FLORISTIC QUALITY ASSESSMENT AND ECOSYSTEM ANALYSIS OF THE INLAND WATERWAY NATURE PRESERVE, EMMET COUNTY, MICHIGAN

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ABSTRACT

The Inland Waterway Nature Preserve, located at the northern end of Crooked River in Alanson, MI, was acquired by the Little Traverse Conservancy in the spring of 2010, and is a twenty three acre addition to the Brill, Williams, Kreag, and Lossing-Harrington preserves. We conducted a floristic survey of the plot and performed a Floristic Quality Analysis (FQA) to aid the Little Traverse Conservancy in conservation prioritization. We created four East to West transects within the plot and identified the vegetation along each. We observed that the property comprised a northern fen and a rich conifer swamp. We found the mean coefficient of conservatism ($\bar{C}$) and Floristic Quality Index (FQI) for the fen to be 4.72 and 37.21, and the $\bar{C}$ and FQI for the cedar swamp to be 4.03 and 42.14 respectively. By FQA standards and our own analysis, the Inland Waterway Nature Preserve is a rich site worth protecting due to its biodiversity and importance as a rare Michigan ecosystem.

INTRODUCTION

The Inland Waterway of Northern Michigan is an aquatic route that historically ran with one end at St. Ignace and reached from Straits of Mackinac, through streams and lakes in Cheboygan and Emmet counties, to Charlevoix, MI (Hill, Map Showing the Beutiful Inland Route, Circa 1900s). The waterway is currently used as a passageway between Crooked Lake and Lake Huron (Figure 1), and contains two locks—structures for raising and lowering boats along the waterway that maintain a steady water level where it would otherwise be variable throughout the year—both of which are managed Michigan Department of Natural Resources (DNR). Much of the lands surrounding the lakes are residential areas, while the edges of the rivers vary in habitat type.

The Inland Waterway Nature Preserve is a plot of land located in Alanson, Michigan in Emmet County and was acquired in 2010 by the Little Traverse Conservatory (LTC) from private owners. The plot we studied is bordered by four other nature preserves—all of which are managed by the LTC—on its northeast edges, the Crooked River lock on its northwest edge, and the Crooked Lake on its southeast edge. The plot is primarily composed of three distinct ecotypes: a wooded area dominated by *Thuja occidentalis* and *Fraxinus nigra*; a fen dominated by *Schoenoplectus validus, Carex lasiocarpa,* and *Eleocharis intermedia* (Figure 2); and a transition zone between the two.

A fen is a peatland rich in minerals from groundwater sources and is characterized by a variety of sedges and pH values ranging from 4–8 (Crum, 1991; Cronk & Fennessy, 2001). The area of study rests atop limestone bedrock and is characterized by drumlin fields on coarse textured ground moraine formed by the most recent glaciation recession (Albert, Denton, & Barnes, 1986; Reid, 1961). This glacial topography results in poor drainage, which creates optimal conditions for peat accumulation at an estimated rate of 100 to 900 years per foot (Crum, 1991). Wetland areas of this type are optimal locations for nutrient cycling, water exchange, and floral and faunal diversity (Barbier, Acreman, & Knowler, 1997; Kost, et al., 2007). Because the flora of fens is sensitive to concentrations of calcium, changes in pH, and changes in water levels, and because the shoreline provides a buffer for run-off and is an important habitat for waterfowl, mammals, insects, and other fauna, fens are biologically diverse areas that deserve conservation attention (Siegel, 1988).

The Floristic Quality Assessment (FQA) is a technique for scoring the floral quality of Michigan landscapes that can aid in spatial conservation prioritization. The assessment involves the calculation of a Floristic Quality Index (FQI), a number calculated by taking the average of the coefficients of conservatism (*C*)—a predetermined number assigned to each species of plant that represents the likelihood of finding each species in its pre-European settlement habitat—of every plant species in a given area. For example, species such as *Potentilla fruticosa* that are likely only to be found in relatively undisturbed habitats would have a high coefficient. Species such as *Acer negundo*, which are readily found in many disturbed and undisturbed areas, would receive a low coefficient. Intermediate coefficients are given to species with distributions varying by location. Locations with many plants with high *C*'s will have high FQIs, and the opposite holds true for locations with many plants with low *C*'s (Herman, et al., 2001).

The FQA and the results of this study can be used for several applications. Herman, et al. (2001) propses the four main applications for the FQA:

(1) *the identification of remnant native habitats of floristic significance,*
(2) *the comparison of floristic quality among different sites,*
(3) *long-term monitoring of floristic quality in natural areas, and*

(4) *monitoring of habitat restoration.*

The methodology of the FQA gives a standardized, measurable way to classify and compare ecosystems. It provides a systematic way to record species and habitat information in a way that can be compared with past and future data. Moreover, there are many stakeholders involved with a certain area including locals, outdoorspeople, politicians, scientists, and developers. Each stakeholder may have a different idea of what is best for an ecosystem. By condensing complex ecological ideas into a simple number format, the FQA provides a simple method of discussing and making decisions that will benefit the most stakeholders, as well as maintain biological diversity.

