Natural Community Delineation and Floristic Quality Assessments of Grass River Natural Area, Antrim County, Michigan

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For:

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Cover photographs: *Utricularia cornuta* in northern fen, MI #1A, Antrim Co., Mich., June 20, 2017; *Sarracenia purpurea* in rich conifer swamp, DELANGE #1B, Antrim Co., MI, June 23, 2017. All photographs in report by R.A. Hackett unless otherwise noted.

Table of Contents

Figures

Tables

Appendices

Cypripedium parviflorum **(yellow lady-slipper) was found in northern fen, rich conifer swamp and poor conifer swamp in GRNA. Photo by Liana May.**

Executive Summary

In the summer 2017, Michigan Natural Features Inventory contracted with Grass River Natural Area (GRNA) to delineate natural communities and conduct floristic quality assessments on their properties. Nine natural communities were identified among the property parcels with a pooled species richness of 368. GRNA is dominated by rich conifer swamp, mesic northern forest, and northern fen, with smaller components of emergent marsh, northern wet meadow, northern shrub thicket, poor conifer swamp, hardwood-conifer swamp and dry-mesic northern forest. Eleven potential vernal pools were mapped and require spring surveys for confirmation. The open wetland communities along Grass River were in good condition with many signs of wildlife and few non-native species and should be prioritized for protection.

The northern fen areas meet criteria for an A/B-ranked natural community element occurrence for the Biotics database. This is the second largest occurrence of 31 northern fens in northern Lower Michigan and one of only six in the region that are ranked A/B. Rich conifer swamp, northern fen and northern wet meadow have FQIs over 50 and are of considerable biodiversity value to the state. Poor conifer swamp, hardwood-conifer swamp and mesic northern forest have FQIs greater than 35 and are floristically important. Twenty percent of the documented flora has C values greater than seven, including 22 species with C values of 10. As a whole, the natural communities at GRNA comprise a significant biodiversity hotspot amidst a highly fragmented landscape that is highly deserving of its status and protection as a natural area.

Twenty-seven species were documented as new Antrim County records for the Michigan Flora. A suspected occurrence of *Sarracenia purpurea* f. *heterophylla* (yellow pitcher plant) was photographed and mapped; however, confirmation requires inspection of flowers which were not present during surveys. This rare form of pitcher plant was recently delisted from its state threatened status. No federal or state threatened or endangered species were observed, however, many occurrences of orchids, carnivorous plants, parasitic plants, and coral fungi were documented. Future surveys could target state threatened *Calypso bulbosa* (calypso orchid) and special concern *Cypripedium arietinum* (ram's-head orchid), both of which have been documented in Antrim County. Other listed species that occur in nearby counties could also be sought, including state threatened *Berula erecta* (cut-leaved water-parsnip), state threatened *Gymnocarpium robertianum* (limestone oak fern) and federal and state endangered *Mimulus michiganensis* (Michigan monkey-flower). Several animals could be targeted as well, including federal and state endangered *Somatochlora hineana* (Hine's emerald dragonfly), special concern *Accipiter gentilis* northern (goshawk), state threatened *Buteo lineatus* (red-shouldered hawk), special concern *Emydoidea blandingii* (Blanding's turtle) and state threatened *Sistrurus catenatus* (eastern massassauga).

Eighteen invasive species of high concern were documented during surveys, most of which were in low abundance, providing an invaluable window of opportunity for early detection and response. It is recommended that a dedicated effort be undertaken to map, prioritize and manage them as soon as possible to prevent ecological degradation and to minimize costs and maximize success of control efforts. Management should focus on preventing new species from arriving and existing species from spreading into the highest quality and most valued areas.

Introduction

In summer 2017, Michigan Natural Features Inventory (MNFI) contracted with Grass River Natural Area (GRNA) to conduct vegetative surveys of the Natural Area, with a focus on wetlands. Priorities for this study were to delineate the natural communities and conduct baseline plant inventories and floristic quality assessments (FQAs) for each type. Plant species that are rare, of special interest, or invasive were also documented, and potential vernal pools were mapped. In addition, recently acquired or rarely visited parcels were prioritized for survey. The most recent comprehensive survey of Grass River Natural Area was conducted 34 years prior (ER Squiers & Associates 1983). The 2017 study was intended to update the plant communities described in that report with current plant species lists and delineation of natural communities according to those defined in Cohen et al. (2015).

Survey Site

Grass River Natural Area is in Antrim County, Michigan, south of Bellaire and north of Alden Highway **(**Figure 1, 2). Most parcels (Figure 3) occur along the banks of the Grass River between Lake Bellaire and Clam Lake stretching to a rail-trail, derived from the former Pere-Marquette Railway (Galbraith & U.S. Railway Mail Service 1897, Meyers et al. 1987). Several properties occur south of the rail-trail and several are on the north shores of Lake Bellaire and Clam Lake. These properties total approximately 1492 acres, including seven miles of trails (GRNA 2016).

Figure 1. Haley Breniser, Executive Director of GRNA, enjoys a loon visiting Clam Lake.

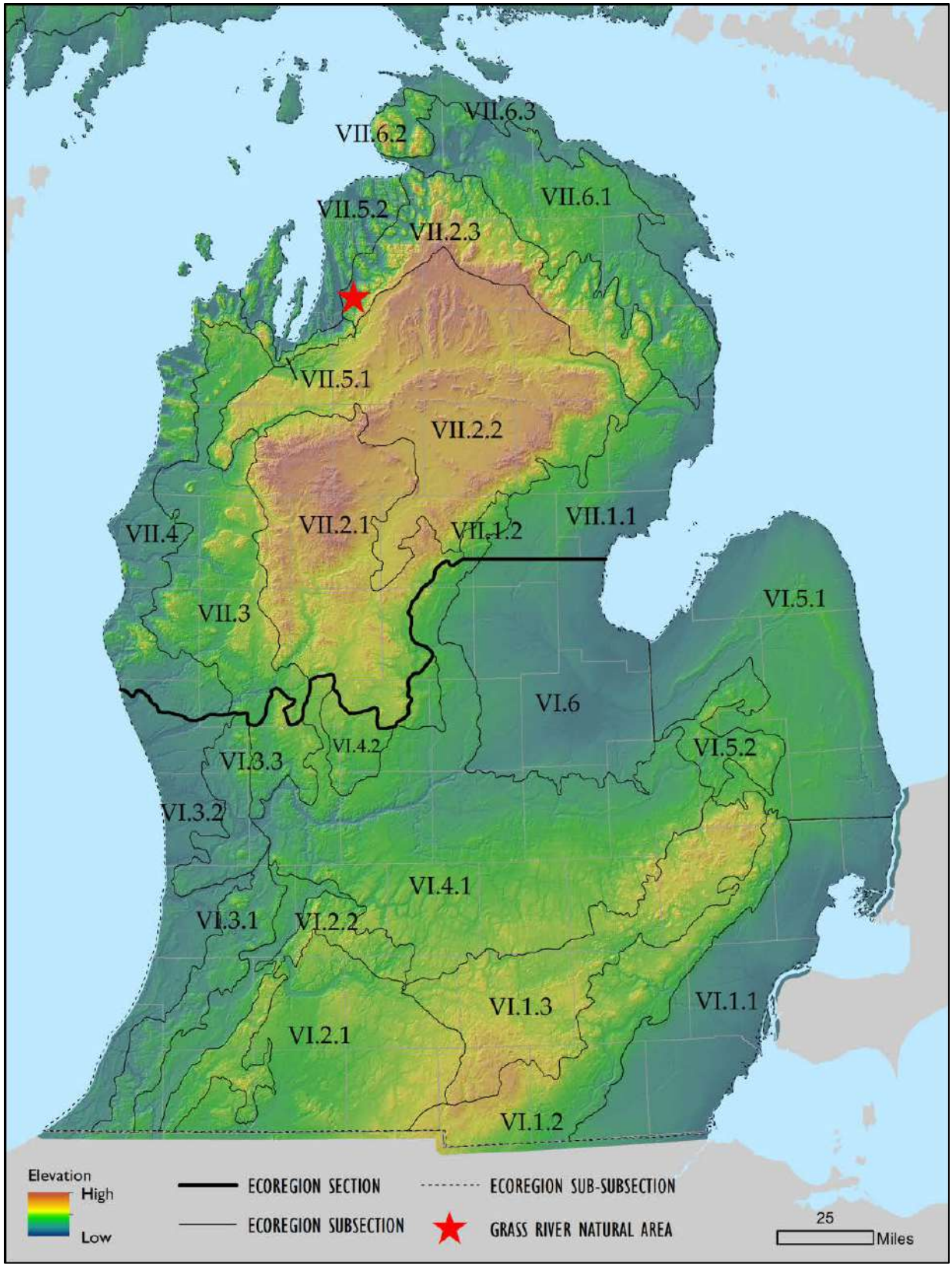

Figure 2. Location of GRNA in Sub-subsection VII.2.3 Vanderbilt Moraines.

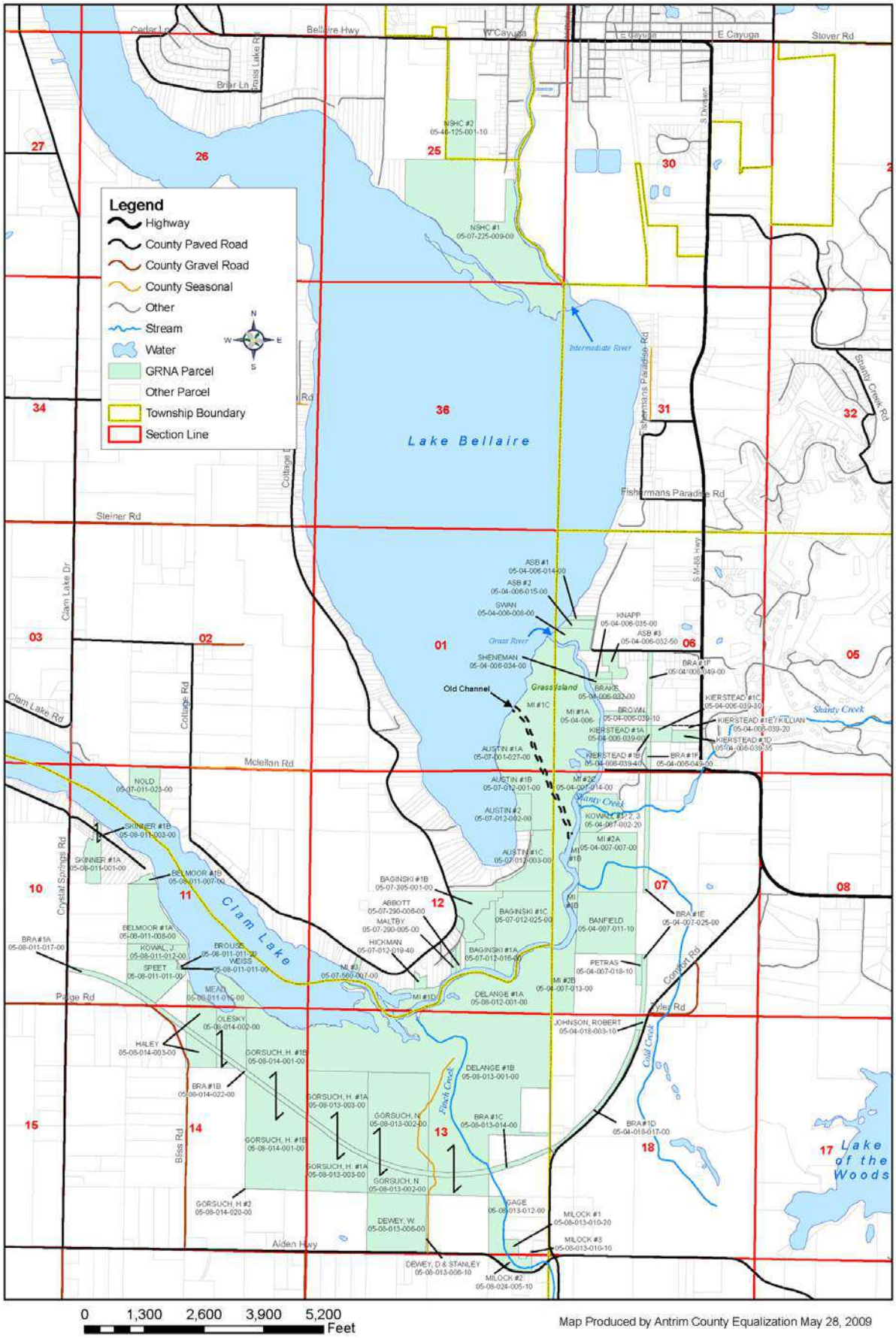

Figure 3. Grass River Natural Area Parcel Map.

GRNA is located in the western portion of the Vanderbilt Moraines Sub-subsection (VII.2.3) approximately two kilometers from the neighboring Traverse City Sub-subsection (VII.5.3) (Albert 1995, Figure 2). The Vanderbilt Moraines Sub-subsection is comprised of morainal ridges that make up some of the steepest topography in Michigan's Lower Peninsula. Outwash channels and plains were created when the Valders glacial front retreated to the north (ER Squiers & Associates 1983). As the ice sheet melted, meltwater streams flowed and self-sorted sediment as it became too heavy or large to carry. These channels and plains adjacent to steep moraines create conditions for groundwater fed streams and springs and their associated wetland communities. Because much of the underlying bedrock is limestone, the groundwater is laden with calcium and magnesium, facilitating the development of calciphytic communities including northern fen and rich conifer swamp (Figure 4). The circa 1800 landcover map (Figure 5) classified the historic forested wetlands as cedar and mixed conifer swamp and the open wetlands as shrub swamp and emergent marsh. Upland forested communities in the Vanderbilt Moraines Sub-subsection were predominantly mesic northern forests. The current study shows a finer scale delineation of natural communities present today, including significant components of northern wet meadow and northern fen within the historical emergent marsh category, and poor conifer swamp, rich conifer swamp and hardwood-conifer swamp within the historical cedar and mixed conifer swamp.

Figure 4. Groundwater-influenced northern fen adjacent to moraine observed from the MI #1 parcel.

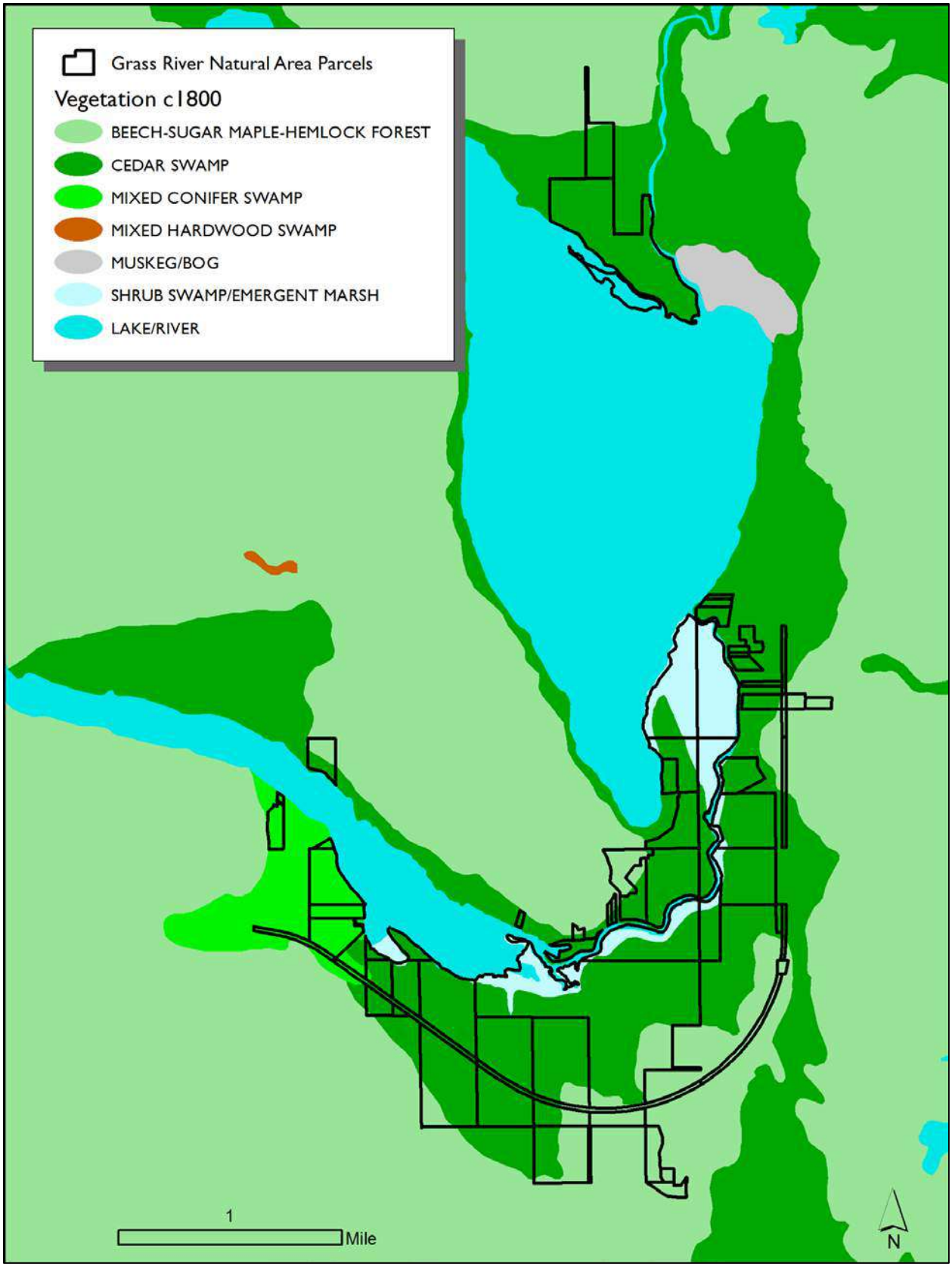

Figure 5. Circa 1800 vegetation of GRNA.

Methods

In preparation for surveys, a comprehensive list of target species was developed using the 1983 report (ER Squiers & Associates) and MNFI's abstracts of natural communities likely to occur in the sub-subsection. Taxonomy was updated to that used in the Michigan Flora (Reznicek et al. 2011). Species targeted for collection were identified by comparing the overall target species list with the Michigan Flora Online to identify species that did not have an Antrim county specimen deposited in a herbarium. These species were collected, where possible, and submitted as new county records to update the Michigan Flora (Reznicek et al. 2011).

Meander surveys of potential natural communities were conducted June 9, from June 19 to June 23, and from August 14 to August 18, 2017. Natural communities were identified following Cohen et al. (2015). All species observed were recorded by natural community type and apparent threats were noted. Point occurrences of species of interest and invasive species were mapped and GPS tracks of surveys conducted were recorded using Back Country Navigator installed on a Samsung tablet. Photographs were taken to showcase each natural community and document significant boundaries to assist the delineation of natural communities. Notes were taken of any wildlife or wildlife sign encounters and photographs were captured when possible. Natural community ranking criteria (MNFI 1988) were utilized to determine whether any delineated natural communities met criteria for inclusion as element occurrences (EOs) in the Biotics database.

Vascular plants were identified and keyed in the field, or documented for later identification. Plant species requiring specimens from Antrim County for the Michigan Flora were collected if: 1) collection would not decimate the population, 2) the specimen was accessible, 3) there was a specimen in fruit or flower, and 4) the collector had made a note to collect that species.

Lists of vascular plant species were compiled for each natural community, pooled for all of sites surveyed at GRNA and entered into the Universal FQA Calculator (Freyman and Masters 2013) following the Michigan Floristic Quality Assessment (FQA) Database (Reznicek et al. 2014). Alpha diversity metrics of total, native, and non-native species richness, mean coefficient of conservatism (C) and the floristic quality index (FQI) were calculated. C values are a measure of a plant's fidelity to specific circa 1800 natural communities (conservatism), ranging from zero to ten, with high values indicating greater fidelity to specific natural habitats and lower values indicating more general habitat requirements. Mean C is calculated by summing all species C values and dividing the sum by the total number of species. The FQI is determined by multiplying the mean C by the square root of the species richness, which allows for better comparison between large sites with a greater number of species and small sites with fewer species. Generally, an FQI score less than 20 indicates that the site is of insignificant floristic value, a score greater than 35 indicates a floristically important site, and a score greater than 50 indicates a site with considerable biodiversity value to the state (Herman et al. 2001).

The 1983 report (ER Squiers & Associates) noted a concern about contaminants reaching the waters of GRNA from adjacent sites. Current potential risks to groundwater were investigated using the Michigan Department of Environmental Quality's risks to (MDEQ) Environmental Mapper (http://www.mcgi.state.mi.us/EnvironmentalMapper/). GRNA and surrounding areas were examined for *Land Use Restrictions* imposed for environmental contamination (e.g.,

restrictive covenant, notice of corrective action), *Environmental Management Notices* (e.g., leaking underground storage tanks, brownfields), and *Wellhead Protection Areas*. Further investigation of these risks or remediation actions was beyond the scope of this project.

Results

Natural Communities

Nearly all parcels were surveyed directly during at least one of the survey periods. Parcels referred to as ASB #3, KNAPP, SHEMEMAN, BRAKE, BROWN, KIERSTEAD, HALEY and OKLESLY were not accessed directly and their community composition was determined by views from adjacent areas via kayak or car, composition of surrounding areas, and aerial imagery.

Grass River Natural Area contains considerable botanical diversity supporting at least 368 species (315 native, 53 non-native) documented across nine natural community types (Table 1; Appendices 1-11). Occurrences of emergent marsh, northern wet meadow, northern fen, northern shrub thicket, poor conifer swamp, rich conifer swamp, hardwood-conifer swamp, dry-mesic northern forest, and mesic northern forest were delineated, including 185 acres of northern fen that met criteria for an A/B-ranked natural community EO (Figure 6, 7). One hundred and thirteen acres were significantly altered by anthropogenic disturbance, including pine plantations, residential properties, old fields, agricultural areas and a rail-trail that crosses through the southern portion of the natural area. These are considered anthropogenic systems, not natural communities.

Table 1. Summary of natural communities and anthropogenic communities documented in GRNA in 2017.

Natural Community	Abbr.	Class	Canopy	Area (Acres)	Percent native	Total FQI
Emergent marsh	EM	wetland	open	6	94.7	22.7
Northern wet meadow	NWM	wetland	open	49	93.5	55.5
Northern fen	NF	wetland	open	185	91.8	68.7
Northern shrub thicket	NST	wetland	shrub	41	96.2	26.5
Poor conifer swamp	PCS	wetland	forested	82	98.5	46.0
Rich conifer swamp	RCS	wetland	forested	503	92.3	69.1
Hardwood-conifer swamp	HCS	wetland	forested	53	92.8	32.4
Dry-mesic northern forest	DMNF	upland	forested	30	89.1	39.2
Mesic northern forest	MNF	upland	forested	283	96.2	19.4
Anthropogenic systems	ANTH	upland	open, forested	113	67.9	24.0

Emergent marsh, northern fen, northern wet meadow and rich conifer swamp occurred directly adjacent to the Bellaire and Clam Lakes and the Grass River. Northern fens and northern wet meadow, transitioned to rich conifer swamp, poor conifer swamp or hardwood-conifer swamp, based on soils and groundwater influence. These transitioned with increasing elevation and soil drainage to dry-mesic or mesic northern forest. Northern shrub thicket occurred between northern wet meadow and rich conifer swamp on the north shore of Lake Bellaire near the mouth of the Intermediate River. Anthropogenic systems occurred mostly along the outer boundaries of the GRNA. Each of the natural communities and anthropogenic systems are described below.

Figure 6. *Phragmites australis* subsp. *americanus* (native reed/phragmites) was observed in northern fen in the DELANGE #1B parcel.

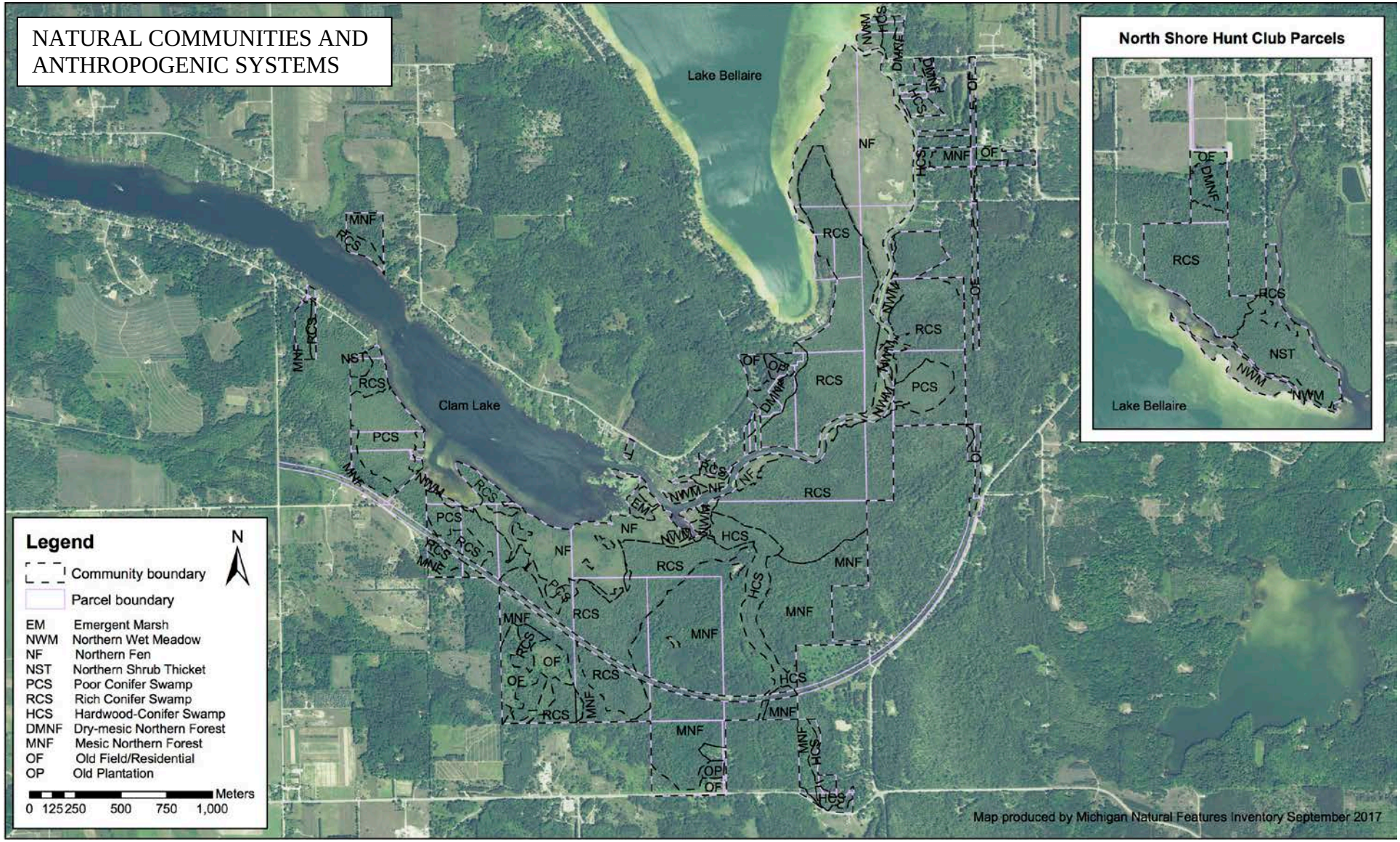

Figure 7. Natural communities and anthropogenic systems delineated within the parcel boundaries of GRNA are marked by dashed black lines. GRNA parcels are outlined in purple. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Emergent Marsh

Emergent marsh is an herbaceous wetland that is typically inundated with at least six inches of water the majority of the year (Figure 8). These marshes occur along the shores of rivers, lakes, and streams throughout Michigan and are subject to fluctuating water levels, seasonal flooding and flooding by beaver. Due to the continuous flooding of these wetlands, the vegetative community is composed predominantly of emergent and floating plants (Kost et al. 2007).

Figure 8. Emergent marsh along the edge of northern shrub thicket in the NSHC #3 parcel.

Emergent marsh (Figure 9) comprised approximately six acres of GRNA, primarily near the juncture of the Grass River and Clam Lake and along the Grass River just south of Lake Bellaire. The species richness was 19, with 18 native and one non-native species, and the total FQI was 22.7. The marshes were dominated by *Carex aquatilis* (sedge), *Carex lasiocarpa* (wire sedge), *Carex stricta* (tussock sedge), *Decodon verticillatus* (whorled loosestrife), *Lemna* spp. (duckweed), *Nuphar variegata* (yellow pond-lilies), *Nymphaea odorata* (sweet-scented waterlily), *Persicaria amphibia* (water smartweed), *Pontederia cordata* (pickerel-weed), *Schoenoplectus acutus* (hardstem bulrush), *S. tabernaemontani* (softstem bulrush), *Sparganium emersum* (green-fruited bur-reed), *S. eurycarpum* (common bur-reed) and *T. latifolia* (broad-leaved cat-tail). In areas more protected from wave action, *Utricularia vulgaris* (common bladderwort) was found. Patches of *Phragmites australis* var. *americanus* (native reed/ phragmites) were also noted in this community type.

The only non-native species observed in emergent marsh was the invasive *Typha angustifolia* (narrow-leaved cat-tail) which was sparse.

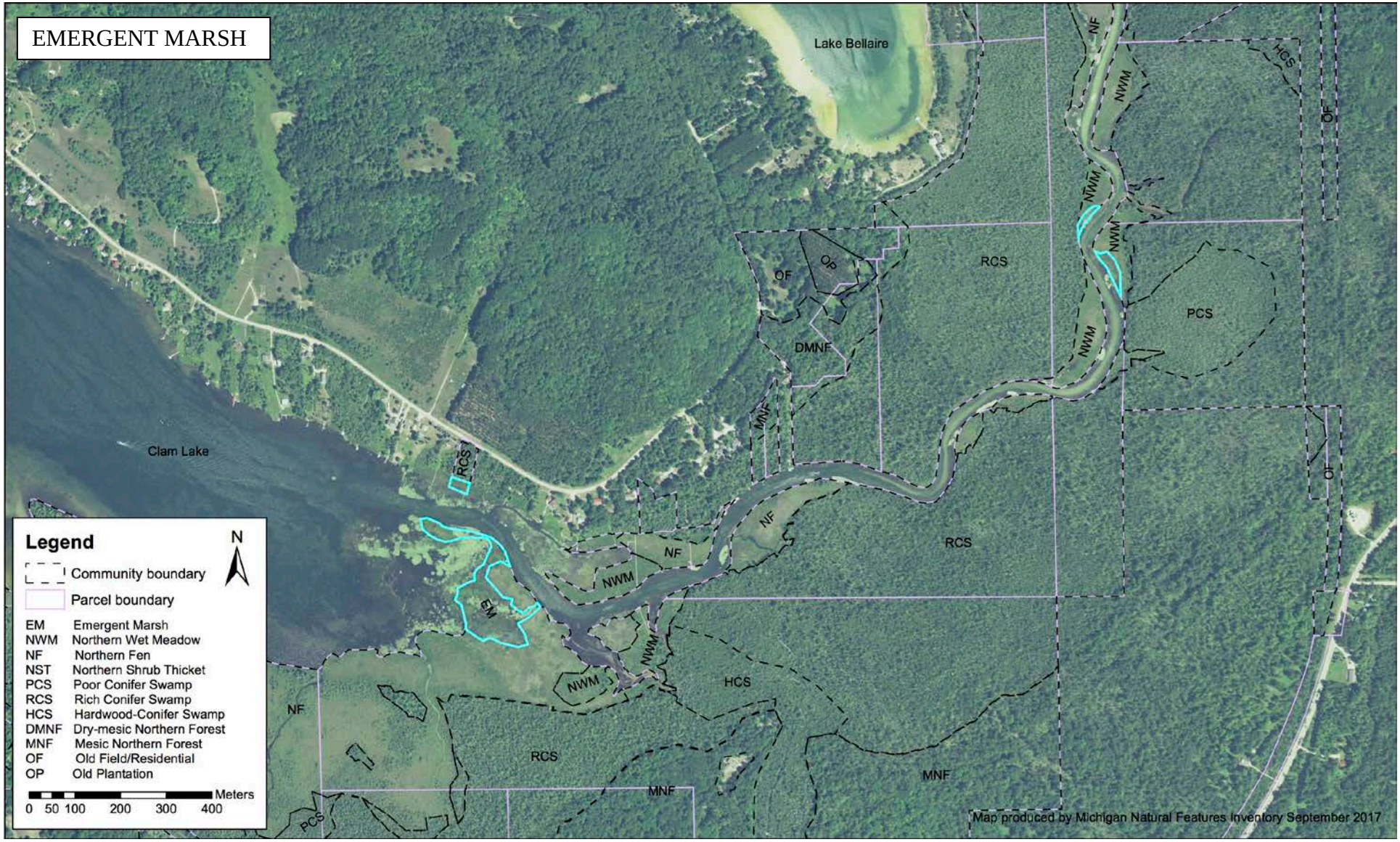

Figure 9. Emergent marsh delineated within the parcel boundaries of GRNA is highlighted in cyan. The purple lines outline parcels owned by GRNA. The black dashed lines outline natural communities within GRNA property.

Northern Wet Meadow

Northern wet meadow is an open wetland community dominated by sedges, grasses, and occasional small shrubs (Figure 10). It occurs along the borders of rivers and streams, and occasionally lakes and ponds, on strongly acidic to circumneutral sapric peat or sometimes on saturated mineral soils (Cohen and Kost 2007). It is primarily groundwater fed and is subject to seasonally fluctuating water levels. Water levels typically remain at or near the surface throughout the year.

Figure 10. Northern wet meadow borders the Grass River in the MI #2C parcel.

Northern wet meadow comprised approximately 49 acres of GRNA, bordering northern fen, rich conifer swamp, poor conifer swamp, and emergent marsh (Figure 11). The species richness was 123, with 115 native and 8 non-native species, and the total FQI was 55.5. The gradual transition between highly diverse and similar communities likely contributed to its high species richness. The community was mostly dominated by *Carex stricta* (sedge), with an abundance of *C. lasiocarpa* (wiregrass sedge), *Cladium mariscoides* (twig-rush), and *Calamagrostis stricta* (narrow-leaved reedgrass) with occasional *Carex utriculata* (sedge) and *C. interior* (inland sedge). Shrubby areas of *Myrica gale* (sweet gale) and *Dasiphora fruticosa* (shrubby cinquefoil) were frequent, and stunted *Thuja occidentalis* (northern white-cedar) and *Larix laricina* (tamarack) dotted the landscape. *Sarracenia purpurea* (pitcher plant) and *Platanthera psycodes* (purple fringed orchid) were occasionally observed. Patches of native phragmites were also noted here.

Occasional occurrences of invasive *Cirsium palustre* (marsh thistle), *Elaeagnus umbellata* (autumn olive), *Iris pseudacorus* (yellow flag), *Lythrum salicaria* (purple loosestrife) and narrow-leaved cat-tail were documented. These species are highly invasive and can spread quickly, displacing native species. Several other non-native species of less immediate concern were observed occasionally, including *Populus alba* (white poplar), bittersweet nightshade *and Mentha* x*piperita* (peppermint).

