

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



Prepared by:

Rachel Hackett, Phyllis Higman, and Liana May

Michigan Natural Features Inventory

PO Box 13036

Lansing, MI 48901-3036

For:

Grass River Natural Area

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***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. 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.

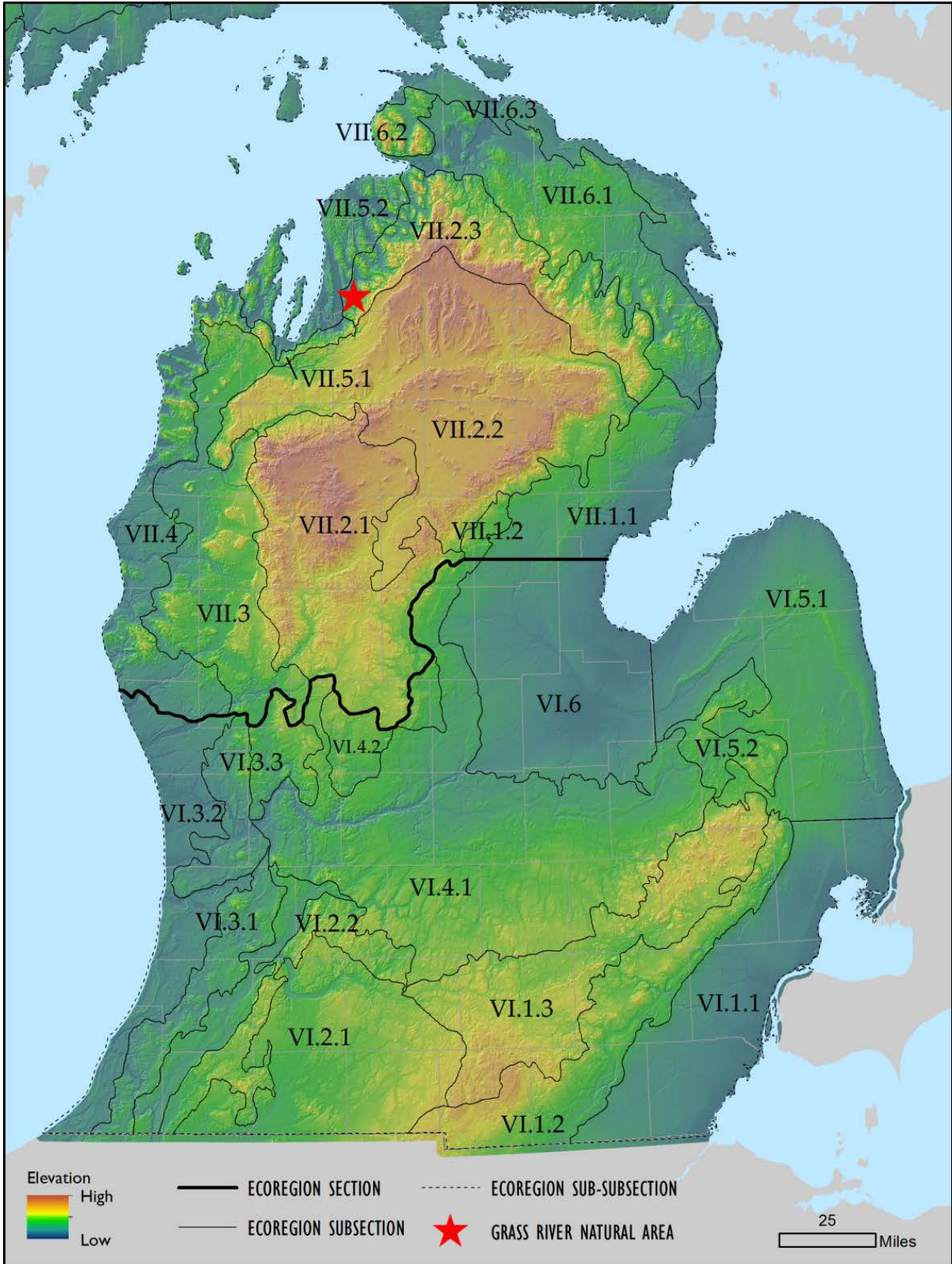


Figure 2. Location of GRNA in Sub-subsection VII.2.3 Vanderbilt Moraines.

GRNA is located in 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 Valdres 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. This 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.

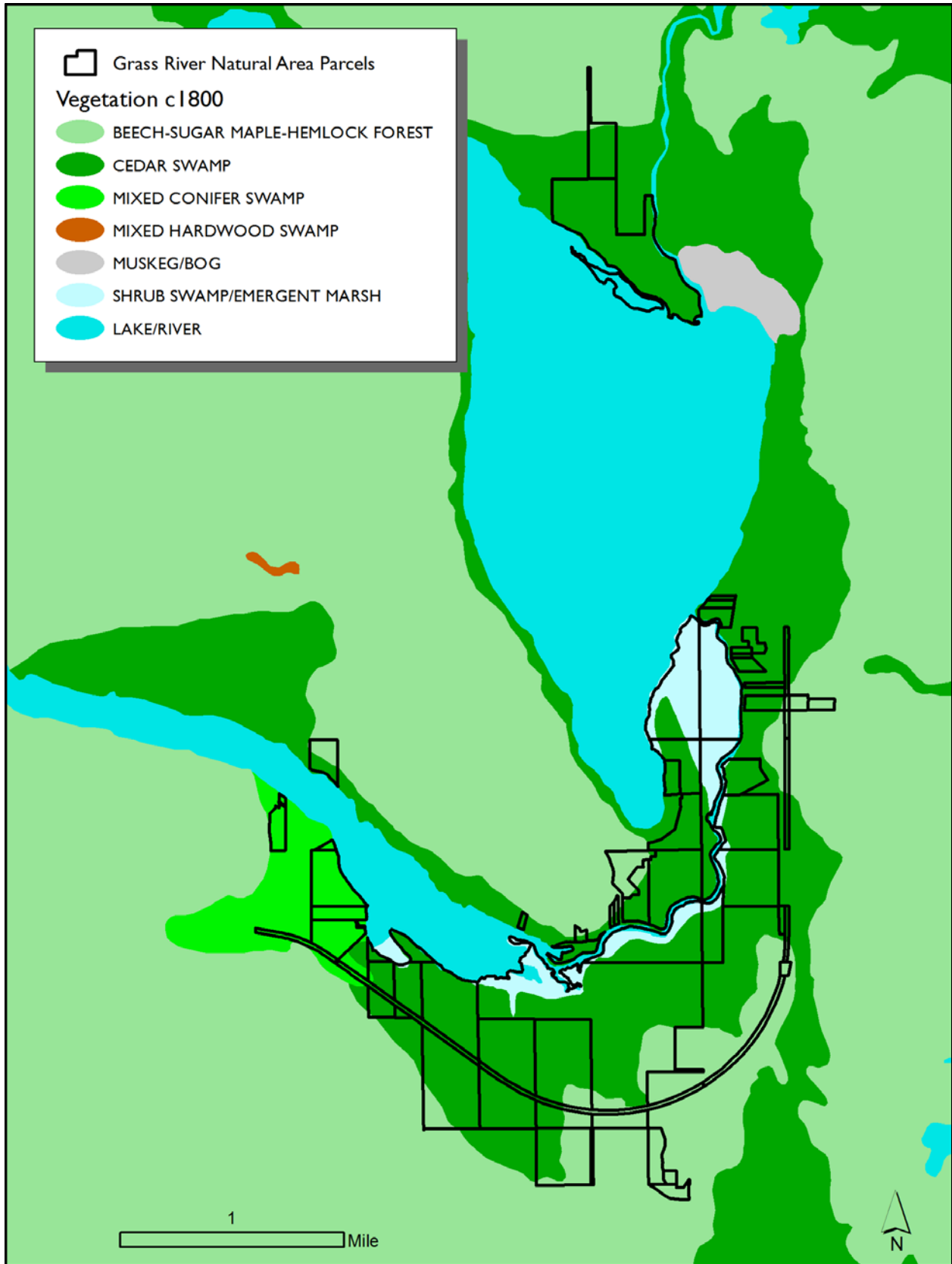


Figure 5. Circa 1800 vegetation of GRNA.

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 OKLESLEY 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 in the parcels on the north shore of Lake Bellaire near the mouth of the Cedar 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, (44.9160217, -85.22393267).

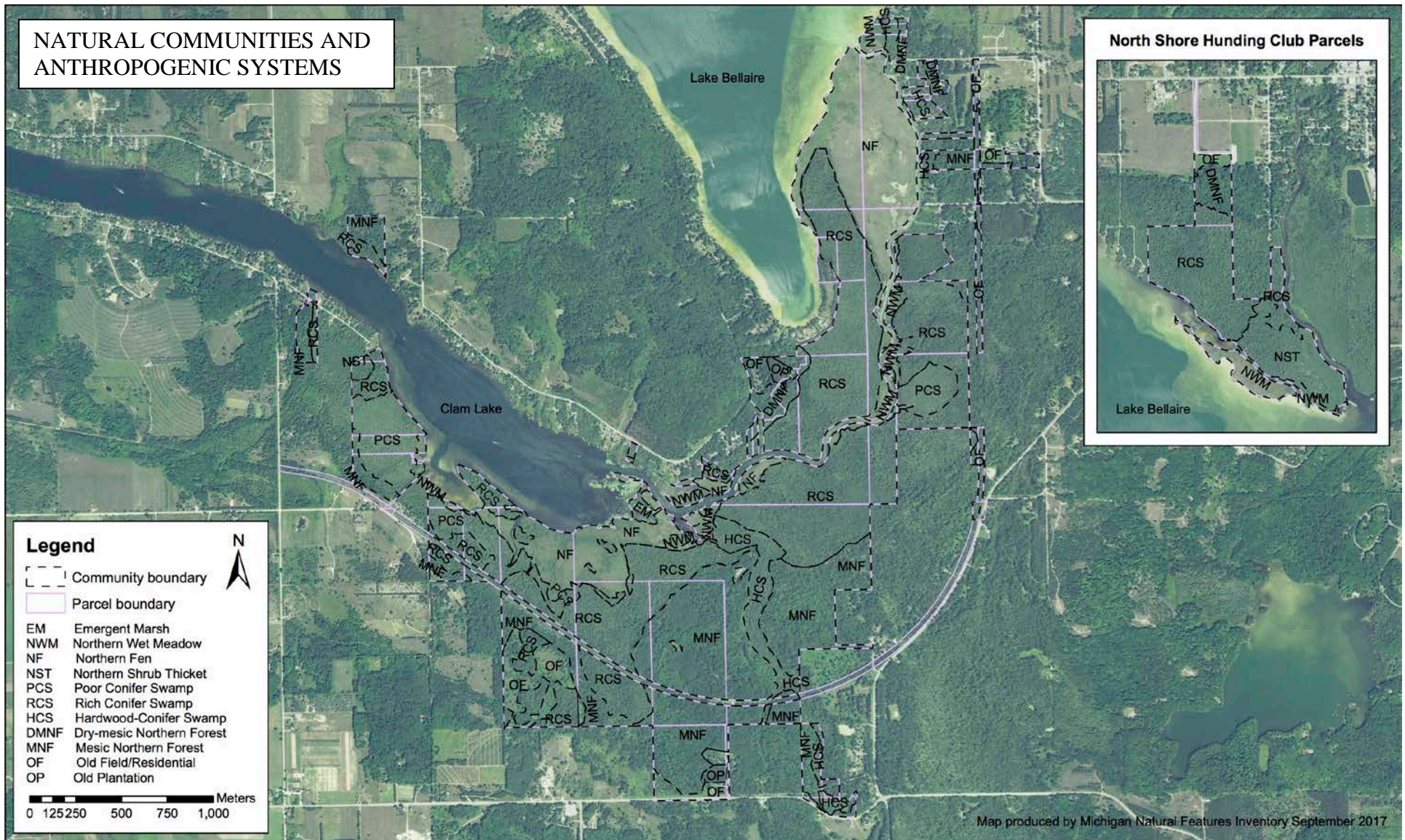


Figure 7. Natural communities and anthropogenic systems delineated within the parcel boundaries of GRNA are marked by dashed black lines. The purple lines outline parcels owned by GRNA.

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, (44.95899049, -85.21181011).

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.

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

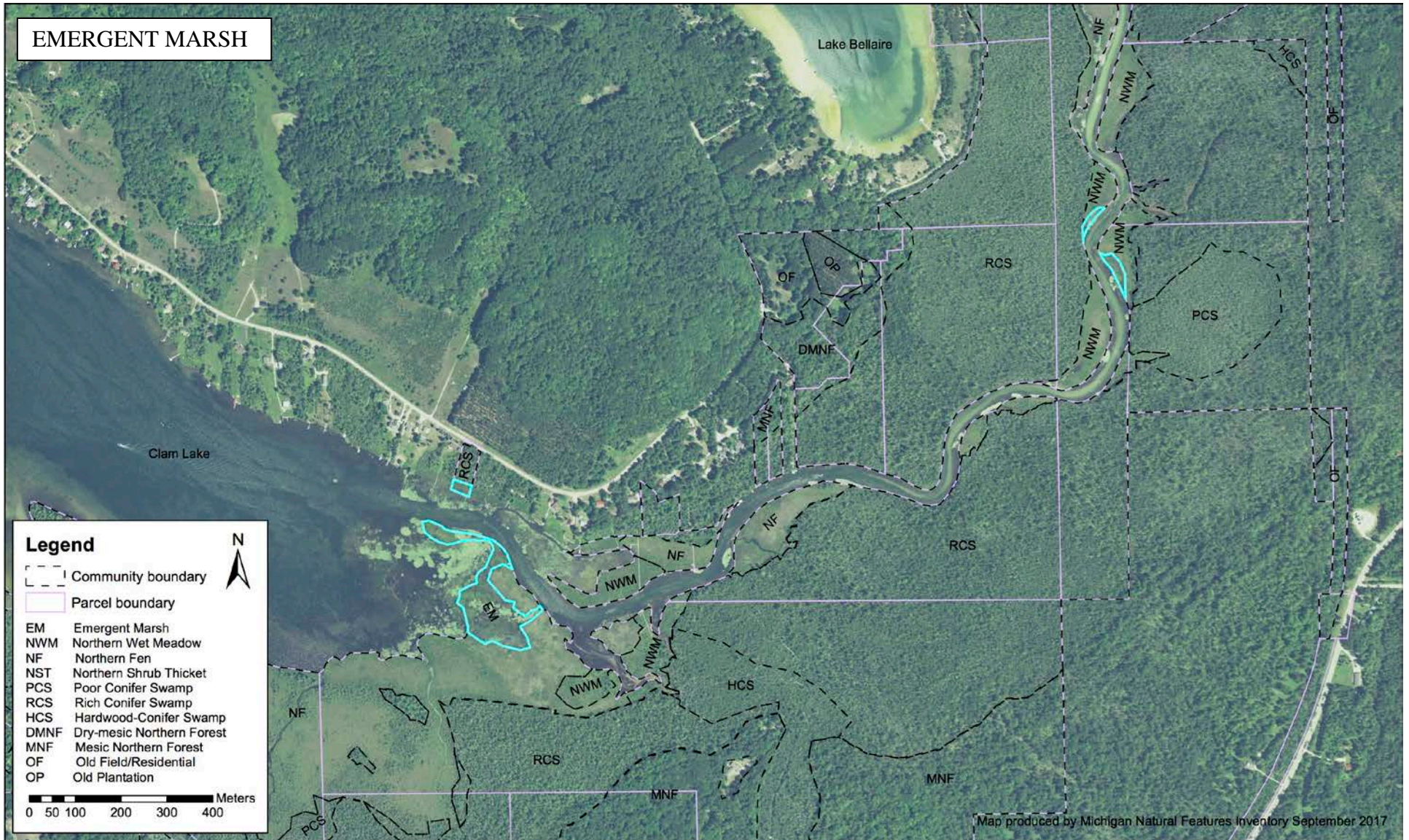


Figure 9. Emergent marsh delineated within the parcel boundaries of GRNA is highlighted in cyan. The purple lines outline parcels owned by GRNA. The black dashed lines outline natural communities within GRNA property.

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 (44.92305876, -85.20975842).

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 psychodes* (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).

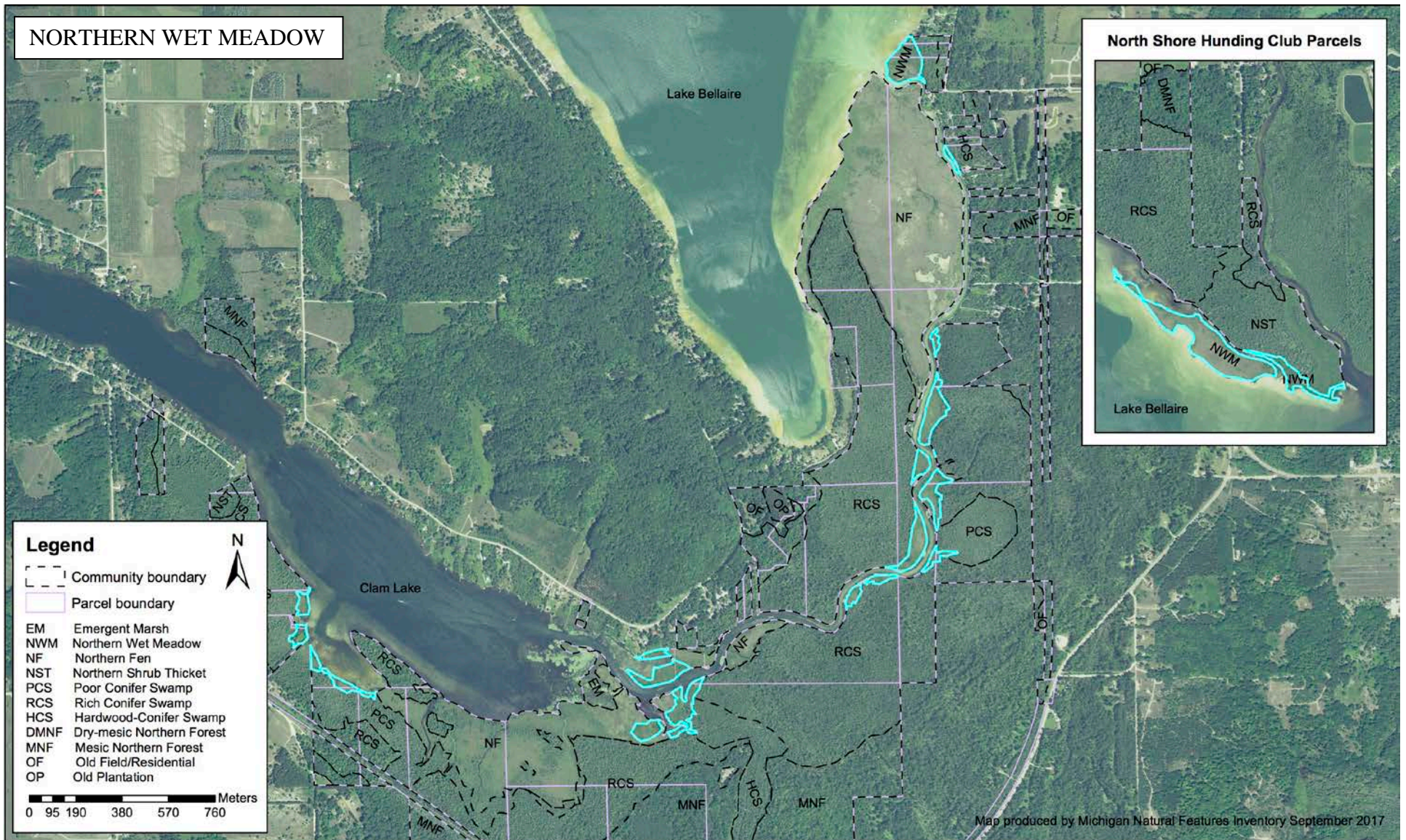


Figure 11. Northern wet meadow delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

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. They typically occur 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 (44.93423187, -852077594).

Northern fen comprised approximately 185 acres of GRNA, the third most abundant natural community documented during this inventory (Figure 19), where it 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 (44.91354864, -85.22905392).



Figure 14. *Sarracenia purpurea* (pitcher plant) observed in the DELANGE #1B parcel (144.91687689, -85.22316002).



Figure 15. Many forbs bloom in late summer among the sedges in northern fen in the DELANGE #1B parcel (44.91637525, -85.22516015).

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. There were several observations of mammal scat. 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 m²) 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).



Figure 16. A sandhill crane in northern fen in the MI #1A parcel (44.93364995, -85.20742508).

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. Thirty-one percent of the species documented in northern fen had C values greater than seven including *Lobelia kalmia* (Kalm’s lobelia) and *Trichophorum alpinum* (bulrush) which have C values of 10. (Figure 17, 18).



Figure 17. *Lobelia kalmii* (Kalm’s lobelia) in northern fen in the MI #1A parcel.



Figure 18. *Trichophorum alpinum* (bulrush) in northern fen in the DELANGE #1B parcel (44.91672278, -85.22375734).

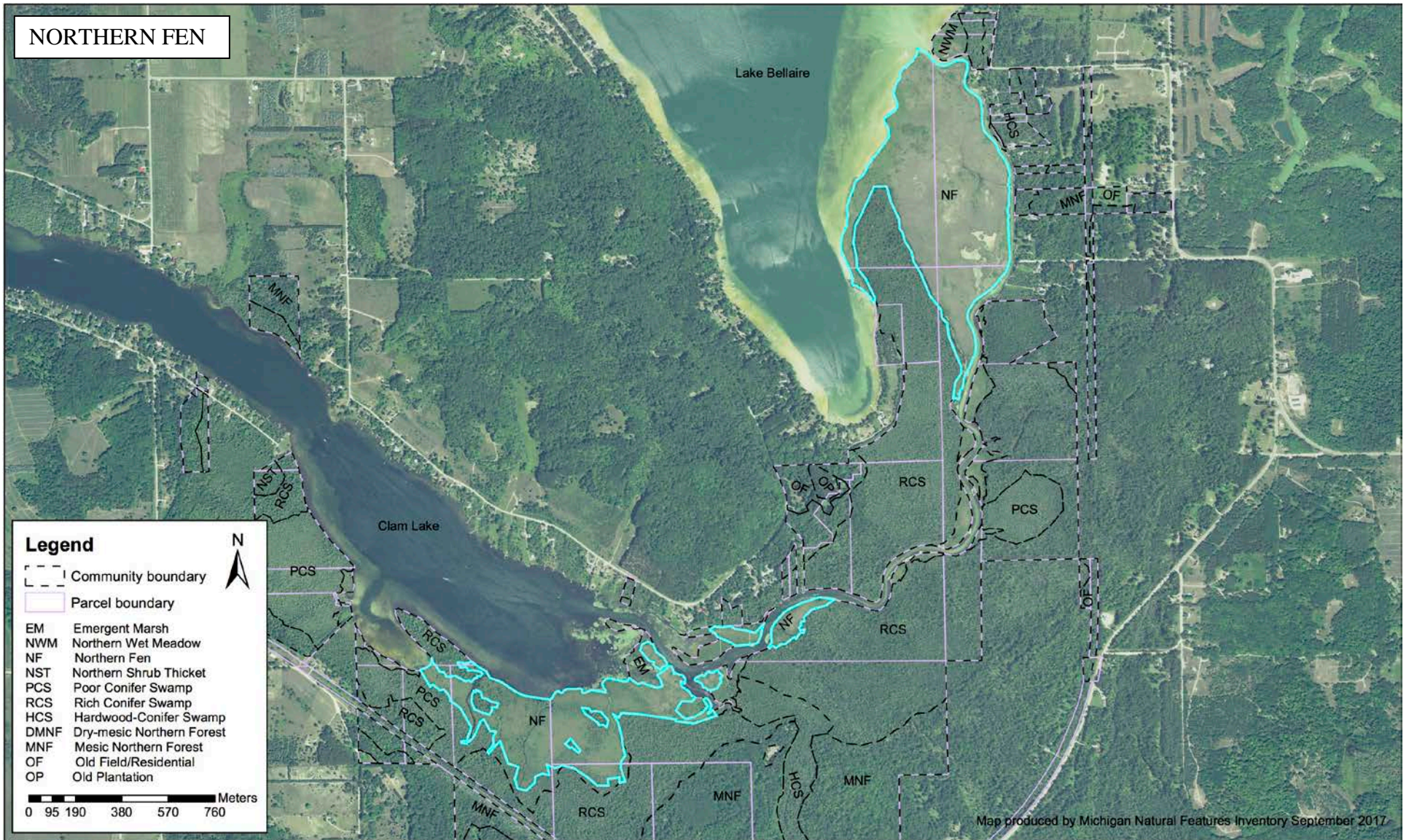


Figure 19. Northern fen delineated within the parcel boundaries of GRNA is highlighted in cyan.

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 less diversity than surrounding communities (Cohen and Kost 2007).



Figure 20. Dense shrubs dominate northern shrub thicket in the NSHC #1 parcel (44.95899049, -85.21181011).

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, *Toxicodendron vernix* 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 Cedar 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*).