With specific regard to the Inland Waterway Nature Preserve of Alanson, MI, the FQA serves as a base point for management through the Little Traverse Conservancy, presently and in the future. Especially useful in this endeavor is a comprehensive species list, which will allow future stakeholders to understand how the ecosystem is changing. Moreover, the results of this study can be used to make more generalized decisions regarding protection, maintenance, and mitigation of other similar wetlands.

The goals of this study were: describe the flora found in the newly acquired plot, generate a comprehensive species list, identify the major habitats according to Albert, et al. (2007), and conduct an FQA. We hope that our findings will aid the LTC in making informed conservation decisions about the newly acquired land.

MATERIALS AND METHODS

The Inland Waterway Nature Preserve is a 23 acre parcel of land located in Emmet County in the northwest Lower Peninsula of Michigan 45° 25' 58.74" N, 84° 47' 28.78" W. The ecosystem types were determined by referencing Little Traverse Conservancy (2010) and Albert, et al. (2007), and comparing plant species abundances, soil types, and geographic location.

We created a comprehensive plant list and conducted the FQA by making four 2 meter wide transects that we placed 34.5 meters apart in order to maximize our coverage of the parcel (Figure 2). The transects were surveyed during the second week in August 2010. We began each transect at the water's edge and progressed due west until we reached the approximate property line or the point at which no new species were recorded. Abundance of each species was estimated to be individual, few, interspersed, abundant, or dominant. Plants were identified by sight in the field and specimens were collected to be identified in the lab using Voss (1972, 1985, 1996), Gleason and Cronquist (1991), the USDA Plant Database, Cobb et al. (2005), Holmgren (1998), Soper and Heimburger (1982), and the University of Michigan Biostation herbarium. We consulted experts Glenn Adelson, Ryan O'Connor, and Ben Oyserman for help identifying plants that lacked reproductive vegetative parts or were difficult to identify due to season. In addition to sampling, we used active searching to find species not observed within the transects (Stohlgren 2007).

We measured soil conditions by taking four soil cores from each transect: at the water's edge, in the fen, in the intermediate shrub zone, and in the cedar swamp. Texture was then determined in the lab by estimating soil components by feel and referencing Brady and Weil (1996). Soil color was established using the Munsell color chart, and pH was measured using an accument AP series handheld pH/mV/ion meter.

To assess the "floristic and natural significance" of the Inland Waterway Nature Preserve, we performed a Floristic Quality Assessment (FQA) (Herman, et al., 2001). The methodology is outlined in Herman et al. (2001) and modeled after a similar system of analysis developed for the Chicago Region outlines in Swink and Wilhelm (1994).

Each native species within Michigan has a coefficient of conservation (*C*) ranging from 0–10. This value represents the "estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a pre-European settlement condition" (Herman, et al. 2001). We created a comprehensive list of plants (Appendix B) and retrieved the coefficients of conservation for each plant species from Albert, et al. (2007). The mean coefficient of conservatism ($\bar{\mathrm{C}}$) was calculated for each ecotype and the plot as a whole by taking the sum of the *C* for each plant divided by the total number of taxa (*n*) (Equation 1).

$$\bar{C} = \sum C/n \qquad \text{Eqn. 1}$$

This calculated relative average is a tool used to compare similar natural areas. A Floristic Quality Index (FQI) was created in order to make the mean coefficient of conservatism more applicable as a comparative tool with other sites regardless of size or quantity of taxa. The FQI figure was generated by multiplying the mean coefficient of conservatism ($\bar{C}$) by the square root of the total number of plants ($\sqrt{n}$) (Equation 2).

$$\mathrm{FQI} = \bar{C}\sqrt{n} \qquad \text{Eqn. 2}$$

Wilhelm and Masters (1995) state that a $\bar{C}$ value of 3.5+ or an FQI of 35+ suggests floristic quality of "at least of marginal natural area quality." A $\bar{C}$ of 4.5+ or an FQI of 45+ constitutes most certainly remnant "natural area potential". The mean coefficient of conservatism and the FQI calculated for the plot under study, in combination with these guideline figures offered by Wilhelm and Masters (1995), allow us and the Little Traverse Conservency to make a more quantitative assessment of the diversity of flora in the area under study.

RESULTS

We found a total of 132 species present in the fen (F), cedar swamp (CS), and intermediate area (I), of which 121 were native and 11 were adventives (see Table 1 for a summary of this data). The $\bar{C}$ for the 132 species present in the three locations (F, CS, I) was 4.48, and the FQI was 51.52. Physiognomic categories contributing to the site included trees, shrubs, vines, forbs, grasses, sedges, ferns, and fern allies. A complete list of species found in the Inland Waterway Nature Preserve, including representative of physiognomic category and relative abundance, can be found in Appendix A.

