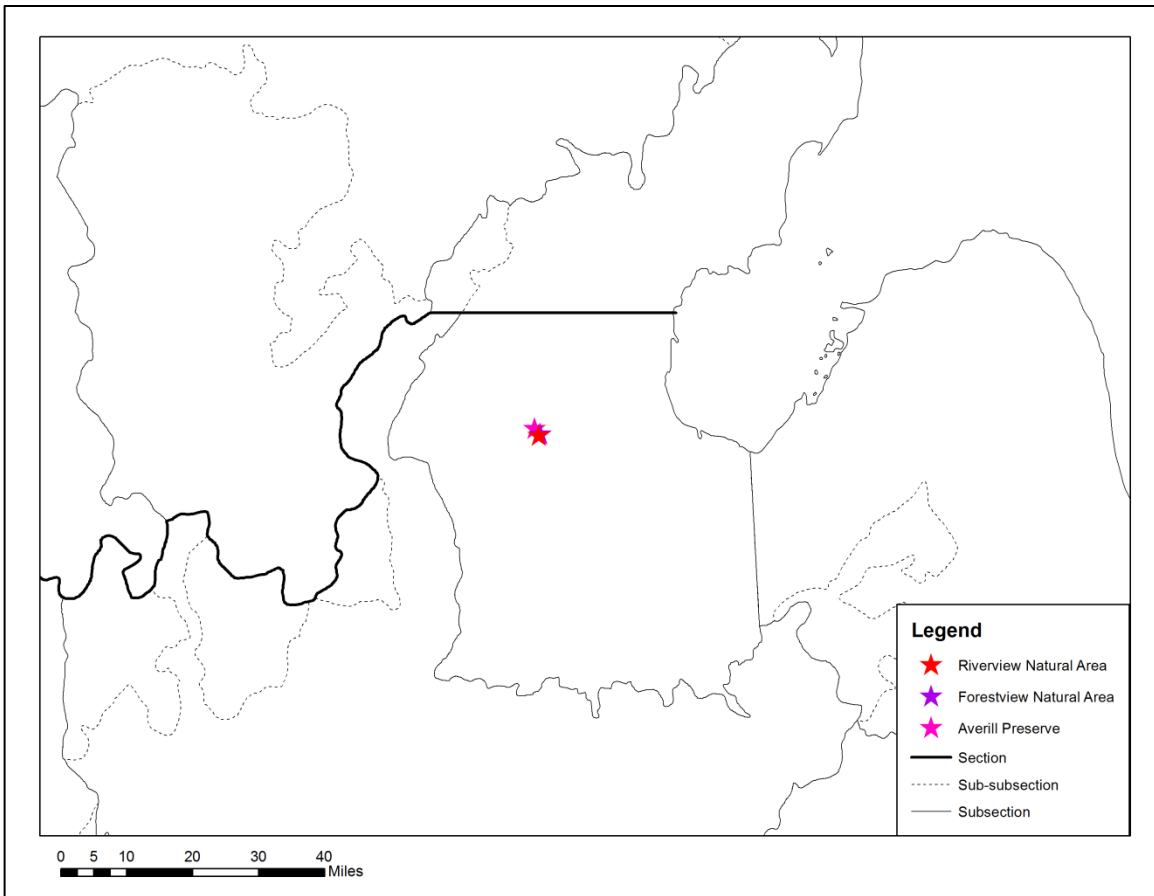


Figure 2. Saginaw Bay Lake Plain Subsection VI.6.

The three LFC preserves are also all located within the Tittabawassee River Watershed (TRW), the fifth largest watershed in Michigan and the largest tributary watershed of the Saginaw River (contributing 50% of its flow). Located centrally in Michigan's Lower Peninsula (Figure 3), the TRW lies within a 13-county area that includes parts of Arenac, Bay, Clare, Gladwin, Gratiot, Isabella, Mecosta, Midland, Montcalm, Ogemaw, Osceola, Roscommon and Saginaw counties. The TRW's 621 stream miles drain a land area of approximately 2,472 mi² (Schrouder, et al. 2009).

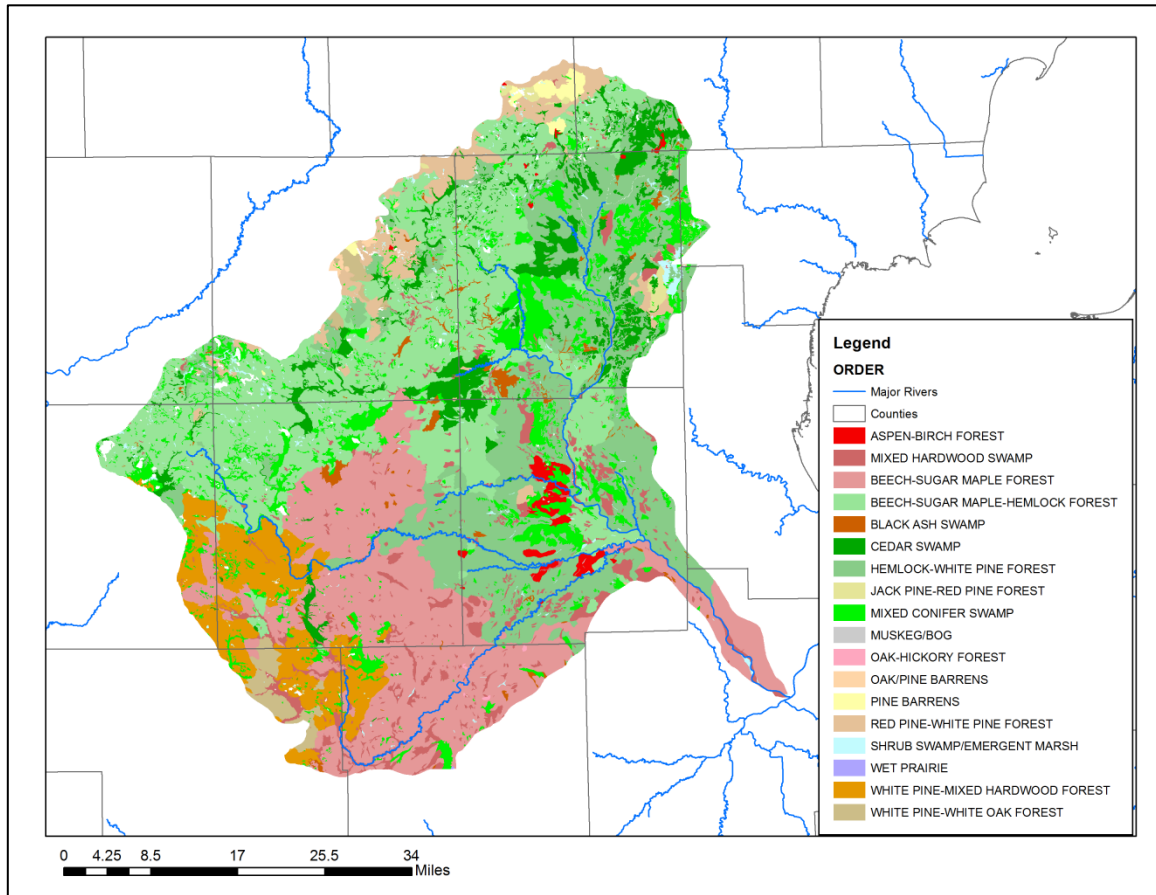


Figure 3. Tittabawassee River watershed and associated circa 1800 vegetation.

Historically, the Tittabawassee River watershed was predominantly forested. Mesic northern forest (65%) and dry-mesic northern forest (12%) were the most common natural community types prior to the logging era, followed by dry northern forest and mixed conifer swamp (Figure 3). After the logging era, the majority of the southern portion of the watershed was converted to agriculture and urban settlements. The northern portion primarily regenerated back to a forested condition, largely due to former timber lands reverting back to the state. Today, second and third growth mesic and dry-mesic northern forests still dominate the landscape, however agriculture now makes up 44.8% of the watershed (Schrouder, et al. 2009).

To better understand and manage the different types of river systems across the state, researchers developed a statewide model that breaks watersheds such as the Tittabawassee, into smaller river segments. These segments are based on water temperature, gradient, and size. As shown in Figure 4, The Tittabawassee River consists of cold and cold transitional streams in the headwaters and warm small rivers downstream from the headwaters. The lower mainstem where the preserves are

located, is considered a warm, large river type. Currently, there are 143 dams registered with the MDEQ within the watershed (Schrouder, et al. 2009), and most are located in the headwaters where there are steeper gradients (Figure 5). All three preserves are located between Sanford Dam to the north, and Dow Dam to the south. Despite the major human modifications in the region, the watershed contains only four 303d listings. The largest 303d listing area is situated along the mainstem where the three preserves are located.

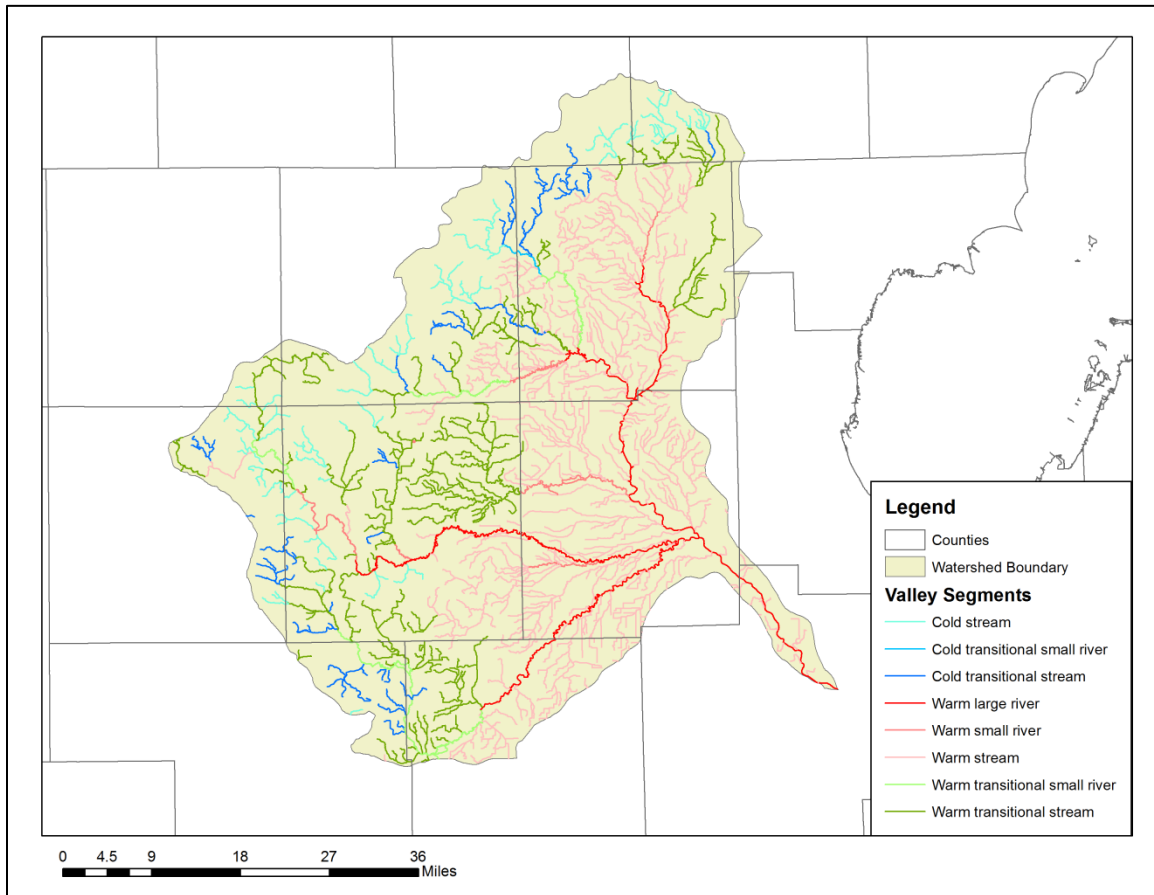


Figure 4. Ecological Valley Segments within the Tittabawassee River watershed. Valley Segments are based on the Valley Segment Ecological Classification developed by the Institute for Fisheries Research, University of Michigan.

The Preserves

Being in such close proximity to the industrial city of Midland as well as Saginaw and Bay City, most of this area was probably logged sometime in the mid to late 1800's during the height of the logging era, and again in the early 20th century (based on average tree diameter and height). Most of the mature trees observed during the surveys appeared to be approximately 60 to 80 years old, which means the majority of the forests were probably last cut in the 1930's to 1950's. Some of the areas at Forestview were cut as recently 2009 (Lipchitz, personal communication). Black and white aerial photographs from the late 1930's of the area would help ascertain both natural cover and tree age in that timeframe. In the late 19th century the Averill Preserve was a significant log banking grounds during the rapid timbering of Michigan's virgin forests. In fact, it was estimated to be the largest banking grounds in the world. Over one billion board feet of timber were moved into the Tittabawassee River and floated downstream to mills in Midland, Saginaw and Bay City.

Based on circa 1800 vegetation data, the majority of these preserves were historically dominated by both mesic northern forest and floodplain forest. Today, floodplain forest and mesic northern forest are still the dominant natural community types. Dry-mesic northern forest, old field, shrub thicket, bog, and emergent marsh are found in moderate to small-sized pockets.

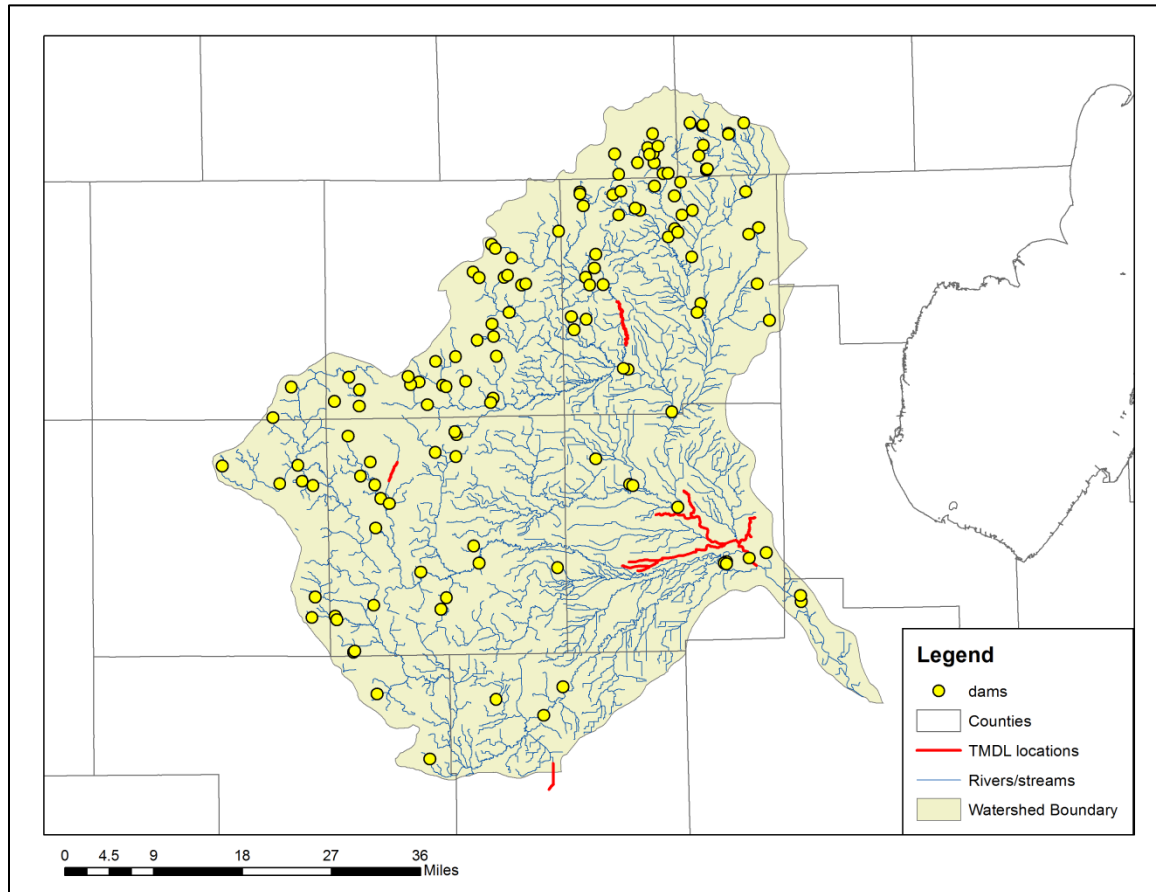


Figure 5. Location of 303d designated river sections and dams in the Tittabawassee River watershed.

Overview of Ecological Surveys

MNFI was tasked with collecting field data on plants, natural communities, birds, mussels and riverine habitat. The MNFI biologists reviewed preserve boundaries, landcover data, digital aerial photographs and topographic maps to better familiarize themselves with each of the sites. Bird data were collected in March and June of 2014 from all three preserves. Plant and natural community data were collected in June, August, and September, 2014. Mussel and riverine habitat data were collected in September, 2014 in the Tittabawassee River and Averill Creek. In addition, a biologist collected very limited data on amphibians and reptiles in July, 2014.

The following chapters summarize each of the categories mentioned above: 1) plants and natural communities; 2) birds; and 3) aquatics and riverine habitat. The chapters on birds and aquatic and riverine habitat contain sections on methods, results, and discussion. The plants and natural communities chapter is broken down by the three preserves, and contains site descriptions, information on rare plant and non-native species, key threats, and management recommendations.

2. Plants and Natural Communities

Site Ecological Summary: Averill Preserve

Twp: Lincoln Township

Sections: 33 and 34

Size: 74 acres

General Site Description:

Bounded by Midland County Park and Recreation's Pere Marquette Rail-Trail on the north and over 5,300 feet of the Tittabawassee River to the south, the Averill Preserve is a long, narrow 74-acre property held by The Little Forks Conservancy since 2003. The property is south of East Wackerly Road and west of Pioneer Trail Road. This is the Conservancy's second nature preserve. The preserve has been dramatically impacted by 19th and 20th century human activities, and is predominantly characterized by old field and early successional habitats dominated by shrubs and young trees, especially white pine (*Pinus strobus*) on formerly cleared uplands. Narrow bands of floodplain forest occur along the bank of the



Figure 6. Natural Communities and Land Cover of Averill Preserve.

Tittabawassee River and along Averill Creek, although at least portions of the latter area were likely cleared historically. Early successional forest and silver maple-lined meander scars occur in the northern part of the property near the Pere Marquette Rail-Trail.

Floodplain Forest

The floodplain forest along Averill Creek is young, reflecting historic land clearing in the area. The canopy supports small-diameter green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*), and is open and patchy due to the devastation of green ash by the emerald ash borer (Figure 7). Silver maple (*Acer saccharinum*) and cottonwood (*Populus deltoides*) are occasional in this area. In part a result of the open canopy, the ground layer is lush and dense, characterized by jumpseed (*Persicaria virginiana*), sedges (primarily *Carex grayi* and *C. lupulina*), Virginia creeper (*Parthenocissus quinquefolia*), Lake Ontario aster (*Symphotrichum ontarionis*), white avens (*Geum canadense*), white grass (*Leersia virginica*), moneywort (*Lysimachia nummularia*), fringed loosestrife (*L. ciliata*), wood-sage (*Teucrium canadense*), and patches of reed canary grass (*Phalaris arundinacea*).



Figure 7. Open floodplain forest along Averill Creek. Openness is primarily due to ash die-off from the emerald ash borer.

The narrow band of floodplain forest along the Tittabawassee River consists of a mesic levee and very narrow first bottom. The lowest areas support cottonwood, green ash, and silver maple. Large mature basswood (*Tilia americana*) trees are very common on the levee. Shrubs are common throughout the site, especially in canopy gaps and in small clearings along the river. In particular, ninebark (*Physocarpus opulifolius*) is very abundant, and often associated with Morrow honeysuckle (*Lonicera morrowii*), autumn olive (*Elaeagnus umbellata*), common buckthorn (*Rhamnus cathartica*), European highbush-cranberry (*Viburnum opulus*), and gray dogwood (*Cornus foemina*). The ground layer is dense in canopy gaps and openings and patchy in shade. Typical species include late goldenrod (*Solidago gigantea*), tall goldenrod (*S. altissima*), Virginia wild-rye (*Elymus virginicus*), sedge (*Carex grisea*), Virginia creeper, Canada anemone (*Anemone canadensis*), wild madder (*Galium obtusum*), wood-sage, hog-peanut (*Amphicarpaea bracteata*), purple meadow-rue (*Thalictrum dasycarpum*), scouring rush (*Equisetum hyemale*), and thin-leaved sunflower (*Helianthus decapetalus*).

Old Field/Early Successional Forest

The majority of the Averill Preserve was historically cleared, presumably at least in part to support log banking operations in the late 1800's. Although the uplands appear to have been dominated by herbaceous species as recently as the late 1990's (based on 1998 aerial photographs), woody invasion has been rapid over the past 15 years, with young white pines common throughout the uplands, in association with ninebark, dogwoods, staghorn sumac (*Rhus typhina*), Morrow honeysuckle, common buckthorn, common privet (*Ligustrum vulgare*), and wild black currant (*Ribes americanum*). Common herbaceous species include those of the river floodplain, in addition to a mixture of native and non-native old field species such as tall goldenrod, Queen Anne's-lace (*Daucus carota*), switchgrass (*Panicum virgatum*), white vervain (*Verbena urticifolia*), wild bergamot (*Monarda fistulosa*), grass-leaved goldenrod (*Euthamia graminifolia*), black-eyed Susan (*Rudbeckia hirta*), crown vetch (*Securigera varia*), and ear-leaved brome (*Bromus latiglumis*). Old meander scars surrounded by old field, shrub thicket, and early successional forest support species also typical of the floodplain forest, such as green ash, slender willow (*Salix petiolaris*), white grass, sedges, and southern blue flag (*Iris virginica*).

Two visits to this site (25 June and 11 August 2014) resulted in the identification of 221 vascular plants to species level, including 165 native taxa (75%), or approximately 9% of the native taxa known from Michigan (Reznicek et al. 2011). See Appendix A for a plant list and summary of the floristic quality assessment.

Rare Species:

Two state-listed species, the state threatened forked aster (*Eurybia furcata*) and state threatened beak grass (*Diarrhena obovata*) were documented from this site (Figures 8 and 9). Most significantly, the population of forked aster is the first one documented in the state since 1934. Previously, forked aster was known from two historical locations, one in Monroe County and one along the Chippewa River in Midland County. The population at Averill Preserve is concentrated in a clearing with mostly native species on the bank of the Tittabawassee River near its confluence with the L & B Drain. A smaller colony was also noted in shaded floodplain forest west of this location. Beak grass occurred as scattered small clumps in the floodplain forest along the Tittabawassee River and locally near the mouth of Averill Creek. These patches of beakgrass are part of one of the largest populations in Michigan, extending over three miles of riverbank between Sanford and Midland.



Figure 8. Patch of state threatened beak grass near the mouth of Averill Creek.



Figure 9. Small colony of state threatened forked aster near the mouth L&B Drain.

Non-Native Species:

Among the non-native taxa, the most common species were autumn olive, common buckthorn, Morrow honeysuckle, common privet, multiflora rose, smooth brome (*Bromus inermis*), spotted knapweed (*Centaurea stoebe*), white sweet-clover (*Melilotus alba*), yellow sweet-clover (*M. officinalis*), Kentucky bluegrass (*Poa pratensis*), moneywort, and reed canary grass.

Key Threats:

Invasive Species: Due to the historic disturbance and predominance of early successional habitat, the majority of this site is infested by invasive plant species, including common buckthorn, glossy buckthorn, Morrow honeysuckle, autumn olive, and reed canary grass. In addition, emerald ash borer has killed most of the canopy ashes throughout the site; this is particularly noticeable along the upper reaches of Averill Creek.

Deer herbivory: Signs of deer browse and trails were somewhat evident at this site, however it is unclear how high deer densities are in this area between US-10 and the river. Deer have a tendency to favor certain herbaceous and woody plant species which can lead to the elimination of important ground cover species and/or recruitment of certain canopy species. This is a common problem throughout the Lower Peninsula, particularly in areas with a high amount of fragmentation.

Dams: This site is located between Sanford Dam to the northwest and Dow Dam to the southeast. In evaluating gauge data from Sanford Dam, it is quite apparent that river level fluctuations are unusually dramatic even on a daily basis. These water level fluctuations have caused severe erosion along the river bank, particularly the steeper portions found on the eastern portion of the site.

Management Recommendations:

Maintain Forked Aster Populations: This site is unusual in that the population of forked aster, the first documented in Michigan since 1934 and also the largest of the three populations discovered over the

course of these surveys, is concentrated in an anthropogenic clearing where the L & B Drain drains into the Tittabawassee River. Forked aster appears to be sensitive to canopy closure and deer browse. Maintenance and management of the open habitat along the river will likely require occasional removal of woody species and possibly brush-hogging. Given the rarity of forked aster in Michigan and the upper Midwest, we strongly recommend monitoring the surrounding habitat and forked aster population, and managing woody encroachment as needed to maintain these small but significant populations.

Control Invasive Species: The preponderance of invasive species at this site is partly the result of historical disturbances and clearing. Invasive plants of particular concern, such as those that are capable of altering community structure and nutrient cycling, should at least be controlled in the less disturbed floodplain forest habitats, particularly Averill Creek.

Manage for Natural Forest Succession: One of the primary management decisions at this site is whether to permit the succession of the old fields and shrub thickets to forest (presumably dry-mesic northern forest and floodplain forest), or to maintain at least some of the open acreage in early successional states. If the latter is preferred, a combination of brush-hogging, mowing, and prescribed fire is likely sufficient to maintain an interesting assemblage of native and non-native herbaceous species. Given the lack of mature forest in the area surrounding Midland as well as the annual costs associated with maintaining early successional habitat, we highly recommend allowing the old fields and shrub thickets to naturally succeed to mature northern dry-mesic, mesic and floodplain forest. Averill Preserve could be used as a demonstration site for forest succession in the immediate area, educating visitors about the natural process of succession, effective management techniques, and the benefits of mature forest in the region.

Site Ecological Summary: Forestview Natural Area

Twp: Homer Township

Sections: 2 and 3

Size: 70 acres

General Site Description:

The preserve is directly across the Tittabawassee River from Riverview Natural Area. It can be accessed from the west side of Tittabawassee Rd. approximately 0.2 miles south of N. Saginaw Rd. Visitors park at the trailhead off Tittabawassee River Rd. and follow a dirt road for approximately 0.5 miles before reaching the bulk of the preserve. The eastern portion of the site consists of dry-mesic northern forest bordered by a small mature red pine plantation which quickly drops down into a narrow band of hardwood-conifer swamp. Immediately west of the swamp is a large floodplain forest bordering the river. The floodplain forest consists of a broad sandy levee, narrow bottoms interspersed with sandy terraces, and several meander scars.

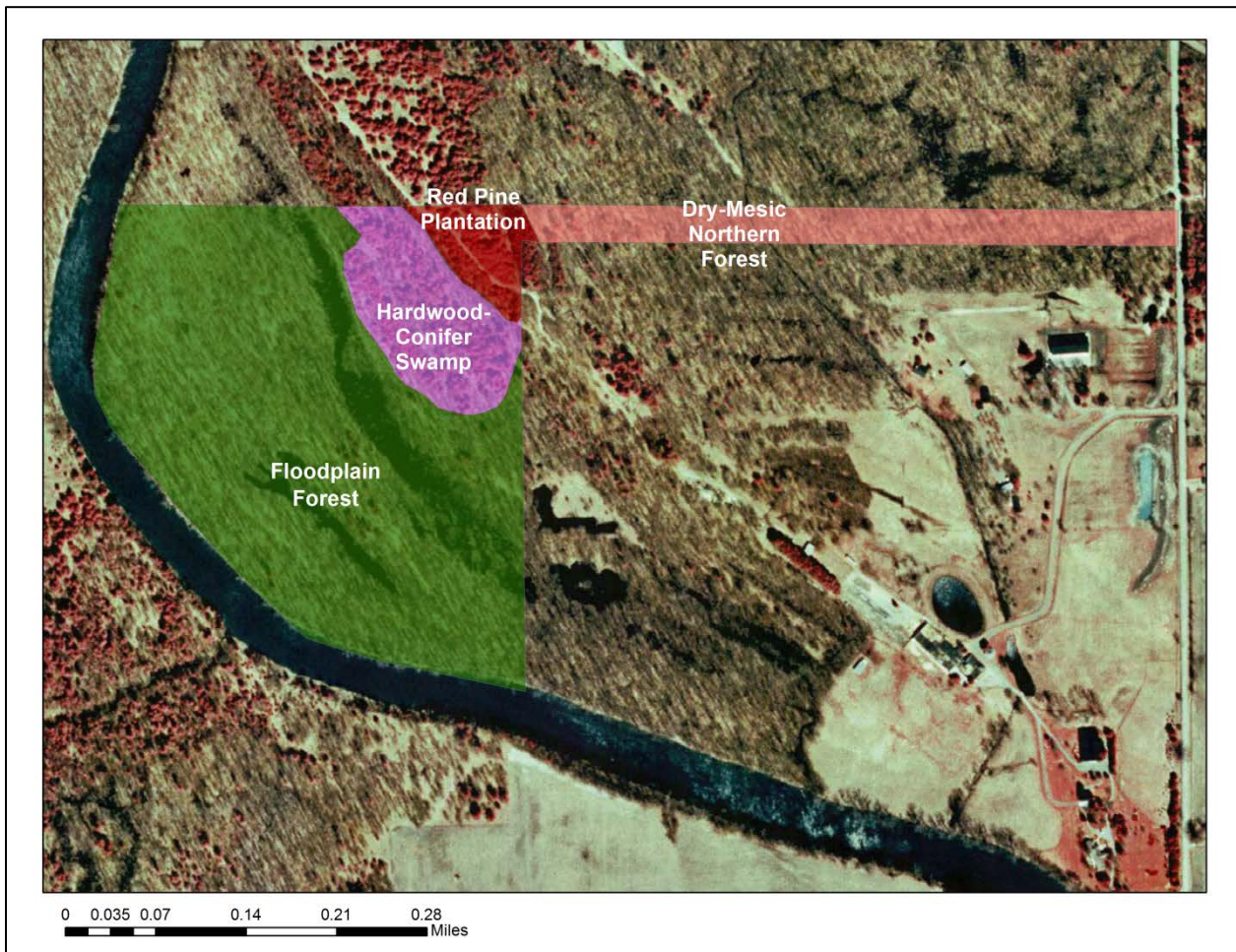


Figure 10. Natural Communities and land cover of Forestview Natural Area.

Floodplain Forest

This site is characterized predominantly by a broad band of floodplain forest along the Tittabawassee River. Characteristic canopy species on the broad, sandy terraces and narrow bottoms include green ash (*Fraxinus pennsylvanica*), black ash (*F. nigra*), silver maple (*Acer saccharinum*), basswood (*Tilia americana*), American elm (*Ulmus americana*), bur oak (*Quercus macrocarpa*), and hackberry (*Celtis occidentalis*). Beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and black maple (*A. nigrum*) are locally common on mesic, slightly elevated terraces. The understory is open, with occasional to common musclewood (*Carpinus caroliniana*) and downy hawthorn (*Crataegus mollis*). The lush, species-rich ground layer supports fowl manna grass (*Glyceria striata*), bottlebrush grass (*Elymus hystrix*), Virginia wild-rye (*E. virginicus*), several sedges (e.g., *Carex bromoides*, *C. cristatella*, *C. grayi*, *C. grisea*, *C. lupulina*, *C. muskingumensis*, and many others), white grass (*Leersia virginica*), riverbank grape (*Vitis riparia*), Virginia creeper (*Parthenocissus quinquefolia*), beak grass (*Diarrhena obovata*), fringed loosestrife (*Lysimachia ciliata*), moneywort (*L. nummularia*), New York fern (*Thelypteris noveboracensis*), wood nettle (*Laportea canadensis*), common blue violet (*Viola sororia*), wild-ginger (*Asarum canadense*), wood-sage (*Teucrium canadense*), clearweed (*Pilea pumila*), jumpseed (*Persicaria virginiana*), and many other species. Buttonbush (*Cephalanthus occidentalis*) is locally dominant around the margins of the deepest meander scars, which are otherwise inundated with water and have a low density of herbaceous cover except at the very margins of the depressions (Figure 11).