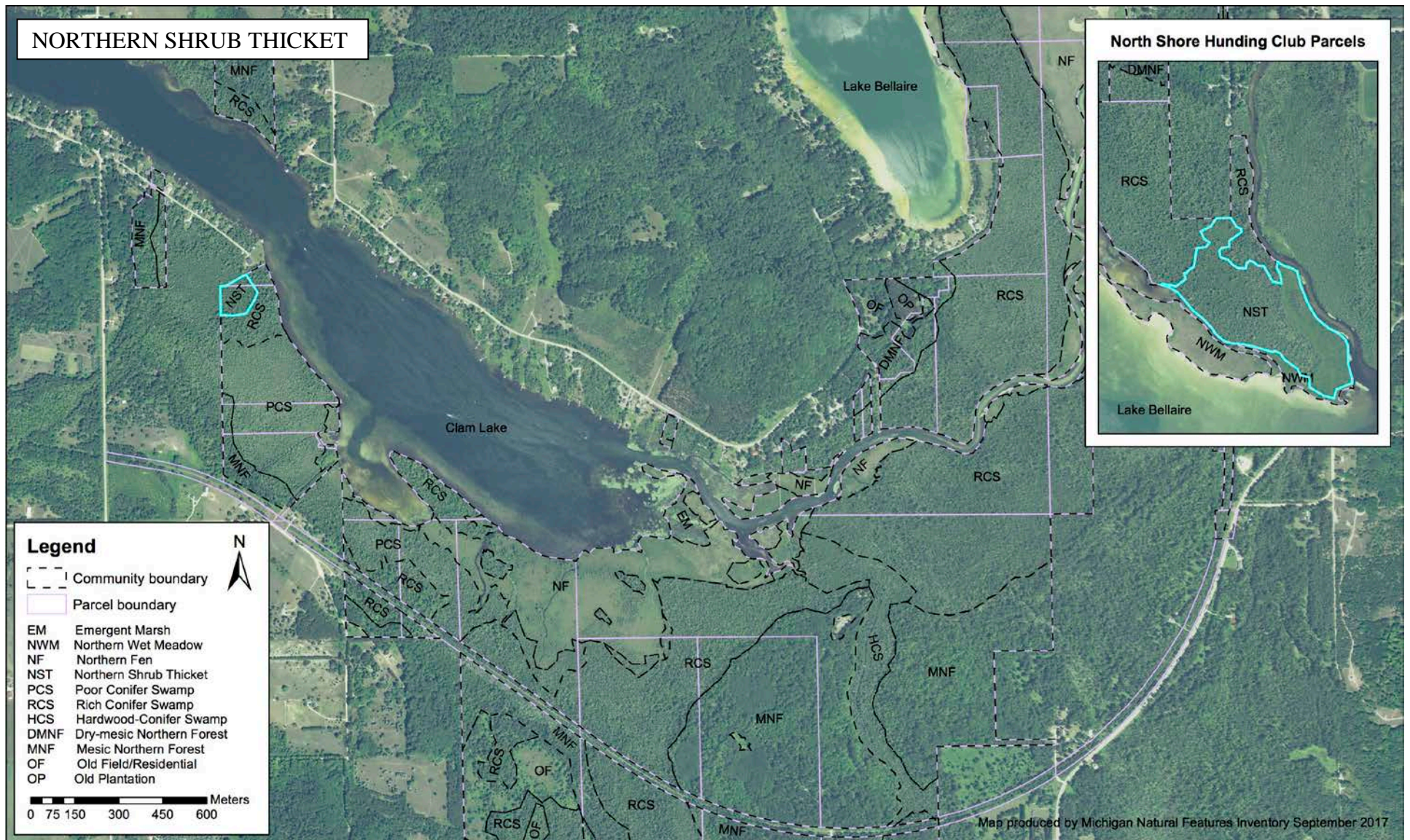


Figure 21. Northern shrub thicket delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

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 (44.91276255, -85.23255155).

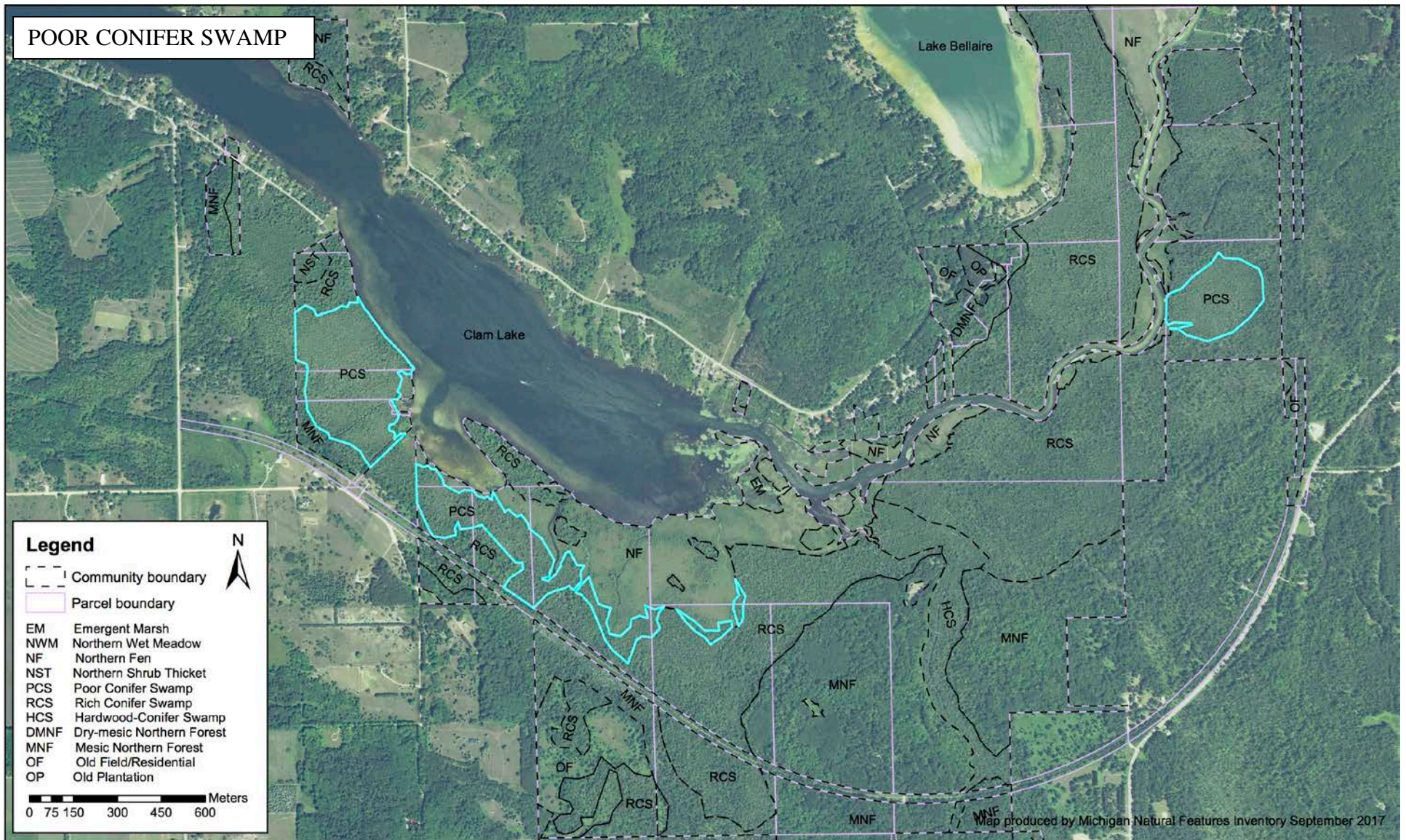


Figure 24. Poor conifer swamp delineated within the parcel boundaries of GRNA is highlighted in cyan.

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 (44.92006187, -85.20944961).



Figure 26. *Lobelia cardinalis* (cardinal flower) in the understory of rich conifer swamp in the NSHC #1 parcel (44.96448017, -85.21488141).

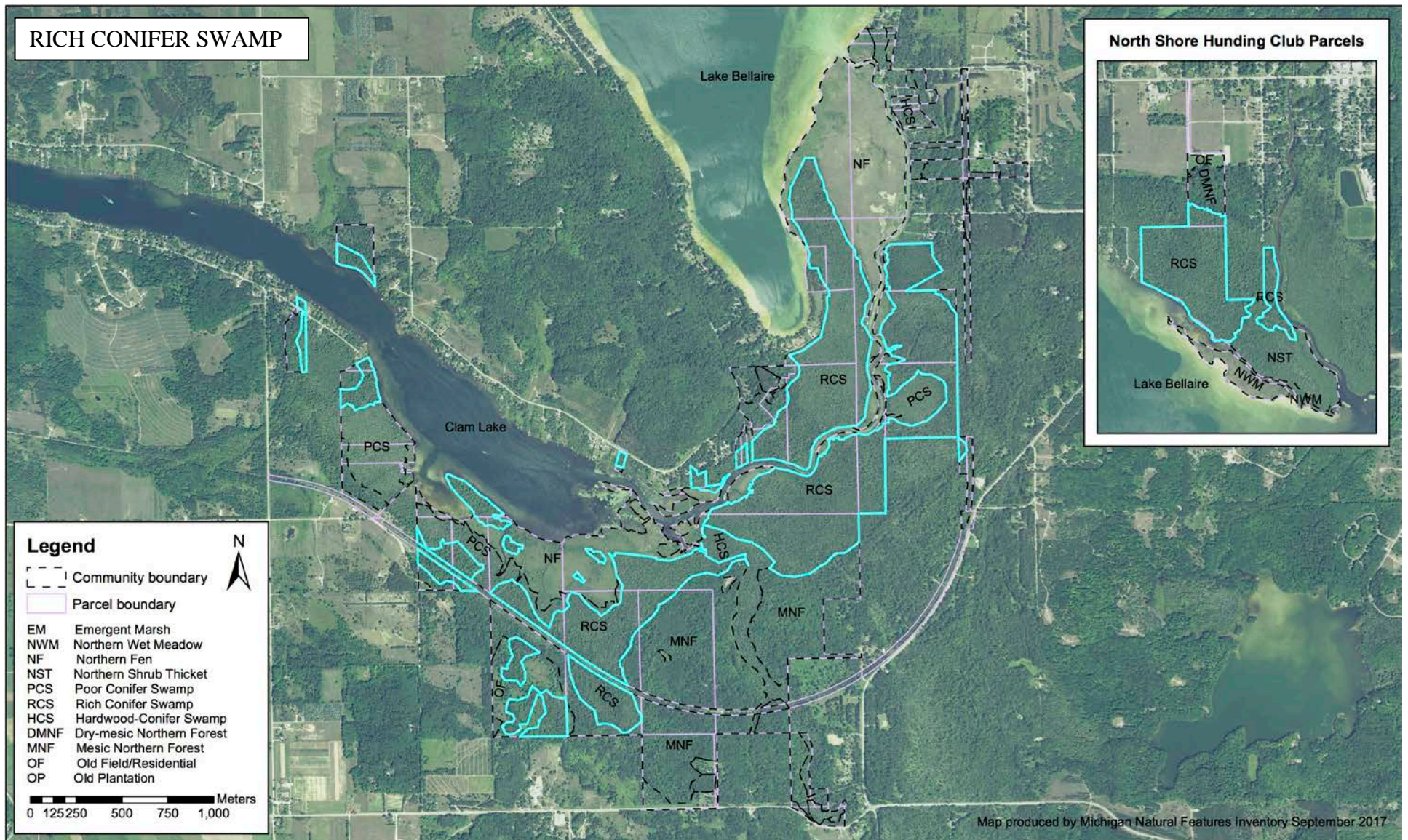


Figure 27. Rich conifer swamp delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

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 understory, 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 (44.94055587, -85.20921118).

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 thyrsoiflora* (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 (44.915165, -85.221258).

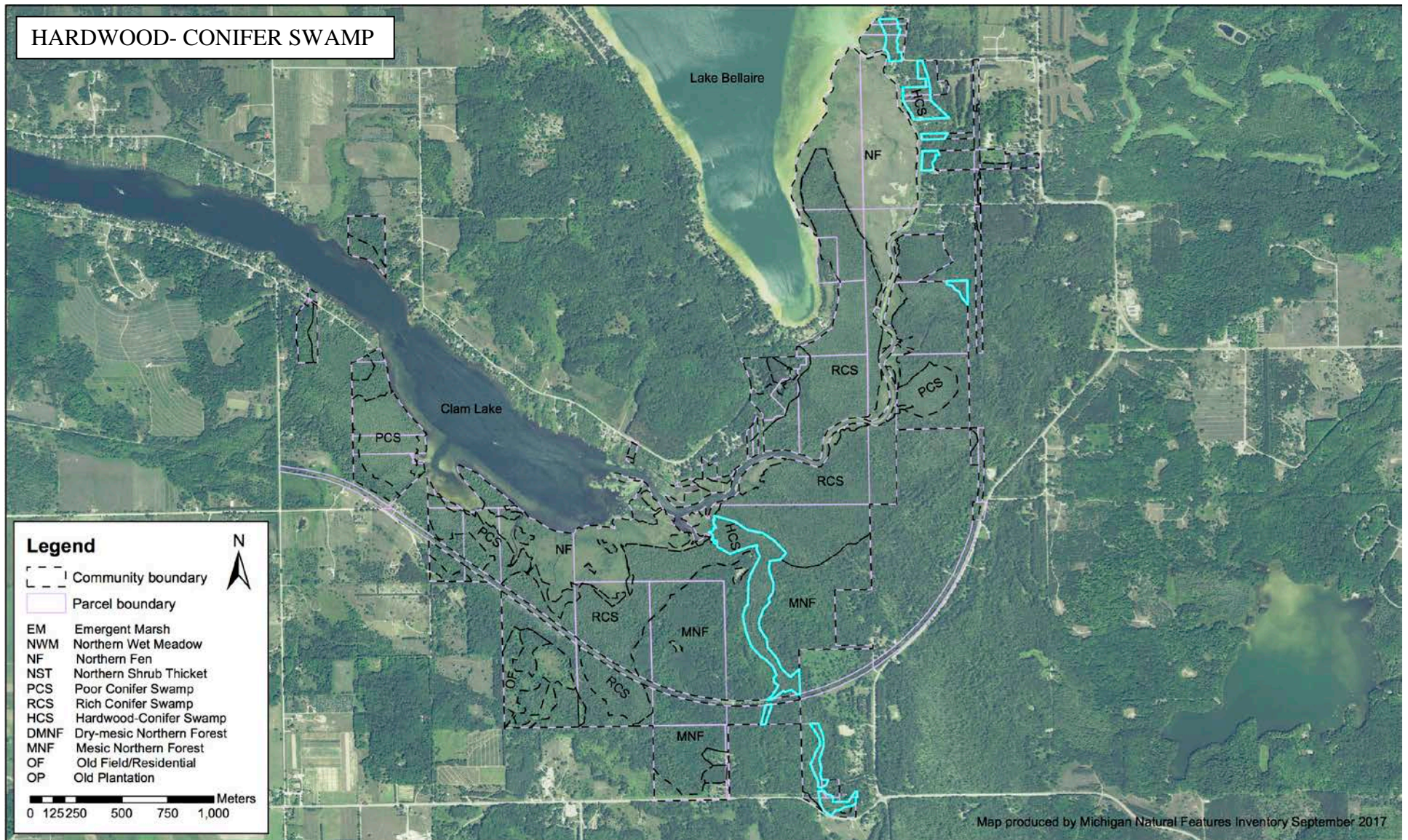


Figure 30. Harwood-conifer swamp delineated within the parcel boundaries of GRNA is highlighted in cyan.

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 (44.96962702, -85.21770046).

Dry-mesic northern forest comprised approximately 30 acres (Figure 32) of GRNA, bordering rich conifer swamp, hardwood conifer swamp, and 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.

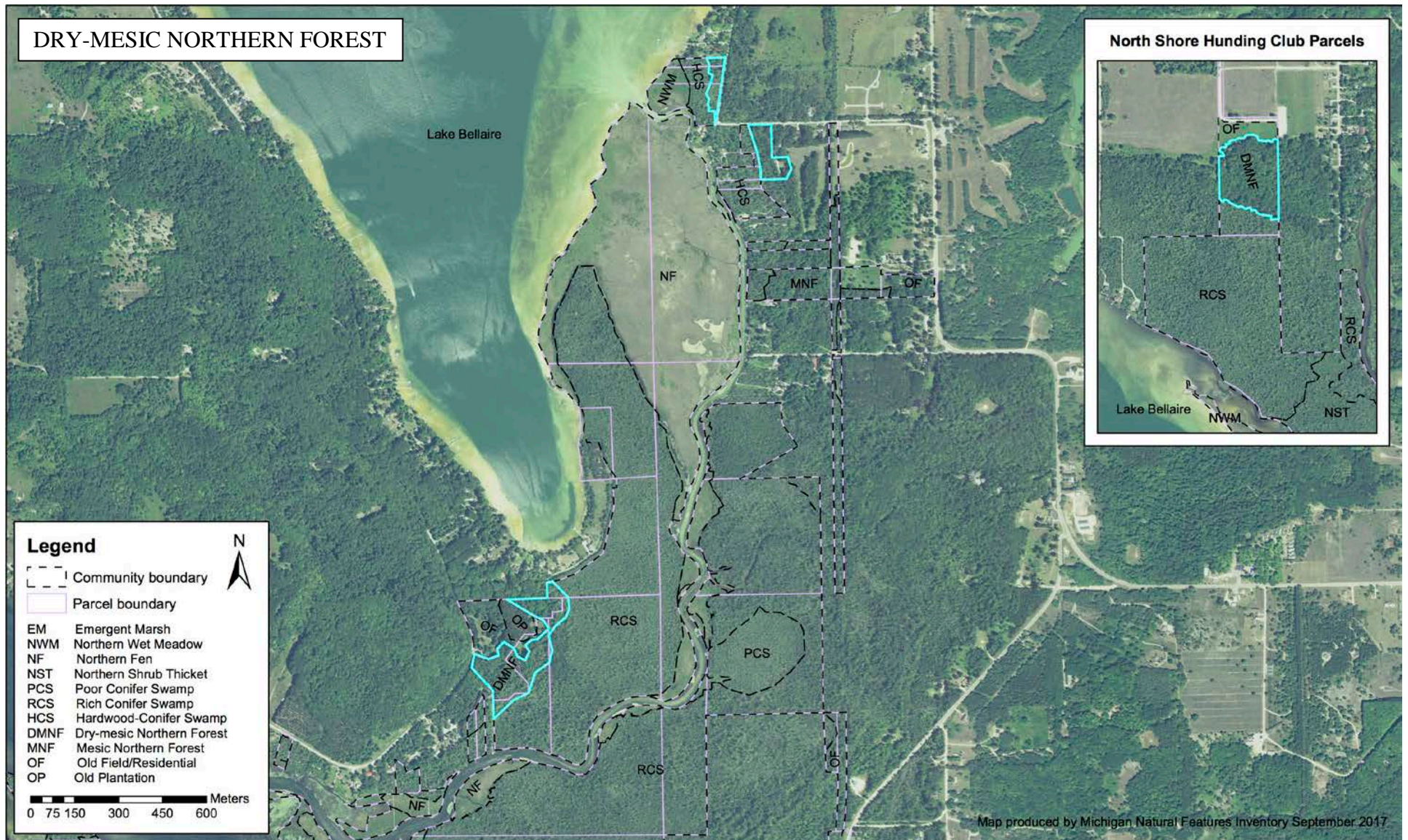


Figure 32. Dry-mesic northern forest delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

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 that create canopy gaps and 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 (44.90457964, -85.21590021).

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 xbella* (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.

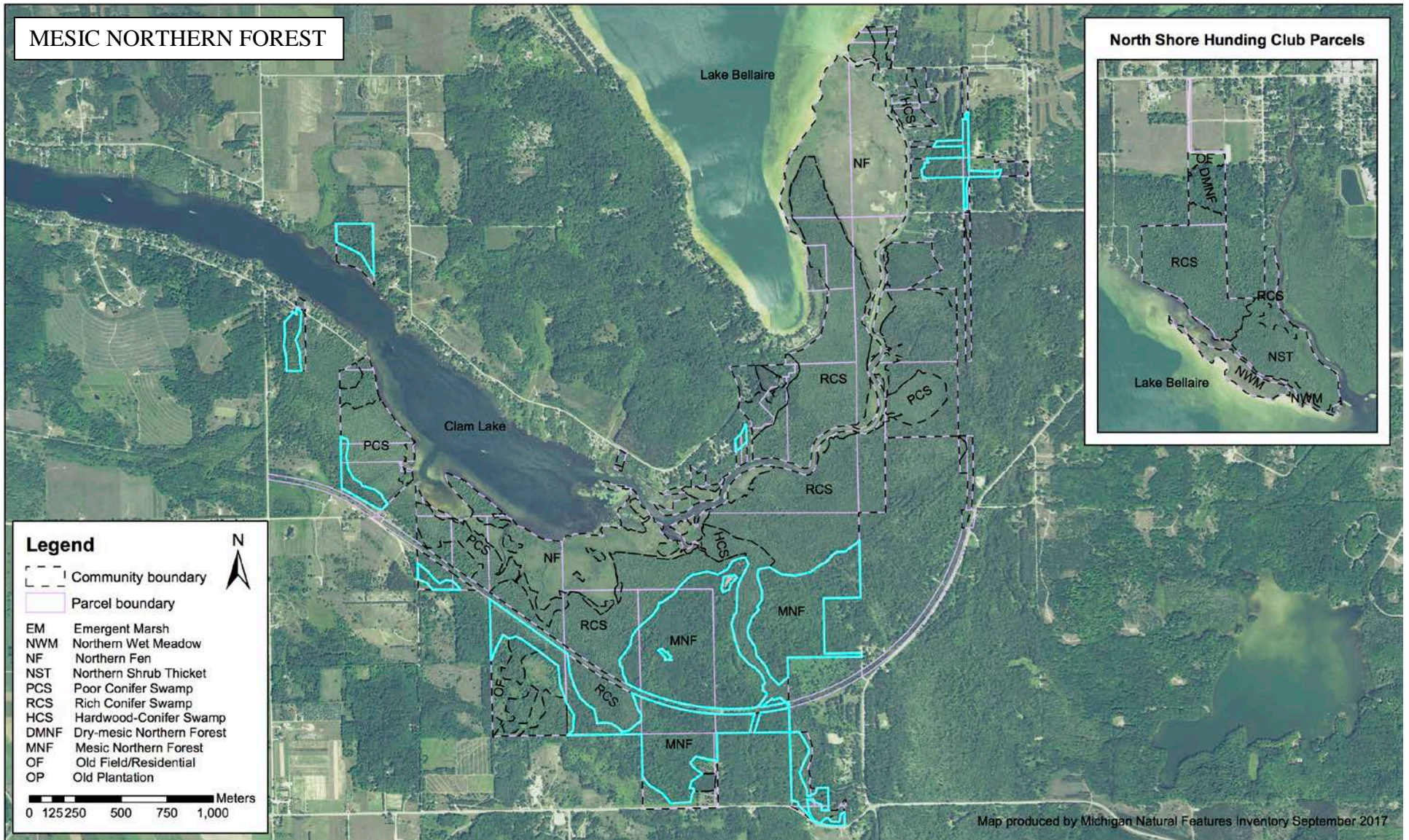


Figure 34. Mesic northern forest delineated within the parcel boundaries of GRNA is highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

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 bisects portions of rich and poor conifer swamp at the western edge of GRNA. A total of 109 plant species, 35 of which are 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 (44.90769161, -85.2357854).



Figure 36. An old red pine plantation on the BAGINSKI #1B parcel (44.92450004, -85.2174629).

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. A patch of the non-native *Veronica officinalis* (common speedwell) was also observed in this area



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 pinesap flowers in the BAGINSKI #1B parcel.