We divided the preserve into two ecosystems: fen and cedar swamp. Each of these ecosystems included species present in the intermediate area. In the fen, the most abundant sedges found included *Carex lasiocarpa*, *Eleocharis intermedia*, *Schoenoplectus acutus*, *Schoenoplectus tabernaemontani* (*Scirpus validus*), and *Carex flava*. The most abundant grasses were *Calamagrostis Canadensis* and *Calamagrostis stricta*. The most abundant shrubs found in the fen included *Potentilla fruticosa*, *Triadenum fraseri*, and *Myrica gale*. We only found one species of fern (*Thelypteris palustris*). Species with a C value of 10 included *Calamagrostis stricta*, *Utricularia cornuta, Muhlenbergia glomerata, Lobelia kalmii, Cladium marsicoides*, and *Andromeda glaucophylla.*

In the cedar swamp, the most abundant forbs included *Epilobium parviflorum*, *Rubus pubescens,* and *Trientalis borealis*. Understory species found included *Rubus parviflorus*, *Cornus amomum*, *Thelypteris palustris*, *Selaginella rupestris*, *Parthenocissus quinquefolia*, *Osmunda regalis*, and *Lonicera canadensis*. Overstory species found in the cedar swamp included *Abies balsamea* and *Thuja occidentalis*. Species with a C of 10 included *Ribes hudsonianum*.

We analyzed texture and pH of the soil from the preserve (Table 2). Soil texture at the water's edge and in the fen was light in color and clay in texture. The cedar swamp and intermediate zone samples were very dark and high in organic matter. The soil substrate in these ecosystems was identified as peat. Both ecosystems were moderately alkaline with pH from 7.68 to 7.98.

DISCUSSION

The purpose of this study was to use the FQA and supplemental tools to determine the habitat type and natural significance of the Inland Waterway Nature Preserve. The information generated in this study includes a comprehensive species list, each species' coefficient of conservatism (C), a mean coefficient of conservatism ($\bar{C}$), and a Floristic Quality Index (FQI) number for the whole system. Each factor contributes to assessing the fen as an ecosystem in order to aid the Little Traverse Conservancy in management and decision making for this area and related habitats.

FQA and Coefficients of Conservatism

The overall $\bar{C}$ of the Inland Waterway Nature Preserve is 4.48. This number can be used to compare this site to similar ecosystems. The preserve has an overall Floristic Quality Index of

51.52. The $\bar{C}$ for the fen area of the preserve is 4.72, with an FQI value of 37.21. The cedar swamp has a $\bar{C}$ of 4.03 and an FQI value of 42.14. Areas of Michigan with an FQI higher than 35 deserve heightened conservation efforts as they are considered to represent ecosystems that are floristically important and sufficiently faithful to pre-settlement conditions (Herman, 2001). Therefore both the fen and the cedar swamp are independently worthy of conservation with FQI values about 35. Areas with an FQI of 50 or more are considered extremely rare and significantly represent Michigan's native natural landscapes (Herman, 2001). After adding species from both the fen and cedar swamp, the preserve had an overall FQI of over 50. Therefore, by FQI standards, it is a rich site worth protecting due to its biodiversity and importance as a rare Michigan ecosystem.

Assessment of the Inland Waterway Fen

We determined the main ecosystem types of the Inland Waterway Nature Preserve to be a northern fen and rich conifer swamp with a transitional zone between the two. While the fen is located near a waterway and shares some characteristics of a costal fen, we categorized it as a northern fen based on its location north of the climatic tension zone, moderately alkaline clay soil, and abundance of *Carex lasiocarpa, Myrica gale, Eriophorum spissum, Lobelia kalmii, Rynchospora alba,* and *Cladium mariscoides*. We identified the rich conifer swamp ecosystem based on the dominance of *Thuja occidentalis* and Fraxinus nigra ~~*Larix laricina*~~, the lack of a tall shrub layer, and a substrate consisting of moderately alkaline woody peat.

All fens are in contact with a source of mineral-rich, aerated water—in our case the Crooked River (Crum, 1991). Because the inland water route is heavily trafficked, shore erosion from wake is a possible concern. However, the presence of rooted sedges, grasses, woody plants, and the clay composition of the soil will most likely prevent erosion from being a major issue.

The proximity of the Crooked River/ Alanson Lock also has potential to affect the fen ecosystem. In most "natural" habitats, the water table and river level will shift from year to year depending the amounts of precipitation, evaporation, transpiration and runoff that occur, in addition to the amount of water absorbed by the soil. At the fen in the Inland Waterway Nature Preserve, the water level is held steady by the lock. This means that the natural fluctuation of water, and correlating microhabitats that were present before the lock was built, no longer occurs. We cannot draw any conclusions about what this means from the information we have, but it is likely that the lack of frequent flooding has caused some wetland plant species that rely on periodic inundation to be out-competed by plants that are more adapted to steady water levels. It is also possible that the steady water level has caused the plant community to be more established than other sites, with less opportunity for colonization by new species, including non-natives.