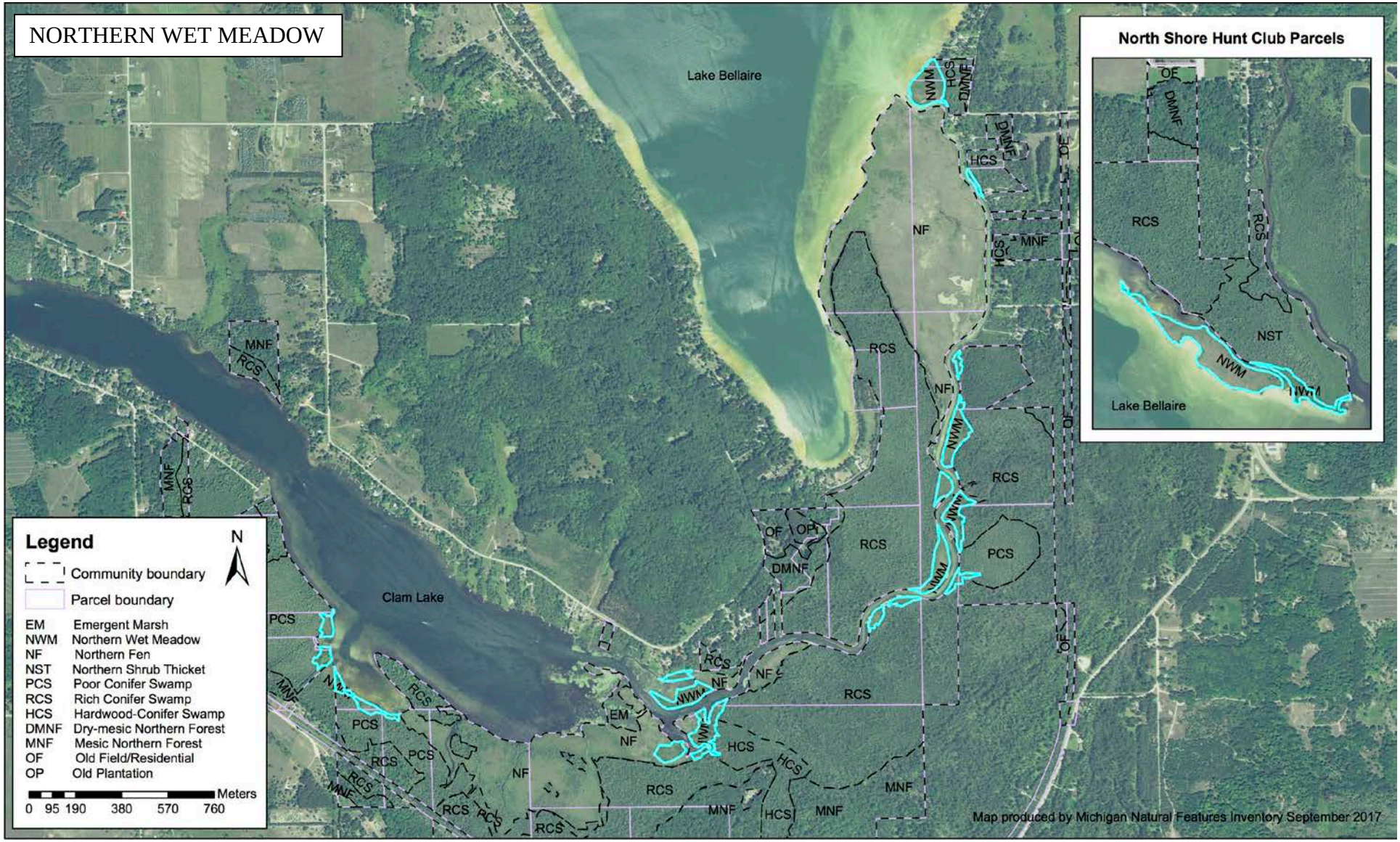

Figure 11. Northern wet meadow delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Northern Fen

Northern fen is a highly diverse, open canopy wetland system dominated by sedges rushes, forbs and shrubs, growing on neutral to moderately alkaline saturated peat and marl. It typically occurs where water infiltrates down through steep moraines overlaying dolomite and limestone bedrock producing cold, calcareous groundwater that seeps out from the base. Marl zones form where algae interact with the calcium and magnesium-rich groundwater to produce a gray mineral precipitate of calcium carbonate at the surface (Figure 12). Peat mounds carpeted by sphagnum, low-growing shrubby patches, and stunted conifers are also common (Figure 13). Variations in the amount of calcareous ground water seepage and lateral flow, flooding by beaver and occasional fires influence the species composition and structure and the formation of distinct vegetative zones.

Figure 12. *Utricularia cornuta* (horned bladderwort) growing in a marl zone of a northern fen in parcel MI #1A.

Northern fen comprised approximately 185 acres of GRNA, the third most abundant natural community documented during this inventory **(**Figure 19**). I**t borders northern wet meadow, poor conifer swamp, and rich conifer swamp. The species richness was 170, with 156 native and 14 non-native species and the total FQI was 65.2. The marl zones were dominated by twig-rush, *Rhynchospora alba* (beak rush), *Rhynchospora capillacea* (beak rush), *Schoenoplectus* spp. (bulrushes), *Triglochin maritima* (common bog arrow-grass), and *Utricularia* spp. (bladderworts). This zone transitions to a diversity of sedges, grasses, forbs, and small shrubs in the surrounding areas (Figure 14, 15). Several orchids, including *Calopogon tuberosus* (grass-pink), *Cypripedium parviflorum* (yellow lady-slipper), *Pogonia ophioglossoides* (rose pogonia),

and *Spiranthes cernua* (nodding ladies-tresses), were observed, as well as carnivorous *Sarracenia purpurea* (pitcher plant) and *Drosera rotundifolia* (round-leaved sundew). Patches of native phragmites were also noted.

Figure 13. Peat mounds covered with sphagnum mosses, sedges and stunted conifers in the GORSUCH H #1A parcel.

Figure 14. *Sarracenia purpurea* (pitcher plant) observed in the DELANGE #1B parcel.

Figure 15. Many forbs bloom in late summer among the sedges in northern fen in the DELANGE #1B parcel.

Wildlife, especially birds, was commonly encountered in the northern fen communities. Sandhill cranes (*Grus canadensis*), mute swans (*Cygnus olor*), trumpeter swans (*Cygnus buccinator*), Wilson's snipes (*Gallinago delicata*), green herons (*Butorides virescens*), common mergansers (*Mergus merganser*) were a daily occurrence (Figure 16). Crayfish exoskeletons, leopard frogs (*Lithobates pipiens;* Figure 16), and green frogs (*Rana clamitans*) were also frequently observed. A green snake and several occurrences of mammal scat were also spotted. It is suspected that some of the scat was that of river otters (*Lontra canadensis*) given the high shell content and altered vegetation in the area. One location appeared to be a dwelling of some sort of river-going mammal.

Several highly invasive species were observed in low numbers including marsh thistle, autumn olive, yellow flag and *Phalaris arundinacea* (reed canary grass). Several dense patches (~25 m^2) of narrow-leaved cat-tail were noted in the fen areas south of Grass River, but it was absent from the large northern fen 'island' near the SE end of Lake Bellaire (MI parcels).

Several other non-native species of less concern were occasionally observed, including *Hieracium aurantiacum* (orange hawkweed), *Hieracium caespitosum* (yellow hawkweed), *Hieracium piloselloides* (king devil), *Leucanthemum vulgare* (ox-eye daisy), *Phleum pretense* (timothy grass), *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), *Ranunculus acris* (tall buttercup), *Rumex acetosella* (sheep sorrel), and *Stellaria media* (common chickweed).

Due to the high species richness and FQI, representative composition and structure, large acreage (185 acres) and low abundance of invasive species, the northern fen areas at GRNA qualify as a new A/B-ranked EO for the MNFI Biotics database. Natural communities are ranked from A to D, where A-ranked occurrences are excellent examples of communities, representative of historical conditions (structure, composition, natural processes, size, landscape context) and D-ranked occurrences are highly disturbed from natural conditions and not likely to recover for many years. An A/B occurrence is largely representative of natural conditions, but with some artificial disturbances, such as presence of invasive species or minor alteration of hydrology. Thirty-one percent of the species documented in northern fen had C values greater than seven including *Lobelia kalmia* (Kalm's lobelia; C=10; Fig. 17) and *Trichophorum alpinum* (bulrush; C=10; Fig. 18).

Figure 16. A sandhill crane in northern fen in the MI #1A parcel.

Figure 17. *Lobelia kalmii* (Kalm's lobelia) was observed in the MI #1A parcel.

Figure 18. ***Trichophorum alpinum*** **(bulrush) in northern fen in the DELANGE #1B parcel.**

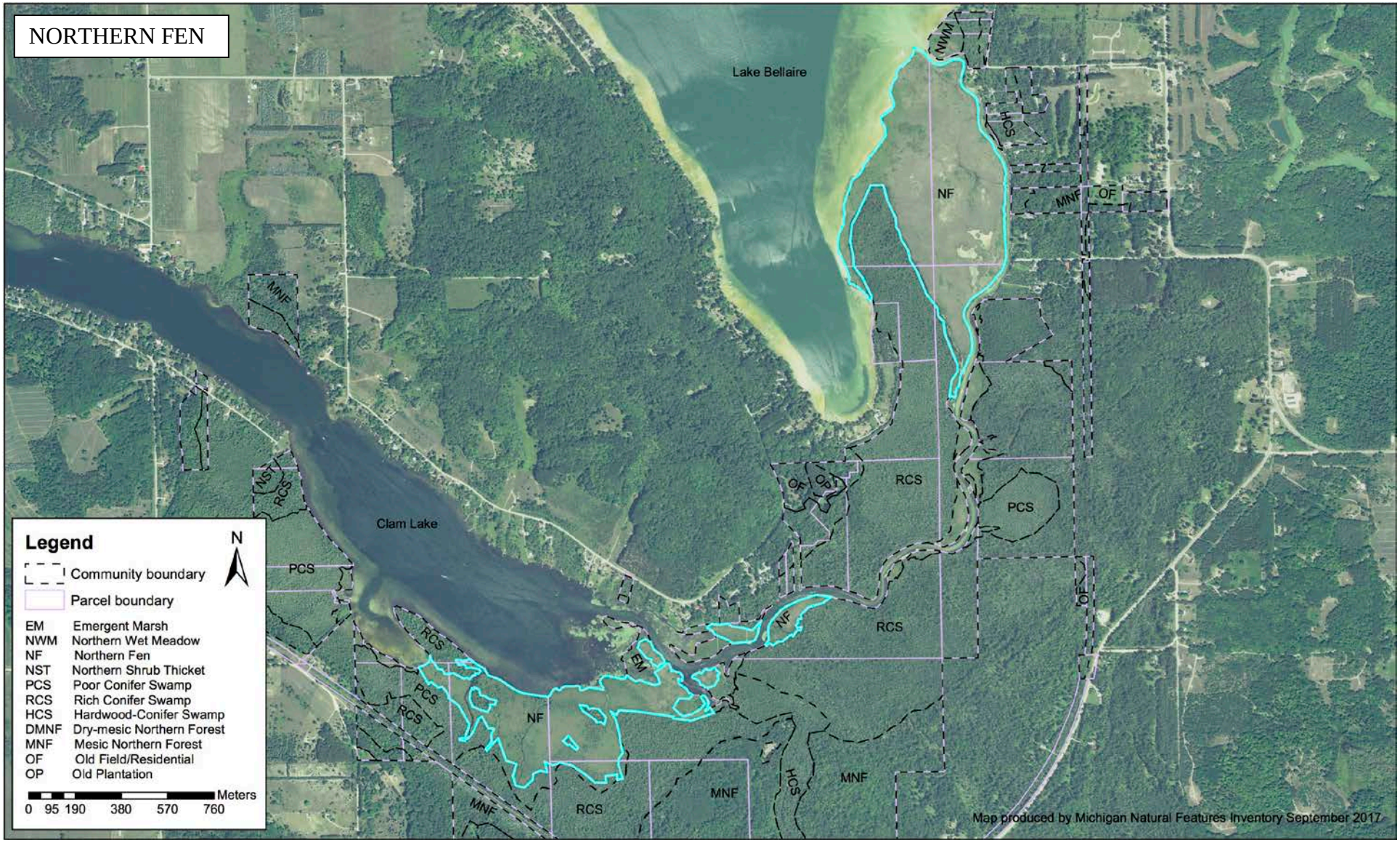

Figure 19. Northern fen delineated within the parcel boundaries of GRNA is highlighted in cyan.

Northern Shrub Thicket

Northern shrub thicket is a mostly-closed, low-canopy wetland community dominated by shrubs including *Alnus incana* (tag alder), *Cornus* spp. (dogwoods) and *Salix* spp. (willows), with few mature trees (Figure 20). It occurs along the borders of rivers and streams, and occasionally ponds and lakes (Cohen and Kost 2007). The soils are saturated, nutrient-rich organics, often with peat. Northern shrub thickets are subject to frequent water level fluctuations, flooding by beaver, and windthrows which influence the community composition and structure. Dense tag alder shrubs and lack of mature tree canopy distinguish it from other open and forested wetlands. Tag alder shades and crowds out many herbaceous species and tree saplings often resulting in lower diversity than surrounding communities (Cohen and Kost 2007).

Figure 20. Dense shrubs dominate northern shrub thicket in the NSHC #1 parcel.

Northern shrub thicket comprised approximately 41 acres of GRNA, mostly in parcels on the north shore of Lake Bellaire (Figure 21), where it occurred adjacent to northern wet meadow and rich conifer swamp. The species richness was 26, with 25 native and one non-native species, and the total FQI was 26.5. It was dominated by *Alnus incana* (tag alder), *Toxicodendron vernix* (poison sumac), *Cornus amomum* (silky dogwood), *Myrica gale* (sweet gale), *Carex stricta* (tussock sedge), *Ribes* spp. (gooseberry, currant), *Onoclea sensibilis* (sensitive fern), and *Osmunda regalis* (royal fern), with occasional *Thuja occidentalis* (northern white-cedar), *Picea mariana* (black spruce), *Larix laricina* (tamarack), and *Fraxinus nigra* (black ash) trees less than 10 m tall. In the parcels on the north shore of Lake Bellaire, poison sumac was especially dense in both the northern shrub thicket and rich conifer swamp. An occurrence of *Euphorbia virgata* (leafy spurge) was observed on the shoreline of Lake Bellaire bordering the shrub-thicket.

River otter (*Lutra canadensis*) scat with anal jelly was observed near the mouth of the Intermediate River and several ground dwelling birds were flushed in the interior of the shrub thicket on the north shore of Lake Bellaire. Positive species identification could not be made due to the dense growth and shadows, but they were likely ruffed grouse (*Bonasa umbellus*).

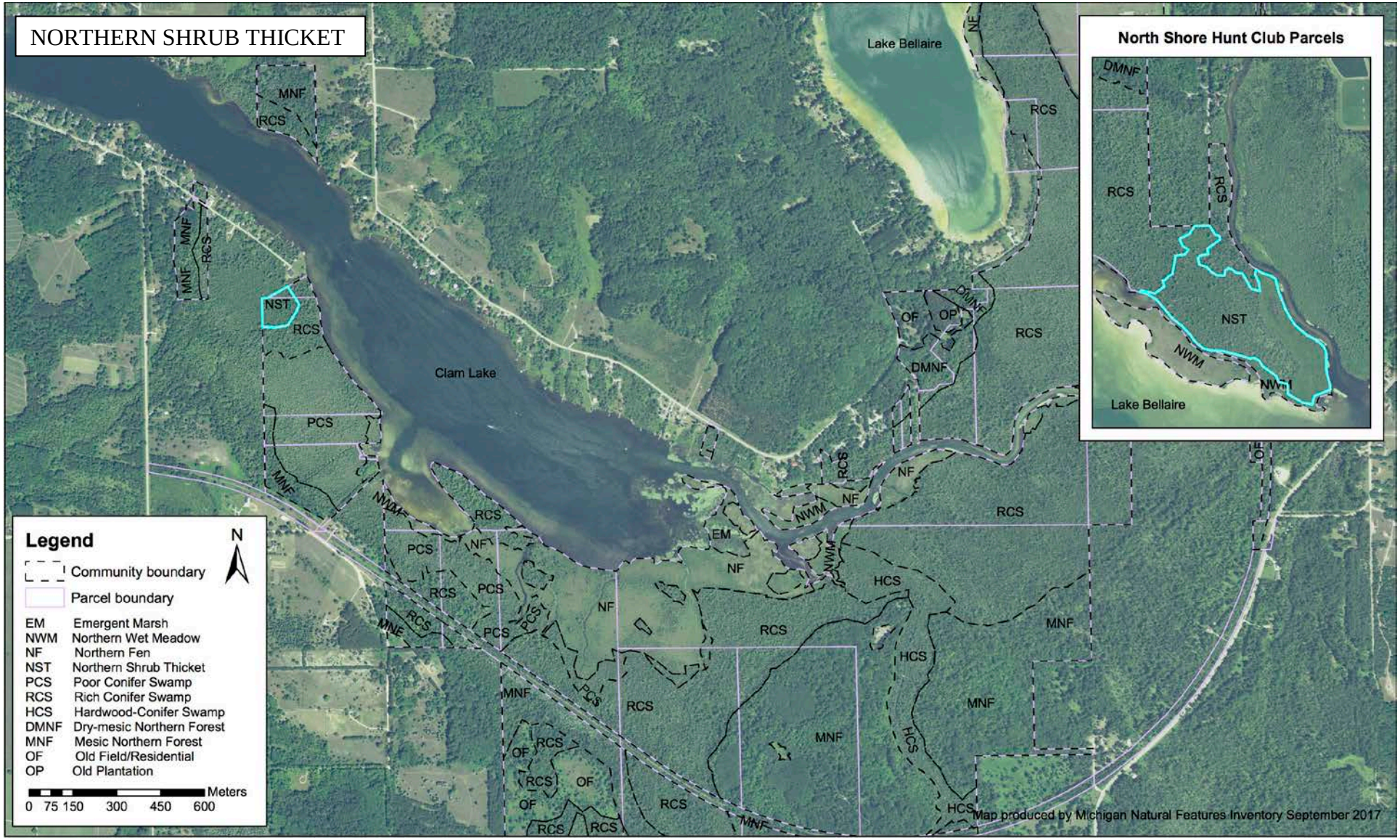

Figure 21. Northern shrub thicket delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Poor Conifer Swamp

Poor conifer swamp is a forested wetland community dominated by *Picea mariana* (black spruce) and *Larix laricina* (tamarack) with a ground layer of sphagnum mosses and abundant ericaceous shrubs (heath family; Cohen 2006; Figure 22). It is a nutrient poor system with little groundwater influence and occurs on acidic, saturated peat soils, predominantly in depressions and kettles in glacial outwash and glacial lake plains. The community structure and composition are influenced by windthrow, flooding by beaver, insect outbreaks, peat accumulation and occasionally fire.

Figure 22. Poor conifer swamp in the GORSUCH H #1B parcel.

Poor conifer swamp comprised approximately 82 acres of GRNA (Figure 24) adjacent to rich conifer swamp and northern fen. The species richness was 65, with 64 native and one non-native species, and the total FQI was 46. The canopy was co-dominated by black spruce and tamarack with occasional northern white-cedar and balsam fir, and ranged from 25-70% closure. Poison sumac was common. Ericaceous species were abundant including *Andromeda glaucophylla* (bog-rosemary), *Chamaedaphne calyculata* (leatherleaf), *Gaultheria hispidula* (creeping-snowberry), *Gaultheria procumbens* (wintergreen), *Gaylussacia baccata* (huckleberry), *Rhododendron groenlandicum* (Labrador-tea), *Vaccinium myrtilloides* (Canada blueberry), and *Vaccinium oxycoccos* (small cranberry). There were many pockets of pitcher plant and *Parnassia*

glauca (grass-of-Parnassus), occasionally with round-leaved sundew. Grass-pink (Figure 23) and *Cypripedium reginae* (showy lady-slipper) orchids were occasionally observed.

In the GORSUCH H #1B parcel near the northern fen and west of 'Otter Creek', there were pitcher plants lacking red coloration in the leaves that are suspected to be the recently delisted *Sarracenia purpurea* f. *heterophylla* (yellow pitcher plant). These plants were unusually large compared to other pitcher plants observed in GRNA. Confirmation requires examination of flowers, which also lack red coloration, but they were absent at the time of observation. The justification for delisting this form of pitcher plant was that it arises from a gene mutation independently in different populations and is not an evolutionary unit (Reznicek pers. com.).

The only invasive species observed in poor conifer swamp during this study was *Elaeagnus umbellata* (autumn olive) which was occasional.

Figure 23. *Calopogon tuberosus* (grass pink) was observed in a poor conifer swamp opening surrounded by black spruce in the GORSUCH H #1B parcel.

Figure 24. Poor conifer swamp delineated within the parcel boundaries of GRNA is highlighted in cyan.

Rich Conifer Swamp

Rich conifer swamp is a groundwater-influenced, nutrient-rich forested wetland dominated by northern white-cedar. It occurs in outwash channels and depressions in moraines, outwash plains and lakeplains, and is often associated with headwaters of cold, calcareous streams and groundwater springs (Figure 25). Soils are usually saturated circumneutral to moderately alkaline peats with frequent peat mounds covered by acidic *Sphagnum* spp. (sphagnum) mosses (Kost 2002, Cohen et al. 2015). Community composition and structure are influenced by groundwater seepage, seasonal water-level fluctuations, windthrow, flooding by beaver, hummock and hollow development, and occasionally fire.

Rich conifer swamp is the most abundant community in GRNA, covering approximately 503 acres (Figure 27). It lies adjacent to northern fen, northern wet meadow, northern shrub thicket, poor conifer swamp, dry-mesic northern forest, and mesic-northern forest. It had high species diversity with 207 total species (191 native and 16 non-native), and a total FQI of 69.1. Northern white-cedar dominated most of the canopy with co- or sub-dominants of tamarack and balsam fir. Less common canopy associates included *Pinus strobus* (white pine), *Acer rubrum* (red maple), black ash, and *Betula allegheniensis* (yellow birch). Tag alder dominated the understory, but poison sumac was abundant or co-dominant in several parcels, most densely in the north shore of the Lake Bellaire. Other shrubs and small trees included *Cornus alternifolia* (alternate leaved dogwood), *Cornus amomum* (silky dogwood), *and Cornus sericea* (red-osier dogwood), *Ilex verticillata* (winterberry), *Lonicera oblongifolia* (swamp fly honeysuckle), *Lonicera dioica* (red honeysuckle), Labrador-tea, *Rubus strigosus* (wild red raspberry), *Rubus pubescens* (dwarf raspberry) *Tsuga canadensis* (hemlock), and *Vaccinium* spp. (blueberries). The forest floor was uneven with many exposed roots, downed woody debris, and sphagnum mounds. Ferns, sedges, blueberries, grasses and bare ground were common. Occasional occurrences of *Lobelia cardinalis* (cardinal flower; Figure 26) were a striking contrast in the understory. Several carnivorous plants and orchids were also observed, including round-leafed sundew, pitcher plant, *Corallorhiza trifida* (early coral-root), yellow lady-slipper, showy lady-slipper, and purple fringed orchid.

Invasive species observed included *Alliaria petiolata* (garlic mustard), Japanese barberry, marsh thistle, autumn olive, yellow flag, *Myosotis scorpioides* (forget-me-not), reed canary grass, *Rosa multiflora* (multiflora rose) and narrow-leaved cat-tail. Non-native species of less immediate concern included *Epilobium parviflorum* (willow-herb), orange hawkweed, yellow hawkweed, *Hypericum perforatum* (common St. John's-wort), tall buttercup, bittersweet nightshade, *Taraxacum officinale* (common dandelion) and *Veronica arvensis* (corn speedwell).

Wildlife and wildlife signs observed included a green heron (*Butorides virescens*) and large padded down sedge-areas littered with shell-filled scat.

Figure 25. Rich conifer swamp with a small creek running through the MI #2B parcel .

Figure 26. *Lobelia cardinalis* (cardinal flower) in the understory of rich conifer swamp in the NSHC #1 parcel.

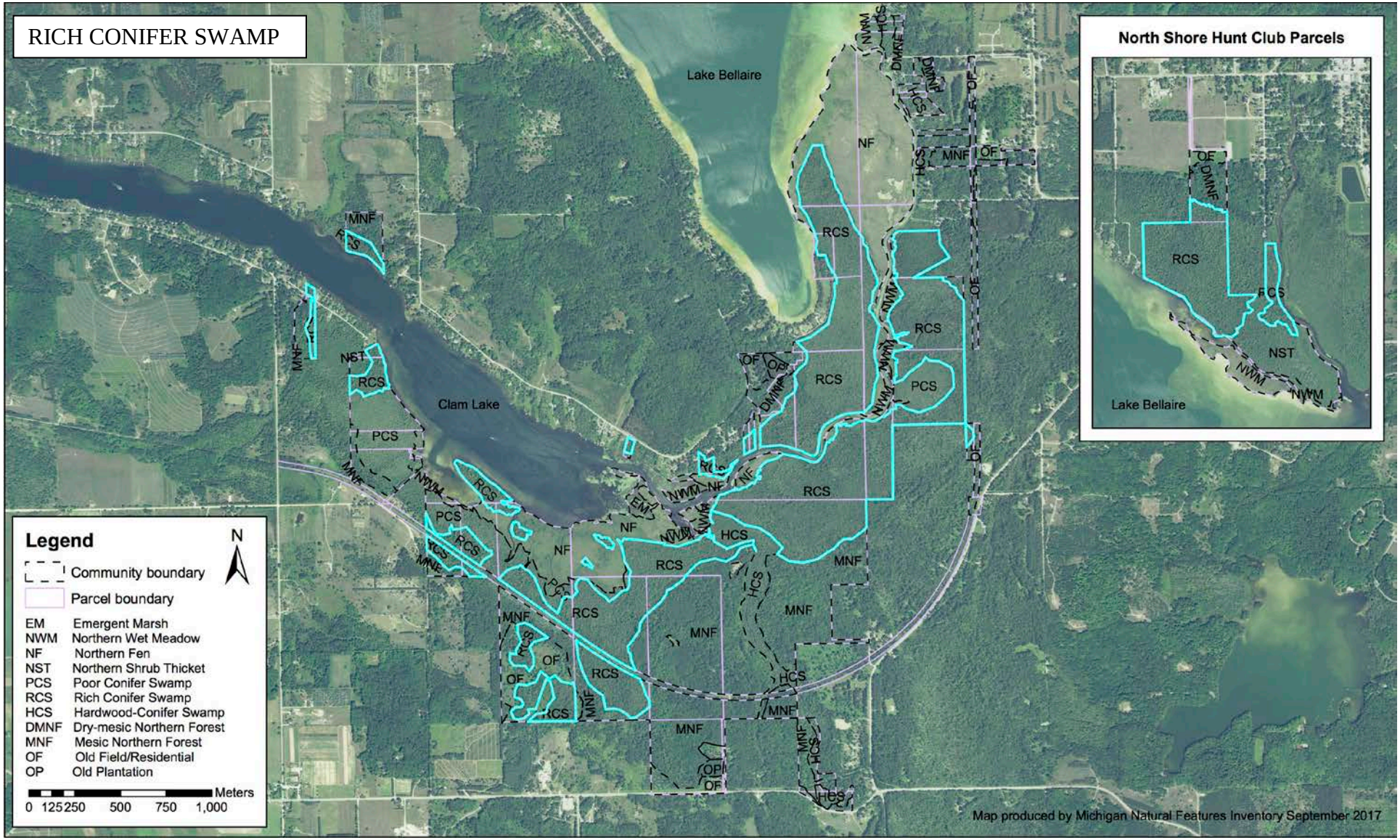

Figure 27. Rich conifer swamp delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Hardwood-Conifer Swamp

Hardwood-Conifer Swamp is a forested wetland community dominated by a mix of lowland deciduous hardwoods and conifers (Slaughter et al. 2007). It is groundwater influenced and often associated with groundwater seepage areas and headwaters of streams. Water level fluctuations, windthrow, and flooding by beaver influence community composition and structure. Hardwood-conifer swamp is confined to ecotonal areas between uplands and other wetland communities and does not occur where peat accumulation isolates it from the groundwater. The canopy varies regionally, but is often dominated by balsam fir, red maple, yellow birch, white pine, *Populus tremuloides* (quaking aspen), northern white-cedar and hemlock (Slaughter et al. 2007, Cohen et al. 2015). Tag alder is common in the subcanopy, in gaps and along the borders (Figure 28).

Figure 28. Tag alder is common in the understory and gaps in hardwood-conifer swamp as shown here in the ASB #2 parcel.

Hardwood-conifer swamp comprised approximately 53 acres (Figure 30) of GRNA and occurs adjacent to northern wet meadow and dry-mesic northern forest. There was a total species richness of 97, with 90 native and seven non-native species, and the total FQI was 39.4. The canopy was dominated by northern white-cedar and yellow birch with frequent occurrences of *Populus balsamifera* (balsam poplar) and *Populus grandidentata* (big-tooth aspen). Common shrubs included tag alder, *Lonicera canadensis*. (Canadian fly honeysuckle), *Rhamnus alnifolia* (alder-leaved buckthorn), wild red raspberry, dwarf raspberry *Sambucus canadensis* (elderberry), and poison sumac. Common herbaceous plants documented included *Equisetum* spp. (horsetails), *Carex disperma, C. hystericina, C. interior, C. intumescens, C. lupulina, C. stricta, C. utriculata, C. vulpinoidea, Lysimachia thyrsiflora* (tufted loosestrife; Figure 29), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Solidago* spp. (goldenrods) and *Trientalis borealis* (star-flower).

Invasive species observed included marsh thistle, autumn olive, *Lysimachia nummularia* (moneywort), forget-me-not, and reed canary grass. Non-native species of less immediate concern included orange hawkweed, yellow hawkweed and bittersweet nightshade.

Figure 29. ***Lysimachia thyrsiflora*** **(tufted loosestrife) growing in the understory of hardwood-conifer swamp in the DELANGE #1B parcel.**

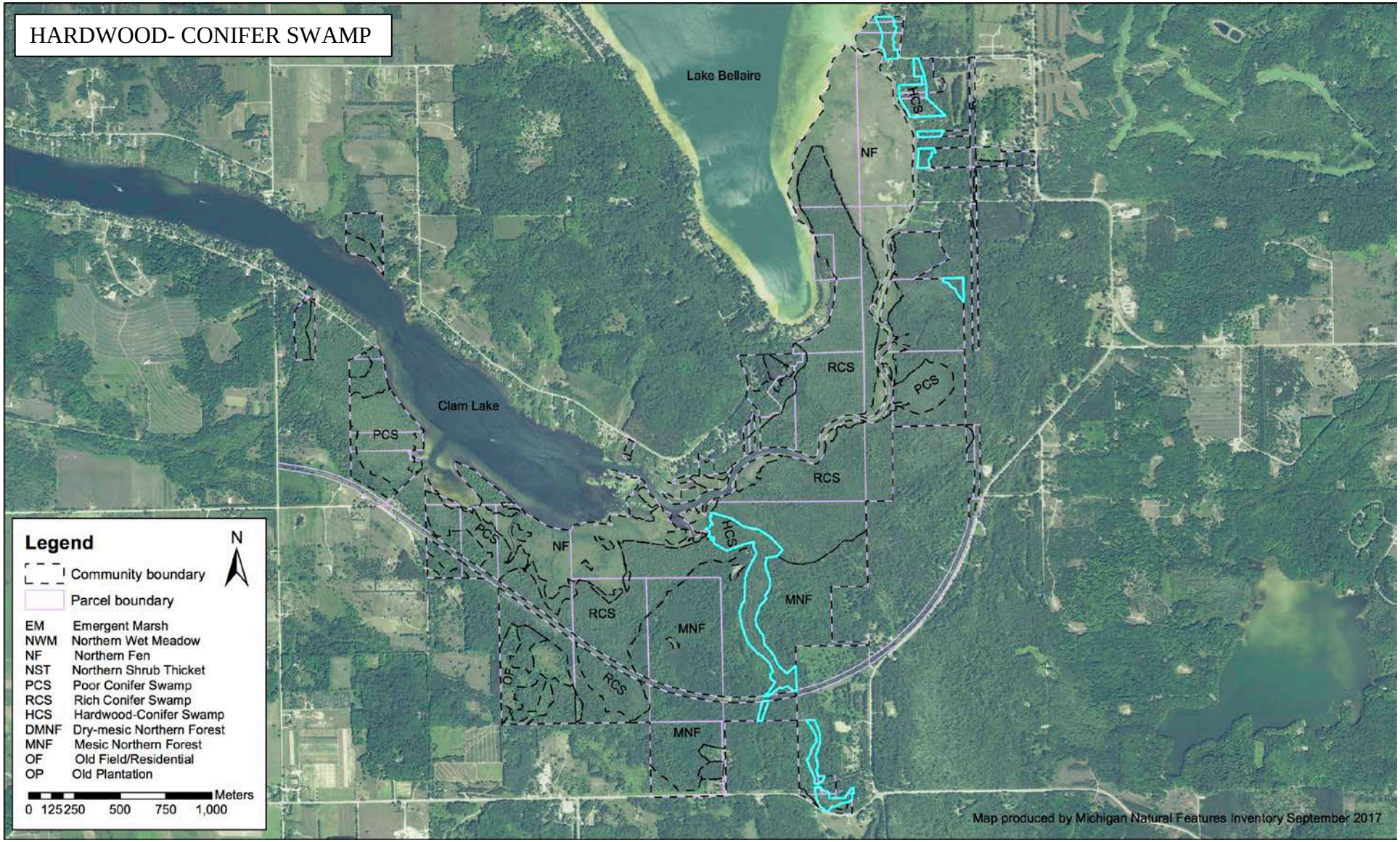

Figure 30. Harwood-conifer swamp delineated within the parcel boundaries of GRNA is highlighted in cyan.

Dry-mesic Northern Forest

Dry-mesic northern forest is an upland forested community with a pine or pine-hardwood canopy typically dominated by white pine and *Pinus resinosa* (red pine), with *Quercus rubra* (red oak), and/or hemlock associates. It occurs on acidic well-drained sands, most frequently on glacial outwash plains and lakeplains. The ground layer is often dominated by *Pteridium aquilinum* (bracken fern; Figure 31), with a diversity of shrubs, sedges, grasses and forbs intermixed. Historically, these forests originated from infrequent catastrophic fire and were maintained by frequent low-intensity ground fires. Fire creates areas of bare mineral soil that are most suitable for germination of the conifer dominants. Windthrow and insect outbreaks also influence the structure and composition of these forests.

Figure 31. White pine saplings and bracken fern are abundant in the understory of the dry-mesic northern forest community in the NSHC #2 parcel.

Dry-mesic northern forest comprised approximately 30 acres (Figure 32) of GRNA, bordering rich conifer swamp, hardwood conifer swamp, old field/residential areas and pine plantations. The species richness was 26, with 25 native and one non-native species, and the total FQI was 19.4. The canopy was almost exclusively white pine, with significant contributions from red maple, *Acer saccharum* (sugar maple), yellow birch, red pine, quaking aspen, red oak, and hemlock. The ground layer was mostly open with pockets of bracken fern, *Lycopodium* spp. (clubmosses), and clumps of *Carex communis* (sedge). Occasional occurrences of the invasive Japanese barberry were observed in the NSHC #2 parcel.

Six potential vernal pools were documented in this community. These are described further in the Vernal Pool section.