Figure 11. Semi-open meander scar within the floodplain forest.

Hardwood-Conifer Swamp

East of the floodplain forest, there is a narrow band of hardwood-conifer swamp located at the base of a steep ridge. This habitat shares many species with the adjacent floodplain forest, but hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), and red maple (*Acer rubrum*) are more prevalent here. The uplands immediately to the east of the swamp are locally dominated by large-toothed aspen (*Populus grandidentata*), with an area of planted red pines (*Pinus resinosa*) on the disturbed, sandy crest of the ridge.

Dry-Mesic Northern Forest

The long, narrow easement extending from this area east to North Tittabawassee River Road passes through dry-mesic northern forest characterized by red oak (*Quercus rubra*), white oak (*Q. alba*), black cherry (*Prunus serotina*), white pine, and red maple, interspersed with areas of low, wet, open southern hardwood swamp dominated by green ash and silver maple, with a ground layer dominated by *Carex bromoides* and other sedges in addition to ferns such as sensitive fern (*Onoclea sensibilis*).

Floristic Summary:

Two visits to the Forestview site (25 June and 12 August 2014) resulted in the identification of 269 vascular plants to species level, including 230 native taxa (86%), or approximately 13% of the native taxa known from Michigan (Reznicek et al. 2011). See Appendix B for the plant list and summary of the floristic quality assessment.

Rare Species:

Two state-listed species, the state threatened beak grass (*Diarrhena obovata*) and state special concern American gromwell (*Lithospermum latifolium*) were documented from this site. Beak grass is locally common in the floodplain forest immediately adjacent to the Tittabawassee River. These plants are part of one of the largest populations in Michigan extending over three miles of riverbank between Sanford and Midland. American gromwell is widely distributed as scattered colonies and individual clumps in the same areas, although it is restricted to a narrower band of habitat on a broad, forested sandy levee immediately adjacent to the river.



Figure 12. Large colony of state threatened beak grass on sandy levee.



Figure 13. Closeup view of state special concern American gromwell also on sandy levee.

Non-Native Species: Among the non-native taxa, the most common species were autumn-olive (*Elaeagnus umbellata*), Morrow honeysuckle (*Lonicera morrowii*), Japanese barberry (*Berberis thunbergii*), lawn prunella (*Prunella vulgaris*), moneywort (*Lysimachia nummularia*), hedge-parsley (*Torilis japonica*), and bull thistle (*Cirsium vulgare*).

Key Threats:

Invasive Species: Invasive plants such as autumn olive and moneywort are the primary threat at this site. Invasives were particularly abundant in the southern portion of the floodplain which appears to have been historically grazed. In addition, emerald ash borer has killed-off most of the canopy ashes throughout the site, particularly in the hardwood-conifer swamp and meander scars, and persistence of the species and its effects is likely into the future.

Deer herbivory: Signs of deer browse and trails were somewhat evident at this site, particularly in the upland areas in the eastern portion of the site. However it is unclear how high deer densities are in this area. Deer have a tendency to favor certain herbaceous and woody plant species which can lead to the elimination of important ground cover species and/or recruitment of certain canopy species.

Past Forest Management Practices: Additional threats are posed by past forest management practices that eliminated most of the large-diameter canopy trees from this site, opened up the canopy, and disturbed the sensitive alluvial soils in the floodplain. It is evident that logging has periodically occurred throughout history at this site, with some logging occurring as recently as 2008 (Lipschitz, personal communication). Only a few large diameter trees still remain at this site, largely in areas that appear to have been historically grazed such as the very southwest portion of the site.

Dams: This site is located between Sanford Dam to the northwest and Dow Dam to the southeast. In evaluating gauge data from Sanford Dam, it is quite apparent that river level fluctuations are unusually dramatic even on a daily basis. These water level fluctuations have caused some erosion along the river bank, particularly the steeper banks found in the southern most portion of the site.

Management Recommendations:

Controlling Invasive Species: Monitor and treat infestations of invasive plant species, particularly those that threaten to alter community structure or nutrient cycling. In addition to autumn-olive, Morrow honeysuckle, and Japanese barberry, common buckthorn (*Rhamnus cathartica*) and glossy buckthorn (*Frangula alnus*) were occasionally encountered and should be eradicated where possible. The site is still recovering from recent logging activities that opened up the canopy and disturbed the soils over much of the floodplain, especially along old logging roads. Although these areas will slowly recover in the absence of additional disturbances, they are particularly susceptible to the establishment and spread of non-native plants and should be monitored.

Controlling Deer Populations: In addition to the treatment of invasive species, the impacts of deer browse and activity should be monitored to determine if the local deer population is at ecologically sustainable densities, such that regeneration of woody species and populations of favored herbaceous species are not significantly impacted. An annual managed deer hunt on the natural area may be warranted if neighboring landowners are willing to cooperate and assist in reducing deer densities.

Site Ecological Summary: Riverview Natural Area

Location: Homer Township

Sections: 2, 3, and 11

Size: 419 acres

General Site Description: The 419 acre Riverview Natural Area is located off of Wheeler Rd. It is the largest of the three sites surveyed, and supports several natural community types, including floodplain forest, mesic northern forest, dry-mesic northern forest, and bog in addition to areas of row crops and an artificial clearing (Figure 14). The majority of natural habitat is a combination of floodplain forest on broad, low-relief terraces and bottoms west of the Tittabawassee River, and dry-mesic northern forest interspersed with a variety of forest types on a broad, relatively flat plateau west of the floodplain.

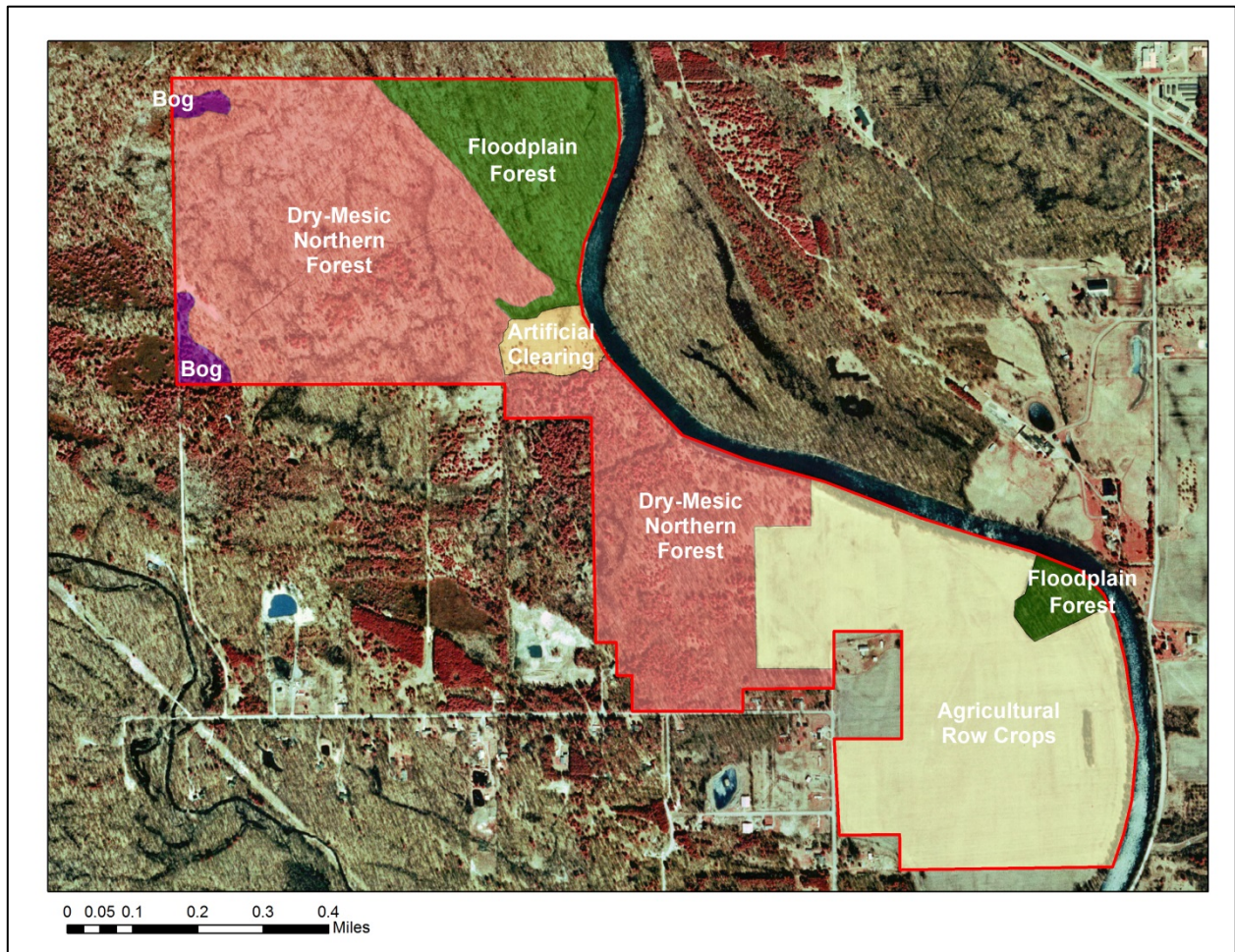


Figure 14. Natural Communities and Land Cover of Riverview Natural Area.

Floodplain Forest

The floodplain forest at this site supports a diverse assemblage of mature canopy trees. Silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and bur oak (*Quercus macrocarpa*) are characteristic, with basswood (*Tilia americana*), red oak (*Quercus rubra*), hackberry (*Celtis occidentalis*), sugar maple (*Acer saccharum*), and black maple (*A. nigrum*) common, especially on higher mesic sandy terraces. Other tree species include swamp white oak (*Quercus bicolor*), black ash (*Fraxinus nigra*), cottonwood (*Populus deltoides*) and red maple (*Acer rubrum*). Common small trees and shrubs include muscledwood (*Carpinus caroliniana*), ironwood (*Ostrya virginia*), downy hawthorn (*Crataegus mollis*), autumn olive (*Elaeagnus umbellata*), Morrow honeysuckle (*Lonicera morrowii*), and ninebark (*Physocarpus opulifolius*). Characteristic ground layer species include beak grass (*Diarrhena obovata*), wood-sage (*Teucrium canadense*), hog-peanut (*Amphicarpaea bracteata*), bottlebrush grass (*Elymus hystrix*), Virginia wild-rye (*E. virginicus*), northern bedstraw (*Galium boreale*), fragrant bedstraw (*G. triflorum*), Virginia creeper (*Parthenocissus quinquefolia*), heart-leaved aster (*Symphotrichum cordifolium*), wild blue violet (*Viola sororia*), purple meadow-rue (*Thalictrum dasycarpum*), clearweed (*Pilea pumila*), Canada anemone (*Anemone canadensis*), moneywort (*Lysimachia nummularia*), sedges (esp. *Carex bromoides*, *C. formosa*, *C. grayi*, *C. grisea*, *C. lupulina*, and *C. muskingumensis*), long-awned wood grass (*Brachyelytrum erectum*), white grass (*Leersia virginica*), and sensitive fern (*Onoclea sensibilis*).

Floodplain Forest (small woodlot)

In the south eastern portion of the site, surrounded by agricultural fields and the river, is a small woodlot supporting an unusual patch of floodplain forest that appears to experience frequent inundation and deposition of sandy alluvium in the lowest spots. Several species noted here were rare or absent elsewhere, including ostrich fern (*Matteuccia struthiopteris*), zigzag goldenrod (*Solidago flexicaulis*), starry false Solomon's-seal (*Maianthemum stellatum*), American gromwell (*Lithospermum latifolium*), bellwort (*Uvularia grandiflora*), common blue phlox (*Phlox divaricata*), and the sedges *Carex woodii* and *C. hitchcockiana*. The isolated woodlot showed less evidence of recent disturbances, including timber harvests, and the canopy was dominated by larger-diameter trees than are typical in any of the areas we surveyed. This woodlot and its associated mature canopy trees should be maintained in a natural state. This area supported several species absent or uncommon elsewhere in the Natural Area, including populations of two rare plant species: forked aster (state threatened) and American gromwell (state threatened).

Dry-Mesic Northern Forest

The uplands between Wheeler Rd. and the river as well as the large flat plateau west of the floodplain are predominantly characterized by dry-mesic northern forest interspersed with southern hardwood swamp and pockets of mesic northern forest. The dry-mesic northern forests are dominated by white oak (*Quercus alba*), red oak (*Q. rubra*), white pine (*Pinus strobus*), black cherry (*Prunus serotina*), and paper birch (*Betula papyrifera*), with ironwood (*Ostrya virginiana*) and witch-hazel (*Hamamelis virginiana*) in the understory. The relatively sparse ground layer is characterized by Pennsylvania sedge (*Carex pennsylvanica*), bracken fern (*Pteridium aquilinum*), sedge (*Carex radiata*), calico aster (*Symphotrichum lateriflorum*), poverty grass (*Danthonia spicata*), Canada bluegrass (*Poa compressa*), Canada mayflower

(*Maianthemum canadense*), starflower (*Trientalis borealis*), and rough-leaved rice-grass (*Oryzopsis asperifolia*).

Islands of Mesic Northern Forest

Within the dry-mesic northern forest on the large flat plateau, there are several pockets or “islands” of mature mesic northern forest. These islands are characterized by hemlock (*Tsuga canadensis*) and beech (*Fagus grandifolia*), associated with red oak, red maple (*Acer rubrum*), and basswood in the canopy (Figure 15). The ground layer is sparse in most places, and characterized by New York fern (*Thelypteris noveboracensis*), Canada mayflower, starflower, goldthread (*Coptis trifolia*), and Indian cucumber-root (*Medeola virginiana*).



Figure 15. Small island of mesic northern forest dominated by hemlock, beech, red oak on the large flat plateau.

Artificial Clearing

An upland, sandy clearing just west of the trail and the Tittabawassee River supports young white pines and a diversity of native and non-native species of disturbed, acidic sands, such as common false foxglove (*Agalinis tenuifolia*), flat-topped white aster (*Doellingeria umbellata*), rough hawkweed (*Hieracium scabrum*), intermediate pinweed (*Lechea intermedia*), gray goldenrod (*Solidago nemoralis*), and panic

grass (*Dichanthelium columbianum*). Many of the species found in this opening are indicative of disturbance and were not found elsewhere in the natural area. This area is quickly succeeding to dry-mesic northern forest as evidenced by the big-toothed aspen and white pine seedlings, saplings and young trees scattered throughout the site.

Bog

Northwest of the western boundary of the natural area are several shallow bog depressions dominated by leatherleaf (*Chamaedaphne calyculata*), associated with white pine, red maple, chokeberry (*Aronia prunifolia*), huckleberry (*Gaylussacia baccata*), swamp dewberry (*Rubus hispidus*), bluejoint grass (*Calamagrostis canadensis*), and few-seed sedge (*Carex oligosperma*). Within the boundaries of the site, even shallower, narrow boggy depressions support such bog species as the sedges *Carex atlantica* and *C. folliculata*.

Floristic Summary

Four visits to this site (26 June, 27 June, 11 August, 8 September 2014) resulted in the identification of 296 vascular plants to species level, including 261 native taxa (88%), or approximately 14% of the native taxa known from Michigan (Reznicek et al. 2011). See Appendix C for the plant list and summary of the floristic quality assessment.

Rare Species: Three state-listed species were documented from this site: the state threatened forked aster (*Eurybia furcata*), the state threatened beak grass (*Diarrhena obovata*), and the state special concern American gromwell (*Lithospermum latifolium*). Of particular note is the population of forked aster, one of three sites documented in 2014, including two occurrences on Little Forks Conservancy properties (this site and Averill Preserve). The plants at Riverview Natural Area occur on the eroded south bank of the Tittabawassee River adjacent to the small, isolated woodlot in the eastern portion of the site (Figure 16). Also in this area, above the immediate riverbank, is the only colony of American gromwell noted at this site. Beak grass occurs commonly along the river, extending well into the floodplain forest in places. The species is locally dominant in and adjacent to the natural area (Figure 17). These plants are part of a much larger population extending over three miles of riverbank between Sanford and Midland.



Figure 16. State threatened forked aster along eroding river bank adjacent to isolated woodlot.

Figure 17. Extensive patch of state threatened beak grass in floodplain forest.

Non-Native Species: Among the non-native taxa, particularly common taxa included autumn olive, Morrow honeysuckle, Japanese barberry (*Berberis thunbergii*), hedge-parsley (*Torilis japonica*), lawn prunella (*Prunella vulgaris*), moneywort, Canada bluegrass, smooth brome (*Bromus inermis*), and crown-vetch (*Securigera varia*).

Key Threats:

Invasive Species: Compared to the other two sites, the number and abundance of invasive species at Riverview Natural Area is relatively low. Areas that had a particularly high density of invasive plant species included the steep eroding river bank (mostly on the southern and mid portion of the site), the narrow sandy levee and first bottom adjacent to the agricultural field, the artificial clearing, and other small forest openings.

Deer Herbivory: Signs of deer browse and trails were quite evident at this site particularly in the mesic and dry-mesic northern forests. The ground layer of many of these upland forest areas was quite depauperate at the time of the surveys, and tree saplings were sparse throughout. However, similar to the other sites, it is unclear how high deer densities are in this area. Deer have a tendency to favor certain herbaceous and woody plant species which can lead to the elimination of important ground cover species and/or recruitment of certain canopy species.

Past Forest Management Practices: An additional threat is posed by historic forest management practices that eliminated large-diameter canopy trees, opened the canopy, and disturbed the sensitive alluvial soils. It is evident that logging occurred at this site probably as recent as the late 1900's (a large percentage of the mesic northern forest on the large plateau is very young). A few large diameter trees still remain at this site, particularly in the mesic northern forest islands where hemlock still occurs on the large upland plateau, and the small, isolated woodlot surrounded by the agricultural field.

Dams: This site is located between Sanford Dam to the northwest and Dow Dam to the southeast. In evaluating gauge data from Sanford Dam, it is quite apparent that river level fluctuations are unusually dramatic even on a daily basis. These water level fluctuations can cause unusually severe erosion along the river banks, particularly the steeper slopes found on the southern portion of the site.

Management Recommendations:

Control Invasive Species: Monitor and treat infestations of invasive plant species, particularly those that threaten to alter community structure or nutrient cycling of the forested communities, such as autumn olive, Morrow honeysuckle, common buckthorn (*Rhamnus cathartica*), and glossy buckthorn (*Frangula alnus*). Efforts should focus on controlling non-native plants invading the interior forest areas from the disturbed river bank and levee where most of the invasives are concentrated.

Controlling Deer Herbivory: In addition to the treatment of invasive species, the impacts of deer browse and activity should be monitored to determine if the local deer population is at ecologically sustainable densities, such that regeneration of woody species and populations of favored herbaceous species are not

significantly impacted. Due to the large size of this site, we highly recommend managed deer hunting to reduce the deer herd on the property and minimize their associated negative ecological impacts.

Managing for Mature Forest: One of the primary conservation decisions at this site is whether to permit the succession of the artificial clearing and other small openings to forest (mesic and dry-mesic northern forest and floodplain forest), or to maintain at least some of the open acreage in early successional states. If the latter is preferred, a combination of brush-hogging and mowing is likely sufficient to maintain an interesting assemblage of native and non-native herbaceous species. Although the artificial clearing (described above) supports many interesting native species that were documented only from that area, it also fragments the upland forest communities in a landscape that is already highly fragmented. Given the importance of large, unfragmented forested blocks in the region and the high rate of succession already occurring here, we highly recommend allowing the opening to naturally succeed to dry-mesic northern forest. In addition, the majority of forest at this site is second and third growth forest that was probably last cut in the mid-20th century. We highly recommend allowing these forested natural communities to revert to old growth forest over time. This can be done by allowing trees to naturally mature, leaving dead standing snags, keeping dead woody debris on the ground, and maintaining diverse structure and species composition.

3. *Birds*

Methods

We conducted call-response surveys for Red-shouldered Hawk (*Buteo lineatus*, state threatened) and Northern Goshawk (*Accipiter gentilis*, state special concern) at locations with potential nesting habitat on April 22, 2014. Survey points were separated by approximately 400 meter (m) intervals, with a total of 13 points surveyed (Figure 18). Each point was surveyed for approximately 6 minutes, which consisted of two minutes of conspecific broadcasts and one minute (min) of silent listening for each species. While walking between survey stations, we also visually inspected trees for stick nests. We also surveyed the forest along the river banks for raptor nests using binoculars.

We conducted avian point counts to evaluate the overall breeding bird community of parcels investigated and potentially locate rare songbird species (e.g., cerulean warbler [*Dendroica cerulea*, state threatened], hooded warbler [*Wilsonia citrina*, state special concern], and Louisiana waterthrush [*Seiurus motacilla*, state special concern]). We generated a grid of sampling points to cover the parcels using the Jenness Enterprises Repeating Shapes tool (Jenness 2012) within ESRI ArcMap version 10.0 (ESRI 2013) and 250 m by 250 m spacing. A total of 31 points were located within the Little Forks Conservancy parcels (Figure 18). The points were given a unique identification number and uploaded to a GPS unit for field location.

We visited each point once during June 8-25, 2014 between sunrise and five hours after sunrise. We recorded the species and number of individuals observed during three independent periods (2 min, 3 min, and 5 min) for a total of 10 min at each station (Ralph et al. 1995). Use of the three survey periods provides flexibility in making comparisons with other surveys (e.g., North American Breeding Bird Survey) and commonly used protocols. Each bird observation was assigned to one of four distance categories (0-25 m, 25-50 m, 50-100 m, and >100 m) based on the estimated distance from the observer to facilitate future distance analyses and refinement of density and population estimates.



Figure 18. Locations of raptor and songbird surveys conducted by the Michigan Natural Features Inventory in 2014 on Little Forks Conservancy properties.

Results

Red-tailed Hawk (*Buteo jamaicensis*) was the only raptor species observed during call-response surveys. No raptor stick nests were found during surveys. However, a likely Barred Owl (*Strix varia*) nesting site was found during bird point count surveys, as evidenced by the observation of an adult and vocalizations of juveniles.

A total of 50 bird species were recorded during point count surveys at 31 stations (Table 1). Two additional species, Blue-winged Warbler (*Vermivora cyanoptera*) and Mourning Warbler (*Geothlypis philadelphia*), were observed incidentally while walking between survey stations for a total of 52 bird species recorded. We detected an average of 11 species per point count station. Seven species were commonly observed, being detected at over half the stations: Eastern Wood-pewee (*Contopus virens*), Red-eyed Vireo (*Vireo olivaceus*), Blue Jay (*Cyanocitta cristata*), American Crow (*Corvus brachyrhynchos*), Black-capped Chickadee (*Poecile atricapillus*), Tufted Titmouse (*Baeolophus bicolor*), and Rose-breasted Grosbeak (*Pheucticus ludovicianus*).

The following 10 species were detected at 25-50% of the point count stations: Mourning Dove (*Zenaida macroura*), Red-bellied Woodpecker (*Melanerpes carolinus*), Northern Flicker (*Colaptes auratus*), Great Crested Flycatcher (*Myiarchus crinitus*), White-breasted Nuthatch (*Sitta carolinensis*), American Robin (*Turdus migratorius*), Northern Cardinal (*Cardinalis cardinalis*), Song Sparrow (*Melospiza melodia*), Brown-headed Cowbird (*Molothrus ater*), and Scarlet Tanager (*Piranga olivacea*).

We observed 11 species sporadically at 10-25% of the stations: Downy Woodpecker (*Picoides pubescens*), Hairy Woodpecker (*P. villosus*), Pileated Woodpecker (*Dryocopus pileatus*), Wood Thrush (*Hylocichla mustelina*), Gray Catbird (*Dumetella carolinensis*), Cedar Waxwing (*Bombycilla cedrorum*), Ovenbird (*Seiurus aurocapilla*), Indigo Bunting (*Passerina cyanea*), Red-winged Blackbird (*Agelaius phoeniceus*), Baltimore Oriole (*Icterus galbula*), and American Goldfinch (*Spinus tristis*). The remaining 22 species were recorded at <10% of the point count locations (i.e., 1-3 stations).

We observed several bird species that are considered conservation priorities in various regional/state plans (Table 2). Three species detected during surveys, Veery (*Catharus fuscescens*), Wood Thrush, and Blue-winged Warbler, are considered focal species for landbird habitat conservation by the Upper Mississippi River and Great Lakes Region Joint Venture (hereafter Joint Venture; Potter et al. 2007). The Little Forks properties are located within Bird Conservation Region 12, the Boreal Hardwood Transition. In addition to Veery and Wood Thrush, we detected five species, Northern Flicker, Black-throated Green Warbler (*Setophaga virens*), Mourning Warbler, Common Yellowthroat (*Geothlypis trichas*), and Rose-breasted Grosbeak, that are considered priority landbird species under the BCR 12 plan (Matteson et al. 2009). Matteson et al. (2009) identified priority landbird species as those being of high continental/regional concern or having a high proportion of their global population/range within BCR 12. Northern Flicker, Blue-winged Warbler, and Wood Thrush are also considered species of greatest conservation need (SGCN) in Michigan's Wildlife Action Plan (Eagle et al. 2005). We also observed two additional SGCN, the Acadian Flycatcher (*Empidonax virens*) and Eastern Kingbird (*Tyrannus tyrannus*).

Table 1. Bird species detected (indicated with an “X”) by survey station during point counts conducted on Little Forks Conservancy property during 2014.

Species	Point Count Station																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Acadian Flycatcher															X	X															
American Crow	X	X		X		X			X	X	X	X		X	X			X	X	X	X	X	X		X	X		X	X	X	X
American Goldfinch			X	X	X	X									X			X	X												
American Redstart					X																										
American Robin		X		X		X	X						X	X		X		X	X	X	X			X					X	X	X
Barred Owl																				X		X									
Baltimore Oriole								X			X							X						X			X	X			
Black-capped Chickadee	X	X	X		X	X	X			X		X	X		X				X		X	X		X			X		X		X
Blue-gray Gnatcatcher										X					X																
Brown-headed Cowbird	X	X		X			X	X				X		X	X				X									X			
Blue Jay	X	X	X	X			X				X	X	X		X			X	X	X					X			X	X	X	X
Brown Creeper																			X					X							
Black-throated Green Warbler																											X				
Cedar Waxwing		X		X	X	X																						X	X		X
Chipping Sparrow																		X	X				X								
Common Grackle															X											X					
Common Yellowthroat								X						X					X												
Downy Woodpecker			X				X							X			X										X	X			
Eastern Bluebird																														X	
Eastern Kingbird				X																											

Table 1. Continued.

	Point Count Station																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Eastern Phoebe																							X								X
Eastern Wood- Pewee		X					X	X	X	X	X	X	X	X	X		X	X		X				X			X	X	X	X	X
European Starling																							X								
Great Crested Flycatcher			X				X			X	X			X		X	X	X	X	X		X	X								X
Gray Catbird			X	X	X	X																									
Hairy Woodpecker	X								X	X		X			X	X														X	
House Sparrow					X																		X								
House Wren		X		X																											
Indigo Bunting																X	X				X	X							X	X	X
Mourning Dove		X			X													X	X	X	X	X	X							X	X
Northern Cardinal	X	X	X		X				X	X		X						X	X							X				X	X
Northern Flicker							X	X			X		X	X												X	X	X			
Ovenbird							X	X							X															X	
Pine Warbler																		X				X								X	
Pileated Woodpecker												X	X					X												X	
Rose-breasted Grosbeak	X	X	X		X	X			X		X	X		X	X		X	X	X					X	X					X	X
Ring-billed Gull																							X								
Red-bellied Woodpecker				X			X	X	X	X	X					X	X			X	X		X				X	X	X		
Red-eyed Vireo		X					X	X	X	X	X	X	X	X	X	X	X	X						X			X		X	X	X
Red-winged Blackbird				X	X	X																									X
Scarlet Tanager							X		X	X				X	X	X			X	X	X	X		X	X	X	X				X
Song Sparrow	X	X	X	X	X	X					X							X	X			X					X	X	X	X	X

Table 1. Continued.

	Point Count Station																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Tree Swallow						X												X		X												
Tufted Titmouse			X				X	X	X	X	X	X		X	X	X		X	X	X	X	X	X									X
Veery																															X	
White-breasted Nuthatch	X						X	X	X		X	X	X										X							X		
Wild Turkey																X															X	X
Wood Thrush							X	X			X		X	X						X												
Yellow Warbler		X		X	X																											
Yellow-throated Vireo																																X
Total No. Species	9	15	10	13	12	9	16	11	11	11	13	11	9	13	13	11	9	21	13	9	10	8	13	7	6	5	9	11	12	17	15	

Table 2. Bird species detected on Little Forks Conservancy property during 2014 that have special status in one or more conservation plans.

Species	General Habitat Requirements	Focal Species ¹	Priority Landbird ²	SGCN ³
Northern Flicker	Open forests and forest edges, but also orchards, suburban areas, pastures, and old fields		X	X
Acadian Flycatcher	Wet forests, such as floodplains, but also occurs in mesic forests			X
Eastern Kingbird	Open savannas, including grasslands, old fields, pastures, and orchards			X
Veery	Large tracts of moist forest, dense understory of deciduous trees/shrubs	X	X	
Wood Thrush	Large tracts of wet and mesic deciduous forest, sometimes dry forests	X	X	X
Blue-winged Warbler	Open shrubby areas, forest openings, stream edges, and old fields with shrubs/small trees	X		X
Black-throated Green Warbler	Large tracts of mature deciduous, mixed, or coniferous forest		X	
Mourning Warbler	Regenerating forest openings with shrub and herbaceous cover		X	
Common Yellowthroat	Dense vegetation, typically with shrubs, often in or near wetlands		X	
Rose-breasted Grosbeak	Edges of mesic deciduous forests, but also dry and wet forests, orchards, and parks		X	

¹Focal species in the Upper Mississippi River and Great Lakes Region Joint Venture Landbird Habitat Conservation Strategy (Potter et al. 2007).

²Priority landbird species in the Bird Conservation Plan for the Boreal Hardwood Transition (Bird Conservation Region 12; Matteson et al. 2009).

³Species of greatest conservation need in the Michigan Wildlife Action Plan (Eagle et al. 2005).

Discussion

No rare raptor species were detected during surveys conducted in 2014; however, the Little Forks Conservancy properties adjacent to the Titabawassee River appear suitable for Red-shouldered Hawk (*Buteo lineatus*, state threatened). In Michigan, Red-shouldered Hawks occur in extensive mature floodplain, bottomland, and mesic northern hardwood forests interspersed with wetlands and grasslands. Allowing these forested tracts along the river to mature and avoiding fragmentation could improve conditions for Red-shouldered Hawk. We recommend periodic surveys to determine if Red-shouldered Hawks are nesting on Little Forks Conservancy lands or adjacent lands to the west and north of the Riverview preserve.

We did not detect any rare songbird species in 2014 but we did observe several species considered conservation priorities within the region. Most of the species detected on Little Forks Conservancy land that are of special conservation concern occur in forested landscapes. The Riverview Natural Area and surrounding lands represent a relatively large block of forest within a landscape consisting of suburban

development, agricultural land, and smaller fragments of forest. Large blocks of forest in the area are likely providing breeding habitat and migration stopovers for Neotropical migrant songbirds, such as Wood Thrush and Veery. The maintenance and expansion of mature forest blocks on Little Forks Conservancy lands would benefit forest-interior species, such as Acadian Flycatcher and Wood Thrush. Activities that reduce the cover of mature forest or increase fragmentation could lower the value of the parcels to forest-interior nesting songbirds. We observed brown-headed cowbirds at over 35% of the point-count stations surveyed. Cowbirds thrive in fragmented landscapes and reduce the reproductive success of forest-breeding songbirds through nest parasitism. Potter et al. (2007) identified forest fragmentation and cowbird parasitism as important limiting factors for both Wood Thrush and Veery. Efforts to reduce forest fragmentation could decrease nest parasitism by Brown-headed Cowbirds on declining forest songbirds. We recommend conducting point counts periodically to monitor songbird use as a means to evaluate forest management on Little Forks Conservancy properties.