Species Presence, Species Abundance, Soil Analysis

We identified 121 native plant species within the fen and cedar swamp, the majority of which were found in relative abundance. We also found a number of plants that had very high coefficients of conservation, meaning that they are only found in very specific habitats. In the fen these were *Lobelia kalmia, Andromeda glaucophylla, Muhlenbergia glomerata, Calamagrostis stricta, Potentilla fruticosa, Sarracenia purpurea, and Utricularia cornuta*. In the transitional zone we found *Salix candida*, and in the cedar swamp we found *Ribes hudsonianum*.

The only non-native plant species that we found in any abundance within the fen and conifer swamp were *Phalaris arundinacea* (Reed Canary Grass), *Solanum dulcamara* (Nightshade), and *Lythrum salicaria* (Purple Loosestrife). None of these were dominant species, which implies that they are either recently introduced or are being held in check by competition and predation. The southern edge of the fen has an abundance of the native variety of *Phragmites australis* stems, which are believed to be two colonies of individuals. None of the *P. australis* individuals are of the invasive strain (Heather Siersma. 17 Aug, 2010 personal comm., sight observation).

Even though the number of non-native invasive plants in these ecosystems is very low when compared to the general flora, the proximity of the river presents another conservation concern. The movement of water from Round Lake and Crooked Lake past the fen of the Inland Waterway Nature Preserve provides an easy route for colonization by new plant species, including non-native invasives. The amount of boat traffic along this route also increases the likelihood of new plants being introduced, especially because many boats are brought in from other areas by trailer; as many invasive plants have yet to gain a foothold, it may be beneficial to monitor for invasive plants along the water's edge.

Caveats and Improvements

The Floristic Quality Assessment is not intended to be a stand-alone method for recognizing, monitoring, comparing, or restoring wetlands (Herman, 2001). It is intended, instead, to serve as one method to determine natural significance of a given area in Michigan (Herman, et al., 2001). Therefore, it should be noted that the FQA is not exhaustive and should be supplemented with other methods of assessing ecosystems. Though there is often overlap between fidelity to pre-settlement landscape and such factors, the FQA does not specifically take species endangerment status, rarity, or legal status into account (Herman 2001). It is important to note such species, and their importance in maintaining biological diversity, for future generations.

It should also be pointed out that the FQA for Michigan was developed in the 1990s based on the opinion of a few experienced botanists. Therefore, the coefficients of conservatism may be slightly subjective or outdated. Quantifying nature and estimating "pre-settlement conditions" are both difficult tasks, but are the foundation of the FQA. As both species and ecosystems are constantly evolving, it is important to return to and update current analyses.

In order to supplement the FQA for this study, rough estimates of species abundance were taken. Moreover, the main objective provided by the Little Traverse Conservancy was to compile a comprehensive species list. Regardless of the FQA, this task was accomplished to the best of our ability.

The species list is not entire, due to difficulties in identifying several plants. Typically, plant censuses for a given habitat take place over the course of multiple months to account for variations in plant phenology. It is best to visit a site multiple times during a season in order to find plants in fruit or flower, as this makes them much easier to identify. Our study took place over the course of 10 days, and we were therefore limited to one phenological phase, and missed the flowering or fruiting times of some plants. Some of these plants, lacking their reproductive anatomy, were impossible to identify by dichotomous key. These plants were excluded from the study, but present in the habitat. Further, some aspects of the project were subjective. Plants could have been misidentified in the field, and abundance values could vary based on opinion.

Concluding Remarks

The Inland Waterway Nature Preserve was found to contain a northern fen and a cedar swamp. Based on FQI analysis, both were of floristic significance. Overall, the preserve contains a high number of species faithful to pre-settlement habitats, which is indicative of rich biodiversity. Because of this, it is important to continue conservation and practice long-term management of the site. We recommend monitoring the abundance of invasive species, and limiting human activity that deteriorates the Preserve.

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TABLES

Table 1: Floristic Quality Data

Total Species	133
Native Species	121
Adventive Taxa	7
Species not found in	5
Mean coefficient of conservatism (Nt & Ad)	4.5469
FQI (Nt &Ad)	51.442

Table 2: Soil Data

	pH	Color Chart	Color	Texture
Water's Edge				
T1	7.69	10yr 3/2	very dark greyish brown	clay
T2	7.88	10yr 10/2	greyish brown	clay
T3	7.90	10yr 3/1	brownish black	clay
T4	7.95	10yr 3/1	brownish black	clay
Fen				
T1	7.68	10yr 5/2	greyish brown black	clay
T2	7.92	10yr 4/2	dark greyish brown	clay
T3	7.96	10yr 3/1	brownish black	clay
T4	7.93	10 yr 2/2	very dark brown	clay
Intermediate				
T1	7.69	10yr 2/1	black	peat
T2	7.87	10yr 4/2	dark greyish brown	peat
T3	7.98	10yr 2/1	black	peat
T4	7.88	10yr 2/1	black	peat
Cedar Swamp				
T1	7.80	10yr 10/2	light brownish grey	peat
T2	7.95	10yr 2/1	black	peat
T3	7.95	10yr 2/1	black	peat
T4	7.94	10yr 2/1	black	peat

FIGURE 2 Photograph of the fen at the Inland Waterway Nature Preserve. Taken on 8/18/2010.