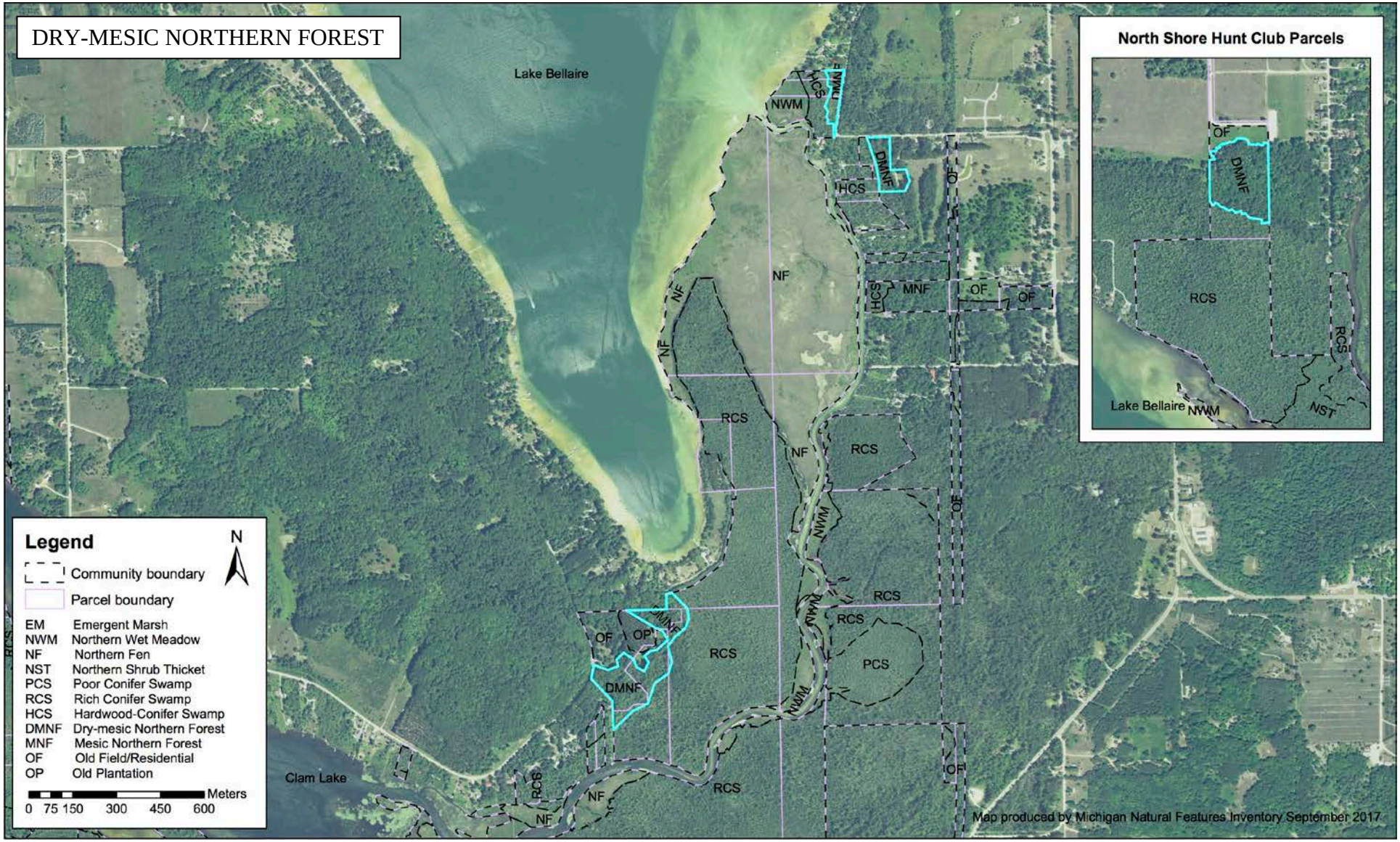

Figure 32. Dry-mesic northern forest delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Mesic Northern Forest

Mesic northern forest is an upland forested community dominated by northern hardwoods, including sugar maple, *Fagus grandifolia* (American beech), with frequent associates of yellow birch, red oak, and hemlock and white pine (Figure 33). Soils are typically loamy sands to sandy loams (Cohen 2000). Mesic northern forests are sustained by frequent, small windthrow events which create canopy gaps that allow shade-tolerant canopy seedlings to regenerate. These forests occurred as a matrix community, covering over 12 million acres in Michigan prior to European settlement and logging (Comer et al. 1995, Cohen 2000). They were multigenerational, persisted for long time periods and experienced infrequent catastrophic windthrow events.

Figure 33. Mesic northern forest is dominated by northern hardwoods with conifer associates such as white pine and hemlock in the GAGE Parcel.

Mesic northern forest comprised approximately 283 acres, the second most abundant community in GRNA (Figure 34). It borders rich conifer swamp, poor conifer swamp, and hardwood-conifer swamp. The species richness reached 101, with 90 native and 11 non-native species, and the total FQI was 39.2. The canopy was comprised mostly of sugar maple, red maple), yellow birch, beech, red oak, and hemlock, with occasional *Picea glauca* (white spruce), white pine and northern white-cedar. There were pockets of *Abies balsamea* (balsam fir) and inclusions of small wetlands with species such as *Carex crinita, C. disperma, C. intumescens,* and *C. lupulina* (sedges).

Occasional occurrences of invasive marsh thistle, autumn olive, *Lonicera* x*bella* (hybrid honeysuckle), and *Lonicera morrowii* (morrow honeysuckle) were observed. Non-native species of less immediate concern include *Agrostis gigantea* (red-top), *Epipactis helleborine* (helleborine), orange hawkweed, *Picea pungens* (blue spruce), bittersweet nightshade, common dandelion and *Veronica officinalis* (common speedwell).

Five potential vernal pools were documented in this community. These are described further in the Vernal Pool section.

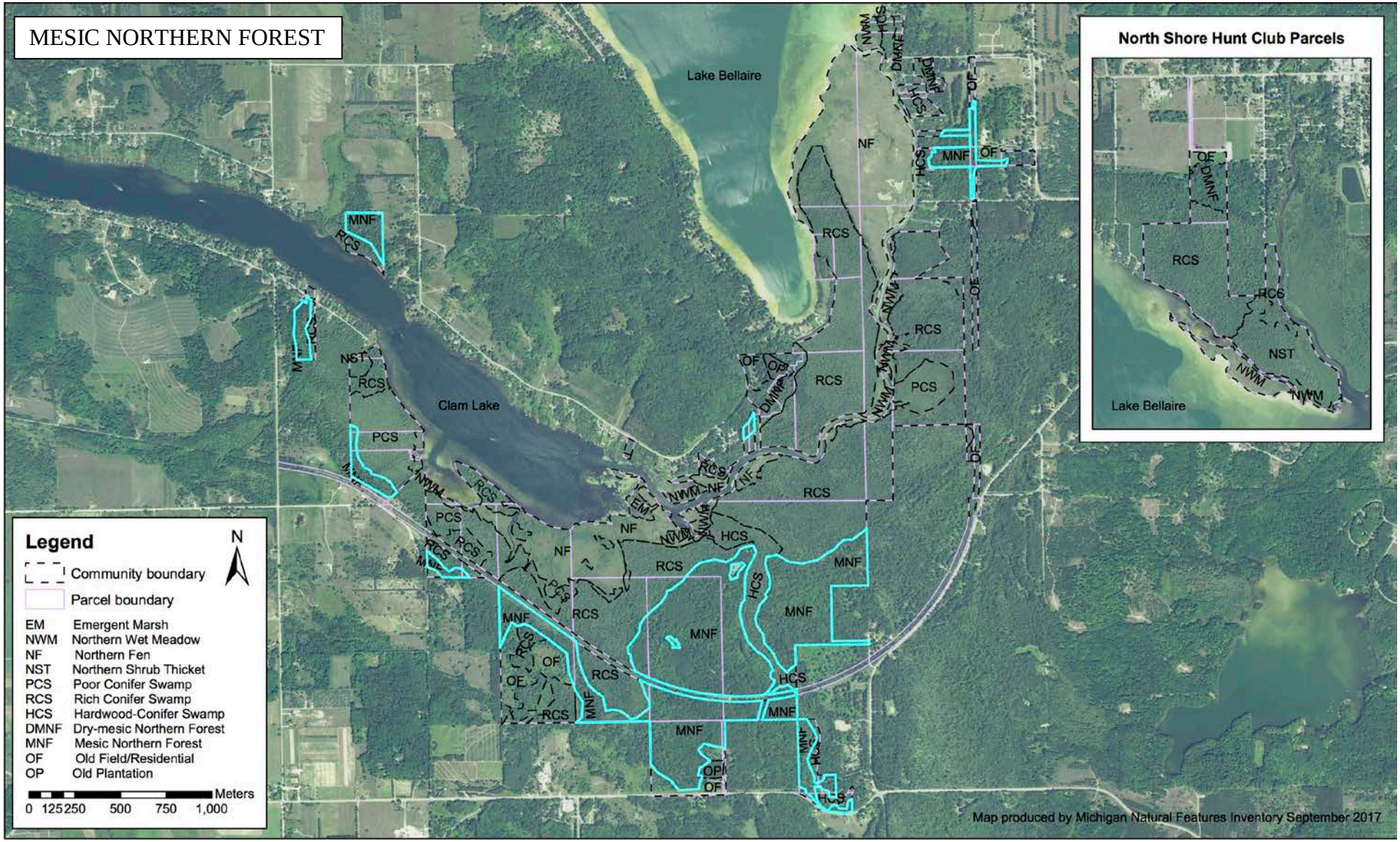

Figure 34. Mesic northern forest delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Anthropogenic Systems

Approximately 113 acres of GRNA had strong anthropogenic disturbance and were delineated as anthropogenic systems (Figure 39, 40). These areas included old farmstead/residential areas (Figure 35), the rail-trail, utility right-of-ways, educational areas for the nature center, and old red pine plantations (Figure 36). These were mostly upland areas bordering upland forests, with many non-native invasive and weedy species. However, the rail-trail does bisect portions of rich and poor conifer swamp at the western edge of GRNA. A total of 109 plant species, 74 native and 35 non-native, were identified in these systems combined, and the total FQI was 24.

Figure 35. An old field/residential area on the GORSUCH H #1B parcel.

Figure 36. An old red pine plantation on the BAGINSKI #1B parcel.

The old field/residential area in the GORSUCH H #1B parcel south of the rail-trail contained large patches of native *Schizachyrium scoparium* (little bluestem), *Dasiphora fruticosa* (shrubby cinquefoil), and *Rubus* spp. bushes (raspberry/blackberry), both favorites of local wildlife for the fruits themselves or the insects that reside there (Figure 37). Unfortunately these areas also contained the invasive *Centaurea stoebe* (spotted knapweed), which often expands to form monocultures in open upland communities.

Figure 37. An old field/residential area dominated by little bluestem in the GORSUCH #1B parcel.

A pond that is isolated from the surface waters of Finch Creek occurs in the old field/residential area on the MILOCK parcels. It is surrounded by an assortment of native, non-native and cultivar species in a small open canopy area, and harbored a variety of wildlife.

Hypopitys monotropa (pinesap) was observed in the plantation in the BAGINSKI parcels. Lacking chlorophyll, this parasitic plant obtains its nutrients from fungi associated with trees in the Pinaceae (Pine) family (Figure 38). The similar *Monotropa uniflora* (Indian-pipe) has only a single flower; the nodding flowers in both species become erect as they mature into fruit. A patch of the non-native *Veronica officinalis* (common speedwell) was also observed in this plantation.

Figure 38. Maturing *Hypopitys monotropa* (pinesap) flowers in the BAGINSKI #1B parcel.

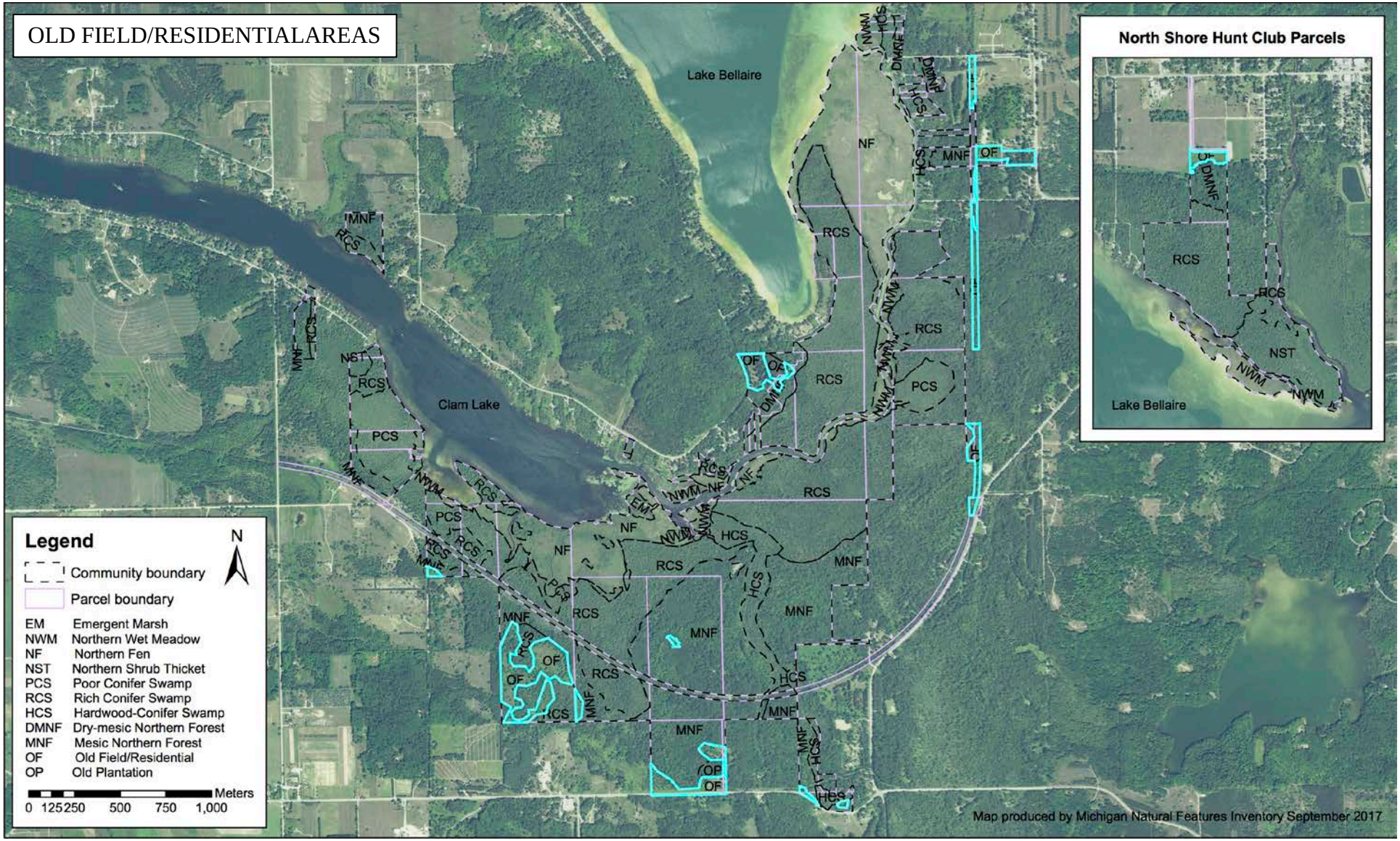

Figure 39. Old field/residential areas delineated within the parcel boundaries of GRNA are highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

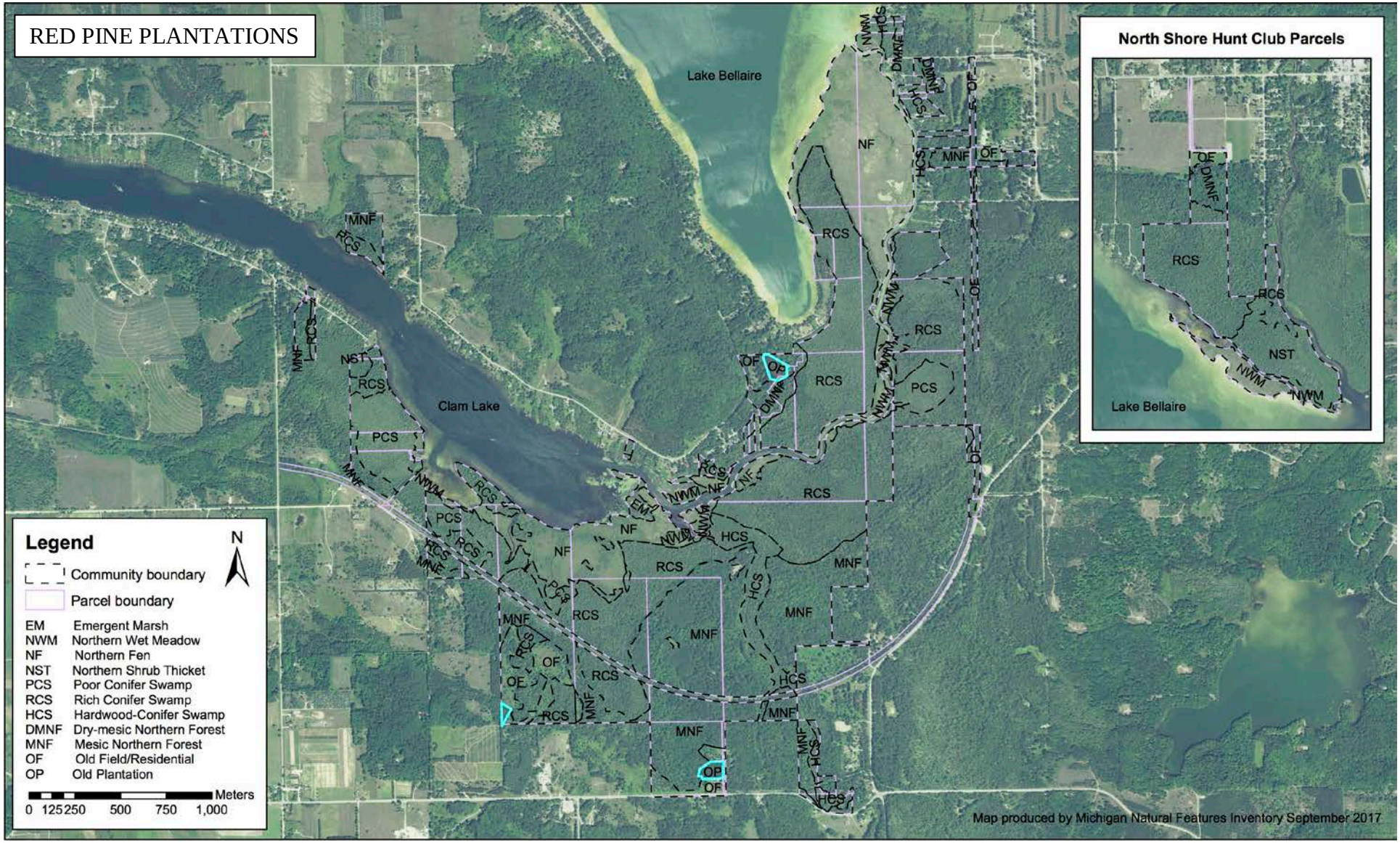

Figure 40. Old red pine plantations delineated within the parcel boundaries of GRNA are highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunt Club.

Vernal pools

Vernal pools in Michigan are seasonal wetlands naturally occurring in small, shallow depressions in forested landscapes (Lee, pers. com; Figure 41) They are flooded in the spring and dry most of the rest of the year, although they can occasionally be wet in the fall. They lack a permanent connection to surface water and therefore lack fish. The cyclic nature of these pools allows many animals to breed, brood, and feed annually with less risk of higher level predation. Most vernal pools occur in upland forests where poorly drained or impermeable clay soils retain water at or near the surface for longer periods of time than the surrounding areas. Although vernal pools are best identified when they are wet, there are signs that indicate their presence when they are dry, including: 1) depression(s) in a mostly level and forested landscape, 2) leaves darkened by water stains or film of sediment and/or anoxic decay odors, 3) high water marks on nearby trees, 4) buttressed or stilted tree bases/roots, 5) presence of wetland vegetation in an otherwise upland area, and 6) obvious lack of upland vegetation (Thomas et al. 2010, Marchland 2016).

Figure 41. An example of a vernal pool during spring flooding in southern Michigan. (Photo by Yu Man Lee).

Evidence of vernal pools was observed in both mesic- and dry-mesic northern forests at GRNA, where there were depressions with darkened leaves, buttressed trees with water marks, and a lack of upland vegetation (Figure 42). Occasionally facultative wetland species or mosses were present. Eleven potential vernal pools were mapped (Figure 43). A detailed list by property associated with latitude, longitude and photos is included in Appendix 12. Faunal indicators are

necessary for determination of vernal pools, including breeding evidence of obligate or facultative amphibian species (several mated pairs, egg masses, larvae) or the presence of fairy shrimp (*Eubranchipus* spp.) or clam shrimp (e.g., *Lynceus brachyurus*). Obligate or facultative amphibians include spotted salamander (*Ambystoma maculatum*), blue-spotted salamander (*Ambystoma laterale*), wood frog (*Rana sylvatica*), spring peeper (*Pseudacris crucifer crucifer*), and gray treefrog (*Hyla versicolor*). These can usually only be found in the pools during the spring wet season.

Figure 42. A potential vernal pool in mesic northern forest in the SKINNER #1A parcel.

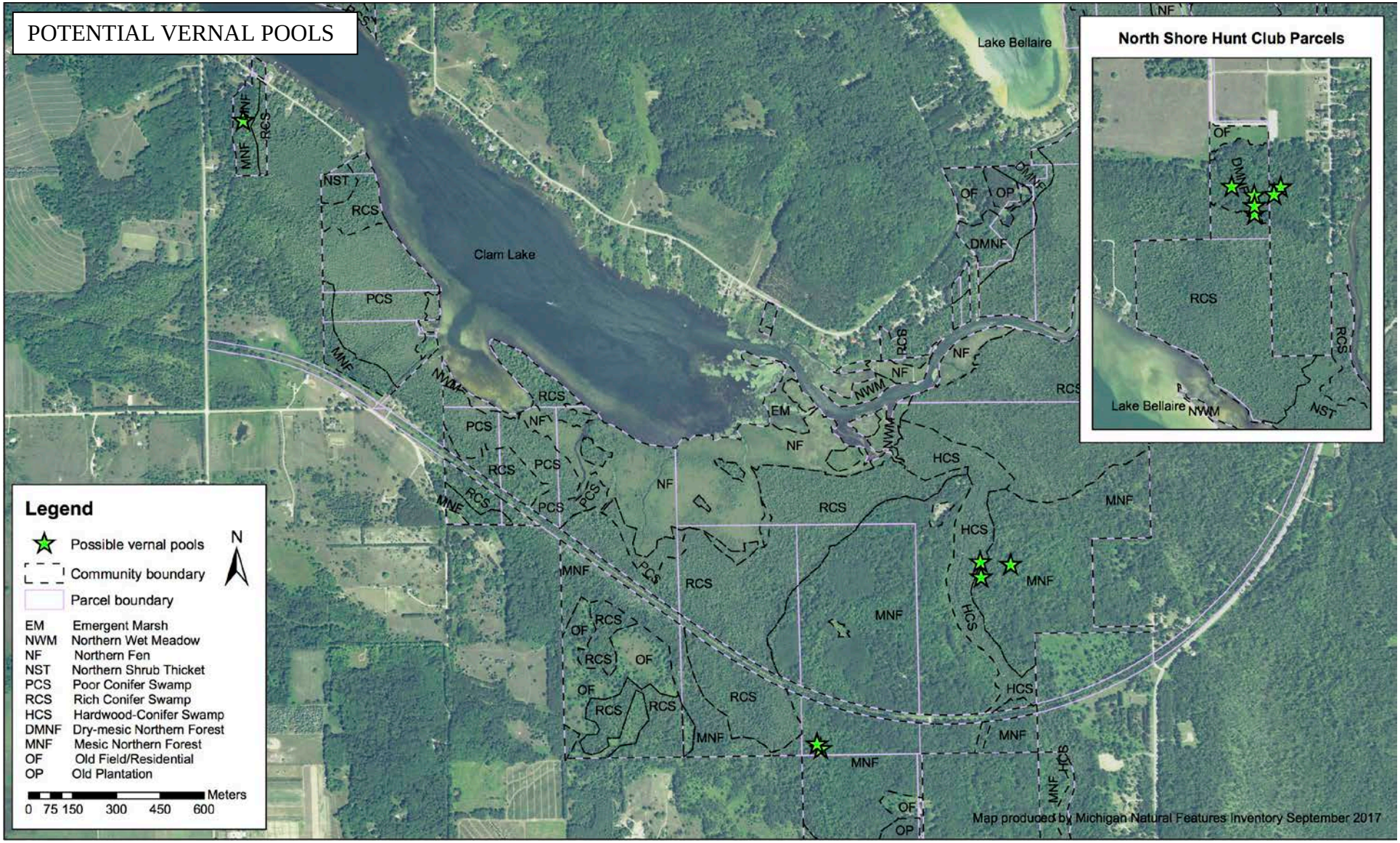

Figure 43. Potential vernal pools delineated within the parcel boundaries of GRNA are highlighted with green stars.

Species Documented

A total of 368 plants were identified to species (Appendix 1). Of that 315 (85.6%) were native and 53 (14.4%) were non-native. Seventy three species (20 %) have C values greater than seven. One suspected occurrence of the rare but recently delisted yellow pitcher plant (Figure 44) was documented in northern fen, but definitive identification requires flowers, which were not present at the time of survey. No federal or state listed plant species were observed during the 2017 surveys. Twenty-six specimens were collected as new Antrim County records (Table 2) and their locations are included in Appendix 13. Three specimens were deposited directly in the University of Michigan (UM) Herbarium and twenty-four (one duplicate) were deposited in the Central Michigan University Herbarium (CMC). The CMU specimens are digitally stored via the Symbiota Consortium of Midwest Herbaria Portal and digitally shared with the UM Herbarium. All verified specimens will be included in the Michigan Flora. An additional county record (*Arethusa bulbosa*) was photographed but not collected due to the small population size (Figure 45), and will be submitted as a photo-record for inclusion in the Michigan Flora.

Table 2. List of 27 new county records documented at GRNA with non-native species in bold.

Scientific Name	Common Name
*Arethusa bulbosa**	dragon's mouth
Apocynum cannabinum	Indian-hemp
Berberis thunbergii	**Japanese barberry**
Carex aquatilis	sedge
Carex buxbaumii	sedge
Carex diandra	sedge
*Carex exilis***	sedge
Carex lupulina	sedge
Carex pseudocyperus	sedge
Cirsium vulgare	**bull thistle**
*Dichanthelium depauperatum***	panic grass
Epilobium palustre	marsh willow-herb
Iris pseudacorus	**yellow flag**
Lonicera morrowii	**morrow honeysuckle**
Lycopus uniflorus	northern bugle weed
Lysimachia nummularia	**moneywort**
Phragmites australis subsp. *americanus*	reed, native phragmites
Picea pungens	**blue spruce**
Rumex orbiculatus	great water dock
Schoenoplectus tabernaemontani	soft-stem bulrush
Solidago canadensis	Canada goldenrod
Solidago gigantea	late goldenrod
Symphyotrichum firmum	smooth swamp aster
Symphyotrichum lanceolatum	panicled aster
Typha angustifolia	***narrow-leaved cat-tail***
*Utricularia minor***	small bladderwort
Verbena hastata	blue vervain

*Submitted by photo-record **Collected by Liana May; remainder by Rachel Hackett.

Figure 44. The suspected *Sarracenia purpurea* f. *heterophylla* (yellow pitcher plant) lacks the purple pigment in the leaves of the more common *S. purpurea.* It was photographed in northern fen in the GORSUCH H #1B parcel.

Many other native species of interest were found (Table 3), including ten orchids, seven carnivorous plants, one parasitic plant, several coral fungi and native phragmites. Appendix 14 provides a list of these species and their locations.

Table 3. Native species of interest documented during surveys.

Scientific name	Common name	Type	Obs.
Arethusa bulbosa	dragon's mouth	orchid	1
Calopogon tuberosus	grass-pink	orchid	1
Clavulinopsis spp. likely *C. fusiformus*	yellow coral fungus	coral fungus	5
Corallorhiza trifida	early coralroot orchid	orchid	1
Cypripedium parviflorum	yellow lady-slipper	orchid	4
Cypripedium reginae	showy pink lady-slipper	orchid	1
Drosera rotundifolia	round-leaf sundew	carnivorous	6
Goodyera pubescens	downy rattlesnake plantain	orchid	1
Hypopitys monotropa	pinesap	parasitic	1
Phragmites australis subsp. americanus	native reed/phragmites	native	1
Platanthera huronensis	Lake Huron green orchid	orchid	1
Platanthera psycodes	purple fringed orchid	orchid	15
Pogonia ophioglossoides	rose pogonia	orchid	3
Ramariopsis kunzei (likely)	white coral fungus	coral fungus	1
Sarracenia purpurea	pitcher plant	carnivorous	20
*Sarracenia purpurea f. heterophylla**	yellow pitcher plant	carnivorous	1
Spiranthes cernua	nodding ladies-tresses	orchid	10
Utricularia cornuta	horned bladderwort	carnivorous	2
Utricularia minor	small bladderwort	carnivorous	1
Utricularia intermedia	flat-leaved bladderwort	carnivorous	1
Utricularia vulgaris	common bladderwort	carnivorous	1

*Requires confirmation when flowers are present.

Figure 45. *Arethusa bulbosa* (dragon's mouth) was observed in rich conifer swamp. Photo by Liana May.

Threats

Invasive Species

Of the 53 non-native species documented during surveys, 18 pose the highest threat to the ecological integrity of the natural communities at GRNA. These are listed in Table 4 with their acronyms and the natural and/or anthropogenic system they were observed in. A detailed list of these species and their coordinates are provided in Appendix 15. Point locations that were captured are shown in Figure 46.

Table 4. Invasive species of highest concern documented. The natural community acronyms are provided in Table 1 on page 8.

Scientific name	Common name	Acronym	Natural Community
Alliaria petiolata	garlic mustard	ALLPET	RCS (edge)
Berberis thunbergii	Japanese barberry	BERTHU	RCS, DMNF
Centaurea stoebe	spotted knapweed	CENSTO	ANTH
Cirsium arvense	Canada thistle	CIRARV	ANTH
Cirsium palustre	marsh thistle	CIRPAL	NWM, NF, RCS, HCS, MNF, ANTH
Cirsium vulgare	bull thistle	CIRVUL	ANTH
Elaeagnus umbellata	autumn olive	ELAUMB	NWM, NF, PCS, RCS, HCS, MNF, ANTH
Euphorbia virgata	leafy spurge	EUPVIR	NST (edge), ANTH
Iris pseudacorus	yellow flag	IRIPSE	NWM, NF, RCS
Lonicera morrowii	morrow honeysuckle	LONMOR	MNF, ANTH
Lonicera x*bella*	hybrid honeysuckle	LONBEL	MNF
Lysimachia nummularia	moneywort	LYSNUM	HCS
Lythrum salicaria	purple loosestrife	LYTSAL	NWM
Myosotis scorpioides	forget-me-not	MYOSCO	RCS, HCS
Phalaris arundinacea	reed canary grass	PHAARU	RCS, HCS
Phragmites australis subsp. *australis**	Eurasian phragmites	PHRAUS	EM
Rosa multiflora	multiflora rose	ROSMUL	RCS
Typha angustifolia	narrow-leaved cat-tail	TYPANG	EM, NWM, NF, RCS

*Not on GRNA properties, but in the adjacent Clam Lake.

Typha angustifolia (narrow-leaved cat-tail) was the most commonly observed invasive species during surveys. There were several dense patches in the southern fen near the Sedge Meadow Boardwalk Loop and near the southeastern portion of Clam Lake. Otherwise it was sparsely scattered in emergent wetlands bordering the Grass River, and was occasionally observed further inland in conifer swamps. Notably, it was absent in the large northern fen island at the southeast end of Lake Bellaire. Several suspected hybrid cat-tail specimens were collected and examined. They were determined to have morphological characteristics of narrow-leaved cat-tail (eFloras 2008; Reznicek et al. 2011); however, genetic testing is required for definitive identification.

Phalaris arundinacea (reed canary grass) was observed occasionally in rich conifer swamp, hardwood-conifer swamp and mesic northern forest. This species is considered native to Michigan, however, it has intermixed with introductions from Europe (Reznicek et al. 2011), and

occurs as an invasive weed across much of Michigan's landscape. It is referred to an invasive species in this report.

Cirsium palustre (marsh thistle) was observed occasionally in northern wet meadow, northern fen, rich conifer swamp, hardwood-conifer swamp, mesic northern forest, along the rail-trail and in old field. ***Cirsium vulgare*** (bull thistle) was observed primarily along ditches along the rail-trail where it was rare to occasional. ***Cirsium arvense*** (Canada thistle) was observed occasionally in old fields and along trails.

Lythrum salicaria (purple loosestrife) was observed only on the SPEET parcel within GRNA, but also on several parcels adjacent to GRNA along Clam Lake. ***Iris pseudacorus*** was observed occasionally along the Grass River in northern wet meadow and northern fen.

Lysimachia nummularia (moneywort) and ***Myosotis scorpiodes*** (forget-me-not) invade swamps as creeping ground covers on the forest floor. Moneywort was abundant in the ABS#1 parcel and the ABS #2 and SWAN parcels adjacent to Willow Day Park, but was not observed in any other areas. Forget-me-not was found in these same parcels and in several other areas of rich conifer swamp on the eastern and southern portions of GRNA. These parcels had a disproportionate number of non-native species compared to other areas of GRNA.

Only two occurrences of ***Euphorbia virgata*** (leafy spurge) and one of ***Alliaria petiolata*** (garlic mustard) were observed during these surveys. Leafy spurge was noted on the rail-trail and on the NSHC #1 parcel on the shore of Lake Bellaire. Garlic mustard was observed in the SKINNER parcel along the border of rich conifer swamp.

Centaurea stoebe (spotted knapweed) was common in portions of the old field/residential areas, and occurred occasionally along the rail-trail.

Five invasive shrub species were noted in GRNA. ***Elaeagnus umbellata*** (autumn-olive) was observed rarely in northern wet meadow and northern fen, and occasionally in mesic northern forest and forested wetlands. ***Berberis thunbergii*** (Japanese barberry) was occasionally observed in rich conifer swamp and dry-mesic northern forest. ***Rosa multiflora*** (multiflora rose) was observed near the Woodland Boardwalk in rich conifer swamp. Large shrubs of ***Lonicera morrowii*** (morrow honeysuckle) were observed in old fields, and smaller shrubs were observed infrequently in mesic northern forest. ***Lonicera xbella*** was observed occasionally in mesic northern forest bordering lands adjacent to GRNA.

Although not observed on GRNA property, the invasive ***Phragmites australis*** **subsp.** ***australis*** (Eurasian phragmites) was observed along the neighboring shores of Clam Lake.

The 35 other non-native species documented during this inventory are of less immediate concern to the high quality wetlands of GRNA. They are listed in Table 5 along with the natural communities they were found in.

Table 5. Non-native species of less immediate concern documented at GRNA. The natural community abbreviations are shown in Table 1 on page 8.