4. *Mussels and River Habitat*

Introduction

The MNFI performed surveys for native unionid mussels and river habitat assessments within the Riverview Natural Area, Averill Preserve, and Forestview Natural Area during the summer of 2014. Survey sites were located within the main stem of the Tittabawassee River and Averill Creek. The aim of these surveys was to determine unionid mussel species presence/absence and relative abundance, and assess riverine habitat quality.

Methods

Surveys took place in wadeable habitats (less than approximately 70cm depth) and utilized visual and tactile methods of detection. A measured search area was used to quantify sampling effort, allow comparisons to be made among sites, and allow mussel density estimates to be made. Typically 128m² provides a good compromise between the amount of search effort per site and the number of sites to be completed within the scope of a project. The size of this search area is also consistent with a number of mussel surveys in Michigan that have used 128m² as a standard search area. Due to the depth of the Tittabawassee River, surveys were restricted to a zone of wadeable habitat near the river banks.

A combination of visual and tactile means was used to search for live unionids and shells. A glass bottom bucket was used to facilitate visual searches. In areas where visual detection was difficult (e.g. because of suspended silt in the water) hands were passed through the substrate. Occasional tactile searches through the substrate were made at all sites to help ensure that buried mussels were not overlooked. Shells were identified to species and returned to the river near where they were found. Live individuals are identified to species and planted back into the substrate anterior end down (siphon end up) in the immediate vicinity of where they are found. The number of individuals of unionid mussels, both live and shells, is determined for each site. The presence/absence of zebra mussels (*Dreissena polymorpha*), and Asian clams (*Corbicula fluminea*) was recorded. In cases where zebra mussels are found attached to live native unionid mussels, the number attached to each is counted. Zebra mussels attached to live unionid mussels are removed by hand before the unionid is placed back in the substrate. The presence of zebra mussel byssal threads on unionid mussel shells is noted as an indication of past infestation.

Water chemistry and habitat characteristics were recorded to describe and document conditions at the time of the surveys. The substrate within each transect was characterized by estimating percent composition of each of the following six particle size classes (diameter); boulder (>256mm), cobble (256-64mm), pebble (64-16mm), gravel (16-2mm), sand (2-0.0625mm), silt/clay (<0.0625mm) (Hynes 1970). Woody debris, aquatic vegetation, exposed solid clay substrate, and erosion were noted when observed. Conductivity and pH were recorded with an Oakton handheld meter. Alkalinity was measured with a LaMotte kit (model DR-A) and hardness was measured with a Hach kit. Latitude and longitude of sites were recorded with a handheld GPS unit.

A Qualitative Habitat Evaluation Index (QHEI)(Rankin 2006, Rankin 1995) was scored at each survey site to further document and assess the condition of riverine habitat. The QHEI is a physical habitat index that provides a quantified evaluation of riverine macrohabitat characteristics that are important to fish communities. It is composed of six metrics, including substrate, in-stream cover, channel morphology, riparian zone and bank erosion, pool/glide and riffle-run quality, and gradient. Each of these metrics is scored separately then summed to provide a total QHEI score for a given survey site. A maximum total score of 100 is possible. QHEI scores can be assigned to general narrative categories (excellent to very

poor) to communicate habitat quality (Rankin 2006). A sample QHEI field sheet with factors used to score each metric is provided in Appendix E.

Results

Unionid mussel surveys and habitat assessments were performed at six sites, including five in the main stem of the Tittabawasse River and one in Averill Creek (Figure 19). Sites 1-3 were located in the Averill Preserve, Site 4 in River Bend Park, and Sites 5 and 6 in Riverview Natural Area. Latitude and longitude of survey sites is given in Table 3. Only one unionid mussel species (fatmucket, *Lampsilis siliquoidea*) was found during the study. It was represented by a single shell at Site 4 in the main stem of the Tittabawasse. No live unionid mussels, or listed/special concern mussel species were found. A number of incidental finds of other aquatic taxa were made (Table 4). Native aquatic snails were found at four sites, though just one site had live individuals and the others had only shells. Live crayfish were spotted at two sites, and live fingernail clams (Sphaeriidae) were present at the Averill Creek site. Live zebra mussels were found at one site, and zebra mussel shells were found at three sites.

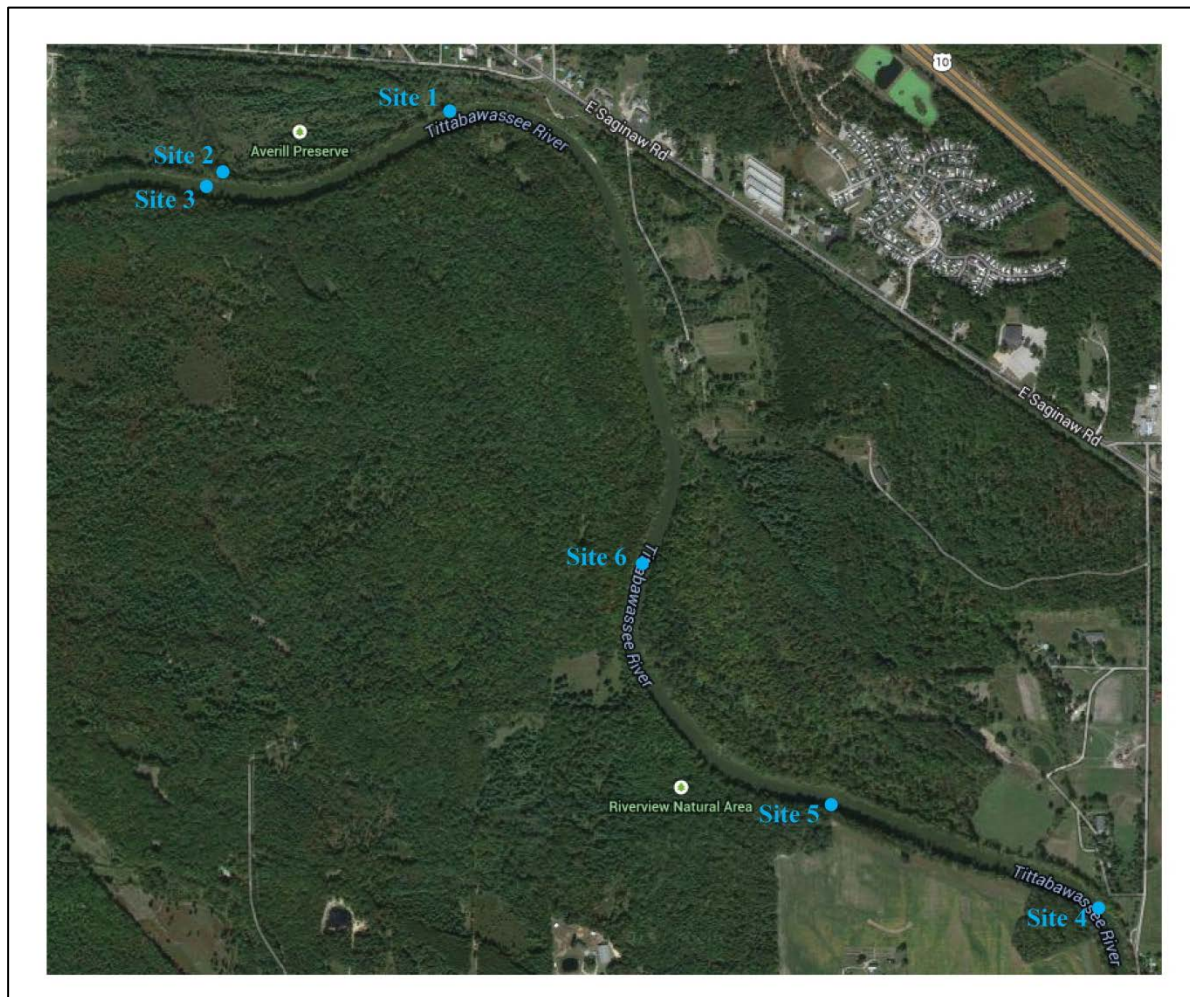


Figure 19. Locations of aquatic survey sites, September 2014.

Table 3. Latitude and longitude of aquatic survey sites, September 2014.

Site #	Waterway	Access	Latitude (N)	Longitude (W)
1	Tittabawassee R.	Avrill Preserve	43.66327	84.34335
2	Averill Creek	Avrill Preserve	43.66170	84.35126
3	Tittabawassee R.	Avrill Preserve	43.66140	84.35131
4	Tittabawassee R.	River Bend Park	43.64294	84.32097
5	Tittabawassee R.	Riverview Natural Area	43.64664	84.33109
6	Tittabawassee R.	Riverview Natural Area	43.65297	84.33681

Table 4. Numbers of unionid mussels recorded at each survey site. Presence/absence of non-native bivalves and incidental finds are noted.

		1	2	3	4	5	6
Species	Common name	#	#	#	#	#	#
<i>Lampsilis siliquoidea</i>	Fatmucket				S(1)		
Total # individuals and density		0	0	0	0	0	0
# species live		0	0	0	0	0	0
# species live or shell		0	0	0	1	0	0
Area searched (m ²)		128	128	128	128	128	128
Cambaridae	Crayfish			L		L	
Gastropods	Aquatic snails	L	S	S	S		
	Fingernail						
Sphaeriidae	clams		L				
<i>Corbicula fluminea</i>	Asian clams						
<i>Dreissena polymorpha</i>	Zebra mussels	S		L	S		S

Water chemistry measures are provided in Table 5. pH ranged from 7.80 at Site 5 to 8.41 at Site 3. These values are within the tolerable range for most fish species (pH 5-9). Variation in pH among sites may be partly due to rain showers that occurred over the three days water quality data was collected. Conductivity was unusually high at Site 2 in Averill Creek (1168µS). Alkalinity and hardness measures indicated relatively hard water (172-204 mg/l CaCO₃).

Table 5. Water chemistry measurements taken at aquatic survey sites.

Site #	River	pH	Conductivity (µS)	Alkalinity (mg/l CaCO ₃)	Hardness (mg/l)	Water temp. (C)
1	Tittabawassee R.	7.81	399	182	280	24.7
2	Averill Creek	7.99	1168	204	400	19.4
3	Tittabawassee R.	8.41	404	172	300	24.0
4	Tittabawassee R.	7.93	414	192	260	23.6
5	Tittabawassee R.	7.80	440	186	260	22.3
6	Tittabawassee R.	8.01	405	178	300	22.6

Substrate types were varied among the different survey sites, though most sites had a large proportion of silt (Table 6). The survey site in Averill Creek was located close to the confluence with the Tittabawassee main stem (10-50m upstream) and had a substrate of silt and sand. Further upstream in Averill Creek the substrate graded into a mixture of types ranging from cobble to silt. However, this upstream section was too shallow and small to support unionid mussels. Site 3 in the Tittabawassee River had a mixture of larger substrate size classes in addition to silt and sand, which are generally more favorable for mussels. The river bottom at Sites 5 and 6 were partly covered by clay hardpan.

Table 6. Substrate particle size composition based on visual estimation within the mussel search area at each aquatic survey site. Particle size classes are based on Hynes (1970): boulder (>256mm), cobble (256-64mm), pebble (64-16mm), gravel (16-2mm), sand (2-0.0625mm), and silt/clay (<0.0625mm).

Site #	River	Boulder	Cobble	Pebble	Gravel	Sand	Silt	Clay
1	Tittabawassee R.					40	60	
2	Averill Creek					40	60	
2*	Averill Creek (30m upstream from Site 2)		5	10	35	30	20	
3	Tittabawassee R.	2	13	20	20	20	25	
4	Tittabawassee R.			2	3	35	60	
5	Tittabawassee R.		2	18	5		30	45
6	Tittabawassee R.					20	60	30

Current speed was slow (approx. 0.2m/sec.) at the time surveys took place except for at Site 5 where it was noticeably faster (approx. 1m/sec.) (Table 7). This variation in current may have been due to river flow regulation at the Sanford Dam upstream of the study area. Aquatic vegetation and woody debris were present at most sites. Survey sites within main stem of the Tittabawassee River consisted of runs, with no discernible pools or riffles. Averill Creek had a more varied structure with run, pool, and riffle habitat. Qualitative Habitat Evaluation Index scores for each site, and sub-scores for each metric, are given in Table 8. QHEI scores ranged from a minimum of 51 at Site 4, to a maximum of 57 at Site 3. The average score of all five sites was 53.4.

Table 7. Physical habitat characteristics at aquatic survey sites.

Site #	River	Current speed*	Aquatic vegetation?	Woody debris?	%Pool	%Riffle	%Run
1	Tittabawassee	slow	Y	N			100
2	Averill Creek	near zero	N	Y	20	10	70
3	Tittabawassee	slow	Y	Y			100
4	Tittabawassee	slow	Y	Y			100
5	Tittabawassee	medium	N	Y			100
6	Tittabawassee	slow	Y	Y			100

*slow = approx. 0.2m/sec.; medium = approx. 1m/sec.; fast = approx. 2m/sec.

Table 8. Qualitative Habitat Evaluation Index (QHEI) scores of each aquatic survey site, and sub-scores for each metric.

Habitat Factor	Maximum Score Possible							Average Metric Sub-score
		1	2	3	4	5	6	
Substrate	20	5	5	8	6	6	5	5.8
Instream Cover	20	12	17	14	13	13	14	13.8
Channel Morphology Bank Erosion & Riparian Zone	20	8.5	13.5	8	8	8	8	9.0
Pool/Current	10	9	8	10	7	8.25	9	8.5
Riffle/Run	12	7	6	7	7	7	7	6.8
Gradient	8	0	2	0	0	0	0	0.3
QHEI Score	10	10	4	10	10	10	10	9.0
Average Total Score	100	51.5	55.5	57	51	52.3	53	53.4

Discussion

The Tittabawassee River has historically supported relatively high unionid mussel species richness. MNFI performed surveys downstream of Midland in 2001 and found 18 mussel species, six represented by live individuals and 12 by shell alone (Badra and Goforth 2002). These included three state endangered mussel species and three species of special concern. Earlier surveys of the upper Tittabawassee River drainage by Hoeh and Trdan (1984) from 1979-1981 revealed fourteen species including one state threatened and three special concern species (Appendix F). The federally endangered snuffbox (*Epioblasma triquetra*) has also been reported historically from the Tittabawassee watershed (UMMZ Mollusk Collection record). It's important to note that the areas surveyed have been isolated from the 2014 study area for decades by multiple dams and impoundments, which could prevent the recovery of mussel populations in this stretch of river between the Sanford and Dow Dams.

Fatmucket are one of the most silt tolerant unionid mussel species, and occur in a wide range of habitats in rivers and lakes. They are one of the most frequently encountered unionids, documented in 42 of Michigan's 58 major watersheds (Badra 2010). Rare unionid mussels tend to have a small number of

known fish species they can use as hosts to successfully reproduce, and these tend to be less common species like logperch or darters. Fatmucket on the other hand are generalists known to utilize twenty different fish species as hosts. These include abundant and widespread fish like small mouth bass, bluegill, and common shiner.

Threats

Invasive Species

Zebra mussels must anchor themselves to hard surfaces with byssal threads to survive. When they die or are removed, a small pencil eraser sized clump of byssal threads is left behind still firmly attached to its former home. The one unionid shell found in this survey had at least 22 byssal thread clumps on the surface, indicating the native mussel was heavily infested by zebra mussels and likely died from it (Figure 20). In river and lake habitats dominated by soft substrates, similar to the sand and silt found at most of the sites in this survey, unionid mussels protruding up from the bottom provide a hard surface for zebra mussels to attach to in an otherwise inhospitable substrate.



Figure 20. Fatmucket (*Lampsilis siliquoidea*) at aquatic survey Site 4 in the main stem of the Tittabawassee River. Dark clumps of byssal threads from past zebra mussel (*Dreissena polymorpha*) infestation are visible on the surface of the shell.

Unionid mussels have larvae, called glochidia, which must attach to a fish host in order to survive and transform to the adult stage. Glochidia are on average 0.1mm in length and don't noticeably harm their host. They remain on the fish between a few weeks and several months, transform to the adult stage then drop off the fish. As adults, unionid mussels are relatively sessile, moving only a few meters a day. The ride they get on their host fish allows them to be transported to new habitats (including upstream) and allow for exchange genes among populations. Barriers to fish hosts, like dams and impoundments, also prevent migration of unionid mussels and gene flow among their populations (Watters 1996). In addition to the long term isolation of stream reaches and associated populations, dams and impoundments facilitate introduction and persistence of invasive species like zebra mussels (Johnson et al. 2008). Veligers, zebra

mussel larvae, can be transported inadvertently on boats, trailers, bait buckets, and other gear to rivers and lakes they would otherwise not be introduced to.

Pollution

Conductivity is a measure of the ability of water to carry an electrical current. It is determined by the amount of inorganic dissolved substances including chloride, nitrate, sulfate, and phosphate (negatively charged ions), and sodium, magnesium, calcium, iron, and aluminum (positively charged ions). The geology of a given watershed is normally a strong factor in determining the amount of these substances present in river water. For example, streams that run through clay soils pick up materials in the clay that ionize in water resulting in higher conductivity, while streams that run through areas dominated by granite have lower conductivity because granite has an abundance of materials that do not ionize in water. Conductivity can be affected by point and non-point discharges into streams as well. Input of chlorides, phosphate, and nitrates can raise conductivity in rivers and lakes. Unusually high conductivity measures can be indicative of impacts such as excessive input of fertilizer or sewage overflows. Conductivity of rivers in the United States ranges between 50 and 1500 μ S. Streams supporting good fisheries typically measure between 150 and 500 μ S.

The unusually high conductivity at Site 2 in Averill Creek could be the result of surficial geology, or of point or non-point source discharges. Brine deposits are extensive in the Tittabawassee watershed and have been utilized commercially since 1860 (Cook 1914). An increase in salinity greatly increases conductivity, so natural brine deposits are a potential cause. There may be opportunity to improve water quality if an anthropogenic source, such as chlorides or nitrates, is identified and remedied.

Alkalinity is a measure of how much calcium carbonate (mg/liter of CaCO₃) is present in water and is one factor in determining how much acid can be added to water without causing a change in pH. In this way it buffers against rapid changes in pH. Alkalinity is influenced by the surficial geology of the watershed. Streams flowing through areas with limestone tend to have high alkalinity. The U.S. EPA has suggested that 20mg/l CaCO₃ is a minimum to support aquatic life. Hardness is a similar measure that accounts for other minerals such as magnesium and iron, in addition to calcium carbonate. The alkalinity and hardness measures in this study were within normal ranges (172-204 mg/l CaCO₃), with enough buffering capacity to help protect aquatic life from fluctuations in pH.

Habitat Degradation

QHEI scores can be assigned to general narrative categories (excellent to very poor) to communicate river habitat quality (Rankin 2006) (Table 9). All mussel survey sites in this study scored within the Fair range (45-59). Looking at the sub-scores for each metric allows us to identify which habitat components are contributing positively and negatively to the overall score. The substrate metric scored very low across all sites due to a high proportion of silt, sand, and clay. The clay hardpan seen at Sites 5 and 6 may be the result of scouring from flashy flow events and/or historic impacts such as logging. Unionid mussels are typically excluded from clay hardpan because it is too hard for them to bury into. Channel morphology scored very low except for Site 2 in Averill Creek, and riffle/run metrics scored very low across all sites due to a lack of riffle/run stream morphology types. A large intact riparian zone throughout most the study area contributed positively to QHEI scores in spite of erosion to the river banks. The gradient of the main stem sites also scored high, with relatively high gradient for a river the size of the Tittabawassee. There was a moderate amount of in-stream cover (e.g. woody debris and root wads) to provide habitat for fish, and also fair scores for pool depth and water current.

Table 9. General narrative ratings assigned to Qualitative Habitat Evaluation Index (QHEI) scores (from Rankin 2006).

Narrative Rating	QHEI Score	
	Headwaters	Larger Streams
Excellent	≥70	≥75
Good	55-69	60-74
Fair	43-54	45-59
Poor	30-42	30-44
Very poor	<30	<30

Barriers

The Sanford Dam, located 2 miles upstream of the study area, is one of four hydroelectric dams that regulate the flow of the Tittabawassee River. USGS stream flow data for the stream gauge located at the city of Midland indicate a daily flow pattern of high variation (Figures 21 and 22). This diurnal pattern is created by hydroelectric energy demands and production. The Sanford Dam has the greatest influence on river flow of the four dams (ATS 2007, Stratus 2008). The other three hydroelectric dams are the Secord, Smallwood, and Edenville Dams. The study area is located between the Sanford Dam upstream, and the Dow Dam, located at the Dow plant in Midland.

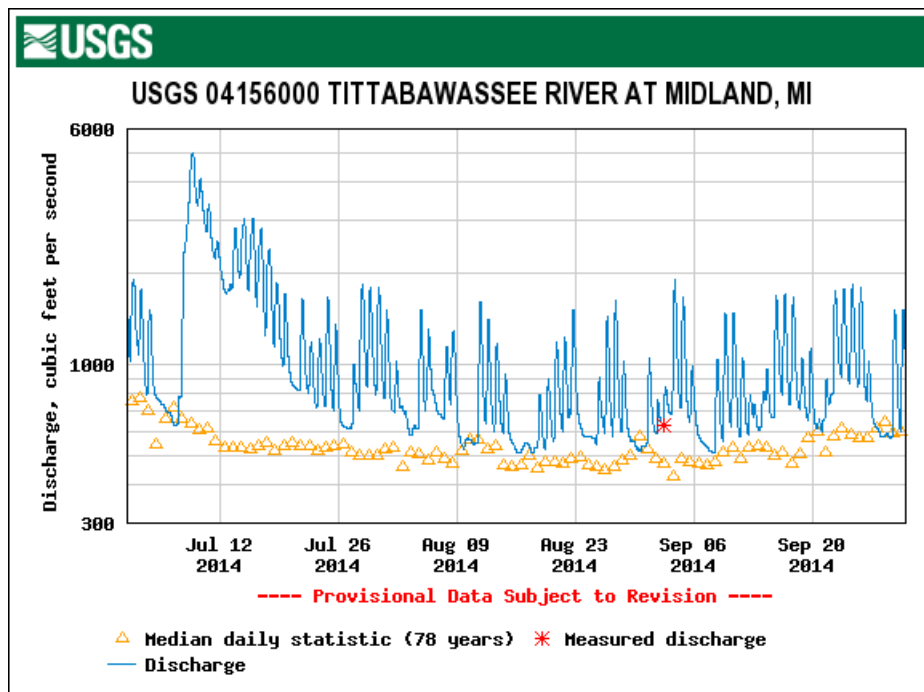


Figure 21. Graph of flow (cfs) of the Tittabawassee River at Midland, MI from July 1-September 30, 2014 (USGS).

While performing mussel surveys a change in water level was clearly visibly over less than an hour’s time. The frequent inundation and drying of the river banks appears to be preventing vegetation from establishing, resulting in a very distinctive zone of bare mud along the river bank. The river valley

throughout most of the study area is very steep and in effect appears channelized. Erosion of un-vegetated river banks may have contributed to this, as well as increased siltation of the river. The steep banks reduce safe access to the river for recreation. Due to energy demands fulfilled by hydroelectric power, altering the release schedule of the Sanford Dam upstream the Riverview Natural Area and Averill Preserve may or may not currently be a socio-politically feasible way of taking a step toward returning this section of the Tittabawassee River to a more natural hydrology and improved river habitat quality.

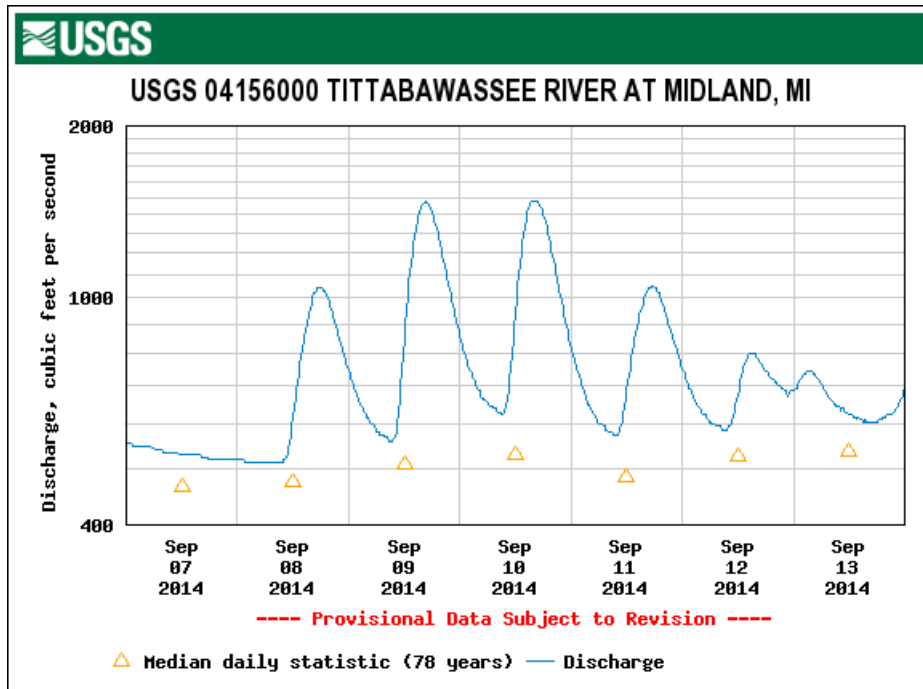


Figure 22. Graph of flow (cfs) of the Tittabawassee River at Midland, MI from September 7-13, 2014. Aquatic surveys took place September 8-10, 2014 (USGS).

Threats Summary

A nation-wide assessment of threats to imperiled freshwater fauna identified altered sediment loads and nutrient inputs from agricultural nonpoint pollution, exotic species, and altered hydrologic regimes associated with impoundments as the three leading threats (Richter et al. 1997). All three of these have impacted the unionid mussel community of the Tittabawassee River watershed. Other long term historical impacts to unionid mussel populations and the river ecosystem as a whole include the chemical industry and late 1800's logging, including associated fires and rafting of logs down the river (Schrouder et al. 2009). A drain tile outlet was located about 100m south of Site 5 (Figure 23) and was associated with a steeply cut gully leading to the Tittabawassee main stem (Figure 24). It may be possible to reduce erosion at this site by re-engineering the drain field and outlet.



Figure 23. Drain outlet located approximately 100m south of aquatic survey Site 5 in Riverview Natural Area.



Figure 24. Steep, eroded gully leading to the Tittabawassee River from the drain outlet south of aquatic survey Site 5 in Riverview Natural Area.

5. Summary of Survey Results

Introduction

This section provides a summary of the survey results broken down by natural communities, rare plants, birds, and aquatics. It also includes an overall summary of ecological significance of the three LFC preserves. These sections are followed up by a summary of historic impacts and the most significant current threats impacting the three preserves. This chapter concludes with a series of priority management recommendations focused on the long-term ecological health of the preserves, including the section of the Tittabawassee River and their associated biodiversity.

Natural Communities

The three LFC preserves contain several natural community types typical for the Saginaw Bay Lake Plain ecoregion. Mesic northern forest, totaling 224 acres and covering 40% of the area, was the most abundant natural community within the preserve boundaries. The most significant natural community in terms of plant diversity is floodplain forest, which is found in all three preserves, but primarily in Riverview and Forestview Natural Areas. Floodplain forest totals 119 acres, and occupies 21% of the land within the preserves. Although none of the floodplain forest was exceptional enough to be entered into the MNFI Natural Heritage Database, the portion of floodplain forest within the Riverview Natural Area actually only represents a small percentage of a significant floodplain forest extending to the north and west following the river.

Other significant natural communities within the preserves include the small islands of mature mesic northern forest in the Riverview Natural Area, and the narrow band of hardwood conifer swamp in the Forestview Natural Area. Although both of these community types are small, they are unique when compared to the surrounding landscape. The mesic northern forest islands (in fact too small to map for our purposes) are located on the flat western plateau of the Riverview Natural Area. These islands contain large specimens of both beech and eastern hemlock; currently, two uncommon species in this area. It appears these islands were left uncut during the most recent logging activity at this site, possibly due to their uniqueness, or to serve as a deer yard during harsh winters.

Rare Plants

Three listed species, the state threatened forked aster (*Eurybia furcata*), state threatened beak grass (*Diarrhena obovata*), and state special concern American gromwell (*Lithospermum latifolium*) were documented from at least two of the preserves. Of the three species, the population of forked aster is probably the most significant since it's the first population documented in the state since 1934. Previously, forked aster was only known from two historical locations, one in Monroe County and one along the Chippewa River in Midland County. Forked aster was found at both the Averill and Riverview preserves. The population at Averill Preserve is concentrated in a clearing with mostly native species on the bank of the Tittabawassee River near its confluence with the L & B Drain, along with a smaller colony in the floodplain forest west of this location. The population at Riverview Natural Area is located on an eroding river bank at the

edge of a small isolated patch of floodplain forest surrounded by row crops at the southern end of the property.

American gromwell was found at both the Forestview and Riverview Natural Areas. This herbaceous perennial is widely distributed as scattered colonies and individual clumps in the southwestern portion of the Forestview Natural Area, on a broad, forested sandy levee immediately adjacent to the river. It is also found in a small colony at the Riverview Natural Area in the same small patch of isolated floodplain forest that supports the population of forked aster.

Beak grass occurs commonly in the floodplain forest along the river at both the Riverview and Forestview Natural Areas, extending well into the floodplain forest particularly at Riverview. The species is actually the dominant ground cover in some places, particularly along the sandy levee. The beak grass population in the area appears to extend over at least three miles of riverbank between Sanford and Midland. A smaller colony was also found near the mouth of Averill Creek. Based on the MNFI Natural Heritage Database, it appears this population may be one of the largest populations of beak grass in the state.

Birds

Fifty bird species were recorded during point count surveys at 31 stations spread across the three preserves. Two additional species were observed incidentally while walking between survey stations for a total of 52 bird species observed at the preserves during the breeding season. This is a fairly significant number of species for a relatively small area indicating its importance for breeding birds. In addition, an immature bald eagle was incidentally observed during plant surveys flying north along the river corridor at Riverview Natural Area.

A total of 10 species, or 20% of those observed, have been designated with special conservation status by at least one large scale conservation plan. Three species detected during surveys, Veery, Wood Thrush, and Blue-winged Warbler, are considered focal species by the Upper Mississippi River and Great Lakes Region Joint Venture. Seven species, Veery, Wood Thrush, Northern Flicker, Black-throated Green Warbler, Mourning Warbler, Common Yellowthroat, and Rose-breasted Grosbeak, are all considered conservation priorities under the Bird Conservation Region 12 (boreal hardwood transition) plan. In addition, Northern Flicker, Blue-winged Warbler, Wood Thrush, Acadian Flycatcher, and Eastern Kingbird are considered species of greatest conservation



Figure 26. Wood Thrush.

Figure 26. Acadian Flycatcher.

need (SGCN) in Michigan's Wildlife Action Plan. Wood thrush was the only species identified that is designated as a priority species by all three large scale conservation plans (Figure 25). Interior sensitive species, such as Wood Thrush and Acadian Flycatcher (Figure 26), represent forest nesting species that tend to react negatively to habitat fragmentation. Wood Thrush prefers interior deciduous and mixed forests, especially well-developed, upland mesic areas (Simons and Farnsworth 1996). Key habitat elements include trees greater than 16 meters (50 ft.) in height, a high diversity of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter. This describes a large portion of both the Riverview and Forestview Natural Areas. Although Wood Thrushes are considered to be area sensitive (Roth et al. 1996), the amount of core habitat within 5 km of a nest may be a better predictor of nest success than the amount of total forest cover (Driscoll et al. 2005). This increases the significance of maintaining or enhancing the surrounding privately held forest land adjacent to and nearby the Riverview Preserve.

Aquatics

Historically, the Tittabawassee River supported relatively high unionid mussel species richness. According to the MNFI Natural Heritage Database and museum records, surveys of the upper Tittabawassee River revealed fourteen species including one state threatened and three special concern species. The federally endangered snuffbox was also historically documented from the Tittabawassee River. As recently as 2002, MNFI found 18 mussel species, six represented by live individuals and 12 by shell alone south of Midland. These included three state endangered mussel species and three species of special concern.

Unfortunately, only one dead shell of a common silt tolerant species, fat mucket, was found in the stretch of the Tittabawassee River adjacent to the three preserves during mussel surveys. This section of the river has clearly been heavily impacted by historical land use, such as logging, and the two dams located upstream and downstream of this stretch of river.