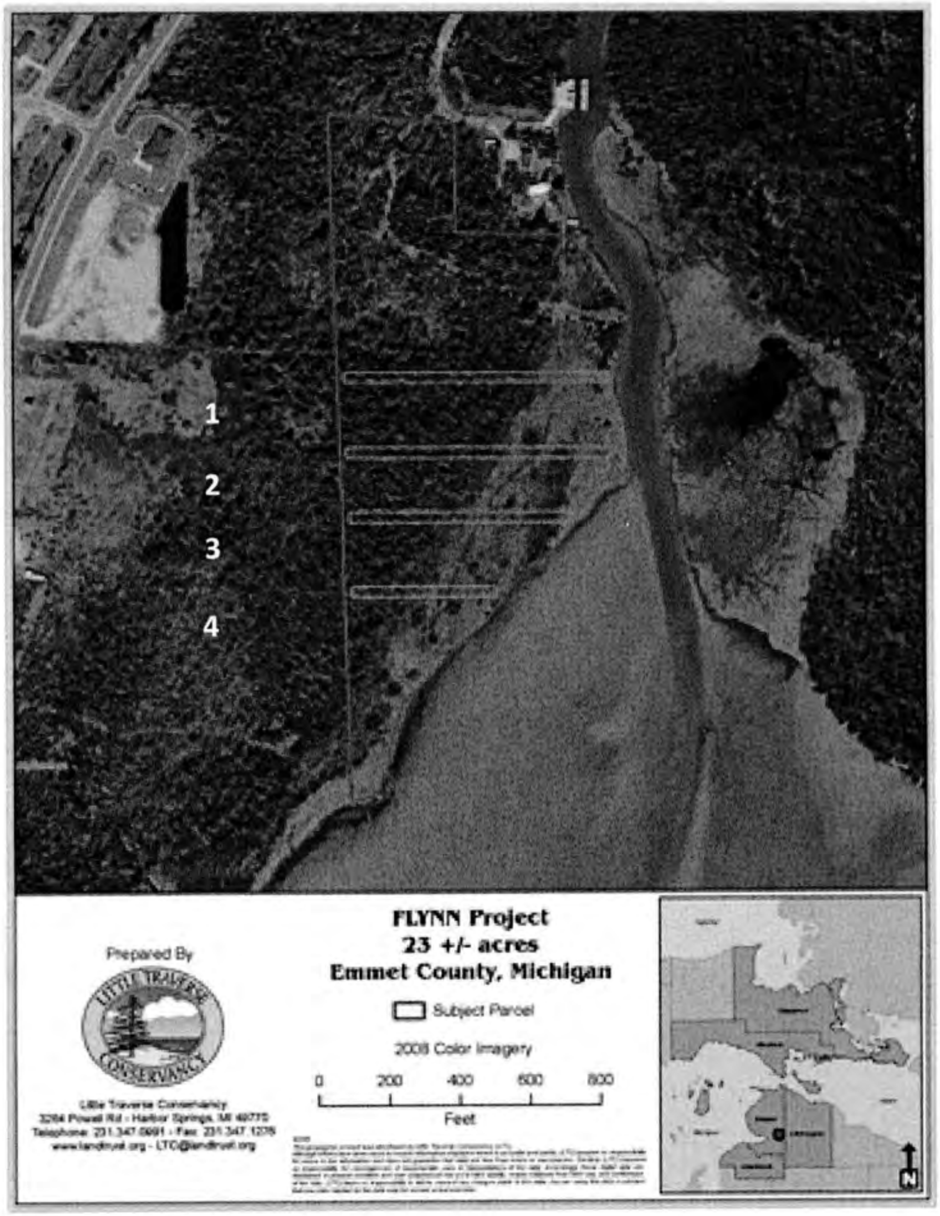

FIGURE 3 Inland Waterway Nature Preserve. Transects 1-4 illustrated from North to South.

APPENDIX A

KEY

Acronym = Six different reference code for each taxa
C = Coefficient of Conservatism
Nt = Native Taxa
- A = Annual
- B = Biennial
- P = Perennial

AD = Adventive Taxa
* = Adventive Taxa [Defaults to 0 (zero) in the 2000 FQA Computer Program]
PHYS = Physiogomy
F = Fen
CS = Cedar Swamp
I = Intermediate Area Between Fen and Cedar Swamp
Abundance:
- 1 = Individual
- 2 = Few
- 3 = Interspersed
- 4 = Abundant
- 5 = Dominant

Floristic Quality Assessment with wetland categories and examples of computer applications for the state of Michigan (Herman et al., 2001).