Scientific name	Common name	Natural Community
Agrostis gigantea	redtop	MNF, ANTH
Berteroa incana	hoary alyssum	RCS, DMNF, ANTH
Bromus inermis	smooth brome	ANTH
Dactylis glomerata	orchard grass	ANTH
Daucus carota	wild carrot	ANTH
Dianthus armeria	deptford pink	ANTH
Elymus repens	quack grass	ANTH
Epilobium parviflorum	willow-herb	RCS
Epipactis helleborine	helleborine	MNF
Hieracium aurantiacum	orange hawkweed	NF, RCS, HCS, MNF, ANTH
Hieracium caespitosum	king-devil, yellow hawkweed	NF, RCS, HCS, ANTH
Hieracium piloselloides	king-devil	NF
Hypericum perforatum	common St. john's-wort	RCS, ANTH
Leucanthemum vulgare	ox-eye daisy	NF, ANTH
Medicago lupulina	black medic	ANTH
Melilotus albus	white sweet-clover	ANTH
Mentha xpiperita	peppermint	NWM
Phleum pratense	timothy	NF, ANTH
Ranunculus acris	tall buttercup	NF, RCS
Rumex acetosella	sheep sorrel	NF, RCS, ANTH
Rumex obtusifolius	bitter dock	ANTH
Picea pungens	blue spruce	MNF, ANTH
Plantago lanceolata	English plantain	ANTH
Plantago major	common plantain	ANTH
Poa compressa	Canada bluegrass	NF, ANTH
Poa pratensis	Kentucky bluegrass	NF, ANTH
Populus alba	white poplar	NWM
Potentilla recta	rough-fruited cinquefoil	ANTH
Solanum dulcamara	bittersweet nightshade	NWM, RCS, HCS, MNF
Stellaria media	common chickweed	NF, ANTH
Taraxacum officinale	dandelion	RCS, MNF, ANTH
Tragpogon pratensis	common goats beard	ANTH
Trofolium pratense	red clover	ANTH
Verbascum thapsus	common mullein	ANTH
Veronica arvensis	corn speedwell	RCS
Veronica officinalis	common speedwell	MNF, ANTH
Vicia villosa	hairy vetch	ANTH

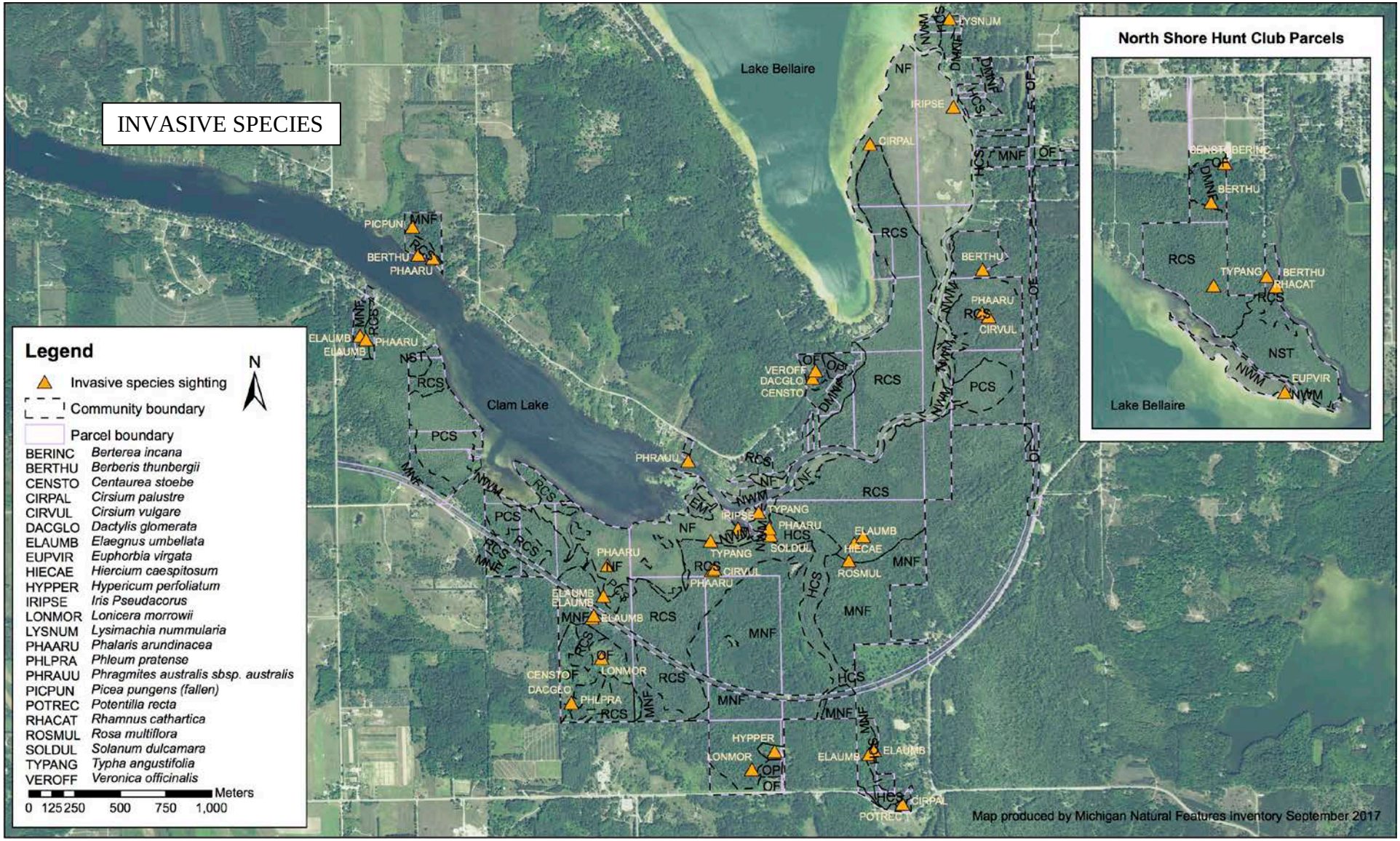

Figure 46. Invasive species mapped in GRNA during 2017 surveys. Comprehensive invasive species surveys were not conducted for this study.

Nutrient loading

There are many residential parcels near GRNA, along Lake Bellaire, Grass River, and Clam Lake with lawns that are mowed to the waterfront or that have other unnatural shorelines, such as seawalls and large rocks brought in from elsewhere and deposited. In addition, the 1983 report (ER Squiers & Associates) suggested that agricultural and/or domestic wastes may be entering the system from upstream sources. Nutrient run-off is typically higher from unnatural shorelines and high nutrient levels have been implicated in facilitating the establishment and persistence of some invasive species, such as Eurasian phragmites.

Groundwater contamination

Groundwater flows differently than the surface water of a watershed, and it is possible that areas outside of a watershed area could affect the water quality of groundwater-fed wetlands at GRNA. The MDEQ Environmental Mapper showed several documented land use restrictions and environmental management concerns in the watersheds surrounding GRNA, Lake Bellaire, and Clam Lake. They are described below.

Land use restrictions

There were three land use restriction sites in Bellaire, Michigan, two from the Lamina, Inc. (1999, 2000), and one from Woodland Oil Bellaire Bulk Plant (2000). The owners of those areas are prohibited from use of groundwater on that property and excavation without proper permits. Possible contaminants to the groundwater from those sources included copper, cyanide, trichloroethylene (TCE), and tetrachloroethylene (PCE) from the Lamina, Inc. site, and various petroleum products from Woodland Oil Bellaire Bulk Plant.

Underground storage tanks

There were eight documented underground storage tanks: six have been closed and two were documented as open. Contaminants of concern included gasoline or diesel fuel. The two open underground storage tanks were Bay Oil Co. (gasoline) and Derrer Oil and Son Co. (diesel fuel).

Environmental contamination

There were six sites documented for environmental contamination (Table 6). Most contamination appears to be shallow releases of volatile compounds in locations where they would be released in surface water before reaching groundwater-fed wetlands.

Abandoned wells

What appeared to be an open, abandoned, hand dug well was located in the GAGE parcel (44.90311883, -85.2156887) during surveys. Abandoned wells can cause injury to animals and pose a threat to water quality by providing a direct entry point for surface contaminants to reach groundwater aquifers. The Michigan Department of Environmental Quality has more information and resources to locate and seal abandoned wells. (http://www.michigan.gov/deq/0,4561,7-135-3313_3675_3689---,00.html).

Table 6. Six sites of environmental contamination near GRNA property that were documented on the Michigan Department of Environmental Quality Environmental Mapper online tool.

Address	City	Contaminant
206 South Beech St	Bellaire	Selenium
East Broad St	Bellaire	1,2,4-trimethylbenzene, xylenes
3650 Derenzy Rd	Bellaire	Copper
7837 Crystal Springs Rd	Helena Twp.	fuel oil
East off Cemetery Rd, North of Westwood	Rapid River	not listed
US 131	Mancelona	2,4-dimethylphenol, benzene, ethylbenzene, phenol, toluene, xylenes, alkyl phenols

Discussion and Recommendations

Natural Communities

The open wetland communities, emergent marsh, northern wet meadow and northern fen, are in good condition with many signs of wildlife usage and few current threats. They appear to have experienced the least anthropogenic impacts in GRNA and retain species and structure characteristic of their reference communities. They are also subject to the natural processes that historically shaped them, with the exception of fire in the wet meadow and northern fen. Northern wet meadow and northern fen have particularly high native species richness (115, 156) and total FQI values (55.5, 65.2). These FQIs are above the threshold value of 50 indicating they are of considerable biodiversity value to the state and worthy of protection. Emergent marsh has lower native species richness (19) and an FQI of only 22.7; however, surveys were limited to GRNA parcel boundaries and did not focus on submergent species. Also, native species comprise 94.7% of the total emergent marsh species with only one invasive species observed.

Northern fen spans 158 acres of GRNA and qualifies as an A/B ranked natural community to be included in Biotics. It is the second largest of 31 northern fen EOs in northern Lower Michigan and one of only six in the region with an A/B rank (Figure 47). The open wetlands should be prioritized for protection and monitored for threats, such as hydrologic alteration, disturbance by recreational activities and spread of invasive species, particularly in the Clam Lake region. Due to the large acreage of northern fen in GRNA, the difficulty of accessing portions of it and the short survey windows of this study, further survey is warranted to fully capture its ecological history and diversity, as well as potential threats that could influence the A/B/ ranking.

The presence of native phragmites in northern wet meadow and northern fen is notable in light of the devastating invasions of the invasive Eurasian phragmites in many parts of the state. Although not observed on GRNA property, Eurasian phragmites was observed nearby along the shores of Clam Lake. Keeping the native phragmites occurrences in GRNA isolated from Eurasian phragmites is important not only for the wetlands themselves, but also for sustaining the genetic diversity and viability of this taxon in Michigan.

Due to significant alterations from reference conditions through logging, fragmentation and or suppression of natural processes such as fire (Figure 48), the surrounding natural communities do

not meet criteria for EO status; however, they cover significant acreage, and harbor significant biological diversity and wildlife habitat. Except for dry-mesic northern forest, the percentages of native species are all greater than 90% and the abundance of invasive species is remarkably low. Rich conifer swamp covers the largest acreage (503) and has the highest species richness and FQI values (207; 69.1) of all of the natural communities surveyed during this study. It is well above the threshold for natural area status and protection. The FQIs of poor conifer swamp (46) and hardwood conifer swamp (39.4) are well above the threshold of 35, indicating they are of floristic importance to the state. Together, these forested wetland communities provide a substantial buffer for the high quality open wetlands along the Grass River and Clam Lake. The dry-mesic and mesic upland forests are the most altered from reference conditions in composition, structure, and natural processes, but, have remarkably low invasive species abundance.

Taken as a whole, the natural communities at GRNA comprise a significant biodiversity hotspot amidst a highly fragmented landscape that is highly deserving of its status and protection as a natural area.

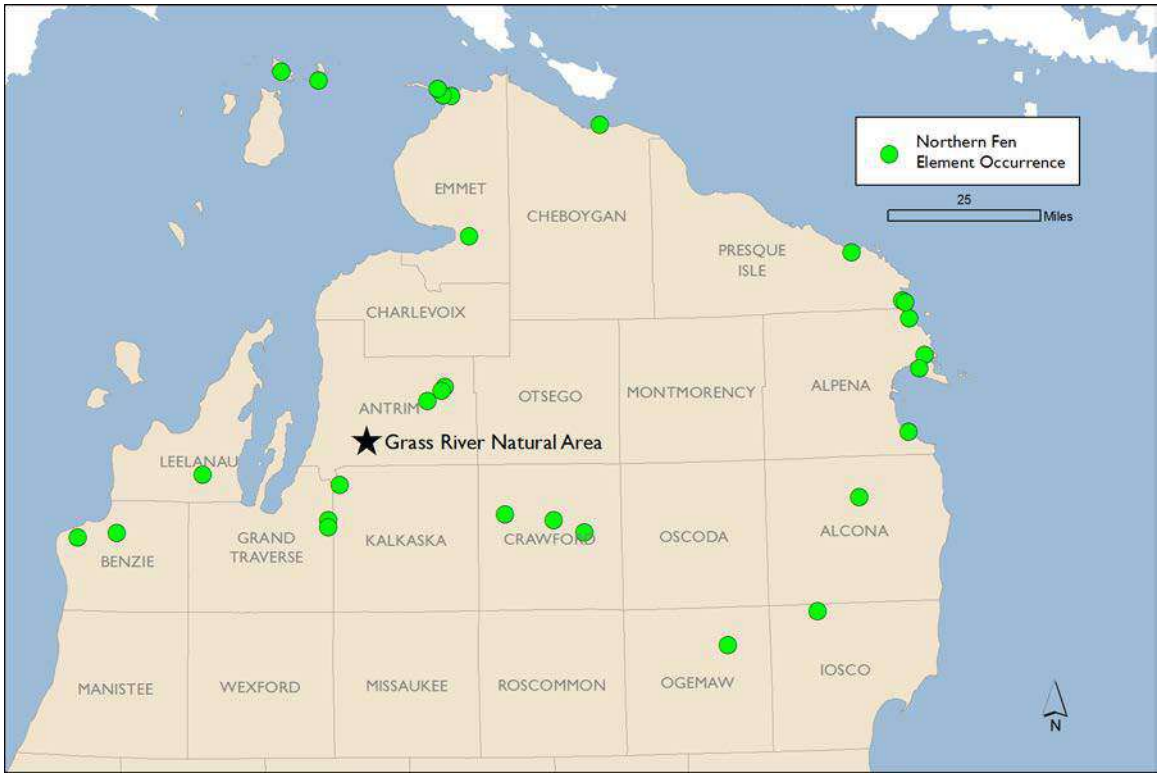

Figure 47. Northern fen occurrence documented in GRNA is the second largest of 31 northern fen element occurrences in northern Lower Michigan.

Anthropogenic Systems

The old field/residential areas are highly fragmented and altered from historical conditions and are a source of numerous weedy and invasive species, including the highly invasive *Centaurea stoebe* (spotted knapweed). There are some large pockets of *Schizachyrium scoparium* (little bluestem), native forbs and shrubs of interest to wildlife, however, these represent novel

ecosystems for the area. It is recommended that specific management goals be determined for these areas. Of greatest concern is keeping the many weedy and invasive species from spreading to higher quality areas.

Figure 48. 1938 aerial imagery showing extensive cutting of both upland and lowland forests in GRNA and the surrounding environment.

Species Documented

Three hundred and sixty-eight species were documented within GRNA, including 170 species that were not documented in the 1983 study and 27 new Antrim County records. Among the new species were 12 invasive species (Table 7) and 49 graminoids in the Poaceae (grass) and

Cyperaceae (sedge) families. One hundred and nine species were documented in 1983 that were not observed during the current study. The majority of these are likely to be found with additional survey, particularly during early spring in forested uplands and in submergent marsh zones, which were not the focus of this study. The addition of 170 species to the flora of GRNA and collection of 27 new county records is a substantial contribution to the state, both regionally and statewide.

Table 7. Invasive species newly documented since the 1983 (ER Squiers & Assoc.) study of GRNA.

Scientific Name	Common Name	Scientific Name	Common Name
Alliaria petiolata	garlic mustard	*Euphorbia virgata*	leafy spurge
Berberis thunbergii	Japanese barberry	*Lonicera morrowii*	morrow honeysuckle
Centaurea stoebe	spotted knapweed	*Lonicera* x*bella*	hybrid honeysuckle
Cirsium arvense	Canada thistle	*Lysimachia nummularia*	moneywort
Cirsium vulgaris	bull thistle	*Lythrum salicaria*	purple loosestrife

Rare species

Of the five special concern (SC) species documented in 1983, four are no longer listed (dragon's mouth, *Diphasiastrum complanatum* (ground cedar), yellow lady-slipper and *Chimaphila umbellata* (pipsissewa). One *Cuscuta* (dodder) was not keyed to species and therefore its rarity cannot be determined. *Vaccinium vitis-idaea* (mountain-cranberry), which was reported as a state threatened plant (T) in 1983, is a circumpolar arctic-subarctic species that is now listed as state endangered and is otherwise known only from Isle Royale in Michigan. Its noted occurrence in 1983 was likely a misidentification. One suspected occurrence of yellow pitcher plant was documented in GRNA in 2017, but requires flowers for confirmation. Although it is no longer a listed species in Michigan, if confirmed, it will be one of only a few reported occurrences of this form of pitcher plant in the state.

No federal or state-listed plants were observed, however, the approximately 500 acres of rich conifer and hardwood-conifer swamps documented provide potentially suitable habitat for *Calypso bulbosa* (calypso orchid, T) and *Cypripedium arietinum* (ram's head orchid, SC). Both of these species have been documented in Antrim County. The *Pterospora andromedea* (pine-drops) reported in the 1983 study was not observed during the 2017 study, and is now listed as a state threatened species. It typically occurs in fairly dry soils in association with pine and other confers species and could still persist at GRNA. Other rare species that could be sought *Berula erecta* (cut-leaved water parsnip, SC), *Gymnocarpium robertianum* (limestone oak fern, T) and *Mimulus michiganensis* (Michigan monkey-flower; federal and state endangered [LE, E]). Several animals could be targeted as well, including *Somatochlora hineana* (Hine's emerald dragonfly, LE, E), *Accipiter gentilis* (northern goshawk, SC), *Buteo lineatus* (red-shouldered hawk, T), *Emydoidea blandingii* (Blanding's turtle, SC) and *Sistrurus catenatus* (eastern massassauga, T).

Invasive Species

The 18 invasive species of high concern (Table 4) were found mostly in low abundance, providing an invaluable window of opportunity to address them before they become more widespread. It is recommended that they be surveyed and mapped, prioritized and managed as soon as possible to prevent ecosystem degradation and to minimize costs and maximize success

of control efforts. Management should focus on eradicating outliers where possible and preventing their spread in the highest quality and most valued areas. Mapping is essential to effective prioritization, by providing information on sources, outliers, and pathways so that control efforts can be directed to the most important places where success is likely to be achieved, instead of randomly or ineffectively. Thorough invasive species surveys were not within the scope of the current study, thus the mapped points do not likely represent the full picture of their distribution at GRNA. However, they do provide some guidance for next steps.

Open wetland invaders

Narrow-leaved cat-tail is the species of most immediate threat to the high quality open wetlands. This species spreads quickly, often forming near-monocultures that displace native species. It also hybridizes with the native common cat-tail producing an even more aggressive hybrid, *Typha* x*glauca* (hybrid cat-tail). Common cat-tail is prevalent in GRNA and hybridization with narrow-leaved cat-tail is likely without intervention. Preventing Eurasian phragmites from reaching GRNA from Clam Lake and preventing further spread of reed canary grass, purple loosestrife, marsh thistle and yellow-flag in these wetlands are also high priorities.

Early detection species

Rapid assessment and response to eradicate or contain garlic mustard, leafy spurge and purple loosestrife, which appear to be quite rare at GRNA, is another high priority. While not a threat to the open wetlands, garlic mustard will inevitably spread throughout the mesic northern forest and some of the forested wetlands if not checked. It is critical to prevent the development of a seed bank, as seeds are known to be viable for ten or more years. Leafy spurge will spread through the open uplands and even into some wet pockets. It forms deep, persistent roots that are extremely difficult to extract and will regenerate from root fragments. Purple loosestrife is a well-known invader that has been controlled effectively with biocontrol. However, small populations don't usually support the beetle and weevil populations that eat various parts of the plant, and control by other techniques is sometimes warranted.

Shrubs

Multiflora rose is a persistent perennial and due to its sharp, down-curved thorns, it can make normally open areas untraversable. The thorny Japanese barberry can do the same thing, although it is often not on the radar of land managers. Both species can persist as 'sleepers' for many years before they expand, and are often overlooked when they can be most easily controlled. Expansion of the invasive honeysuckles and autumn olive will also form impenetrable thickets. All of these shrubs change the structure and composition of the forest, altering or displacing habitat for native species. They produce abundant berries which are dispersed readily by birds, deer, turkey, and grouse. They typically don't thrive in full canopy, thus focusing on the outliers and pushing them back towards their sources, along with monitoring canopy openings is often an effective tactic to minimize their spread.

More thorough surveys may determine that multiflora rose, non-native honeysuckles and Japanese barberry, are rare enough for targeted early detection response—treat every occurrence as soon as possible to prevent them from becoming a significant problem. Autumn olive appears to be more widespread and will likely require prioritization, with a focus on protecting the most

valued areas. A better understanding of the distribution of outliers, sources and pathways will help in determining the most effective strategy.

Intensive detection monitoring for *Rhamnus cathartica* (common buckthorn) and *Alnus frangula* (glossy buckthorn), which, surprisingly, were not observed during this study, is recommended. The establishment and spread of these species, is extremely undesirable, particularly glossy buckthorn, which would be devastating to the high quality northern wet meadow and northern fen areas.

Thistles

The thistles are challenging due to their abundant wind-blown seed and prickly nature. Marsh thistle is currently the biggest concern, as it already occurs sporadically throughout both the open and forested wetlands. There is little data on the overall impacts of this species but it is becoming increasingly more common in wetlands throughout northern Michigan. It is a monocarpic biennial, which takes 2-3 years to flower and then dies. Thus, the focus for this species is to kill it before the flowers go to seed—noting that it can flower more than once during a season. It is thought to be somewhat shade-intolerant, so minimizing and monitoring canopy gaps will likely be helpful. Bull-thistle was observed near creeks in rich conifer swamp and in ditches along the rail-trail. It is not a threat to the open wetlands, but can establish dense patches in disturbed openings. Like marsh thistle, it dies after flowering. Canada thistle was only noted in old fields and occasionally along the rail-trail, but it can establish in northern wet meadows and possibly northern fen. Unlike the marsh and bull thistle it is a perennial that establishes deep tap roots and extensive lateral roots that generate new plants and will regenerate if fragmented—nipping the flowers before going to seed does not kill the plant. Early control of this species is essential to keep it from degrading the high quality open wetlands.

Swamp ground creepers

Long-term ecological impacts from moneywort and forget-me-not have yet to be determined (GLANSIS, 2014). However, due to many occurrences of these species that appear to be dominating and displacing native species in wetland seeps, including at least one where state and federal endangered Michigan monkey-flower occurs (Slaughter 2015), they are included in the list of invasive plants for GRNA. Determining the extent of these species and assessing their risk based upon GRNA management goals is recommended. It will be important to stay abreast of research on the ecological impacts and best control methods for these species.

Spotted knapweed

Unlike the uncommon occurrences of most invasive species at GRNA, spotted knapweed is well established in some of the anthropogenic systems. It is intolerant of shade and water and therefore not a direct threat to the high quality wetlands. Control efforts are best directed towards monitoring and eradicating outliers along foot trails, the rail-trail and forest openings. Where it is well established, it is best to control it only as part of a of a carefully considered, integrated management plan with specific management goals and monitoring to inform future management. It is important to note that prescribed burning may reduce non-native cool season grasses in favor of warm season grasses such as *Schizachyrium scoparium*, but fire alone does not control spotted knapweed and can increase its spread (Dewey 2000, Rice and Harrington 2005).

Other non-native species

The 35 other non-native species are of less immediate concern to the high quality wetlands at GRNA, however, they it is important to keep them on the radar and monitor for potential future impacts. Many of these can be invasive under certain conditions and may warrant treatment based upon specific management priorities and goals.

Invasive Species Decontamination Protocols

Due to the relatively low abundance and localized occurrences of many of the invasive species at GRNA, one of the most effective actions that can be implemented is to stop their spread by people. Seeds and other propagules are easily spread through recreational activities, vehicles, boats and equipment. Developing protocols for minimizing the spread of invasive species is a high priority. Sources of information that can be helpful include the Play-Clean-Go and Clean Boats-Clean Waters programs and decontamination policy and procedure and guidance documents recently developed State of Michigan:
http://www.playcleango.org/
http://www.canr.msu.edu/clean_boats_clean_waters/
https://www.michigan.gov/documents/deq/qol-wrd-policy-invasive-species-decontamination_476846_7.pdf

Particular attention should be paid to those residential properties with a higher abundance of invasive species, as the risk of spread from these areas is high. The ABS #1, ABS #2, SWAN, SKINNER, SPEET properties near Clam Lake, and the NOLD properties all had higher abundance of invasive species, such as autumn olive. The SPEET property contained the only occurrences of purple loosestrife and the SKINNER property contained the only occurrence of garlic mustard documented during this study. Outreach and education to these landowners would be useful to minimize these invasion pathways. Installing boot brushes at strategic locations would be an effective reminder of how people contribute to invasions and an effective tool for reducing their spread.

Shoreline Habitat

To reduce the threat of nutrient run-off and increase habitat for animals such as turtles and otters, it would be beneficial to support local efforts to educate landowners about the negative impacts of nutrient run-off and the benefits of restoring natural shorelines using native species. Natural shorelines are more effective at intercepting nutrients and toxins before they reach the waters of rivers, lakes and streams. Useful sources of information are the Michigan Inland Lakes Shoreline partnership and the Michigan Natural Shoreline Partnership:
http://www.mishorelinepartnership.org/
http://michiganlakes.msue.msu.edu/michigan_natural_shoreline_partnership

In addition, native species provide greater benefits to wildlife through their entire life cycle, unlike many non-native species. For example, some non-native species provide good nectaring resources for adult pollinators, but are toxic to their larva. Douglas Tallamy has documented the dramatic difference that native species have in supporting the tremendous diversity of native insects that are essential for baby birds (Tallamy 2009, Darke & Tallamy 2014). Baby birds are picky and voracious eaters. Loss of the native insects they require, by displacement of their native food sources and host plants by non-native species, affects the entire food chain.

Groundwater Contamination & Water Quality

The 1983 study (ER Squiers & Associates) indicated that the majority of soils found within GRNA are not suitable for septic drains and are vulnerable to surface water contamination. They noted that while the groundwater aquifers directly beneath GRNA are classified as 'protected' from surface contamination, those to the south and east of GRNA are 'vulnerable'. They cited a 1979 report that listed the northern portion of the Grass River directly adjacent to GRNA, as an on-site problem area, stemming from on-site wastewater disposal in an area of high water table. Assessing water quality and groundwater contamination was beyond the scope of this study, however, the information retrieved from the MDEQ Environmental Mapper revealed several areas of potential concern. Since the natural communities of greatest proportion at GRNA are groundwater fed, a thorough assessment of current or future risks of water quality degradation and groundwater contamination is recommended. The abandoned well discovered during this study and any others should be properly closed to prevent contamination from that source and to prevent injury to animals.

Figure 49. *Platanthera huronensis* (Lake Huron green orchid) in northern fen in the GORSUCH H #1E parcel. Photo by Phyllis Higman.

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Figure 50. *Cypripedium parviflorum* (yellow lady-slipper) in northern fen in the DELANGE #1B parcel.

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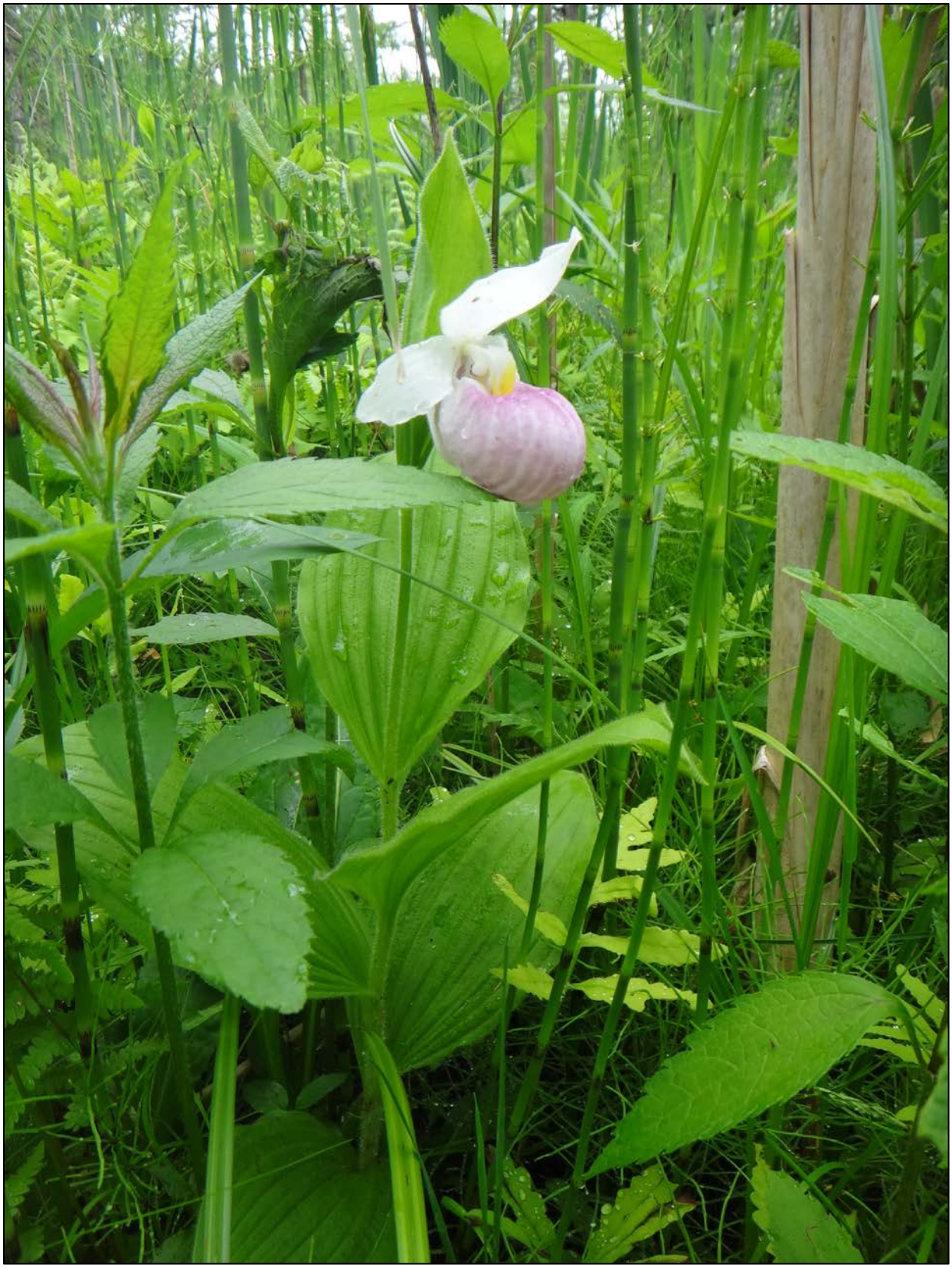

***Cypripedium reginae* (showy lady-slipper) was found in northern fen and rich conifer swamp in GRNA.**

Appendix 1. Grass River Natural Area - Floristic Quality Assessment: All Communities

Grass River Natural Area 2017	
Bellaire, Antrim County, Michigan, 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:	Rachel Hackett, Liana May, Phyllis Higman
Duration Notes:	Surveys were conducted 9 June 2017 (Liana May), from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes:	The majority of the properties are rich conifer swamp, mesic northern forest, and northern fen. Other natural communities include emergent marsh, northern wet meadow, northern shrub thicket, poor conifer swamp, hardwood-conifer swamp, dry-mesic northern forest, and old fields/residential/red pine plantations. Twenty-seven new county occurrence specimens were collected. Those collected by Rachel Hackett (24) will be deposited in Central Michigan University Herbarium (CMC), digitally stored via the Symbiota Consortium of Midwest Herbaria Portal, and sent to University of Michigan Herbarium for inclusion in Michigan Flora. Three specimens collected by Liana May will be deposited in the University of Michigan Herbarium for inclusion in Michigan Flora. Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Cardamine* spp., *Dryopteris* spp., *Eleocharis* spp., *Fraxinus* spp. saplings (*F. americana* likely), *Geum* spp., *Lonicera* spp., Lycopodiaceae, *Populus* spp. saplings, *Quercus* hybrid with one parent likely *Q. macrocarpa*, *Quercus* spp. saplings, and *Viola* spp. *Dichanthelium implicatum* in Michigan Flora has the accepted name of *Dichanthelium acuminatum* via tropicos.org.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	4.3	Total Species:	368	85.60%	Annual:	14	3.80%
Native Mean C:	5.0	Native Species:	315	14.40%	Perennial:	344	93.50%
Total FQI:	82.5	Non-native Species:	53		Biennial:	10	2.70%
Native FQI:	88.7				Native Annual:	8	2.20%
Adjusted FQI:	46.3	**Species Wetness**:			Native Perennial:	305	82.90%
% C value 0:	16.3	Mean Wetness:	-1.0		Native Biennial:	2	0.50%
% C value 1-3:	20.4	Native Mean Wetness:	-1.6				
% C value 4-6:	42.9						
% C value 7-10:	20.4	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	4.0	Tree:	25	6.80%	Sedge:	49	13.30%
Native Shrub Mean C:	5.3	Shrub:	49	13.30%	Rush:	3	0.80%
Native Herbaceous Mean C:	5.1	Vine:	9	2.40%	Fern:	26	7.10%
		Forb:	178	48.40%	Bryophyte:	0	0%
		Grass:	29	7.90%			

Species:

Grass River Natural Area 2017

Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Abies balsamea	Pinaceae	ABIBAL	native	3	0	tree	perennial	balsam fir
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red 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 purpurea	Orobanchaceae	AGAPUR	native	7	-3	forb	annual	purple false foxglove
Agrostis gigantea	Poaceae	AGRGIG	non-native	0	-3	grass	perennial	redtop
Agrostis perennans	Poaceae	AGRPER	native	5	3	grass	perennial	autumn bent
Agrostis scabra; a. hyemalis	Poaceae	AGRSCA	native	4	0	grass	perennial	ticklegrass
Alliaria petiolata	Brassicaceae	ALLPET	non-native	0	3	forb	biennial	garlic mustard
Allium tricoccum	Alliaceae	ALLTRI	native	5	3	forb	perennial	wild leek
Alnus incana; a. rugosa	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
Anaphalis margaritacea	Asteraceae	ANAMAR	native	3	5	forb	perennial	pearly everlasting
Andromeda glaucophylla	Ericaceae	ANDGLA	native	10	-5	shrub	perennial	bog-rosemary
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Anemone cylindrica	Ranunculaceae	ANECYL	native	6	5	forb	perennial	thimbleweed
Anemone virginiana	Ranunculaceae	ANEVIR	native	3	3	forb	perennial	thimbleweed
Antennaria howellii	Asteraceae	ANTHOW	native	2	5	forb	perennial	small pussytoes
Antennaria parlinii	Asteraceae	ANTPAL	native	2	5	forb	perennial	smooth pussytoes
Apocynum androsaemifolium	Apocynaceae	APOAND	native	3	5	forb	perennial	spreading dogbane