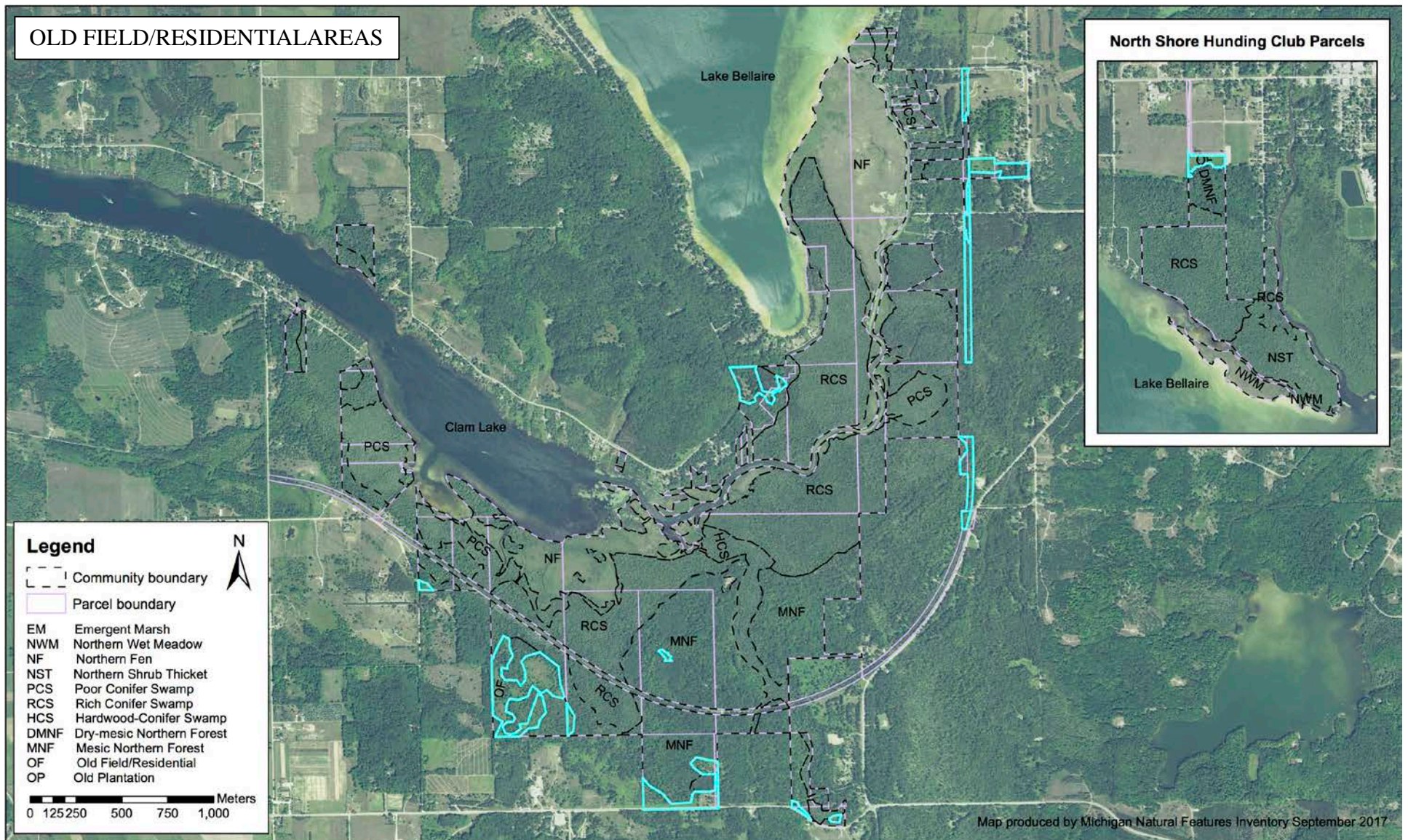


Figure 39. Old field/residential areas delineated within the parcel boundaries of GRNA are highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

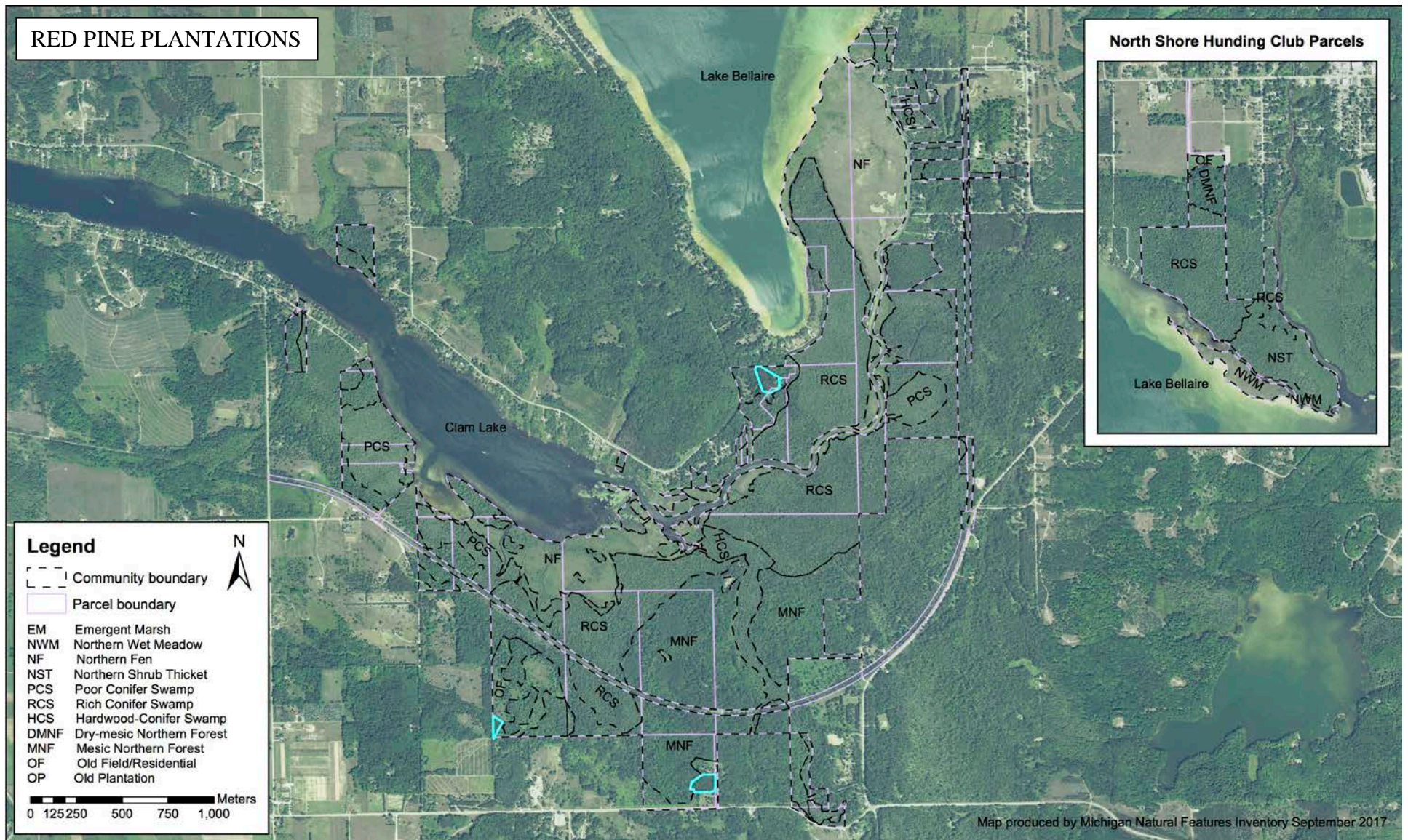


Figure 40. Old red pine plantations delineated within the parcel boundaries of GRNA are highlighted in cyan. The inset in the upper right corner shows the parcels along the North Shore of Lake Bellaire that once belonged to the Hunting Club.

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 (44.92655199, -85.24989771).

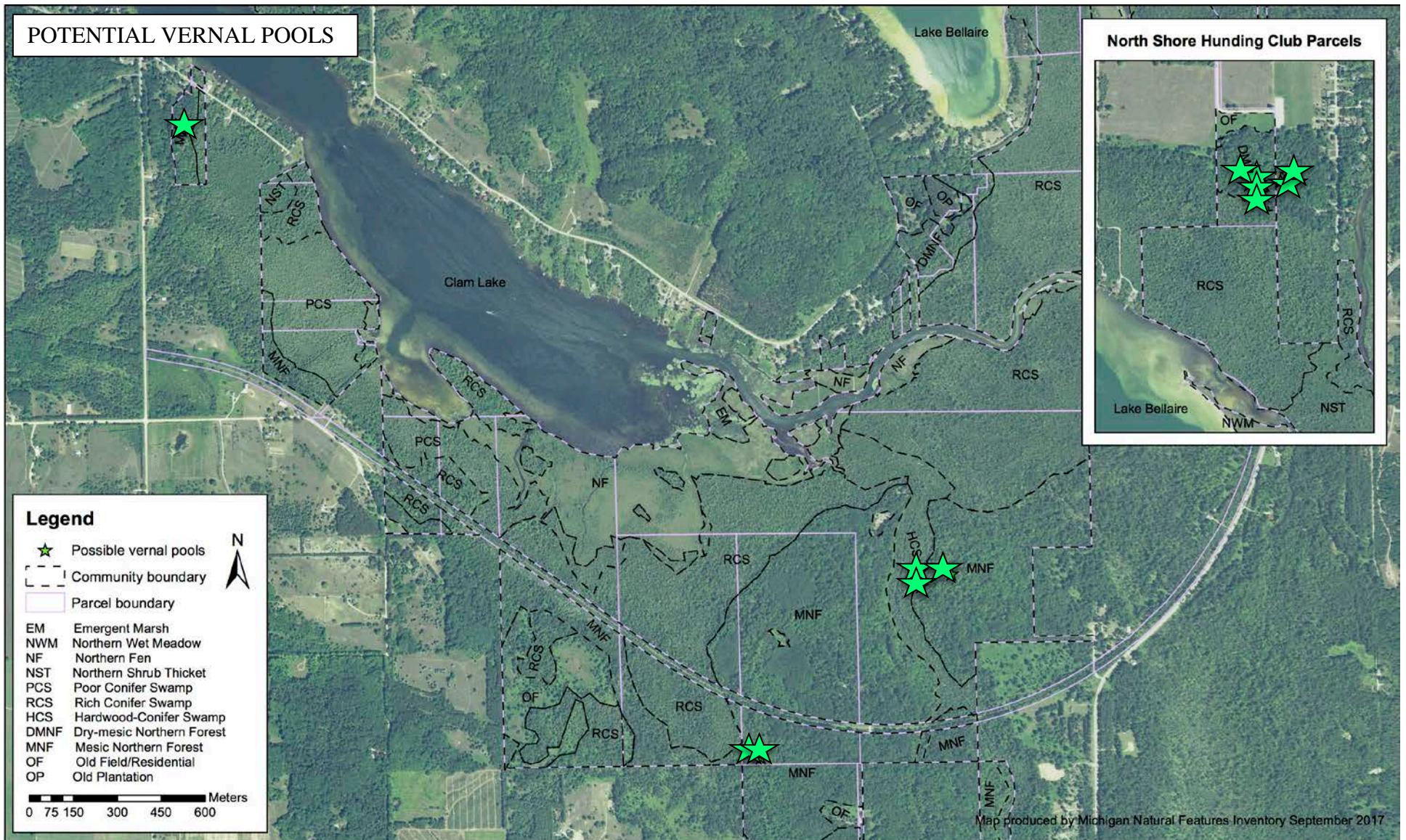


Figure 43. Potential vernal pools delineated within the parcel boundaries of GRNA are highlighted with green stars.

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

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



Figure 44. The suspected 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 (44.91700091, 85.23624524).

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

*Requires confirmation when flowers are present.



Figure 45. 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 |
|--|---------------------|---------|-----------------------------------|
| <i>Alliaria petiolata</i> | garlic mustard | ALLPET | RCS (edge) |
| <i>Berberis thunbergii</i> | Japanese barberry | BERTHU | RCS, DMNF |
| <i>Centaurea stoebe</i> | spotted knapweed | CENSTO | ANTH |
| <i>Cirsium arvense</i> | Canada thistle | CIRARV | ANTH |
| <i>Cirsium palustre</i> | marsh thistle | CIRPAL | NWM, NF, RCS, HCS, MNF, ANTH |
| <i>Cirsium vulgare</i> | bull thistle | CIRVUL | ANTH |
| <i>Elaeagnus umbellata</i> | autumn olive | ELAUMB | NWM, NF, PCS, RCS, HCS, MNF, ANTH |
| <i>Euphorbia virgata</i> | leafy spurge | EUPVIR | NST (edge), ANTH |
| <i>Iris pseudacorus</i> | yellow flag | IRIPSE | NWM, NF, RCS |
| <i>Lonicera morrowii</i> | morrow honeysuckle | LONMOR | MNF, ANTH |
| <i>Lonicera xbella</i> | hybrid honeysuckle | LONBEL | MNF |
| <i>Lysimachia nummularia</i> | moneywort | LYSNUM | HCS |
| <i>Lythrum salicaria</i> | purple loosestrife | LYTSAL | NWM |
| <i>Myosotis scorpioides</i> | forget-me-not | MYOSCO | RCS, HCS |
| <i>Phalaris arundinacea</i> | reed canary grass | PHAARU | RCS, HCS |
| <i>Phragmites australis</i> subsp. <i>australis</i> * | Eurasian phragmites | PHRAUS | EM |
| <i>Rosa multiflora</i> | multiflora rose | ROSMUL | RCS |
| <i>Typha angustifolia</i> | narrow-leaf cattail | 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 as 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 |
|--------------------------------|-----------------------------|--------------------------|
| <i>Agrostis gigantea</i> | redtop | MNF, ANTH |
| <i>Berteroa incana</i> | hoary alyssum | RCS, DMNF, ANTH |
| <i>Bromus inermis</i> | smooth brome | ANTH |
| <i>Dactylis glomerata</i> | orchard grass | ANTH |
| <i>Daucus carota</i> | wild carrot | ANTH |
| <i>Dianthus armeria</i> | deptford pink | ANTH |
| <i>Elymus repens</i> | quack grass | ANTH |
| <i>Epilobium parviflorum</i> | willow-herb | RCS |
| <i>Epipactis helleborine</i> | helleborine | MNF |
| <i>Hieracium aurantiacum</i> | orange hawkweed | NF, RCS, HCS, MNF, ANTH |
| <i>Hieracium caespitosum</i> | king-devil, yellow hawkweed | NF, RCS, HCS, ANTH |
| <i>Hieracium piloselloides</i> | king-devil | NF |
| <i>Hypericum perforatum</i> | common St. john's-wort | RCS, ANTH |
| <i>Leucanthemum vulgare</i> | ox-eye daisy | NF, ANTH |
| <i>Medicago lupulina</i> | black medic | ANTH |
| <i>Melilotus albus</i> | white sweet-clover | ANTH |
| <i>Mentha x piperita</i> | peppermint | NWM |
| <i>Phleum pratense</i> | timothy | NF, ANTH |
| <i>Ranunculus acris</i> | tall buttercup | NF, RCS |
| <i>Rumex acetosella</i> | sheep sorrel | NF, RCS, ANTH |
| <i>Rumex obtusifolius</i> | bitter dock | ANTH |
| <i>Picea pungens</i> | blue spruce | MNF, ANTH |
| <i>Plantago lanceolata</i> | English plantain | ANTH |
| <i>Plantago major</i> | common plantain | ANTH |
| <i>Poa compressa</i> | Canada bluegrass | NF, ANTH |
| <i>Poa pratensis</i> | Kentucky bluegrass | NF, ANTH |
| <i>Populus alba</i> | white poplar | NWM |
| <i>Potentilla recta</i> | rough-fruited cinquefoil | ANTH |
| <i>Solanum dulcamara</i> | bittersweet nightshade | NWM, RCS, HCS, MNF |
| <i>Stellaria media</i> | common chickweed | NF, ANTH |
| <i>Taraxacum officinale</i> | dandelion | RCS, MNF, ANTH |
| <i>Tragopogon pratensis</i> | common goats beard | ANTH |
| <i>Trofolium pratense</i> | red clover | ANTH |
| <i>Verbascum thapsus</i> | common mullein | ANTH |
| <i>Veronica arvensis</i> | corn speedwell | RCS |
| <i>Veronica officinalis</i> | common speedwell | MNF, ANTH |
| <i>Vicia villosa</i> | hairy vetch | ANTH |

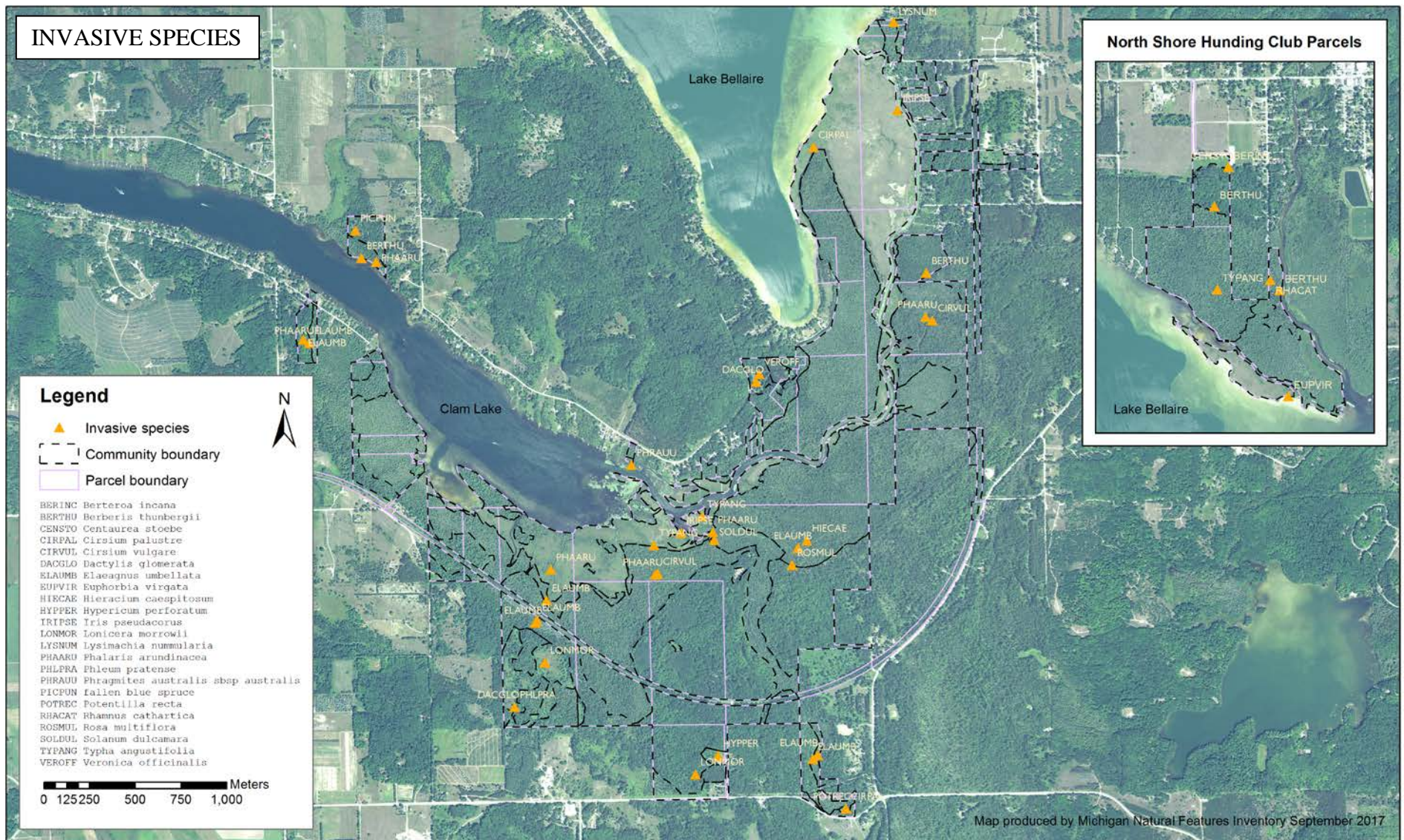


Figure 46. Invasive species observed in GRNA during 2017 surveys. Comprehensive invasive species surveys were not conducted during this study.

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 are 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 and only one invasive species was 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 and the difficulty of accessing the northern fen island by Lake Bellaire, further survey is warranted to fully capture the ecological history and diversity of this natural community and its potential threats.

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 remarkable 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. 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 are 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 |
|----------------------------|-------------------|------------------------------|--------------------|
| <i>Alliaria petiolata</i> | garlic mustard | <i>Euphorbia virgata</i> | leafy spurge |
| <i>Berberis thunbergii</i> | Japanese barberry | <i>Lonicera morrowii</i> | morrow honeysuckle |
| <i>Centaurea stoebe</i> | spotted knapweed | <i>Lonicera xbella</i> | hybrid honeysuckle |
| <i>Cirsium arvense</i> | Canada thistle | <i>Lysimachia nummularia</i> | Moneywort |
| <i>Cirsium vulgare</i> | bull thistle | <i>Lythrum salicaria</i> | 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. *Pterospora andromedea* (pine-drops) was reported in the 1983 study, but not observed during the 2017 study, is now listed as state threatened. It typically occurs in fairly dry soils in association with pine and other conifers species and could still persist at GRNA. Other rarities 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), northern goshawk (*Accipiter gentilis*, SC), red-shouldered hawk (*Buteo lineatus*, T), *Emydoidea blandingii* (Blanding’s turtle, SC) and eastern massassauga (*Sistrurus catenatus*, 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 xglauca* (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 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, but 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.

Acknowledgements

Many individuals provided valuable assistance on this project. Haley Breniser (GRNA) and Brad Slaughter (MNFI) helped secure the funding and Haley provided maps and other documents relevant to GRNA, a kayak and accessories, and local expertise to complete the project. James Dake (GRNA) assisted with equipment and facility usage and Rich Hannon (GRNA) joined surveyors in the field on several occasions. Joshua Cohen provided critical guidance on natural community identification and ranking. Brian Klatt, Mike Monfils, Helen Enander, Rebecca Rogers, Nancy Toben, and Ashley Adkins (MNFI) provided administrative and technical support.



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 2014

Year:

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.

Dichantheium implicatum in Michigan Flora has the accepted name of *Dichantheium 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 | Species Wetness: | | Native Annual: | 8 2.20% |
| Adjusted FQI: | 46.3 | Mean Wetness: | -1.0 | Native Perennial: | 305 82.90% |
| % C value 0: | 16.3 | Native Mean Wetness: | -1.6 | Native Biennial: | 2 0.50% |
| % C value 1-3: | 20.4 | Physiognomy Metrics: | | Physiognomy Metrics: | |
| % C value 4-6: | 42.9 | Tree: | 25 6.80% | Sedge: | 49 13.30% |
| % C value 7-10: | 20.4 | Shrub: | 49 13.30% | Rush: | 3 0.80% |
| Native Tree Mean C: | 4.0 | Vine: | 9 2.40% | Fern: | 26 7.10% |
| Native Shrub Mean C: | 5.3 | Forb: | 178 48.40% | Bryophyte: | 0 0% |
| Native Herbaceous Mean C: | 5.1 | Grass: | 29 7.90% | | |

Species:

Grass River Natural Area 2017

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

Grass River Natural Area 2017

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

Grass River Natural Area 2017

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|----------------|----------------|----------------|----------|----------|--------------------|-----------------|-------------------------|
| <i>Carex crinita</i> | Cyperaceae | CXCRIN | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex deweyana</i> | Cyperaceae | CXDEWE | native | 3 | 3 | sedge | perennial | sedge |
| <i>Carex diandra</i> | Cyperaceae | CXDIAN | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex disperma</i> | Cyperaceae | CXDISP | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex eburnea</i> | Cyperaceae | CXE BUR | native | 7 | 3 | sedge | perennial | sedge |
| <i>Carex exilis</i> | Cyperaceae | CXEXIL | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex gracillima</i> | Cyperaceae | CXGRAA | native | 4 | 3 | sedge | perennial | sedge |
| <i>Carex hystericina</i> | Cyperaceae | CXHYST | native | 2 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex intumescens</i> | Cyperaceae | CXINTU | native | 3 | -3 | sedge | perennial | sedge |
| <i>Carex lacustris</i> | Cyperaceae | CXLACU | native | 6 | -5 | sedge | perennial | sedge |
| <i>Carex laevivaginata</i> | Cyperaceae | CXLAEV | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex lasiocarpa</i> | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex leptonevia</i> | Cyperaceae | CXLEPO | native | 3 | 0 | sedge | perennial | sedge |
| <i>Carex lupulina</i> | Cyperaceae | CXLUPA | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex pedunculata</i> | Cyperaceae | CXPEDU | native | 5 | 3 | sedge | perennial | sedge |
| <i>Carex pensylvanica</i> | Cyperaceae | CXPENS | native | 4 | 5 | sedge | perennial | sedge |
| <i>Carex prairea</i> | Cyperaceae | CXPRAI | native | 10 | -3 | sedge | perennial | sedge |
| <i>Carex retrorsa</i> | Cyperaceae | CXRETS | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex rosea; c. convoluta</i> | Cyperaceae | CXROSE | native | 2 | 5 | sedge | perennial | curly-styled wood sedge |
| <i>Carex stipata</i> | Cyperaceae | CXSTIP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex trisperma</i> | Cyperaceae | CXTRIS | native | 9 | -5 | sedge | perennial | sedge |
| <i>Carex utriculata; c. rostrata</i> | Cyperaceae | CXUTRI | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex vulpinoidea</i> | Cyperaceae | CXVULP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Centaurea stoebe; c. maculosa</i> | Asteraceae | CENSTO | non-native | 0 | 5 | forb | biennial | spotted knapweed |
| <i>Cephalanthus occidentalis</i> | Rubiaceae | CEPOCC | native | 7 | -5 | shrub | perennial | buttonbush |
| <i>Chamaedaphne calyculata</i> | Ericaceae | CHACAL | native | 8 | -5 | shrub | perennial | leatherleaf |
| <i>Chelone glabra</i> | Plantaginaceae | CHEGLB | native | 7 | -5 | forb | perennial | turtlehead |
| <i>Chrysosplenium americanum</i> | Saxifragaceae | CHROME | native | 6 | -5 | forb | perennial | golden saxifrage |
| <i>Cicuta bulbifera</i> | Apiaceae | CICBUL | native | 5 | -5 | forb | perennial | water hemlock |
| <i>Circaea canadensis; c. lutetiana</i> | Onagraceae | CIRCAN | native | 2 | 3 | forb | perennial | enchanters-nightshade |
| <i>Cirsium arvense</i> | Asteraceae | CIRARV | non-native | 0 | 3 | forb | perennial | canada thistle |
| <i>Cirsium muticum</i> | Asteraceae | CIRMUT | native | 6 | -5 | forb | biennial | swamp thistle |
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Cirsium vulgare</i> | 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 |
|---|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|---------------------------------------|
| <i>Cladium mariscoides</i> | Cyperaceae | CLAMAR | native | 10 | -5 | sedge | perennial | twig-rush |
| <i>Clematis virginiana</i> | Ranunculaceae | CLEVIR | native | 4 | 0 | vine | perennial | virgins bower |
| <i>Clinopodium vulgare</i> | Lamiaceae | CLIVUL | native | 3 | 5 | forb | perennial | wild-basil |
| <i>Clintonia borealis</i> | Convallariaceae | CLIBOR | native | 5 | 0 | forb | perennial | bluebead-lily; corn-lily |
| <i>Comarum palustre; potentilla p.</i> | Rosaceae | COMPAL | native | 7 | -5 | forb | perennial | marsh cinquefoil |
| <i>Conyza canadensis</i> | Asteraceae | CONCAN | native | 0 | 3 | forb | annual | horseweed |
| <i>Coptis trifolia</i> | Ranunculaceae | COPTRI | native | 5 | -3 | forb | perennial | goldthread |
| <i>Corallorhiza trifida</i> | Orchidaceae | CORTRF | native | 6 | -3 | forb | perennial | early coral-root |
| <i>Cornus alternifolia</i> | Cornaceae | CORALT | native | 5 | 3 | tree | perennial | alternate-leaved dogwood |
| <i>Cornus amomum</i> | Cornaceae | CORAMO | native | 2 | -3 | shrub | perennial | silky dogwood |
| <i>Cornus canadensis</i> | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| <i>Cornus foemina</i> | Cornaceae | CORFOE | native | 1 | 0 | shrub | perennial | gray dogwood |
| <i>Cornus sericea; c. stolonifera</i> | Cornaceae | CORSER | native | 2 | -3 | shrub | perennial | red-osier |
| <i>Cypripedium acaule</i> | Orchidaceae | CYPACA | native | 5 | -3 | forb | perennial | pink lady-slipper; moccasin flower |
| <i>Cypripedium parviflorum; c. calceolus</i> | Orchidaceae | CYPPAR | native | 5 | 0 | forb | perennial | yellow lady-slipper |
| <i>Cypripedium reginae</i> | Orchidaceae | CYPREG | native | 9 | -3 | forb | perennial | showy or queens lady-slipper |
| <i>Dactylis glomerata</i> | Poaceae | DACGLO | non-native | 0 | 3 | grass | perennial | orchard grass |
| <i>Danthonia spicata</i> | Poaceae | DANSPI | native | 4 | 5 | grass | perennial | poverty grass; oatgrass |
| <i>Dasiphora fruticosa; potentilla f.</i> | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| <i>Daucus carota</i> | Apiaceae | DAUCAR | non-native | 0 | 5 | forb | biennial | queen-annes-lace |
| <i>Decodon verticillatus</i> | Lythraceae | DECVER | native | 7 | -5 | shrub | perennial | whorled or swamp loosestrife |
| <i>Dendrolycopodium obscurum; lycopodium o.</i> | Lycopodiaceae | DENOBS | native | 5 | 3 | fern | perennial | ground-pine |
| <i>Dianthus armeria</i> | Caryophyllaceae | DIAARM | non-native | 0 | 5 | forb | annual | deptford pink |
| <i>Dichanthelium depauperatum; panicum d.</i> | Poaceae | DICDEP | native | 4 | 5 | grass | perennial | panic grass |
| <i>Dichanthelium implicatum; panicum i.</i> | Poaceae | DICIMP | native | 3 | 0 | grass | perennial | panic grass |
| <i>Doellingeria umbellata; aster u.</i> | Asteraceae | DOEUMB | native | 5 | -3 | forb | perennial | flat-topped white aster |
| <i>Drosera rotundifolia</i> | Droseraceae | DROROT | native | 6 | -5 | forb | perennial | round-leaved sundew |
| <i>Dryopteris carthusiana</i> | Dryopteridaceae | DRYCAR | native | 5 | -3 | fern | perennial | spinulose woodfern |
| <i>Dryopteris clintoniana</i> | Dryopteridaceae | DRYCLI | native | 8 | -3 | fern | perennial | clintons woodfern |
| <i>Dryopteris cristata</i> | Dryopteridaceae | DRYCRI | native | 6 | -5 | fern | perennial | crested shield fern |
| <i>Dryopteris intermedia</i> | Dryopteridaceae | DRYINT | native | 5 | 0 | fern | perennial | evergreen woodfern |