ACRONYM	C	SCIENTIFIC NAME	PHYS	COMMON NAME	LOCATION	ABUNDANCE
-	0	PICEA PUNGENS	Ad Tree	Blue Spruce	I/CS	2
ABIBAL	3	Abies balsamea	Nt Tree	Balsam Fur	CS	3
ACERUB	1	Acer rubrum	Nt Tree	Red Maple	CS	1
AGRCAN	0	AGROSTIS GIGANTEA	Ad P-Grass	Redtop	F/I	2
ALNRUG	5	Alnus rugosa	Nt Shrub	Tag Alder	F/CS	2
ANDGLA	10	Andromeda glaucophylla	Nt Shrub	Bog Rosemary	F	2
ANECAN	4	Anemone canadensis	Nt P-Forb	Canada Anenome	CS	1
ARANUD	5	Aralia nudicaulis	Nt P-Forb	Wild Sarsaparilla	CS	2
ARITRI	5	Arisaema triphyllum	Nt P-Forb	Jack-In-The-Pulpit	CS	2
AROPRU	5	Aronia prunifolia	Nt Shrub	Black Chokeberry	F	3
ASCINC	6	Asclepias incarnata	Nt P-Forb	Swamp Milkweed	F/CS	1
ASCSYR	1	Asclepias syriaca	Nt P-Forb	Common Milkweed	CS	1
ASTLAN	2	Aster lanceolatus	Nt-Forb	Eastern Lined Aster	CS	2
ASTLAT	2	Aster lateriflorus	Nt P-Forb	Side-Flowering Aster	F/CS	1
ATHFIL	4	Athyrium filix-femina	Nt Fern	Lady Fern	CS	3
BETPAP	2	Betula papyrifera	Nt Tree	Paper Birch	CS	2
BROCLI	6	Bromus ciliatus	Nt P-Grass	Fringed Brome	CS	2
CALCAN	3	Calamagrostis canadensis	Nt P-Grass	Blue-Joint Grass	I	4

ACRONYM	C	SCIENTIFIC NAME	PHYS	COMMON NAME	LOCATION	ABUNDANCE
CALSTR	10	Calamagrostis stricta	Nt P-Grass	Narrow-Leaved Reedgrass	F/I	3
CALTPA	6	Caltha palustris	Nt P-Forb	Marsh-Merigold	CS	2
CAMAPR	7	Campanula aparinoides	Nt P-Forb	Marsh Bellflower	F	1
CAUTHA	5	Caulophyllum thalictroides	Nt P-Forb	Blue Cohosh	CS	2
CHEGLB	7	Chelone glabra	Nt P-Forb	Turtlehead	CS	1
CICBUL	5	Cicuta bulbifera	Nt P-Forb	Water Hemlock	CS	1
CIRPAL	0	CIRSIUM PALUSTRE	Ad B-Forb	Marsh-Thistle	CS	2
CLAMAR	10	Cladium marsicoides	Nt P-Sedge	Twig-Rush	F	3
CLEVIR	4	Clematis virginiana	Nt W-Vine	Virgin's Bower	CS	2
COPTRI	5	Coptis trifolia	Nt P-Forb	Goldthread	CS	3
CORAMO	2	Cornus amomum	Nt Shrub	Silky Dogwood	F/CS	3
CORCAA	6	Cornus canadensis	Nt Shrub	Bunchberry	CS	2
CORSTO	2	Cornus stolonifera	Nt Shrub	Red-Osier Dogwood	I/CS	2
CXAQUA	7	Carex aquatilis	Nt P-Sedge	Sedge	CS/F	4
CXFLAV	4	Carex flava	Nt P-Sedge	Sedge	F/CS	4
CXINTU	3	Carex intumescens	Nt P-Sedge	Sedge	CS	1
CXLASI	8	Carex lasiocarpa	Nt P-Sedge	Sedge	F	5
CXPENS	4	Carex pennsylvanica	Nt P-Sedge	Sedge	CS	3
DRYCRI	6	Dryopteris cristata	Nt Fern	Crested Shield Fern	CS	2
DRYINT	5	Dryopteris intermedia	Nt Fern	Evergreen Woodfern	CS	2
ELEINT	7	Eleocharis intermedia	Nt A Sedge	Spike-Rush	F	4
ELYVIR	4	Elymus virginicus	Nt P-Grass	Virginia Wild Rye	CS	2
EPIPAR	0	EPILOBIUM PARVIFLORUM	Ad P-Forb	Willow-Herb	CS	4
EQUARV	0	Equisetum arvense	Nt Fern Ally	Common Horsetail	CS	3
EQUSYL	5	Equisetum sylvaticum	Nt Fern Ally	Giant Horsetail	CS	2
ERISTR	4	Erigeron strigosus	Nt P-Forb	Daisy Fleabane	F	1
EUPMAM	4	Eupatorium maculatum	Nt P-Forb	Joe-Pye Weed	F/CS	3
EUPPER	4	Eupatorium perfoliatum	Nt P-Forb	Common Boneset	F	2
EUTGRA	3	Euthamia graminifolia	Nt P-Forb	Grass-Leaved Goldenrod	F/I	3
FRAAME	5	Fraxinus americana	Nt Tree	White Ash	CS	2
FRANIG	6	Fraxinus nigra	Nt Tree	Black Ash	F/I/CS	3
FRAVIR	2	Fragaria virginiana	Nt P-Forb	Wild Strawberry	F/CS	2
GALTRR	4	Galium triflorum	Nt P-Forb	Fragrant Bedstraw	CS	2
GAUHIS	8	Gaultheria hispidula	Nt Shrub	Creeping Snowberry	CS	2
GENRUB	7	Gentiana rubricaulis	Nt P-Forb	Great Lakes Gentian	F	1
GEURIV	7	Geum rivale	Nt P-Forb	Purple Avens	CS	1
GLYSTR	4	Glyceria striata	Nt P-Grass	Fowl Manna Grass	CS	3