Grass River Natural Area 2017 Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Apocynum cannabinum; a. sibiricum	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
Aralia nudicaulis	Araliaceae	ARANUD	native	5	3	forb	perennial	wild sarsaparilla
Arethusa bulbosa	Orchidaceae	AREBUL	native	10	-5	forb	perennial	dragons mouth
Arisaema triphyllum	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
Artemisia campestris	Asteraceae	ARTCAM	native	5	5	forb	biennial	wormwood
Asclepias incarnata	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
Asclepias syriaca	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
Athyrium filix-femina	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
Berberis thunbergii	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
Berteroa incana	Brassicaceae	BERINC	non-native	0	5	forb	annual	hoary alyssum
Betula alleghaniensis	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
Betula papyrifera	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
Bidens comosa	Asteraceae	BIDCOM	native	5	-3	forb	annual	swamp tickseed
Bidens frondosa	Asteraceae	BIDFRO	native	1	-3	forb	annual	common beggar-ticks
Boehmeria cylindrica	Urticaceae	BOECYL	native	5	-5	forb	perennial	false nettle
Botrypus virginianus	Ophioglossaceae	BOTVIR	native	5	3	fern	perennial	rattlesnake fern
Brachyelytrum aristosum; b. erectum	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
Bromus ciliatus	Poaceae	BROCIL	native	6	-3	grass	perennial	fringed brome
Bromus inermis	Poaceae	BROINE	non-native	0	5	grass	perennial	smooth brome
Calamagrostis canadensis	Poaceae	CALCAN	native	3	-5	grass	perennial	blue-joint
Calamagrostis stricta; c. inexpansa; c. lacustris	Poaceae	CALSTR	native	10	-3	grass	perennial	narrow-leaved reedgrass
Calopogon tuberosus	Orchidaceae	CALTUB	native	9	-5	forb	perennial	grass-pink
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Calystegia sepium	Convolvulaceae	CALSEP	native	2	0	vine	perennial	hedge bindweed
Campanula aparinoides	Campanulaceae	CAMAPA	native	7	-5	forb	perennial	marsh bellflower
Cardamine bulbosa	Brassicaceae	CARBUL	native	4	-5	forb	perennial	spring cress
Cardamine diphylla; dentaria d.	Brassicaceae	CARDIP	native	5	3	forb	perennial	two-leaved toothwort
Carex aquatilis	Cyperaceae	CXAQUA	native	7	-5	sedge	perennial	sedge
Carex arctata	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
Carex aurea	Cyperaceae	CXAURE	native	3	-3	sedge	perennial	sedge
Carex bebbii	Cyperaceae	CXBEBB	native	4	-5	sedge	perennial	sedge
Carex brunnescens	Cyperaceae	CXBRUN	native	5	-3	sedge	perennial	sedge
Carex buxbaumii	Cyperaceae	CXBUXB	native	10	-5	sedge	perennial	sedge
Carex communis	Cyperaceae	CXCOMM	native	2	5	sedge	perennial	sedge
Carex comosa	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge

Grass River Natural Area 2017								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Carex crinita	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
Carex deweyana	Cyperaceae	CXDEWE	native	3	3	sedge	perennial	sedge
Carex diandra	Cyperaceae	CXDIAN	native	8	-5	sedge	perennial	sedge
Carex disperma	Cyperaceae	CXDISP	native	10	-5	sedge	perennial	sedge
Carex eburnea	Cyperaceae	CXEBUR	native	7	3	sedge	perennial	sedge
Carex exilis	Cyperaceae	CXEXIL	native	10	-5	sedge	perennial	sedge
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex gracillima	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
Carex hystericina	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex intumescens	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
Carex lacustris	Cyperaceae	CXLACU	native	6	-5	sedge	perennial	sedge
Carex laevivaginata	Cyperaceae	CXLAEV	native	8	-5	sedge	perennial	sedge
Carex lasiocarpa	Cyperaceae	CXLASI	native	8	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex leptonervia	Cyperaceae	CXLEPO	native	3	0	sedge	perennial	sedge
Carex lupulina	Cyperaceae	CXLUPA	native	4	-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 prairea	Cyperaceae	CXPRAI	native	10	-3	sedge	perennial	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 stipata	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex trisperma	Cyperaceae	CXTRIS	native	9	-5	sedge	perennial	sedge
Carex utriculata; c. rostrata	Cyperaceae	CXUTRI	native	5	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Centaurea stoebe; c. maculosa	Asteraceae	CENSTO	non-native	0	5	forb	biennial	spotted knapweed
Cephalanthus occidentalis	Rubiaceae	CEPOCC	native	7	-5	shrub	perennial	buttonbush
Chamaedaphne calyculata	Ericaceae	CHACAL	native	8	-5	shrub	perennial	leatherleaf
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Chrysosplenium americanum	Saxifragaceae	CHRAME	native	6	-5	forb	perennial	golden saxifrage
Cicuta bulbifera	Apiaceae	CICBUL	native	5	-5	forb	perennial	water hemlock
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 muticum	Asteraceae	CIRMUT	native	6	-5	forb	biennial	swamp thistle
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Cirsium vulgare	Asteraceae	CIRVUL	non-native	0	3	forb	biennial	bull thistle

Grass River Natural Area 2017 Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Cladium mariscoides	Cyperaceae	CLAMAR	native	10	-5	sedge	perennial	twig-rush
Clematis virginiana	Ranunculaceae	CLEVIR	native	4	0	vine	perennial	virgins bower
Clinopodium vulgare	Lamiaceae	CLIVUL	native	3	5	forb	perennial	wild-basil
Clintonia borealis	Convallariaceae	CLIBOR	native	5	0	forb	perennial	bluebead-lily; corn-lily
Comarum palustre; potentilla p.	Rosaceae	COMPAL	native	7	-5	forb	perennial	marsh cinquefoil
Conyza canadensis	Asteraceae	CONCAN	native	0	3	forb	annual	horseweed
Coptis trifolia	Ranunculaceae	COPTRI	native	5	-3	forb	perennial	goldthread
Corallorhiza trifida	Orchidaceae	CORTRF	native	6	-3	forb	perennial	early coral-root
Cornus alternifolia	Cornaceae	CORALT	native	5	3	tree	perennial	alternate-leaved dogwood
Cornus amomum	Cornaceae	CORAMO	native	2	-3	shrub	perennial	silky 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
Cypripedium acaule	Orchidaceae	CYPACA	native	5	-3	forb	perennial	pink lady-slipper; moccasin flower
Cypripedium parviflorum; c. calceolus	Orchidaceae	CYPPAR	native	5	0	forb	perennial	yellow lady-slipper
Cypripedium reginae	Orchidaceae	CYPREG	native	9	-3	forb	perennial	showy or queens lady-slipper
Dactylis glomerata	Poaceae	DACGLO	non-native	0	3	grass	perennial	orchard grass
Danthonia spicata	Poaceae	DANSPI	native	4	5	grass	perennial	poverty grass; oatgrass
Dasiphora fruticosa; potentilla f.	Rosaceae	DASFRU	native	8	-3	shrub	perennial	shrubby cinquefoil
Daucus carota	Apiaceae	DAUCAR	non-native	0	5	forb	biennial	queen-annes-lace
Decodon verticillatus	Lythraceae	DECVER	native	7	-5	shrub	perennial	whorled or swamp loosestrife
Dendrolycopodium obscurum; lycopodium o.	Lycopodiaceae	DENOBS	native	5	3	fern	perennial	ground-pine
Dianthus armeria	Caryophyllaceae	DIAARM	non-native	0	5	forb	annual	deptford pink
Dichanthelium depauperatum; panicum d.	Poaceae	DICDEP	native	4	5	grass	perennial	panic grass
Dichanthelium implicatum; panicum i.	Poaceae	DICIMP	native	3	0	grass	perennial	panic grass
Doellingeria umbellata; aster u.	Asteraceae	DOEUMB	native	5	-3	forb	perennial	flat-topped white aster
Drosera rotundifolia	Droseraceae	DROROT	native	6	-5	forb	perennial	round-leaved sundew
Dryopteris carthusiana	Dryopteridaceae	DRYCAR	native	5	-3	fern	perennial	spinulose woodfern
Dryopteris clintoniana	Dryopteridaceae	DRYCLI	native	8	-3	fern	perennial	clintons woodfern
Dryopteris cristata	Dryopteridaceae	DRYCRI	native	6	-5	fern	perennial	crested shield fern
Dryopteris intermedia	Dryopteridaceae	DRYINT	native	5	0	fern	perennial	evergreen woodfern

Grass River Natural Area 2017								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Dulichium arundinaceum	Cyperaceae	DULARU	native	8	-5	sedge	perennial	three-way sedge
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Eleocharis elliptica	Cyperaceae	ELEELL	native	6	-5	sedge	perennial	golden-seeded spike rush
Eleocharis erythropoda	Cyperaceae	ELEERY	native	4	-5	sedge	perennial	spike-rush
Eleocharis palustris; e. smallii	Cyperaceae	ELEPAL	native	5	-5	sedge	perennial	spike-rush
Elymus hystrix; hystrix patula	Poaceae	ELYHYS	native	5	3	grass	perennial	bottlebrush grass
Elymus repens; agropyron r.	Poaceae	ELYREP	non-native	0	3	grass	perennial	quack grass
Elymus trachycaulus; agropyron t.	Poaceae	ELYTRA	native	8	3	grass	perennial	slender wheatgrass
Epigaea repens	Ericaceae	EPIREP	native	7	3	shrub	perennial	trailing-arbutus
Epilobium ciliatum	Onagraceae	EPICIL	native	3	-3	forb	perennial	willow-herb
Epilobium palustre	Onagraceae	EPIPAL	native	10	-5	forb	perennial	marsh willow-herb
Epilobium parviflorum	Onagraceae	EPIPAR	non-native	0	-5	forb	perennial	willow-herb
Epipactis helleborine	Orchidaceae	EPIHEL	non-native	0	0	forb	perennial	helleborine
Equisetum arvense	Equisetaceae	EQUARV	native	0	0	fern	perennial	common horsetail
Equisetum fluviatile	Equisetaceae	EQUFLU	native	7	-5	fern	perennial	water horsetail
Equisetum hyemale	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
Equisetum palustre	Equisetaceae	EQUPAL	native	8	-3	fern	perennial	marsh horsetail
Equisetum scirpoides	Equisetaceae	EQUSCI	native	7	0	fern	perennial	dwarf scouring rush
Equisetum sylvaticum	Equisetaceae	EQUSYL	native	5	-3	fern	perennial	woodland horsetail
Erigeron strigosus	Asteraceae	ERISTR	native	4	3	forb	perennial	daisy fleabane
Eriophorum viridi-carinatum	Cyperaceae	ERIVID	native	8	-5	sedge	perennial	green-keeled cotton-grass
Erythronium americanum	Liliaceae	ERYAME	native	5	5	forb	perennial	yellow trout lily
Eupatorium perfoliatum	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
Euphorbia corollata	Euphorbiaceae	EUPCOR	native	4	5	forb	perennial	flowering spurge
Euphorbia virgata; e. esula	Euphorbiaceae	EUPVIR	non-native	0	5	forb	perennial	leafy spurge
Euthamia graminifolia	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
Eutrochium maculatum; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
Fagus grandifolia	Fagaceae	FAGGRA	native	6	3	tree	perennial	american beech
Fragaria virginiana	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
Fraxinus americana	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
Fraxinus nigra	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
Galium asprellum	Rubiaceae	GALASP	native	5	-5	vine	perennial	rough bedstraw
Galium labradoricum	Rubiaceae	GALLAB	native	8	-5	forb	perennial	bog bedstraw
Galium tinctorium	Rubiaceae	GALTIN	native	5	-5	forb	perennial	stiff bedstraw
Galium triflorum	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
Gaultheria hispidula	Ericaceae	GAUHIS	native	8	-3	shrub	perennial	creeping-snowberry

Grass River Natural Area 2017								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Gaultheria procumbens	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
Gaylussacia baccata	Ericaceae	GAYBAC	native	7	3	shrub	perennial	huckleberry
Geum canadense	Rosaceae	GEUCAN	native	1	0	forb	perennial	white avens
Geum rivale	Rosaceae	GEURIV	native	7	-5	forb	perennial	purple avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Gnaphalium uliginosum	Asteraceae	GNAULI	native	3	0	forb	annual	low cudweed
Goodyera pubescens	Orchidaceae	GOOPUB	native	7	3	forb	perennial	downy rattlesnake plantain
Gymnocarpium dryopteris	Cystopteridaceae	GYMDRY	native	5	3	fern	perennial	oak fern
Hamamelis virginiana	Hamamelidaceae	HAMVIR	native	5	3	shrub	perennial	witch-hazel
Hieracium aurantiacum	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
Hieracium caespitosum	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
Hieracium piloselloides	Asteraceae	HIEPIS	non-native	0	5	forb	perennial	king devil
Hydrocotyle americana	Araliaceae	HYDAME	native	6	-5	forb	perennial	water-pennywort
Hypericum kalmianum	Hypericaceae	HYPKAL	native	10	-3	shrub	perennial	kalms st. johns-wort
Hypericum perforatum	Hypericaceae	HYPPER	non-native	0	5	forb	perennial	common st. johns-wort
Hypopitys monotropa; monotropa hypopithys	Ericaceae	HYPMON	native	6	5	forb	perennial	pinesap
Ilex mucronata; nemopanthus m.	Aquifoliaceae	ILEMUC	native	7	-5	shrub	perennial	mountain holly
Ilex verticillata	Aquifoliaceae	ILEVER	native	5	-3	shrub	perennial	michigan holly
Impatiens capensis	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
Iris pseudacorus	Iridaceae	IRIPSE	non-native	0	-5	forb	perennial	yellow flag
Iris virginica	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
Juncus effusus	Juncaceae	JUNEFF	native	3	-5	rush	perennial	soft-stemmed rush
Juncus nodosus	Juncaceae	JUNNOD	native	5	-5	rush	perennial	joint rush
Juncus tenuis	Juncaceae	JUNTEN	native	1	0	rush	perennial	path rush
Juniperus communis	Cupressaceae	JUNCOI	native	4	3	shrub	perennial	common or ground juniper
Larix laricina	Pinaceae	LARLAR	native	5	-3	tree	perennial	tamarack
Lathyrus palustris	Fabaceae	LATPAL	native	7	-3	vine	perennial	marsh pea
Leersia oryzoides	Poaceae	LEEORY	native	3	-5	grass	perennial	cut grass
Lemna minor	Araceae	LEMMIN	native	5	-5	forb	perennial	common duckweed
Leucanthemum vulgare; chrysanthemum leucanthemum	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy
Lilium philadelphicum	Liliaceae	LILPHI	native	7	0	forb	perennial	wood lily
Lindera benzoin	Lauraceae	LINBEN	native	7	-3	shrub	perennial	spicebush
Linnaea borealis	Linnaeaceae	LINBOR	native	6	0	forb	perennial	twinflower
Lobelia cardinalis	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower

Grass River Natural Area 2017								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Lobelia kalmii	Campanulaceae	LOBKAL	native	10	-5	forb	perennial	bog lobelia
Lobelia siphilitica	Campanulaceae	LOBSIP	native	4	-3	forb	perennial	great blue lobelia
Lonicera canadensis	Caprifoliaceae	LONCAN	native	5	3	shrub	perennial	canadian fly honeysuckle
Lonicera dioica	Caprifoliaceae	LONDIO	native	5	3	vine	perennial	red honeysuckle
Lonicera morrowii	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle
Lonicera oblongifolia	Caprifoliaceae	LONOBL	native	8	-5	shrub	perennial	swamp fly honeysuckle
Lonicera Ã—bella	Caprifoliaceae	LONBEL	non-native	0	3	shrub	perennial	hybrid honeysuckle
Lycopodium clavatum	Lycopodiaceae	LYCCLA	native	4	0	fern	perennial	running ground-pine
Lycopus americanus	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
Lycopus uniflorus	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
Lysimachia nummularia	Myrsinaceae	LYSNUM	non-native	0	-3	forb	perennial	moneywort
Lysimachia quadriflora	Myrsinaceae	LYSQUR	native	10	-5	forb	perennial	whorled loosestrife
Lysimachia thyrsiflora	Myrsinaceae	LYSTHY	native	6	-5	forb	perennial	tufted loosestrife
Lythrum salicaria	Lythraceae	LYTSAL	non-native	0	-5	forb	perennial	purple loosestrife
Maianthemum canadense	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
Maianthemum stellatum; smilacina s.	Convallariaceae	MAISTE	native	5	0	forb	perennial	starry false solomon-seal
Maianthemum trifolium; smilacina t.	Convallariaceae	MAITRI	native	10	-5	forb	perennial	false mayflower
Matteuccia struthiopteris	Onocleaceae	MATSTR	native	3	0	fern	perennial	ostrich fern
Medeola virginiana	Convallariaceae	MEDVIR	native	10	3	forb	perennial	indian cucumber-root
Medicago lupulina	Fabaceae	MEDLUP	non-native	0	3	forb	annual	black medick
Melilotus albus	Fabaceae	MELALB	non-native	0	3	forb	biennial	white sweet-clover
Mentha canadensis; m. arvensis	Lamiaceae	MENCAS	native	3	-3	forb	perennial	wild mint
Mentha Ã—piperita	Lamiaceae	MENPIP	non-native	0	-5	forb	perennial	peppermint
Menyanthes trifoliata	Menyanthaceae	MENTRI	native	8	-5	forb	perennial	buckbean
Mimulus ringens	Phrymaceae	MIMRIN	native	5	-5	forb	perennial	monkey-flower
Mitchella repens	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
Mitella nuda	Saxifragaceae	MITNUD	native	8	-3	forb	perennial	naked miterwort
Muhlenbergia glomerata	Poaceae	MUHGLO	native	10	-5	grass	perennial	marsh wild-timothy
Myosotis scorpioides	Boraginaceae	MYOSCO	non-native	0	-5	forb	perennial	forget-me-not
Myrica gale	Myricaceae	MYRGAL	native	6	-5	shrub	perennial	sweet gale
Nasturtium officinale	Brassicaceae	NASOFF	native	4	-5	forb	perennial	watercress
Nuphar variegata	Nymphaeaceae	NUPVAR	native	7	-5	forb	perennial	yellow pond-lily
Nymphaea odorata	Nymphaeaceae	NYMODO	native	6	-5	forb	perennial	sweet-scented waterlily
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Orthilia secunda	Ericaceae	ORTSEC	native	7	0	forb	perennial	one-sided pyrola
Oryzopsis asperifolia	Poaceae	ORYASP	native	6	5	grass	perennial	rough-leaved rice-grass

Grass River Natural Area 2017 Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Osmunda cinnamomea	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
Osmunda claytoniana	Osmundaceae	OSMCLN	native	6	0	fern	perennial	interrupted fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Packera paupercula; senecio p.; senecio plattensis	Asteraceae	PACPAU	native	3	0	forb	perennial	balsam ragwort
Panicum capillare	Poaceae	PANCAP	native	0	0	grass	annual	witch grass
Parnassia glauca	Parnassiaceae	PARGLA	native	8	-5	forb	perennial	grass-of-parnassus
Parthenocissus quinquefolia	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
Persicaria amphibia; polygonum a.	Polygonaceae	PERAMP	native	6	-5	forb	perennial	water smartweed
Persicaria hydropiperoides; polygonum h.	Polygonaceae	PERHYS	native	5	-5	forb	perennial	mild water-pepper
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phegopteris connectilis; thelypteris phegopteris	Thelypteridaceae	PHECON	native	5	3	fern	perennial	northern beech-fern
Phleum pratense	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
Phragmites australis var. americanus	Poaceae	PHRAUM	native	5	-3	grass	perennial	reed
Picea glauca	Pinaceae	PICGLA	native	3	3	tree	perennial	white spruce
Picea mariana	Pinaceae	PICMAR	native	6	-3	tree	perennial	black spruce
Picea pungens	Pinaceae	PICPUN	non-native	0	3	tree	perennial	blue spruce
Pilea fontana	Urticaceae	PILFON	native	5	-3	forb	annual	bog clearweed
Pinus resinosa	Pinaceae	PINRES	native	6	3	tree	perennial	red pine
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Plantago lanceolata	Plantaginaceae	PLALAN	non-native	0	3	forb	perennial	english plantain
Plantago major	Plantaginaceae	PLAMAJ	non-native	0	3	forb	perennial	common plantain
Platanthera clavellata; habenaria c.	Orchidaceae	PLACLA	native	6	-3	forb	perennial	small green wood orchid
Platanthera huronensis; habenaria hyperborea	Orchidaceae	PLAHUR	native	5	-3	forb	perennial	lake huron green orchid
Platanthera psycodes; habenaria p.	Orchidaceae	PLAPSY	native	7	-3	forb	perennial	purple fringed orchid
Poa alsodes	Poaceae	POAALS	native	9	0	grass	perennial	bluegrass
Poa compressa	Poaceae	POACOM	non-native	0	3	grass	perennial	canada bluegrass
Poa palustris	Poaceae	POAPAS	native	3	-3	grass	perennial	fowl meadow grass
Poa pratensis	Poaceae	POAPRA	non-native	0	3	grass	perennial	kentucky bluegrass
Pogonia ophioglossoides	Orchidaceae	POGOPH	native	10	-5	forb	perennial	rose pogonia
Polygala paucifolia	Polygalaceae	POLPAU	native	7	3	forb	perennial	gay-wings

Grass River Natural Area 2017								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Polygonatum pubescens	Convallariaceae	POLPUB	native	5	5	forb	perennial	downy solomon seal
Pontederia cordata	Pontederiaceae	PONCOR	native	8	-5	forb	perennial	pickerel-weed
Populus alba	Salicaceae	POPALB	non-native	0	5	tree	perennial	white poplar
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	tree	perennial	balsam poplar
Populus grandidentata	Salicaceae	POPGRA	native	4	3	tree	perennial	big-tooth aspen
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Potamogeton natans	Potamogetonaceae	POTNAT	native	5	-5	forb	perennial	pondweed
Potentilla anserina	Rosaceae	POTANS	native	5	-3	forb	perennial	silverweed
Potentilla recta	Rosaceae	POTREC	non-native	0	5	forb	perennial	rough-fruited cinquefoil
Proserpinaca palustris	Haloragaceae	PROPAL	native	6	-5	forb	perennial	mermaid-weed
Prunella vulgaris	Lamiaceae	PRUVUL	native	0	0	forb	perennial	self-heal
Prunus serotina	Rosaceae	PRUSER	native	2	3	tree	perennial	wild black cherry
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
Pyrola elliptica	Ericaceae	PYRELL	native	6	3	forb	perennial	large-leaved shinleaf
Quercus rubra	Fagaceae	QUERUB	native	5	3	tree	perennial	red oak
Ranunculus abortivus	Ranunculaceae	RANABO	native	0	0	forb	perennial	small-flowered buttercup
Ranunculus acris	Ranunculaceae	RANACR	non-native	0	0	forb	perennial	tall or common buttercup
Ranunculus hispidus	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
Ranunculus recurvatus	Ranunculaceae	RANREC	native	5	-3	forb	perennial	hooked crowfoot
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Rhododendron groenlandicum; ledum g.	Ericaceae	RHOGRO	native	8	-5	shrub	perennial	labrador-tea
Rhynchospora alba	Cyperaceae	RHYALB	native	6	-5	sedge	perennial	beak-rush
Rhynchospora capillacea	Cyperaceae	RHYCAL	native	10	-5	sedge	perennial	beak-rush
Ribes cynosbati	Grossulariaceae	RIBCYN	native	4	3	shrub	perennial	prickly or wild gooseberry
Ribes hirtellum	Grossulariaceae	RIBHIR	native	6	-3	shrub	perennial	swamp gooseberry
Ribes triste	Grossulariaceae	RIBTRI	native	6	-5	shrub	perennial	swamp red currant
Rosa multiflora	Rosaceae	ROSMUL	non-native	0	3	shrub	perennial	multiflora rose
Rosa palustris	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
Rubus allegheniensis	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
Rubus hispidus	Rosaceae	RUBHIS	native	4	-3	shrub	perennial	swamp dewberry
Rubus occidentalis	Rosaceae	RUBOCC	native	1	5	shrub	perennial	black raspberry
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Rubus strigosus	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
Rudbeckia hirta	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
Rumex acetosella	Polygonaceae	RUMACL	non-native	0	3	forb	perennial	sheep sorrel
Rumex obtusifolius	Polygonaceae	RUMOBT	non-native	0	0	forb	perennial	bitter dock

Grass River Natural Area 2017 Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Rumex orbiculatus	Polygonaceae	RUMORB	native	9	-5	forb	perennial	great 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 canadensis	Adoxaceae	SAMCAN	native	3	-3	shrub	perennial	elderberry
Sarracenia purpurea	Sarraceniaceae	SARPUR	native	10	-5	forb	perennial	pitcher-plant
Schizachne purpurascens	Poaceae	SCHPUP	native	5	3	grass	perennial	false melic
Schizachyrium scoparium; andropogon s.	Poaceae	SCHSCO	native	5	3	grass	perennial	little bluestem
Schoenoplectus acutus; scirpus a.	Cyperaceae	SCHACU	native	5	-5	sedge	perennial	hardstem bulrush
Schoenoplectus pungens; scirpus americanus	Cyperaceae	SCHPUN	native	5	-5	sedge	perennial	threesquare
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
Scutellaria galericulata	Lamiaceae	SCUGAL	native	5	-5	forb	perennial	marsh skullcap
Scutellaria lateriflora	Lamiaceae	SCULAT	native	5	-5	forb	perennial	mad-dog skullcap
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago caesia	Asteraceae	SOLCAE	native	6	3	forb	perennial	bluestem goldenrod
Solidago canadensis	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Solidago uliginosa	Asteraceae	SOLULI	native	4	-5	forb	perennial	bog goldenrod
Sparganium emersum; s. chlorocarpum	Typhaceae	SPAEME	native	6	-5	forb	perennial	green-fruited bur-reed
Sparganium eurycarpum	Typhaceae	SPAEUR	native	5	-5	forb	perennial	common bur-reed
Spinulum annotinum; lycopodium a.	Lycopodiaceae	SPIANN	native	5	0	fern	perennial	stiff clubmoss
Spiraea alba	Rosaceae	SPIALB	native	4	-3	shrub	perennial	meadowsweet
Spiranthes cernua	Orchidaceae	SPICER	native	4	-3	forb	perennial	nodding ladies-tresses
Stellaria media	Caryophyllaceae	STEMED	non-native	0	3	forb	annual	common chickweed
Symphyotrichum boreale; aster b.	Asteraceae	SYMBOR	native	9	-5	forb	perennial	northern bog aster

Grass River Natural Area 2017 Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Symphyotrichum firmum; aster puniceus	Asteraceae	SYMFIR	native	4	-3	forb	perennial	smooth swamp aster
Symphyotrichum lanceolatum; aster l.	Asteraceae	SYMLAN	native	2	-3	forb	perennial	panicled aster
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Symphyotrichum puniceum; aster p.	Asteraceae	SYMPUN	native	5	-5	forb	perennial	swamp aster
Symphyotrichum urophyllum; aster sagittifolius	Asteraceae	SYMURO	native	2	5	forb	perennial	arrow-leaved aster
Taraxacum officinale	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
Thalictrum dasycarpum	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
Thalictrum dioicum	Ranunculaceae	THADIO	native	6	3	forb	perennial	early meadow-rue
Thelypteris noveboracensis	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Tiarella cordifolia	Saxifragaceae	TIACOR	native	9	3	forb	perennial	foamflower
Tilia americana	Malvaceae	TILAME	native	5	3	tree	perennial	basswood
Toxicodendron rydbergii; t. radicans	Anacardiaceae	TOXRYD	native	3	0	shrub	perennial	poison-ivy
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Tragopogon pratensis	Asteraceae	TRAPRA	non-native	0	5	forb	biennial	common goats beard
Triadenum fraseri	Hypericaceae	TRIFRA	native	6	-5	forb	perennial	marsh st. johns-wort
Trichophorum alpinum; scirpus hudsonianus	Cyperaceae	TRIALP	native	10	-5	sedge	perennial	bulrush
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Trifolium pratense	Fabaceae	TRIPRA	non-native	0	3	forb	perennial	red clover
Triglochin maritima	Juncaginaceae	TRIMAR	native	8	-5	forb	perennial	common bog arrow-grass
Trillium cernuum	Trilliaceae	TRICER	native	5	0	forb	perennial	nodding trillium
Tsuga canadensis	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
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
Utricularia cornuta	Lentibulariaceae	UTRCOR	native	10	-5	forb	perennial	horned bladderwort
Utricularia intermedia	Lentibulariaceae	UTRINT	native	10	-5	forb	perennial	flat-leaved bladderwort
Utricularia minor	Lentibulariaceae	UTRMIN	native	10	-5	forb	perennial	small bladderwort
Utricularia vulgaris	Lentibulariaceae	UTRVUL	native	6	-5	forb	perennial	common bladderwort
Vaccinium myrtilloides	Ericaceae	VACMYR	native	4	-3	shrub	perennial	canada blueberry

Grass River Natural Area 2017								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Vaccinium oxycoccos	Ericaceae	VACOXY	native	8	-5	shrub	perennial	small cranberry
Verbascum thapsus	Scrophulariaceae	VERTHA	non-native	0	5	forb	biennial	common mullein
Verbena hastata	Verbenaceae	VERHAS	native	4	-3	forb	perennial	blue vervain
Veronica arvensis	Plantaginaceae	VERARV	non-native	0	3	forb	annual	corn speedwell
Veronica officinalis	Plantaginaceae	VEROOF	non-native	0	3	forb	perennial	common speedwell
Viburnum acerifolium	Adoxaceae	VIBACE	native	6	5	shrub	perennial	maple-leaved viburnum
Viburnum cassinoides	Adoxaceae	VIBCAS	native	6	3	shrub	perennial	wild-raisin
Vicia villosa	Fabaceae	VICVIL	non-native	0	5	vine	annual	hairy vetch
Viola canadensis	Violaceae	VIOCAN	native	5	3	forb	perennial	canada violet
Viola cucullata	Violaceae	VIOCUC	native	5	-5	forb	perennial	marsh violet
Viola labradorica; v. conspersa	Violaceae	VIOLAB	native	3	0	forb	perennial	dog violet
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape

Appendix 2. Grass River Natural Area - Floristic Quality Assessment: Emergent Marsh

Grass River Natural Area 2017: Emergent Marsh
Bellaire, Antrim County, Michigan, 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: Rachel Hackett
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: Emergent marsh was located along Grass River or shores of Lake Bellaire or Clam Lake and composed of mostly emergent and floating vegetation.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	5.2	Total Species:	19		Annual:	0	0%
Native Mean C:	5.5	Native Species:	18	94.70%	Perennial:	19	100.00%
Total FQI:	22.7	Non-native Species:	1	5.30%	Biennial:	0	0%
Native FQI:	23.3				Native Annual:	0	0%
Adjusted FQI:	53.5	**Species Wetness:**			Native Perennial:	18	94.70%
% C value 0:	5.3	Mean Wetness:	-4.9		Native Biennial:	0	0%
% C value 1-3:	5.3	Native Mean Wetness:	-4.9				
% C value 4-6:	63.2						
% C value 7-10:	26.3	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	n/a	Tree:	0	0%	Sedge:	7	36.80%
Native Shrub Mean C:	7.0	Shrub:	1	5.30%	Rush:	0	0%
Native Herbaceous Mean C:	5.4	Vine:	0	0%	Fern:	0	0%
		Forb:	10	52.60%	Bryophyte:	0	0%
		Grass:	1	5.30%			

Species:

Grass River Natural Area 2017: Emergent Marsh								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Carex aquatilis	Cyperaceae	CXAQUA	native	7	-5	sedge	perennial	sedge
Carex comosa	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge
Carex lasiocarpa	Cyperaceae	CXLASI	native	8	-5	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Decodon verticillatus	Lythraceae	DECVER	native	7	-5	shrub	perennial	whorled or swamp loosestrife
Eleocharis palustris; e. smallii	Cyperaceae	ELEPAL	native	5	-5	sedge	perennial	spike-rush
Nuphar variegata	Nymphaeaceae	NUPVAR	native	7	-5	forb	perennial	yellow pond-lily
Nymphaea odorata	Nymphaeaceae	NYMODO	native	6	-5	forb	perennial	sweet-scented waterlily
Phragmites australis var. americanus	Poaceae	PHRAUM	native	5	-3	grass	perennial	reed
Pontederia cordata	Pontederiaceae	PONCOR	native	8	-5	forb	perennial	pickerel-weed
Proserpinaca palustris	Haloragaceae	PROPAL	native	6	-5	forb	perennial	mermaid-weed
Sagittaria latifolia	Alismataceae	SAGLAT	native	4	-5	forb	perennial	common arrowhead
Schoenoplectus acutus; scirpus a.	Cyperaceae	SCHACU	native	5	-5	sedge	perennial	hardstem bulrush
Schoenoplectus tabernaemontani; scirpus validus	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
Sparganium emersum; s. chlorocarpum	Typhaceae	SPAEME	native	6	-5	forb	perennial	green-fruited bur-reed
Sparganium eurycarpum	Typhaceae	SPAEUR	native	5	-5	forb	perennial	common bur-reed
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
Utricularia vulgaris	Lentibulariaceae	UTRVUL	native	6	-5	forb	perennial	common bladderwort

Appendix 3. Grass River Natural Area - Floristic Quality Assessment: Northern Wet Meadow

Grass River Natural Area 2017: Northern Wet Meadow
Bellaire, Antrim County, Michigan, 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: Rachel Hackett, Phyllis Higman
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: In Grass River Natural Area, northern wet meadow borders northern fen, rich conifer swamp, poor conifer swamp, or emergent marsh. It occurs on strongly acid to circumneutral sapric peats and lacks the distinct marl zones of northern fen. It is a grass- and sedge-dominated wetland, often with on overwhelming abundance of *Carex stricta*, and lacks a shrub component.