Summary of Ecological Significance

The Riverview, Averill, and Forestview Preserves provide critical habitat for three state listed plant species. One of these species, forked aster, is really unique in that it hasn't been documented in Michigan for 80 years. Finding it at not just one preserve, but two of the preserves was incredibly exciting and unanticipated. The population of beak grass is also very significant because it is one of the largest populations known in Michigan. Beak grass is found in floodplain forests along medium sized rivers that experience moderate levels of flooding disturbance. Based on additional observations outside of the preserves, it appears that this population occurs along at least three miles of riverbank. Combined, the three preserves also provide habitat for at least 358 native plant species, representing approximately 20% of the native species known to occur in the entire state (Reznicek et. al. 2011).

Table 10. Floristic summary for Averill Preserve, Forestview Natural Area, and Riverview Natural Area.

Site	# Taxa	# Native Taxa	<i>C</i>	Native <i>C</i>	FQI	Native FQI
Averill Preserve	221	165	2.8	3.7	41.6	47.5
Forestview Natural Area	269	230	3.5	4.1	57.4	62.2
Riverview Natural Area	296	261	3.8	4.3	65.4	69.5
Total	431	358	3.6	4.4	74.7	83.1

C, Native *C*, FQI, and Native FQI follow Reznicek et al. (2014) as presented in Freyman and Masters (2013).

Combined, these three preserves also provide breeding habitat for 52 bird species, 10 of which have special conservation status in at least one large scale conservation plan. This is a relatively high number of birds for the spatial extent of the preserves, again demonstrating their relative significance. Together with the surrounding forests and wetlands, this area also represents a relatively large block of forest and natural area within a landscape primarily consisting of suburban development, agricultural land, and smaller fragments of forest. Large blocks of forest in the area are providing critical breeding habitat and migratory stopover habitat for neotropical migratory songbirds. As expected, forest interior songbirds, such as Wood Thrush, Veery, Ovenbird, Acadian Flycatcher and Blue-gray Gnatcatcher, were concentrated in the northern portion of the Riverview Natural Area. This area represents the highest level of forest interior habitat across all three preserves. Based on aerial photographs and visual observations, the forested area to the north may harbor additional forest interior sensitive species.

Historic Impacts

This region of the state contained an abundance of natural resources including white pine and other valuable tree species, fur, brine, fisheries, and productive soils. This abundance of resources attracted investors and workers to the Saginaw Bay region, which was quickly exploited by early European settlers and business tycoons in the mid and late 1800's. The intensity of all this human activity had a tremendous negative impact on the health of both the land and river resources within the Saginaw Bay watershed. Although we do not have specific accounts of the land use history of the three LFC preserves along the Tittabawassee River that were surveyed, these sites would not have been able avoid most of the above mentioned impacts, particularly those associated with timber harvesting. In fact, one of the world's largest 19th century timber banking grounds was located in what is now the Averill Preserve, attesting to the timber operations on that property and in the immediate vicinity.

Current Stressors

The most significant stressors, or sources of stress, at the three preserves are invasive species, dams, deer herbivory, and encroaching development.

Invasive Species

All three preserves harbor a fair to moderate number of non-native and invasive plant species. These invasive plants include grasses, annuals, herbaceous perennials, and shrubs. A total of 73 non-native species were documented at the preserves, or 17% of all plant species noted during the surveys. The most problematic or at least most ubiquitous invasive species at these sites were moneywort, autumn olive, Morrow honeysuckle, Japanese barberry, and common buckthorn. These species continue to threaten the integrity of natural plant communities by displacing native species, altering community structure, modifying hydrology, and altering nutrient cycling.

Dams

The three preserves are located between the Sanford Dam located upstream approximately two miles, and the Dow Dam, located at the Dow plant in Midland approximately four miles to the south. The Sanford Dam is one of four hydroelectric dams that regulate the flow of the Tittabawassee River. It is an earth gravity hydroelectric dam that was constructed in 1925 and currently operated by Boyce Hydropower, LCC (Schrouder et al. 2009). The USGS stream flow data for the stream gauge located at the city of Midland indicate a daily flow pattern of high variation. This diurnal pattern is created by hydroelectric energy demands and production, and the Sanford Dam has the greatest influence on river flow of the four major dams. This high daily variation in water flow has caused and continues to cause numerous problems in both the river channel and adjacent riparian zone. Constant releases of high water volumes leads to bed scour, channelization, severe river bank erosion, sedimentation, uprooting of native plants, and the spread of invasive plant species.

Deer Herbivory

White-tailed deer are ubiquitous throughout the Lower Peninsula of Michigan and are particularly abundant in the southern portion of the state. This is attributed to milder winters, longer growing seasons, high amount of habitat fragmentation or edge, and numerous areas of refuge provided by human settlement such as suburban communities. Based on casual observation of signs of deer at each site (browsed plants, deer tracks and trails, lack of woody plant regeneration, bedding areas) it appears that deer densities are moderate to high at each of these sites. This estimation is actually in line with what we typically observe at other forested sites in the Lower Peninsula, and is not at all surprising.

Encroaching Development

All three sites are surrounded by privately owned lands (with the exception of the river front). This poses potential difficulties for the long-term maintenance and enhancement of native biological diversity at each site. Many of these adjacent private parcels are already being managed for goals that may be incompatible with ecological integrity such as timber, agricultural production, deer hunting and other recreational pursuits, or housing. These activities are contributing to a number of stresses including: stormwater runoff, water pollution, habitat fragmentation, soil erosion, and decreased native species diversity and canopy recruitment.

Recommended Actions

The actions we feel are the most important to take to alleviate the various stresses above are: 1) controlling invasive plant species, 2) decreasing the deer population, 3) managing for old growth forest, and 4) managing for natural hydrologic regimes.

1) Controlling Invasive Species

Invasive species are found throughout all three preserves, although some areas appear to be less affected than others. The easiest group of plants to try and control might be the more common invasive shrub species found throughout all three preserves: autumn olive, common buckthorn, glossy buckthorn, Morrow honeysuckle, common privet, and multiflora rose. The populations of invasive shrubs found at all three preserves tend to be more isolated, and not as dense as some of the herbaceous perennial invasive species such as moneywort and reed canary grass. Given that Averill Preserve contains a significant amount of early successional habitat, we recommend focusing efforts on eliminating invasive shrubs from the two other preserves first.

2) Reducing Deer Population

As with many forested natural areas in the Lower Peninsula of Michigan as well as other places in the Midwest, white-tailed deer populations are too high to sustain healthy levels of native plant diversity and woody plant recruitment into the overstory of forested systems. Controlled hunting appears to be the only viable method for bringing deer numbers down to a sustainable level for long-term forest health. Based on our limited knowledge of the preserves, the Forestview and Riverview Natural Areas appear to provide the best opportunities and potential benefits for controlled deer hunts, although further analysis of deer population numbers and herbivory impacts at each site is recommended prior to investigating a formal deer hunt.

Since Forestview Natural Area is adjacent to several active farms, we recommend that the LFC contact each adjacent farmer to determine their interest in reducing deer numbers. The Riverview Natural Area on the other hand is primarily surrounded by private non-industrial forest land. Although these landowners may be more interested in increasing deer numbers for hunting purposes, they may also be interested in improving hunting experiences and/or forest health. Both of these goals can be achieved by strategically reducing overall deer numbers. We recommend contacting these landowners about their interest in improving forest health. If deer hunting is a top priority, we recommend exploring the benefits of quality deer management (QDM) with the local MDNR wildlife biologist.

3) Managing for Old Growth

Historically, this portion of the Tittabawassee River was entirely forested with small scattered pockets of forest openings caused by natural disturbances such as windthrow. Since the mid-1800's, this region has witnessed extensive land conversions from dense, towering conifer-hardwood forests to old field, shrub scrub, agriculture, early successional forest, and urban development. Similarly, these three preserves have all undergone significant modifications over the past 160 ± years. The evidence can be found in the old stumps, even aged growth, young

forest, open canopy, and old fields encountered during surveys. Despite these changes, each of these preserves has enormous potential to continue succeeding towards a more mature forested system. Given the relative lack of large tracts of natural area, contiguous forest, or old growth forest in this region of the state, we recommend that the LFC primarily manage all three sites for old growth forest. This includes the large old fields and shrub thickets at Averill preserve, the large artificial clearing at Riverview, and potentially portions of the active agricultural land on the southern portion of the Riverview Natural Area.

Not only would old growth forest management be beneficial to forest plant diversity, it would also provide critical and stable habitat for neotropical songbirds, particularly forest interior nesting species such as Wood Thrush, Ovenbird, Veery, Blue-gray Nuthatcher, Acadian Flycatcher, Pileated Woodpecker, and Red-shouldered Hawk. Old growth forest in this region could potentially support American marten if more conifers, such as white pine and hemlock, were integrated into the canopy. However, American marten has only been reintroduced to two locations in the northern Lower Peninsula (DNR), so the chances of a pair of martens naturally migrating from one of these areas and occupying this portion of the Tittabawassee River are low. Additionally, large tracts of mature forest could support roosting and/or maternity habitat for several declining bat species including northern long-eared bat which is currently being considered for federal listing.

4) Managing for Natural Hydrologic Regimes

Modifying the schedule of hydroelectric dam water releases is one of the most challenging natural resource issues to address today. However, it will be impossible for this section of the Tittabawassee River to recover biologically without altering the intensity and frequency of water releases from Sanford Dam. The river here is a warmwater system with highly flashy flows and water levels fluctuating several feet in a day. Since we are unfamiliar with the details of construction and operations of Sanford Dam, we cannot make any specific recommendations for water control management. However, numerous hydroelectric dams across the country have successfully modified their water release schedules to continue supplying hydroelectric power and recreational opportunities while helping meet aquatic and floodplain biodiversity outcomes (Postel and Richter 2003). The Nature Conservancy recently created a freshwater website, (<http://www.nature.org/initiatives/freshwater/>) which includes summaries of more than 850 flow restoration projects being undertaken around the world. Strategies used for modifying hydropower dams include: 1) building a smaller re-regulating dam downstream of the hydroelectric dam, 2) building a pumped storage facility at a higher elevation, 3) optimizing power generation across all energy sources in the region, 4) optimizing the operation of a cascade or system of dams on the same river system, and 5) making use of state of the art hydrologic forecasts and modeling (Richter and Thomas 2007).

6. Literature Cited

- Albert, D.A. 1995. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: A working map and classification. USDA, Forest Service, North Central Forest Experiment Station, St. Paul, MN.
- ATS. 2007. GeoMorph® Pilot Site Characterization Report: Upper Tittabawassee River and Floodplain Soils Midland, Michigan. Prepared for Ann Arbor Technical Services, Inc. for The Dow Chemical Company.
- Badra, P.J. 2010. Assessment of the status and distribution of native mussels (Unionidae) in Michigan, and results of unionid surveys in the Eastern Upper Peninsula and Huron-Clinton Metroparks. Report number MNFI 2010-11. Report to Michigan Department of Natural Resources and Environment, Water Bureau, Lansing, MI. 71pp.
- Badra, P.J. and R.R. Goforth. 2002. Surveys of native freshwater mussels in the lower reaches of Great Lakes tributary rivers in Michigan. Report number MNFI 2002-03. Report to Michigan Dept. of Environmental Quality, Coastal Zone Management Unit, Lansing, MI. 39pp.
- Cook, C.W. 1914. The Brine and Salt Deposits of Michigan: Their origin, distribution, and exploitation. Michigan Geological and Biological Survey, Publication 15, Geological Series 12. Wynkoop Hallenbeck Crawford Co., State Printers, Lansing, Michigan.
- Driscoll, M.L., T. Donovan, R. Mickey, A. Howard, and K.K Fleming. 2005. Determinants of wood thrush nest success: a multi-scale, model selection approach. *Journal of Wildlife Management* 69(2): 699-709.
- Eagle, A.C., E.M. Hay-Chmielewski, K.T. Cleveland, A.L. Derosier, M.E. Herbert, and R.A. Rustem, eds. 2005. Michigan's Wildlife Action Plan. Michigan Department of Natural Resources, Lansing, Michigan. 1592 pp. <http://www.michigan.gov/dnrwildlifeactionplan>.
- Freyman, W.A., and L.A. Masters. 2013. The Universal Floristic Quality Assessment (FQA) Calculator. Available <http://www.universalfqa.org/>. (Accessed 2 December 2014).
- Hynes, H.B.N. 1970. *The Ecology of Running Waters*. Liverpool University Press, Liverpool, pg24.
- Hoeh, W.R. and R.J. Trdan. 1984. The freshwater mussels (Pelecypoda: Unionidae) of the Upper Tittabawassee River drainage, Michigan. *Malacological Review* 17:97-98.
- Johnson, P.T.J., J.D. Olden, M.J. Vander Zanden. 2008. Dam invaders: impoundments facilitate biological invasions into freshwaters. *Frontiers in Ecology and the Environment* 6:357-363.
- Matteson, S., K. Kreitinger, G. Bartelt, G. Butcher, D. Sample, and T. Will. 2009. Partners in Flight Bird Conservation Plan for The Boreal Hardwood Transition (Bird Conservation Region 12 — U.S. Portion). Version 1.0. Partners in Flight. www.partnersinflight.org.
- Postel, S., and B. Richter. 2003. *Rivers for life: managing water for people and nature*. Island Press, Washington, D.C., USA.

- Potter, B.A., G.J. Soulliere, D.N. Ewert, M.G. Knutson, W.E. Thogmartin, J.S. Castrale, and M.J. Roell. 2007. Upper Mississippi River and Great Lakes Region Joint Venture Landbird Habitat Conservation Strategy. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 124 pp.
- Ralph, C. J., J. R. Sauer, and S. Droege (eds.). 1995. Monitoring bird populations by point counts. General Technical Report PSW-GTR-149. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, California. 187 pp.
- Rankin, E.T. 1995. The use of habitat assessments in water resource management programs, pp. 181-208. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.
- Rankin, E.T. 2006. Methods for assessing habitat in flowing waters: Using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Technical Bulletin EAS/2006-06-1.
- Reznicek, A.A., E.G. Voss, and B.S. Walters. 2011. Michigan Flora Online. University of Michigan, Ann Arbor, MI. Available <http://www.michiganflora.net/home.aspx>. (Accessed 2 December 2014).
- Reznicek, A.A., B.S. Walters, M.R. Penskar, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database – 2014. Available <http://www.michiganflora.net/fqa-database.pdf>. (Accessed 2 December 2014).
- Richter, B. D., and G. A. Thomas. 2007. Restoring environmental flows by modifying dam operations. Ecology and Society 12(1): 12. [online] URL: <http://www.ecologyandsociety.org/vol12/iss1/art12/>.
- Richter, B.D., D.P. Braun, M.A. Mendelson, and L.L. Master. 1997. Threats to imperiled freshwater fauna. Conservation Biology 11:1081-1093.
- Roth, R.R., M.S. Johnson, and T.J. Underwood. 1996. Wood Thrush. In The Birds of North America, No. 246 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Schrouder, K.S., R.N. Lockwood, and J.P. Baker. 2009. Tittabawassee River assessment. Michigan Department of Natural Resources, Fisheries Special Report 52, Ann Arbor.
- Stratus Consulting Inc. 2008. Natural Resource Damage Assessment Plan for the Tittabawassee River System Assessment Area. Prepared for Remediation and Redevelopment Division, Michigan Department of Environmental Quality.
- Watters, G.T. 1996. Small dams as barriers to freshwater mussels (Bivalvia, Unionoida) and their hosts. Biological Conservation 75:79-85.

**Appendix A:
Floristic Quality Assessment – Averill Preserve**

Averill Preserve (Little Forks Conservancy)

06/25/2014

Averill Preserve

Midland

Midland

MI

USA

FQA DB Region:

Michigan

FQA DB Publication Year:

2014

Reznicek, A.A., M.R. Penskar, B.S. Walters, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database. Herbarium, University of Michigan, Ann Arbor, MI and Michigan Natural Features Inventory, Michigan State University, Lansing, MI. <http://michiganflora.net>

FQA DB Description:

Practitioner:

Brad Slaughter, John Paskus

Latitude:

43.6628

Longitude:

-84.348

Weather Notes:

Duration Notes:

Community Type Notes:

Old field, floodplain forest, early successional forest, southern hardwood swamp

Additional spp. added by B. Slaughter 11 August 2014. Also noted: *Persicaria* sp., *Epilobium* sp., *Prenanthes* sp., *Crataegus* sp.

Other Notes:

Private/Public:

Private

Conservatism-Based Metrics:

Total Mean C:

2.8

Native Mean C:

3.7

Total FQI:

41.7

Native FQI:

47.7

Adjusted FQI:

32

% C value 0:

28.4

% C value 1-3:

28.8

% C value 4-6:

38.7

% C value 7-10:

4.1

Native Tree Mean C:

3.5

Native Shrub Mean C:

3.3

Native Herbaceous Mean C:

3.8

Species Richness:

Total Species:

222

Native Species:

166 74.80%

Non-native Species:

56 25.20%

Species Wetness:

Mean Wetness:	0.6
Native Mean Wetness:	-0.1

Physiognomy Metrics:

Tree:	26	11.70%
Shrub:	26	11.70%
Vine:	11	5%
Forb:	118	53.20%
Grass:	22	9.90%
Sedge:	13	5.90%
Rush:	0	0%
Fern:	6	2.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	6	2.70%
Perennial:	206	92.80%
Biennial:	10	4.50%
Native Annual:	2	0.90%
Native Perennial:	162	73%
Native Biennial:	2	0.90%

Species:

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Acer negundo</i>	Sapindaceae	ACENEG	native	0	0	tree	perennial	box-elder
<i>Acer rubrum</i>	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
<i>Acer saccharinum</i>	Sapindaceae	ACESAI	native	2	-3	tree	perennial	silver maple
<i>Acer saccharum</i>	Sapindaceae	ACESAU	native	5	3	tree	perennial	sugar maple
<i>Achillea millefolium</i>	Asteraceae	ACHMIL	native	1	3	forb	perennial	yarrow
<i>Acorus calamus</i>	Acoraceae	ACOCAL	non-native	0	-5	forb	perennial	calamus
<i>Ageratina altissima</i> ; <i>eupatorium rugosum</i>	Asteraceae	AGEALT	native	4	3	forb	perennial	white snakeroot
<i>Agrostis gigantea</i>	Poaceae	AGRGIG	non-native	0	-3	grass	perennial	redtop
<i>Alisma triviale</i> ; <i>a. plantago-aquatica</i>	Alismataceae	ALITRI	native	1	-5	forb	perennial	northern water-plantain
<i>Allium canadense</i>	Alliaceae	ALLCAN	native	4	3	forb	perennial	wild garlic
<i>Amphicarpaea bracteata</i>	Fabaceae	AMPBRA	native	5	0	vine	annual	hog-peanut
<i>Anemone canadensis</i>	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
<i>Anemone virginiana</i>	Ranunculaceae	ANEVIR	native	3	3	forb	perennial	thimbleweed
<i>Apios americana</i>	Fabaceae	APIAME	native	3	-3	vine	perennial	groundnut
<i>Apocynum androsaemifolium</i>	Apocynaceae	APOAND	native	3	5	forb	perennial	spreading dogbane

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Apocynum cannabinum</i> ; <i>a. sibiricum</i>	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
<i>Arisaema dracontium</i>	Araceae	ARIDRA	native	8	-3	forb	perennial	green dragon
<i>Arisaema triphyllum</i>	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
<i>Asarum canadense</i>	Aristolochiaceae	ASACAN	native	5	5	forb	perennial	wild-ginger
<i>Asclepias syriaca</i>	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
<i>Asclepias tuberosa</i>	Apocynaceae	ASCTUB	native	5	5	forb	perennial	butterfly-weed
<i>Asparagus officinalis</i>	Asparagaceae	ASPOFF	non-native	0	3	forb	perennial	garden asparagus
<i>Athyrium filix-femina</i>	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
<i>Berberis thunbergii</i>	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
<i>Betula papyrifera</i>	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
<i>Bromus inermis</i>	Poaceae	BROINE	non-native	0	5	grass	perennial	smooth brome
<i>Bromus latiglumis</i>	Poaceae	BROLAT	native	6	-3	grass	perennial	ear-leaved brome
<i>Calystegia sepium</i>	Convolvulaceae	CALSEP	native	2	0	vine	perennial	hedge bindweed
<i>Carex crinita</i>	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
<i>Carex cristatella</i>	Cyperaceae	CXCRIS	native	3	-3	sedge	perennial	sedge
<i>Carex gracillima</i>	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
<i>Carex grayi</i>	Cyperaceae	CXGRAY	native	6	-3	sedge	perennial	sedge
<i>Carex grisea</i> ; <i>c. amphibola</i>	Cyperaceae	CXGRIS	native	3	0	sedge	perennial	sedge
<i>Carex lacustris</i>	Cyperaceae	CXLACU	native	6	-5	sedge	perennial	sedge
<i>Carex lupulina</i>	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
<i>Carex rosea</i> ; <i>c. convoluta</i>	Cyperaceae	CXROSE	native	2	5	sedge	perennial	curly-styled wood sedge
<i>Carex stipata</i>	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
<i>Carex stricta</i>	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
<i>Carex tribuloides</i>	Cyperaceae	CXTRIB	native	3	-3	sedge	perennial	sedge
<i>Carex vulpinoidea</i>	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
<i>Carya ovata</i>	Juglandaceae	CAROVA	native	5	3	tree	perennial	shagbark hickory
<i>Celtis occidentalis</i>	Cannabaceae	CELOCC	native	5	0	tree	perennial	hackberry
<i>Centaurea stoebe</i> ; <i>c. maculosa</i>	Asteraceae	CENSTO	non-native	0	5	forb	biennial	spotted knapweed
<i>Cinna arundinacea</i>	Poaceae	CINARU	native	7	-3	grass	perennial	wood reedgrass
<i>Circaea canadensis</i> ; <i>c. lutetiana</i>	Onagraceae	CIRCAN	native	2	3	forb	perennial	enchanters-nightshade
<i>Cirsium arvense</i>	Asteraceae	CIRARV	non-native	0	3	forb	perennial	canada thistle
<i>Cirsium discolor</i>	Asteraceae	CIRDIS	native	4	5	forb	biennial	pasture thistle
<i>Clematis virginiana</i>	Ranunculaceae	CLEVIR	native	4	0	vine	perennial	virgins bower
<i>Convallaria majalis</i>	Convallariaceae	CONMAJ	non-native	0	5	forb	perennial	lily-of-the-valley
<i>Cornus alternifolia</i>	Cornaceae	CORALT	native	5	3	tree	perennial	alternate-leaved dogwood
<i>Cornus foemina</i>	Cornaceae	CORFOE	native	1	0	shrub	perennial	gray dogwood
<i>Cornus sericea</i> ; <i>c. stolonifera</i>	Cornaceae	CORSER	native	2	-3	shrub	perennial	red-osier
<i>Corylus americana</i>	Betulaceae	CORAMA	native	5	3	shrub	perennial	hazelnut
<i>Daucus carota</i>	Apiaceae	DAUCAR	non-native	0	5	forb	biennial	queen-annes-lace
<i>Desmodium canadense</i>	Fabaceae	DESCAD	native	3	0	forb	perennial	showy tick-trefoil

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Dianthus armeria	Caryophyllaceae	DIAARM	non-native	0	5	forb	annual	deptford pink
Diarrhena obovata; d. americana	Poaceae	DIAOBO	native	9	-3	grass	perennial	beak grass
Dichanthelium latifolium; panicum l.	Poaceae	DICLAT	native	5	3	grass	perennial	broad-leaved panic grass
Diervilla lonicera	Diervillaceae	DIELON	native	4	5	shrub	perennial	bush-honeysuckle
Doellingeria umbellata; aster u.	Asteraceae	DOEUMB	native	5	-3	forb	perennial	flat-topped white aster
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Elymus canadensis	Poaceae	ELYSAN	native	5	3	grass	perennial	canada wild rye
Elymus repens; agropyron r.	Poaceae	ELYREP	non-native	0	3	grass	perennial	quack grass
Elymus riparius	Poaceae	ELYRIP	native	8	-3	grass	perennial	riverbank wild-rye
Elymus virginicus	Poaceae	ELYVIR	native	4	-3	grass	perennial	virginia wild-rye
Epipactis helleborine	Orchidaceae	EPIHEL	non-native	0	0	forb	perennial	helleborine
Equisetum arvense	Equisetaceae	EQUARV	native	0	0	fern	perennial	common horsetail
Equisetum hyemale	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
Eragrostis spectabilis	Poaceae	ERASPE	native	3	5	grass	perennial	purple love grass
Erigeron strigosus	Asteraceae	ERISTR	native	4	3	forb	perennial	daisy fleabane
Euonymus obovatus	Celastraceae	EUOOBO	native	5	3	shrub	perennial	running strawberry-bush
Eurybia furcata; aster f.	Asteraceae	EURFUR	native	10	5	forb	perennial	forked aster
Eutrochium purpureum; eupatorium p.	Asteraceae	EUTPUR	native	5	0	forb	perennial	green-stemmed joe-pye-weed
Festuca subverticillata; f. obtusa	Poaceae	FESSUB	native	5	3	grass	perennial	nodding fescue
Fragaria virginiana	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
Frangula alnus; rhamnus frangula	Rhamnaceae	FRAALN	non-native	0	0	shrub	perennial	glossy buckthorn
Fraxinus americana	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
Fraxinus nigra	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
Fraxinus pennsylvanica	Oleaceae	FRAPEN	native	2	-3	tree	perennial	red ash
Gaillardia pulchella	Asteraceae	GAIPUL	non-native	0	5	forb	annual	blanket-flower
Galium album; g. mollugo	Rubiaceae	GALALB	non-native	0	5	forb	perennial	white bedstraw
Galium obtusum	Rubiaceae	GALOBT	native	5	-3	forb	perennial	wild madder
Galium palustre	Rubiaceae	GALPAL	native	3	-5	forb	perennial	marsh bedstraw
Galium triflorum	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
Geranium maculatum	Geraniaceae	GERMAC	native	4	3	forb	perennial	wild geranium
Geum aleppicum	Rosaceae	GEUALE	native	3	0	forb	perennial	yellow avens
Geum canadense	Rosaceae	GEUCAN	native	1	0	forb	perennial	white avens
Geum laciniatum	Rosaceae	GEULAC	native	2	-3	forb	perennial	rough avens
Glyceria grandis	Poaceae	GLYGRA	native	6	-5	grass	perennial	reed manna grass
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Hamamelis virginiana	Hamamelidaceae	HAMVIR	native	5	3	shrub	perennial	witch-hazel
Helianthus decapetalus	Asteraceae	HELDEC	native	5	3	forb	perennial	pale sunflower
Helianthus giganteus	Asteraceae	HELGIG	native	5	-3	forb	perennial	tall sunflower
Helianthus tuberosus	Asteraceae	HELTUB	native	6	0	forb	perennial	jerusalem-artichoke
Heracleum maximum	Apiaceae	HERMAX	native	3	-3	forb	perennial	cow-parsnip

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Hylotelephium telephium</i> ; sedum t.	Crassulaceae	HYLTEL	non-native	0	5	forb	perennial	live-forever
<i>Hypericum perforatum</i>	Hypericaceae	HYPPER	non-native	0	5	forb	perennial	common st. johns-wort
<i>Ilex verticillata</i>	Aquifoliaceae	ILEVER	native	5	-3	shrub	perennial	michigan holly
<i>Impatiens capensis</i>	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
<i>Iris virginica</i>	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
<i>Juncus tenuis</i>	Juncaceae	JUNTEN	native	1	0	forb	perennial	path rush
<i>Juniperus virginiana</i>	Cupressaceae	JUNVIR	native	3	3	tree	perennial	red-cedar
<i>Lactuca canadensis</i>	Asteraceae	LACCAN	native	2	3	forb	biennial	tall lettuce
<i>Laportea canadensis</i>	Urticaceae	LAPCAN	native	4	-3	forb	perennial	wood nettle
<i>Lathyrus latifolius</i>	Fabaceae	LATLAT	non-native	0	5	vine	perennial	everlasting pea
<i>Leersia virginica</i>	Poaceae	LEEVIR	native	5	-3	grass	perennial	white grass
<i>Lepidium campestre</i>	Brassicaceae	LEPCAM	non-native	0	5	forb	biennial	field cress
<i>Leucanthemum vulgare</i> ; <i>chrysanthemum leucanthemum</i>	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy
<i>Ligustrum vulgare</i>	Oleaceae	LIGVUL	non-native	0	3	shrub	perennial	common privet
<i>Lilium michiganense</i>	Liliaceae	LILMIC	native	5	-3	forb	perennial	michigan lily
<i>Lobelia cardinalis</i>	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower
<i>Lobelia siphilitica</i>	Campanulaceae	LOBSIP	native	4	-3	forb	perennial	great blue lobelia
<i>Lonicera dioica</i>	Caprifoliaceae	LONDIO	native	5	3	vine	perennial	red honeysuckle
<i>Lonicera morrowii</i>	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle
<i>Lotus corniculatus</i>	Fabaceae	LOTCOR	non-native	0	3	forb	perennial	birdfoot trefoil
<i>Lycopus americanus</i>	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
<i>Lysimachia ciliata</i>	Myrsinaceae	LYSCIL	native	4	-3	forb	perennial	fringed loosestrife
<i>Lysimachia nummularia</i>	Myrsinaceae	LYSNUM	non-native	0	-3	forb	perennial	moneywort
<i>Maianthemum racemosum</i> ; <i>smilacina r.</i>	Convallariaceae	MAIRAC	native	5	3	forb	perennial	false spikenard
<i>Maianthemum stellatum</i> ; <i>smilacina s.</i>	Convallariaceae	MAISTE	native	5	0	forb	perennial	starry false solomon-seal
<i>Medicago sativa</i>	Fabaceae	MEDSAT	non-native	0	5	forb	perennial	alfalfa
<i>Melilotus albus</i>	Fabaceae	MELALB	non-native	0	3	forb	biennial	white sweet-clover
<i>Melilotus officinalis</i>	Fabaceae	MELLOF	non-native	0	3	forb	biennial	yellow sweet-clover
<i>Mentha spicata</i>	Lamiaceae	MENSPI	non-native	0	-3	forb	perennial	spearmint
<i>Mentha</i> Æ— <i>piperita</i>	Lamiaceae	MENPIP	non-native	0	-5	forb	perennial	peppermint
<i>Monarda fistulosa</i>	Lamiaceae	MONFIS	native	2	3	forb	perennial	wild-bergamot
<i>Muhlenbergia mexicana</i>	Poaceae	MUHMEX	native	3	-3	grass	perennial	leafy satin grass
<i>Onoclea sensibilis</i>	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
<i>Osmunda cinnamomea</i>	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
<i>Oxalis stricta</i> ; <i>o. fontana</i>	Oxalidaceae	OXASTR	native	0	3	forb	perennial	yellow wood-sorrel
<i>Panicum virgatum</i>	Poaceae	PANVIR	native	4	0	grass	perennial	switch grass
<i>Parthenocissus quinquefolia</i>	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
<i>Pastinaca sativa</i>	Apiaceae	PASSAT	non-native	0	5	forb	biennial	wild parsnip
<i>Penstemon digitalis</i>	Plantaginaceae	PENDIG	native	2	0	forb	perennial	foxglove beard-tongue
<i>Persicaria virginiana</i> ; <i>polygonum v.</i>	Polygonaceae	PERVIR	native	4	0	forb	perennial	jumpseed