ACRONYM	C	SCIENTIFIC NAME	PHYS	COMMON NAME	LOCATION	ABUNDANCE
GYMDRY	5	Gymnocarpium dryopteris	Nt Fern	Oak Fern	CS	3
ILEVER	5	Ilex verticillata	Nt Shrub	Michigan Holly	CS	1
IRIVER	5	Iris versicolor	Nt P-Forb	Wild Blue Flag	F/CS	2
LARLAR	5	Larix larIcina	Nt Tree	Tamarack	F/CS	1
LATPAL	7	Lathyrus palustris	Nt P-Forb	Marsh Pea	F	2
LINBOR	6	Linnaea borealis	Nt P-Forb	Twinflower	CS	2
LOBKAL	10	Lobelia kalmii	Nt P-Forb	Bog Lobelia	F	1
LONCAN	5	Lonicera canadensis	Nt Shrub	American Honeyuckle	I/CS	3
LYCAME	2	Lycopus americanus	Nt P-Forb	Common Water-Horehound	CS	1
LYCUNI	2	Lycopus uniflorus	Nt P-Forb	Northern Bugal Weed	F/I/CS	1
LYSTHY	6	Lysimachia thyrsiflora	Nt P-Forb	Tufted Loosestrife	CS	1
LYTSAL	0	LYTHRUM SALICARIA	Ad P-Forb	Purple Loosestrife	F/CS	1
MAICAC	4	Maianthemum canadense	Nt P-Forb	Canada Mayflower	CS	3
MENARV	3	Mentha arvensis	Nt P-Forb	Wild Mint	CS	3
MILEFF	8	Milium effusm	Nt P-Grass	Wood Millet	CS	2
MILEFF	8	Milium effusm	Nt P-Grass	Wood Millet	CS	2
MUHGLO	10	Muhlenbergia glomerata	Nt P-Grass	Marsh Wild-Timothy	F	2
MYOLAX	6	Myosotis laxa	Nt P-Forb	Smal Forget-Me-Not	CS	1
MYRGAL	6	Myrica gale	Nt Shrub	Sweet Gale	F/I	4
ONOSEN	2	Onoclea sensibilis	Nt Fern	Sensitive Fern	CS	1
OSMCIN	5	Osmunda cinnamomea	Nt Fern	Cinnamon Fern	CS	2
OSMREG	5	Osmunda regalis	Nt Fern	Royal Fern	CS	3
OSTVIR	5	Ostrya virginiana	Nt Tree	Ironwood; Hop Hornbeam	CS	2
PARQUI	5	Parthenocissus quinquefolia	Nt W-Vine	Virginia Creeper	CS	4
PHAARU	0	Phalaris arundinacea	Nt P-Grass	Reed Canary Grass	CS	4
PHRAUS	0	Phragmites australis	Nt P-Grass	Reed	I	3
PICGLA	3	Picea glauca	Nt Tree	White Spruce	CS	2
PICMAR	6	Picea mariana	Nt Tree	Black Spruce	CS	1
PINRES	6	Pinus resinosa	Nt Tree	Red Pine	CS	1
PINSTR	3	Pinus strobus	Nt Tree	White Pine	CS	1
POATRI	0	POATRIVALIS	Ad P-Grass	Bluegrass	I	2
POPGRA	4	Populus grandidentata	Nt Tree	Big-Toothed Aspen	CS	2
POTFRU	10	Potentilla fruticosa	Nt Shrub	Shrubby Cinquefoil	F	4
PRUSER	2	Prunus serotina	Nt Tree	Wild Black Cherry	CS	2
PRUVIR	2	Prunus virginiana	Nt Shrub	Choke Cherry	I	2
PRUVUL	0	Prunella vulgaris	Nt P-Forb	Lawn Prunella	CS	2
PYRASA	8	Pyrola asarifolia	Nt P-Forb	Pink Pyrola	CS	2
RHAALN	8	Rhamnus alnifolia	Nt Shrub	Alder-Leaved	F/CS	2