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

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

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

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

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| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|------------------|----------------|----------------|----------|----------|--------------------|-----------------|-------------------------------|
| <i>Polygonatum pubescens</i> | Convallariaceae | POLPUB | native | 5 | 5 | forb | perennial | downy solomon seal |
| <i>Pontederia cordata</i> | Pontederiaceae | PONCOR | native | 8 | -5 | forb | perennial | pickerel-weed |
| <i>Populus alba</i> | Salicaceae | POPALB | non-native | 0 | 5 | tree | perennial | white poplar |
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| <i>Populus grandidentata</i> | Salicaceae | POPGRA | native | 4 | 3 | tree | perennial | big-tooth aspen |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Potamogeton natans</i> | Potamogetonaceae | POTNAT | native | 5 | -5 | forb | perennial | pondweed |
| <i>Potentilla anserina</i> | Rosaceae | POTANS | native | 5 | -3 | forb | perennial | silverweed |
| <i>Potentilla recta</i> | Rosaceae | POTREC | non-native | 0 | 5 | forb | perennial | rough-fruited cinquefoil |
| <i>Proserpinaca palustris</i> | Haloragaceae | PROPAL | native | 6 | -5 | forb | perennial | mermaid-weed |
| <i>Prunella vulgaris</i> | Lamiaceae | PRUVUL | native | 0 | 0 | forb | perennial | self-heal |
| <i>Prunus serotina</i> | Rosaceae | PRUSER | native | 2 | 3 | tree | perennial | wild black cherry |
| <i>Pteridium aquilinum</i> | Dennstaedtiaceae | PTEAQU | native | 0 | 3 | fern | perennial | bracken fern |
| <i>Pyrola elliptica</i> | Ericaceae | PYRELL | native | 6 | 3 | forb | perennial | large-leaved shinleaf |
| <i>Quercus rubra</i> | Fagaceae | QUERUB | native | 5 | 3 | tree | perennial | red oak |
| <i>Ranunculus abortivus</i> | Ranunculaceae | RANABO | native | 0 | 0 | forb | perennial | small-flowered buttercup |
| <i>Ranunculus acris</i> | Ranunculaceae | RANACR | non-native | 0 | 0 | forb | perennial | tall or common buttercup |
| <i>Ranunculus hispidus</i> | Ranunculaceae | RANHIS | native | 5 | 0 | forb | perennial | swamp buttercup |
| <i>Ranunculus recurvatus</i> | Ranunculaceae | RANREC | native | 5 | -3 | forb | perennial | hooked crowfoot |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Rhododendron groenlandicum;</i> <i>ledum g.</i> | Ericaceae | RHOGRO | native | 8 | -5 | shrub | perennial | labrador-tea |
| <i>Rhynchospora alba</i> | Cyperaceae | RHYALB | native | 6 | -5 | sedge | perennial | beak-rush |
| <i>Rhynchospora capillacea</i> | Cyperaceae | RHYCAL | native | 10 | -5 | sedge | perennial | beak-rush |
| <i>Ribes cynosbati</i> | Grossulariaceae | RIBCYN | native | 4 | 3 | shrub | perennial | prickly or wild gooseberry |
| <i>Ribes hirtellum</i> | Grossulariaceae | RIBHIR | native | 6 | -3 | shrub | perennial | swamp gooseberry |
| <i>Ribes triste</i> | Grossulariaceae | RIBTRI | native | 6 | -5 | shrub | perennial | swamp red currant |
| <i>Rosa multiflora</i> | Rosaceae | ROSMUL | non-native | 0 | 3 | shrub | perennial | multiflora rose |
| <i>Rosa palustris</i> | Rosaceae | ROSPAL | native | 5 | -5 | shrub | perennial | swamp rose |
| <i>Rubus allegheniensis</i> | Rosaceae | RUBALL | native | 1 | 3 | shrub | perennial | common blackberry |
| <i>Rubus hispidus</i> | Rosaceae | RUBHIS | native | 4 | -3 | shrub | perennial | swamp dewberry |
| <i>Rubus occidentalis</i> | Rosaceae | RUBOCC | native | 1 | 5 | shrub | perennial | black raspberry |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Rubus strigosus</i> | Rosaceae | RUBSTR | native | 2 | 0 | shrub | perennial | wild red raspberry |
| <i>Rudbeckia hirta</i> | Asteraceae | RUDHIR | native | 1 | 3 | forb | perennial | black-eyed susan |
| <i>Rumex acetosella</i> | Polygonaceae | RUMACL | non-native | 0 | 3 | forb | perennial | sheep sorrel |
| <i>Rumex obtusifolius</i> | 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 |
|--|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Rumex orbiculatus</i> | Polygonaceae | RUMORB | native | 9 | -5 | forb | perennial | great water dock |
| <i>Sagittaria latifolia</i> | Alismataceae | SAGLAT | native | 4 | -5 | forb | perennial | common arrowhead |
| <i>Salix discolor</i> | Salicaceae | SALDIS | native | 1 | -3 | shrub | perennial | pussy willow |
| <i>Salix petiolaris</i> | Salicaceae | SALPET | native | 1 | -3 | shrub | perennial | slender willow |
| <i>Sambucus canadensis</i> | Adoxaceae | SAMCAN | native | 3 | -3 | shrub | perennial | elderberry |
| <i>Sarracenia purpurea</i> | Sarraceniaceae | SARPUR | native | 10 | -5 | forb | perennial | pitcher-plant |
| <i>Schizachne purpurascens</i> | Poaceae | SCHPUP | native | 5 | 3 | grass | perennial | false melic |
| <i>Schizachyrium scoparium;</i> <i>andropogon s.</i> | Poaceae | SCHSCO | native | 5 | 3 | grass | perennial | little bluestem |
| <i>Schoenoplectus acutus; scirpus</i> <i>a.</i> | Cyperaceae | SCHACU | native | 5 | -5 | sedge | perennial | hardstem bulrush |
| <i>Schoenoplectus pungens; scirpus</i> <i>americanus</i> | Cyperaceae | SCHPUN | native | 5 | -5 | sedge | perennial | threesquare |
| <i>Schoenoplectus</i> <i>tabernaemontani; scirpus</i> <i>validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Scirpus atrovirens</i> | Cyperaceae | SCIATV | native | 3 | -5 | sedge | perennial | bulrush |
| <i>Scirpus cyperinus</i> | Cyperaceae | SCICYP | native | 5 | -5 | sedge | perennial | wool-grass |
| <i>Scutellaria galericulata</i> | Lamiaceae | SCUGAL | native | 5 | -5 | forb | perennial | marsh skullcap |
| <i>Scutellaria lateriflora</i> | Lamiaceae | SCULAT | native | 5 | -5 | forb | perennial | mad-dog skullcap |
| <i>Solanum dulcamara</i> | Solanaceae | SOLDUL | non-native | 0 | 0 | vine | perennial | bittersweet nightshade |
| <i>Solidago caesia</i> | Asteraceae | SOLCAE | native | 6 | 3 | forb | perennial | bluestem goldenrod |
| <i>Solidago canadensis</i> | Asteraceae | SOLCAN | native | 1 | 3 | forb | perennial | canada goldenrod |
| <i>Solidago gigantea</i> | Asteraceae | SOLGIG | native | 3 | -3 | forb | perennial | late goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Solidago uliginosa</i> | Asteraceae | SOLULI | native | 4 | -5 | forb | perennial | bog goldenrod |
| <i>Sparganium emersum; s.</i> <i>chlorocarpum</i> | Typhaceae | SPAEME | native | 6 | -5 | forb | perennial | green-fruited bur-reed |
| <i>Sparganium eurycarpum</i> | Typhaceae | SPAEUR | native | 5 | -5 | forb | perennial | common bur-reed |
| <i>Spinulum annotinum;</i> <i>lycopodium a.</i> | Lycopodiaceae | SPIANN | native | 5 | 0 | fern | perennial | stiff clubmoss |
| <i>Spiraea alba</i> | Rosaceae | SPIALB | native | 4 | -3 | shrub | perennial | meadowsweet |
| <i>Spiranthes cernua</i> | Orchidaceae | SPICER | native | 4 | -3 | forb | perennial | nodding ladies-tresses |
| <i>Stellaria media</i> | Caryophyllaceae | STEMED | non-native | 0 | 3 | forb | annual | common chickweed |
| <i>Symphotrichum boreale; aster</i> <i>b.</i> | 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 |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|-------------------------|
| <i>Symphotrichum firmum</i> ; <i>aster puniceus</i> | Asteraceae | SYMFIR | native | 4 | -3 | forb | perennial | smooth swamp aster |
| <i>Symphotrichum lanceolatum</i> ; <i>aster l.</i> | Asteraceae | SYMLAN | native | 2 | -3 | forb | perennial | panicked aster |
| <i>Symphotrichum lateriflorum</i> ; <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | forb | perennial | calico aster |
| <i>Symphotrichum puniceum</i> ; <i>aster p.</i> | Asteraceae | SYMPUN | native | 5 | -5 | forb | perennial | swamp aster |
| <i>Symphotrichum urophyllum</i> ; <i>aster sagittifolius</i> | Asteraceae | SYMURO | native | 2 | 5 | forb | perennial | arrow-leaved aster |
| <i>Taraxacum officinale</i> | Asteraceae | TAROFF | non-native | 0 | 3 | forb | perennial | common dandelion |
| <i>Thalictrum dasycarpum</i> | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| <i>Thalictrum dioicum</i> | Ranunculaceae | THADIO | native | 6 | 3 | forb | perennial | early meadow-rue |
| <i>Thelypteris noveboracensis</i> | Thelypteridaceae | THENOV | native | 5 | 0 | fern | perennial | new york fern |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Tiarella cordifolia</i> | Saxifragaceae | TIACOR | native | 9 | 3 | forb | perennial | foamflower |
| <i>Tilia americana</i> | Malvaceae | TILAME | native | 5 | 3 | tree | perennial | basswood |
| <i>Toxicodendron rydbergii</i> ; <i>t. radicans</i> | Anacardiaceae | TOXRYD | native | 3 | 0 | shrub | perennial | poison-ivy |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Tragopogon pratensis</i> | Asteraceae | TRAPRA | non-native | 0 | 5 | forb | biennial | common goats beard |
| <i>Triadenum fraseri</i> | Hypericaceae | TRIFRA | native | 6 | -5 | forb | perennial | marsh st. johns-wort |
| <i>Trichophorum alpinum</i> ; <i>scirpus hudsonianus</i> | Cyperaceae | TRIALP | native | 10 | -5 | sedge | perennial | bulrush |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Trifolium pratense</i> | Fabaceae | TRIPRA | non-native | 0 | 3 | forb | perennial | red clover |
| <i>Triglochin maritima</i> | Juncaginaceae | TRIMAR | native | 8 | -5 | forb | perennial | common bog arrow-grass |
| <i>Trillium cernuum</i> | Trilliaceae | TRICER | native | 5 | 0 | forb | perennial | nodding trillium |
| <i>Tsuga canadensis</i> | Pinaceae | TSUCAN | native | 5 | 3 | tree | perennial | hemlock |
| <i>Typha angustifolia</i> | Typhaceae | TYPANG | non-native | 0 | -5 | forb | perennial | narrow-leaved cat-tail |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| <i>Ulmus americana</i> | Ulmaceae | ULMAME | native | 1 | -3 | tree | perennial | american elm |
| <i>Utricularia cornuta</i> | Lentibulariaceae | UTRCOR | native | 10 | -5 | forb | perennial | horned bladderwort |
| <i>Utricularia intermedia</i> | Lentibulariaceae | UTRINT | native | 10 | -5 | forb | perennial | flat-leaved bladderwort |
| <i>Utricularia minor</i> | Lentibulariaceae | UTRMIN | native | 10 | -5 | forb | perennial | small bladderwort |
| <i>Utricularia vulgaris</i> | Lentibulariaceae | UTRVUL | native | 6 | -5 | forb | perennial | common bladderwort |
| <i>Vaccinium myrtilloides</i> | 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 |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|-----------------------|
| <i>Vaccinium oxycoccos</i> | Ericaceae | VACOXY | native | 8 | -5 | shrub | perennial | small cranberry |
| <i>Verbascum thapsus</i> | Scrophulariaceae | VERTHA | non-native | 0 | 5 | forb | biennial | common mullein |
| <i>Verbena hastata</i> | Verbenaceae | VERHAS | native | 4 | -3 | forb | perennial | blue vervain |
| <i>Veronica arvensis</i> | Plantaginaceae | VERARV | non-native | 0 | 3 | forb | annual | corn speedwell |
| <i>Veronica officinalis</i> | Plantaginaceae | VEROOF | non-native | 0 | 3 | forb | perennial | common speedwell |
| <i>Viburnum acerifolium</i> | Adoxaceae | VIBACE | native | 6 | 5 | shrub | perennial | maple-leaved viburnum |
| <i>Viburnum cassinoides</i> | Adoxaceae | VIBCAS | native | 6 | 3 | shrub | perennial | wild-raisin |
| <i>Vicia villosa</i> | Fabaceae | VICVIL | non-native | 0 | 5 | vine | annual | hairy vetch |
| <i>Viola canadensis</i> | Violaceae | VIOCAN | native | 5 | 3 | forb | perennial | canada violet |
| <i>Viola cucullata</i> | Violaceae | VIOCUC | native | 5 | -5 | forb | perennial | marsh violet |
| <i>Viola labradorica; v. conspersa</i> | Violaceae | VIOLAB | native | 3 | 0 | forb | perennial | dog violet |
| <i>Vitis riparia</i> | 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: 2014

Year:

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: 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 | Species Wetness: | | Native Annual: | 0 0% |
| Adjusted FQI: | 53.5 | Mean Wetness: | -4.9 | Native Perennial: | 18 94.70% |
| % C value 0: | 5.3 | Native Mean Wetness: | -4.9 | Native Biennial: | 0 0% |
| % C value 1-3: | 5.3 | Physiognomy Metrics: | | Physiognomy Metrics: | |
| % C value 4-6: | 63.2 | Tree: | 0 0% | Sedge: | 7 36.80% |
| % C value 7-10: | 26.3 | Shrub: | 1 5.30% | Rush: | 0 0% |
| Native Tree Mean C: | n/a | Vine: | 0 0% | Fern: | 0 0% |
| Native Shrub Mean C: | 7.0 | Forb: | 10 52.60% | Bryophyte: | 0 0% |
| Native Herbaceous Mean C: | 5.4 | Grass: | 1 5.30% | | |

Species:

Grass River Natural Area 2017: Emergent Marsh

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|---------------------------------|
| <i>Carex aquatilis</i> | Cyperaceae | CXAQUA | native | 7 | -5 | sedge | perennial | sedge |
| <i>Carex comosa</i> | Cyperaceae | CXCOMO | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex lasiocarpa</i> | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Decodon verticillatus</i> | Lythraceae | DECVER | native | 7 | -5 | shrub | perennial | whorled or swamp loosestrife |
| <i>Eleocharis palustris; e. smallii</i> | Cyperaceae | ELEPAL | native | 5 | -5 | sedge | perennial | spike-rush |
| <i>Nuphar variegata</i> | Nymphaeaceae | NUPVAR | native | 7 | -5 | forb | perennial | yellow pond-lily |
| <i>Nymphaea odorata</i> | Nymphaeaceae | NYMODO | native | 6 | -5 | forb | perennial | sweet-scented waterlily |
| <i>Phragmites australis var. americanus</i> | Poaceae | PHRAUM | native | 5 | -3 | grass | perennial | reed |
| <i>Pontederia cordata</i> | Pontederiaceae | PONCOR | native | 8 | -5 | forb | perennial | pickerel-weed |
| <i>Proserpinaca palustris</i> | Haloragaceae | PROPAL | native | 6 | -5 | forb | perennial | mermaid-weed |
| <i>Sagittaria latifolia</i> | Alismataceae | SAGLAT | native | 4 | -5 | forb | perennial | common arrowhead |
| <i>Schoenoplectus acutus; scirpus a.</i> | Cyperaceae | SCHACU | native | 5 | -5 | sedge | perennial | hardstem bulrush |
| <i>Schoenoplectus tabernaemontani; scirpus validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Sparganium emersum; s. chlorocarpum</i> | Typhaceae | SPAEME | native | 6 | -5 | forb | perennial | green-fruited bur-reed |
| <i>Sparganium eurycarpum</i> | Typhaceae | SPAEUR | native | 5 | -5 | forb | perennial | common bur-reed |
| <i>Typha angustifolia</i> | Typhaceae | TYPANG | non-native | 0 | -5 | forb | perennial | narrow-leaved cat-tail |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| <i>Utricularia vulgaris</i> | 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 2014

Year:

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: 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.

Dichantheium implicatum in Michigan Flora has the accepted name of *Dichantheium 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 | | | Physiognomy Metrics: | |
| % C value 7-10: | 29.3 | Physiognomy Metrics: | | Sedge: | 24 19.50% |
| Native Tree Mean C: | 2.7 | Tree: | 7 5.70% | Rush: | 0 0% |
| Native Shrub Mean C: | 5.2 | Shrub: | 18 14.60% | Fern: | 4 3.30% |
| Native Herbaceous Mean C: | 5.6 | Vine: | 4 3.30% | Bryophyte: | 0 0% |
| | | Forb: | 57 46.30% | | |
| | | Grass: | 9 7.30% | | |

Species:

Grass River Natural Area 2017: Northern Wet Meadow

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|----------------|----------------|----------------|----------|----------|--------------------|-----------------|-------------------------|
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Agalinis purpurea</i> | Orobanchaceae | AGAPUR | native | 7 | -3 | forb | annual | purple false foxglove |
| <i>Agrostis scabra; a. hyemalis</i> | Poaceae | AGRSCA | native | 4 | 0 | grass | perennial | ticklegass |
| <i>Alnus incana; a. rugosa</i> | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| <i>Andromeda glaucophylla</i> | Ericaceae | ANDGLA | native | 10 | -5 | shrub | perennial | bog-rosemary |
| <i>Anemone canadensis</i> | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| <i>Apocynum cannabinum; a. sibiricum</i> | Apocynaceae | APOCAN | native | 3 | 0 | forb | perennial | indian-hemp |
| <i>Asclepias incarnata</i> | Apocynaceae | ASCINC | native | 6 | -5 | forb | perennial | swamp milkweed |
| <i>Boehmeria cylindrica</i> | Urticaceae | BOE CYL | native | 5 | -5 | forb | perennial | false nettle |
| <i>Bromus ciliatus</i> | Poaceae | BROCIL | native | 6 | -3 | grass | perennial | fringed brome |
| <i>Calamagrostis canadensis</i> | Poaceae | CALCAN | native | 3 | -5 | grass | perennial | blue-joint |
| <i>Calamagrostis stricta; c. inexpansa; c. lacustris</i> | Poaceae | CALSTR | native | 10 | -3 | grass | perennial | narrow-leaved reedgrass |
| <i>Calystegia sepium</i> | Convolvulaceae | CALSEP | native | 2 | 0 | vine | perennial | hedge bindweed |
| <i>Campanula aparinoides</i> | Campanulaceae | CAMAPA | native | 7 | -5 | forb | perennial | marsh bellflower |
| <i>Carex aquatilis</i> | Cyperaceae | CXAQUA | native | 7 | -5 | sedge | perennial | sedge |
| <i>Carex buxbaumii</i> | Cyperaceae | CXBUXB | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex comosa</i> | Cyperaceae | CXCOMO | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex diandra</i> | Cyperaceae | CXDIAN | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex lacustris</i> | Cyperaceae | CXLACU | native | 6 | -5 | sedge | perennial | sedge |
| <i>Carex lasiocarpa</i> | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex pellita; c. lanuginosa</i> | Cyperaceae | CXPELL | native | 2 | -5 | sedge | perennial | sedge |
| <i>Carex prairea</i> | Cyperaceae | CXPRAI | native | 10 | -3 | sedge | perennial | sedge |
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex utriculata; c. rostrata</i> | Cyperaceae | CXUTRI | native | 5 | -5 | sedge | perennial | sedge |
| <i>Cephalanthus occidentalis</i> | Rubiaceae | CEPOCC | native | 7 | -5 | shrub | perennial | buttonbush |
| <i>Chelone glabra</i> | Plantaginaceae | CHEGLB | native | 7 | -5 | forb | perennial | turtlehead |
| <i>Cicuta bulbifera</i> | Apiaceae | CICBUL | native | 5 | -5 | forb | perennial | water hemlock |
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Cladium mariscoides</i> | Cyperaceae | CLAMAR | native | 10 | -5 | sedge | perennial | twig-rush |
| <i>Comarum palustre; potentilla p.</i> | Rosaceae | COMPAL | native | 7 | -5 | forb | perennial | marsh cinquefoil |
| <i>Cornus amomum</i> | Cornaceae | CORAMO | native | 2 | -3 | shrub | perennial | silky dogwood |
| <i>Cornus sericea; c. stolonifera</i> | 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 |
|---|---------------|----------------|----------------|----------|----------|--------------------|-----------------|---------------------------------|
| <i>Dasiphora fruticosa; potentilla f.</i> | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| <i>Decodon verticillatus</i> | Lythraceae | DECVER | native | 7 | -5 | shrub | perennial | whorled or swamp loosestrife |
| <i>Dichanthelium implicatum; panicum i.</i> | Poaceae | DICIMP | native | 3 | 0 | grass | perennial | panic grass |
| <i>Dulichium arundinaceum</i> | Cyperaceae | DULARU | native | 8 | -5 | sedge | perennial | three-way sedge |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Eleocharis elliptica</i> | Cyperaceae | ELEELL | native | 6 | -5 | sedge | perennial | golden-seeded spike rush |
| <i>Eleocharis erythropoda</i> | Cyperaceae | ELEERY | native | 4 | -5 | sedge | perennial | spike-rush |
| <i>Eleocharis palustris; e. smallii</i> | Cyperaceae | ELEPAL | native | 5 | -5 | sedge | perennial | spike-rush |
| <i>Epilobium palustre</i> | Onagraceae | EPICAL | native | 10 | -5 | forb | perennial | marsh willow-herb |
| <i>Equisetum fluviatile</i> | Equisetaceae | EQUFLU | native | 7 | -5 | fern | perennial | water horsetail |
| <i>Eriophorum viridi-carinatum</i> | Cyperaceae | ERIVID | native | 8 | -5 | sedge | perennial | green-keeled cotton-grass |
| <i>Eupatorium perfoliatum</i> | Asteraceae | EUPPER | native | 4 | -3 | forb | perennial | boneset |
| <i>Euthamia graminifolia</i> | Asteraceae | EUTGRA | native | 3 | 0 | forb | perennial | grass-leaved goldenrod |
| <i>Eutrochium maculatum; eupatorium m.</i> | Asteraceae | EUTMAC | native | 4 | -5 | forb | perennial | joe-pye-weed |
| <i>Galium labradoricum</i> | Rubiaceae | GALLAB | native | 8 | -5 | forb | perennial | bog bedstraw |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Hypericum kalmianum</i> | Hypericaceae | HYPKAL | native | 10 | -3 | shrub | perennial | kalms st. johns-wort |
| <i>Iris pseudacorus</i> | Iridaceae | IRIPSE | non-native | 0 | -5 | forb | perennial | yellow flag |
| <i>Iris virginica</i> | Iridaceae | IRIVIR | native | 5 | -5 | forb | perennial | southern blue flag |
| <i>Larix laricina</i> | Pinaceae | LARLAR | native | 5 | -3 | tree | perennial | tamarack |
| <i>Lathyrus palustris</i> | Fabaceae | LATPAL | native | 7 | -3 | vine | perennial | marsh pea |
| <i>Lemna minor</i> | Araceae | LEMMIN | native | 5 | -5 | forb | perennial | common duckweed |
| <i>Lobelia kalmii</i> | Campanulaceae | LOBKAL | native | 10 | -5 | forb | perennial | bog lobelia |
| <i>Lycopus americanus</i> | Lamiaceae | LYCAME | native | 2 | -5 | forb | perennial | common water horehound |
| <i>Lycopus uniflorus</i> | Lamiaceae | LYCUNI | native | 2 | -5 | forb | perennial | northern bugle weed |
| <i>Lysimachia thysiflora</i> | Myrsinaceae | LYSTHY | native | 6 | -5 | forb | perennial | tufted loosestrife |
| <i>Lythrum salicaria</i> | Lythraceae | LYTSAL | non-native | 0 | -5 | forb | perennial | purple loosestrife |
| <i>Mentha canadensis; m. arvensis</i> | Lamiaceae | MENCAS | native | 3 | -3 | forb | perennial | wild mint |
| <i>Mentha A—piperita</i> | Lamiaceae | MENPIP | non-native | 0 | -5 | forb | perennial | peppermint |
| <i>Menyanthes trifoliata</i> | Menyanthaceae | MENTRI | native | 8 | -5 | forb | perennial | buckbean |
| <i>Muhlenbergia glomerata</i> | Poaceae | MUHGLO | native | 10 | -5 | grass | perennial | marsh wild-timothy |
| <i>Myrica gale</i> | Myricaceae | MYRGAL | native | 6 | -5 | shrub | perennial | sweet gale |
| <i>Nasturtium officinale</i> | Brassicaceae | NASOFF | native | 4 | -5 | forb | perennial | watercress |
| <i>Nuphar variegata</i> | Nymphaeaceae | NUPVAR | native | 7 | -5 | forb | perennial | yellow pond-lily |
| <i>Nymphaea odorata</i> | 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 |
|--|----------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Onoclea sensibilis</i> | Onocleaceae | ONOSEN | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Osmunda regalis</i> | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |
| <i>Parnassia glauca</i> | Parnassiaceae | PARGLA | native | 8 | -5 | forb | perennial | grass-of-parnassus |
| <i>Persicaria amphibia; polygonum</i> | Polygonaceae | PERAMP | native | 6 | -5 | forb | perennial | water smartweed |
| <i>a.</i> | | | | | | | | |
| <i>Phragmites australis var. americanus</i> | Poaceae | PHRAUM | native | 5 | -3 | grass | perennial | reed |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| <i>Poa palustris</i> | Poaceae | POAPAS | native | 3 | -3 | grass | perennial | fowl meadow grass |
| <i>Pogonia ophioglossoides</i> | Orchidaceae | POGOPH | native | 10 | -5 | forb | perennial | rose pogonia |
| <i>Pontederia cordata</i> | Pontederiaceae | PONCOR | native | 8 | -5 | forb | perennial | pickerel-weed |
| <i>Populus alba</i> | Salicaceae | POPALB | non-native | 0 | 5 | tree | perennial | white poplar |
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Proserpinaca palustris</i> | Haloragaceae | PROPAL | native | 6 | -5 | forb | perennial | mermaid-weed |
| <i>Ranunculus hispidus</i> | Ranunculaceae | RANHIS | native | 5 | 0 | forb | perennial | swamp buttercup |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Rhynchospora alba</i> | Cyperaceae | RHYALB | native | 6 | -5 | sedge | perennial | beak-rush |
| <i>Rosa palustris</i> | Rosaceae | ROSPAL | native | 5 | -5 | shrub | perennial | swamp rose |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Sagittaria latifolia</i> | Alismataceae | SAGLAT | native | 4 | -5 | forb | perennial | common arrowhead |
| <i>Salix discolor</i> | Salicaceae | SALDIS | native | 1 | -3 | shrub | perennial | pussy willow |
| <i>Salix petiolaris</i> | Salicaceae | SALPET | native | 1 | -3 | shrub | perennial | slender willow |
| <i>Sambucus canadensis</i> | Adoxaceae | SAMCAN | native | 3 | -3 | shrub | perennial | elderberry |
| <i>Sarracenia purpurea</i> | Sarraceniaceae | SARPUR | native | 10 | -5 | forb | perennial | pitcher-plant |
| <i>Schoenoplectus acutus; scirpus</i> | Cyperaceae | SCHACU | native | 5 | -5 | sedge | perennial | hardstem bulrush |
| <i>a.</i> | | | | | | | | |
| <i>Schoenoplectus pungens; scirpus americanus</i> | Cyperaceae | SCHPUN | native | 5 | -5 | sedge | perennial | threesquare |
| <i>Schoenoplectus tabernaemontani; scirpus validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Scutellaria galericulata</i> | Lamiaceae | SCUGAL | native | 5 | -5 | forb | perennial | marsh skullcap |
| <i>Solanum dulcamara</i> | Solanaceae | SOLDUL | non-native | 0 | 0 | vine | perennial | bittersweet nightshade |
| <i>Solidago canadensis</i> | Asteraceae | SOLCAN | native | 1 | 3 | forb | perennial | canada goldenrod |
| <i>Solidago gigantea</i> | Asteraceae | SOLGIG | native | 3 | -3 | forb | perennial | late goldenrod |
| <i>Solidago ohioensis</i> | Asteraceae | SOLOHI | native | 8 | -5 | forb | perennial | ohio goldenrod |
| <i>Solidago rugosa</i> | 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 |
| <i>Sparganium emersum</i> ; <i>s. chlorocarpum</i> | Typhaceae | SPAEME | native | 6 | -5 | forb | perennial | green-fruited bur-reed |
| <i>Sparganium eurycarpum</i> | Typhaceae | SPAEUR | native | 5 | -5 | forb | perennial | common bur-reed |
| <i>Spiraea alba</i> | Rosaceae | SPIALB | native | 4 | -3 | shrub | perennial | meadowsweet |
| <i>Symphotrichum boreale</i> ; <i>aster b.</i> | Asteraceae | SYMBOR | native | 9 | -5 | forb | perennial | northern bog aster |
| <i>Symphotrichum firmum</i> ; <i>aster puniceus</i> | Asteraceae | SYMFIR | native | 4 | -3 | forb | perennial | smooth swamp aster |
| <i>Symphotrichum lanceolatum</i> ; <i>aster l.</i> | Asteraceae | SYMLAN | native | 2 | -3 | forb | perennial | panicked aster |
| <i>Symphotrichum lateriflorum</i> ; <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | forb | perennial | calico aster |
| <i>Symphotrichum puniceum</i> ; <i>aster p.</i> | Asteraceae | SYMPUN | native | 5 | -5 | forb | perennial | swamp aster |
| <i>Thalictrum dasycarpum</i> | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Triadenum fraseri</i> | Hypericaceae | TRIFRA | native | 6 | -5 | forb | perennial | marsh st. johns-wort |
| <i>Trichophorum alpinum</i> ; <i>scirpus hudsonianus</i> | Cyperaceae | TRIALP | native | 10 | -5 | sedge | perennial | bulrush |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Triglochin maritima</i> | Juncaginaceae | TRIMAR | native | 8 | -5 | forb | perennial | common bog arrow-grass |
| <i>Typha angustifolia</i> | Typhaceae | TYPANG | non-native | 0 | -5 | forb | perennial | narrow-leaved cat-tail |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| <i>Utricularia intermedia</i> | Lentibulariaceae | UTRINT | native | 10 | -5 | forb | perennial | flat-leaved bladderwort |
| <i>Utricularia vulgaris</i> | Lentibulariaceae | UTRVUL | native | 6 | -5 | forb | perennial | common bladderwort |
| <i>Vitis riparia</i> | 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 2014

Year:

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 | | | Physognomy Metrics: | |
| % C value 7-10: | 31.2 | Physiognomy Metrics: | | Sedge: | 29 17.10% |
| Native Tree Mean C: | 3.7 | Tree: | 10 5.90% | Rush: | 0 0% |
| Native Shrub Mean C: | 5.9 | Shrub: | 21 12.40% | Fern: | 9 5.30% |
| Native Herbaceous Mean C: | 5.5 | Vine: | 3 1.80% | Bryophyte: | 0 0% |
| | | Forb: | 82 48.20% | | |
| | | Grass: | 16 9.40% | | |

Species:

Grass River Natural Area 2017: Northern Fen

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|----------------|---------|---------|----|----|-------------|-----------|-------------------------|
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Agalinis purpurea</i> | Orobanchaceae | AGAPUR | native | 7 | -3 | forb | annual | purple false foxglove |
| <i>Agrostis scabra; a. hyemalis</i> | Poaceae | AGRSCA | native | 4 | 0 | grass | perennial | ticklegass |
| <i>Alnus incana; a. rugosa</i> | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| <i>Andromeda glaucophylla</i> | Ericaceae | ANDGLA | native | 10 | -5 | shrub | perennial | bog-rosemary |
| <i>Anemone canadensis</i> | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| <i>Antennaria howellii</i> | Asteraceae | ANTHOW | native | 2 | 5 | forb | perennial | small pussytoes |
| <i>Apocynum cannabinum; a. sibiricum</i> | Apocynaceae | APOCAN | native | 3 | 0 | forb | perennial | indian-hemp |
| <i>Artemisia campestris</i> | Asteraceae | ARTCAM | native | 5 | 5 | forb | biennial | wormwood |
| <i>Asclepias incarnata</i> | Apocynaceae | ASCINC | native | 6 | -5 | forb | perennial | swamp milkweed |
| <i>Asclepias syriaca</i> | Apocynaceae | ASCSYR | native | 1 | 5 | forb | perennial | common milkweed |
| <i>Betula alleghaniensis</i> | Betulaceae | BETALL | native | 7 | 0 | tree | perennial | yellow birch |
| <i>Betula papyrifera</i> | Betulaceae | BETPAP | native | 2 | 3 | tree | perennial | paper birch |
| <i>Bidens comosa</i> | Asteraceae | BIDCOM | native | 5 | -3 | forb | annual | swamp tickseed |
| <i>Boehmeria cylindrica</i> | Urticaceae | BOECYL | native | 5 | -5 | forb | perennial | false nettle |
| <i>Bromus ciliatus</i> | Poaceae | BROCIL | native | 6 | -3 | grass | perennial | fringed brome |
| <i>Calamagrostis canadensis</i> | Poaceae | CALCAN | native | 3 | -5 | grass | perennial | blue-joint |
| <i>Calamagrostis stricta; c. inexpansa; c. lacustris</i> | Poaceae | CALSTR | native | 10 | -3 | grass | perennial | narrow-leaved reedgrass |
| <i>Calopogon tuberosus</i> | Orchidaceae | CALTUB | native | 9 | -5 | forb | perennial | grass-pink |
| <i>Caltha palustris</i> | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| <i>Calystegia sepium</i> | Convolvulaceae | CALSEP | native | 2 | 0 | vine | perennial | hedge bindweed |
| <i>Campanula aparinoides</i> | Campanulaceae | CAMAPA | native | 7 | -5 | forb | perennial | marsh bellflower |
| <i>Carex aquatilis</i> | Cyperaceae | CXAQUA | native | 7 | -5 | sedge | perennial | sedge |
| <i>Carex buxbaumii</i> | Cyperaceae | CXBUXB | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex comosa</i> | Cyperaceae | CXCOMO | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex diandra</i> | Cyperaceae | CXDIAN | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex eburnea</i> | Cyperaceae | CXEBCUR | native | 7 | 3 | sedge | perennial | sedge |
| <i>Carex exilis</i> | Cyperaceae | CXEXIL | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex hystericina</i> | Cyperaceae | CXHYST | native | 2 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex lasiocarpa</i> | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex prairea</i> | Cyperaceae | CXPRAI | native | 10 | -3 | sedge | perennial | sedge |
| <i>Carex pseudo-cyperus</i> | 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 |
|---|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------------|
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex trisperma</i> | Cyperaceae | CXTRIS | native | 9 | -5 | sedge | perennial | sedge |
| <i>Carex utriculata; c. rostrata</i> | Cyperaceae | CXUTRI | native | 5 | -5 | sedge | perennial | sedge |
| <i>Chamaedaphne calyculata</i> | Ericaceae | CHACAL | native | 8 | -5 | shrub | perennial | leatherleaf |
| <i>Cicuta bulbifera</i> | Apiaceae | CICBUL | native | 5 | -5 | forb | perennial | water hemlock |
| <i>Cirsium muticum</i> | Asteraceae | CIRMUT | native | 6 | -5 | forb | biennial | swamp thistle |
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Cladium mariscoides</i> | Cyperaceae | CLAMAR | native | 10 | -5 | sedge | perennial | twig-rush |
| <i>Comarum palustre; potentilla p.</i> | Rosaceae | COMPAL | native | 7 | -5 | forb | perennial | marsh cinquefoil |
| <i>Cornus amomum</i> | Cornaceae | CORAMO | native | 2 | -3 | shrub | perennial | silky dogwood |
| <i>Cornus canadensis</i> | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| <i>Cornus sericea; c. stolonifera</i> | Cornaceae | CORSER | native | 2 | -3 | shrub | perennial | red-osier |
| <i>Cypripedium parviflorum; c. calceolus</i> | Orchidaceae | CYPPAR | native | 5 | 0 | forb | perennial | yellow lady-slipper |
| <i>Cypripedium reginae</i> | Orchidaceae | CYPREG | native | 9 | -3 | forb | perennial | showy or queens lady-slipper |
| <i>Danthonia spicata</i> | Poaceae | DANSPI | native | 4 | 5 | grass | perennial | poverty grass; oatgrass |
| <i>Dasiphora fruticosa; potentilla f.</i> | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| <i>Decodon verticillatus</i> | Lythraceae | DECVER | native | 7 | -5 | shrub | perennial | whorled or swamp loosestrife |
| <i>Dichanthelium depauperatum; panicum d.</i> | Poaceae | DICDEP | native | 4 | 5 | grass | perennial | panic grass |
| <i>Dichanthelium implicatum; panicum i.</i> | Poaceae | DICIMP | native | 3 | 0 | grass | perennial | panic grass |
| <i>Drosera rotundifolia</i> | Droseraceae | DROROT | native | 6 | -5 | forb | perennial | round-leaved sundew |
| <i>Dryopteris cristata</i> | Dryopteridaceae | DRYCRI | native | 6 | -5 | fern | perennial | crested shield fern |
| <i>Dulichium arundinaceum</i> | Cyperaceae | DULARU | native | 8 | -5 | sedge | perennial | three-way sedge |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Eleocharis elliptica</i> | Cyperaceae | ELEELL | native | 6 | -5 | sedge | perennial | golden-seeded spike rush |
| <i>Eleocharis erythropoda</i> | Cyperaceae | ELEERY | native | 4 | -5 | sedge | perennial | spike-rush |
| <i>Eleocharis palustris; e. smallii</i> | Cyperaceae | ELEPAL | native | 5 | -5 | sedge | perennial | spike-rush |
| <i>Elymus trachycaulus; agropyron t.</i> | Poaceae | ELYTRA | native | 8 | 3 | grass | perennial | slender wheatgrass |
| <i>Epilobium palustre</i> | Onagraceae | EPIPAL | native | 10 | -5 | forb | perennial | marsh willow-herb |
| <i>Equisetum arvense</i> | Equisetaceae | EQUARV | native | 0 | 0 | fern | perennial | common horsetail |
| <i>Equisetum fluviatile</i> | Equisetaceae | EQUFLU | native | 7 | -5 | fern | perennial | water horsetail |
| <i>Equisetum hyemale</i> | Equisetaceae | EQUHYE | native | 2 | 0 | fern | perennial | scouring rush |
| <i>Equisetum palustre</i> | 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 |
|--|---------------|----------------|----------------|----------|----------|--------------------|-----------------|---------------------------|
| <i>Eriophorum viridi-carinatum</i> | Cyperaceae | ERIVID | native | 8 | -5 | sedge | perennial | green-keeled cotton-grass |
| <i>Erythronium americanum</i> | Liliaceae | ERYAME | native | 5 | 5 | forb | perennial | yellow trout lily |
| <i>Eupatorium perfoliatum</i> | Asteraceae | EUPPER | native | 4 | -3 | forb | perennial | boneset |
| <i>Eutrochium maculatum</i> ; <i>eupatorium m.</i> | Asteraceae | EUTMAC | native | 4 | -5 | forb | perennial | joe-pye-weed |
| <i>Fragaria virginiana</i> | Rosaceae | FRAVIR | native | 2 | 3 | forb | perennial | wild strawberry |
| <i>Galium labradoricum</i> | Rubiaceae | GALLAB | native | 8 | -5 | forb | perennial | bog bedstraw |
| <i>Gaultheria hispidula</i> | Ericaceae | GAUHIS | native | 8 | -3 | shrub | perennial | creeping-snowberry |
| <i>Geum rivale</i> | Rosaceae | GEURIV | native | 7 | -5 | forb | perennial | purple avens |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Hieracium aurantiacum</i> | Asteraceae | HIEAUR | non-native | 0 | 5 | forb | perennial | orange hawkweed |
| <i>Hieracium caespitosum</i> | Asteraceae | HIECAE | non-native | 0 | 5 | forb | perennial | king devil |
| <i>Hieracium piloselloides</i> | Asteraceae | HIEPIS | non-native | 0 | 5 | forb | perennial | king devil |
| <i>Hypericum kalmianum</i> | Hypericaceae | HYPKAL | native | 10 | -3 | shrub | perennial | kalms st. johns-wort |
| <i>Impatiens capensis</i> | Balsaminaceae | IMPCAP | native | 2 | -3 | forb | annual | spotted touch-me-not |
| <i>Iris pseudacorus</i> | Iridaceae | IRIPSE | non-native | 0 | -5 | forb | perennial | yellow flag |
| <i>Iris virginica</i> | Iridaceae | IRIVIR | native | 5 | -5 | forb | perennial | southern blue flag |
| <i>Larix laricina</i> | Pinaceae | LARLAR | native | 5 | -3 | tree | perennial | tamarack |
| <i>Lathyrus palustris</i> | Fabaceae | LATPAL | native | 7 | -3 | vine | perennial | marsh pea |
| <i>Leucanthemum vulgare</i> ; <i>chrysanthemum leucanthemum</i> | Asteraceae | LEUVUL | non-native | 0 | 5 | forb | perennial | ox-eye daisy |
| <i>Lilium philadelphicum</i> | Liliaceae | LILPHI | native | 7 | 0 | forb | perennial | wood lily |
| <i>Linnaea borealis</i> | Linnaeaceae | LINBOR | native | 6 | 0 | forb | perennial | twinflower |
| <i>Lobelia cardinalis</i> | Campanulaceae | LOBCAR | native | 7 | -5 | forb | perennial | cardinal-flower |
| <i>Lobelia kalmii</i> | Campanulaceae | LOBKAL | native | 10 | -5 | forb | perennial | bog lobelia |
| <i>Lycopus americanus</i> | Lamiaceae | LYCAME | native | 2 | -5 | forb | perennial | common water horehound |
| <i>Lycopus uniflorus</i> | Lamiaceae | LYCUNI | native | 2 | -5 | forb | perennial | northern bugle weed |
| <i>Lysimachia quadriflora</i> | Myrsinaceae | LYSQUR | native | 10 | -5 | forb | perennial | whorled loosestrife |
| <i>Lysimachia thyrsoiflora</i> | Myrsinaceae | LYSTHY | native | 6 | -5 | forb | perennial | tufted loosestrife |
| <i>Mentha canadensis</i> ; <i>m. arvensis</i> | Lamiaceae | MENCAS | native | 3 | -3 | forb | perennial | wild mint |
| <i>Menyanthes trifoliata</i> | Menyanthaceae | MENTRI | native | 8 | -5 | forb | perennial | buckbean |
| <i>Muhlenbergia glomerata</i> | Poaceae | MUHGLO | native | 10 | -5 | grass | perennial | marsh wild-timothy |
| <i>Myrica gale</i> | Myricaceae | MYRGAL | native | 6 | -5 | shrub | perennial | sweet gale |
| <i>Nuphar variegata</i> | Nymphaeaceae | NUPVAR | native | 7 | -5 | forb | perennial | yellow pond-lily |
| <i>Nymphaea odorata</i> | Nymphaeaceae | NYMODO | native | 6 | -5 | forb | perennial | sweet-scented waterlily |
| <i>Onoclea sensibilis</i> | Onocleaceae | ONosen | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Osmunda cinnamomea</i> | Osmundaceae | OSMCIN | native | 5 | -3 | fern | perennial | cinnamon fern |
| <i>Osmunda regalis</i> | 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 |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|--------------------------|
| <i>Parnassia glauca</i> | Parnassiaceae | PARGLA | native | 8 | -5 | forb | perennial | grass-of-parnassus |
| <i>Phalaris arundinacea</i> | Poaceae | PHAARU | native | 0 | -3 | grass | perennial | reed canary grass |
| <i>Phleum pratense</i> | Poaceae | PHLPRA | non-native | 0 | 3 | grass | perennial | timothy |
| <i>Phragmites australis</i> var. <i>americanus</i> | Poaceae | PHRAUM | native | 5 | -3 | grass | perennial | reed |
| <i>Picea mariana</i> | Pinaceae | PICMAR | native | 6 | -3 | tree | perennial | black spruce |
| <i>Pinus resinosa</i> | Pinaceae | PINRES | native | 6 | 3 | tree | perennial | red pine |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| <i>Platanthera huronensis</i> ; <i>habenaria hyperborea</i> | Orchidaceae | PLAHUR | native | 5 | -3 | forb | perennial | lake huron green orchid |
| <i>Platanthera psycodes</i> ; <i>habenaria</i> <i>p.</i> | Orchidaceae | PLAPSY | native | 7 | -3 | forb | perennial | purple fringed orchid |
| <i>Poa compressa</i> | Poaceae | POACOM | non-native | 0 | 3 | grass | perennial | canada bluegrass |
| <i>Poa palustris</i> | Poaceae | POAPAS | native | 3 | -3 | grass | perennial | fowl meadow grass |
| <i>Poa pratensis</i> | Poaceae | POAPRA | non-native | 0 | 3 | grass | perennial | kentucky bluegrass |
| <i>Pogonia ophioglossoides</i> | Orchidaceae | POGOPH | native | 10 | -5 | forb | perennial | rose pogonia |
| <i>Pontederia cordata</i> | Pontederiaceae | PONCOR | native | 8 | -5 | forb | perennial | pickerel-weed |
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Potamogeton natans</i> | Potamogetonaceae | POTNAT | native | 5 | -5 | forb | perennial | pondweed |
| <i>Potentilla anserina</i> | Rosaceae | POTANS | native | 5 | -3 | forb | perennial | silverweed |
| <i>Proserpinaca palustris</i> | Haloragaceae | PROPAL | native | 6 | -5 | forb | perennial | mermaid-weed |
| <i>Ranunculus acris</i> | Ranunculaceae | RANACR | non-native | 0 | 0 | forb | perennial | tall or common buttercup |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Rhododendron groenlandicum</i> ; <i>ledum</i> g. | Ericaceae | RHOGRO | native | 8 | -5 | shrub | perennial | labrador-tea |
| <i>Rhynchospora alba</i> | Cyperaceae | RHYALB | native | 6 | -5 | sedge | perennial | beak-rush |
| <i>Rhynchospora capillacea</i> | Cyperaceae | RHYCAL | native | 10 | -5 | sedge | perennial | beak-rush |
| <i>Rosa palustris</i> | Rosaceae | ROSPAL | native | 5 | -5 | shrub | perennial | swamp rose |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Rudbeckia hirta</i> | Asteraceae | RUDHIR | native | 1 | 3 | forb | perennial | black-eyed susan |
| <i>Rumex acetosella</i> | Polygonaceae | RUMACL | non-native | 0 | 3 | forb | perennial | sheep sorrel |
| <i>Sagittaria latifolia</i> | Alismataceae | SAGLAT | native | 4 | -5 | forb | perennial | common arrowhead |
| <i>Salix discolor</i> | Salicaceae | SALDIS | native | 1 | -3 | shrub | perennial | pussy willow |
| <i>Salix petiolaris</i> | Salicaceae | SALPET | native | 1 | -3 | shrub | perennial | slender willow |
| <i>Sarracenia purpurea</i> | Sarraceniaceae | SARPUR | native | 10 | -5 | forb | perennial | pitcher-plant |
| <i>Schoenoplectus acutus</i> ; <i>scirpus</i> <i>a.</i> | 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 |
|--|------------------|---------|------------|----|----|-------------|-----------|-------------------------|
| <i>Schoenoplectus pungens</i> ; <i>scirpus americanus</i> | Cyperaceae | SCHPUN | native | 5 | -5 | sedge | perennial | threesquare |
| <i>Schoenoplectus tabernaemontani</i> ; <i>scirpus validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Scirpus atrovirens</i> | Cyperaceae | SCIATV | native | 3 | -5 | sedge | perennial | bulrush |
| <i>Scutellaria galericulata</i> | Lamiaceae | SCUGAL | native | 5 | -5 | forb | perennial | marsh skullcap |
| <i>Solidago canadensis</i> | Asteraceae | SOLCAN | native | 1 | 3 | forb | perennial | canada goldenrod |
| <i>Solidago gigantea</i> | Asteraceae | SOLGIG | native | 3 | -3 | forb | perennial | late goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Solidago uliginosa</i> | Asteraceae | SOLULI | native | 4 | -5 | forb | perennial | bog goldenrod |
| <i>Sparganium eurycarpum</i> | Typhaceae | SPAEUR | native | 5 | -5 | forb | perennial | common bur-reed |
| <i>Spiranthes cernua</i> | Orchidaceae | SPICER | native | 4 | -3 | forb | perennial | nodding ladies-tresses |
| <i>Stellaria media</i> | Caryophyllaceae | STEMED | non-native | 0 | 3 | forb | annual | common chickweed |
| <i>Symphotrichum boreale</i> ; <i>aster b.</i> | Asteraceae | SYMBOR | native | 9 | -5 | forb | perennial | northern bog aster |
| <i>Symphotrichum lanceolatum</i> ; <i>aster l.</i> | Asteraceae | SYMLAN | native | 2 | -3 | forb | perennial | panicled aster |
| <i>Symphotrichum lateriflorum</i> ; <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | forb | perennial | calico aster |
| <i>Symphotrichum puniceum</i> ; <i>aster p.</i> | Asteraceae | SYMPUN | native | 5 | -5 | forb | perennial | swamp aster |
| <i>Thalictrum dasycarpum</i> | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Triadenum fraseri</i> | Hypericaceae | TRIFRA | native | 6 | -5 | forb | perennial | marsh st. johns-wort |
| <i>Trichophorum alpinum</i> ; <i>scirpus hudsonianus</i> | Cyperaceae | TRIALP | native | 10 | -5 | sedge | perennial | bulrush |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Triglochin maritima</i> | Juncaginaceae | TRIMAR | native | 8 | -5 | forb | perennial | common bog arrow-grass |
| <i>Typha angustifolia</i> | Typhaceae | TYPANG | non-native | 0 | -5 | forb | perennial | narrow-leaved cat-tail |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| <i>Utricularia cornuta</i> | Lentibulariaceae | UTRCOR | native | 10 | -5 | forb | perennial | horned bladderwort |
| <i>Utricularia intermedia</i> | Lentibulariaceae | UTRINT | native | 10 | -5 | forb | perennial | flat-leaved bladderwort |
| <i>Utricularia minor</i> | Lentibulariaceae | UTRMIN | native | 10 | -5 | forb | perennial | small bladderwort |
| <i>Utricularia vulgaris</i> | 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 |
|-------------------------------|---------------|----------------|----------------|----------|----------|--------------------|-----------------|--------------------|
| <i>Vaccinium myrtilloides</i> | Ericaceae | VACMYR | native | 4 | -3 | shrub | perennial | canada blueberry |
| <i>Vaccinium oxycoccos</i> | Ericaceae | VACOXY | native | 8 | -5 | shrub | perennial | small cranberry |
| <i>Verbena hastata</i> | Verbenaceae | VERHAS | native | 4 | -3 | forb | perennial | blue vervain |
| <i>Vitis riparia</i> | 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: 2014