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phleum pratense	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
Phlox divaricata	Polemoniaceae	PHLDIV	native	5	3	forb	perennial	wild blue phlox
Physalis virginiana	Solanaceae	PHYVIG	native	4	5	forb	perennial	virginia ground-cherry
Physocarpus opulifolius	Rosaceae	PHYOPU	native	4	-3	shrub	perennial	ninebark
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Pinus sylvestris	Pinaceae	PINSYL	non-native	0	3	tree	perennial	scotch pine
Plantago lanceolata	Plantaginaceae	PLALAN	non-native	0	3	forb	perennial	english plantain
Plantago rugelii	Plantaginaceae	PLARUG	native	0	0	forb	perennial	red-stalked plantain
Poa compressa	Poaceae	POACOM	non-native	0	3	grass	perennial	canada bluegrass
Poa pratensis	Poaceae	POAPRA	non-native	0	3	grass	perennial	kentucky bluegrass
Podophyllum peltatum	Berberidaceae	PODPEL	native	3	3	forb	perennial	may-apple
Populus deltoides	Salicaceae	POPDEL	native	1	0	tree	perennial	cottonwood
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Potentilla recta	Rosaceae	POTREC	non-native	0	5	forb	perennial	rough-fruited cinquefoil
Prunella vulgaris	Lamiaceae	PRUVUL	native	0	0	forb	perennial	self-heal
Prunus serotina	Rosaceae	PRUSER	native	2	3	tree	perennial	wild black cherry
Prunus virginiana	Rosaceae	PRUVIR	native	2	3	shrub	perennial	choke cherry
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
Quercus alba	Fagaceae	QUEALB	native	5	3	tree	perennial	white oak
Quercus ellipsoidalis; q. coccinea	Fagaceae	QUEELL	native	4	5	tree	perennial	hills oak
Quercus macrocarpa	Fagaceae	QUEMAC	native	5	3	tree	perennial	bur oak
Quercus palustris	Fagaceae	QUEPAL	native	8	-3	tree	perennial	pin oak
Ranunculus acris	Ranunculaceae	RANACR	non-native	0	0	forb	perennial	tall or common buttercup
Ranunculus flabellaris; ranunculus lapponicus	Ranunculaceae	RANFLA	native	10	-5	forb	perennial	yellow water crowfoot
Ranunculus hispidus	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
Ranunculus recurvatus	Ranunculaceae	RANREC	native	5	-3	forb	perennial	hooked crowfoot
Rhamnus cathartica	Rhamnaceae	RHACAT	non-native	0	0	tree	perennial	common buckthorn
Rhus typhina	Anacardiaceae	RHUTYP	native	2	3	shrub	perennial	staghorn sumac
Ribes americanum	Grossulariaceae	RIBAME	native	6	-3	shrub	perennial	wild black currant
Ribes cynosbati	Grossulariaceae	RIBCYN	native	4	3	shrub	perennial	prickly or wild gooseberry
Rosa multiflora	Rosaceae	ROSMUL	non-native	0	3	shrub	perennial	multiflora rose
Rosa palustris	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
Rubus occidentalis	Rosaceae	RUBOCC	native	1	5	shrub	perennial	black raspberry
Rubus strigosus	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
Rudbeckia fulgida	Asteraceae	RUDFUL	native	9	-5	forb	perennial	black-eyed susan
Rudbeckia hirta	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
Rudbeckia laciniata	Asteraceae	RUDLAC	native	6	-3	forb	perennial	cut-leaf coneflower
Rumex acetosella	Polygonaceae	RUMACL	non-native	0	3	forb	perennial	sheep sorrel
Rumex crispus	Polygonaceae	RUMCRI	non-native	0	0	forb	perennial	curly dock

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Rumex obtusifolius	Polygonaceae	RUMOBT	non-native	0	0	forb	perennial	bitter dock
Salix discolor	Salicaceae	SALDIS	native	1	-3	shrub	perennial	pussy willow
Salix petiolaris	Salicaceae	SALPET	native	1	-3	shrub	perennial	slender willow
Sambucus racemosa	Adoxaceae	SAMRAC	native	3	3	shrub	perennial	red-berried elder
Samolus parviflorus	Theophrastaceae	SAMPAR	native	5	-5	forb	perennial	water-pimpernel
Sanguinaria canadensis	Papaveraceae	SANCAA	native	5	3	forb	perennial	bloodroot
Sanicula odorata; s. gregaria	Apiaceae	SANODO	native	2	0	forb	perennial	black snakeroot
Saponaria officinalis	Caryophyllaceae	SAPOFF	non-native	0	3	forb	perennial	bouncing bet
Sassafras albidum	Lauraceae	SASALB	native	5	3	tree	perennial	sassafras
Scirpus atrovirens	Cyperaceae	SCIATV	native	3	-5	sedge	perennial	bulrush
Scrophularia marilandica	Scrophulariaceae	SCRMAR	native	5	3	forb	perennial	late figwort
Scutellaria lateriflora	Lamiaceae	SCULAT	native	5	-5	forb	perennial	mad-dog skullcap
Securigera varia; coronilla v.	Fabaceae	SECVAR	non-native	0	5	forb	perennial	crown-vetch
Silene latifolia; s. pratensis	Caryophyllaceae	SILLAT	non-native	0	5	forb	annual	white campion
Sium suave	Apiaceae	SIUSUA	native	5	-5	forb	perennial	water-parsnip
Smilax hispida; s. tamnoides	Smilacaceae	SMIHIS	native	5	0	vine	perennial	bristly greenbrier
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago altissima	Asteraceae	SOLALT	native	1	3	forb	perennial	tall goldenrod
Solidago flexicaulis	Asteraceae	SOLFLE	native	6	3	forb	perennial	zigzag goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago juncea	Asteraceae	SOLJUN	native	3	5	forb	perennial	early goldenrod
Sorghastrum nutans	Poaceae	SORNUT	native	6	3	grass	perennial	indian grass
Symphotrichum laeve; aster l.	Asteraceae	SYMLAE	native	5	3	forb	perennial	smooth aster
Symphotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Symphotrichum ontarionis; aster o.	Asteraceae	SYMONT	native	6	0	forb	perennial	lake ontario aster
Taraxacum officinale	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
Teucrium canadense	Lamiaceae	TEUCAN	native	4	-3	forb	perennial	wood-sage
Thalictrum dasycarpum	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
Tilia americana	Malvaceae	TILAME	native	5	3	tree	perennial	basswood
Torilis japonica	Apiaceae	TORJAP	non-native	0	3	forb	annual	hedge-parsley
Toxicodendron radicans	Anacardiaceae	TOXRAD	native	2	0	vine	perennial	poison-ivy
Tragopogon pratensis	Asteraceae	TRAPRA	non-native	0	5	forb	biennial	common goats beard
Trifolium pratense	Fabaceae	TRIPRA	non-native	0	3	forb	perennial	red clover
Trifolium repens	Fabaceae	TRIREP	non-native	0	3	forb	perennial	white clover
Triosteum aurantiacum	Caprifoliaceae	TRIAUN	native	5	5	forb	perennial	horse-gentian
Typha angustifolia	Typhaceae	TYPANG	non-native	0	-5	forb	perennial	narrow-leaved cat-tail
Ulmus americana	Ulmaceae	ULMAME	native	1	-3	tree	perennial	american elm
Ulmus pumila	Ulmaceae	ULMPUM	non-native	0	3	tree	perennial	siberian elm
Urtica dioica	Urticaceae	URTDIO	native	1	0	forb	perennial	stinging nettle
Verbascum thapsus	Scrophulariaceae	VERTHA	non-native	0	5	forb	biennial	common mullein

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Verbena urticifolia	Verbenaceae	VERURT	native	4	0	forb	perennial	white vervain
Vernonia missurica	Asteraceae	VERMIS	native	4	0	forb	perennial	missouri ironweed
Viburnum lentago	Adoxaceae	VIBLEN	native	4	0	shrub	perennial	nannyberry
Viburnum opulus	Adoxaceae	VIBOPU	non-native	0	-3	shrub	perennial	european highbush-cranberry
Viola sororia	Violaceae	VIOSOR	native	1	0	forb	perennial	common blue violet
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape
Zizia aurea	Apiaceae	ZIZAUR	native	6	0	forb	perennial	golden alexanders

Appendix B:
Floristic Quality Assessment – Forestview Natural Area

Forestview Natural Area (Little Forks Conservancy)

06/25/2014

Forestview Natural Area

Midland

Midland

MI

USA

FQA DB Region:

Michigan

FQA DB Publication Year:

2014

FQA DB Description:

Reznicek, A.A., M.R. Penskar, B.S. Walters, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database. Herbarium, University of Michigan, Ann Arbor, MI and Michigan Natural Features Inventory, Michigan State University, Lansing, MI. <http://michiganflora.net>

Practitioner:

Brad Slaughter, John Paskus

Latitude:

43.6518

Longitude:

-84.3351

Weather Notes:

Duration Notes:

Community Type Notes:

Dry-mesic northern forest, mesic northern forest, hardwood-conifer swamp, floodplain forest, southern hardwood swamp

Other Notes:

Additional spp. added by B. Slaughter 12 August 2014. Also noted: *Persicaria* sp., *Euphorbia* sp., *Ranunculus* sp. (aquatic), *Hieracium* sp., *Crataegus* sp., *Bidens* sp.

Private/Public:

Private

Conservatism-Based Metrics:

Total Mean C:

3.6

Native Mean C:

4.2

Total FQI:

59

Native FQI:

63.7

Adjusted FQI:

38.8

% C value 0:

17.5

% C value 1-3:

26.4

% C value 4-6:

47.6

% C value 7-10:

8.6

Native Tree Mean C:

4.4

Native Shrub Mean C:

4.2

Native Herbaceous Mean C:

4.1

Species Richness:

Total Species:

269

Native Species:	230	85.50%
Non-native Species:	39	14.50%

Species Wetness:		
Mean Wetness:	0.2	
Native Mean Wetness:	-0.2	

Physiognomy Metrics:		
Tree:	32	11.90%
Shrub:	17	6.30%
Vine:	9	3.30%
Forb:	139	51.70%
Grass:	26	9.70%
Sedge:	33	12.30%
Rush:	0	0%
Fern:	13	4.80%
Bryophyte:	0	0%

Duration Metrics:		
Annual:	9	3.30%
Perennial:	248	92.20%
Biennial:	12	4.50%
Native Annual:	7	2.60%
Native Perennial:	218	81%
Native Biennial:	5	1.90%

Species:

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Acer nigrum; a. saccharum	Sapindaceae	ACENIG	native	4	3	tree	perennial	black maple
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Acer saccharinum	Sapindaceae	ACESAI	native	2	-3	tree	perennial	silver maple
Acer saccharum	Sapindaceae	ACESAU	native	5	3	tree	perennial	sugar maple
Adiantum pedatum	Pteridaceae	ADIPED	native	6	3	fern	perennial	maidenhair fern
Ageratina altissima; eupatorium rugosum	Asteraceae	AGEALT	native	4	3	forb	perennial	white snakeroot
Alisma triviale; a. plantago-aquatica	Alismataceae	ALITRI	native	1	-5	forb	perennial	northern water-plantain
Ambrosia artemisiifolia	Asteraceae	AMBART	native	0	3	forb	annual	common ragweed
Amphicarpaea bracteata	Fabaceae	AMPBRA	native	5	0	vine	annual	hog-peanut
Andropogon gerardii	Poaceae	ANDGER	native	5	0	grass	perennial	big bluestem
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Anemone quinquefolia	Ranunculaceae	ANEQUI	native	5	3	forb	perennial	wood anemone
Anemone virginiana	Ranunculaceae	ANEVIR	native	3	3	forb	perennial	thimbleweed

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Apios americana</i>	Fabaceae	APIAME	native	3	-3	vine	perennial	groundnut
<i>Apocynum cannabinum</i> ; <i>a. sibiricum</i>	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
<i>Aquilegia canadensis</i>	Ranunculaceae	AQUCAN	native	5	3	forb	perennial	wild columbine
<i>Arctium minus</i>	Asteraceae	ARCMIN	non-native	0	3	forb	biennial	common burdock
<i>Arisaema triphyllum</i>	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
<i>Asarum canadense</i>	Aristolochiaceae	ASACAN	native	5	5	forb	perennial	wild-ginger
<i>Asclepias syriaca</i>	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
<i>Asparagus officinalis</i>	Asparagaceae	ASPOFF	non-native	0	3	forb	perennial	garden asparagus
<i>Athyrium filix-femina</i>	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
<i>Barbarea vulgaris</i>	Brassicaceae	BARVUL	non-native	0	0	forb	biennial	yellow rocket
<i>Berberis thunbergii</i>	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
<i>Betula alleghaniensis</i>	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
<i>Betula papyrifera</i>	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
<i>Bidens frondosa</i>	Asteraceae	BIDFRO	native	1	-3	forb	annual	common beggar-ticks
<i>Brachyelytrum aristosum</i> ; <i>b. erectum</i>	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
<i>Bromus inermis</i>	Poaceae	BROINE	non-native	0	5	grass	perennial	smooth brome
<i>Bromus latiglumis</i>	Poaceae	BROLAT	native	6	-3	grass	perennial	ear-leaved brome
<i>Caltha palustris</i>	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
<i>Calystegia sepium</i>	Convolvulaceae	CALSEP	native	2	0	vine	perennial	hedge bindweed
<i>Campanula rotundifolia</i>	Campanulaceae	CAMROT	native	6	3	forb	perennial	harebell
<i>Carex arctata</i>	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
<i>Carex bromoides</i>	Cyperaceae	CXBROM	native	6	-3	sedge	perennial	sedge
<i>Carex cephaloidea</i>	Cyperaceae	CXCEPD	native	5	3	sedge	perennial	sedge
<i>Carex communis</i>	Cyperaceae	CXCOMM	native	2	5	sedge	perennial	sedge
<i>Carex comosa</i>	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge
<i>Carex crinita</i>	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
<i>Carex cristatella</i>	Cyperaceae	CXCRIS	native	3	-3	sedge	perennial	sedge
<i>Carex formosa</i>	Cyperaceae	CXFORM	native	10	0	sedge	perennial	sedge
<i>Carex gracillima</i>	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
<i>Carex grayi</i>	Cyperaceae	CXGRAY	native	6	-3	sedge	perennial	sedge
<i>Carex grisea</i> ; <i>c. amphibola</i>	Cyperaceae	CXGRIS	native	3	0	sedge	perennial	sedge
<i>Carex hirtifolia</i>	Cyperaceae	CXHIRI	native	5	3	sedge	perennial	sedge
<i>Carex hystericina</i>	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
<i>Carex intumescens</i>	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
<i>Carex lacustris</i>	Cyperaceae	CXLACU	native	6	-5	sedge	perennial	sedge
<i>Carex lupulina</i>	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
<i>Carex muskingumensis</i>	Cyperaceae	CXMUSK	native	6	-5	sedge	perennial	sedge
<i>Carex pedunculata</i>	Cyperaceae	CXPEDU	native	5	3	sedge	perennial	sedge
<i>Carex pensylvanica</i>	Cyperaceae	CXPENS	native	4	5	sedge	perennial	sedge
<i>Carex prasina</i>	Cyperaceae	CXPRAS	native	10	-5	sedge	perennial	sedge

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Carex radiata; c. rosea	Cyperaceae	CXRADI	native	2	0	sedge	perennial	straight-styled wood sedge
Carex retrorsa	Cyperaceae	CXRETS	native	3	-5	sedge	perennial	sedge
Carex rosea; c. convoluta	Cyperaceae	CXROSE	native	2	5	sedge	perennial	curly-styled wood sedge
Carex scabrata	Cyperaceae	CXSCAB	native	4	-5	sedge	perennial	sedge
Carex sparganioides	Cyperaceae	CXSPAR	native	5	3	sedge	perennial	sedge
Carex stipata	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
Carex tribuloides	Cyperaceae	CXTRIB	native	3	-3	sedge	perennial	sedge
Carex tuckermanii	Cyperaceae	CXTUCK	native	8	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Carpinus caroliniana	Betulaceae	CARCAO	native	6	0	tree	perennial	blue-beech
Carya cordiformis	Juglandaceae	CARCOR	native	5	0	tree	perennial	bitternut hickory
Carya ovata	Juglandaceae	CAROVA	native	5	3	tree	perennial	shagbark hickory
Celtis occidentalis	Cannabaceae	CELOCC	native	5	0	tree	perennial	hackberry
Centaurea stoebe; c. maculosa	Asteraceae	CENSTO	non-native	0	5	forb	biennial	spotted knapweed
Cephalanthus occidentalis	Rubiaceae	CEPOCC	native	7	-5	shrub	perennial	buttonbush
Cerastium fontanum	Caryophyllaceae	CERFON	non-native	0	3	forb	perennial	mouse-ear chickweed
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Cicuta maculata	Apiaceae	CICMAC	native	4	-5	forb	biennial	water hemlock
Cinna arundinacea	Poaceae	CINARU	native	7	-3	grass	perennial	wood reedgrass
Circaea canadensis; c. lutetiana	Onagraceae	CIRCAN	native	2	3	forb	perennial	enchanters-nightshade
Cirsium arvense	Asteraceae	CIRARV	non-native	0	3	forb	perennial	canada thistle
Cirsium vulgare	Asteraceae	CIRVUL	non-native	0	3	forb	biennial	bull thistle
Crataegus mollis	Rosaceae	CRAMOL	native	2	0	tree	perennial	hawthorn
Cryptotaenia canadensis	Apiaceae	CRYCAN	native	2	0	forb	perennial	honestwort
Cystopteris bulbifera	Cystopteridaceae	CYSBUL	native	5	-3	fern	perennial	bulblet fern
Dactylis glomerata	Poaceae	DACGLO	non-native	0	3	grass	perennial	orchard grass
Danthonia spicata	Poaceae	DANSPI	native	4	5	grass	perennial	poverty grass; oatgrass
Daucus carota	Apiaceae	DAUCAR	non-native	0	5	forb	biennial	queen-annes-lace
Diarrhena obovata; d. americana	Poaceae	DIAOBO	native	9	-3	grass	perennial	beak grass
Dichanthelium clandestinum; panicum c.	Poaceae	DICCLA	native	3	-3	grass	perennial	panic grass
Dichanthelium latifolium; panicum l.	Poaceae	DICLAT	native	5	3	grass	perennial	broad-leaved panic grass
Dioscorea villosa; dioscorea villosa	Dioscoreaceae	DIOVIL	native	4	0	forb	perennial	wild yam
Doellingeria umbellata; aster u.	Asteraceae	DOEUMB	native	5	-3	forb	perennial	flat-topped white aster
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Elymus hystrix; hystrix patula	Poaceae	ELYHYS	native	5	3	grass	perennial	bottlebrush grass
Elymus riparius	Poaceae	ELYRIP	native	8	-3	grass	perennial	riverbank wild-rye
Elymus virginicus	Poaceae	ELYVIR	native	4	-3	grass	perennial	virginia wild-rye
Epilobium coloratum	Onagraceae	EPICOL	native	3	-5	forb	perennial	cinnamon willow-herb
Epipactis helleborine	Orchidaceae	EPIHEL	non-native	0	0	forb	perennial	helleborine
Equisetum arvense	Equisetaceae	EQUARV	native	0	0	fern	perennial	common horsetail

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Equisetum hyemale</i>	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
<i>Erechtites hieraciifolius</i>	Asteraceae	EREHIE	native	2	3	forb	annual	fireweed
<i>Erigeron annuus</i>	Asteraceae	ERIANN	native	0	3	forb	biennial	daisy fleabane
<i>Erigeron philadelphicus</i>	Asteraceae	ERIPHI	native	2	0	forb	perennial	philadelphia fleabane
<i>Erigeron strigosus</i>	Asteraceae	ERISTR	native	4	3	forb	perennial	daisy fleabane
<i>Euonymus obovatus</i>	Celastraceae	EUOOBO	native	5	3	shrub	perennial	running strawberry-bush
<i>Eupatorium perfoliatum</i>	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
<i>Euthamia graminifolia</i>	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
<i>Eutrochium maculatum</i> ; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
<i>Fagus grandifolia</i>	Fagaceae	FAGGRA	native	6	3	tree	perennial	american beech
<i>Festuca subverticillata</i> ; f. obtusa	Poaceae	FESSUB	native	5	3	grass	perennial	nodding fescue
<i>Fragaria virginiana</i>	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
<i>Frangula alnus</i> ; rhamnus frangula	Rhamnaceae	FRAALN	non-native	0	0	shrub	perennial	glossy buckthorn
<i>Fraxinus nigra</i>	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
<i>Fraxinus pennsylvanica</i>	Oleaceae	FRAPEN	native	2	-3	tree	perennial	red ash
<i>Galium asprellum</i>	Rubiaceae	GALASP	native	5	-5	vine	perennial	rough bedstraw
<i>Galium boreale</i>	Rubiaceae	GALBOR	native	3	0	forb	perennial	northern bedstraw
<i>Galium circaezans</i>	Rubiaceae	GALCIR	native	4	3	forb	perennial	white wild licorice
<i>Galium obtusum</i>	Rubiaceae	GALOBT	native	5	-3	forb	perennial	wild madder
<i>Galium triflorum</i>	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
<i>Gaultheria procumbens</i>	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
<i>Geranium maculatum</i>	Geraniaceae	GERMAC	native	4	3	forb	perennial	wild geranium
<i>Geum canadense</i>	Rosaceae	GEUCAN	native	1	0	forb	perennial	white avens
<i>Glyceria grandis</i>	Poaceae	GLYGRA	native	6	-5	grass	perennial	reed manna grass
<i>Glyceria striata</i>	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
<i>Hackelia virginiana</i>	Boraginaceae	HACVIR	native	1	3	forb	biennial	beggars lice
<i>Hamamelis virginiana</i>	Hamamelidaceae	HAMVIR	native	5	3	shrub	perennial	witch-hazel
<i>Hepatica americana</i>	Ranunculaceae	HEPAME	native	6	5	forb	perennial	round-lobed hepatica
<i>Hylodesmum glutinosum</i> ; desmodium g.	Fabaceae	HYLGLU	native	5	5	forb	perennial	clustered-leaved tick-trefoil
<i>Hypericum perforatum</i>	Hypericaceae	HYPPER	non-native	0	5	forb	perennial	common st. johns-wort
<i>Impatiens capensis</i>	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
<i>Iris virginica</i>	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
<i>Juncus effusus</i>	Juncaceae	JUNEFF	native	3	-5	forb	perennial	soft-stemmed rush
<i>Juncus tenuis</i>	Juncaceae	JUNTEN	native	1	0	forb	perennial	path rush
<i>Juniperus virginiana</i>	Cupressaceae	JUNVIR	native	3	3	tree	perennial	red-cedar
<i>Laportea canadensis</i>	Urticaceae	LAPCAN	native	4	-3	forb	perennial	wood nettle
<i>Leersia oryzoides</i>	Poaceae	LEEORY	native	3	-5	grass	perennial	cut grass
<i>Leersia virginica</i>	Poaceae	LEEVIR	native	5	-3	grass	perennial	white grass
<i>Lemna minor</i>	Araceae	LEMMIN	native	5	-5	forb	perennial	common duckweed
<i>Leucanthemum vulgare</i> ; chrysanthemum leucanthemum	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Linaria vulgaris</i>	Plantaginaceae	LINVUL	non-native	0	5	forb	perennial	butter-and-eggs
<i>Lithospermum latifolium</i>	Boraginaceae	LITLAT	native	10	5	forb	perennial	broad-leaved puccoon
<i>Lobelia cardinalis</i>	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower
<i>Lobelia siphilitica</i>	Campanulaceae	LOBSIP	native	4	-3	forb	perennial	great blue lobelia
<i>Lonicera morrowii</i>	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle
<i>Lycopus americanus</i>	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
<i>Lycopus uniflorus</i>	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
<i>Lysimachia ciliata</i>	Myrsinaceae	LYSCIL	native	4	-3	forb	perennial	fringed loosestrife
<i>Lysimachia nummularia</i>	Myrsinaceae	LYSNUM	non-native	0	-3	forb	perennial	moneywort
<i>Lysimachia quadrifolia</i>	Myrsinaceae	LYSQUL	native	8	3	forb	perennial	four-leaved loosestrife
<i>Lythrum salicaria</i>	Lythraceae	LYTSAL	non-native	0	-5	forb	perennial	purple loosestrife
<i>Maianthemum canadense</i>	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
<i>Maianthemum racemosum</i> ; <i>smilacina</i> r.	Convallariaceae	MAIRAC	native	5	3	forb	perennial	false spikenard
<i>Matteuccia struthiopteris</i>	Onocleaceae	MATSTR	native	3	0	fern	perennial	ostrich fern
<i>Medeola virginiana</i>	Convallariaceae	MEDVIR	native	10	3	forb	perennial	indian cucumber-root
<i>Medicago lupulina</i>	Fabaceae	MEDLUP	non-native	0	3	forb	annual	black medick
<i>Melilotus albus</i>	Fabaceae	MELALB	non-native	0	3	forb	biennial	white sweet-clover
<i>Menispermum canadense</i>	Menispermaceae	MENCAE	native	5	0	vine	perennial	moonseed
<i>Mentha spicata</i>	Lamiaceae	MENSPI	non-native	0	-3	forb	perennial	spearmint
<i>Mimulus ringens</i>	Phrymaceae	MIMRIN	native	5	-5	forb	perennial	monkey-flower
<i>Mitchella repens</i>	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
<i>Oenothera biennis</i>	Onagraceae	OENBIE	native	2	3	forb	biennial	common evening-primrose
<i>Oenothera perennis</i>	Onagraceae	OENPER	native	5	0	forb	perennial	small sundrops
<i>Onoclea sensibilis</i>	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
<i>Oryzopsis asperifolia</i>	Poaceae	ORYASP	native	6	5	grass	perennial	rough-leaved rice-grass
<i>Osmorhiza claytonii</i>	Apiaceae	OSMCLI	native	4	3	forb	perennial	hairy sweet-cicely
<i>Osmunda cinnamomea</i>	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
<i>Osmunda regalis</i>	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
<i>Ostrya virginiana</i>	Betulaceae	OSTVIR	native	5	3	tree	perennial	ironwood; hop-hornbeam
<i>Oxalis stricta</i> ; <i>o. fontana</i>	Oxalidaceae	OXASTR	native	0	3	forb	perennial	yellow wood-sorrel
<i>Packera aurea</i> ; <i>senecio</i> a.	Asteraceae	PACAUR	native	5	-3	forb	perennial	golden ragwort
<i>Panicum virgatum</i>	Poaceae	PANVIR	native	4	0	grass	perennial	switch grass
<i>Parthenocissus quinquefolia</i>	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
<i>Pedicularis lanceolata</i>	Orobanchaceae	PEDLAN	native	8	-3	forb	perennial	swamp-betony
<i>Persicaria virginiana</i> ; <i>polygonum</i> v.	Polygonaceae	PERVIR	native	4	0	forb	perennial	jumpseed
<i>Phleum pratense</i>	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
<i>Phlox divaricata</i>	Polemoniaceae	PHLDIV	native	5	3	forb	perennial	wild blue phlox
<i>Phryma leptostachya</i>	Phrymaceae	PHRLEP	native	4	3	forb	perennial	lopseed
<i>Pilea pumila</i>	Urticaceae	PILPUM	native	5	-3	forb	annual	clearweed
<i>Pinus resinosa</i>	Pinaceae	PINRES	native	6	3	tree	perennial	red pine

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Pinus strobus</i>	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
<i>Plantago lanceolata</i>	Plantaginaceae	PLALAN	non-native	0	3	forb	perennial	english plantain
<i>Plantago rugelii</i>	Plantaginaceae	PLARUG	native	0	0	forb	perennial	red-stalked plantain
<i>Platanus occidentalis</i>	Platanaceae	PLAOCC	native	7	-3	tree	perennial	sycamore
<i>Poa compressa</i>	Poaceae	POACOM	non-native	0	3	grass	perennial	canada bluegrass
<i>Poa pratensis</i>	Poaceae	POAPRA	non-native	0	3	grass	perennial	kentucky bluegrass
<i>Poa sylvestris</i>	Poaceae	POASYL	native	8	0	grass	perennial	woodland bluegrass
<i>Podophyllum peltatum</i>	Berberidaceae	PODPEL	native	3	3	forb	perennial	may-apple
<i>Polygala paucifolia</i>	Polygalaceae	POLPAU	native	7	3	forb	perennial	gay-wings
<i>Polygala polygama</i>	Polygalaceae	POLPOL	native	9	3	forb	biennial	racemed milkwort
<i>Polygonatum pubescens</i>	Convallariaceae	POLPUB	native	5	5	forb	perennial	downy solomon seal
<i>Polystichum acrostichoides</i>	Dryopteridaceae	POLACR	native	6	3	fern	perennial	christmas fern
<i>Populus grandidentata</i>	Salicaceae	POPGRA	native	4	3	tree	perennial	big-tooth aspen
<i>Potentilla simplex</i>	Rosaceae	POTSIM	native	2	3	forb	perennial	old-field cinquefoil
<i>Prenanthes alba</i>	Asteraceae	PREALB	native	5	3	forb	perennial	white lettuce
<i>Prunella vulgaris</i>	Lamiaceae	PRUVUL	native	0	0	forb	perennial	self-heal
<i>Prunus serotina</i>	Rosaceae	PRUSER	native	2	3	tree	perennial	wild black cherry
<i>Prunus virginiana</i>	Rosaceae	PRUVIR	native	2	3	shrub	perennial	choke cherry
<i>Pteridium aquilinum</i>	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
<i>Quercus alba</i>	Fagaceae	QUEALB	native	5	3	tree	perennial	white oak
<i>Quercus bicolor</i>	Fagaceae	QUEBIC	native	8	-3	tree	perennial	swamp white oak
<i>Quercus ellipsoidalis</i> ; <i>q. coccinea</i>	Fagaceae	QUEELL	native	4	5	tree	perennial	hills oak
<i>Quercus macrocarpa</i>	Fagaceae	QUEMAC	native	5	3	tree	perennial	bur oak
<i>Quercus rubra</i>	Fagaceae	QUERUB	native	5	3	tree	perennial	red oak
<i>Ranunculus abortivus</i>	Ranunculaceae	RANABO	native	0	0	forb	perennial	small-flowered buttercup
<i>Ranunculus acris</i>	Ranunculaceae	RANACR	non-native	0	0	forb	perennial	tall or common buttercup
<i>Ranunculus hispidus</i>	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
<i>Ranunculus pennsylvanicus</i>	Ranunculaceae	RANPEN	native	6	-5	forb	annual	bristly crowfoot
<i>Rhamnus alnifolia</i>	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
<i>Rhamnus cathartica</i>	Rhamnaceae	RHACAT	non-native	0	0	tree	perennial	common buckthorn
<i>Ribes americanum</i>	Grossulariaceae	RIBAME	native	6	-3	shrub	perennial	wild black currant
<i>Ribes cynosbati</i>	Grossulariaceae	RIBCYN	native	4	3	shrub	perennial	prickly or wild gooseberry
<i>Rosa multiflora</i>	Rosaceae	ROSMUL	non-native	0	3	shrub	perennial	multiflora rose
<i>Rubus allegheniensis</i>	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
<i>Rubus occidentalis</i>	Rosaceae	RUBOCC	native	1	5	shrub	perennial	black raspberry
<i>Rubus strigosus</i>	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
<i>Rudbeckia hirta</i>	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
<i>Rumex crispus</i>	Polygonaceae	RUMCRI	non-native	0	0	forb	perennial	curly dock
<i>Rumex verticillatus</i>	Polygonaceae	RUMVER	native	7	-5	forb	perennial	water dock
<i>Sagittaria latifolia</i>	Alismataceae	SAGLAT	native	4	-5	forb	perennial	common arrowhead