ACRONYM	C	SCIENTIFIC NAME	PHYS	COMMON NAME	LOCATION	ABUNDANCE
				Buckthorn		
RHYALB	6	Rhynchospora alba	Nt P-Sedge	Beak Rush	F	3
RIBCYN	4	Ribes cynosbati	Nt Shrub	Wild Gooseberry	CS	2
RIBHUD	10	Ribes hudsonianum	Nt Shrub	Northern Black Currant	CS	2
RIBLAC	6	Ribes lacustre	Nt Shrub	Swamp Black Currant	CS	2
ROSBLA	3	Rosa blanda	Nt Shrub	Wild Rose	I	3
RUBPAR	6	Rubus parviflorus	Nt Shrub	Thimbleberry	CS	3
RUBPUB	4	Rubus pubescens	Nt P-Forb	Dwarf-Raspberry	CS	4
RUBSTR	2	Rubus strigosis	Nt Shrub	Wild Red Raspberry	CS/I	2
SALCAN	9	Salix candida	Nt Shrub	Hoary Willow	F/I	1
SALMYR	9	Salix myricoides	Nt Shrub	Blueleaf Willow	F	1
SARPUP	10	Sarracenia purpurea	Nt P-forb	Pitcher-plant	I/CS	3
SCHACU	5	Schoenoplectus acutus	Nt P-Sedge	Hardstem Bulrush	F	4
SCHTAB	4	Schoenoplectus tabernaemontani (Scirpus validus)	Nt P-Sedge	Softstem Bulrush	F	4
SCHTAB	4	Schoenoplectus tabernaemontani (Scirpus validus)	Nt P-Sedge	Softstem Bulrush	F	4
SCIATR	3	Scirpus atrovirens	Nt P-Forb	Bulrush	CS	2
SCICYP	5	Scirpus cyperinus	Nt P-Forb	Wool-Grass	CS	2
SCUGAL	5	Scutellaria galericulata	Nt P-Forb	Common Skullcap	CS	1
SELRUP	8	Selaginella rupestris	Nt Fern Ally	Sand Club Moss	CS	3
SOLCAN	1	Solidago canadensis	Nt P-Forb	Canada Goldenrod	F	2
SOLDUL	0	SOLANUM DULCAMARA	Ad P-Forb	Bittersweet Nightshade	CS	3
SOLJUN	3	Solidago juncea	Nt P-Forb	Early Goldenrod	F/CS	1
SOLRUG	3	Solidago rugosa	Nt P-Forb	Rough Goldenrod	F/CS	1
SOLSPE	5	Solidago speciosa	Nt P-Forb	Showy Goldenrod	F/I	2
TAROFF	0	TARAXACUM OFFICINALE	Ad P-Forb	Common Dandelion	CS	2
THADAS	3	Thalictrum dasycarpum	Nt P-Forb	Purple Meadow-Rue	F/CS	1
THEPAL	2	Thelypteris palustris	Nt Fern	Marsh Fern	F/I	4
THEPHE	5	Thelypteris phegopteris	Nt Fern	Northern Beech-Fern	CS	2
THUOCC	4	Thuja occidentalis	Nt Tree	Arbor Vitae	F	3
TOXRAR	2	Toxicodendron radicans	Nt W-Vine	Poison-Ivy	I/CS	4
TRIBOR	5	Trientalis borealis	Nt P-Forb	Starflower	CS	4
TRIFRA	6	Triadenum fraseri	Nt P-Forb	Marsh St.John's Wort	F	4
TYPANG	0	TYPHA ANGUSTIFOLIA	Ad P-Forb	Narrow-Leaved-Cat-Tail	F	2
TYPLAT	1	Typha latifolia	Nt P-Forb	Broad-Leaved-Cat-Tail	CS	2
ULMRUB	2	Ulmus rubra	Nt Tree	Slippery Elm	I	1

ACRONYM	C	SCIENTIFIC NAME	PHYS	COMMON NAME	LOCATION	ABUNDANCE
UTRCOR	10	Utricularia cornuta	Nt A-Forb	Horned Bladderwort	F	3
VACMAC	8	Vaccinium macrocarpon	Nt Shrub	Large Cranberry	F	3
VACMR	4	Vaccinium mrytiloides	Nt Shrub	Canada Blueberry	CS	1
VIBLEN	4	Viburnum lentago	Nt Shrub	Nannyberry	F/CS	2
VIBOPO	0	VIRBURNUM OPULUS	Ad Shrub	European Highbush Cranberry	F/I	2