Dichanthelium implicatum in Michigan Flora has the accepted name of *Dichanthelium acuminatum* via tropicos.org.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	5.0	Total Species:	123		Annual:	1	0.80%
Native Mean C:	5.4	Native Species:	115	93.50%	Perennial:	121	98.40%
Total FQI:	55.5	Non-native Species:	8	6.50%	Biennial:	1	0.80%
Native FQI:	57.9				Native Annual:	1	0.80%
Adjusted FQI:	52.2	**Species Wetness:**			Native Perennial:	114	92.70%
% C value 0:	6.5	Mean Wetness:	-3.7		Native Biennial:	0	0%
% C value 1-3:	24.4	Native Mean Wetness:	-3.8				
% C value 4-6:	39.8						
% C value 7-10:	29.3	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	2.7	Tree:	7	5.70%	Sedge:	24	19.50%
Native Shrub Mean C:	5.2	Shrub:	18	14.60%	Rush:	0	0%
Native Herbaceous Mean C:	5.6	Vine:	4	3.30%	Fern:	4	3.30%
		Forb:	57	46.30%	Bryophyte:	0	0%
		Grass:	9	7.30%			

Species:

Grass River Natural Area 2017: Northern Wet Meadow								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Agalinis purpurea	Orobanchaceae	AGAPUR	native	7	-3	forb	annual	purple false foxglove
Agrostis scabra; a. hyemalis	Poaceae	AGRSCA	native	4	0	grass	perennial	ticklegrass
Alnus incana; a. rugosa	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
Andromeda glaucophylla	Ericaceae	ANDGLA	native	10	-5	shrub	perennial	bog-rosemary
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Apocynum cannabinum; a. sibiricum	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
Asclepias incarnata	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
Boehmeria cylindrica	Urticaceae	BOECYL	native	5	-5	forb	perennial	false nettle
Bromus ciliatus	Poaceae	BROCIL	native	6	-3	grass	perennial	fringed brome
Calamagrostis canadensis	Poaceae	CALCAN	native	3	-5	grass	perennial	blue-joint
Calamagrostis stricta; c. inexpansa; c. lacustris	Poaceae	CALSTR	native	10	-3	grass	perennial	narrow-leaved reedgrass
Calystegia sepium	Convolvulaceae	CALSEP	native	2	0	vine	perennial	hedge bindweed
Campanula aparinoides	Campanulaceae	CAMAPA	native	7	-5	forb	perennial	marsh bellflower
Carex aquatilis	Cyperaceae	CXAQUA	native	7	-5	sedge	perennial	sedge
Carex buxbaumii	Cyperaceae	CXBUXB	native	10	-5	sedge	perennial	sedge
Carex comosa	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge
Carex diandra	Cyperaceae	CXDIAN	native	8	-5	sedge	perennial	sedge
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex lacustris	Cyperaceae	CXLACU	native	6	-5	sedge	perennial	sedge
Carex lasiocarpa	Cyperaceae	CXLASI	native	8	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex pellita; c. lanuginosa	Cyperaceae	CXPELL	native	2	-5	sedge	perennial	sedge
Carex prairea	Cyperaceae	CXPRAI	native	10	-3	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex utriculata; c. rostrata	Cyperaceae	CXUTRI	native	5	-5	sedge	perennial	sedge
Cephalanthus occidentalis	Rubiaceae	CEPOCC	native	7	-5	shrub	perennial	buttonbush
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Cicuta bulbifera	Apiaceae	CICBUL	native	5	-5	forb	perennial	water hemlock
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Cladium mariscoides	Cyperaceae	CLAMAR	native	10	-5	sedge	perennial	twig-rush
Comarum palustre; potentilla p.	Rosaceae	COMPAL	native	7	-5	forb	perennial	marsh cinquefoil
Cornus amomum	Cornaceae	CORAMO	native	2	-3	shrub	perennial	silky dogwood
Cornus sericea; c. stolonifera	Cornaceae	CORSER	native	2	-3	shrub	perennial	red-osier

Grass River Natural Area 2017: Northern Wet Meadow								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Dasiphora fruticosa; potentilla f.	Rosaceae	DASFRU	native	8	-3	shrub	perennial	shrubby cinquefoil
Decodon verticillatus	Lythraceae	DECVER	native	7	-5	shrub	perennial	whorled or swamp loosestrife
Dichanthelium implicatum; panicum i.	Poaceae	DICIMP	native	3	0	grass	perennial	panic grass
Dulichium arundinaceum	Cyperaceae	DULARU	native	8	-5	sedge	perennial	three-way sedge
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Eleocharis elliptica	Cyperaceae	ELEELL	native	6	-5	sedge	perennial	golden-seeded spike rush
Eleocharis erythropoda	Cyperaceae	ELEERY	native	4	-5	sedge	perennial	spike-rush
Eleocharis palustris; e. smallii	Cyperaceae	ELEPAL	native	5	-5	sedge	perennial	spike-rush
Epilobium palustre	Onagraceae	EPIPAL	native	10	-5	forb	perennial	marsh willow-herb
Equisetum fluviatile	Equisetaceae	EQUFLU	native	7	-5	fern	perennial	water horsetail
Eriophorum viridi-carinatum	Cyperaceae	ERIVID	native	8	-5	sedge	perennial	green-keeled cotton-grass
Eupatorium perfoliatum	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
Euthamia graminifolia	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
Eutrochium maculatum; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
Galium labradoricum	Rubiaceae	GALLAB	native	8	-5	forb	perennial	bog bedstraw
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Hypericum kalmianum	Hypericaceae	HYPKAL	native	10	-3	shrub	perennial	kalms st. johns-wort
Iris pseudacorus	Iridaceae	IRIPSE	non-native	0	-5	forb	perennial	yellow flag
Iris virginica	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
Larix laricina	Pinaceae	LARLAR	native	5	-3	tree	perennial	tamarack
Lathyrus palustris	Fabaceae	LATPAL	native	7	-3	vine	perennial	marsh pea
Lemna minor	Araceae	LEMMIN	native	5	-5	forb	perennial	common duckweed
Lobelia kalmii	Campanulaceae	LOBKAL	native	10	-5	forb	perennial	bog lobelia
Lycopus americanus	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
Lycopus uniflorus	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
Lysimachia thyrsiflora	Myrsinaceae	LYSTHY	native	6	-5	forb	perennial	tufted loosestrife
Lythrum salicaria	Lythraceae	LYTSAL	non-native	0	-5	forb	perennial	purple loosestrife
Mentha canadensis; m. arvensis	Lamiaceae	MENCAS	native	3	-3	forb	perennial	wild mint
Mentha Ã—piperita	Lamiaceae	MENPIP	non-native	0	-5	forb	perennial	peppermint
Menyanthes trifoliata	Menyanthaceae	MENTRI	native	8	-5	forb	perennial	buckbean
Muhlenbergia glomerata	Poaceae	MUHGLO	native	10	-5	grass	perennial	marsh wild-timothy
Myrica gale	Myricaceae	MYRGAL	native	6	-5	shrub	perennial	sweet gale
Nasturtium officinale	Brassicaceae	NASOFF	native	4	-5	forb	perennial	watercress
Nuphar variegata	Nymphaeaceae	NUPVAR	native	7	-5	forb	perennial	yellow pond-lily
Nymphaea odorata	Nymphaeaceae	NYMODO	native	6	-5	forb	perennial	sweet-scented waterlily

Grass River Natural Area 2017: Northern Wet Meadow								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Parnassia glauca	Parnassiaceae	PARGLA	native	8	-5	forb	perennial	grass-of-parnassus
Persicaria amphibia; polygonum a.	Polygonaceae	PERAMP	native	6	-5	forb	perennial	water smartweed
Phragmites australis var. americanus	Poaceae	PHRAUM	native	5	-3	grass	perennial	reed
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Poa palustris	Poaceae	POAPAS	native	3	-3	grass	perennial	fowl meadow grass
Pogonia ophioglossoides	Orchidaceae	POGOPH	native	10	-5	forb	perennial	rose pogonia
Pontederia cordata	Pontederiaceae	PONCOR	native	8	-5	forb	perennial	pickerel-weed
Populus alba	Salicaceae	POPALB	non-native	0	5	tree	perennial	white poplar
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	tree	perennial	balsam poplar
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Proserpinaca palustris	Haloragaceae	PROPAL	native	6	-5	forb	perennial	mermaid-weed
Ranunculus hispidus	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Rhynchospora alba	Cyperaceae	RHYALB	native	6	-5	sedge	perennial	beak-rush
Rosa palustris	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
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 canadensis	Adoxaceae	SAMCAN	native	3	-3	shrub	perennial	elderberry
Sarracenia purpurea	Sarraceniaceae	SARPUR	native	10	-5	forb	perennial	pitcher-plant
Schoenoplectus acutus; scirpus a.	Cyperaceae	SCHACU	native	5	-5	sedge	perennial	hardstem bulrush
Schoenoplectus pungens; scirpus americanus	Cyperaceae	SCHPUN	native	5	-5	sedge	perennial	threesquare
Schoenoplectus tabernaemontani; scirpus validus	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
Scutellaria galericulata	Lamiaceae	SCUGAL	native	5	-5	forb	perennial	marsh skullcap
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago canadensis	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago ohioensis	Asteraceae	SOLOHI	native	8	-5	forb	perennial	ohio goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod

Grass River Natural Area 2017: Northern Wet Meadow								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Sparganium emersum; s. chlorocarpum	Typhaceae	SPAEME	native	6	-5	forb	perennial	green-fruited bur-reed
Sparganium eurycarpum	Typhaceae	SPAEUR	native	5	-5	forb	perennial	common bur-reed
Spiraea alba	Rosaceae	SPIALB	native	4	-3	shrub	perennial	meadowsweet
Symphyotrichum boreale; aster b.	Asteraceae	SYMBOR	native	9	-5	forb	perennial	northern bog aster
Symphyotrichum firmum; aster puniceus	Asteraceae	SYMFIR	native	4	-3	forb	perennial	smooth swamp aster
Symphyotrichum lanceolatum; aster l.	Asteraceae	SYMLAN	native	2	-3	forb	perennial	panicled aster
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Symphyotrichum puniceum; aster p.	Asteraceae	SYMPUN	native	5	-5	forb	perennial	swamp aster
Thalictrum dasycarpum	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Triadenum fraseri	Hypericaceae	TRIFRA	native	6	-5	forb	perennial	marsh st. johns-wort
Trichophorum alpinum; scirpus hudsonianus	Cyperaceae	TRIALP	native	10	-5	sedge	perennial	bulrush
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Triglochin maritima	Juncaginaceae	TRIMAR	native	8	-5	forb	perennial	common bog arrow-grass
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
Utricularia intermedia	Lentibulariaceae	UTRINT	native	10	-5	forb	perennial	flat-leaved bladderwort
Utricularia vulgaris	Lentibulariaceae	UTRVUL	native	6	-5	forb	perennial	common bladderwort
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape

Appendix 4. Grass River Natural Area - Floristic Quality Assessment: Northern Fen

Grass River Natural Area 2017: Northern Fen
Bellaire, Antrim County, Michigan, 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: Rachel Hackett, Liana May, Phyllis Higman
Duration Notes: Surveys were conducted 9 June 2017 (Liana May), from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: In Grass River Natural Area, northern fen borders northern wet meadow, poor conifer swamp, or rich conifer swamp. It is strongly influenced by calcareous ground-water occurring on circumneutral to moderately alkaline peats. It supports a diverse array of graminoids, forbs, shrubs and stunted conifers, including many cacliphytic species.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Cardamine* spp., *Eleocharis* spp., and *Viola* spp.

Dichanthelium implicatum in Michigan Flora has the accepted name of *Dichanthelium acuminatum* via tropicos.org.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	5.0	Total Species:	170		Annual:	4	2.40%
Native Mean C:	5.5	Native Species:	156	91.80%	Perennial:	163	95.90%
Total FQI:	65.2	Non-native Species:	14	8.20%	Biennial:	3	1.80%
Native FQI:	68.7				Native Annual:	3	1.80%
Adjusted FQI:	52.7	**Species Wetness:**			Native Perennial:	151	88.80%
% C value 0:	9.4	Mean Wetness:	-2.7		Native Biennial:	2	1.20%
% C value 1-3:	21.2	Native Mean Wetness:	-3.1				
% C value 4-6:	38.2						
% C value 7-10:	31.2	**Physiognomy Metrics:**			**Physognomy Metrics:**		
Native Tree Mean C:	3.7	Tree:	10	5.90%	Sedge:	29	17.10%
Native Shrub Mean C:	5.9	Shrub:	21	12.40%	Rush:	0	0%
Native Herbaceous Mean C:	5.5	Vine:	3	1.80%	Fern:	9	5.30%
		Forb:	82	48.20%	Bryophyte:	0	0%
		Grass:	16	9.40%			

Species:

Grass River Natural Area 2017: Northern Fen								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Agalinis purpurea	Orobanchaceae	AGAPUR	native	7	-3	forb	annual	purple false foxglove
Agrostis scabra; a. hyemalis	Poaceae	AGRSCA	native	4	0	grass	perennial	ticklegrass
Alnus incana; a. rugosa	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
Andromeda glaucophylla	Ericaceae	ANDGLA	native	10	-5	shrub	perennial	bog-rosemary
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Antennaria howellii	Asteraceae	ANTHOW	native	2	5	forb	perennial	small pussytoes
Apocynum cannabinum; a. sibiricum	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
Artemisia campestris	Asteraceae	ARTCAM	native	5	5	forb	biennial	wormwood
Asclepias incarnata	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
Asclepias syriaca	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
Betula alleghaniensis	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
Betula papyrifera	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
Bidens comosa	Asteraceae	BIDCOM	native	5	-3	forb	annual	swamp tickseed
Boehmeria cylindrica	Urticaceae	BOECYL	native	5	-5	forb	perennial	false nettle
Bromus ciliatus	Poaceae	BROCIL	native	6	-3	grass	perennial	fringed brome
Calamagrostis canadensis	Poaceae	CALCAN	native	3	-5	grass	perennial	blue-joint
Calamagrostis stricta; c. inexpansa; c. lacustris	Poaceae	CALSTR	native	10	-3	grass	perennial	narrow-leaved reedgrass
Calopogon tuberosus	Orchidaceae	CALTUB	native	9	-5	forb	perennial	grass-pink
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Calystegia sepium	Convolvulaceae	CALSEP	native	2	0	vine	perennial	hedge bindweed
Campanula aparinoides	Campanulaceae	CAMAPA	native	7	-5	forb	perennial	marsh bellflower
Carex aquatilis	Cyperaceae	CXAQUA	native	7	-5	sedge	perennial	sedge
Carex buxbaumii	Cyperaceae	CXBUXB	native	10	-5	sedge	perennial	sedge
Carex comosa	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge
Carex diandra	Cyperaceae	CXDIAN	native	8	-5	sedge	perennial	sedge
Carex eburnea	Cyperaceae	CXEBUR	native	7	3	sedge	perennial	sedge
Carex exilis	Cyperaceae	CXEXIL	native	10	-5	sedge	perennial	sedge
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex hystericina	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex lasiocarpa	Cyperaceae	CXLASI	native	8	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex prairea	Cyperaceae	CXPRAI	native	10	-3	sedge	perennial	sedge
Carex pseudo-cyperus	Cyperaceae	CXPSEU	native	5	-5	sedge	perennial	sedge

Grass River Natural Area 2017: Northern Fen								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex trisperma	Cyperaceae	CXTRIS	native	9	-5	sedge	perennial	sedge
Carex utriculata; c. rostrata	Cyperaceae	CXUTRI	native	5	-5	sedge	perennial	sedge
Chamaedaphne calyculata	Ericaceae	CHACAL	native	8	-5	shrub	perennial	leatherleaf
Cicuta bulbifera	Apiaceae	CICBUL	native	5	-5	forb	perennial	water hemlock
Cirsium muticum	Asteraceae	CIRMUT	native	6	-5	forb	biennial	swamp thistle
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Cladium mariscoides	Cyperaceae	CLAMAR	native	10	-5	sedge	perennial	twig-rush
Comarum palustre; potentilla p.	Rosaceae	COMPAL	native	7	-5	forb	perennial	marsh cinquefoil
Cornus amomum	Cornaceae	CORAMO	native	2	-3	shrub	perennial	silky dogwood
Cornus canadensis	Cornaceae	CORCAA	native	6	0	shrub	perennial	bunchberry
Cornus sericea; c. stolonifera	Cornaceae	CORSER	native	2	-3	shrub	perennial	red-osier
Cypripedium parviflorum; c. calceolus	Orchidaceae	CYPPAR	native	5	0	forb	perennial	yellow lady-slipper
Cypripedium reginae	Orchidaceae	CYPREG	native	9	-3	forb	perennial	showy or queens lady-slipper
Danthonia spicata	Poaceae	DANSPI	native	4	5	grass	perennial	poverty grass; oatgrass
Dasiphora fruticosa; potentilla f.	Rosaceae	DASFRU	native	8	-3	shrub	perennial	shrubby cinquefoil
Decodon verticillatus	Lythraceae	DECVER	native	7	-5	shrub	perennial	whorled or swamp loosestrife
Dichanthelium depauperatum; panicum d.	Poaceae	DICDEP	native	4	5	grass	perennial	panic grass
Dichanthelium implicatum; panicum i.	Poaceae	DICIMP	native	3	0	grass	perennial	panic grass
Drosera rotundifolia	Droseraceae	DROROT	native	6	-5	forb	perennial	round-leaved sundew
Dryopteris cristata	Dryopteridaceae	DRYCRI	native	6	-5	fern	perennial	crested shield fern
Dulichium arundinaceum	Cyperaceae	DULARU	native	8	-5	sedge	perennial	three-way sedge
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Eleocharis elliptica	Cyperaceae	ELEELL	native	6	-5	sedge	perennial	golden-seeded spike rush
Eleocharis erythropoda	Cyperaceae	ELEERY	native	4	-5	sedge	perennial	spike-rush
Eleocharis palustris; e. smallii	Cyperaceae	ELEPAL	native	5	-5	sedge	perennial	spike-rush
Elymus trachycaulus; agropyron t.	Poaceae	ELYTRA	native	8	3	grass	perennial	slender wheatgrass
Epilobium palustre	Onagraceae	EPIPAL	native	10	-5	forb	perennial	marsh willow-herb
Equisetum arvense	Equisetaceae	EQUARV	native	0	0	fern	perennial	common horsetail
Equisetum fluviatile	Equisetaceae	EQUFLU	native	7	-5	fern	perennial	water horsetail
Equisetum hyemale	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
Equisetum palustre	Equisetaceae	EQUPAL	native	8	-3	fern	perennial	marsh horsetail

Grass River Natural Area 2017: Northern Fen								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Eriophorum viridi-carinatum	Cyperaceae	ERIVID	native	8	-5	sedge	perennial	green-keeled cotton-grass
Erythronium americanum	Liliaceae	ERYAME	native	5	5	forb	perennial	yellow trout lily
Eupatorium perfoliatum	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
Eutrochium maculatum; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
Fragaria virginiana	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
Galium labradoricum	Rubiaceae	GALLAB	native	8	-5	forb	perennial	bog bedstraw
Gaultheria hispidula	Ericaceae	GAUHIS	native	8	-3	shrub	perennial	creeping-snowberry
Geum rivale	Rosaceae	GEURIV	native	7	-5	forb	perennial	purple avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Hieracium aurantiacum	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
Hieracium caespitosum	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
Hieracium piloselloides	Asteraceae	HIEPIS	non-native	0	5	forb	perennial	king devil
Hypericum kalmianum	Hypericaceae	HYPKAL	native	10	-3	shrub	perennial	kalms st. johns-wort
Impatiens capensis	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
Iris pseudacorus	Iridaceae	IRIPSE	non-native	0	-5	forb	perennial	yellow flag
Iris virginica	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
Larix laricina	Pinaceae	LARLAR	native	5	-3	tree	perennial	tamarack
Lathyrus palustris	Fabaceae	LATPAL	native	7	-3	vine	perennial	marsh pea
Leucanthemum vulgare; chrysanthemum leucanthemum	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy
Lilium philadelphicum	Liliaceae	LILPHI	native	7	0	forb	perennial	wood lily
Linnaea borealis	Linnaeaceae	LINBOR	native	6	0	forb	perennial	twinflower
Lobelia cardinalis	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower
Lobelia kalmii	Campanulaceae	LOBKAL	native	10	-5	forb	perennial	bog lobelia
Lycopus americanus	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
Lycopus uniflorus	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
Lysimachia quadriflora	Myrsinaceae	LYSQUR	native	10	-5	forb	perennial	whorled loosestrife
Lysimachia thyrsiflora	Myrsinaceae	LYSTHY	native	6	-5	forb	perennial	tufted loosestrife
Mentha canadensis; m. arvensis	Lamiaceae	MENCAS	native	3	-3	forb	perennial	wild mint
Menyanthes trifoliata	Menyanthaceae	MENTRI	native	8	-5	forb	perennial	buckbean
Muhlenbergia glomerata	Poaceae	MUHGLO	native	10	-5	grass	perennial	marsh wild-timothy
Myrica gale	Myricaceae	MYRGAL	native	6	-5	shrub	perennial	sweet gale
Nuphar variegata	Nymphaeaceae	NUPVAR	native	7	-5	forb	perennial	yellow pond-lily
Nymphaea odorata	Nymphaeaceae	NYMODO	native	6	-5	forb	perennial	sweet-scented waterlily
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Osmunda cinnamomea	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern

Grass River Natural Area 2017: Northern Fen								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Parnassia glauca	Parnassiaceae	PARGLA	native	8	-5	forb	perennial	grass-of-parnassus
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phleum pratense	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
Phragmites australis var. americanus	Poaceae	PHRAUM	native	5	-3	grass	perennial	reed
Picea mariana	Pinaceae	PICMAR	native	6	-3	tree	perennial	black spruce
Pinus resinosa	Pinaceae	PINRES	native	6	3	tree	perennial	red pine
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Platanthera huronensis; habenaria hyperborea	Orchidaceae	PLAHUR	native	5	-3	forb	perennial	lake huron green orchid
Platanthera psycodes; habenaria p.	Orchidaceae	PLAPSY	native	7	-3	forb	perennial	purple fringed orchid
Poa compressa	Poaceae	POACOM	non-native	0	3	grass	perennial	canada bluegrass
Poa palustris	Poaceae	POAPAS	native	3	-3	grass	perennial	fowl meadow grass
Poa pratensis	Poaceae	POAPRA	non-native	0	3	grass	perennial	kentucky bluegrass
Pogonia ophioglossoides	Orchidaceae	POGOPH	native	10	-5	forb	perennial	rose pogonia
Pontederia cordata	Pontederiaceae	PONCOR	native	8	-5	forb	perennial	pickerel-weed
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	tree	perennial	balsam poplar
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Potamogeton natans	Potamogetonaceae	POTNAT	native	5	-5	forb	perennial	pondweed
Potentilla anserina	Rosaceae	POTANS	native	5	-3	forb	perennial	silverweed
Proserpinaca palustris	Haloragaceae	PROPAL	native	6	-5	forb	perennial	mermaid-weed
Ranunculus acris	Ranunculaceae	RANACR	non-native	0	0	forb	perennial	tall or common buttercup
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Rhododendron groenlandicum; ledum g.	Ericaceae	RHOGRO	native	8	-5	shrub	perennial	labrador-tea
Rhynchospora alba	Cyperaceae	RHYALB	native	6	-5	sedge	perennial	beak-rush
Rhynchospora capillacea	Cyperaceae	RHYCAL	native	10	-5	sedge	perennial	beak-rush
Rosa palustris	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Rudbeckia hirta	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
Rumex acetosella	Polygonaceae	RUMACL	non-native	0	3	forb	perennial	sheep sorrel
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
Sarracenia purpurea	Sarraceniaceae	SARPUR	native	10	-5	forb	perennial	pitcher-plant
Schoenoplectus acutus; scirpus a.	Cyperaceae	SCHACU	native	5	-5	sedge	perennial	hardstem bulrush

Grass River Natural Area 2017: Northern Fen								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Schoenoplectus pungens; scirpus americanus	Cyperaceae	SCHPUN	native	5	-5	sedge	perennial	threesquare
Schoenoplectus tabernaemontani; scirpus validus	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
Scirpus atrovirens	Cyperaceae	SCIATV	native	3	-5	sedge	perennial	bulrush
Scutellaria galericulata	Lamiaceae	SCUGAL	native	5	-5	forb	perennial	marsh skullcap
Solidago canadensis	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Solidago uliginosa	Asteraceae	SOLULI	native	4	-5	forb	perennial	bog goldenrod
Sparganium eurycarpum	Typhaceae	SPAEUR	native	5	-5	forb	perennial	common bur-reed
Spiranthes cernua	Orchidaceae	SPICER	native	4	-3	forb	perennial	nodding ladies-tresses
Stellaria media	Caryophyllaceae	STEMED	non-native	0	3	forb	annual	common chickweed
Symphyotrichum boreale; aster b.	Asteraceae	SYMBOR	native	9	-5	forb	perennial	northern bog aster
Symphyotrichum lanceolatum; aster l.	Asteraceae	SYMLAN	native	2	-3	forb	perennial	panicled aster
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Symphyotrichum puniceum; aster p.	Asteraceae	SYMPUN	native	5	-5	forb	perennial	swamp aster
Thalictrum dasycarpum	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Triadenum fraseri	Hypericaceae	TRIFRA	native	6	-5	forb	perennial	marsh st. johns-wort
Trichophorum alpinum; scirpus hudsonianus	Cyperaceae	TRIALP	native	10	-5	sedge	perennial	bulrush
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Triglochin maritima	Juncaginaceae	TRIMAR	native	8	-5	forb	perennial	common bog arrow-grass
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
Utricularia cornuta	Lentibulariaceae	UTRCOR	native	10	-5	forb	perennial	horned bladderwort
Utricularia intermedia	Lentibulariaceae	UTRINT	native	10	-5	forb	perennial	flat-leaved bladderwort
Utricularia minor	Lentibulariaceae	UTRMIN	native	10	-5	forb	perennial	small bladderwort
Utricularia vulgaris	Lentibulariaceae	UTRVUL	native	6	-5	forb	perennial	common bladderwort

Grass River Natural Area 2017: Northern Fen								
Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Vaccinium myrtilloides	Ericaceae	VACMYR	native	4	-3	shrub	perennial	canada blueberry
Vaccinium oxycoccos	Ericaceae	VACOXY	native	8	-5	shrub	perennial	small cranberry
Verbena hastata	Verbenaceae	VERHAS	native	4	-3	forb	perennial	blue vervain
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape

Appendix 5. Grass River Natural Area - Floristic Quality Assessment: Northern Shrub Thicket

Grass River Natural Area 2017: Northern Shrub Thicket
Bellaire, Antrim County, Michigan, 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: Rachel Hackett
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: In Grass River Natural Area, northern shrub thicket borders northern wet meadow and rich conifer swamp. It is very dense shrub and small tree vegetation with a low canopy, usually dominated by *Alnus incana*. Other abundant species include *Toxicodendron vernix* and *Cornus* spp.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Cardamine* spp., *Fraxinus* spp. saplings, and *Viola* spp.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	5.2	Total Species:	26		Annual:	1	3.80%
Native Mean C:	5.4	Native Species:	25	96.20%	Perennial:	25	96.20%
Total FQI:	26.5	Non-native Species:	1	3.80%	Biennial:	0	0%
Native FQI:	27.0				Native Annual:	1	3.80%
Adjusted FQI:	53.0	**Species Wetness:**			Native Perennial:	24	92.30%
% C value 0:	7.7	Mean Wetness:	-3.6		Native Biennial:	0	0%
% C value 1-3:	15.4	Native Mean Wetness:	-3.9				
% C value 4-6:	50.0						
% C value 7-10:	26.9	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	6.0	Tree:	1	3.80%	Sedge:	5	19.20%
Native Shrub Mean C:	7.0	Shrub:	5	19.20%	Rush:	0	0%
Native Herbaceous Mean C:	4.9	Vine:	1	3.80%	Fern:	3	11.50%
		Forb:	11	42.30%	Bryophyte:	0	0%
		Grass:	0	0%			

Species:

Grass River Natural Area 2017: Northern Shrub Thicket								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Carex buxbaumii	Cyperaceae	CXBUXB	native	10	-5	sedge	perennial	sedge
Carex diandra	Cyperaceae	CXDIAN	native	8	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Conyza canadensis	Asteraceae	CONCAN	native	0	3	forb	annual	horseweed
Dulichium arundinaceum	Cyperaceae	DULARU	native	8	-5	sedge	perennial	three-way sedge
Euphorbia virgata; e. esula	Euphorbiaceae	EUPVIR	non-native	0	5	forb	perennial	leafy spurge
Eutrochium maculatum; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
Fraxinus nigra	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
Hypericum kalmianum	Hypericaceae	HYPKAL	native	10	-3	shrub	perennial	kalms st. johns-wort
Iris virginica	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
Menyanthes trifoliata	Menyanthaceae	MENTRI	native	8	-5	forb	perennial	buckbean
Mimulus ringens	Phrymaceae	MIMRIN	native	5	-5	forb	perennial	monkey-flower
Nuphar variegata	Nymphaeaceae	NUPVAR	native	7	-5	forb	perennial	yellow pond-lily
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Persicaria hydropiperoides; polygonum h.	Polygonaceae	PERHYS	native	5	-5	forb	perennial	mild water-pepper
Potentilla anserina	Rosaceae	POTANS	native	5	-3	forb	perennial	silverweed
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Ribes hirtellum	Grossulariaceae	RIBHIR	native	6	-3	shrub	perennial	swamp gooseberry
Rosa palustris	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
Schoenoplectus tabernaemontani; scirpus validus	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
Sparganium eurycarpum	Typhaceae	SPAEUR	native	5	-5	forb	perennial	common bur-reed
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape

Appendix 6. Grass River Natural Area - Floristic Quality Assessment: Poor Conifer Swamp

Grass River Natural Area 2017: Poor Conifer Swamp
Bellaire, Antrim County, Michigan, 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: Rachel Hackett
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: In Grass River Natural Area, poor conifer swamp borders rich conifer swamp and northern fen. It in a nutrient-poor peatland occuring on extremely acidic saturated peats with little groundwater influence. Characteristic species include black spruce, tamarack, ericaceous shrubs and sphagnum mosses.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Viola* spp.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	5.7	Total Species:	65		Annual:	0	0%
Native Mean C:	5.8	Native Species:	64	98.50%	Perennial:	65	100.00%
Total FQI:	46.0	Non-native Species:	1	1.50%	Biennial:	0	0%
Native FQI:	46.4				Native Annual:	0	0%
Adjusted FQI:	57.6	**Species Wetness:**			Native Perennial:	64	98.50%
% C value 0:	1.5	Mean Wetness:	-3.1		Native Biennial:	0	0%
% C value 1-3:	13.8	Native Mean Wetness:	-3.2				
% C value 4-6:	47.7						
% C value 7-10:	36.9	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	3.8	Tree:	5	7.70%	Sedge:	10	15.40%
Native Shrub Mean C:	6.5	Shrub:	16	24.60%	Rush:	0	0%
Native Herbaceous Mean C:	5.8	Vine:	1	1.50%	Fern:	2	3.10%
		Forb:	29	44.60%	Bryophyte:	0	0%
		Grass:	2	3.10%			

Species:

Grass River Natural Area 2017: Poor Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Abies balsamea	Pinaceae	ABIBAL	native	3	0	tree	perennial	balsam fir
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Andromeda glaucophylla	Ericaceae	ANDGLA	native	10	-5	shrub	perennial	bog-rosemary
Asclepias incarnata	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
Bromus ciliatus	Poaceae	BROCIL	native	6	-3	grass	perennial	fringed brome
Calopogon tuberosus	Orchidaceae	CALTUB	native	9	-5	forb	perennial	grass-pink
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex hystericina	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex lasiocarpa	Cyperaceae	CXLASI	native	8	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex prairea	Cyperaceae	CXPRAI	native	10	-3	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex trisperma	Cyperaceae	CXTRIS	native	9	-5	sedge	perennial	sedge
Chamaedaphne calyculata	Ericaceae	CHACAL	native	8	-5	shrub	perennial	leatherleaf
Comarum palustre; potentilla p.	Rosaceae	COMPAL	native	7	-5	forb	perennial	marsh cinquefoil
Cornus canadensis	Cornaceae	CORCAA	native	6	0	shrub	perennial	bunchberry
Cypripedium reginae	Orchidaceae	CYPREG	native	9	-3	forb	perennial	showy or queens lady-slipper
Dasiphora fruticosa; potentilla f.	Rosaceae	DASFRU	native	8	-3	shrub	perennial	shrubby cinquefoil
Decodon verticillatus	Lythraceae	DECVER	native	7	-5	shrub	perennial	whorled or swamp loosestrife
Drosera rotundifolia	Droseraceae	DROROT	native	6	-5	forb	perennial	round-leaved sundew
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Eriophorum viridi-carinatum	Cyperaceae	ERIVID	native	8	-5	sedge	perennial	green-keeled cotton-grass
Erythronium americanum	Liliaceae	ERYAME	native	5	5	forb	perennial	yellow trout lily
Eupatorium perfoliatum	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
Eutrochium maculatum; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
Galium labradoricum	Rubiaceae	GALLAB	native	8	-5	forb	perennial	bog bedstraw
Gaultheria hispidula	Ericaceae	GAUHIS	native	8	-3	shrub	perennial	creeping-snowberry
Gaultheria procumbens	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
Gaylussacia baccata	Ericaceae	GAYBAC	native	7	3	shrub	perennial	huckleberry
Geum rivale	Rosaceae	GEURIV	native	7	-5	forb	perennial	purple avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Larix laricina	Pinaceae	LARLAR	native	5	-3	tree	perennial	tamarack

Grass River Natural Area 2017: Poor Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Lathyrus palustris	Fabaceae	LATPAL	native	7	-3	vine	perennial	marsh pea
Lilium philadelphicum	Liliaceae	LILPHI	native	7	0	forb	perennial	wood lily
Linnaea borealis	Linnaeaceae	LINBOR	native	6	0	forb	perennial	twinflower
Lobelia kalmii	Campanulaceae	LOBKAL	native	10	-5	forb	perennial	bog lobelia
Lysimachia thyrsiflora	Myrsinaceae	LYSTHY	native	6	-5	forb	perennial	tufted loosestrife
Maianthemum canadense	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
Menyanthes trifoliata	Menyanthaceae	MENTRI	native	8	-5	forb	perennial	buckbean
Mitchella repens	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
Myrica gale	Myricaceae	MYRGAL	native	6	-5	shrub	perennial	sweet gale
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Parnassia glauca	Parnassiaceae	PARGLA	native	8	-5	forb	perennial	grass-of-parnassus
Picea mariana	Pinaceae	PICMAR	native	6	-3	tree	perennial	black spruce
Rhododendron groenlandicum; ledum g.	Ericaceae	RHOGRO	native	8	-5	shrub	perennial	labrador-tea
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Sarracenia purpurea	Sarraceniaceae	SARPUR	native	10	-5	forb	perennial	pitcher-plant
Scirpus cyperinus	Cyperaceae	SCICYP	native	5	-5	sedge	perennial	wool-grass
Solidago ohioensis	Asteraceae	SOLOHI	native	8	-5	forb	perennial	ohio goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Solidago uliginosa	Asteraceae	SOLULI	native	4	-5	forb	perennial	bog goldenrod
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Symphyotrichum puniceum; aster p.	Asteraceae	SYMPUN	native	5	-5	forb	perennial	swamp aster
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Toxicodendron rydbergii; t. radicans	Anacardiaceae	TOXRYD	native	3	0	shrub	perennial	poison-ivy
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Typha latifolia	Typhaceae	TYPLAT	native	1	-5	forb	perennial	broad-leaved cat-tail
Vaccinium myrtilloides	Ericaceae	VACMYR	native	4	-3	shrub	perennial	canada blueberry
Vaccinium oxycoccos	Ericaceae	VACOXY	native	8	-5	shrub	perennial	small cranberry
Verbena hastata	Verbenaceae	VERHAS	native	4	-3	forb	perennial	blue vervain

Appendix 7. Grass River Natural Area - Floristic Quality Assessment: Rich Conifer Swamp

Grass River Natural Area 2017: Rich Conifer Swamp
Bellaire, Antrim County, Michigan, 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: Rachel Hackett, Liana May, Phyllis Higman
Duration Notes: Surveys were conducted 9 June 2017 (Liana May), from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: Rich conifer swamp is the most abundant community in Grass River Natural Area, where it borders poor conifer swamp, northern fen, northern wet meadow, northern shrub thicket, mesic northern forest, and dry-mesic northern forest. It is a ground-water influenced system occurring on circumneutral to moderately alkaline peats with a canopy dominated by *Thuja occidentalis*. Other canopy species include *Larix laricina*, *Abies balsamea*, and *Picea* spp. *Alnus incana* and *Toxicodendron vernix* were common, and the diverse ground layer included many graminoids, forbs, ericaceous shrubs and sphagnum mosses.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Cardamine* spp., *Dryopteris* spp., *Eleocharis* spp., *Geum* spp., *Lonicera* spp., and *Viola* spp.