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Sanguinaria canadensis</i>	Papaveraceae	SANCAA	native	5	3	forb	perennial	bloodroot
<i>Sanicula odorata</i> ; <i>s. gregaria</i>	Apiaceae	SANODO	native	2	0	forb	perennial	black snakeroot
<i>Sassafras albidum</i>	Lauraceae	SASALB	native	5	3	tree	perennial	sassafras
<i>Schizachne purpurascens</i>	Poaceae	SCHPUP	native	5	3	grass	perennial	false melic
<i>Schoenoplectus tabernaemontani</i> ; <i>scirpus validus</i>	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
<i>Scirpus atrovirens</i>	Cyperaceae	SCIATV	native	3	-5	sedge	perennial	bulrush
<i>Scirpus cyperinus</i>	Cyperaceae	SCICYP	native	5	-5	sedge	perennial	wool-grass
<i>Scirpus pendulus</i>	Cyperaceae	SCIPEN	native	3	-5	sedge	perennial	bulrush
<i>Scrophularia marilandica</i>	Scrophulariaceae	SCRMAR	native	5	3	forb	perennial	late figwort
<i>Scutellaria lateriflora</i>	Lamiaceae	SCULAT	native	5	-5	forb	perennial	mad-dog skullcap
<i>Securigera varia</i> ; <i>coronilla v.</i>	Fabaceae	SECVAR	non-native	0	5	forb	perennial	crown-vetch
<i>Sisyrinchium angustifolium</i>	Iridaceae	SISANG	native	4	0	forb	perennial	stout blue-eyed-grass
<i>Sium suave</i>	Apiaceae	SIUSUA	native	5	-5	forb	perennial	water-parsnip
<i>Smilax ecirrata</i>	Smilacaceae	SMIECI	native	6	5	forb	perennial	upright carrion-flower
<i>Smilax hispida</i> ; <i>s. tamnoides</i>	Smilacaceae	SMIHIS	native	5	0	vine	perennial	bristly greenbrier
<i>Solanum carolinense</i>	Solanaceae	SOLCAR	non-native	0	3	forb	perennial	horse-nettle
<i>Solidago canadensis</i>	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
<i>Solidago gigantea</i>	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
<i>Solidago hispida</i>	Asteraceae	SOLHIS	native	3	5	forb	perennial	hairy goldenrod
<i>Solidago rugosa</i>	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
<i>Sphenopholis intermedia</i>	Poaceae	SPHINT	native	4	0	grass	perennial	slender wedgegrass
<i>Stellaria longifolia</i>	Caryophyllaceae	STELOF	native	5	-3	forb	perennial	long-leaved chickweed
<i>Symphyotrichum cordifolium</i> ; <i>aster c.</i>	Asteraceae	SYMCOR	native	4	5	forb	perennial	heart-leaved aster
<i>Symphyotrichum laeve</i> ; <i>aster l.</i>	Asteraceae	SYMLAE	native	5	3	forb	perennial	smooth aster
<i>Symphyotrichum lateriflorum</i> ; <i>aster l.</i>	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
<i>Symphyotrichum ontarionis</i> ; <i>aster o.</i>	Asteraceae	SYMONT	native	6	0	forb	perennial	lake ontario aster
<i>Taraxacum officinale</i>	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
<i>Teucrium canadense</i>	Lamiaceae	TEUCAN	native	4	-3	forb	perennial	wood-sage
<i>Thalictrum dasycarpum</i>	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
<i>Thalictrum dioicum</i>	Ranunculaceae	THADIO	native	6	3	forb	perennial	early meadow-rue
<i>Thelypteris noveboracensis</i>	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
<i>Thelypteris palustris</i>	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
<i>Thuja occidentalis</i>	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
<i>Tilia americana</i>	Malvaceae	TILAME	native	5	3	tree	perennial	basswood
<i>Torilis japonica</i>	Apiaceae	TORJAP	non-native	0	3	forb	annual	hedge-parsley
<i>Toxicodendron radicans</i>	Anacardiaceae	TOXRAD	native	2	0	vine	perennial	poison-ivy
<i>Trientalis borealis</i>	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
<i>Trifolium repens</i>	Fabaceae	TRIREP	non-native	0	3	forb	perennial	white clover
<i>Tsuga canadensis</i>	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
<i>Tussilago farfara</i>	Asteraceae	TUSFAR	non-native	0	3	forb	perennial	coltsfoot

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Typha angustifolia	Typhaceae	TYPANG	non-native	0	-5	forb	perennial	narrow-leaved cat-tail
Typha latifolia	Typhaceae	TYPLAT	native	1	-5	forb	perennial	broad-leaved cat-tail
Ulmus americana	Ulmaceae	ULMAME	native	1	-3	tree	perennial	american elm
Urtica dioica	Urticaceae	URTDIO	native	1	0	forb	perennial	stinging nettle
Verbascum thapsus	Scrophulariaceae	VERTHA	non-native	0	5	forb	biennial	common mullein
Verbena hastata	Verbenaceae	VERHAS	native	4	-3	forb	perennial	blue vervain
Verbena urticifolia	Verbenaceae	VERURT	native	4	0	forb	perennial	white vervain
Veronicastrum virginicum	Plantaginaceae	VERVIR	native	8	0	forb	perennial	culvers-root
Viburnum lentago	Adoxaceae	VIBLEN	native	4	0	shrub	perennial	nannyberry
Viola blanda	Violaceae	VIOBLA	native	5	-3	forb	perennial	sweet white violet
Viola cucullata	Violaceae	VIOCUC	native	5	-5	forb	perennial	marsh violet
Viola pubescens	Violaceae	VIOPUB	native	4	3	forb	perennial	yellow violet
Viola sororia	Violaceae	VIOSOR	native	1	0	forb	perennial	common blue violet
Viola striata	Violaceae	VIOSTR	native	5	-3	forb	perennial	cream violet
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape
Zizia aurea	Apiaceae	ZIZAUR	native	6	0	forb	perennial	golden alexanders

**Appendix C:
Floristic Quality Assessment – Riverview Natural Area**

Riverview Natural Area and Vicinity

06/26/2014

Riverview NA

Midland

Midland

MI

USA

FQA DB Region:

Michigan

FQA DB Publication Year:

2014

FQA DB Description:

Reznicek, A.A., M.R. Penskar, B.S. Walters, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database. Herbarium, University of Michigan, Ann Arbor, MI and Michigan Natural Features Inventory, Michigan State University, Lansing, MI. <http://michiganflora.net>

Practitioner:

Brad Slaughter, John Paskus

Latitude:

43.6946

Longitude:

-84.3424

Weather Notes:

Duration Notes:

Community Type Notes:

Dry-mesic northern forest, floodplain forest, mesic southern forest, mesic northern forest, bog, old field

Other Notes:

Additions made by B. Slaughter and J. Paskus 27 June 2014 and by B. Slaughter 11 August and 8 September 2014. Also noted: *Crataegus* sp., *Platanthera* sp.

Private/Public:

Private

Conservatism-Based Metrics:

Total Mean C:

3.8

Native Mean C:

4.3

Total FQI:

65.4

Native FQI:

69.5

Adjusted FQI:

40.4

% C value 0:

14.5

% C value 1-3:

26.4

% C value 4-6:

49

% C value 7-10:

10.1

Native Tree Mean C:

4.1

Native Shrub Mean C:

4.8

Native Herbaceous Mean C:

4.3

Species Richness:		
Total Species:	296	
Native Species:	261	88.20%
Non-native Species:	35	11.80%

Species Wetness:	
Mean Wetness:	0.6
Native Mean Wetness:	0.3

Physiognomy Metrics:		
Tree:	36	12.20%
Shrub:	27	9.10%
Vine:	10	3.40%
Forb:	149	50.30%
Grass:	27	9.10%
Sedge:	33	11.10%
Rush:	0	0%
Fern:	14	4.70%
Bryophyte:	0	0%

Duration Metrics:		
Annual:	17	5.70%
Perennial:	273	92.20%
Biennial:	6	2%
Native Annual:	11	3.70%
Native Perennial:	246	83.10%
Native Biennial:	4	1.40%

Species:								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Acer nigrum; a. saccharum	Sapindaceae	ACENIG	native	4	3	tree	perennial	black maple
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Acer saccharinum	Sapindaceae	ACESAI	native	2	-3	tree	perennial	silver maple
Acer saccharum	Sapindaceae	ACESAU	native	5	3	tree	perennial	sugar maple
Achillea millefolium	Asteraceae	ACHMIL	native	1	3	forb	perennial	yarrow
Adiantum pedatum	Pteridaceae	ADIPED	native	6	3	fern	perennial	maidenhair fern
Agalinis tenuifolia	Orobanchaceae	AGATEN	native	5	-3	forb	annual	common false foxglove
Ageratina altissima; eupatorium rugosum	Asteraceae	AGEALT	native	4	3	forb	perennial	white snakeroot
Agrimonia gryposepala	Rosaceae	AGRGRY	native	2	3	forb	perennial	tall agrimony

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Agrostis perennans</i>	Poaceae	AGRPER	native	5	3	grass	perennial	autumn bent
<i>Alnus incana</i> ; <i>a. rugosa</i>	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
<i>Ambrosia artemisiifolia</i>	Asteraceae	AMBART	native	0	3	forb	annual	common ragweed
<i>Amelanchier arborea</i>	Rosaceae	AMEARB	native	4	3	tree	perennial	juneberry
<i>Amelanchier interior</i>	Rosaceae	AMEINT	native	4	5	shrub	perennial	serviceberry
<i>Amphicarpaea bracteata</i>	Fabaceae	AMPBRA	native	5	0	vine	annual	hog-peanut
<i>Anemone canadensis</i>	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
<i>Anemone virginiana</i>	Ranunculaceae	ANEVIR	native	3	3	forb	perennial	thimbleweed
<i>Antennaria howellii</i>	Asteraceae	ANTHOW	native	2	5	forb	perennial	small pussytoes
<i>Antennaria parlinii</i>	Asteraceae	ANTPAL	native	2	5	forb	perennial	smooth pussytoes
<i>Apocynum androsaemifolium</i>	Apocynaceae	APOAND	native	3	5	forb	perennial	spreading dogbane
<i>Apocynum cannabinum</i> ; <i>a. sibiricum</i>	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
<i>Aquilegia canadensis</i>	Ranunculaceae	AQUCAN	native	5	3	forb	perennial	wild columbine
<i>Arctium minus</i>	Asteraceae	ARCMIN	non-native	0	3	forb	biennial	common burdock
<i>Arisaema triphyllum</i>	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
<i>Aronia prunifolia</i>	Rosaceae	AROPRU	native	5	-3	shrub	perennial	chokeberry
<i>Asarum canadense</i>	Aristolochiaceae	ASACAN	native	5	5	forb	perennial	wild-ginger
<i>Asclepias incarnata</i>	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
<i>Asclepias syriaca</i>	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
<i>Athyrium filix-femina</i>	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
<i>Berberis thunbergii</i>	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
<i>Betula alleghaniensis</i>	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
<i>Betula papyrifera</i>	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
<i>Bidens cernua</i>	Asteraceae	BIDCER	native	3	-5	forb	annual	nodding beggar-ticks
<i>Bidens connata</i>	Asteraceae	BIDCON	native	5	-3	forb	annual	purple-stemmed tickseed
<i>Bidens frondosa</i>	Asteraceae	BIDFRO	native	1	-3	forb	annual	common beggar-ticks
<i>Boechera laevigata</i> ; <i>arabis l.</i>	Brassicaceae	BOELAE	native	5	5	forb	biennial	smooth bank cress
<i>Brachyelytrum aristosum</i> ; <i>b. erectum</i>	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
<i>Bromus inermis</i>	Poaceae	BROINE	non-native	0	5	grass	perennial	smooth brome
<i>Bromus latiglumis</i>	Poaceae	BROLAT	native	6	-3	grass	perennial	ear-leaved brome
<i>Calamagrostis canadensis</i>	Poaceae	CALCAN	native	3	-5	grass	perennial	blue-joint
<i>Campanula rotundifolia</i>	Campanulaceae	CAMROT	native	6	3	forb	perennial	harebell
<i>Carex arctata</i>	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
<i>Carex atlantica</i> ; <i>c. howei</i>	Cyperaceae	CXATLA	native	7	-3	sedge	perennial	sedge
<i>Carex bromoides</i>	Cyperaceae	CXBROM	native	6	-3	sedge	perennial	sedge
<i>Carex brunnescens</i>	Cyperaceae	CXBRUN	native	5	-3	sedge	perennial	sedge
<i>Carex buxbaumii</i>	Cyperaceae	CXBUXB	native	10	-5	sedge	perennial	sedge
<i>Carex canescens</i>	Cyperaceae	CXCANE	native	8	-5	sedge	perennial	sedge
<i>Carex crinita</i>	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Carex echinodes; c. tenera	Cyperaceae	CXECHO	native	5	-3	sedge	perennial	sedge
Carex folliculata	Cyperaceae	CXFOLL	native	10	-5	sedge	perennial	sedge
Carex formosa	Cyperaceae	CXFORM	native	10	0	sedge	perennial	sedge
Carex gracillima	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
Carex granularis	Cyperaceae	CXGRAN	native	2	-3	sedge	perennial	sedge
Carex grayi	Cyperaceae	CXGRAY	native	6	-3	sedge	perennial	sedge
Carex grisea; c. amphibola	Cyperaceae	CXGRIS	native	3	0	sedge	perennial	sedge
Carex hirtifolia	Cyperaceae	CXHIRI	native	5	3	sedge	perennial	sedge
Carex hitchcockiana	Cyperaceae	CXHITC	native	5	5	sedge	perennial	sedge
Carex hystericina	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
Carex intumescens	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
Carex lupulina	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
Carex muskingumensis	Cyperaceae	CXMUSK	native	6	-5	sedge	perennial	sedge
Carex oligosperma	Cyperaceae	CXOLIS	native	10	-5	sedge	perennial	sedge
Carex pedunculata	Cyperaceae	CXPEDU	native	5	3	sedge	perennial	sedge
Carex pensylvanica	Cyperaceae	CXPENS	native	4	5	sedge	perennial	sedge
Carex radiata; c. rosea	Cyperaceae	CXRADI	native	2	0	sedge	perennial	straight-styled wood sedge
Carex sparganioides	Cyperaceae	CXSPAR	native	5	3	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex swanii	Cyperaceae	CXSWAN	native	4	3	sedge	perennial	sedge
Carex tuckermanii	Cyperaceae	CXTUCK	native	8	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Carex woodii	Cyperaceae	CXWOOD	native	8	3	sedge	perennial	sedge
Carpinus caroliniana	Betulaceae	CARCAO	native	6	0	tree	perennial	blue-beech
Carya ovata	Juglandaceae	CAROVA	native	5	3	tree	perennial	shagbark hickory
Celastrus scandens	Celastraceae	CELSCA	native	3	3	vine	perennial	american bitterweet
Celtis occidentalis	Cannabaceae	CELOCC	native	5	0	tree	perennial	hackberry
Cerastium arvense	Caryophyllaceae	CERARV	native	6	3	forb	perennial	field chickweed
Cerastium fontanum	Caryophyllaceae	CERFON	non-native	0	3	forb	perennial	mouse-ear chickweed
Chamaedaphne calyculata	Ericaceae	CHACAL	native	8	-5	shrub	perennial	leatherleaf
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Chenopodium album	Amaranthaceae	CHEALB	non-native	0	3	forb	annual	lamb-quarters
Cinna arundinacea	Poaceae	CINARU	native	7	-3	grass	perennial	wood reedgrass
Circaea alpina	Onagraceae	CIRALP	native	4	-3	forb	perennial	small enchanters-nightshade
Cirsium discolor	Asteraceae	CIRDIS	native	4	5	forb	biennial	pasture thistle
Clematis virginiana	Ranunculaceae	CLEVIR	native	4	0	vine	perennial	virgins bower
Comandra umbellata	Santalaceae	COMUMB	native	5	3	forb	perennial	bastard-toadflax
Comptonia peregrina	Myricaceae	COMPER	native	6	5	shrub	perennial	sweetfern
Coptis trifolia	Ranunculaceae	COPTRI	native	5	-3	forb	perennial	goldthread

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Cornus alternifolia</i>	Cornaceae	CORALT	native	5	3	tree	perennial	alternate-leaved dogwood
<i>Cornus canadensis</i>	Cornaceae	CORCAA	native	6	0	shrub	perennial	bunchberry
<i>Cornus foemina</i>	Cornaceae	CORFOE	native	1	0	shrub	perennial	gray dogwood
<i>Crataegus mollis</i>	Rosaceae	CRAMOL	native	2	0	tree	perennial	hawthorn
<i>Cryptotaenia canadensis</i>	Apiaceae	CRYCAN	native	2	0	forb	perennial	honewort
<i>Cystopteris bulbifera</i>	Cystopteridaceae	CYSBUL	native	5	-3	fern	perennial	bulblet fern
<i>Danthonia spicata</i>	Poaceae	DANSPI	native	4	5	grass	perennial	poverty grass; oatgrass
<i>Desmodium paniculatum</i>	Fabaceae	DESPAN	native	4	3	forb	perennial	panicled tick-trefoil
<i>Dianthus armeria</i>	Caryophyllaceae	DIAARM	non-native	0	5	forb	annual	deptford pink
<i>Diarrhena obovata</i> ; <i>d. americana</i>	Poaceae	DIAOBO	native	9	-3	grass	perennial	beak grass
<i>Dichanthelium clandestinum</i> ; <i>panicum c.</i>	Poaceae	DICCLA	native	3	-3	grass	perennial	panic grass
<i>Dichanthelium columbianum</i> ; <i>panicum c.</i>	Poaceae	DICCOL	native	5	3	grass	perennial	panic grass
<i>Dichanthelium latifolium</i> ; <i>panicum l.</i>	Poaceae	DICLAT	native	5	3	grass	perennial	broad-leaved panic grass
<i>Dichanthelium linearifolium</i> ; <i>panicum l.</i>	Poaceae	DICLIE	native	4	5	grass	perennial	slender-leaved panic grass
<i>Diervilla lonicera</i>	Diervillaceae	DIELON	native	4	5	shrub	perennial	bush-honeysuckle
<i>Dioscorea villosa</i> ; <i>dioscorea villosa</i>	Dioscoreaceae	DIOVIL	native	4	0	forb	perennial	wild yam
<i>Doellingeria umbellata</i> ; <i>aster u.</i>	Asteraceae	DOEUMB	native	5	-3	forb	perennial	flat-topped white aster
<i>Dryopteris goldiana</i>	Dryopteridaceae	DRYGOL	native	10	0	fern	perennial	goldies woodfern
<i>Echinochloa muricata</i>	Poaceae	ECHMUR	native	1	-5	grass	annual	barnyard grass
<i>Elaeagnus umbellata</i>	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
<i>Elymus canadensis</i>	Poaceae	ELYSAN	native	5	3	grass	perennial	canada wild rye
<i>Elymus hystrix</i> ; <i>hystrix patula</i>	Poaceae	ELYHYS	native	5	3	grass	perennial	bottlebrush grass
<i>Elymus virginicus</i>	Poaceae	ELYVIR	native	4	-3	grass	perennial	virginia wild-rye
<i>Epifagus virginiana</i>	Orobanchaceae	EPIVIR	native	10	5	forb	annual	beech-drops
<i>Epilobium coloratum</i>	Onagraceae	EPICOL	native	3	-5	forb	perennial	cinnamon willow-herb
<i>Epipactis helleborine</i>	Orchidaceae	EPIHEL	non-native	0	0	forb	perennial	helleborine
<i>Equisetum arvense</i>	Equisetaceae	EQUARV	native	0	0	fern	perennial	common horsetail
<i>Equisetum hyemale</i>	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
<i>Erechtites hieraciifolius</i>	Asteraceae	EREHIE	native	2	3	forb	annual	fireweed
<i>Erigeron philadelphicus</i>	Asteraceae	ERIPHI	native	2	0	forb	perennial	philadelphia fleabane
<i>Erigeron strigosus</i>	Asteraceae	ERISTR	native	4	3	forb	perennial	daisy fleabane
<i>Eriophorum virginicum</i>	Cyperaceae	ERIVIG	native	8	-5	sedge	perennial	tawny cotton-grass
<i>Euonymus obovatus</i>	Celastraceae	EUOOBO	native	5	3	shrub	perennial	running strawberry-bush
<i>Eurybia furcata</i> ; <i>aster f.</i>	Asteraceae	EURFUR	native	10	5	forb	perennial	forked aster
<i>Eurybia macrophylla</i> ; <i>aster m.</i>	Asteraceae	EURMAC	native	4	5	forb	perennial	big-leaved aster
<i>Euthamia graminifolia</i>	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
<i>Eutrochium purpureum</i> ; <i>eupatorium p.</i>	Asteraceae	EUTPUR	native	5	0	forb	perennial	green-stemmed joe-pye-weed
<i>Fagus grandifolia</i>	Fagaceae	FAGGRA	native	6	3	tree	perennial	american beech
<i>Festuca subverticillata</i> ; <i>f. obtusa</i>	Poaceae	FESSUB	native	5	3	grass	perennial	nodding fescue

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Fragaria virginiana</i>	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
<i>Frangula alnus</i> ; <i>rhamnus frangula</i>	Rhamnaceae	FRAALN	non-native	0	0	shrub	perennial	glossy buckthorn
<i>Fraxinus americana</i>	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
<i>Fraxinus nigra</i>	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
<i>Fraxinus pennsylvanica</i>	Oleaceae	FRAPEN	native	2	-3	tree	perennial	red ash
<i>Galium boreale</i>	Rubiaceae	GALBOR	native	3	0	forb	perennial	northern bedstraw
<i>Galium circaezans</i>	Rubiaceae	GALCIR	native	4	3	forb	perennial	white wild licorice
<i>Galium obtusum</i>	Rubiaceae	GALOBT	native	5	-3	forb	perennial	wild madder
<i>Galium triflorum</i>	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
<i>Gaultheria procumbens</i>	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
<i>Gaylussacia baccata</i>	Ericaceae	GAYBAC	native	7	3	shrub	perennial	huckleberry
<i>Geranium maculatum</i>	Geraniaceae	GERMAC	native	4	3	forb	perennial	wild geranium
<i>Geum aleppicum</i>	Rosaceae	GEUALE	native	3	0	forb	perennial	yellow avens
<i>Geum canadense</i>	Rosaceae	GEUCAN	native	1	0	forb	perennial	white avens
<i>Glyceria striata</i>	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
<i>Goodyera pubescens</i>	Orchidaceae	GOOPUB	native	7	3	forb	perennial	downy rattlesnake plantain
<i>Hackelia virginiana</i>	Boraginaceae	HACVIR	native	1	3	forb	biennial	beggars lice
<i>Hamamelis virginiana</i>	Hamamelidaceae	HAMVIR	native	5	3	shrub	perennial	witch-hazel
<i>Helenium autumnale</i>	Asteraceae	HELAUT	native	5	-3	forb	perennial	sneezeweed
<i>Hieracium aurantiacum</i>	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
<i>Hieracium caespitosum</i>	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
<i>Hieracium scabrum</i>	Asteraceae	HIESCA	native	3	5	forb	perennial	rough hawkweed
<i>Hylodesmum glutinosum</i> ; <i>desmodium g.</i>	Fabaceae	HYLGLU	native	5	5	forb	perennial	clustered-leaved tick-trefoil
<i>Impatiens capensis</i>	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
<i>Iris virginica</i>	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
<i>Juncus canadensis</i>	Juncaceae	JUNCAN	native	6	-5	forb	perennial	canadian rush
<i>Juncus effusus</i>	Juncaceae	JUNEFF	native	3	-5	forb	perennial	soft-stemmed rush
<i>Juncus tenuis</i>	Juncaceae	JUNTEN	native	1	0	forb	perennial	path rush
<i>Laportea canadensis</i>	Urticaceae	LAPCAN	native	4	-3	forb	perennial	wood nettle
<i>Lathyrus venosus</i>	Fabaceae	LATVEN	native	8	0	vine	perennial	veiny pea
<i>Lechea intermedia</i>	Cistaceae	LECINT	native	6	5	forb	perennial	intermediate pinweed
<i>Leersia oryzoides</i>	Poaceae	LEEORY	native	3	-5	grass	perennial	cut grass
<i>Leersia virginica</i>	Poaceae	LEEVIR	native	5	-3	grass	perennial	white grass
<i>Leucanthemum vulgare</i> ; <i>chrysanthemum leucanthemum</i>	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy
<i>Ligustrum vulgare</i>	Oleaceae	LIGVUL	non-native	0	3	shrub	perennial	common privet
<i>Lilium michiganense</i>	Liliaceae	LILMIC	native	5	-3	forb	perennial	michigan lily
<i>Lithospermum latifolium</i>	Boraginaceae	LITLAT	native	10	5	forb	perennial	broad-leaved puccoon
<i>Lobelia cardinalis</i>	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower
<i>Lonicera morrowii</i>	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Lycopus americanus</i>	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
<i>Lycopus uniflorus</i>	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
<i>Lysimachia ciliata</i>	Myrsinaceae	LYSCIL	native	4	-3	forb	perennial	fringed loosestrife
<i>Lysimachia nummularia</i>	Myrsinaceae	LYSNUM	non-native	0	-3	forb	perennial	moneywort
<i>Lysimachia quadrifolia</i>	Myrsinaceae	LYSQUL	native	8	3	forb	perennial	four-leaved loosestrife
<i>Maianthemum canadense</i>	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
<i>Maianthemum racemosum</i> ; <i>smilacina</i> r.	Convallariaceae	MAIRAC	native	5	3	forb	perennial	false spikenard
<i>Maianthemum stellatum</i> ; <i>smilacina</i> s.	Convallariaceae	MAISTE	native	5	0	forb	perennial	starry false solomon-seal
<i>Malus pumila</i>	Rosaceae	MALPUM	non-native	0	5	tree	perennial	apple
<i>Matteuccia struthiopteris</i>	Onocleaceae	MATSTR	native	3	0	fern	perennial	ostrich fern
<i>Medicago lupulina</i>	Fabaceae	MEDLUP	non-native	0	3	forb	annual	black medick
<i>Medicago sativa</i>	Fabaceae	MEDSAT	non-native	0	5	forb	perennial	alfalfa
<i>Menispermum canadense</i>	Menispermaceae	MENCAE	native	5	0	vine	perennial	moonseed
<i>Mimulus ringens</i>	Phrymaceae	MIMRIN	native	5	-5	forb	perennial	monkey-flower
<i>Mitchella repens</i>	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
<i>Mitella diphylla</i>	Saxifragaceae	MITDIP	native	8	3	forb	perennial	bishops-cap
<i>Monarda fistulosa</i>	Lamiaceae	MONFIS	native	2	3	forb	perennial	wild-bergamot
<i>Monotropa uniflora</i>	Ericaceae	MONOUN	native	5	3	forb	perennial	indian-pipe
<i>Muhlenbergia mexicana</i>	Poaceae	MUHMEX	native	3	-3	grass	perennial	leafy satin grass
<i>Nepeta cataria</i>	Lamiaceae	NEPCAT	non-native	0	3	forb	perennial	catnip
<i>Oenothera perennis</i>	Onagraceae	OENPER	native	5	0	forb	perennial	small sundrops
<i>Onoclea sensibilis</i>	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
<i>Oryzopsis asperifolia</i>	Poaceae	ORYASP	native	6	5	grass	perennial	rough-leaved rice-grass
<i>Osmorhiza claytonii</i>	Apiaceae	OSMCLI	native	4	3	forb	perennial	hairy sweet-cicely
<i>Osmunda cinnamomea</i>	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
<i>Osmunda regalis</i>	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
<i>Ostrya virginiana</i>	Betulaceae	OSTVIR	native	5	3	tree	perennial	ironwood; hop-hornbeam
<i>Oxalis stricta</i> ; <i>o. fontana</i>	Oxalidaceae	OXASTR	native	0	3	forb	perennial	yellow wood-sorrel
<i>Packera aurea</i> ; <i>senecio</i> a.	Asteraceae	PACAUUR	native	5	-3	forb	perennial	golden ragwort
<i>Panicum virgatum</i>	Poaceae	PANVIR	native	4	0	grass	perennial	switch grass
<i>Parthenocissus quinquefolia</i>	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
<i>Penstemon hirsutus</i>	Plantaginaceae	PENHIR	native	5	5	forb	perennial	hairy beard-tongue
<i>Persicaria virginiana</i> ; <i>polygonum</i> v.	Polygonaceae	PERVIR	native	4	0	forb	perennial	jumpseed
<i>Phalaris arundinacea</i>	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
<i>Phleum pratense</i>	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
<i>Phlox divaricata</i>	Polemoniaceae	PHLDIV	native	5	3	forb	perennial	wild blue phlox
<i>Phryma leptostachya</i>	Phrymaceae	PHRLEP	native	4	3	forb	perennial	lopseed
<i>Physocarpus opulifolius</i>	Rosaceae	PHYOPU	native	4	-3	shrub	perennial	ninebark
<i>Pilea pumila</i>	Urticaceae	PILPUM	native	5	-3	forb	annual	clearweed

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Pinus resinosa</i>	Pinaceae	PINRES	native	6	3	tree	perennial	red pine
<i>Pinus strobus</i>	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
<i>Plantago lanceolata</i>	Plantaginaceae	PLALAN	non-native	0	3	forb	perennial	english plantain
<i>Plantago rugelii</i>	Plantaginaceae	PLARUG	native	0	0	forb	perennial	red-stalked plantain
<i>Poa compressa</i>	Poaceae	POACOM	non-native	0	3	grass	perennial	canada bluegrass
<i>Poa pratensis</i>	Poaceae	POAPRA	non-native	0	3	grass	perennial	kentucky bluegrass
<i>Podophyllum peltatum</i>	Berberidaceae	PODPEL	native	3	3	forb	perennial	may-apple
<i>Polygonatum biflorum</i>	Convallariaceae	POLBIF	native	4	3	forb	perennial	solomon-seal
<i>Populus deltoides</i>	Salicaceae	POPDEL	native	1	0	tree	perennial	cottonwood
<i>Populus grandidentata</i>	Salicaceae	POPGRA	native	4	3	tree	perennial	big-tooth aspen
<i>Populus tremuloides</i>	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
<i>Potentilla recta</i>	Rosaceae	POTREC	non-native	0	5	forb	perennial	rough-fruited cinquefoil
<i>Potentilla simplex</i>	Rosaceae	POTSIM	native	2	3	forb	perennial	old-field cinquefoil
<i>Prenanthes alba</i>	Asteraceae	PREALB	native	5	3	forb	perennial	white lettuce
<i>Proserpinaca palustris</i>	Haloragaceae	PROPAL	native	6	-5	forb	perennial	mermaid-weed
<i>Prunella vulgaris</i>	Lamiaceae	PRUVUL	native	0	0	forb	perennial	self-heal
<i>Prunus serotina</i>	Rosaceae	PRUSER	native	2	3	tree	perennial	wild black cherry
<i>Pseudognaphalium obtusifolium</i> ; <i>gnaphalium</i> o.	Asteraceae	PSEOBT	native	2	5	forb	biennial	old-field balsam
<i>Pteridium aquilinum</i>	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
<i>Pyrola elliptica</i>	Ericaceae	PYRELL	native	6	3	forb	perennial	large-leaved shinleaf
<i>Quercus alba</i>	Fagaceae	QUEALB	native	5	3	tree	perennial	white oak
<i>Quercus bicolor</i>	Fagaceae	QUEBIC	native	8	-3	tree	perennial	swamp white oak
<i>Quercus ellipsoidalis</i> ; <i>q. coccinea</i>	Fagaceae	QUEELL	native	4	5	tree	perennial	hills oak
<i>Quercus macrocarpa</i>	Fagaceae	QUEMAC	native	5	3	tree	perennial	bur oak
<i>Quercus rubra</i>	Fagaceae	QUERUB	native	5	3	tree	perennial	red oak
<i>Quercus velutina</i>	Fagaceae	QUEVEL	native	6	5	tree	perennial	black oak
<i>Ranunculus abortivus</i>	Ranunculaceae	RANABO	native	0	0	forb	perennial	small-flowered buttercup
<i>Ranunculus hispidus</i>	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
<i>Ranunculus recurvatus</i>	Ranunculaceae	RANREC	native	5	-3	forb	perennial	hooked crowfoot
<i>Rhamnus cathartica</i>	Rhamnaceae	RHACAT	non-native	0	0	tree	perennial	common buckthorn
<i>Ribes americanum</i>	Grossulariaceae	RIBAME	native	6	-3	shrub	perennial	wild black currant
<i>Ribes cynosbati</i>	Grossulariaceae	RIBCYN	native	4	3	shrub	perennial	prickly or wild gooseberry
<i>Rubus allegheniensis</i>	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
<i>Rubus hispidus</i>	Rosaceae	RUBHIS	native	4	-3	shrub	perennial	swamp dewberry
<i>Rudbeckia hirta</i>	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
<i>Rumex acetosella</i>	Polygonaceae	RUMACL	non-native	0	3	forb	perennial	sheep sorrel
<i>Sanguinaria canadensis</i>	Papaveraceae	SANCAA	native	5	3	forb	perennial	bloodroot
<i>Sanicula odorata</i> ; <i>s. gregaria</i>	Apiaceae	SANODO	native	2	0	forb	perennial	black snakeroot
<i>Scirpus atrovirens</i>	Cyperaceae	SCIATV	native	3	-5	sedge	perennial	bulrush

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Scirpus pendulus</i>	Cyperaceae	SCIPEN	native	3	-5	sedge	perennial	bulrush
<i>Scrophularia lanceolata</i>	Scrophulariaceae	SCRLAN	native	5	3	forb	perennial	early figwort
<i>Scutellaria lateriflora</i>	Lamiaceae	SCULAT	native	5	-5	forb	perennial	mad-dog skullcap
<i>Securigera varia</i> ; coronilla v.	Fabaceae	SECVAR	non-native	0	5	forb	perennial	crown-vetch
<i>Silene latifolia</i> ; s. pratensis	Caryophyllaceae	SILLAT	non-native	0	5	forb	annual	white campion
<i>Sisyrinchium angustifolium</i>	Iridaceae	SISANG	native	4	0	forb	perennial	stout blue-eyed-grass
<i>Smilax hispida</i> ; s. tamnoides	Smilacaceae	SMIHIS	native	5	0	vine	perennial	bristly greenbrier
<i>Solidago altissima</i>	Asteraceae	SOLALT	native	1	3	forb	perennial	tall goldenrod
<i>Solidago caesia</i>	Asteraceae	SOLCAE	native	6	3	forb	perennial	bluestem goldenrod
<i>Solidago flexicaulis</i>	Asteraceae	SOLFLE	native	6	3	forb	perennial	zigzag goldenrod
<i>Solidago gigantea</i>	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
<i>Solidago hispida</i>	Asteraceae	SOLHIS	native	3	5	forb	perennial	hairy goldenrod
<i>Solidago juncea</i>	Asteraceae	SOLJUN	native	3	5	forb	perennial	early goldenrod
<i>Solidago rugosa</i>	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
<i>Spiraea tomentosa</i>	Rosaceae	SPITOM	native	5	-3	shrub	perennial	steeplebush
<i>Spiranthes ochroleuca</i> ; s. cernua	Orchidaceae	SPIOCH	native	8	3	forb	perennial	yellow ladies-tresses
<i>Staphylea trifolia</i>	Staphyleaceae	STATRI	native	9	0	shrub	perennial	bladdernut
<i>Symphyotrichum cordifolium</i> ; aster c.	Asteraceae	SYMCOR	native	4	5	forb	perennial	heart-leaved aster
<i>Symphyotrichum laeve</i> ; aster l.	Asteraceae	SYMLAE	native	5	3	forb	perennial	smooth aster
<i>Symphyotrichum lateriflorum</i> ; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
<i>Symphyotrichum novae-angliae</i> ; aster n.	Asteraceae	SYMNOV	native	3	-3	forb	perennial	new england aster
<i>Symphyotrichum ontarionis</i> ; aster o.	Asteraceae	SYMONT	native	6	0	forb	perennial	lake ontario aster
<i>Taraxacum officinale</i>	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
<i>Teucrium canadense</i>	Lamiaceae	TEUCAN	native	4	-3	forb	perennial	wood-sage
<i>Thalictrum dasycarpum</i>	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
<i>Thelypteris noveboracensis</i>	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
<i>Thelypteris palustris</i>	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
<i>Thuja occidentalis</i>	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
<i>Tilia americana</i>	Malvaceae	TILAME	native	5	3	tree	perennial	basswood
<i>Torilis japonica</i>	Apiaceae	TORJAP	non-native	0	3	forb	annual	hedge-parsley
<i>Toxicodendron radicans</i>	Anacardiaceae	TOXRAD	native	2	0	vine	perennial	poison-ivy
<i>Tragopogon pratensis</i>	Asteraceae	TRAPRA	non-native	0	5	forb	biennial	common goats beard
<i>Trientalis borealis</i>	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
<i>Trifolium hybridum</i>	Fabaceae	TRIHYP	non-native	0	3	forb	perennial	alsike clover
<i>Trifolium pratense</i>	Fabaceae	TRIPRA	non-native	0	3	forb	perennial	red clover
<i>Trillium grandiflorum</i>	Trilliaceae	TRIGRA	native	5	3	forb	perennial	common trillium
<i>Tsuga canadensis</i>	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
<i>Typha latifolia</i>	Typhaceae	TYPLAT	native	1	-5	forb	perennial	broad-leaved cat-tail
<i>Ulmus americana</i>	Ulmaceae	ULMAME	native	1	-3	tree	perennial	american elm

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Ulmus rubra	Ulmaceae	ULMRUB	native	2	0	tree	perennial	slippery elm
Urtica dioica	Urticaceae	URTDIO	native	1	0	forb	perennial	stinging nettle
Uvularia grandiflora	Convallariaceae	UVUGRA	native	5	5	forb	perennial	bellwort
Vaccinium angustifolium	Ericaceae	VACANG	native	4	3	shrub	perennial	low sweet blueberry
Verbena urticifolia	Verbenaceae	VERURT	native	4	0	forb	perennial	white vervain
Veronicastrum virginicum	Plantaginaceae	VERVIR	native	8	0	forb	perennial	culvers-root
Viburnum opulus	Adoxaceae	VIBOPU	non-native	0	-3	shrub	perennial	european highbush-cranberry
Vicia villosa	Fabaceae	VICVIL	non-native	0	5	vine	annual	hairy vetch
Viola renifolia	Violaceae	VIOREN	native	6	-3	forb	perennial	kidney-leaved violet
Viola sororia	Violaceae	VIOSOR	native	1	0	forb	perennial	common blue violet
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape
Woodwardia virginica	Blechnaceae	WOOVIR	native	10	-5	fern	perennial	virginia chain-fern
Zanthoxylum americanum	Rutaceae	ZANAME	native	3	3	shrub	perennial	prickly-ash
Zizia aurea	Apiaceae	ZIZAUR	native	6	0	forb	perennial	golden alexanders

**Appendix D:
Floristic Quality Assessment – Summary of all sites**

Little Forks Conservancy Preserves

06/25/2014

Little Forks Conserv

Midland

MI

USA

FQA DB Region:

Michigan

FQA DB Publication Year:

2014

Reznicek, A.A., M.R. Penskar, B.S. Walters, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database. Herbarium, University of Michigan, Ann Arbor, MI and Michigan Natural Features Inventory, Michigan State University, Lansing, MI. <http://michiganflora.net>

FQA DB Description:

Practitioner:

Brad Slaughter, John Paskus

Latitude:

43.6575

Longitude:

-84.3396

Weather Notes:

Duration Notes:

Community Type Notes:

Primarily floodplain forest, with significant areas of dry-mesic northern forest, mesic northern forest, southern hardwood swamp, and smaller areas of bog, old field, and other communities.

Averill Preserve, Forestview Natural Area, Riverview Natural Area. Additional surveys: 26-27 June (Slaughter, Paskus), 11-12 August (Slaughter), 8 September (Slaughter).

Also noted (Averill): *Persicaria* sp., *Epilobium* sp., *Prenanthes* sp., *Crataegus* sp.

Also noted (Forestview): *Persicaria* sp., *Euphorbia* sp., *Ranunculus* sp. (aquatic), *Hieracium* sp., *Crataegus* sp., *Bidens* sp.

Other Notes:

Also noted (Riverview): *Crataegus* sp., *Platanthera* sp.

Private/Public:

Public

Conservatism-Based Metrics:

Total Mean C:

3.6

Native Mean C:

4.4

Total FQI:

74.7

Native FQI:

83.3

Adjusted FQI:

40.1

% C value 0:

19.3

% C value 1-3:

24.6

% C value 4-6:	45.7	
% C value 7-10:	10.4	
Native Tree Mean C:	4.2	
Native Shrub Mean C:	4.3	
Native Herbaceous Mean C:	4.4	
Species Richness:		
Total Species:	431	
Native Species:	358	83.10%
Non-native Species:	73	16.90%
Species Wetness:		
Mean Wetness:	0.5	
Native Mean Wetness:	0	
Physiognomy Metrics:		
Tree:	44	10.20%
Shrub:	42	9.70%
Vine:	16	3.70%
Forb:	230	53.40%
Grass:	38	8.80%
Sedge:	46	10.70%
Rush:	0	0%
Fern:	15	3.50%
Bryophyte:	0	0%
Duration Metrics:		
Annual:	19	4.40%
Perennial:	391	90.70%
Biennial:	21	4.90%
Native Annual:	12	2.80%
Native Perennial:	336	78%
Native Biennial:	10	2.30%

Species:

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Acer negundo	Sapindaceae	ACENEG	native	0	0	tree	perennial	box-elder
Acer nigrum; a. saccharum	Sapindaceae	ACENIG	native	4	3	tree	perennial	black maple
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Acer saccharinum	Sapindaceae	ACESAI	native	2	-3	tree	perennial	silver maple
Acer saccharum	Sapindaceae	ACESAU	native	5	3	tree	perennial	sugar maple
Achillea millefolium	Asteraceae	ACHMIL	native	1	3	forb	perennial	yarrow

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Acorus calamus</i>	Acoraceae	ACOCAL	non-native	0	-5	forb	perennial	calamus
<i>Adiantum pedatum</i>	Pteridaceae	ADIPED	native	6	3	fern	perennial	maidenhair fern
<i>Agalinis tenuifolia</i>	Orobanchaceae	AGATEN	native	5	-3	forb	annual	common false foxglove
<i>Ageratina altissima</i> ; <i>eupatorium rugosum</i>	Asteraceae	AGEALT	native	4	3	forb	perennial	white snakeroot
<i>Agrimonia gryposepala</i>	Rosaceae	AGRGRY	native	2	3	forb	perennial	tall agrimony
<i>Agrostis gigantea</i>	Poaceae	AGRIGIG	non-native	0	-3	grass	perennial	redtop
<i>Agrostis perennans</i>	Poaceae	AGRPER	native	5	3	grass	perennial	autumn bent
<i>Alisma triviale</i> ; <i>a. plantago-aquatica</i>	Alismataceae	ALITRI	native	1	-5	forb	perennial	northern water-plantain
<i>Allium canadense</i>	Alliaceae	ALLCAN	native	4	3	forb	perennial	wild garlic
<i>Alnus incana</i> ; <i>a. rugosa</i>	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
<i>Ambrosia artemisiifolia</i>	Asteraceae	AMBART	native	0	3	forb	annual	common ragweed
<i>Amelanchier arborea</i>	Rosaceae	AMEARB	native	4	3	tree	perennial	juneberry
<i>Amelanchier interior</i>	Rosaceae	AMEINT	native	4	5	shrub	perennial	serviceberry
<i>Amphicarpaea bracteata</i>	Fabaceae	AMPBRA	native	5	0	vine	annual	hog-peanut
<i>Andropogon gerardii</i>	Poaceae	ANDGER	native	5	0	grass	perennial	big bluestem
<i>Anemone canadensis</i>	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
<i>Anemone quinquefolia</i>	Ranunculaceae	ANEQUI	native	5	3	forb	perennial	wood anemone
<i>Anemone virginiana</i>	Ranunculaceae	ANEVIR	native	3	3	forb	perennial	thimbleweed
<i>Antennaria howellii</i>	Asteraceae	ANTHOW	native	2	5	forb	perennial	small pussytoes
<i>Antennaria parlinii</i>	Asteraceae	ANTPAL	native	2	5	forb	perennial	smooth pussytoes
<i>Apios americana</i>	Fabaceae	APIAME	native	3	-3	vine	perennial	groundnut
<i>Apocynum androsaemifolium</i>	Apocynaceae	APOAND	native	3	5	forb	perennial	spreading dogbane
<i>Apocynum cannabinum</i> ; <i>a. sibiricum</i>	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
<i>Aquilegia canadensis</i>	Ranunculaceae	AQUCAN	native	5	3	forb	perennial	wild columbine
<i>Arctium minus</i>	Asteraceae	ARCMIN	non-native	0	3	forb	biennial	common burdock
<i>Arisaema dracontium</i>	Araceae	ARIDRA	native	8	-3	forb	perennial	green dragon
<i>Arisaema triphyllum</i>	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
<i>Aronia prunifolia</i>	Rosaceae	AROPRU	native	5	-3	shrub	perennial	chokeberry
<i>Asarum canadense</i>	Aristolochiaceae	ASACAN	native	5	5	forb	perennial	wild-ginger
<i>Asclepias incarnata</i>	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
<i>Asclepias syriaca</i>	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
<i>Asclepias tuberosa</i>	Apocynaceae	ASCTUB	native	5	5	forb	perennial	butterfly-weed
<i>Asparagus officinalis</i>	Asparagaceae	ASPOFF	non-native	0	3	forb	perennial	garden asparagus
<i>Athyrium filix-femina</i>	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
<i>Barbarea vulgaris</i>	Brassicaceae	BARVUL	non-native	0	0	forb	biennial	yellow rocket
<i>Berberis thunbergii</i>	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
<i>Betula alleghaniensis</i>	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
<i>Betula papyrifera</i>	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
<i>Bidens cernua</i>	Asteraceae	BIDCER	native	3	-5	forb	annual	nodding beggar-ticks
<i>Bidens connata</i>	Asteraceae	BIDCON	native	5	-3	forb	annual	purple-stemmed tickseed
<i>Bidens frondosa</i>	Asteraceae	BIDFRO	native	1	-3	forb	annual	common beggar-ticks

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Boechera laevigata</i> ; <i>arabis l.</i>	Brassicaceae	BOELAE	native	5	5	forb	biennial	smooth bank cress
<i>Brachyelytrum aristosum</i> ; <i>b. erectum</i>	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
<i>Bromus inermis</i>	Poaceae	BROINE	non-native	0	5	grass	perennial	smooth brome
<i>Bromus latiglumis</i>	Poaceae	BROLAT	native	6	-3	grass	perennial	ear-leaved brome
<i>Calamagrostis canadensis</i>	Poaceae	CALCAN	native	3	-5	grass	perennial	blue-joint
<i>Caltha palustris</i>	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
<i>Calystegia sepium</i>	Convolvulaceae	CALSEP	native	2	0	vine	perennial	hedge bindweed
<i>Campanula rotundifolia</i>	Campanulaceae	CAMROT	native	6	3	forb	perennial	harebell
<i>Capnoides sempervirens</i> ; <i>corydalis s.</i>	Papaveraceae	CAPSEM	native	5	5	forb	biennial	pink or pale corydalis
<i>Carex arctata</i>	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
<i>Carex atlantica</i> ; <i>c. howei</i>	Cyperaceae	CXATLA	native	7	-3	sedge	perennial	sedge
<i>Carex bromoides</i>	Cyperaceae	CXBROM	native	6	-3	sedge	perennial	sedge
<i>Carex brunnescens</i>	Cyperaceae	CXBRUN	native	5	-3	sedge	perennial	sedge
<i>Carex buxbaumii</i>	Cyperaceae	CXBUXB	native	10	-5	sedge	perennial	sedge
<i>Carex canescens</i>	Cyperaceae	CXCANE	native	8	-5	sedge	perennial	sedge
<i>Carex cephaloidea</i>	Cyperaceae	CXCEPD	native	5	3	sedge	perennial	sedge
<i>Carex communis</i>	Cyperaceae	CXCOMM	native	2	5	sedge	perennial	sedge
<i>Carex comosa</i>	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge
<i>Carex crinita</i>	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
<i>Carex cristatella</i>	Cyperaceae	CXCRIS	native	3	-3	sedge	perennial	sedge
<i>Carex echinodes</i> ; <i>c. tenera</i>	Cyperaceae	CXECHO	native	5	-3	sedge	perennial	sedge
<i>Carex folliculata</i>	Cyperaceae	CXFOLL	native	10	-5	sedge	perennial	sedge
<i>Carex formosa</i>	Cyperaceae	CXFORM	native	10	0	sedge	perennial	sedge
<i>Carex gracillima</i>	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
<i>Carex granularis</i>	Cyperaceae	CXGRAN	native	2	-3	sedge	perennial	sedge
<i>Carex grayi</i>	Cyperaceae	CXGRAY	native	6	-3	sedge	perennial	sedge
<i>Carex grisea</i> ; <i>c. amphibola</i>	Cyperaceae	CXGRIS	native	3	0	sedge	perennial	sedge
<i>Carex hirtifolia</i>	Cyperaceae	CXHIRI	native	5	3	sedge	perennial	sedge
<i>Carex hitchcockiana</i>	Cyperaceae	CXHITC	native	5	5	sedge	perennial	sedge
<i>Carex hystericina</i>	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
<i>Carex intumescens</i>	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
<i>Carex lacustris</i>	Cyperaceae	CXLACU	native	6	-5	sedge	perennial	sedge
<i>Carex lupulina</i>	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
<i>Carex muskingumensis</i>	Cyperaceae	CXMUSK	native	6	-5	sedge	perennial	sedge
<i>Carex oligosperma</i>	Cyperaceae	CXOLIS	native	10	-5	sedge	perennial	sedge
<i>Carex pedunculata</i>	Cyperaceae	CXPEDU	native	5	3	sedge	perennial	sedge
<i>Carex pensylvanica</i>	Cyperaceae	CXPENS	native	4	5	sedge	perennial	sedge
<i>Carex prasina</i>	Cyperaceae	CXPRAS	native	10	-5	sedge	perennial	sedge
<i>Carex radiata</i> ; <i>c. rosea</i>	Cyperaceae	CXRADI	native	2	0	sedge	perennial	straight-styled wood sedge
<i>Carex retrorsa</i>	Cyperaceae	CXRETS	native	3	-5	sedge	perennial	sedge
<i>Carex rosea</i> ; <i>c. convoluta</i>	Cyperaceae	CXROSE	native	2	5	sedge	perennial	curly-styled wood sedge

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Carex scabrata	Cyperaceae	CXSCAB	native	4	-5	sedge	perennial	sedge
Carex sparganioides	Cyperaceae	CXSPAR	native	5	3	sedge	perennial	sedge
Carex stipata	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex swanii	Cyperaceae	CXSWAN	native	4	3	sedge	perennial	sedge
Carex tribuloides	Cyperaceae	CXTRIB	native	3	-3	sedge	perennial	sedge
Carex tuckermanii	Cyperaceae	CXTUCK	native	8	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Carex woodii	Cyperaceae	CXWOOD	native	8	3	sedge	perennial	sedge
Carpinus caroliniana	Betulaceae	CARCAO	native	6	0	tree	perennial	blue-beech
Carya cordiformis	Juglandaceae	CARCOR	native	5	0	tree	perennial	bitternut hickory
Carya ovata	Juglandaceae	CAROVA	native	5	3	tree	perennial	shagbark hickory
Celastrus scandens	Celastraceae	CELSCA	native	3	3	vine	perennial	american bittersweet
Celtis occidentalis	Cannabaceae	CELOCC	native	5	0	tree	perennial	hackberry
Centaurea stoebe; c. maculosa	Asteraceae	CENSTO	non-native	0	5	forb	biennial	spotted knapweed
Cephalanthus occidentalis	Rubiaceae	CEPOCC	native	7	-5	shrub	perennial	buttonbush
Cerastium arvense	Caryophyllaceae	CERARV	native	6	3	forb	perennial	field chickweed
Cerastium fontanum	Caryophyllaceae	CERFON	non-native	0	3	forb	perennial	mouse-ear chickweed
Chamaedaphne calyculata	Ericaceae	CHACAL	native	8	-5	shrub	perennial	leatherleaf
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Chenopodium album	Amaranthaceae	CHEALB	non-native	0	3	forb	annual	lamb-quarters
Cicuta maculata	Apiaceae	CICMAC	native	4	-5	forb	biennial	water hemlock
Cinna arundinacea	Poaceae	CINARU	native	7	-3	grass	perennial	wood reedgrass
Circaea alpina	Onagraceae	CIRALP	native	4	-3	forb	perennial	small enchanters-nightshade
Circaea canadensis; c. lutetiana	Onagraceae	CIRCAN	native	2	3	forb	perennial	enchanters-nightshade
Cirsium arvense	Asteraceae	CIRARV	non-native	0	3	forb	perennial	canada thistle
Cirsium discolor	Asteraceae	CIRDIS	native	4	5	forb	biennial	pasture thistle
Cirsium vulgare	Asteraceae	CIRVUL	non-native	0	3	forb	biennial	bull thistle
Clematis virginiana	Ranunculaceae	CLEVIR	native	4	0	vine	perennial	virgins bower
Comandra umbellata	Santalaceae	COMUMB	native	5	3	forb	perennial	bastard-toadflax
Comptonia peregrina	Myricaceae	COMPER	native	6	5	shrub	perennial	sweetfern
Convallaria majalis	Convallariaceae	CONMAJ	non-native	0	5	forb	perennial	lily-of-the-valley
Coptis trifolia	Ranunculaceae	COPTRI	native	5	-3	forb	perennial	goldthread
Cornus alternifolia	Cornaceae	CORALT	native	5	3	tree	perennial	alternate-leaved dogwood
Cornus canadensis	Cornaceae	CORCAA	native	6	0	shrub	perennial	bunchberry
Cornus foemina	Cornaceae	CORFOE	native	1	0	shrub	perennial	gray dogwood
Cornus sericea; c. stolonifera	Cornaceae	CORSER	native	2	-3	shrub	perennial	red-osier
Corylus americana	Betulaceae	CORAMA	native	5	3	shrub	perennial	hazelnut
Crataegus mollis	Rosaceae	CRAMOL	native	2	0	tree	perennial	hawthorn
Cryptotaenia canadensis	Apiaceae	CRYCAN	native	2	0	forb	perennial	honestwort
Cystopteris bulbifera	Cystopteridaceae	CYSBUL	native	5	-3	fern	perennial	bulblet fern

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Dactylis glomerata</i>	Poaceae	DACGLO	non-native	0	3	grass	perennial	orchard grass
<i>Danthonia spicata</i>	Poaceae	DANSPI	native	4	5	grass	perennial	poverty grass; oatgrass
<i>Daucus carota</i>	Apiaceae	DAUCAR	non-native	0	5	forb	biennial	queen-annes-lace
<i>Desmodium canadense</i>	Fabaceae	DESCAD	native	3	0	forb	perennial	showy tick-trefoil
<i>Desmodium paniculatum</i>	Fabaceae	DESPAN	native	4	3	forb	perennial	panicked tick-trefoil
<i>Dianthus armeria</i>	Caryophyllaceae	DIAARM	non-native	0	5	forb	annual	deptford pink
<i>Diarrhena obovata</i> ; <i>d. americana</i>	Poaceae	DIAOBO	native	9	-3	grass	perennial	beak grass
<i>Dichanthelium clandestinum</i> ; <i>panicum c.</i>	Poaceae	DICCLA	native	3	-3	grass	perennial	panic grass
<i>Dichanthelium columbianum</i> ; <i>panicum c.</i>	Poaceae	DICCOL	native	5	3	grass	perennial	panic grass
<i>Dichanthelium latifolium</i> ; <i>panicum l.</i>	Poaceae	DICLAT	native	5	3	grass	perennial	broad-leaved panic grass
<i>Dichanthelium linearifolium</i> ; <i>panicum l.</i>	Poaceae	DICLIE	native	4	5	grass	perennial	slender-leaved panic grass
<i>Diervilla lonicera</i>	Diervillaceae	DIELON	native	4	5	shrub	perennial	bush-honeysuckle
<i>Dioscorea villosa</i> ; <i>dioscorea villosa</i>	Dioscoreaceae	DIOVIL	native	4	0	forb	perennial	wild yam
<i>Doellingeria umbellata</i> ; <i>aster u.</i>	Asteraceae	DOEUMB	native	5	-3	forb	perennial	flat-topped white aster
<i>Dryopteris goldiana</i>	Dryopteridaceae	DRYGOL	native	10	0	fern	perennial	goldies woodfern
<i>Echinochloa muricata</i>	Poaceae	ECHMUR	native	1	-5	grass	annual	barnyard grass
<i>Elaeagnus umbellata</i>	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
<i>Elymus canadensis</i>	Poaceae	ELYCAN	native	5	3	grass	perennial	canada wild rye
<i>Elymus hystrix</i> ; <i>hystrix patula</i>	Poaceae	ELYHYS	native	5	3	grass	perennial	bottlebrush grass
<i>Elymus repens</i> ; <i>agropyron r.</i>	Poaceae	ELYREP	non-native	0	3	grass	perennial	quack grass
<i>Elymus riparius</i>	Poaceae	ELYRIP	native	8	-3	grass	perennial	riverbank wild-rye
<i>Elymus virginicus</i>	Poaceae	ELYVIR	native	4	-3	grass	perennial	virginia wild-rye
<i>Epifagus virginiana</i>	Orobanchaceae	EPIVIR	native	10	5	forb	annual	beech-drops
<i>Epilobium coloratum</i>	Onagraceae	EPICOL	native	3	-5	forb	perennial	cinnamon willow-herb
<i>Epipactis helleborine</i>	Orchidaceae	EPIHEL	non-native	0	0	forb	perennial	helleborine
<i>Equisetum arvense</i>	Equisetaceae	EQUARV	native	0	0	fern	perennial	common horsetail
<i>Equisetum hyemale</i>	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
<i>Eragrostis spectabilis</i>	Poaceae	ERASPE	native	3	5	grass	perennial	purple love grass
<i>Erechtites hieraciifolius</i>	Asteraceae	EREHIE	native	2	3	forb	annual	fireweed
<i>Erigeron annuus</i>	Asteraceae	ERIANN	native	0	3	forb	biennial	daisy fleabane
<i>Erigeron philadelphicus</i>	Asteraceae	ERIPHI	native	2	0	forb	perennial	philadelphia fleabane
<i>Erigeron strigosus</i>	Asteraceae	ERISTR	native	4	3	forb	perennial	daisy fleabane
<i>Eriophorum virginicum</i>	Cyperaceae	ERIVIG	native	8	-5	sedge	perennial	tawny cotton-grass
<i>Euonymus obovatus</i>	Celastraceae	EUOOBO	native	5	3	shrub	perennial	running strawberry-bush
<i>Eupatorium perfoliatum</i>	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
<i>Eurybia furcata</i> ; <i>aster f.</i>	Asteraceae	EURFUR	native	10	5	forb	perennial	forked aster
<i>Eurybia macrophylla</i> ; <i>aster m.</i>	Asteraceae	EURMAC	native	4	5	forb	perennial	big-leaved aster
<i>Euthamia graminifolia</i>	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
<i>Eutrochium maculatum</i> ; <i>eupatorium m.</i>	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
<i>Eutrochium purpureum</i> ; <i>eupatorium p.</i>	Asteraceae	EUTPUR	native	5	0	forb	perennial	green-stemmed joe-pye-weed
<i>Fagus grandifolia</i>	Fagaceae	FAGGRA	native	6	3	tree	perennial	american beech

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Festuca subverticillata</i> ; f. obtusa	Poaceae	FESSUB	native	5	3	grass	perennial	nodding fescue
<i>Fragaria virginiana</i>	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
<i>Frangula alnus</i> ; <i>rhamnus frangula</i>	Rhamnaceae	FRAALN	non-native	0	0	shrub	perennial	glossy buckthorn
<i>Fraxinus americana</i>	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
<i>Fraxinus nigra</i>	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
<i>Fraxinus pennsylvanica</i>	Oleaceae	FRAPEN	native	2	-3	tree	perennial	red ash
<i>Gaillardia pulchella</i>	Asteraceae	GAIPUL	non-native	0	5	forb	annual	blanket-flower
<i>Galium album</i> ; g. mollugo	Rubiaceae	GALALB	non-native	0	5	forb	perennial	white bedstraw
<i>Galium asprellum</i>	Rubiaceae	GALASP	native	5	-5	vine	perennial	rough bedstraw
<i>Galium boreale</i>	Rubiaceae	GALBOR	native	3	0	forb	perennial	northern bedstraw
<i>Galium circaezans</i>	Rubiaceae	GALCIR	native	4	3	forb	perennial	white wild licorice
<i>Galium obtusum</i>	Rubiaceae	GALOBT	native	5	-3	forb	perennial	wild madder
<i>Galium palustre</i>	Rubiaceae	GALPAL	native	3	-5	forb	perennial	marsh bedstraw
<i>Galium triflorum</i>	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
<i>Gaultheria procumbens</i>	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
<i>Gaylussacia baccata</i>	Ericaceae	GAYBAC	native	7	3	shrub	perennial	huckleberry
<i>Geranium maculatum</i>	Geraniaceae	GERMAC	native	4	3	forb	perennial	wild geranium
<i>Geum aleppicum</i>	Rosaceae	GEUALE	native	3	0	forb	perennial	yellow avens
<i>Geum canadense</i>	Rosaceae	GEUCAN	native	1	0	forb	perennial	white avens
<i>Geum laciniatum</i>	Rosaceae	GEULAC	native	2	-3	forb	perennial	rough avens
<i>Glyceria grandis</i>	Poaceae	GLYGRA	native	6	-5	grass	perennial	reed manna grass
<i>Glyceria striata</i>	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
<i>Goodyera pubescens</i>	Orchidaceae	GOOPUB	native	7	3	forb	perennial	downy rattlesnake plantain
<i>Hackelia virginiana</i>	Boraginaceae	HACVIR	native	1	3	forb	biennial	beggars lice
<i>Hamamelis virginiana</i>	Hamamelidaceae	HAMVIR	native	5	3	shrub	perennial	witch-hazel
<i>Helenium autumnale</i>	Asteraceae	HELAUT	native	5	-3	forb	perennial	sneezeweed
<i>Helianthus decapetalus</i>	Asteraceae	HELDEC	native	5	3	forb	perennial	pale sunflower
<i>Helianthus giganteus</i>	Asteraceae	HELGIG	native	5	-3	forb	perennial	tall sunflower
<i>Helianthus tuberosus</i>	Asteraceae	HELTUB	native	6	0	forb	perennial	jerusalem-artichoke
<i>Hepatica americana</i>	Ranunculaceae	HEPAME	native	6	5	forb	perennial	round-lobed hepatica
<i>Heraclium maximum</i>	Apiaceae	HERMAX	native	3	-3	forb	perennial	cow-parsnip
<i>Hieracium aurantiacum</i>	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
<i>Hieracium caespitosum</i>	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
<i>Hieracium scabrum</i>	Asteraceae	HIESCA	native	3	5	forb	perennial	rough hawkweed
<i>Hylodesmum glutinosum</i> ; <i>desmodium g.</i>	Fabaceae	HYLGLU	native	5	5	forb	perennial	clustered-leaved tick-trefoil
<i>Hylotelephium telephium</i> ; <i>sedum t.</i>	Crassulaceae	HYLTEL	non-native	0	5	forb	perennial	live-forever
<i>Hypericum perforatum</i>	Hypericaceae	HYPPER	non-native	0	5	forb	perennial	common st. johns-wort
<i>Ilex verticillata</i>	Aquifoliaceae	ILEVER	native	5	-3	shrub	perennial	michigan holly
<i>Impatiens capensis</i>	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
<i>Iris virginica</i>	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
<i>Juncus canadensis</i>	Juncaceae	JUNCAN	native	6	-5	forb	perennial	canadian rush