Dichanthelium implicatum in Michigan Flora has the accepted name of *Dichanthelium acuminatum* via tropicos.org.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	4.8	Total Species:	207		Annual:	5	2.40%
Native Mean C:	5.2	Native Species:	191	92.30%	Perennial:	199	96.10%
Total FQI:	69.1	Non-native Species:	16	7.70%	Biennial:	3	1.40%
Native FQI:	71.9				Native Annual:	4	1.90%
Adjusted FQI:	49.9	**Species Wetness:**			Native Perennial:	186	89.90%
% C value 0:	9.7	Mean Wetness:	-2.0		Native Biennial:	1	0.50%
% C value 1-3:	20.3	Native Mean Wetness:	-2.3				
% C value 4-6:	44.9						
% C value 7-10:	25.1	**Physiognomy Metrics:**			**Physiognamy Metrics:**		
Native Tree Mean C:	3.9	Tree:	16	7.70%	Sedge:	29	14.00%
Native Shrub Mean C:	6.0	Shrub:	32	15.50%	Rush:	0	0%
Native Herbaceous Mean C:	5.1	Vine:	7	3.40%	Fern:	17	8.20%
		Forb:	95	45.90%	Bryophyte:	0	0%
		Grass:	11	5.30%			

Species:

Grass River Natural Area 2017: Rich Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Abies balsamea	Pinaceae	ABIBAL	native	3	0	tree	perennial	balsam fir
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Adiantum pedatum	Pteridaceae	ADIPED	native	6	3	fern	perennial	maidenhair fern
Agrostis perennans	Poaceae	AGRPER	native	5	3	grass	perennial	autumn bent
Alliaria petiolata	Brassicaceae	ALLPET	non-native	0	3	forb	biennial	garlic mustard
Alnus incana; a. rugosa	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
Anaphalis margaritacea	Asteraceae	ANAMAR	native	3	5	forb	perennial	pearly everlasting
Andromeda glaucophylla	Ericaceae	ANDGLA	native	10	-5	shrub	perennial	bog-rosemary
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Apocynum cannabinum; a. sibiricum	Apocynaceae	APOCAN	native	3	0	forb	perennial	indian-hemp
Aralia nudicaulis	Araliaceae	ARANUD	native	5	3	forb	perennial	wild sarsaparilla
Arethusa bulbosa	Orchidaceae	AREBUL	native	10	-5	forb	perennial	dragons mouth
Arisaema triphyllum	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
Asclepias incarnata	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
Asclepias syriaca	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
Athyrium filix-femina	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
Berberis thunbergii	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
Betula alleghaniensis	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
Betula papyrifera	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
Bidens comosa	Asteraceae	BIDCOM	native	5	-3	forb	annual	swamp tickseed
Bidens frondosa	Asteraceae	BIDFRO	native	1	-3	forb	annual	common beggar-ticks
Boehmeria cylindrica	Urticaceae	BOECYL	native	5	-5	forb	perennial	false nettle
Botrypus virginianus	Ophioglossaceae	BOTVIR	native	5	3	fern	perennial	rattlesnake fern
Bromus ciliatus	Poaceae	BROCIL	native	6	-3	grass	perennial	fringed brome
Calamagrostis canadensis	Poaceae	CALCAN	native	3	-5	grass	perennial	blue-joint
Calamagrostis stricta; c. inexpansa; c. lacustris	Poaceae	CALSTR	native	10	-3	grass	perennial	narrow-leaved reedgrass
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Campanula aparinoides	Campanulaceae	CAMAPA	native	7	-5	forb	perennial	marsh bellflower
Cardamine bulbosa	Brassicaceae	CARBUL	native	4	-5	forb	perennial	spring cress
Carex arctata	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
Carex aurea	Cyperaceae	CXAURE	native	3	-3	sedge	perennial	sedge
Carex bebbii	Cyperaceae	CXBEBB	native	4	-5	sedge	perennial	sedge
Carex brunnescens	Cyperaceae	CXBRUN	native	5	-3	sedge	perennial	sedge
Carex comosa	Cyperaceae	CXCOMO	native	5	-5	sedge	perennial	sedge

Grass River Natural Area 2017: Rich Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Carex crinita	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
Carex disperma	Cyperaceae	CXDISP	native	10	-5	sedge	perennial	sedge
Carex eburnea	Cyperaceae	CXEBUR	native	7	3	sedge	perennial	sedge
Carex exilis	Cyperaceae	CXEXIL	native	10	-5	sedge	perennial	sedge
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex intumescens	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
Carex lasiocarpa	Cyperaceae	CXLASI	native	8	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex leptonervia	Cyperaceae	CXLEPO	native	3	0	sedge	perennial	sedge
Carex lupulina	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
Carex merritt-fernaldii	Cyperaceae	CXMERR	native	4	5	sedge	perennial	sedge
Carex pedunculata	Cyperaceae	CXPEDU	native	5	3	sedge	perennial	sedge
Carex pseudo-cyperus	Cyperaceae	CXPSEU	native	5	-5	sedge	perennial	sedge
Carex stipata	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex trisperma	Cyperaceae	CXTRIS	native	9	-5	sedge	perennial	sedge
Carex utriculata; c. rostrata	Cyperaceae	CXUTRI	native	5	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Chamaedaphne calyculata	Ericaceae	CHACAL	native	8	-5	shrub	perennial	leatherleaf
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Circaea canadensis; c. lutetiana	Onagraceae	CIRCAN	native	2	3	forb	perennial	enchanters-nightshade
Cirsium muticum	Asteraceae	CIRMUT	native	6	-5	forb	biennial	swamp thistle
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Clematis virginiana	Ranunculaceae	CLEVIR	native	4	0	vine	perennial	virgins bower
Clintonia borealis	Convallariaceae	CLIBOR	native	5	0	forb	perennial	bluebead-lily; corn-lily
Comarum palustre; potentilla p.	Rosaceae	COMPAL	native	7	-5	forb	perennial	marsh cinquefoil
Coptis trifolia	Ranunculaceae	COPTRI	native	5	-3	forb	perennial	goldthread
Corallorhiza trifida	Orchidaceae	CORTRF	native	6	-3	forb	perennial	early coral-root
Cornus alternifolia	Cornaceae	CORALT	native	5	3	tree	perennial	alternate-leaved dogwood
Cornus amomum	Cornaceae	CORAMO	native	2	-3	shrub	perennial	silky dogwood
Cornus canadensis	Cornaceae	CORCAA	native	6	0	shrub	perennial	bunchberry
Cornus sericea; c. stolonifera	Cornaceae	CORSER	native	2	-3	shrub	perennial	red-osier
Cypripedium acaule	Orchidaceae	CYPACA	native	5	-3	forb	perennial	pink lady-slipper; moccasin flower
Cypripedium parviflorum; c. calceolus	Orchidaceae	CYPPAR	native	5	0	forb	perennial	yellow lady-slipper

Grass River Natural Area 2017: Rich Conifer Swamp Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Cypripedium reginae	Orchidaceae	CYPREG	native	9	-3	forb	perennial	showy or queens lady-slipper
Dasiphora fruticosa; potentilla f.	Rosaceae	DASFRU	native	8	-3	shrub	perennial	shrubby cinquefoil
Decodon verticillatus	Lythraceae	DECVER	native	7	-5	shrub	perennial	whorled or swamp loosestrife
Dichanthelium implicatum; panicum i.	Poaceae	DICIMP	native	3	0	grass	perennial	panic grass
Drosera rotundifolia	Droseraceae	DROROT	native	6	-5	forb	perennial	round-leaved sundew
Dryopteris clintoniana	Dryopteridaceae	DRYCLI	native	8	-3	fern	perennial	clintons woodfern
Dryopteris cristata	Dryopteridaceae	DRYCRI	native	6	-5	fern	perennial	crested shield fern
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Epigaea repens	Ericaceae	EPIREP	native	7	3	shrub	perennial	trailing-arbutus
Epilobium ciliatum	Onagraceae	EPICIL	native	3	-3	forb	perennial	willow-herb
Epilobium palustre	Onagraceae	EPIPAL	native	10	-5	forb	perennial	marsh willow-herb
Epilobium parviflorum	Onagraceae	EPIPAR	non-native	0	-5	forb	perennial	willow-herb
Equisetum fluviatile	Equisetaceae	EQUFLU	native	7	-5	fern	perennial	water horsetail
Equisetum palustre	Equisetaceae	EQUPAL	native	8	-3	fern	perennial	marsh horsetail
Equisetum scirpoides	Equisetaceae	EQUSCI	native	7	0	fern	perennial	dwarf scouring rush
Equisetum sylvaticum	Equisetaceae	EQUSYL	native	5	-3	fern	perennial	woodland horsetail
Eriophorum viridi-carinatum	Cyperaceae	ERIVID	native	8	-5	sedge	perennial	green-keeled cotton-grass
Eupatorium perfoliatum	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
Eutrochium maculatum; eupatorium m.	Asteraceae	EUTMAC	native	4	-5	forb	perennial	joe-pye-weed
Fraxinus americana	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
Fraxinus nigra	Oleaceae	FRANIG	native	6	-3	tree	perennial	black ash
Galium asprellum	Rubiaceae	GALASP	native	5	-5	vine	perennial	rough bedstraw
Galium labradoricum	Rubiaceae	GALLAB	native	8	-5	forb	perennial	bog bedstraw
Galium tinctorium	Rubiaceae	GALTIN	native	5	-5	forb	perennial	stiff bedstraw
Galium triflorum	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
Gaultheria hispidula	Ericaceae	GAUHIS	native	8	-3	shrub	perennial	creeping-snowberry
Gaultheria procumbens	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
Gaylussacia baccata	Ericaceae	GAYBAC	native	7	3	shrub	perennial	huckleberry
Geum rivale	Rosaceae	GEURIV	native	7	-5	forb	perennial	purple avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Gymnocarpium dryopteris	Cystopteridaceae	GYMDRY	native	5	3	fern	perennial	oak fern
Hieracium aurantiacum	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
Hieracium caespitosum	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
Hydrocotyle americana	Araliaceae	HYDAME	native	6	-5	forb	perennial	water-pennywort

Grass River Natural Area 2017: Rich Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Hypericum perforatum	Hypericaceae	HYPPER	non-native	0	5	forb	perennial	common st. johns-wort
Ilex mucronata; nemopanthus m.	Aquifoliaceae	ILEMUC	native	7	-5	shrub	perennial	mountain holly
Ilex verticillata	Aquifoliaceae	ILEVER	native	5	-3	shrub	perennial	michigan holly
Impatiens capensis	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
Iris pseudacorus	Iridaceae	IRIPSE	non-native	0	-5	forb	perennial	yellow flag
Iris virginica	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
Larix laricina	Pinaceae	LARLAR	native	5	-3	tree	perennial	tamarack
Lathyrus palustris	Fabaceae	LATPAL	native	7	-3	vine	perennial	marsh pea
Leersia oryzoides	Poaceae	LEEORY	native	3	-5	grass	perennial	cut grass
Lemna minor	Araceae	LEMMIN	native	5	-5	forb	perennial	common duckweed
Lilium philadelphicum	Liliaceae	LILPHI	native	7	0	forb	perennial	wood lily
Lindera benzoin	Lauraceae	LINBEN	native	7	-3	shrub	perennial	spicebush
Linnaea borealis	Linnaeaceae	LINBOR	native	6	0	forb	perennial	twinflower
Lobelia cardinalis	Campanulaceae	LOBCAR	native	7	-5	forb	perennial	cardinal-flower
Lobelia siphilitica	Campanulaceae	LOBSIP	native	4	-3	forb	perennial	great blue lobelia
Lonicera dioica	Caprifoliaceae	LONDIO	native	5	3	vine	perennial	red honeysuckle
Lonicera oblongifolia	Caprifoliaceae	LONOBL	native	8	-5	shrub	perennial	swamp fly honeysuckle
Lycopus uniflorus	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
Lysimachia thyrsiflora	Myrsinaceae	LYSTHY	native	6	-5	forb	perennial	tufted loosestrife
Maianthemum canadense	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
Maianthemum stellatum; smilacina s.	Convallariaceae	MAISTE	native	5	0	forb	perennial	starry false solomon-seal
Maianthemum trifolium; smilacina t.	Convallariaceae	MAITRI	native	10	-5	forb	perennial	false mayflower
Matteuccia struthiopteris	Onocleaceae	MATSTR	native	3	0	fern	perennial	ostrich fern
Medeola virginiana	Convallariaceae	MEDVIR	native	10	3	forb	perennial	indian cucumber-root
Mentha canadensis; m. arvensis	Lamiaceae	MENCAS	native	3	-3	forb	perennial	wild mint
Menyanthes trifoliata	Menyanthaceae	MENTRI	native	8	-5	forb	perennial	buckbean
Mitchella repens	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
Mitella nuda	Saxifragaceae	MITNUD	native	8	-3	forb	perennial	naked miterwort
Myosotis scorpioides	Boraginaceae	MYOSCO	non-native	0	-5	forb	perennial	forget-me-not
Myrica gale	Myricaceae	MYRGAL	native	6	-5	shrub	perennial	sweet gale
Nuphar variegata	Nymphaeaceae	NUPVAR	native	7	-5	forb	perennial	yellow pond-lily
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Orthilia secunda	Ericaceae	ORTSEC	native	7	0	forb	perennial	one-sided pyrola
Osmunda cinnamomea	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern

Grass River Natural Area 2017: Rich Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Packera paupercula; senecio p.; senecio plattensis	Asteraceae	PACPAU	native	3	0	forb	perennial	balsam ragwort
Parnassia glauca	Parnassiaceae	PARGLA	native	8	-5	forb	perennial	grass-of-parnassus
Parthenocissus quinquefolia	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phragmites australis var. americanus	Poaceae	PHRAUM	native	5	-3	grass	perennial	reed
Picea glauca	Pinaceae	PICGLA	native	3	3	tree	perennial	white spruce
Picea mariana	Pinaceae	PICMAR	native	6	-3	tree	perennial	black spruce
Pilea fontana	Urticaceae	PILFON	native	5	-3	forb	annual	bog clearweed
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Platanthera clavellata; habenaria c.	Orchidaceae	PLACLA	native	6	-3	forb	perennial	small green wood orchid
Platanthera psycodes; habenaria p.	Orchidaceae	PLAPSY	native	7	-3	forb	perennial	purple fringed orchid
Poa alsodes	Poaceae	POAALS	native	9	0	grass	perennial	bluegrass
Poa palustris	Poaceae	POAPAS	native	3	-3	grass	perennial	fowl meadow grass
Polygala paucifolia	Polygalaceae	POLPAU	native	7	3	forb	perennial	gay-wings
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	tree	perennial	balsam poplar
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Prunella vulgaris	Lamiaceae	PRUVUL	native	0	0	forb	perennial	self-heal
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
Quercus rubra	Fagaceae	QUERUB	native	5	3	tree	perennial	red oak
Ranunculus abortivus	Ranunculaceae	RANABO	native	0	0	forb	perennial	small-flowered buttercup
Ranunculus acris	Ranunculaceae	RANACR	non-native	0	0	forb	perennial	tall or common buttercup
Ranunculus hispidus	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
Ranunculus recurvatus	Ranunculaceae	RANREC	native	5	-3	forb	perennial	hooked crowfoot
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Rhododendron groenlandicum; ledum g.	Ericaceae	RHOGRO	native	8	-5	shrub	perennial	labrador-tea
Ribes cynosbati	Grossulariaceae	RIBCYN	native	4	3	shrub	perennial	prickly or wild gooseberry
Ribes triste	Grossulariaceae	RIBTRI	native	6	-5	shrub	perennial	swamp red currant
Rosa multiflora	Rosaceae	ROSMUL	non-native	0	3	shrub	perennial	multiflora rose
Rosa palustris	Rosaceae	ROSPAL	native	5	-5	shrub	perennial	swamp rose
Rubus hispidus	Rosaceae	RUBHIS	native	4	-3	shrub	perennial	swamp dewberry
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Rumex orbiculatus	Polygonaceae	RUMORB	native	9	-5	forb	perennial	great water dock
Sarracenia purpurea	Sarraceniaceae	SARPUR	native	10	-5	forb	perennial	pitcher-plant

Grass River Natural Area 2017: Rich Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
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
Scutellaria galericulata	Lamiaceae	SCUGAL	native	5	-5	forb	perennial	marsh skullcap
Scutellaria lateriflora	Lamiaceae	SCULAT	native	5	-5	forb	perennial	mad-dog skullcap
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Solidago uliginosa	Asteraceae	SOLULI	native	4	-5	forb	perennial	bog goldenrod
Sparganium eurycarpum	Typhaceae	SPAEUR	native	5	-5	forb	perennial	common bur-reed
Symphyotrichum boreale; aster b.	Asteraceae	SYMBOR	native	9	-5	forb	perennial	northern bog aster
Symphyotrichum firmum; aster puniceus	Asteraceae	SYMFIR	native	4	-3	forb	perennial	smooth swamp aster
Symphyotrichum lanceolatum; aster l.	Asteraceae	SYMLAN	native	2	-3	forb	perennial	panicled aster
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Symphyotrichum puniceum; aster p.	Asteraceae	SYMPUN	native	5	-5	forb	perennial	swamp aster
Taraxacum officinale	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
Thalictrum dasycarpum	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
Thelypteris noveboracensis	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Tiarella cordifolia	Saxifragaceae	TIACOR	native	9	3	forb	perennial	foamflower
Toxicodendron rydbergii; t. radicans	Anacardiaceae	TOXRYD	native	3	0	shrub	perennial	poison-ivy
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Trichophorum alpinum; scirpus hudsonianus	Cyperaceae	TRIALP	native	10	-5	sedge	perennial	bulrush
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Tsuga canadensis	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
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

Grass River Natural Area 2017: Rich Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Utricularia intermedia	Lentibulariaceae	UTRINT	native	10	-5	forb	perennial	flat-leaved bladderwort
Vaccinium myrtilloides	Ericaceae	VACMYR	native	4	-3	shrub	perennial	canada blueberry
Vaccinium oxycoccos	Ericaceae	VACOXY	native	8	-5	shrub	perennial	small cranberry
Veronica arvensis	Plantaginaceae	VERARV	non-native	0	3	forb	annual	corn speedwell
Viburnum cassinoides	Adoxaceae	VIBCAS	native	6	3	shrub	perennial	wild-raisin
Viola cucullata	Violaceae	VIOCUC	native	5	-5	forb	perennial	marsh violet
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape

Appendix 8. Grass River Natural Area - Floristic Quality Assessment: Hardwood-Conifer Swamp

Grass River Natural Area 2017: Hardwood-Conifer Swamp
Bellaire, Antrim County, Michigan, 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: Rachel Hackett
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: Hardwood-conifer swamp is a groundwater influenced wetland with a mix of conifer and hardwood species. The canopy was dominated by *Thuja occidentalis* and *Betula alleganiensis*, with frequent occurrences of *Populus balsamifera*, *Populus grandidenta* and *Tsuga canadensis*. The shrub and ground layers supported a diversity of shrubs, sedges, forbs, and ferns.

The parcels adjacent to Willow Day Park had more exotic species than most other parcels.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Cardamine* spp., *Fraxinus* spp. saplings (*F. americana* likely), *Geum* spp., *Lonicera* spp., *Populus* spp. saplings, and *Viola* spp.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	4.0	Total Species:	97		Annual:	1	1.00%
Native Mean C:	4.3	Native Species:	90	92.80%	Perennial:	95	97.90%
Total FQI:	39.4	Non-native Species:	7	7.20%	Biennial:	1	1.00%
Native FQI:	40.8				Native Annual:	1	1.00%
Adjusted FQI:	41.4	**Species Wetness:**			Native Perennial:	89	91.80%
% C value 0:	9.3	Mean Wetness:	-1.6		Native Biennial:	0	0%
% C value 1-3:	34.0	Native Mean Wetness:	-1.8				
% C value 4-6:	41.2						
% C value 7-10:	15.5	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	3.5	Tree:	10	10.30%	Sedge:	19	19.60%
Native Shrub Mean C:	5.0	Shrub:	11	11.30%	Rush:	1	1.00%
Native Herbaceous Mean C:	4.4	Vine:	2	2.10%	Fern:	13	13.40%
		Forb:	35	36.10%	Bryophyte:	0	0%
		Grass:	6	6.20%			

Species:

Grass River Natural Area 2017: Hardwood-Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Acer saccharum	Sapindaceae	ACESAU	native	5	3	tree	perennial	sugar maple
Adiantum pedatum	Pteridaceae	ADIPED	native	6	3	fern	perennial	maidenhair fern
Alnus incana; a. rugosa	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
Aralia nudicaulis	Araliaceae	ARANUD	native	5	3	forb	perennial	wild sarsaparilla
Arisaema triphyllum	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
Asclepias syriaca	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
Athyrium filix-femina	Athyriaceae	ATHFIL	native	4	0	fern	perennial	lady fern
Betula alleghaniensis	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
Boehmeria cylindrica	Urticaceae	BOECYL	native	5	-5	forb	perennial	false nettle
Brachyelytrum aristosum; b. erectum	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
Calamagrostis stricta; c. inexpansa; c. lacustris	Poaceae	CALSTR	native	10	-3	grass	perennial	narrow-leaved reedgrass
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Carex arctata	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
Carex aurea	Cyperaceae	CXAURE	native	3	-3	sedge	perennial	sedge
Carex bebbii	Cyperaceae	CXBEBB	native	4	-5	sedge	perennial	sedge
Carex communis	Cyperaceae	CXCOMM	native	2	5	sedge	perennial	sedge
Carex crinita	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
Carex disperma	Cyperaceae	CXDISP	native	10	-5	sedge	perennial	sedge
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex hystericina	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex intumescens	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
Carex laevivaginata	Cyperaceae	CXLAEV	native	8	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex lupulina	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
Carex stipata	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
Carex stricta	Cyperaceae	CXSTRI	native	4	-5	sedge	perennial	sedge
Carex trisperma	Cyperaceae	CXTRIS	native	9	-5	sedge	perennial	sedge
Carex utriculata; c. rostrata	Cyperaceae	CXUTRI	native	5	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Chelone glabra	Plantaginaceae	CHEGLB	native	7	-5	forb	perennial	turtlehead
Circaea canadensis; c. lutetiana	Onagraceae	CIRCAN	native	2	3	forb	perennial	enchanters-nightshade

Grass River Natural Area 2017: Hardwood-Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Coptis trifolia	Ranunculaceae	COPTRI	native	5	-3	forb	perennial	goldthread
Cornus canadensis	Cornaceae	CORCAA	native	6	0	shrub	perennial	bunchberry
Dryopteris cristata	Dryopteridaceae	DRYCRI	native	6	-5	fern	perennial	crested shield fern
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Epilobium ciliatum	Onagraceae	EPICIL	native	3	-3	forb	perennial	willow-herb
Equisetum fluviatile	Equisetaceae	EQUFLU	native	7	-5	fern	perennial	water horsetail
Equisetum palustre	Equisetaceae	EQUPAL	native	8	-3	fern	perennial	marsh horsetail
Equisetum scirpoides	Equisetaceae	EQUSCI	native	7	0	fern	perennial	dwarf scouring rush
Erythronium americanum	Liliaceae	ERYAME	native	5	5	forb	perennial	yellow trout lily
Euthamia graminifolia	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
Galium triflorum	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
Gaultheria hispidula	Ericaceae	GAUHIS	native	8	-3	shrub	perennial	creeping-snowberry
Geum rivale	Rosaceae	GEURIV	native	7	-5	forb	perennial	purple avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Hieracium aurantiacum	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
Hieracium caespitosum	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
Impatiens capensis	Balsaminaceae	IMPCAP	native	2	-3	forb	annual	spotted touch-me-not
Iris virginica	Iridaceae	IRIVIR	native	5	-5	forb	perennial	southern blue flag
Juncus effusus	Juncaceae	JUNEFF	native	3	-5	rush	perennial	soft-stemmed rush
Leersia oryzoides	Poaceae	LEEORY	native	3	-5	grass	perennial	cut grass
Lilium philadelphicum	Liliaceae	LILPHI	native	7	0	forb	perennial	wood lily
Lonicera canadensis	Caprifoliaceae	LONCAN	native	5	3	shrub	perennial	canadian fly honeysuckle
Lysimachia nummularia	Myrsinaceae	LYSNUM	non-native	0	-3	forb	perennial	moneywort
Lysimachia thyrsiflora	Myrsinaceae	LYSTHY	native	6	-5	forb	perennial	tufted loosestrife
Maianthemum canadense	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
Maianthemum stellatum; smilacina s.	Convallariaceae	MAISTE	native	5	0	forb	perennial	starry false solomon-seal
Mentha canadensis; m. arvensis	Lamiaceae	MENCAS	native	3	-3	forb	perennial	wild mint
Myosotis scorpioides	Boraginaceae	MYOSCO	non-native	0	-5	forb	perennial	forget-me-not
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Osmunda cinnamomea	Osmundaceae	OSMCIN	native	5	-3	fern	perennial	cinnamon fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phegopteris connectilis; thelypteris phegopteris	Thelypteridaceae	PHECON	native	5	3	fern	perennial	northern beech-fern
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Poa palustris	Poaceae	POAPAS	native	3	-3	grass	perennial	fowl meadow grass

Grass River Natural Area 2017: Hardwood-Conifer Swamp								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	tree	perennial	balsam poplar
Populus grandidentata	Salicaceae	POPGRA	native	4	3	tree	perennial	big-tooth aspen
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
Ranunculus hispidus	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Rubus strigosus	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
Rumex orbiculatus	Polygonaceae	RUMORB	native	9	-5	forb	perennial	great water dock
Sambucus canadensis	Adoxaceae	SAMCAN	native	3	-3	shrub	perennial	elderberry
Scirpus cyperinus	Cyperaceae	SCICYP	native	5	-5	sedge	perennial	wool-grass
Scutellaria galericulata	Lamiaceae	SCUGAL	native	5	-5	forb	perennial	marsh skullcap
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago canadensis	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	forb	perennial	calico aster
Thalictrum dasycarpum	Ranunculaceae	THADAS	native	3	-3	forb	perennial	purple meadow-rue
Thelypteris noveboracensis	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Toxicodendron rydbergii; t. radicans	Anacardiaceae	TOXRYD	native	3	0	shrub	perennial	poison-ivy
Toxicodendron vernix	Anacardiaceae	TOXVER	native	6	-5	shrub	perennial	poison sumac
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Tsuga canadensis	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
Typha latifolia	Typhaceae	TYPLAT	native	1	-5	forb	perennial	broad-leaved cat-tail
Vitis riparia	Vitaceae	VITRIP	native	3	0	vine	perennial	river-bank grape

Appendix 9. Grass River Natural Area - Floristic Quality Assessment: Dry-mesic Northern Forest

Grass River Natural Area 2017: Dry-mesic Northern Forest
Bellaire, Antrim County, Michigan, 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:	Rachel Hackett, Phyllis Higman
Duration Notes:	Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes:	Dry-mesic northern forest is pine or pine-hardwood community shaped by fire that occurs on well-drained acidic sands or loamy sands.` At GRNA, bracken fern was the most abundant species in the understory, which otherwise was fairly clear.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	3.8	Total Species:	26		Annual:	0	0%
Native Mean C:	3.9	Native Species:	25	96.20%	Perennial:	26	100.00%
Total FQI:	19.4	Non-native Species:	1	3.80%	Biennial:	0	0%
Native FQI:	19.5				Native Annual:	0	0%
Adjusted FQI:	38.2	**Species Wetness:**			Native Perennial:	25	96.20%
% C value 0:		Mean Wetness:	1.1		Native Biennial:		
	7.7		1.0			0	0%
% C value 1-3:	34.6	Native Mean Wetness:	1.0				
% C value 4-6:	46.2						
% C value 7-10:	11.5	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	3.6	Tree:	10	38.50%	Sedge:	4	15.40%
Native Shrub Mean C:	2.0	Shrub:	3	11.50%	Rush:	0	0%
Native Herbaceous Mean C:	4.5	Vine:	0	0%	Fern:	3	11.50%
		Forb:	3	11.50%	Bryophyte:	0	0%
		Grass:	3	11.50%			

Species:

Grass River Natural Area 2017: Dry-mesic Northern Forest								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Abies balsamea	Pinaceae	ABIBAL	native	3	0	Tree	perennial	balsam fir
Acer rubrum	Sapindaceae	ACERUB	native	1	0	Tree	perennial	red maple
Acer saccharum	Sapindaceae	ACESAU	native	5	3	Tree	perennial	sugar maple
Berberis thunbergii	Berberidaceae	BERTHU	non-native	0	3	shrub	perennial	japanese barberry
Betula alleghaniensis	Betulaceae	BETALL	native	7	0	Tree	perennial	yellow birch
Brachyelytrum aristosum; b. erectum	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
Carex communis	Cyperaceae	CXCOMM	native	2	5	sedge	perennial	sedge
Carex lupulina	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
Carex pensylvanica	Cyperaceae	CXPENS	native	4	5	sedge	perennial	sedge
Dendrolycopodium obscurum; lycopodium o.	Lycopodiaceae	DENOBS	native	5	3	Fern	perennial	ground-pine
Elymus hystrix; hystrix patula	Poaceae	ELYHYS	native	5	3	grass	perennial	bottlebrush grass
Fraxinus americana	Oleaceae	FRAAME	native	5	3	Tree	perennial	white ash
Mitchella repens	Rubiaceae	MITREP	native	5	3	Forb	perennial	partridge-berry
Pinus strobus	Pinaceae	PINSTR	native	3	3	Tree	perennial	white pine
Poa alsodes	Poaceae	POAALS	native	9	0	grass	perennial	bluegrass
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	Tree	perennial	balsam poplar
Populus tremuloides	Salicaceae	POPTRE	native	1	0	Tree	perennial	quaking aspen
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	Fern	perennial	bracken fern
Rubus allegheniensis	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
Scirpus cyperinus	Cyperaceae	SCICYP	native	5	-5	sedge	perennial	wool-grass
Spinulum annotinum; lycopodium a.	Lycopodiaceae	SPIANN	native	5	0	Fern	perennial	stiff clubmoss
Symphyotrichum lateriflorum; aster l.	Asteraceae	SYMLAT	native	2	0	Forb	perennial	calico aster
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	Tree	perennial	arbor vitae
Toxicodendron rydbergii; t. radicans	Anacardiaceae	TOXRYD	native	3	0	shrub	perennial	poison-ivy
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	Forb	perennial	star-flower
Tsuga canadensis	Pinaceae	TSUCAN	native	5	3	Tree	perennial	hemlock

Appendix 10. Grass River Natural Area - Floristic Quality Assessment: Mesic Northern Forest

Grass River Natural Area 2017: Mesic Northern Forest
Bellaire, Antrim County, Michigan, 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: Rachel Hackett, Phyllis Higman
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: In Grass River Natural Area, mesic northern forest comprised the second most abundant natural community. Its co-dominants are *Acer saccharum*, *Tsuga canadensis*, *Fagus grandifolia*, *Betula allegheniensis*, *Pinus strobus*, *Quercus rubra*, *Thuja occidentalis*, and *Acer rubrum*. The ground and shrub layers were diverse, but many species characteristic of the spring flora, such as *Trillium grandiflora (common trillium), Dicentra cucullaria* (Dutchman's- breeches) and *Erythronium* spp. (trout-lilies) were not observed during this inventory. Additional surveys, particularly in early spring are warranted.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Fraxinus* spp. saplings (*F. americana* likely), *Lonicera* spp., Lycopodiaceae, *Populus* spp. saplings, *Quercus* hybrid with one parent likely *Q. macrocarpa*, and *Quercus* spp. saplings.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	3.9	Total Species:	101		Annual:	0	0%
Native Mean C:	4.4	Native Species:	90	89.10%	Perennial:	100	99.00%
Total FQI:	39.2	Non-native Species:	11	10.90%	Biennial:	1	1.00%
Native FQI:	41.7				Native Annual:	0	0%
Adjusted FQI:	41.5	**Species Wetness:**			Native Perennial:	90	89.10%
% C value 0:	12.9	Mean Wetness:	0.3		Native Biennial:	0	0%
% C value 1-3:	25.7	Native Mean Wetness:	0.2				
% C value 4-6:	51.5						
% C value 7-10:	9.9	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	3.9	Tree:	18.0	17.80%	Sedge:	14	13.90%
Native Shrub Mean C:	3.7	Shrub:	13.0	12.90%	Rush:	1	1.00%
Native Herbaceous Mean C:	4.6	Vine:	2.0	2.00%	Fern:	15	14.90%
		Forb:	31.0	30.70%	Bryophyte:	0	0%
		Grass:	7.0	6.90%			

Species:

Grass River Natural Area 2017: Mesic Northern Forest								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Abies balsamea	Pinaceae	ABIBAL	native	3	0	tree	perennial	balsam fir
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Acer saccharum	Sapindaceae	ACESAU	native	5	3	tree	perennial	sugar maple
Agrostis gigantea	Poaceae	AGRGIG	non-native	0	-3	grass	perennial	redtop
Allium tricoccum	Alliaceae	ALLTRI	native	5	3	forb	perennial	wild leek
Alnus incana; a. rugosa	Betulaceae	ALNINC	native	5	-3	shrub	perennial	speckled alder
Arisaema triphyllum	Araceae	ARITRI	native	5	0	forb	perennial	jack-in-the-pulpit
Betula alleghaniensis	Betulaceae	BETALL	native	7	0	tree	perennial	yellow birch
Betula papyrifera	Betulaceae	BETPAP	native	2	3	tree	perennial	paper birch
Brachyelytrum aristosum; b. erectum	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Cardamine diphylla; dentaria d.	Brassicaceae	CARDIP	native	5	3	forb	perennial	two-leaved toothwort
Carex bebbii	Cyperaceae	CXBEBB	native	4	-5	sedge	perennial	sedge
Carex communis	Cyperaceae	CXCOMM	native	2	5	sedge	perennial	sedge
Carex crinita	Cyperaceae	CXCRIN	native	4	-5	sedge	perennial	sedge
Carex deweyana	Cyperaceae	CXDEWE	native	3	3	sedge	perennial	sedge
Carex disperma	Cyperaceae	CXDISP	native	10	-5	sedge	perennial	sedge
Carex gracillima	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
Carex interior	Cyperaceae	CXINTE	native	3	-5	sedge	perennial	sedge
Carex intumescens	Cyperaceae	CXINTU	native	3	-3	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex lupulina	Cyperaceae	CXLUPA	native	4	-5	sedge	perennial	sedge
Carex pensylvanica	Cyperaceae	CXPENS	native	4	5	sedge	perennial	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 stipata	Cyperaceae	CXSTIP	native	1	-5	sedge	perennial	sedge
Chrysosplenium americanum	Saxifragaceae	CHRAME	native	6	-5	forb	perennial	golden saxifrage
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Cornus alternifolia	Cornaceae	CORALT	native	5	3	tree	perennial	alternate-leaved dogwood
Cornus foemina	Cornaceae	CORFOE	native	1	0	shrub	perennial	gray dogwood
Dendrolycopodium obscurum; lycopodium o.	Lycopodiaceae	DENOBS	native	5	3	fern	perennial	ground-pine
Doellingeria umbellata; aster u.	Asteraceae	DOEUMB	native	5	-3	forb	perennial	flat-topped white aster
Dryopteris carthusiana	Dryopteridaceae	DRYCAR	native	5	-3	fern	perennial	spinulose woodfern
Dryopteris clintoniana	Dryopteridaceae	DRYCLI	native	8	-3	fern	perennial	clintons woodfern
Dryopteris cristata	Dryopteridaceae	DRYCRI	native	6	-5	fern	perennial	crested shield fern
Dryopteris intermedia	Dryopteridaceae	DRYINT	native	5	0	fern	perennial	evergreen woodfern

Grass River Natural Area 2017: Mesic Northern Forest								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
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
Epigaea repens	Ericaceae	EPIREP	native	7	3	shrub	perennial	trailing-arbutus
Epipactis helleborine	Orchidaceae	EPIHEL	non-native	0	0	forb	perennial	helleborine
Equisetum fluviatile	Equisetaceae	EQUFLU	native	7	-5	fern	perennial	water horsetail
Equisetum palustre	Equisetaceae	EQUPAL	native	8	-3	fern	perennial	marsh horsetail
Fagus grandifolia	Fagaceae	FAGGRA	native	6	3	tree	perennial	american beech
Fraxinus americana	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
Galium labradoricum	Rubiaceae	GALLAB	native	8	-5	forb	perennial	bog bedstraw
Gaultheria procumbens	Ericaceae	GAUPRO	native	5	3	shrub	perennial	wintergreen
Geum canadense	Rosaceae	GEUCAN	native	1	0	forb	perennial	white avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Goodyera pubescens	Orchidaceae	GOOPUB	native	7	3	forb	perennial	downy rattlesnake plantain
Hamamelis virginiana	Hamamelidaceae	HAMVIR	native	5	3	shrub	perennial	witch-hazel
Hieracium aurantiacum	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
Juncus nodosus	Juncaceae	JUNNOD	native	5	-5	rush	perennial	joint rush
Lonicera morrowii	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle
Lonicera x*bella*	Caprifoliaceae	LONBEL	non-native	0	3	shrub	perennial	hybrid honeysuckle
Lycopus uniflorus	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
Maianthemum canadense	Convallariaceae	MAICAN	native	4	3	forb	perennial	canada mayflower
Medeola virginiana	Convallariaceae	MEDVIR	native	10	3	forb	perennial	indian cucumber-root
Mitchella repens	Rubiaceae	MITREP	native	5	3	forb	perennial	partridge-berry
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Oryzopsis asperifolia	Poaceae	ORYASP	native	6	5	grass	perennial	rough-leaved rice-grass
Osmunda claytoniana	Osmundaceae	OSMCLN	native	6	0	fern	perennial	interrupted fern
Osmunda regalis	Osmundaceae	OSMREG	native	5	-5	fern	perennial	royal fern
Parthenocissus quinquefolia	Vitaceae	PARQUI	native	5	3	vine	perennial	virginia creeper
Phalaris arundinacea	Poaceae	PHAARU	native	0	-3	grass	perennial	reed canary grass
Phegopteris connectilis; thelypteris phegopteris	Thelypteridaceae	PHECON	native	5	3	fern	perennial	northern beech-fern
Picea glauca	Pinaceae	PICGLA	native	3	3	tree	perennial	white spruce
Picea pungens	Pinaceae	PICPUN	non-native	0	3	tree	perennial	blue spruce
Pinus resinosa	Pinaceae	PINRES	native	6	3	tree	perennial	red pine
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Polygonatum pubescens	Convallariaceae	POLPUB	native	5	5	forb	perennial	downy solomon seal
Populus grandidentata	Salicaceae	POPGRA	native	4	3	tree	perennial	big-tooth aspen
Populus tremuloides	Salicaceae	POPTRE	native	1	0	tree	perennial	quaking aspen
Prunus serotina	Rosaceae	PRUSER	native	2	3	tree	perennial	wild black cherry

Grass River Natural Area 2017: Mesic Northern Forest								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
Pyrola elliptica	Ericaceae	PYRELL	native	6	3	forb	perennial	large-leaved shinleaf
Rubus allegheniensis	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
Rubus occidentalis	Rosaceae	RUBOCC	native	1	5	shrub	perennial	black raspberry
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Rubus strigosus	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
Schizachne purpurascens	Poaceae	SCHPUP	native	5	3	grass	perennial	false melic
Solanum dulcamara	Solanaceae	SOLDUL	non-native	0	0	vine	perennial	bittersweet nightshade
Solidago caesia	Asteraceae	SOLCAE	native	6	3	forb	perennial	bluestem goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Spinulum annotinum; lycopodium a.	Lycopodiaceae	SPIANN	native	5	0	fern	perennial	stiff clubmoss
Symphyotrichum urophyllum; aster sagittifolius	Asteraceae	SYMURO	native	2	5	forb	perennial	arrow-leaved aster
Taraxacum officinale	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
Thalictrum dioicum	Ranunculaceae	THADIO	native	6	3	forb	perennial	early meadow-rue
Thelypteris noveboracensis	Thelypteridaceae	THENOV	native	5	0	fern	perennial	new york fern
Thelypteris palustris	Thelypteridaceae	THEPAL	native	2	-3	fern	perennial	marsh fern
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
Tilia americana	Malvaceae	TILAME	native	5	3	tree	perennial	basswood
Trientalis borealis	Myrsinaceae	TRIBOR	native	5	0	forb	perennial	star-flower
Trillium cernuum	Trilliaceae	TRICER	native	5	0	forb	perennial	nodding trillium
Tsuga canadensis	Pinaceae	TSUCAN	native	5	3	tree	perennial	hemlock
Verbena hastata	Verbenaceae	VERHAS	native	4	-3	forb	perennial	blue vervain
Veronica officinalis	Plantaginaceae	VEROOF	non-native	0	3	forb	perennial	common speedwell
Viburnum acerifolium	Adoxaceae	VIBACE	native	6	5	shrub	perennial	maple-leaved viburnum
Viola canadensis	Violaceae	VIOCAN	native	5	3	forb	perennial	canada violet
Viola labradorica; v. conspersa	Violaceae	VIOLAB	native	3	0	forb	perennial	dog violet

Appendix 11. Grass River Natural Area - Floristic Quality Assessment: Old field/residential/plantation

Grass River Natural Area 2017: Old field/residential/plantation
Bellaire, Antrim County, Michigan, 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: Rachel Hackett, Phyllis Higman
Duration Notes: Surveys were conducted from 19 June 2017 to 23 June 2017, and from 14 August 2017 to 18 August 2017.
Community Type Notes: These areas have strong anthropological disturbances that have significantly altered the species composition and structure from reference conditions and are classified as anthropogenic systems. These are mostly old residential areas or agricultural fields, and red pine plantations.