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Juncus effusus</i>	Juncaceae	JUNEFF	native	3	-5	forb	perennial	soft-stemmed rush
<i>Juncus tenuis</i>	Juncaceae	JUNTEN	native	1	0	forb	perennial	path rush
<i>Juniperus virginiana</i>	Cupressaceae	JUNVIR	native	3	3	tree	perennial	red-cedar
<i>Lactuca canadensis</i>	Asteraceae	LACCAN	native	2	3	forb	biennial	tall lettuce
<i>Laportea canadensis</i>	Urticaceae	LAPCAN	native	4	-3	forb	perennial	wood nettle
<i>Lathyrus latifolius</i>	Fabaceae	LATLAT	non-native	0	5	vine	perennial	everlasting pea
<i>Lathyrus venosus</i>	Fabaceae	LATVEN	native	8	0	vine	perennial	veiny pea
<i>Lechea intermedia</i>	Cistaceae	LECINT	native	6	5	forb	perennial	intermediate pinweed
<i>Leersia oryzoides</i>	Poaceae	LEEORY	native	3	-5	grass	perennial	cut grass
<i>Leersia virginica</i>	Poaceae	LEEVIR	native	5	-3	grass	perennial	white grass
<i>Lemna minor</i>	Araceae	LEMMIN	native	5	-5	forb	perennial	common duckweed
<i>Lepidium campestre</i>	Brassicaceae	LEPCAM	non-native	0	5	forb	biennial	field cress
<i>Leucanthemum vulgare</i> ; <i>chrysanthemum leucanthemum</i>	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy
<i>Ligustrum vulgare</i>	Oleaceae	LIGVUL	non-native	0	3	shrub	perennial	common privet
<i>Lilium michiganense</i>	Liliaceae	LILMIC	native	5	-3	forb	perennial	michigan lily
<i>Linaria vulgaris</i>	Plantaginaceae	LINVUL	non-native	0	5	forb	perennial	butter-and-eggs
<i>Lithospermum latifolium</i>	Boraginaceae	LITLAT	native	10	5	forb	perennial	broad-leaved puccoon
<i>Lobelia cardinalis</i>	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower
<i>Lobelia siphilitica</i>	Campanulaceae	LOBSIP	native	4	-3	forb	perennial	great blue lobelia
<i>Lonicera dioica</i>	Caprifoliaceae	LONDIO	native	5	3	vine	perennial	red honeysuckle
<i>Lonicera morrowii</i>	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle
<i>Lotus corniculatus</i>	Fabaceae	LOTCOR	non-native	0	3	forb	perennial	birdfoot trefoil
<i>Lycopus americanus</i>	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
<i>Lycopus uniflorus</i>	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
<i>Lysimachia ciliata</i>	Myrsinaceae	LYSCIL	native	4	-3	forb	perennial	fringed loosestrife
<i>Lysimachia nummularia</i>	Myrsinaceae	LYSNUM	non-native	0	-3	forb	perennial	moneywort
<i>Lysimachia quadrifolia</i>	Myrsinaceae	LYSQUL	native	8	3	forb	perennial	four-leaved loosestrife
<i>Lythrum salicaria</i>	Lythraceae	LYTSAL	non-native	0	-5	forb	perennial	purple loosestrife
<i>Maianthemum canadense</i>	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
<i>Maianthemum racemosum</i> ; <i>smilacina r.</i>	Convallariaceae	MAIRAC	native	5	3	forb	perennial	false spikenard
<i>Maianthemum stellatum</i> ; <i>smilacina s.</i>	Convallariaceae	MAISTE	native	5	0	forb	perennial	starry false solomon-seal
<i>Malus pumila</i>	Rosaceae	MALPUM	non-native	0	5	tree	perennial	apple
<i>Matteuccia struthiopteris</i>	Onocleaceae	MATSTR	native	3	0	fern	perennial	ostrich fern
<i>Medeola virginiana</i>	Convallariaceae	MEDVIR	native	10	3	forb	perennial	indian cucumber-root
<i>Medicago lupulina</i>	Fabaceae	MEDLUP	non-native	0	3	forb	annual	black medick
<i>Medicago sativa</i>	Fabaceae	MEDSAT	non-native	0	5	forb	perennial	alfalfa
<i>Melilotus albus</i>	Fabaceae	MELALB	non-native	0	3	forb	biennial	white sweet-clover
<i>Melilotus officinalis</i>	Fabaceae	MELLOF	non-native	0	3	forb	biennial	yellow sweet-clover
<i>Menispermum canadense</i>	Menispermaceae	MENCAE	native	5	0	vine	perennial	moonseed
<i>Mentha spicata</i>	Lamiaceae	MENSPI	non-native	0	-3	forb	perennial	spearmint
<i>Mentha</i> \checkmark — <i>piperita</i>	Lamiaceae	MENPIP	non-native	0	-5	forb	perennial	peppermint

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Mimulus ringens	Phrymaceae	MIMRIN	native	5	-5	forb	perennial	monkey-flower
Mitchella repens	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
Mitella diphylla	Saxifragaceae	MITDIP	native	8	3	forb	perennial	bishops-cap
Monarda fistulosa	Lamiaceae	MONFIS	native	2	3	forb	perennial	wild-bergamot
Monotropa uniflora	Ericaceae	MONOUN	native	5	3	forb	perennial	indian-pipe
Muhlenbergia mexicana	Poaceae	MUHMEX	native	3	-3	grass	perennial	leafy satin grass
Nepeta cataria	Lamiaceae	NEPCAT	non-native	0	3	forb	perennial	catnip
Oenothera biennis	Onagraceae	OENBIE	native	2	3	forb	biennial	common evening-primrose
Oenothera perennis	Onagraceae	OENPER	native	5	0	forb	perennial	small sundrops
Onoclea sensibilis	Onocleaceae	ONosen	native	2	-3	fern	perennial	sensitive fern
Oryzopsis asperifolia	Poaceae	ORYASP	native	6	5	grass	perennial	rough-leaved rice-grass
Osmorhiza claytonii	Apiaceae	OSMCLI	native	4	3	forb	perennial	hairy sweet-cicely
Osmunda cinnamomea	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Ostrya virginiana	Betulaceae	OSTVIR	native	5	3	tree	perennial	ironwood; hop-hornbeam
Oxalis stricta; o. fontana	Oxalidaceae	OXASTR	native	0	3	forb	perennial	yellow wood-sorrel
Packera aurea; senecio a.	Asteraceae	PACAUR	native	5	-3	forb	perennial	golden ragwort
Panicum virgatum	Poaceae	PANVIR	native	4	0	grass	perennial	switch grass
Parthenocissus quinquefolia	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
Pastinaca sativa	Apiaceae	PASSAT	non-native	0	5	forb	biennial	wild parsnip
Pedicularis lanceolata	Orobanchaceae	PEDLAN	native	8	-3	forb	perennial	swamp-betony
Penstemon digitalis	Plantaginaceae	PENDIG	native	2	0	forb	perennial	foxglove beard-tongue
Penstemon hirsutus	Plantaginaceae	PENHIR	native	5	5	forb	perennial	hairy beard-tongue
Persicaria virginiana; polygonum v.	Polygonaceae	PERVIR	native	4	0	forb	perennial	jumpseed
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phleum pratense	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
Phlox divaricata	Polemoniaceae	PHLDIV	native	5	3	forb	perennial	wild blue phlox
Phryma leptostachya	Phrymaceae	PHRLEP	native	4	3	forb	perennial	lopseed
Physalis virginiana	Solanaceae	PHYVIG	native	4	5	forb	perennial	virginia ground-cherry
Physocarpus opulifolius	Rosaceae	PHYOPU	native	4	-3	shrub	perennial	ninebark
Pilea pumila	Urticaceae	PILPUM	native	5	-3	forb	annual	clearweed
Pinus resinosa	Pinaceae	PINRES	native	6	3	tree	perennial	red pine
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Pinus sylvestris	Pinaceae	PINSYL	non-native	0	3	tree	perennial	scotch pine
Plantago lanceolata	Plantaginaceae	PLALAN	non-native	0	3	forb	perennial	english plantain
Plantago rugelii	Plantaginaceae	PLARUG	native	0	0	forb	perennial	red-stalked plantain
Platanus occidentalis	Platanaceae	PLAOCC	native	7	-3	tree	perennial	sycamore
Poa compressa	Poaceae	POACOM	non-native	0	3	grass	perennial	canada bluegrass
Poa pratensis	Poaceae	POAPRA	non-native	0	3	grass	perennial	kentucky bluegrass
Poa sylvestris	Poaceae	POASYL	native	8	0	grass	perennial	woodland bluegrass
Podophyllum peltatum	Berberidaceae	PODPEL	native	3	3	forb	perennial	may-apple

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Polygala paucifolia</i>	Polygalaceae	POLPAU	native	7	3	forb	perennial	gay-wings
<i>Polygala polygama</i>	Polygalaceae	POLPOL	native	9	3	forb	biennial	racemed milkwort
<i>Polygonatum biflorum</i>	Convallariaceae	POLBIF	native	4	3	forb	perennial	solomon-seal
<i>Polygonatum pubescens</i>	Convallariaceae	POLPUB	native	5	5	forb	perennial	downy solomon seal
<i>Polystichum acrostichoides</i>	Dryopteridaceae	POLACR	native	6	3	fern	perennial	christmas fern
<i>Populus deltoides</i>	Salicaceae	POPDEL	native	1	0	tree	perennial	cottonwood
<i>Populus grandidentata</i>	Salicaceae	POPGA	native	4	3	tree	perennial	big-tooth aspen
<i>Populus tremuloides</i>	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
<i>Potentilla recta</i>	Rosaceae	POTREC	non-native	0	5	forb	perennial	rough-fruited cinquefoil
<i>Potentilla simplex</i>	Rosaceae	POTSIM	native	2	3	forb	perennial	old-field cinquefoil
<i>Prenanthes alba</i>	Asteraceae	PREALB	native	5	3	forb	perennial	white lettuce
<i>Proserpinaca palustris</i>	Haloragaceae	PROPAL	native	6	-5	forb	perennial	mermaid-weed
<i>Prunella vulgaris</i>	Lamiaceae	PRUVUL	native	0	0	forb	perennial	self-heal
<i>Prunus serotina</i>	Rosaceae	PRUSER	native	2	3	tree	perennial	wild black cherry
<i>Prunus virginiana</i>	Rosaceae	PRUVIR	native	2	3	shrub	perennial	choke cherry
<i>Pseudognaphalium obtusifolium</i> ; <i>gnaphalium o.</i>	Asteraceae	PSEOBT	native	2	5	forb	biennial	old-field balsam
<i>Pteridium aquilinum</i>	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
<i>Pyrola elliptica</i>	Ericaceae	PYRELL	native	6	3	forb	perennial	large-leaved shinleaf
<i>Quercus alba</i>	Fagaceae	QUEALB	native	5	3	tree	perennial	white oak
<i>Quercus bicolor</i>	Fagaceae	QUEBIC	native	8	-3	tree	perennial	swamp white oak
<i>Quercus ellipsoidalis</i> ; <i>q. coccinea</i>	Fagaceae	QUEELL	native	4	5	tree	perennial	hills oak
<i>Quercus macrocarpa</i>	Fagaceae	QUEMAC	native	5	3	tree	perennial	bur oak
<i>Quercus palustris</i>	Fagaceae	QUEPAL	native	8	-3	tree	perennial	pin oak
<i>Quercus rubra</i>	Fagaceae	QUERUB	native	5	3	tree	perennial	red oak
<i>Quercus velutina</i>	Fagaceae	QUEVEL	native	6	5	tree	perennial	black oak
<i>Ranunculus abortivus</i>	Ranunculaceae	RANABO	native	0	0	forb	perennial	small-flowered buttercup
<i>Ranunculus acris</i>	Ranunculaceae	RANACR	non-native	0	0	forb	perennial	tall or common buttercup
<i>Ranunculus flabellaris</i> ; <i>ranunculus lapponicus</i>	Ranunculaceae	RANFLA	native	10	-5	forb	perennial	yellow water crowfoot
<i>Ranunculus hispidus</i>	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
<i>Ranunculus pensylvanicus</i>	Ranunculaceae	RANPEN	native	6	-5	forb	annual	bristly crowfoot
<i>Ranunculus recurvatus</i>	Ranunculaceae	RANREC	native	5	-3	forb	perennial	hooked crowfoot
<i>Rhamnus alnifolia</i>	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
<i>Rhamnus cathartica</i>	Rhamnaceae	RHACAT	non-native	0	0	tree	perennial	common buckthorn
<i>Rhus typhina</i>	Anacardiaceae	RHUTYP	native	2	3	shrub	perennial	staghorn sumac
<i>Ribes americanum</i>	Grossulariaceae	RIBAME	native	6	-3	shrub	perennial	wild black currant
<i>Ribes cynosbati</i>	Grossulariaceae	RIBCYN	native	4	3	shrub	perennial	prickly or wild gooseberry
<i>Rosa multiflora</i>	Rosaceae	ROSMUL	non-native	0	3	shrub	perennial	multiflora rose
<i>Rosa palustris</i>	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
<i>Rubus allegheniensis</i>	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
<i>Rubus hispidus</i>	Rosaceae	RUBHIS	native	4	-3	shrub	perennial	swamp dewberry
<i>Rubus occidentalis</i>	Rosaceae	RUBOCC	native	1	5	shrub	perennial	black raspberry

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Rubus strigosus	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
Rudbeckia fulgida	Asteraceae	RUDFUL	native	9	-5	forb	perennial	black-eyed susan
Rudbeckia hirta	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
Rudbeckia laciniata	Asteraceae	RUDLAC	native	6	-3	forb	perennial	cut-leaf coneflower
Rumex acetosella	Polygonaceae	RUMACL	non-native	0	3	forb	perennial	sheep sorrel
Rumex crispus	Polygonaceae	RUMCRI	non-native	0	0	forb	perennial	curly dock
Rumex obtusifolius	Polygonaceae	RUMOBT	non-native	0	0	forb	perennial	bitter dock
Rumex verticillatus	Polygonaceae	RUMVER	native	7	-5	forb	perennial	water dock
Sagittaria latifolia	Alismataceae	SAGLAT	native	4	-5	forb	perennial	common arrowhead
Salix discolor	Salicaceae	SALDIS	native	1	-3	shrub	perennial	pussy willow
Salix petiolaris	Salicaceae	SALPET	native	1	-3	shrub	perennial	slender willow
Sambucus racemosa	Adoxaceae	SAMRAC	native	3	3	shrub	perennial	red-berried elder
Samolus parviflorus	Theophrastaceae	SAMPAR	native	5	-5	forb	perennial	water-pimpernel
Sanguinaria canadensis	Papaveraceae	SANCAA	native	5	3	forb	perennial	bloodroot
Sanicula odorata; s. gregaria	Apiaceae	SANODO	native	2	0	forb	perennial	black snakeroot
Saponaria officinalis	Caryophyllaceae	SAPOFF	non-native	0	3	forb	perennial	bouncing bet
Sassafras albidum	Lauraceae	SASALB	native	5	3	tree	perennial	sassafras
Schizachne purpurascens	Poaceae	SCHPUP	native	5	3	grass	perennial	false melic
Schoenoplectus tabernaemontani; scirpus validus	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
Scirpus atrovirens	Cyperaceae	SCIATV	native	3	-5	sedge	perennial	bulrush
Scirpus cyperinus	Cyperaceae	SCICYP	native	5	-5	sedge	perennial	wool-grass
Scirpus pendulus	Cyperaceae	SCIPEN	native	3	-5	sedge	perennial	bulrush
Scrophularia lanceolata	Scrophulariaceae	SCRLAN	native	5	3	forb	perennial	early figwort
Scrophularia marilandica	Scrophulariaceae	SCRMAR	native	5	3	forb	perennial	late figwort
Scutellaria lateriflora	Lamiaceae	SCULAT	native	5	-5	forb	perennial	mad-dog skullcap
Securigera varia; coronilla v.	Fabaceae	SECVAR	non-native	0	5	forb	perennial	crown-vetch
Silene latifolia; s. pratensis	Caryophyllaceae	SILLAT	non-native	0	5	forb	annual	white campion
Sisyrinchium angustifolium	Iridaceae	SISANG	native	4	0	forb	perennial	stout blue-eyed-grass
Sium suave	Apiaceae	SIUSUA	native	5	-5	forb	perennial	water-parsnip
Smilax ecirrata	Smilacaceae	SMIECI	native	6	5	forb	perennial	upright carrion-flower
Smilax hispida; s. tamnoides	Smilacaceae	SMIHIS	native	5	0	vine	perennial	bristly greenbrier
Solanum carolinense	Solanaceae	SOLCAR	non-native	0	3	forb	perennial	horse-nettle
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago altissima	Asteraceae	SOLALT	native	1	3	forb	perennial	tall goldenrod
Solidago caesia	Asteraceae	SOLCAE	native	6	3	forb	perennial	bluestem goldenrod
Solidago canadensis	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
Solidago flexicaulis	Asteraceae	SOLFLE	native	6	3	forb	perennial	zigzag goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago hispida	Asteraceae	SOLHIS	native	3	5	forb	perennial	hairy goldenrod
Solidago juncea	Asteraceae	SOLJUN	native	3	5	forb	perennial	early goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
<i>Sorghastrum nutans</i>	Poaceae	SORNUT	native	6	3	grass	perennial	indian grass
<i>Sphenopholis intermedia</i>	Poaceae	SPHINT	native	4	0	grass	perennial	slender wedgegrass
<i>Spiraea tomentosa</i>	Rosaceae	SPITOM	native	5	-3	shrub	perennial	steepleshub
<i>Spiranthes ochroleuca</i> ; <i>s. cernua</i>	Orchidaceae	SPIOCH	native	8	3	forb	perennial	yellow ladies-tresses
<i>Staphylea trifolia</i>	Staphyleaceae	STATRI	native	9	0	shrub	perennial	bladdernut
<i>Stellaria longifolia</i>	Caryophyllaceae	STELOF	native	5	-3	forb	perennial	long-leaved chickweed
<i>Symphotrichum cordifolium</i> ; aster c.	Asteraceae	SYMCOR	native	4	5	forb	perennial	heart-leaved aster
<i>Symphotrichum laeve</i> ; aster l.	Asteraceae	SYMLAE	native	5	3	forb	perennial	smooth aster
<i>Symphotrichum lateriflorum</i> ; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
<i>Symphotrichum novae-angliae</i> ; aster n.	Asteraceae	SYMNOV	native	3	-3	forb	perennial	new england aster
<i>Symphotrichum ontarionis</i> ; aster o.	Asteraceae	SYMONT	native	6	0	forb	perennial	lake ontario aster
<i>Taraxacum officinale</i>	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
<i>Teucrium canadense</i>	Lamiaceae	TEUCAN	native	4	-3	forb	perennial	wood-sage
<i>Thalictrum dasycarpum</i>	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
<i>Thalictrum dioicum</i>	Ranunculaceae	THADIO	native	6	3	forb	perennial	early meadow-rue
<i>Thelypteris noveboracensis</i>	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
<i>Thelypteris palustris</i>	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
<i>Thuja occidentalis</i>	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
<i>Tilia americana</i>	Malicaceae	TILAME	native	5	3	tree	perennial	basswood
<i>Torilis japonica</i>	Apiaceae	TORJAP	non-native	0	3	forb	annual	hedge-parsley
<i>Toxicodendron radicans</i>	Anacardiaceae	TOXRAD	native	2	0	vine	perennial	poison-ivy
<i>Tragopogon pratensis</i>	Asteraceae	TRAPRA	non-native	0	5	forb	biennial	common goats beard
<i>Trientalis borealis</i>	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
<i>Trifolium hybridum</i>	Fabaceae	TRIHYP	non-native	0	3	forb	perennial	alsike clover
<i>Trifolium pratense</i>	Fabaceae	TRIPRA	non-native	0	3	forb	perennial	red clover
<i>Trifolium repens</i>	Fabaceae	TRIREP	non-native	0	3	forb	perennial	white clover
<i>Trillium grandiflorum</i>	Trilliaceae	TRIGRA	native	5	3	forb	perennial	common trillium
<i>Triosteum aurantiacum</i>	Caprifoliaceae	TRIAUN	native	5	5	forb	perennial	horse-gentian
<i>Tsuga canadensis</i>	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
<i>Tussilago farfara</i>	Asteraceae	TUSFAR	non-native	0	3	forb	perennial	coltsfoot
<i>Typha angustifolia</i>	Typhaceae	TYPANG	non-native	0	-5	forb	perennial	narrow-leaved cat-tail
<i>Typha latifolia</i>	Typhaceae	TYPLAT	native	1	-5	forb	perennial	broad-leaved cat-tail
<i>Ulmus americana</i>	Ulmaceae	ULMAME	native	1	-3	tree	perennial	american elm
<i>Ulmus pumila</i>	Ulmaceae	ULMPUM	non-native	0	3	tree	perennial	siberian elm
<i>Ulmus rubra</i>	Ulmaceae	ULMRUB	native	2	0	tree	perennial	slippery elm
<i>Urtica dioica</i>	Urticaceae	URTDIO	native	1	0	forb	perennial	stinging nettle
<i>Uvularia grandiflora</i>	Convallariaceae	UVUGRA	native	5	5	forb	perennial	bellwort
<i>Vaccinium angustifolium</i>	Ericaceae	VACANG	native	4	3	shrub	perennial	low sweet blueberry
<i>Verbascum thapsus</i>	Scrophulariaceae	VERTHA	non-native	0	5	forb	biennial	common mullein
<i>Verbena hastata</i>	Verbenaceae	VERHAS	native	4	-3	forb	perennial	blue vervain
<i>Verbena urticifolia</i>	Verbenaceae	VERURT	native	4	0	forb	perennial	white vervain

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Vernonia missurica	Asteraceae	VERMIS	native	4	0	forb	perennial	missouri ironweed
Veronicastrum virginicum	Plantaginaceae	VERVIR	native	8	0	forb	perennial	culvers-root
Viburnum lentago	Adoxaceae	VIBLEN	native	4	0	shrub	perennial	nannyberry
Viburnum opulus	Adoxaceae	VIBOPU	non-native	0	-3	shrub	perennial	european highbush-cranberry
Vicia villosa	Fabaceae	VICVIL	non-native	0	5	vine	annual	hairy vetch
Viola blanda	Violaceae	VIOLBLA	native	5	-3	forb	perennial	sweet white violet
Viola cucullata	Violaceae	VIOCUC	native	5	-5	forb	perennial	marsh violet
Viola pubescens	Violaceae	VIOPUB	native	4	3	forb	perennial	yellow violet
Viola renifolia	Violaceae	VIOREN	native	6	-3	forb	perennial	kidney-leaved violet
Viola sororia	Violaceae	VIOSOR	native	1	0	forb	perennial	common blue violet
Viola striata	Violaceae	VIOSTR	native	5	-3	forb	perennial	cream violet
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape
Woodwardia virginica	Blechnaceae	WOOVIR	native	10	-5	fern	perennial	virginia chain-fern
Zanthoxylum americanum	Rutaceae	ZANAME	native	3	3	shrub	perennial	prickly-ash
Zizia aurea	Apiaceae	ZIZAUR	native	6	0	forb	perennial	golden alexanders

**Appendix E:
Qualitative Habitat Evaluation Index (QHEI) data sheet used
to assess stream habitat quality at aquatic survey sites**

Stream & Location: _____ RM: _____ Date: / /

Scorers Full Name & Affiliation: _____

River Code: - - - STORET #: _____ Lat./Long.: _____ / 18 _____ Office verified location []

1] **SUBSTRATE** Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL RIFFLE	OTHER TYPES	POOL RIFFLE	ORIGIN	QUALITY
<input type="checkbox"/> BLDR /SLABS [10]	_____	<input type="checkbox"/> HARDPAN [4]	_____	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> HEAVY [-2]
<input type="checkbox"/> BOULDER [9]	_____	<input type="checkbox"/> DETRITUS [3]	_____	<input type="checkbox"/> TILLS [1]	<input type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> COBBLE [8]	_____	<input type="checkbox"/> MUCK [2]	_____	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> NORMAL [0]
<input type="checkbox"/> GRAVEL [7]	_____	<input type="checkbox"/> SILT [2]	_____	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> FREE [1]
<input type="checkbox"/> SAND [6]	_____	<input type="checkbox"/> ARTIFICIAL [0]	_____	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> EXTENSIVE [-2]
<input type="checkbox"/> BEDROCK [5]	_____			<input type="checkbox"/> RIP/RAP [0]	<input type="checkbox"/> MODERATE [-1]
(Score natural substrates; ignore sludge from point-sources)				<input type="checkbox"/> LACUSTURINE [0]	<input type="checkbox"/> NORMAL [0]
NUMBER OF BEST TYPES: <input type="checkbox"/> 4 or more [2] <input type="checkbox"/> 3 or less [0]				<input type="checkbox"/> SHALE [-1]	<input type="checkbox"/> NONE [1]
<i>Comments</i>				<input type="checkbox"/> COAL FINES [-2]	

Substrate Maximum 20

2] **INSTREAM COVER** Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools). Check ONE (Or 2 & average)

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	<input type="checkbox"/> EXTENSIVE >75% [11]
<input type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	<input type="checkbox"/> MODERATE 25-75% [7]
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> SPARSE 5-<25% [3]
<input type="checkbox"/> ROOTMATS [1]			<input type="checkbox"/> NEARLY ABSENT <5% [1]

Cover Maximum 20

Comments

3] **CHANNEL MORPHOLOGY** Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input type="checkbox"/> LOW [2]	<input type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

Channel Maximum 20

Comments

4] **BANK EROSION AND RIPARIAN ZONE** Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY
<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]
<input type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]
	<input type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]
	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]
		<input type="checkbox"/> CONSERVATION TILLAGE [1]
		<input type="checkbox"/> URBAN OR INDUSTRIAL [0]
		<input type="checkbox"/> MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian. *Riparian* Maximum 10

Comments

5] **POOL / GLIDE AND RIFFLE / RUN QUALITY**

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential Primary Contact Secondary Contact (circle one and comment on back)
Check ONE (ONLY!)	Check ONE (Or 2 & average)	Check ALL that apply	
<input type="checkbox"/> > 1m [6]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	Pool / Current Maximum 12
<input type="checkbox"/> 0.7-<1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input type="checkbox"/> VERY FAST [1]	
<input type="checkbox"/> 0.4-<0.7m [2]	<input type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> INTERSTITIAL [-1]	
<input type="checkbox"/> 0.2-<0.4m [1]		<input type="checkbox"/> FAST [1]	
<input type="checkbox"/> < 0.2m [0]		<input type="checkbox"/> INTERMITTENT [-2]	
		<input type="checkbox"/> MODERATE [1]	

Indicate for reach - pools and riffles.

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input type="checkbox"/> BEST AREAS 5-10cm [1]	<input type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Riffle / Run Maximum 8

Comments

6] **GRADIENT** (ft/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6] %POOL: [] %GLIDE: []

DRAINAGE AREA (mi²) %RUN: [] %RIFFLE: []

Gradient Maximum 10

A/ SAMPLED REACH

Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

METHOD	STAGE
<input type="checkbox"/> BOAT	1st -sample pass- 2nd
<input type="checkbox"/> WADE	<input type="checkbox"/> HIGH <input type="checkbox"/>
<input type="checkbox"/> L. LINE	<input type="checkbox"/> UP <input type="checkbox"/>
<input type="checkbox"/> OTHER	<input type="checkbox"/> NORMAL <input type="checkbox"/>
	<input type="checkbox"/> LOW <input type="checkbox"/>
	<input type="checkbox"/> DRY <input type="checkbox"/>

DISTANCE

0.5 Km

0.2 Km

0.15 Km

0.12 Km

OTHER

_____ meters

CANOPY

> 85%- OPEN

55%-<85%

30%-<55%

10%-<30%

<10%- CLOSED

1st _____ cm

2nd _____ cm

CLARITY

1st --sample pass-- 2nd

< 20 cm

20-<40 cm

40-70 cm

> 70 cm/ CTB

SECCHI DEPTH

B/ AESTHETICS

NUISANCE ALGAE

INVASIVE MACROPHYTES

EXCESS TURBIDITY

DISCOLORATION

FOAM / SCUM

OIL SHEEN

TRASH / LITTER

NUISANCE ODOR

SLUDGE DEPOSITS

CSOs/SSOs/OUTFALLS

D/ MAINTENANCE

PUBLIC / PRIVATE / BOTH / NA

ACTIVE / HISTORIC / BOTH / NA

YOUNG-SUCCESSION-OLD

SPRAY / SNAG / REMOVED

MODIFIED / DIPPED OUT / NA

LEVEED / ONE SIDED

RELOCATED / CUTOFFS

MOVING-BEDLOAD-STABLE

ARMOURED / SLUMPS

ISLANDS / SCOURED

IMPOUNDED / DESICCATED

FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E/ ISSUES

WWTP / CSO / NPDES / INDUSTRY

HARDENED / URBAN / DIRT&GRIME

CONTAMINATED / LANDFILL

BMPs-CONSTRUCTION-SEDIMENT

LOGGING / IRRIGATION / COOLING

BANK / EROSION / SURFACE

FALSE BANK / MANURE / LAGOON

WASH H₂O / TILE / H₂O TABLE

ACID / MINE / QUARRY / FLOW

NATURAL / WETLAND / STAGNANT

PARK / GOLF / LAWN / HOME

ATMOSPHERE / DATA PAUCITY

F/ MEASUREMENTS

\bar{x} width

\bar{x} depth

max. depth

\bar{x} bankfull width

bankfull \bar{x} depth

W/D ratio

bankfull max. depth

floodprone x² width

entrench. ratio

Legacy Tree:

C/ RECREATION AREA DEPTH

POOL: >100ft² >3ft

Stream Drawing:

Appendix F:

**Mussel species recorded from the
Tittabawassee River watershed**

Species	Common Name	1979-1981	2001	MI status	U.S. status
<i>Actinonaias ligamentina</i>	Mucket	L	L		
<i>Alasmidonta marginata</i>	Elktoe	L	S	SC	
<i>Alasmidonta viridis</i>	Slippershell	L		T	
<i>Amblema plicata</i>	Threeridge		S		
<i>Anodontoides ferussacianus</i>	Cylindrical papershell	L			
<i>Cyclonaias tuberculata</i>	Purple wartyback			T	
<i>Elliptio complanata</i>	Eastern elliptio				
<i>Elliptio crassidens</i>	Elephant-ear				
<i>Elliptio dilatata</i>	Spike	L	S		
<i>Epioblasma obliquata perobliqua</i>	White catspaw			E	E
<i>Epioblasma torulosa rangiana</i>	Northern riffleshell			E	E
<i>Epioblasma triquetra</i> *	Snuffbox*			E	E
<i>Fusconaia flava</i>	Wabash pigtoe	L	S		
<i>Lampsilis fasciola</i>	Wavy-rayed lampmussel			T	
<i>Lampsilis siliquoidea</i>	Fatmucket	L	S		
<i>Lampsilis ventricosa</i>	Pocketbook	L	S		
<i>Lasmigona complanata</i>	White heelsplitter	L	L		
<i>Lasmigona compressa</i>	Creek heelsplitter	L			
<i>Lasmigona costata</i>	Fluted-shell		S		
<i>Leptodea fragilis</i>	Fragile papershell		L		
<i>Leptodea leptodon</i>	Scaleshell			SC	E
<i>Ligumia nasuta</i>	Eastern pondmussel			E	
<i>Ligumia recta</i>	Black sandshell		S	E	
<i>Obliquaria reflexa</i>	Three-horned wartyback		S	E	
<i>Obovaria olivaria</i>	Hickorynut		S	E	
<i>Obovaria subrotunda</i>	Round hickorynut			E	
<i>Pleurobema clava</i>	Clubshell			E	E
<i>Pleurobema cordatum</i>	Ohio pigtoe				
<i>Pleurobema sintoxia</i>	Round pigtoe			SC	
<i>Potamilus alatus</i>	Pink heelsplitter				
<i>Potamilus ohioensis</i>	Pink papershell			T	
<i>Ptychobranhus fasciolaris</i>	Kidney-shell	S	S	SC	
<i>Pyganodon grandis</i>	Giant floater	L	L		
<i>Pyganodon lacustris</i>	Lake floater			SC	
<i>Pyganodon subgibbosa</i>	Round lake floater			T	
<i>Quadrula pustulosa</i>	Pimpleback		S		
<i>Quadrula quadrula</i>	Mapleleaf		L		
<i>Simpsonaias ambigua</i>	Salamander mussel			E	
<i>Strophitus undulatus</i>	Strange floater	L			
<i>Toxolasma lividus</i>	Purple lilliput			E	
<i>Toxolasma parvum</i>	Lilliput			E	
<i>Truncilla donaciformis</i>	Fawnsfoot			T	
<i>Truncilla truncata</i>	Deertoe		L	SC	
<i>Utterbackia imbecillis</i>	Paper pondshell	L		SC	
<i>Venustaconcha ellipsiformis</i>	Ellipse			SC	
<i>Villosa fabalis</i>	Rayed bean			E	E
<i>Villosa iris</i>	Rainbow			SC	
<i>Corbicula fluminea</i>	Asian clam		S	Exotic	
<i>Dreissena bugensis</i>	Quagga mussel			Exotic	
<i>Dreissena polymorpha</i>	Zebra mussel		L	Exotic	

Unionid mussel species found in the headwaters of the Tittabawassee River drainage from 1979-1981 (Hoeh and Trdan 1984) and from the lower reach of the main stem below Midland in 2001 (Badra and Goforth 2002) are noted. *In addition, snuffbox (*Epioblasma triquetra*), was recorded historically from the watershed (University of Michigan Museum of Zoology, Mollusk Collection). L= Live found; S= Shell only found.