Also noted but unable to determine species due to lack of reproductive organs or full-growth form at time of observation: *Lonicera* spp., Lycopodiaceae, *Populus* spp. saplings, *Quercus* hybrid with one parent likely *Q. macrocarpa*, and *Quercus* spp. saplings.

Conservatism-Based Metrics:		**Species Richness:**			**Duration Metrics:**		
Total Mean C:	2.3	Total Species:	109		Annual:	6	5.50%
Native Mean C:	3.4	Native Species:	74	67.90%	Perennial:	96	88.10%
Total FQI:	24,0	Non-native Species:	35	32.10%	Biennial:	7	6.40%
Native FQI:	29.2				Native Annual:	2	1.80%
Adjusted FQI:	28,0	**Species Wetness:**			Native Perennial:	72	66.10%
% C value 0:	34.9	Mean Wetness:	1.0		Native Biennial:	0	0%
% C value 1-3:	33,0	Native Mean Wetness:	-0.1				
% C value 4-6:	26.6						
% C value 7-10:	5.5	**Physiognomy Metrics:**			**Physiognomy Metrics:**		
Native Tree Mean C:	3.2	Tree:	13	11.90%	Sedge:	9	8.30%
Native Shrub Mean C:	3.2	Shrub:	12	11.00%	Rush:	1	0.90%
Native Herbaceous Mean C:	3.5	Vine:	2	1.80%	Fern:	5	4.60%
		Forb:	55	50.50%	Bryophyte:	0	0%
		Grass:	12	11.00%			

Species:

Grass River Natural Area 2017: Old field/residential/plantation								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Abies balsamea	Pinaceae	ABIBAL	native	3	0	tree	perennial	balsam fir
Acer rubrum	Sapindaceae	ACERUB	native	1	0	tree	perennial	red maple
Achillea millefolium	Asteraceae	ACHMIL	native	1	3	forb	perennial	yarrow
Agrostis gigantea	Poaceae	AGRGIG	non-native	0	-3	grass	perennial	redtop
Anemone canadensis	Ranunculaceae	ANECAN	native	4	-3	forb	perennial	canada anemone
Anemone cylindrica	Ranunculaceae	ANECYL	native	6	5	forb	perennial	thimbleweed
Anemone virginiana	Ranunculaceae	ANEVIR	native	3	3	forb	perennial	thimbleweed
Antennaria parlinii	Asteraceae	ANTPAL	native	2	5	forb	perennial	smooth pussytoes
Apocynum androsaemifolium	Apocynaceae	APOAND	native	3	5	forb	perennial	spreading dogbane
Asclepias incarnata	Apocynaceae	ASCINC	native	6	-5	forb	perennial	swamp milkweed
Asclepias syriaca	Apocynaceae	ASCSYR	native	1	5	forb	perennial	common milkweed
Berteroa incana	Brassicaceae	BERINC	non-native	0	5	forb	annual	hoary alyssum
Brachyelytrum aristosum; b. erectum	Poaceae	BRAARI	native	7	5	grass	perennial	northern shorthusk
Bromus inermis	Poaceae	BROINE	non-native	0	5	grass	perennial	smooth brome
Caltha palustris	Ranunculaceae	CALPAR	native	6	-5	forb	perennial	marsh-marigold
Carex arctata	Cyperaceae	CXARTT	native	3	5	sedge	perennial	sedge
Carex disperma	Cyperaceae	CXDISP	native	10	-5	sedge	perennial	sedge
Carex flava	Cyperaceae	CXFLAV	native	4	-5	sedge	perennial	sedge
Carex gracillima	Cyperaceae	CXGRAA	native	4	3	sedge	perennial	sedge
Carex hystericina	Cyperaceae	CXHYST	native	2	-5	sedge	perennial	sedge
Carex leptalea	Cyperaceae	CXLEPA	native	5	-5	sedge	perennial	sedge
Carex vulpinoidea	Cyperaceae	CXVULP	native	1	-5	sedge	perennial	sedge
Centaurea stoebe; c. maculosa	Asteraceae	CENSTO	non-native	0	5	forb	biennial	spotted knapweed
Cirsium arvense	Asteraceae	CIRARV	non-native	0	3	forb	perennial	canada thistle
Cirsium palustre	Asteraceae	CIRPAL	non-native	0	-3	forb	biennial	marsh thistle
Cirsium vulgare	Asteraceae	CIRVUL	non-native	0	3	forb	biennial	bull thistle
Clematis virginiana	Ranunculaceae	CLEVIR	native	4	0	vine	perennial	virgins bower
Clinopodium vulgare	Lamiaceae	CLIVUL	native	3	5	forb	perennial	wild-basil
Cornus amomum	Cornaceae	CORAMO	native	2	-3	shrub	perennial	silky dogwood
Dactylis glomerata	Poaceae	DACGLO	non-native	0	3	grass	perennial	orchard grass
Danthonia spicata	Poaceae	DANSPI	native	4	5	grass	perennial	poverty grass; oatgrass
Dasiphora fruticosa; potentilla f.	Rosaceae	DASFRU	native	8	-3	shrub	perennial	shrubby cinquefoil
Daucus carota	Apiaceae	DAUCAR	non-native	0	5	forb	biennial	queen-annes-lace
Dianthus armeria	Caryophyllaceae	DIAARM	non-native	0	5	forb	annual	deptford pink
Elaeagnus umbellata	Elaeagnaceae	ELAUMB	non-native	0	3	shrub	perennial	autumn-olive
Elymus repens; agropyron r.	Poaceae	ELYREP	non-native	0	3	grass	perennial	quack grass

Grass River Natural Area 2017: Old field/residential/plantation								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Equisetum hyemale	Equisetaceae	EQUHYE	native	2	0	fern	perennial	scouring rush
Equisetum palustre	Equisetaceae	EQUPAL	native	8	-3	fern	perennial	marsh horsetail
Erigeron strigosus	Asteraceae	ERISTR	native	4	3	forb	perennial	daisy fleabane
Eupatorium perfoliatum	Asteraceae	EUPPER	native	4	-3	forb	perennial	boneset
Euphorbia corollata	Euphorbiaceae	EUPCOR	native	4	5	forb	perennial	flowering spurge
Euphorbia virgata; e. esula	Euphorbiaceae	EUPVIR	non-native	0	5	forb	perennial	leafy spurge
Euthamia graminifolia	Asteraceae	EUTGRA	native	3	0	forb	perennial	grass-leaved goldenrod
Fragaria virginiana	Rosaceae	FRAVIR	native	2	3	forb	perennial	wild strawberry
Fraxinus americana	Oleaceae	FRAAME	native	5	3	tree	perennial	white ash
Galium triflorum	Rubiaceae	GALTRR	native	4	3	forb	perennial	fragrant bedstraw
Geum rivale	Rosaceae	GEURIV	native	7	-5	forb	perennial	purple avens
Glyceria striata	Poaceae	GLYSTR	native	4	-5	grass	perennial	fowl manna grass
Gnaphalium uliginosum	Asteraceae	GNAULI	native	3	0	forb	annual	low cudweed
Hieracium aurantiacum	Asteraceae	HIEAUR	non-native	0	5	forb	perennial	orange hawkweed
Hieracium caespitosum	Asteraceae	HIECAE	non-native	0	5	forb	perennial	king devil
Hypericum perforatum	Hypericaceae	HYPPER	non-native	0	5	forb	perennial	common st. johns-wort
Hypopitys monotropa; monotropa hypopithys	Ericaceae	HYPMON	native	6	5	forb	perennial	pinesap
Juncus tenuis	Juncaceae	JUNTEN	native	1	0	rush	perennial	path rush
Juniperus communis	Cupressaceae	JUNCOI	native	4	3	shrub	perennial	common or ground juniper
Larix laricina	Pinaceae	LARLAR	native	5	-3	tree	perennial	tamarack
Leucanthemum vulgare; chrysanthemum leucanthemum	Asteraceae	LEUVUL	non-native	0	5	forb	perennial	ox-eye daisy
Lonicera morrowii	Caprifoliaceae	LONMOR	non-native	0	3	shrub	perennial	morrow honeysuckle
Lycopodium clavatum	Lycopodiaceae	LYCCLA	native	4	0	fern	perennial	running ground-pine
Lycopus americanus	Lamiaceae	LYCAME	native	2	-5	forb	perennial	common water horehound
Lycopus uniflorus	Lamiaceae	LYCUNI	native	2	-5	forb	perennial	northern bugle weed
Medicago lupulina	Fabaceae	MEDLUP	non-native	0	3	forb	annual	black medick
Melilotus albus	Fabaceae	MELALB	non-native	0	3	forb	biennial	white sweet-clover
Onoclea sensibilis	Onocleaceae	ONOSEN	native	2	-3	fern	perennial	sensitive fern
Packera paupercula; senecio p.; senecio plattensis	Asteraceae	PACPAU	native	3	0	forb	perennial	balsam ragwort
Panicum capillare	Poaceae	PANCAP	native	0	0	grass	annual	witch grass
Phleum pratense	Poaceae	PHLPRA	non-native	0	3	grass	perennial	timothy
Picea pungens	Pinaceae	PICPUN	non-native	0	3	tree	perennial	blue spruce
Pinus resinosa	Pinaceae	PINRES	native	6	3	tree	perennial	red pine
Pinus strobus	Pinaceae	PINSTR	native	3	3	tree	perennial	white pine
Plantago lanceolata	Plantaginaceae	PLALAN	non-native	0	3	forb	perennial	english plantain

Grass River Natural Area 2017: Old field/residential/plantation								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Plantago major	Plantaginaceae	PLAMAJ	non-native	0	3	forb	perennial	common 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
Populus balsamifera	Salicaceae	POPBAL	native	2	-3	tree	perennial	balsam poplar
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
Pteridium aquilinum	Dennstaedtiaceae	PTEAQU	native	0	3	fern	perennial	bracken fern
Quercus rubra	Fagaceae	QUERUB	native	5	3	tree	perennial	red oak
Ranunculus hispidus	Ranunculaceae	RANHIS	native	5	0	forb	perennial	swamp buttercup
Ranunculus recurvatus	Ranunculaceae	RANREC	native	5	-3	forb	perennial	hooked crowfoot
Rhamnus alnifolia	Rhamnaceae	RHAALN	native	8	-5	shrub	perennial	alder-leaved buckthorn
Rubus allegheniensis	Rosaceae	RUBALL	native	1	3	shrub	perennial	common blackberry
Rubus occidentalis	Rosaceae	RUBOCC	native	1	5	shrub	perennial	black raspberry
Rubus pubescens	Rosaceae	RUBPUB	native	4	-3	shrub	perennial	dwarf raspberry
Rubus strigosus	Rosaceae	RUBSTR	native	2	0	shrub	perennial	wild red raspberry
Rudbeckia hirta	Asteraceae	RUDHIR	native	1	3	forb	perennial	black-eyed susan
Rumex acetosella	Polygonaceae	RUMACL	non-native	0	3	forb	perennial	sheep sorrel
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
Schizachyrium scoparium; andropogon s.	Poaceae	SCHSCO	native	5	3	grass	perennial	little bluestem
Schoenoplectus tabernaemontani; scirpus validus	Cyperaceae	SCHTAB	native	4	-5	sedge	perennial	softstem bulrush
Scirpus cyperinus	Cyperaceae	SCICYP	native	5	-5	sedge	perennial	wool-grass
Solidago canadensis	Asteraceae	SOLCAN	native	1	3	forb	perennial	canada goldenrod
Solidago gigantea	Asteraceae	SOLGIG	native	3	-3	forb	perennial	late goldenrod
Solidago patula	Asteraceae	SOLPAT	native	6	-5	forb	perennial	swamp goldenrod
Solidago rugosa	Asteraceae	SOLRUG	native	3	0	forb	perennial	rough-leaved goldenrod
Symphyotrichum urophyllum; aster sagittifolius	Asteraceae	SYMURO	native	2	5	forb	perennial	arrow-leaved aster
Taraxacum officinale	Asteraceae	TAROFF	non-native	0	3	forb	perennial	common dandelion
Thuja occidentalis	Cupressaceae	THUOCC	native	4	-3	tree	perennial	arbor vitae
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

Grass River Natural Area 2017: Old field/residential/plantation								
Scientific Name	**Family**	**Acronym**	**Native?**	**C**	**W**	**Physiognomy**	**Duration**	**Common Name**
Ulmus americana	Ulmaceae	ULMAME	native	1	-3	tree	perennial	american elm
Verbascum thapsus	Scrophulariaceae	VERTHA	non-native	0	5	forb	biennial	common mullein
Veronica officinalis	Plantaginaceae	VEROOF	non-native	0	3	forb	perennial	common speedwell
Vicia villosa	Fabaceae	VICVIL	non-native	0	5	vine	annual	hairy vetch

Appendix 12. Possible vernal pools mapped during surveys and their coordinates in decimal degrees and parcel.

Parcel	Community	Latitude	Longitude	Photograph
NSHC #2	Dry-mesic Northern Forest	44.9695722	-85.21879087	DSC04033
NSHC #2	Dry-mesic Northern Forest	44.96985353	-85.21973882	DSC04053
NSHC #2	Dry-mesic Northern Forest	44.96900046	-85.21877267	DSC04308
NSHC #2	Dry-mesic Northern Forest	44.96900046	-85.21877267	DSC04309
NSHC #2	Dry-mesic Northern Forest	44.96923618	-85.21877082	DSC04310
NSHC #2	Dry-mesic Northern Forest	44.96923618	-85.21877082	DSC04311
SKINNER #1A	Mesic Northern Forest	44.92655199	-85.24989771	DSC04416
SKINNER #1A	Mesic Northern Forest	44.92655199	-85.24989771	DSC04417
DELANGE #1B	Mesic Northern Forest	44.9120263	-85.21836596	DSC04427
GORSUCH, N.	Mesic Northern Forest	44.9068667	-85.2254729	DSC04451
GORSUCH, N.	Mesic Northern Forest	44.90701166	-85.22562684	DSC04452

Appendix 13. List of new county occurrences collected at GRNA. Non-native species are in bold. Latitude and longitude are in decimal degrees.

Scientific Name	Common Name	Parcel	Latitude	Longitude
Apocynum cannabinum	Indian-hemp	ASB#1	44.941041	-85.209496
Berberis thunbergii	**Japanese barberry**	NSHC #2	44.969190	-85.219197
Berberis thunbergii	**Japanese barberry**	NSHC #1	44.964995	-85.214828
Carex aquatilis	Sedge	DELANGE	44.916788	-85.223876
Carex buxbaumii	Sedge	DELANGE	44.916693	-85.222285
Carex diandra	Sedge	DELANGE	44.915570	-85.223290
Carex exilis	Sedge	DELANGE	44.915529	-85.230442
Carex exilis	sedge	OKLESKY	44.932580	-85.212351
Carex lupulina	sedge	ASB #2	44.940380	-85.208109
Carex pseudocyperis	sedge	DELANGE	44.916788	-85.223876
Cirsium vulgare	**bull thistle**	BELLMORE	44.923461	-85.244131
Dichanthelium depauperatum	panic grass	AUSTIN	44.928447	-85.213080
Epilobium palustre	marsh willow-herb	NSHC #1	44.965102	-85.219144
Iris pseudacorus	**yellow flag**	DELANGE	44.916083	-85.223983
Lonicera morrowii	**morrow honeysuckle**	GORSUCH H #1B	44.909849	-85.233629
Lycopus uniflorus	northern bugle weed	NSHC #1	44.966693	-85.215332
Lysimachia nummularia	**moneywort**	ASB #1	44.940998	-85.208506
Phragmites australis subsp. *americanus*	common reed	DELANGE #1B	44.916022	-85.223933
Phragmites australis subsp. *americanus*	common reed	NOLD	44.929429	-85.244669
Picea pungens	**blue spruce**	NOLD	44.931312	-85.246101
Rumex orbiculatus	great water dock	DELANGE	44.917170	-85.221498
Schoenoplectus tabernaemontani	soft-stem bulrush	DELANGE	44.916788	-85.223876
Solidago canadensis	Canada goldenrod	AUSTIN #1A, MI #1C	44.936081	-85.213705
Solidago gigantea	late goldenrod	DEWEY	44.904690	-85.221300
Symphyotrichum firmum	smooth swamp aster	NHSC #1	44.967146	-85.218826
Symphyotrichum lanceolatum	panicled aster	MI #1D	44.918174	-85.222412
Typha angustifolia	**narrow-leaved cat-tail**	NHSC #1	44.965102	-85.219144
Typha angustifolia	**narrow-leaved cat-tail**	DELANGE #1B	44.916875	-85.222533
Utricularia minor	small bladderwort	AUSTIN	44.932097	-85.212142
Verbena hastata	blue vervain	NOLD	44.931155	-85.245552

Appendix 14. Native species of interest (e.g., orchids, carniverous plants, parasitic plants, coral fungus). To see a complete list of native and non-natives species, see Appendices 1-11.

Scientific name	Common name	Parcel	Photo
Arethusa bulbosa	arethusa/dragon's mouth		
Calopogon tuberosus	grass-pink	GORSUCH, H #1B	DSC04139
Calopogon tuberosus	grass-pink	GORSUCH, H #1B	DSC04140
Calopogon tuberosus	grass-pink	GORSUCH, H #1B	DSC04141
Calopogon tuberosus	grass-pink	GORSUCH, H #1B	DSC04142
Calopogon tuberosus	grass-pink	GORSUCH, H #1B	DSC04143
Calopogon tuberosus	grass-pink	GORSUCH, H #1B	DSC04144
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	NSHC #1	DSC04305
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	NSHC #1	DSC04306
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	NSHC #1	DSC04307
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	NSHC #1	
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	MI #2A	
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	MI #2A	
Clavulinopsis spp. likely C. fusiformus	yellow coral fungus	DELANGE #1A	
Corallorhiza trifida	early coralroot orchid	NSHC #2	DSC04040
Corallorhiza trifida	early coralroot orchid	NSHC #2	DSC04041
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04163
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04164
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04165
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04166
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04167
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04190
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04191
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04192
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04193
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1B	DSC04194
Cypripedium parviflorum	yellow lady-slipper	DELANGE #1A	
Cypripedium reginae	showy lady-slipper	GORSUCH, H #1B	DSC04112
Cypripedium reginae	showy lady-slipper	GORSUCH, H #1B	DSC04113
Cypripedium reginae	showy lady-slipper	GORSUCH, H #1B	DSC04114

Scientific name	Common name	Parcel	Photo
Cypripedium reginae	showy lady-slipper	GORSUCH, H #1B	DSC04115
Cypripedium spp.	lady-slipper	DELANGE #1B	DSC04185
Cypripedium spp.	lady-slipper	DELANGE #1B	DSC04186
Cypripedium spp. (likely)	lady-slipper	Delange #1B	DSC03927
Cypripedium spp. (likely)	lady-slipper	Delange #1B	DSC03928
Drosera rotundifolia	round-leaf sundew	DELANGE #1B	
Drosera rotundifolia	round-leaf sundew	NSHC #2	DSC04038
Drosera rotundifolia	round-leaf sundew	NSHC #2	DSC04039
Drosera rotundifolia	round-leaf sundew	NSHC #1	
Drosera rotundifolia	round-leaf sundew	BELMOOR	
Drosera rotundifolia	round-leaf sundew	DELANGE #1B	
Drosera rotundifolia fruiting	round-leaf sundew	MI #3	
Goodyera pubescens	downy rattlesnake plantain	DELANGE #1B	
Hypopitys monotropa	pinesap	BAGINSKI #1B	DSC04320
Hypopitys monotropa	pinesaf	BAGINSKI #1B	DSC04321
Platanthera huronensis	Lake Huron green orchid	GORSUCH H #1E	
Platanthera psycodes	purple fringed orchid	MI #2A	DSC04351
Platanthera psycodes	purple fringed orchid	MI #2A	DSC04352
Platanthera psycodes	purple fringed orchid	MI #2A	DSC04353
Platanthera psycodes	purple fringed orchid	MI #2A	DSC04356
Platanthera psycodes	purple fringed orchid	MI #2A	DSC04357
Platanthera psycodes	purple fringed orchid		DSC04383
Platanthera psycodes	purple fringed orchid	OLESKY	DSC04400
Platanthera psycodes	purple fringed orchid	OLESKY	DSC04401
Platanthera psycodes	purple fringed orchid	OLESKY	DSC04402
Platanthera psycodes	purple fringed orchid	GORSUCH, H #1B	
Platanthera psycodes	purple fringed orchid	OLESKY	
Platanthera psycodes	purple fringed orchid	GORSUCH, H #1B	
Platanthera psycodes	purple fringed orchid	GORSUCH, H #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	GORSUCH, H #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	DELANGE #1B	
Platanthera psycodes	purple fringed orchid	OLESKY	DSC04403
Pogonia ophioglossoides	rose pogonia	Delange #1B	DSC03919

Scientific name	Common name	Parcel	Photo
Pogonia ophioglossoides	rose pogonia	Delange #1B	DSC03921
Pogonia ophioglossoides	rose pogonia	GORSUCH, H #1B	
Pogonia ophioglossoides	rose pogonia	DELANGE #1B	DSC04158
Pogonia ophioglossoides	rose pogonia	DELANGE #1B	DSC04159
Pogonia ophioglossoides	rose pogonia	DELANGE #1B	DSC04156
Pogonia ophioglossoides	rose pogonia	DELANGE #1B	DSC04157
Ramariopsis kunzei (likely)	white coral fungus	DEWEY, W	DSC04447
Sarracenia purpurea	pitcher plant	GORSUCH, H #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03874
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03875
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03876
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03877
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03923
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03924
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03925
Sarracenia purpurea	pitcher plant	Delange #1B	DSC03926
Sarracenia purpurea	pitcher plant	MI #2C	
Sarracenia purpurea	pitcher plant	GORSUCH, H #1B	
Sarracenia purpurea	pitcher plant	NSHC #1	
Sarracenia purpurea	pitcher plant	BELMOOR	
Sarracenia purpurea	pitcher plant	GORSUCH, H #1B	
Sarracenia purpurea	pitcher plant	GORSUCH, H #1B	
Sarracenia purpurea	pitcher plant	GORSUCH, H #1B	
Sarracenia purpurea	pitcher plant	GORSUCH, H #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	
Sarracenia purpurea	pitcher plant	DELANGE #1B	DSC04158
Sarracenia purpurea	pitcher plant	DELANGE #1B	DSC04159
Sarracenia purpurea	pitcher plant	DELANGE #1B	DSC04156
Sarracenia purpurea	pitcher plant	DELANGE #1B	DSC04157
S.purpurea f. heterophylla	yellow pitcher pant	GORSUCH, H #1B	DSC04406
S.purpurea f. heterophylla	yellow pitcher plant	GORSUCH, H #1B	DSC04407

Scientific name	Common name	Parcel	Photo
Schizachyrium scoparium	little bluestem	DEWEY, D & STANLEY	
Schizachyrium scoparium	little bluestem	GORSUCH, H #1B	DSC04465
Schizachyrium scoparium	little bluestem	GORSUCH, H #1B	DSC04466
Spiranthes cernua	nodding ladies-tresses	MI #1D	DSC04372
Spiranthes cernua	nodding ladies-tresses	MI #1D	DSC04373
Spiranthes cernua	nodding ladies-tresses	MI #1D	DSC04374
Spiranthes cernua	nodding ladies-tresses	OLESKY	
Spiranthes cernua	nodding ladies-tresses	GORSUCH, H #1B	
Spiranthes cernua	nodding ladies-tresses	GORSUCH, H #1B	
Spiranthes cernua	nodding ladies-tresses	GORSUCH, H #1B	
Spiranthes cernua	nodding ladies-tresses	OLESKY	
Spiranthes cernua	nodding ladies-tresses	GORSUCH, H #1B	
Spiranthes cernua	nodding ladies-tresses	DELANGE #1B	
Spiranthes cernua	nodding ladies-tresses	DELANGE #1B	
Spiranthes cernua	nodding ladies-tresses	DELANGE #1B	
Trichophorius alpinum	alpine bulrush	DELANGE #1B	DSC03915
Trichophorius alpinum	alpine bulrush	DELANGE #1B	DSC03918
Utricularia cornuta	horned bladderwort	MI #1A	DSC03955
Utricularia cornuta	horned bladderwort	MI #1A	DSC03956
Utricularia cornuta	horned bladderwort	MI #1A	DSC03957
Utricularia cornuta	horned bladderwort	MI #1A	DSC03958
Utricularia cornuta	horned bladderwort	MI #1A	DSC03959
Utricularia cornuta	horned bladderwort	MI #1A	DSC03960
Utricularia cornuta	horned bladderwort	MI #1A	DSC03961
Utricularia cornuta	horned bladderwort	MI #1A	DSC03962
Utricularia cornuta	horned bladderwort	MI #1A	DSC03963
Utricularia cornuta	horned bladderwort	MI #1A	DSC03964
Utricularia cornuta	horned bladderwort	MI #1A	DSC03965
Utricularia intermedia	flat-leaved bladderwort	DELANGE #1B	DSC04492
Utricularia intermedia	flat-leaved bladderwort	DELANGE #1B	DSC04493
Utricularia intermedia	flat-leaved bladderwort	DELANGE #1B	DSC04494
Utricularia minor	small bladderwort		
Utricularia vulgaris	common bladderwort	MI #1A	DSC03967
Utricularia vulgaris	common bladderwort	MI #1A	DSC03968
Utricularia vulgaris	common bladderwort	MI #1A	DSC03969
Utricularia vulgaris	common bladderwort	MI #1A	DSC03970

Appendix 15. Invasive species of most concern and native but aggressive species found during surveys and their coordinates in decimal degrees or parcel. Some observations have multiple rows to accommodate multiple photos.

Scientific name	Common name	Parcel	Latitude	Longitude	Photo
Alliaria petiolata	garlic mustard	SKINNER			
Berberis thunbergii	Japanese barberry	NSHC #2	44.96919034	-85.21919718	DSC04035
Berberis thunbergii	Japanese barberry	NSHC #2	44.96919034	-85.21919718	DSC04036
Berberis thunbergii	Japanese barberry	NSHC #2	44.96919034	-85.21919718	DSC04037
Berberis thunbergii	Japanese barberry	NSHC #1	44.96499542	-85.21482845	
Berberis thunbergii	Japanese barberry	KOWALL #1, 2, 3	44.9285999	-85.20661813	
Berberis thunbergii	Japanese barberry	NOLD	44.92993987	-85.24572514	
Centaurea stoebe	spotted knapweed	NSHC #2	44.97111284	-85.21817808	DSC04021
Centaurea stoebe	spotted knapweed	NSHC #2	44.97111284	-85.21817808	DSC04022
Cirsium arvense	Canada thistle				
Cirsium palustre	marsh thistle				
Cirsium palustre	marsh thistle	AUSTIN #1A, MI #1C	44.93490822	-85.21424554	
Cirsium vulgare	bull thistle				
Cirsium vulgare	bull thistle	MI #2A	44.92626327	-85.20626153	
Cirsium vulgare	bull thistle	DELANGE #1B	44.91410799	-85.22567634	
Elaeagnus umbellata	autumn olive	GAGE	44.90500031	-85.21487387	DSC04074
Elaeagnus umbellata	autumn olive	GAGE	44.90482231	-85.21522581	DSC04075
Elaeagnus umbellata	autumn olive	DELANGE #1B	44.91522303	-85.21591605	DSC04184
Elaeagnus umbellata	autumn olive	SKINNER #1A	44.92599784	-85.24988303	DSC04418
Elaeagnus umbellata	autumn olive	GORSUCH, H #1B	44.91182556	-85.23422572	
Elaeagnus umbellata	autumn olive	GORSUCH, H #1B	44.91195904	-85.23410419	
Elaeagnus umbellata	autumn olive	GORSUCH, H #1B	44.91290743	-85.23340935	
Elaeagnus umbellata	autumn olive	SKINNER #1A	44.9258191	-85.24947817	DSC04420
Phalaris arundinacea	canary reed grass	SKINNER #1A	44.9258191	-85.24947817	DSC04420
Euphorbia virgata	leafy spurge	NSHC #1	44.95977838	-85.21435472	DSC04014
Euphorbia virgata	leafy spurge	NSHC #1	44.95977838	-85.21435472	DSC04015
Euphorbia virgata	leafy spurge	NSHC #1	44.95977838	-85.21435472	DSC04016
Lonicera morrowii	morrow honeysuckle	DEWEY, W	44.90419573	-85.22337101	
Lonicera morrowii	morrow honeysuckle	GORSUCH, H #1B	44.90984852	-85.23362853	DSC04386
Lonicera x bella	hybrid honeysuckle	NOLD			DSC04387
Lonicera x bella	hybrid honeysuckle	NOLD			
Lysimachia nummularia	moneywort	ASB #2			
Lysimachia nummularia	moneywort	SWAN			

Scientific name	Common name	Parcel	Latitude	Longitude	Photo
Lysimachia nummularia	moneywort	ASB #1	44.94099845	-85.20850586	
Lythrum salicaria	purple loosestrife	SPEET			
Myosotis scorpiodes	forget-me-not	MI #2A			
Myosotis scorpiodes	forget-me-not	KOWALL			
Myosotis scorpiodes	forget-me-not	ASB #1			
Myosotis scorpiodes	forget-me-not	ASB #2			
Myosotis scorpiodes	forget-me-not	SWAN			
Phalaris arundinacea	canary reed grass	MI #2A	44.9264466	-85.20673147	
Phalaris arundinacea	canary reed grass	NOLD	44.92975309	-85.24471089	
Phalaris arundinacea	canary reed grass	DELANGE #1B	44.91607748	-85.2217999	DSC04430
Phalaris arundinacea	canary reed grass	GORSUCH, H #1B	44.91441643	-85.23306031	
Phalaris arundinacea	canary reed grass	DELANGE #1B	44.91405629	-85.225854	
Phragmites australis	Phragmites	AUSTIN #1A, MI #1C	44.93614631	-85.21387756	
Phragmites australis subsp *australis* likely	Phragmites	Clam Lake	44.91947942	-85.22732693	
Rosa multiflora	multifloral rose	DELANGE #1B	44.91438555	-85.21635448	DSC04178
Rosa multiflora	multifloral rose	DELANGE #1B	44.91438555	-85.21635448	DSC04179
Typha angustifolia	narrow-leaf cattail	NSHC #1	44.96510235	-85.21914406	
Typha angustifolia	narrow-leaf cattail	DELANGE #1B	44.91687466	-85.22253267	DSC04431
Typha angustifolia	narrow-leaf cattail	DELANGE #1B	44.91687466	-85.22253267	DSC04432
Typha angustifolia	narrow-leaf cattail	DELANGE #1B	44.91687466	-85.22253267	DSC04433
Typha angustifolia	narrow-leaf cattail	DELANGE #1B	44.91550089	-85.22590216	
Veronica officinalis	common speedwell	BAGINSKI #1B	44.92379823	-85.21834425	DSC04322
Veronica officinalis	common speedwell	BAGINSKI #1B	44.92379823	-85.21834425	DSC04323
Veronica officinalis	common speedwell	BAGINSKI #1B	44.92379823	-85.21834425	DSC04324