Year:

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 | | Physiognomy Metrics: |
| % C value 7-10: 26.9 | Physiognomy Metrics: | Sedge: 5 19.20% |
| Native Tree Mean C: 6.0 | Tree: 1 3.80% | Rush: 0 0% |
| Native Shrub Mean C: 7.0 | Shrub: 5 19.20% | Fern: 3 11.50% |
| Native Herbaceous Mean C: 4.9 | Vine: 1 3.80% | Bryophyte: 0 0% |
| | Forb: 11 42.30% | |
| | Grass: 0 0% | |

Species:

Grass River Natural Area 2017: Northern Shrub Thicket

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Anemone canadensis</i> | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| <i>Carex buxbaumii</i> | Cyperaceae | CXBUXB | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex diandra</i> | Cyperaceae | CXDIAN | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Conyza canadensis</i> | Asteraceae | CONCAN | native | 0 | 3 | forb | annual | horseweed |
| <i>Dulichium arundinaceum</i> | Cyperaceae | DULARU | native | 8 | -5 | sedge | perennial | three-way sedge |
| <i>Euphorbia virgata; e. esula</i> | Euphorbiaceae | EUPVIR | non-native | 0 | 5 | forb | perennial | leafy spurge |
| <i>Eutrochium maculatum; eupatorium m.</i> | Asteraceae | EUTMAC | native | 4 | -5 | forb | perennial | joe-pye-weed |
| <i>Fraxinus nigra</i> | Oleaceae | FRANIG | native | 6 | -3 | tree | perennial | black ash |
| <i>Hypericum kalmianum</i> | Hypericaceae | HYPKAL | native | 10 | -3 | shrub | perennial | kalms st. johns-wort |
| <i>Iris virginica</i> | Iridaceae | IRIVIR | native | 5 | -5 | forb | perennial | southern blue flag |
| <i>Menyanthes trifoliata</i> | Menyanthaceae | MENTRI | native | 8 | -5 | forb | perennial | buckbean |
| <i>Mimulus ringens</i> | Phrymaceae | MIMRIN | native | 5 | -5 | forb | perennial | monkey-flower |
| <i>Nuphar variegata</i> | Nymphaeaceae | NUPVAR | native | 7 | -5 | forb | perennial | yellow pond-lily |
| <i>Onoclea sensibilis</i> | Onocleaceae | ONOSEN | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Osmunda regalis</i> | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |
| <i>Persicaria hydropiperoides; polygonum h.</i> | Polygonaceae | PERHYS | native | 5 | -5 | forb | perennial | mild water-pepper |
| <i>Potentilla anserina</i> | Rosaceae | POTANS | native | 5 | -3 | forb | perennial | silverweed |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Ribes hirtellum</i> | Grossulariaceae | RIBHIR | native | 6 | -3 | shrub | perennial | swamp gooseberry |
| <i>Rosa palustris</i> | Rosaceae | ROSPAL | native | 5 | -5 | shrub | perennial | swamp rose |
| <i>Schoenoplectus tabernaemontani; scirpus validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Sparganium eurycarpum</i> | Typhaceae | SPAEUR | native | 5 | -5 | forb | perennial | common bur-reed |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Vitis riparia</i> | 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 2014

Year:

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 occurring 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 | | Physiognomy Metrics: |
| % C value 7-10: 36.9 | Physiognomy Metrics: | Sedge: 10 15.40% |
| Native Tree Mean C: 3.8 | Tree: 5 7.70% | Rush: 0 0% |
| Native Shrub Mean C: 6.5 | Shrub: 16 24.60% | Fern: 2 3.10% |
| Native Herbaceous Mean C: 5.8 | Vine: 1 1.50% | Bryophyte: 0 0% |
| | Forb: 29 44.60% | |
| | Grass: 2 3.10% | |

Species:

Grass River Natural Area 2017: Poor Conifer Swamp

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|---------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------------|
| <i>Abies balsamea</i> | Pinaceae | ABIBAL | native | 3 | 0 | tree | perennial | balsam fir |
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Andromeda glaucophylla</i> | Ericaceae | ANDGLA | native | 10 | -5 | shrub | perennial | bog-rosemary |
| <i>Asclepias incarnata</i> | Apocynaceae | ASCINC | native | 6 | -5 | forb | perennial | swamp milkweed |
| <i>Bromus ciliatus</i> | Poaceae | BROCIL | native | 6 | -3 | grass | perennial | fringed brome |
| <i>Calopogon tuberosus</i> | Orchidaceae | CALTUB | native | 9 | -5 | forb | perennial | grass-pink |
| <i>Caltha palustris</i> | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex hystericina</i> | Cyperaceae | CXHYST | native | 2 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex lasiocarpa</i> | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex prairea</i> | Cyperaceae | CXPRAI | native | 10 | -3 | sedge | perennial | sedge |
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex trisperma</i> | Cyperaceae | CXTRIS | native | 9 | -5 | sedge | perennial | sedge |
| <i>Chamaedaphne calyculata</i> | Ericaceae | CHACAL | native | 8 | -5 | shrub | perennial | leatherleaf |
| <i>Comarum palustre; potentilla p.</i> | Rosaceae | COMPAL | native | 7 | -5 | forb | perennial | marsh cinquefoil |
| <i>Cornus canadensis</i> | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| <i>Cypripedium reginae</i> | Orchidaceae | CYPREG | native | 9 | -3 | forb | perennial | showy or queens lady-slipper |
| <i>Dasiphora fruticosa; potentilla f.</i> | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| <i>Decodon verticillatus</i> | Lythraceae | DECVER | native | 7 | -5 | shrub | perennial | whorled or swamp loosestrife |
| <i>Drosera rotundifolia</i> | Droseraceae | DROROT | native | 6 | -5 | forb | perennial | round-leaved sundew |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Eriophorum viridi-carinatum</i> | Cyperaceae | ERIVID | native | 8 | -5 | sedge | perennial | green-keeled cotton-grass |
| <i>Erythronium americanum</i> | Liliaceae | ERYAME | native | 5 | 5 | forb | perennial | yellow trout lily |
| <i>Eupatorium perfoliatum</i> | Asteraceae | EUPPER | native | 4 | -3 | forb | perennial | boneset |
| <i>Eutrochium maculatum; eupatorium m.</i> | Asteraceae | EUTMAC | native | 4 | -5 | forb | perennial | joe-pye-weed |
| <i>Galium labradoricum</i> | Rubiaceae | GALLAB | native | 8 | -5 | forb | perennial | bog bedstraw |
| <i>Gaultheria hispidula</i> | Ericaceae | GAUHIS | native | 8 | -3 | shrub | perennial | creeping-snowberry |
| <i>Gaultheria procumbens</i> | Ericaceae | GAUPRO | native | 5 | 3 | shrub | perennial | wintergreen |
| <i>Gaylussacia baccata</i> | Ericaceae | GAYBAC | native | 7 | 3 | shrub | perennial | huckleberry |
| <i>Geum rivale</i> | Rosaceae | GEURIV | native | 7 | -5 | forb | perennial | purple avens |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Larix laricina</i> | 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 |
|---|------------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Lathyrus palustris</i> | Fabaceae | LATPAL | native | 7 | -3 | vine | perennial | marsh pea |
| <i>Lilium philadelphicum</i> | Liliaceae | LILPHI | native | 7 | 0 | forb | perennial | wood lily |
| <i>Linnaea borealis</i> | Linnaeaceae | LINBOR | native | 6 | 0 | forb | perennial | twinflower |
| <i>Lobelia kalmii</i> | Campanulaceae | LOBKAL | native | 10 | -5 | forb | perennial | bog lobelia |
| <i>Lysimachia thysiflora</i> | Myrsinaceae | LYSTHY | native | 6 | -5 | forb | perennial | tufted loosestrife |
| <i>Maianthemum canadense</i> | Convallariaceae | MAICAN | native | 4 | 3 | forb | perennial | canada mayflower |
| <i>Menyanthes trifoliata</i> | Menyanthaceae | MENTRI | native | 8 | -5 | forb | perennial | buckbean |
| <i>Mitchella repens</i> | Rubiaceae | MITREP | native | 5 | 3 | forb | perennial | partridge-berry |
| <i>Myrica gale</i> | Myricaceae | MYRGAL | native | 6 | -5 | shrub | perennial | sweet gale |
| <i>Osmunda regalis</i> | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |
| <i>Parnassia glauca</i> | Parnassiaceae | PARGLA | native | 8 | -5 | forb | perennial | grass-of-parnassus |
| <i>Picea mariana</i> | Pinaceae | PICMAR | native | 6 | -3 | tree | perennial | black spruce |
| <i>Rhododendron groenlandicum;</i> <i>ledum g.</i> | Ericaceae | RHOGRO | native | 8 | -5 | shrub | perennial | labrador-tea |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Sarracenia purpurea</i> | Sarraceniaceae | SARPUR | native | 10 | -5 | forb | perennial | pitcher-plant |
| <i>Scirpus cyperinus</i> | Cyperaceae | SCICYP | native | 5 | -5 | sedge | perennial | wool-grass |
| <i>Solidago ohioensis</i> | Asteraceae | SOLOHI | native | 8 | -5 | forb | perennial | ohio goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Solidago uliginosa</i> | Asteraceae | SOLULI | native | 4 | -5 | forb | perennial | bog goldenrod |
| <i>Symphotrichum lateriflorum;</i> <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | forb | perennial | calico aster |
| <i>Symphotrichum puniceum;</i> <i>aster p.</i> | Asteraceae | SYMPUN | native | 5 | -5 | forb | perennial | swamp aster |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Toxicodendron rydbergii; t.</i> <i>radicans</i> | Anacardiaceae | TOXRYD | native | 3 | 0 | shrub | perennial | poison-ivy |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| <i>Vaccinium myrtilloides</i> | Ericaceae | VACMYR | native | 4 | -3 | shrub | perennial | canada blueberry |
| <i>Vaccinium oxycoccos</i> | Ericaceae | VACOXY | native | 8 | -5 | shrub | perennial | small cranberry |
| <i>Verbena hastata</i> | 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: 2014

Year:

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 | | | Physiognomy Metrics: | |
| % C value 7-10: | 25.1 | Physiognomy Metrics: | | Sedge: | 29 14.00% |
| Native Tree Mean C: | 3.9 | Tree: | 16 7.70% | Rush: | 0 0% |
| Native Shrub Mean C: | 6.0 | Shrub: | 32 15.50% | Fern: | 17 8.20% |
| Native Herbaceous Mean C: | 5.1 | Vine: | 7 3.40% | Bryophyte: | 0 0% |
| | | Forb: | 95 45.90% | | |
| | | Grass: | 11 5.30% | | |

Species:

Grass River Natural Area 2017: Rich Conifer Swamp

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|-------------------------|
| <i>Abies balsamea</i> | Pinaceae | ABIBAL | native | 3 | 0 | tree | perennial | balsam fir |
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Adiantum pedatum</i> | Pteridaceae | ADIPEP | native | 6 | 3 | fern | perennial | maidenhair fern |
| <i>Agrostis perennans</i> | Poaceae | AGRPER | native | 5 | 3 | grass | perennial | autumn bent |
| <i>Alliaria petiolata</i> | Brassicaceae | ALLPET | non-native | 0 | 3 | forb | biennial | garlic mustard |
| <i>Alnus incana; a. rugosa</i> | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| <i>Anaphalis margaritacea</i> | Asteraceae | ANAMAR | native | 3 | 5 | forb | perennial | pearly everlasting |
| <i>Andromeda glaucophylla</i> | Ericaceae | ANDGLA | native | 10 | -5 | shrub | perennial | bog-rosemary |
| <i>Anemone canadensis</i> | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| <i>Apocynum cannabinum; a. sibiricum</i> | Apocynaceae | APOCAN | native | 3 | 0 | forb | perennial | indian-hemp |
| <i>Aralia nudicaulis</i> | Araliaceae | ARANUD | native | 5 | 3 | forb | perennial | wild sarsaparilla |
| <i>Arethusa bulbosa</i> | Orchidaceae | AREBUL | native | 10 | -5 | forb | perennial | dragons mouth |
| <i>Arisaema triphyllum</i> | Araceae | ARITRI | native | 5 | 0 | forb | perennial | jack-in-the-pulpit |
| <i>Asclepias incarnata</i> | Apocynaceae | ASCINC | native | 6 | -5 | forb | perennial | swamp milkweed |
| <i>Asclepias syriaca</i> | Apocynaceae | ASCSYR | native | 1 | 5 | forb | perennial | common milkweed |
| <i>Athyrium filix-femina</i> | Athyriaceae | ATHFIL | native | 4 | 0 | fern | perennial | lady fern |
| <i>Berberis thunbergii</i> | Berberidaceae | BERTHU | non-native | 0 | 3 | shrub | perennial | japanese barberry |
| <i>Betula alleghaniensis</i> | Betulaceae | BETALL | native | 7 | 0 | tree | perennial | yellow birch |
| <i>Betula papyrifera</i> | Betulaceae | BETPAP | native | 2 | 3 | tree | perennial | paper birch |
| <i>Bidens comosa</i> | Asteraceae | BIDCOM | native | 5 | -3 | forb | annual | swamp tickseed |
| <i>Bidens frondosa</i> | Asteraceae | BIDFRO | native | 1 | -3 | forb | annual | common beggar-ticks |
| <i>Boehmeria cylindrica</i> | Urticaceae | BOECYL | native | 5 | -5 | forb | perennial | false nettle |
| <i>Botrypus virginianus</i> | Ophioglossaceae | BOTVIR | native | 5 | 3 | fern | perennial | rattlesnake fern |
| <i>Bromus ciliatus</i> | Poaceae | BROCIL | native | 6 | -3 | grass | perennial | fringed brome |
| <i>Calamagrostis canadensis</i> | Poaceae | CALCAN | native | 3 | -5 | grass | perennial | blue-joint |
| <i>Calamagrostis stricta; c. inexpansa; c. lacustris</i> | Poaceae | CALSTR | native | 10 | -3 | grass | perennial | narrow-leaved reedgrass |
| <i>Caltha palustris</i> | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| <i>Campanula aparinoides</i> | Campanulaceae | CAMAPA | native | 7 | -5 | forb | perennial | marsh bellflower |
| <i>Cardamine bulbosa</i> | Brassicaceae | CARBUL | native | 4 | -5 | forb | perennial | spring cress |
| <i>Carex arctata</i> | Cyperaceae | CXARTT | native | 3 | 5 | sedge | perennial | sedge |
| <i>Carex aurea</i> | Cyperaceae | CXAURE | native | 3 | -3 | sedge | perennial | sedge |
| <i>Carex bebbii</i> | Cyperaceae | CXBEBB | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex brunnescens</i> | Cyperaceae | CXBRUN | native | 5 | -3 | sedge | perennial | sedge |
| <i>Carex comosa</i> | 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 |
|--|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|--|
| <i>Carex crinita</i> | Cyperaceae | CXCRIN | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex disperma</i> | Cyperaceae | CXDISP | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex eburnea</i> | Cyperaceae | CXEBUR | native | 7 | 3 | sedge | perennial | sedge |
| <i>Carex exilis</i> | Cyperaceae | CXEXIL | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex intumescens</i> | Cyperaceae | CXINTU | native | 3 | -3 | sedge | perennial | sedge |
| <i>Carex lasiocarpa</i> | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex leptoneuria</i> | Cyperaceae | CXLEPO | native | 3 | 0 | sedge | perennial | sedge |
| <i>Carex lupulina</i> | Cyperaceae | CXLUPA | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex merritt-fernaldii</i> | Cyperaceae | CXMERR | native | 4 | 5 | sedge | perennial | sedge |
| <i>Carex pedunculata</i> | Cyperaceae | CXPEDU | native | 5 | 3 | sedge | perennial | sedge |
| <i>Carex pseudo-cyperus</i> | Cyperaceae | CXPSEU | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex stipata</i> | Cyperaceae | CXSTIP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex trisperma</i> | Cyperaceae | CXTRIS | native | 9 | -5 | sedge | perennial | sedge |
| <i>Carex utriculata; c. rostrata</i> | Cyperaceae | CXUTRI | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex vulpinoidea</i> | Cyperaceae | CXVULP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Chamaedaphne calyculata</i> | Ericaceae | CHACAL | native | 8 | -5 | shrub | perennial | leatherleaf |
| <i>Chelone glabra</i> | Plantaginaceae | CHEGLB | native | 7 | -5 | forb | perennial | turtlehead |
| <i>Circaea canadensis; c. lutetiana</i> | Onagraceae | CIRCAN | native | 2 | 3 | forb | perennial | enchanters-nightsshade |
| <i>Cirsium muticum</i> | Asteraceae | CIRMUT | native | 6 | -5 | forb | biennial | swamp thistle |
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Clematis virginiana</i> | Ranunculaceae | CLEVIR | native | 4 | 0 | vine | perennial | virgins bower |
| <i>Clintonia borealis</i> | Convallariaceae | CLIBOR | native | 5 | 0 | forb | perennial | bluebead-lily; corn-lily |
| <i>Comarum palustre; potentilla p.</i> | Rosaceae | COMPAL | native | 7 | -5 | forb | perennial | marsh cinquefoil |
| <i>Coptis trifolia</i> | Ranunculaceae | COPTRI | native | 5 | -3 | forb | perennial | goldthread |
| <i>Corallorhiza trifida</i> | Orchidaceae | CORTRF | native | 6 | -3 | forb | perennial | early coral-root |
| <i>Cornus alternifolia</i> | Cornaceae | CORALT | native | 5 | 3 | tree | perennial | alternate-leaved dogwood |
| <i>Cornus amomum</i> | Cornaceae | CORAMO | native | 2 | -3 | shrub | perennial | silky dogwood |
| <i>Cornus canadensis</i> | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| <i>Cornus sericea; c. stolonifera</i> | Cornaceae | CORSER | native | 2 | -3 | shrub | perennial | red-osier pink lady-slipper; moccasin flower |
| <i>Cypripedium acaule</i> | Orchidaceae | CYPACA | native | 5 | -3 | forb | perennial | flower |
| <i>Cypripedium parviflorum; c. calceolus</i> | 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 |
|--|------------------|---------|------------|----|----|-------------|-----------|------------------------------|
| <i>Cypripedium reginae</i> | Orchidaceae | CYPREG | native | 9 | -3 | forb | perennial | showy or queens lady-slipper |
| <i>Dasiphora fruticosa</i> ; <i>potentilla</i> f. | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| <i>Decodon verticillatus</i> | Lythraceae | DECVER | native | 7 | -5 | shrub | perennial | whorled or swamp loosestrife |
| <i>Dichanthelium implicatum</i> ; <i>panicum</i> i. | Poaceae | DICIMP | native | 3 | 0 | grass | perennial | panic grass |
| <i>Drosera rotundifolia</i> | Droseraceae | DROROT | native | 6 | -5 | forb | perennial | round-leaved sundew |
| <i>Dryopteris clintoniana</i> | Dryopteridaceae | DRYCLI | native | 8 | -3 | fern | perennial | clintons woodfern |
| <i>Dryopteris cristata</i> | Dryopteridaceae | DRYCRI | native | 6 | -5 | fern | perennial | crested shield fern |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Epigaea repens</i> | Ericaceae | EPIREP | native | 7 | 3 | shrub | perennial | trailing-arbutus |
| <i>Epilobium ciliatum</i> | Onagraceae | EPICIL | native | 3 | -3 | forb | perennial | willow-herb |
| <i>Epilobium palustre</i> | Onagraceae | EPIPAL | native | 10 | -5 | forb | perennial | marsh willow-herb |
| <i>Epilobium parviflorum</i> | Onagraceae | EPIPAR | non-native | 0 | -5 | forb | perennial | willow-herb |
| <i>Equisetum fluviatile</i> | Equisetaceae | EQUFLU | native | 7 | -5 | fern | perennial | water horsetail |
| <i>Equisetum palustre</i> | Equisetaceae | EQUPAL | native | 8 | -3 | fern | perennial | marsh scourtail |
| <i>Equisetum scirpoides</i> | Equisetaceae | EQUSCI | native | 7 | 0 | fern | perennial | dwarf scouring rush |
| <i>Equisetum sylvaticum</i> | Equisetaceae | EQUSYL | native | 5 | -3 | fern | perennial | woodland horsetail |
| <i>Eriophorum viridi-carinatum</i> | Cyperaceae | ERIVID | native | 8 | -5 | sedge | perennial | green-keeled cotton-grass |
| <i>Eupatorium perfoliatum</i> | Asteraceae | EUPPER | native | 4 | -3 | forb | perennial | boneset |
| <i>Eutrochium maculatum</i> ; <i>eupatorium</i> m. | Asteraceae | EUTMAC | native | 4 | -5 | forb | perennial | joe-pye-weed |
| <i>Fraxinus americana</i> | Oleaceae | FRAAME | native | 5 | 3 | tree | perennial | white ash |
| <i>Fraxinus nigra</i> | Oleaceae | FRANIG | native | 6 | -3 | tree | perennial | black ash |
| <i>Galium asprellum</i> | Rubiaceae | GALASP | native | 5 | -5 | vine | perennial | rough bedstraw |
| <i>Galium labradoricum</i> | Rubiaceae | GALLAB | native | 8 | -5 | forb | perennial | bog bedstraw |
| <i>Galium tinctorium</i> | Rubiaceae | GALTIN | native | 5 | -5 | forb | perennial | stiff bedstraw |
| <i>Galium triflorum</i> | Rubiaceae | GALTRR | native | 4 | 3 | forb | perennial | fragrant bedstraw |
| <i>Gaultheria hispidula</i> | Ericaceae | GAUHIS | native | 8 | -3 | shrub | perennial | creeping-snowberry |
| <i>Gaultheria procumbens</i> | Ericaceae | GAUPRO | native | 5 | 3 | shrub | perennial | wintergreen |
| <i>Gaylussacia baccata</i> | Ericaceae | GAYBAC | native | 7 | 3 | shrub | perennial | huckleberry |
| <i>Geum rivale</i> | Rosaceae | GEURIV | native | 7 | -5 | forb | perennial | purple avens |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Gymnocarpium dryopteris</i> | Cystopteridaceae | GYMDRY | native | 5 | 3 | fern | perennial | oak fern |
| <i>Hieracium aurantiacum</i> | Asteraceae | HIEAUR | non-native | 0 | 5 | forb | perennial | orange hawkweed |
| <i>Hieracium caespitosum</i> | Asteraceae | HIECAE | non-native | 0 | 5 | forb | perennial | king devil |
| <i>Hydrocotyle americana</i> | 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 |
|--|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|---------------------------|
| <i>Hypericum perforatum</i> | Hypericaceae | HYPPER | non-native | 0 | 5 | forb | perennial | common st. johns-wort |
| <i>Ilex mucronata; nemopanthus m.</i> | Aquifoliaceae | ILEMUC | native | 7 | -5 | shrub | perennial | mountain holly |
| <i>Ilex verticillata</i> | Aquifoliaceae | ILEVER | native | 5 | -3 | shrub | perennial | michigan holly |
| <i>Impatiens capensis</i> | Balsaminaceae | IMPCAP | native | 2 | -3 | forb | annual | spotted touch-me-not |
| <i>Iris pseudacorus</i> | Iridaceae | IRIPSE | non-native | 0 | -5 | forb | perennial | yellow flag |
| <i>Iris virginica</i> | Iridaceae | IRIVIR | native | 5 | -5 | forb | perennial | southern blue flag |
| <i>Larix laricina</i> | Pinaceae | LARLAR | native | 5 | -3 | tree | perennial | tamarack |
| <i>Lathyrus palustris</i> | Fabaceae | LATPAL | native | 7 | -3 | vine | perennial | marsh pea |
| <i>Leersia oryzoides</i> | Poaceae | LEEORY | native | 3 | -5 | grass | perennial | cut grass |
| <i>Lemna minor</i> | Araceae | LEMMIN | native | 5 | -5 | forb | perennial | common duckweed |
| <i>Lilium philadelphicum</i> | Liliaceae | LILPHI | native | 7 | 0 | forb | perennial | wood lily |
| <i>Lindera benzoin</i> | Lauraceae | LINBEN | native | 7 | -3 | shrub | perennial | spicebush |
| <i>Linnaea borealis</i> | Linnaeaceae | LINBOR | native | 6 | 0 | forb | perennial | twinflower |
| <i>Lobelia cardinalis</i> | Campanulaceae | LOBCAR | native | 7 | -5 | forb | perennial | cardinal-flower |
| <i>Lobelia siphilitica</i> | Campanulaceae | LOBSIP | native | 4 | -3 | forb | perennial | great blue lobelia |
| <i>Lonicera dioica</i> | Caprifoliaceae | LONDIO | native | 5 | 3 | vine | perennial | red honeysuckle |
| <i>Lonicera oblongifolia</i> | Caprifoliaceae | LONOBL | native | 8 | -5 | shrub | perennial | swamp fly honeysuckle |
| <i>Lycopus uniflorus</i> | Lamiaceae | LYCUNI | native | 2 | -5 | forb | perennial | northern bugle weed |
| <i>Lysimachia thyrsoiflora</i> | Myrsinaceae | LYSTHY | native | 6 | -5 | forb | perennial | tufted loosestrife |
| <i>Maianthemum canadense</i> | Convallariaceae | MAICAN | native | 4 | 3 | forb | perennial | canada mayflower |
| <i>Maianthemum stellatum;</i> <i>smilacina s.</i> | Convallariaceae | MAISTE | native | 5 | 0 | forb | perennial | starry false solomon-seal |
| <i>Maianthemum trifolium;</i> <i>smilacina t.</i> | Convallariaceae | MAITRI | native | 10 | -5 | forb | perennial | false mayflower |
| <i>Matteuccia struthiopteris</i> | Onocleaceae | MATSTR | native | 3 | 0 | fern | perennial | ostrich fern |
| <i>Medeola virginiana</i> | Convallariaceae | MEDVIR | native | 10 | 3 | forb | perennial | indian cucumber-root |
| <i>Mentha canadensis; m. arvensis</i> | Lamiaceae | MENCAS | native | 3 | -3 | forb | perennial | wild mint |
| <i>Menyanthes trifoliata</i> | Menyanthaceae | MENTRI | native | 8 | -5 | forb | perennial | buckbean |
| <i>Mitchella repens</i> | Rubiaceae | MITREP | native | 5 | 3 | forb | perennial | partridge-berry |
| <i>Mitella nuda</i> | Saxifragaceae | MITNUD | native | 8 | -3 | forb | perennial | naked miterwort |
| <i>Myosotis scorpioides</i> | Boraginaceae | MYOSCO | non-native | 0 | -5 | forb | perennial | forget-me-not |
| <i>Myrica gale</i> | Myricaceae | MYRGAL | native | 6 | -5 | shrub | perennial | sweet gale |
| <i>Nuphar variegata</i> | Nymphaeaceae | NUPVAR | native | 7 | -5 | forb | perennial | yellow pond-lily |
| <i>Onoclea sensibilis</i> | Onocleaceae | ONOSEN | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Orthilia secunda</i> | Ericaceae | ORTSEC | native | 7 | 0 | forb | perennial | one-sided pyrola |
| <i>Osmunda cinnamomea</i> | Osmundaceae | OSMCIN | native | 5 | -3 | fern | perennial | cinnamon fern |
| <i>Osmunda regalis</i> | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |

Grass River Natural Area 2017: Rich Conifer Swamp

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|------------------|---------|------------|----|----|-------------|-----------|----------------------------|
| <i>Packera paupercula</i> ; <i>senecio p.</i> ; | | | | | | | | |
| <i>senecio plattensis</i> | Asteraceae | PACPAU | native | 3 | 0 | forb | perennial | balsam ragwort |
| <i>Parnassia glauca</i> | Parnassiaceae | PARGLA | native | 8 | -5 | forb | perennial | grass-of-parnassus |
| <i>Parthenocissus quinquefolia</i> | Vitaceae | PARQUI | native | 5 | 3 | vine | perennial | virginia creeper |
| <i>Phalaris arundinacea</i> | Poaceae | PHAARU | native | 0 | -3 | grass | perennial | reed canary grass |
| <i>Phragmites australis</i> var. | | | | | | | | |
| <i>americanus</i> | Poaceae | PHRAUM | native | 5 | -3 | grass | perennial | reed |
| <i>Picea glauca</i> | Pinaceae | PICGLA | native | 3 | 3 | tree | perennial | white spruce |
| <i>Picea mariana</i> | Pinaceae | PICMAR | native | 6 | -3 | tree | perennial | black spruce |
| <i>Pilea fontana</i> | Urticaceae | PILFON | native | 5 | -3 | forb | annual | bog clearweed |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| <i>Platanthera clavellata</i> ; | | | | | | | | |
| <i>habenaria c.</i> | Orchidaceae | PLACLA | native | 6 | -3 | forb | perennial | small green wood orchid |
| <i>Platanthera psycodes</i> ; <i>habenaria</i> | | | | | | | | |
| <i>p.</i> | Orchidaceae | PLAPSY | native | 7 | -3 | forb | perennial | purple fringed orchid |
| <i>Poa alsodes</i> | Poaceae | POAALS | native | 9 | 0 | grass | perennial | bluegrass |
| <i>Poa palustris</i> | Poaceae | POAPAS | native | 3 | -3 | grass | perennial | fowl meadow grass |
| <i>Polygala paucifolia</i> | Polygalaceae | POLPAU | native | 7 | 3 | forb | perennial | gay-wings |
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Prunella vulgaris</i> | Lamiaceae | PRUVUL | native | 0 | 0 | forb | perennial | self-heal |
| <i>Pteridium aquilinum</i> | Dennstaedtiaceae | PTEAQU | native | 0 | 3 | fern | perennial | bracken fern |
| <i>Quercus rubra</i> | Fagaceae | QUERUB | native | 5 | 3 | tree | perennial | red oak |
| <i>Ranunculus abortivus</i> | Ranunculaceae | RANABO | native | 0 | 0 | forb | perennial | small-flowered buttercup |
| <i>Ranunculus acris</i> | Ranunculaceae | RANACR | non-native | 0 | 0 | forb | perennial | tall or common buttercup |
| <i>Ranunculus hispidus</i> | Ranunculaceae | RANHIS | native | 5 | 0 | forb | perennial | swamp buttercup |
| <i>Ranunculus recurvatus</i> | Ranunculaceae | RANREC | native | 5 | -3 | forb | perennial | hooked crowfoot |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Rhododendron groenlandicum</i> ; | | | | | | | | |
| <i>ledum g.</i> | Ericaceae | RHOGRO | native | 8 | -5 | shrub | perennial | labrador-tea |
| <i>Ribes cynosbati</i> | Grossulariaceae | RIBCYN | native | 4 | 3 | shrub | perennial | prickly or wild gooseberry |
| <i>Ribes triste</i> | Grossulariaceae | RIBTRI | native | 6 | -5 | shrub | perennial | swamp red currant |
| <i>Rosa multiflora</i> | Rosaceae | ROSMUL | non-native | 0 | 3 | shrub | perennial | multiflora rose |
| <i>Rosa palustris</i> | Rosaceae | ROSPAL | native | 5 | -5 | shrub | perennial | swamp rose |
| <i>Rubus hispidus</i> | Rosaceae | RUBHIS | native | 4 | -3 | shrub | perennial | swamp dewberry |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Rumex orbiculatus</i> | Polygonaceae | RUMORB | native | 9 | -5 | forb | perennial | great water dock |
| <i>Sarracenia purpurea</i> | 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 |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Schoenoplectus tabernaemontani</i> ; <i>scirpus validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Scirpus atrovirens</i> | Cyperaceae | SCIATV | native | 3 | -5 | sedge | perennial | bulrush |
| <i>Scirpus cyperinus</i> | Cyperaceae | SCICYP | native | 5 | -5 | sedge | perennial | wool-grass |
| <i>Scutellaria galericulata</i> | Lamiaceae | SCUGAL | native | 5 | -5 | forb | perennial | marsh skullcap |
| <i>Scutellaria lateriflora</i> | Lamiaceae | SCULAT | native | 5 | -5 | forb | perennial | mad-dog skullcap |
| <i>Solanum dulcamara</i> | Solanaceae | SOLDUL | non-native | 0 | 0 | vine | perennial | bittersweet nightshade |
| <i>Solidago gigantea</i> | Asteraceae | SOLGIG | native | 3 | -3 | forb | perennial | late goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Solidago uliginosa</i> | Asteraceae | SOLULI | native | 4 | -5 | forb | perennial | bog goldenrod |
| <i>Sparganium eurycarpum</i> | Typhaceae | SPAEUR | native | 5 | -5 | forb | perennial | common bur-reed |
| <i>Symphotrichum boreale</i> ; <i>aster b.</i> | Asteraceae | SYMBOR | native | 9 | -5 | forb | perennial | northern bog aster |
| <i>Symphotrichum firmum</i> ; <i>aster puniceus</i> | Asteraceae | SYMFIR | native | 4 | -3 | forb | perennial | smooth swamp aster |
| <i>Symphotrichum lanceolatum</i> ; <i>aster l.</i> | Asteraceae | SYMLAN | native | 2 | -3 | forb | perennial | panicked aster |
| <i>Symphotrichum lateriflorum</i> ; <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | forb | perennial | calico aster |
| <i>Symphotrichum puniceum</i> ; <i>aster p.</i> | Asteraceae | SYMPUN | native | 5 | -5 | forb | perennial | swamp aster |
| <i>Taraxacum officinale</i> | Asteraceae | TAROFF | non-native | 0 | 3 | forb | perennial | common dandelion |
| <i>Thalictrum dasycarpum</i> | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| <i>Thelypteris noveboracensis</i> | Thelypteridaceae | THENOV | native | 5 | 0 | fern | perennial | new york fern |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Tiarella cordifolia</i> | Saxifragaceae | TIACOR | native | 9 | 3 | forb | perennial | foamflower |
| <i>Toxicodendron rydbergii</i> ; <i>t. radicans</i> | Anacardiaceae | TOXRYD | native | 3 | 0 | shrub | perennial | poison-ivy |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Trichophorum alpinum</i> ; <i>scirpus hudsonianus</i> | Cyperaceae | TRIALP | native | 10 | -5 | sedge | perennial | bulrush |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Tsuga canadensis</i> | Pinaceae | TSUCAN | native | 5 | 3 | tree | perennial | hemlock |
| <i>Typha angustifolia</i> | Typhaceae | TYPANG | non-native | 0 | -5 | forb | perennial | narrow-leaved cat-tail |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |

Grass River Natural Area 2017: Rich Conifer Swamp

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|-------------------------------|------------------|----------------|----------------|----------|----------|--------------------|-----------------|-------------------------|
| <i>Utricularia intermedia</i> | Lentibulariaceae | UTRINT | native | 10 | -5 | forb | perennial | flat-leaved bladderwort |
| <i>Vaccinium myrtilloides</i> | Ericaceae | VACMYR | native | 4 | -3 | shrub | perennial | canada blueberry |
| <i>Vaccinium oxycoccos</i> | Ericaceae | VACOXY | native | 8 | -5 | shrub | perennial | small cranberry |
| <i>Veronica arvensis</i> | Plantaginaceae | VERARV | non-native | 0 | 3 | forb | annual | corn speedwell |
| <i>Viburnum cassinoides</i> | Adoxaceae | VIBCAS | native | 6 | 3 | shrub | perennial | wild-raisin |
| <i>Viola cucullata</i> | Violaceae | VIOCUC | native | 5 | -5 | forb | perennial | marsh violet |
| <i>Vitis riparia</i> | 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: 2014

Year:

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 alleghaniensis*, with frequent occurrences of *Populus balsamifera*, *Populus grandidentata* 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 | | | Physiognomy Metrics: | |
| % C value 7-10: | 15.5 | Physiognomy Metrics: | | Sedge: | 19 19.60% |
| Native Tree Mean C: | 3.5 | Tree: | 10 10.30% | Rush: | 1 1.00% |
| Native Shrub Mean C: | 5.0 | Shrub: | 11 11.30% | Fern: | 13 13.40% |
| Native Herbaceous Mean C: | 4.4 | Vine: | 2 2.10% | Bryophyte: | 0 0% |
| | | Forb: | 35 36.10% | | |
| | | Grass: | 6 6.20% | | |

Species:

Grass River Natural Area 2017: Hardwood-Conifer Swamp

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|--|----------------|---------|---------|----|----|-------------|-----------|-------------------------|
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Acer saccharum</i> | Sapindaceae | ACESAU | native | 5 | 3 | tree | perennial | sugar maple |
| <i>Adiantum pedatum</i> | Pteridaceae | ADIPED | native | 6 | 3 | fern | perennial | maidenhair fern |
| <i>Alnus incana; a. rugosa</i> | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| <i>Aralia nudicaulis</i> | Araliaceae | ARANUD | native | 5 | 3 | forb | perennial | wild sarsaparilla |
| <i>Arisaema triphyllum</i> | Araceae | ARITRI | native | 5 | 0 | forb | perennial | jack-in-the-pulpit |
| <i>Asclepias syriaca</i> | Apocynaceae | ASCSYR | native | 1 | 5 | forb | perennial | common milkweed |
| <i>Athyrium filix-femina</i> | Athyriaceae | ATHFIL | native | 4 | 0 | fern | perennial | lady fern |
| <i>Betula alleghaniensis</i> | Betulaceae | BETALL | native | 7 | 0 | tree | perennial | yellow birch |
| <i>Boehmeria cylindrica</i> | Urticaceae | BOECYL | native | 5 | -5 | forb | perennial | false nettle |
| <i>Brachyelytrum aristosum; b. erectum</i> | Poaceae | BRAARI | native | 7 | 5 | grass | perennial | northern shorthusk |
| <i>Calamagrostis stricta; c. inexpansa; c. lacustris</i> | Poaceae | CALSTR | native | 10 | -3 | grass | perennial | narrow-leaved reedgrass |
| <i>Caltha palustris</i> | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| <i>Carex arcata</i> | Cyperaceae | CXARTT | native | 3 | 5 | sedge | perennial | sedge |
| <i>Carex aurea</i> | Cyperaceae | CXAURE | native | 3 | -3 | sedge | perennial | sedge |
| <i>Carex bebbii</i> | Cyperaceae | CXBEBB | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex communis</i> | Cyperaceae | CXCOMM | native | 2 | 5 | sedge | perennial | sedge |
| <i>Carex crinita</i> | Cyperaceae | CXCRIN | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex disperma</i> | Cyperaceae | CXDISP | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex hystericina</i> | Cyperaceae | CXHYST | native | 2 | -5 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex intumescens</i> | Cyperaceae | CXINTU | native | 3 | -3 | sedge | perennial | sedge |
| <i>Carex laevivaginata</i> | Cyperaceae | CXLAEV | native | 8 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex lupulina</i> | Cyperaceae | CXLUPA | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex stipata</i> | Cyperaceae | CXSTIP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Carex stricta</i> | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex trisperma</i> | Cyperaceae | CXTRIS | native | 9 | -5 | sedge | perennial | sedge |
| <i>Carex utriculata; c. rostrata</i> | Cyperaceae | CXUTRI | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex vulpinoidea</i> | Cyperaceae | CXVULP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Chelone glabra</i> | Plantaginaceae | CHEGLB | native | 7 | -5 | forb | perennial | turtlehead |
| <i>Circaea canadensis; c. lutetiana</i> | 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 |
|---|------------------|----------------|----------------|----------|----------|--------------------|-----------------|---------------------------|
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Coptis trifolia</i> | Ranunculaceae | COPTRI | native | 5 | -3 | forb | perennial | goldthread |
| <i>Cornus canadensis</i> | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| <i>Dryopteris cristata</i> | Dryopteridaceae | DRYCRI | native | 6 | -5 | fern | perennial | crested shield fern |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Epilobium ciliatum</i> | Onagraceae | EPICIL | native | 3 | -3 | forb | perennial | willow-herb |
| <i>Equisetum fluviatile</i> | Equisetaceae | EQUFLU | native | 7 | -5 | fern | perennial | water horsetail |
| <i>Equisetum palustre</i> | Equisetaceae | EQUPAL | native | 8 | -3 | fern | perennial | marsh horsetail |
| <i>Equisetum scirpoides</i> | Equisetaceae | EQUSCI | native | 7 | 0 | fern | perennial | dwarf scouring rush |
| <i>Erythronium americanum</i> | Liliaceae | ERYAME | native | 5 | 5 | forb | perennial | yellow trout lily |
| <i>Euthamia graminifolia</i> | Asteraceae | EUTGRA | native | 3 | 0 | forb | perennial | grass-leaved goldenrod |
| <i>Galium triflorum</i> | Rubiaceae | GALTRR | native | 4 | 3 | forb | perennial | fragrant bedstraw |
| <i>Gaultheria hispidula</i> | Ericaceae | GAUHIS | native | 8 | -3 | shrub | perennial | creeping-snowberry |
| <i>Geum rivale</i> | Rosaceae | GEURIV | native | 7 | -5 | forb | perennial | purple avens |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Hieracium aurantiacum</i> | Asteraceae | HIEAUR | non-native | 0 | 5 | forb | perennial | orange hawkweed |
| <i>Hieracium caespitosum</i> | Asteraceae | HIECAE | non-native | 0 | 5 | forb | perennial | king devil |
| <i>Impatiens capensis</i> | Balsaminaceae | IMPCAP | native | 2 | -3 | forb | annual | spotted touch-me-not |
| <i>Iris virginica</i> | Iridaceae | IRIVIR | native | 5 | -5 | forb | perennial | southern blue flag |
| <i>Juncus effusus</i> | Juncaceae | JUNEFF | native | 3 | -5 | rush | perennial | soft-stemmed rush |
| <i>Leersia oryzoides</i> | Poaceae | LEEORY | native | 3 | -5 | grass | perennial | cut grass |
| <i>Lilium philadelphicum</i> | Liliaceae | LILPHI | native | 7 | 0 | forb | perennial | wood lily |
| <i>Lonicera canadensis</i> | Caprifoliaceae | LONCAN | native | 5 | 3 | shrub | perennial | canadian fly honeysuckle |
| <i>Lysimachia nummularia</i> | Myrsinaceae | LYSNUM | non-native | 0 | -3 | forb | perennial | moneywort |
| <i>Lysimachia thyrsiflora</i> | Myrsinaceae | LYSTHY | native | 6 | -5 | forb | perennial | tufted loosestrife |
| <i>Maianthemum canadense</i> | Convallariaceae | MAICAN | native | 4 | 3 | forb | perennial | canada mayflower |
| <i>Maianthemum stellatum;</i> <i>smilacina s.</i> | Convallariaceae | MAISTE | native | 5 | 0 | forb | perennial | starry false solomon-seal |
| <i>Mentha canadensis; m. arvensis</i> | Lamiaceae | MENCAS | native | 3 | -3 | forb | perennial | wild mint |
| <i>Myosotis scorpioides</i> | Boraginaceae | MYOSCO | non-native | 0 | -5 | forb | perennial | forget-me-not |
| <i>Onoclea sensibilis</i> | Onocleaceae | ONOSEN | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Osmunda cinnamomea</i> | Osmundaceae | OSMCIN | native | 5 | -3 | fern | perennial | cinnamon fern |
| <i>Osmunda regalis</i> | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |
| <i>Phalaris arundinacea</i> | Poaceae | PHAARU | native | 0 | -3 | grass | perennial | reed canary grass |
| <i>Phegopteris connectilis;</i> <i>thelypteris phegopteris</i> | Thelypteridaceae | PHECON | native | 5 | 3 | fern | perennial | northern beech-fern |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| <i>Poa palustris</i> | 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 |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| <i>Populus grandidentata</i> | Salicaceae | POPGRA | native | 4 | 3 | tree | perennial | big-tooth aspen |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Pteridium aquilinum</i> | Dennstaedtiaceae | PTEAQU | native | 0 | 3 | fern | perennial | bracken fern |
| <i>Ranunculus hispidus</i> | Ranunculaceae | RANHIS | native | 5 | 0 | forb | perennial | swamp buttercup |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Rubus strigosus</i> | Rosaceae | RUBSTR | native | 2 | 0 | shrub | perennial | wild red raspberry |
| <i>Rumex orbiculatus</i> | Polygonaceae | RUMORB | native | 9 | -5 | forb | perennial | great water dock |
| <i>Sambucus canadensis</i> | Adoxaceae | SAMCAN | native | 3 | -3 | shrub | perennial | elderberry |
| <i>Scirpus cyperinus</i> | Cyperaceae | SCICYP | native | 5 | -5 | sedge | perennial | wool-grass |
| <i>Scutellaria galericulata</i> | Lamiaceae | SCUGAL | native | 5 | -5 | forb | perennial | marsh skullcap |
| <i>Solanum dulcamara</i> | Solanaceae | SOLDUL | non-native | 0 | 0 | vine | perennial | bittersweet nightshade |
| <i>Solidago canadensis</i> | Asteraceae | SOLCAN | native | 1 | 3 | forb | perennial | canada goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Symphotrichum lateriflorum</i> ; <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | forb | perennial | calico aster |
| <i>Thalictrum dasycarpum</i> | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| <i>Thelypteris noveboracensis</i> | Thelypteridaceae | THENOV | native | 5 | 0 | fern | perennial | new york fern |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Toxicodendron rydbergii</i> ; <i>t. radicans</i> | Anacardiaceae | TOXRYD | native | 3 | 0 | shrub | perennial | poison-ivy |
| <i>Toxicodendron vernix</i> | Anacardiaceae | TOXVER | native | 6 | -5 | shrub | perennial | poison sumac |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Tsuga canadensis</i> | Pinaceae | TSUCAN | native | 5 | 3 | tree | perennial | hemlock |
| <i>Typha latifolia</i> | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| <i>Vitis riparia</i> | 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 2014

Year:

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 | Species Wetness: | Native Annual: 0 0% | |
| Adjusted FQI: 38.2 | Mean Wetness: 1.1 | Native Perennial: 25 96.20% | |
| % C value 0: 7.7 | 1.0 | Native Biennial: 0 0% | |
| % C value 1-3: 34.6 | Native Mean Wetness: 1.0 | | |
| % C value 4-6: 46.2 | Physiognomy Metrics: | Physiognomy Metrics: | |
| % C value 7-10: 11.5 | Tree: 10 38.50% | Sedge: 4 15.40% | |
| Native Tree Mean C: 3.6 | Shrub: 3 11.50% | Rush: 0 0% | |
| Native Shrub Mean C: 2.0 | Vine: 0 0% | Fern: 3 11.50% | |
| Native Herbaceous Mean C: 4.5 | 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 |
|---|------------------|----------------|----------------|----------|----------|--------------------|-----------------|--------------------|
| <i>Abies balsamea</i> | Pinaceae | ABIBAL | native | 3 | 0 | Tree | perennial | balsam fir |
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | Tree | perennial | red maple |
| <i>Acer saccharum</i> | Sapindaceae | ACESAU | native | 5 | 3 | Tree | perennial | sugar maple |
| <i>Berberis thunbergii</i> | Berberidaceae | BERTHU | non-native | 0 | 3 | shrub | perennial | japanese barberry |
| <i>Betula alleghaniensis</i> | Betulaceae | BETALL | native | 7 | 0 | Tree | perennial | yellow birch |
| <i>Brachyelytrum aristosum</i> ; <i>b. erectum</i> | Poaceae | BRAARI | native | 7 | 5 | grass | perennial | northern shorthusk |
| <i>Carex communis</i> | Cyperaceae | CXCOMM | native | 2 | 5 | sedge | perennial | sedge |
| <i>Carex lupulina</i> | Cyperaceae | CXLUPA | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex pensylvanica</i> | Cyperaceae | CXPENS | native | 4 | 5 | sedge | perennial | sedge |
| <i>Dendrolycopodium obscurum</i> ; <i>lycopodium o.</i> | Lycopodiaceae | DENOBS | native | 5 | 3 | Fern | perennial | ground-pine |
| <i>Elymus hystrix</i> ; <i>hystrix patula</i> | Poaceae | ELYHYS | native | 5 | 3 | grass | perennial | bottlebrush grass |
| <i>Fraxinus americana</i> | Oleaceae | FRAAME | native | 5 | 3 | Tree | perennial | white ash |
| <i>Mitchella repens</i> | Rubiaceae | MITREP | native | 5 | 3 | Forb | perennial | partridge-berry |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | Tree | perennial | white pine |
| <i>Poa alsodes</i> | Poaceae | POAALS | native | 9 | 0 | grass | perennial | bluegrass |
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | Tree | perennial | balsam poplar |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | Tree | perennial | quaking aspen |
| <i>Pteridium aquilinum</i> | Dennstaedtiaceae | PTEAQU | native | 0 | 3 | Fern | perennial | bracken fern |
| <i>Rubus allegheniensis</i> | Rosaceae | RUBALL | native | 1 | 3 | shrub | perennial | common blackberry |
| <i>Scirpus cyperinus</i> | Cyperaceae | SCICYP | native | 5 | -5 | sedge | perennial | wool-grass |
| <i>Spinulum annotinum</i> ; <i>lycopodium a.</i> | Lycopodiaceae | SPIANN | native | 5 | 0 | Fern | perennial | stiff clubmoss |
| <i>Symphotrichum lateriflorum</i> ; <i>aster l.</i> | Asteraceae | SYMLAT | native | 2 | 0 | Forb | perennial | calico aster |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | Tree | perennial | arbor vitae |
| <i>Toxicodendron rydbergii</i> ; <i>t. radicans</i> | Anacardiaceae | TOXRYD | native | 3 | 0 | shrub | perennial | poison-ivy |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | Forb | perennial | star-flower |
| <i>Tsuga canadensis</i> | 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 2014

Year:

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 | | | Physiognomy Metrics: | |
| % C value 7-10: | 9.9 | Physiognomy Metrics: | | Sedge: | 14 13.90% |
| Native Tree Mean C: | 3.9 | Tree: | 18.0 17.80% | Rush: | 1 1.00% |
| Native Shrub Mean C: | 3.7 | Shrub: | 13.0 12.90% | Fern: | 15 14.90% |
| Native Herbaceous Mean C: | 4.6 | Vine: | 2.0 2.00% | Bryophyte: | 0 0% |
| | | Forb: | 31.0 30.70% | | |
| | | 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 |
|---|-----------------|----------------|----------------|----------|----------|--------------------|-----------------|--------------------------|
| <i>Abies balsamea</i> | Pinaceae | ABIBAL | native | 3 | 0 | tree | perennial | balsam fir |
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Acer saccharum</i> | Sapindaceae | ACESAU | native | 5 | 3 | tree | perennial | sugar maple |
| <i>Agrostis gigantea</i> | Poaceae | AGRGIG | non-native | 0 | -3 | grass | perennial | redtop |
| <i>Allium tricoccum</i> | Alliaceae | ALLTRI | native | 5 | 3 | forb | perennial | wild leek |
| <i>Alnus incana; a. rugosa</i> | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| <i>Arisaema triphyllum</i> | Araceae | ARITRI | native | 5 | 0 | forb | perennial | jack-in-the-pulpit |
| <i>Betula alleghaniensis</i> | Betulaceae | BETALL | native | 7 | 0 | tree | perennial | yellow birch |
| <i>Betula papyrifera</i> | Betulaceae | BETPAP | native | 2 | 3 | tree | perennial | paper birch |
| <i>Brachyelytrum aristosum; b. erectum</i> | Poaceae | BRAARI | native | 7 | 5 | grass | perennial | northern shorthusk |
| <i>Caltha palustris</i> | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| <i>Cardamine diphylla; dentaria d.</i> | Brassicaceae | CARDIP | native | 5 | 3 | forb | perennial | two-leaved toothwort |
| <i>Carex bebbii</i> | Cyperaceae | CXBEBB | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex communis</i> | Cyperaceae | CXCOMM | native | 2 | 5 | sedge | perennial | sedge |
| <i>Carex crinita</i> | Cyperaceae | CXCRIN | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex deweyana</i> | Cyperaceae | CXDEWE | native | 3 | 3 | sedge | perennial | sedge |
| <i>Carex disperma</i> | Cyperaceae | CXDISP | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex gracillima</i> | Cyperaceae | CXGRAA | native | 4 | 3 | sedge | perennial | sedge |
| <i>Carex interior</i> | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex intumescens</i> | Cyperaceae | CXINTU | native | 3 | -3 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex lupulina</i> | Cyperaceae | CXLUPA | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex pennsylvanica</i> | Cyperaceae | CXPENS | native | 4 | 5 | sedge | perennial | sedge |
| <i>Carex retrorsa</i> | Cyperaceae | CXRETS | native | 3 | -5 | sedge | perennial | sedge |
| <i>Carex rosea; c. convoluta</i> | Cyperaceae | CXROSE | native | 2 | 5 | sedge | perennial | curly-styled wood sedge |
| <i>Carex stipata</i> | Cyperaceae | CXSTIP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Chrysosplenium americanum</i> | Saxifragaceae | CHRAME | native | 6 | -5 | forb | perennial | golden saxifrage |
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Cornus alternifolia</i> | Cornaceae | CORALT | native | 5 | 3 | tree | perennial | alternate-leaved dogwood |
| <i>Cornus foemina</i> | Cornaceae | CORFOE | native | 1 | 0 | shrub | perennial | gray dogwood |
| <i>Dendrolycopodium obscurum; lycopodium o.</i> | Lycopodiaceae | DENOBS | native | 5 | 3 | fern | perennial | ground-pine |
| <i>Doellingeria umbellata; aster u.</i> | Asteraceae | DOEUMB | native | 5 | -3 | forb | perennial | flat-topped white aster |
| <i>Dryopteris carthusiana</i> | Dryopteridaceae | DRYCAR | native | 5 | -3 | fern | perennial | spinulose woodfern |
| <i>Dryopteris clintoniana</i> | Dryopteridaceae | DRYCLI | native | 8 | -3 | fern | perennial | clintons woodfern |
| <i>Dryopteris cristata</i> | Dryopteridaceae | DRYCRI | native | 6 | -5 | fern | perennial | crested shield fern |
| <i>Dryopteris intermedia</i> | 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 |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Elymus hystrix; hystrix patula</i> | Poaceae | ELYHYS | native | 5 | 3 | grass | perennial | bottlebrush grass |
| <i>Epigaea repens</i> | Ericaceae | EPIREP | native | 7 | 3 | shrub | perennial | trailing-arbutus |
| <i>Epipactis helleborine</i> | Orchidaceae | EPIHEL | non-native | 0 | 0 | forb | perennial | helleborine |
| <i>Equisetum fluviatile</i> | Equisetaceae | EQUFLU | native | 7 | -5 | fern | perennial | water horsetail |
| <i>Equisetum palustre</i> | Equisetaceae | EQUPAL | native | 8 | -3 | fern | perennial | marsh horsetail |
| <i>Fagus grandifolia</i> | Fagaceae | FAGGRA | native | 6 | 3 | tree | perennial | american beech |
| <i>Fraxinus americana</i> | Oleaceae | FRAAME | native | 5 | 3 | tree | perennial | white ash |
| <i>Galium labradoricum</i> | Rubiaceae | GALLAB | native | 8 | -5 | forb | perennial | bog bedstraw |
| <i>Gaultheria procumbens</i> | Ericaceae | GAUPRO | native | 5 | 3 | shrub | perennial | wintergreen |
| <i>Geum canadense</i> | Rosaceae | GEUCAN | native | 1 | 0 | forb | perennial | white avens |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Goodyera pubescens</i> | Orchidaceae | GOOPUB | native | 7 | 3 | forb | perennial | downy rattlesnake plantain |
| <i>Hamamelis virginiana</i> | Hamamelidaceae | HAMVIR | native | 5 | 3 | shrub | perennial | witch-hazel |
| <i>Hieracium aurantiacum</i> | Asteraceae | HIEAUR | non-native | 0 | 5 | forb | perennial | orange hawkweed |
| <i>Juncus nodosus</i> | Juncaceae | JUNNOD | native | 5 | -5 | rush | perennial | joint rush |
| <i>Lonicera morrowii</i> | Caprifoliaceae | LONMOR | non-native | 0 | 3 | shrub | perennial | morrow honeysuckle |
| <i>Lonicera xbella</i> | Caprifoliaceae | LONBEL | non-native | 0 | 3 | shrub | perennial | hybrid honeysuckle |
| <i>Lycopus uniflorus</i> | Lamiaceae | LYCUNI | native | 2 | -5 | forb | perennial | northern bugle weed |
| <i>Maianthemum canadense</i> | Convallariaceae | MAICAN | native | 4 | 3 | forb | perennial | canada mayflower |
| <i>Medeola virginiana</i> | Convallariaceae | MEDVIR | native | 10 | 3 | forb | perennial | indian cucumber-root |
| <i>Mitchella repens</i> | Rubiaceae | MITREP | native | 5 | 3 | forb | perennial | partridge-berry |
| <i>Onoclea sensibilis</i> | Onocleaceae | ONOSEN | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Oryzopsis asperifolia</i> | Poaceae | ORYASP | native | 6 | 5 | grass | perennial | rough-leaved rice-grass |
| <i>Osmunda claytoniana</i> | Osmundaceae | OSMCLN | native | 6 | 0 | fern | perennial | interrupted fern |
| <i>Osmunda regalis</i> | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |
| <i>Parthenocissus quinquefolia</i> | Vitaceae | PARQUI | native | 5 | 3 | vine | perennial | virginia creeper |
| <i>Phalaris arundinacea</i> | Poaceae | PHAARU | native | 0 | -3 | grass | perennial | reed canary grass |
| <i>Phegopteris connectilis; thelypteris phegopteris</i> | Thelypteridaceae | PHECON | native | 5 | 3 | fern | perennial | northern beech-fern |
| <i>Picea glauca</i> | Pinaceae | PICGLA | native | 3 | 3 | tree | perennial | white spruce |
| <i>Picea pungens</i> | Pinaceae | PICPUN | non-native | 0 | 3 | tree | perennial | blue spruce |
| <i>Pinus resinosa</i> | Pinaceae | PINRES | native | 6 | 3 | tree | perennial | red pine |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| <i>Polygonatum pubescens</i> | Convallariaceae | POLPUB | native | 5 | 5 | forb | perennial | downy solomon seal |
| <i>Populus grandidentata</i> | Salicaceae | POPGRA | native | 4 | 3 | tree | perennial | big-tooth aspen |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Prunus serotina</i> | 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 |
|--|------------------|----------------|----------------|----------|----------|--------------------|-----------------|------------------------|
| <i>Pteridium aquilinum</i> | Dennstaedtiaceae | PTEAQU | native | 0 | 3 | fern | perennial | bracken fern |
| <i>Pyrola elliptica</i> | Ericaceae | PYRELL | native | 6 | 3 | forb | perennial | large-leaved shinleaf |
| <i>Rubus allegheniensis</i> | Rosaceae | RUBALL | native | 1 | 3 | shrub | perennial | common blackberry |
| <i>Rubus occidentalis</i> | Rosaceae | RUBOCC | native | 1 | 5 | shrub | perennial | black raspberry |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Rubus strigosus</i> | Rosaceae | RUBSTR | native | 2 | 0 | shrub | perennial | wild red raspberry |
| <i>Schizachne purpurascens</i> | Poaceae | SCHPUP | native | 5 | 3 | grass | perennial | false melic |
| <i>Solanum dulcamara</i> | Solanaceae | SOLDUL | non-native | 0 | 0 | vine | perennial | bittersweet nightshade |
| <i>Solidago caesia</i> | Asteraceae | SOLCAE | native | 6 | 3 | forb | perennial | bluestem goldenrod |
| <i>Solidago gigantea</i> | Asteraceae | SOLGIG | native | 3 | -3 | forb | perennial | late goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Spinulum annotinum;</i> <i>lycopodium a.</i> | Lycopodiaceae | SPIANN | native | 5 | 0 | fern | perennial | stiff clubmoss |
| <i>Symphotrichum urophyllum;</i> <i>aster sagittifolius</i> | Asteraceae | SYMURO | native | 2 | 5 | forb | perennial | arrow-leaved aster |
| <i>Taraxacum officinale</i> | Asteraceae | TAROFF | non-native | 0 | 3 | forb | perennial | common dandelion |
| <i>Thalictrum dioicum</i> | Ranunculaceae | THADIO | native | 6 | 3 | forb | perennial | early meadow-rue |
| <i>Thelypteris noveboracensis</i> | Thelypteridaceae | THENOV | native | 5 | 0 | fern | perennial | new york fern |
| <i>Thelypteris palustris</i> | Thelypteridaceae | THEPAL | native | 2 | -3 | fern | perennial | marsh fern |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Tilia americana</i> | Malvaceae | TILAME | native | 5 | 3 | tree | perennial | basswood |
| <i>Trientalis borealis</i> | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| <i>Trillium cernuum</i> | Trilliaceae | TRICER | native | 5 | 0 | forb | perennial | nodding trillium |
| <i>Tsuga canadensis</i> | Pinaceae | TSUCAN | native | 5 | 3 | tree | perennial | hemlock |
| <i>Verbena hastata</i> | Verbenaceae | VERHAS | native | 4 | -3 | forb | perennial | blue vervain |
| <i>Veronica officinalis</i> | Plantaginaceae | VEROOF | non-native | 0 | 3 | forb | perennial | common speedwell |
| <i>Viburnum acerifolium</i> | Adoxaceae | VIBACE | native | 6 | 5 | shrub | perennial | maple-leaved viburnum |
| <i>Viola canadensis</i> | Violaceae | VIOCAN | native | 5 | 3 | forb | perennial | canada violet |
| <i>Viola labradorica; v. conspersa</i> | 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 2014

Year:

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 |
| <i>Abies balsamea</i> | Pinaceae | ABIBAL | native | 3 | 0 | tree | perennial | balsam fir |
| <i>Acer rubrum</i> | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |
| <i>Achillea millefolium</i> | Asteraceae | ACHMIL | native | 1 | 3 | forb | perennial | yarrow |
| <i>Agrostis gigantea</i> | Poaceae | AGRGIG | non-native | 0 | -3 | grass | perennial | redtop |
| <i>Anemone canadensis</i> | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| <i>Anemone cylindrica</i> | Ranunculaceae | ANECYL | native | 6 | 5 | forb | perennial | thimbleweed |
| <i>Anemone virginiana</i> | Ranunculaceae | ANEVIR | native | 3 | 3 | forb | perennial | thimbleweed |
| <i>Antennaria parlinii</i> | Asteraceae | ANTPAL | native | 2 | 5 | forb | perennial | smooth pussytoes |
| <i>Apocynum androsaemifolium</i> | Apocynaceae | APOAND | native | 3 | 5 | forb | perennial | spreading dogbane |
| <i>Asclepias incarnata</i> | Apocynaceae | ASCINC | native | 6 | -5 | forb | perennial | swamp milkweed |
| <i>Asclepias syriaca</i> | Apocynaceae | ASCSYR | native | 1 | 5 | forb | perennial | common milkweed |
| <i>Berteroa incana</i> | Brassicaceae | BERINC | non-native | 0 | 5 | forb | annual | hoary alyssum |
| <i>Brachyelytrum aristosum; b. erectum</i> | Poaceae | BRAARI | native | 7 | 5 | grass | perennial | northern shorthusk |
| <i>Bromus inermis</i> | Poaceae | BROINE | non-native | 0 | 5 | grass | perennial | smooth brome |
| <i>Caltha palustris</i> | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| <i>Carex arctata</i> | Cyperaceae | CXARTT | native | 3 | 5 | sedge | perennial | sedge |
| <i>Carex disperma</i> | Cyperaceae | CXDISP | native | 10 | -5 | sedge | perennial | sedge |
| <i>Carex flava</i> | Cyperaceae | CXFLAV | native | 4 | -5 | sedge | perennial | sedge |
| <i>Carex gracillima</i> | Cyperaceae | CXGRAA | native | 4 | 3 | sedge | perennial | sedge |
| <i>Carex hystericina</i> | Cyperaceae | CXHYST | native | 2 | -5 | sedge | perennial | sedge |
| <i>Carex leptalea</i> | Cyperaceae | CXLEPA | native | 5 | -5 | sedge | perennial | sedge |
| <i>Carex vulpinoidea</i> | Cyperaceae | CXVULP | native | 1 | -5 | sedge | perennial | sedge |
| <i>Centaurea stoebe; c. maculosa</i> | Asteraceae | CENSTO | non-native | 0 | 5 | forb | biennial | spotted knapweed |
| <i>Cirsium arvense</i> | Asteraceae | CIRARV | non-native | 0 | 3 | forb | perennial | canada thistle |
| <i>Cirsium palustre</i> | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| <i>Cirsium vulgare</i> | Asteraceae | CIRVUL | non-native | 0 | 3 | forb | biennial | bull thistle |
| <i>Clematis virginiana</i> | Ranunculaceae | CLEVIR | native | 4 | 0 | vine | perennial | virgins bower |
| <i>Clinopodium vulgare</i> | Lamiaceae | CLIVUL | native | 3 | 5 | forb | perennial | wild-basil |
| <i>Cornus amomum</i> | Cornaceae | CORAMO | native | 2 | -3 | shrub | perennial | silky dogwood |
| <i>Dactylis glomerata</i> | Poaceae | DACGLO | non-native | 0 | 3 | grass | perennial | orchard grass |
| <i>Danthonia spicata</i> | Poaceae | DANSPI | native | 4 | 5 | grass | perennial | poverty grass; oatgrass |
| <i>Dasiphora fruticosa; potentilla f.</i> | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| <i>Daucus carota</i> | Apiaceae | DAUCAR | non-native | 0 | 5 | forb | biennial | queen-annes-lace |
| <i>Dianthus armeria</i> | Caryophyllaceae | DIAARM | non-native | 0 | 5 | forb | annual | deptford pink |
| <i>Elaeagnus umbellata</i> | Elaeagnaceae | ELAUMB | non-native | 0 | 3 | shrub | perennial | autumn-olive |
| <i>Elymus repens; agropyron r.</i> | 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 |
|---|----------------|----------------|----------------|----------|----------|--------------------|-----------------|--------------------------|
| <i>Equisetum hyemale</i> | Equisetaceae | EQUHYE | native | 2 | 0 | fern | perennial | scouring rush |
| <i>Equisetum palustre</i> | Equisetaceae | EQUPAL | native | 8 | -3 | fern | perennial | marsh horsetail |
| <i>Erigeron strigosus</i> | Asteraceae | ERISTR | native | 4 | 3 | forb | perennial | daisy fleabane |
| <i>Eupatorium perfoliatum</i> | Asteraceae | EUPPER | native | 4 | -3 | forb | perennial | boneset |
| <i>Euphorbia corollata</i> | Euphorbiaceae | EUPCOR | native | 4 | 5 | forb | perennial | flowering spurge |
| <i>Euphorbia virgata; e. esula</i> | Euphorbiaceae | EUPVIR | non-native | 0 | 5 | forb | perennial | leafy spurge |
| <i>Euthamia graminifolia</i> | Asteraceae | EUTGRA | native | 3 | 0 | forb | perennial | grass-leaved goldenrod |
| <i>Fragaria virginiana</i> | Rosaceae | FRAVIR | native | 2 | 3 | forb | perennial | wild strawberry |
| <i>Fraxinus americana</i> | Oleaceae | FRAAME | native | 5 | 3 | tree | perennial | white ash |
| <i>Galium triflorum</i> | Rubiaceae | GALTRR | native | 4 | 3 | forb | perennial | fragrant bedstraw |
| <i>Geum rivale</i> | Rosaceae | GEURIV | native | 7 | -5 | forb | perennial | purple avens |
| <i>Glyceria striata</i> | Poaceae | GLYSTR | native | 4 | -5 | grass | perennial | fowl manna grass |
| <i>Gnaphalium uliginosum</i> | Asteraceae | GNAULI | native | 3 | 0 | forb | annual | low cudweed |
| <i>Hieracium aurantiacum</i> | Asteraceae | HIEAUR | non-native | 0 | 5 | forb | perennial | orange hawkweed |
| <i>Hieracium caespitosum</i> | Asteraceae | HIECAE | non-native | 0 | 5 | forb | perennial | king devil |
| <i>Hypericum perforatum</i> | Hypericaceae | HYPPER | non-native | 0 | 5 | forb | perennial | common st. johns-wort |
| <i>Hypopitys monotropa;</i> <i>monotropa hypopithys</i> | Ericaceae | HYPMON | native | 6 | 5 | forb | perennial | pinemap |
| <i>Juncus tenuis</i> | Juncaceae | JUNTEN | native | 1 | 0 | rush | perennial | path rush |
| <i>Juniperus communis</i> | Cupressaceae | JUNCOI | native | 4 | 3 | shrub | perennial | common or ground juniper |
| <i>Larix laricina</i> | Pinaceae | LARLAR | native | 5 | -3 | tree | perennial | tamarack |
| <i>Leucanthemum vulgare;</i> <i>chrysanthemum leucanthemum</i> | Asteraceae | LEUVUL | non-native | 0 | 5 | forb | perennial | ox-eye daisy |
| <i>Lonicera morrowii</i> | Caprifoliaceae | LONMOR | non-native | 0 | 3 | shrub | perennial | morrow honeysuckle |
| <i>Lycopodium clavatum</i> | Lycopodiaceae | LYCCLA | native | 4 | 0 | fern | perennial | running ground-pine |
| <i>Lycopus americanus</i> | Lamiaceae | LYCAME | native | 2 | -5 | forb | perennial | common water horehound |
| <i>Lycopus uniflorus</i> | Lamiaceae | LYCUNI | native | 2 | -5 | forb | perennial | northern bugle weed |
| <i>Medicago lupulina</i> | Fabaceae | MEDLUP | non-native | 0 | 3 | forb | annual | black medick |
| <i>Melilotus albus</i> | Fabaceae | MELALB | non-native | 0 | 3 | forb | biennial | white sweet-clover |
| <i>Onoclea sensibilis</i> | Onocleaceae | ONOSEN | native | 2 | -3 | fern | perennial | sensitive fern |
| <i>Packera paupercula; senecio p.;</i> <i>senecio plattensis</i> | Asteraceae | PACPAU | native | 3 | 0 | forb | perennial | balsam ragwort |
| <i>Panicum capillare</i> | Poaceae | PANCAP | native | 0 | 0 | grass | annual | witch grass |
| <i>Phleum pratense</i> | Poaceae | PHLPRA | non-native | 0 | 3 | grass | perennial | timothy |
| <i>Picea pungens</i> | Pinaceae | PICPUN | non-native | 0 | 3 | tree | perennial | blue spruce |
| <i>Pinus resinosa</i> | Pinaceae | PINRES | native | 6 | 3 | tree | perennial | red pine |
| <i>Pinus strobus</i> | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| <i>Plantago lanceolata</i> | Plantaginaceae | PLALAN | non-native | 0 | 3 | forb | perennial | english plantain |

| Grass River Natural Area 2017: Old field/residential/plantation | | | | | | | | |
|---|------------------|---------|------------|---|----|-------------|-----------|--------------------------|
| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
| <i>Plantago major</i> | Plantaginaceae | PLAMAJ | non-native | 0 | 3 | forb | perennial | common plantain |
| <i>Poa compressa</i> | Poaceae | POACOM | non-native | 0 | 3 | grass | perennial | canada bluegrass |
| <i>Poa pratensis</i> | Poaceae | POAPRA | non-native | 0 | 3 | grass | perennial | kentucky bluegrass |
| <i>Populus balsamifera</i> | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| <i>Populus tremuloides</i> | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| <i>Potentilla recta</i> | Rosaceae | POTREC | non-native | 0 | 5 | forb | perennial | rough-fruited cinquefoil |
| <i>Prunella vulgaris</i> | Lamiaceae | PRUVUL | native | 0 | 0 | forb | perennial | self-heal |
| <i>Prunus serotina</i> | Rosaceae | PRUSER | native | 2 | 3 | tree | perennial | wild black cherry |
| <i>Pteridium aquilinum</i> | Dennstaedtiaceae | PTEAQU | native | 0 | 3 | fern | perennial | bracken fern |
| <i>Quercus rubra</i> | Fagaceae | QUERUB | native | 5 | 3 | tree | perennial | red oak |
| <i>Ranunculus hispidus</i> | Ranunculaceae | RANHIS | native | 5 | 0 | forb | perennial | swamp buttercup |
| <i>Ranunculus recurvatus</i> | Ranunculaceae | RANREC | native | 5 | -3 | forb | perennial | hooked crowfoot |
| <i>Rhamnus alnifolia</i> | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| <i>Rubus allegheniensis</i> | Rosaceae | RUBALL | native | 1 | 3 | shrub | perennial | common blackberry |
| <i>Rubus occidentalis</i> | Rosaceae | RUBOCC | native | 1 | 5 | shrub | perennial | black raspberry |
| <i>Rubus pubescens</i> | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| <i>Rubus strigosus</i> | Rosaceae | RUBSTR | native | 2 | 0 | shrub | perennial | wild red raspberry |
| <i>Rudbeckia hirta</i> | Asteraceae | RUDHIR | native | 1 | 3 | forb | perennial | black-eyed susan |
| <i>Rumex acetosella</i> | Polygonaceae | RUMACL | non-native | 0 | 3 | forb | perennial | sheep sorrel |
| <i>Rumex obtusifolius</i> | Polygonaceae | RUMOBT | non-native | 0 | 0 | forb | perennial | bitter dock |
| <i>Salix discolor</i> | Salicaceae | SALDIS | native | 1 | -3 | shrub | perennial | pussy willow |
| <i>Salix petiolaris</i> | Salicaceae | SALPET | native | 1 | -3 | shrub | perennial | slender willow |
| <i>Schizachyrium scoparium;</i> <i>andropogon s.</i> | Poaceae | SCHSCO | native | 5 | 3 | grass | perennial | little bluestem |
| <i>Schoenoplectus</i> <i>tabernaemontani;</i> <i>scirpus</i> <i>validus</i> | Cyperaceae | SCHTAB | native | 4 | -5 | sedge | perennial | softstem bulrush |
| <i>Scirpus cyperinus</i> | Cyperaceae | SCICYP | native | 5 | -5 | sedge | perennial | wool-grass |
| <i>Solidago canadensis</i> | Asteraceae | SOLCAN | native | 1 | 3 | forb | perennial | canada goldenrod |
| <i>Solidago gigantea</i> | Asteraceae | SOLGIG | native | 3 | -3 | forb | perennial | late goldenrod |
| <i>Solidago patula</i> | Asteraceae | SOLPAT | native | 6 | -5 | forb | perennial | swamp goldenrod |
| <i>Solidago rugosa</i> | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| <i>Symphotrichum urophyllum;</i> <i>aster sagittifolius</i> | Asteraceae | SYMURO | native | 2 | 5 | forb | perennial | arrow-leaved aster |
| <i>Taraxacum officinale</i> | Asteraceae | TAROFF | non-native | 0 | 3 | forb | perennial | common dandelion |
| <i>Thuja occidentalis</i> | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| <i>Tragopogon pratensis</i> | Asteraceae | TRAPRA | non-native | 0 | 5 | forb | biennial | common goats beard |
| <i>Trifolium pratense</i> | 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 |
|-----------------------------|------------------|----------------|----------------|----------|----------|--------------------|-----------------|--------------------|
| <i>Ulmus americana</i> | Ulmaceae | ULMAME | native | 1 | -3 | tree | perennial | american elm |
| <i>Verbascum thapsus</i> | Scrophulariaceae | VERTHA | non-native | 0 | 5 | forb | biennial | common mullein |
| <i>Veronica officinalis</i> | Plantaginaceae | VEROOF | non-native | 0 | 3 | forb | perennial | common speedwell |
| <i>Vicia villosa</i> | 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 |
|--|-------------------------------|--------------------|-----------------|------------------|
| <i>Apocynum cannabinum</i> | Indian-hemp | ASB#1 | 44.941041 | -85.209496 |
| <i>Berberis thunbergii</i> | Japanese barberry | NSHC #2 | 44.969190 | -85.219197 |
| <i>Berberis thunbergii</i> | Japanese barberry | NSHC #1 | 44.964995 | -85.214828 |
| <i>Carex aquatilis</i> | Sedge | DELANGE | 44.916788 | -85.223876 |
| <i>Carex buxbaumii</i> | Sedge | DELANGE | 44.916693 | -85.222285 |
| <i>Carex diandra</i> | Sedge | DELANGE | 44.915570 | -85.223290 |
| <i>Carex exilis</i> | Sedge | DELANGE | 44.915529 | -85.230442 |
| <i>Carex exilis</i> | sedge | OKLESKY | 44.932580 | -85.212351 |
| <i>Carex lupulina</i> | sedge | ASB #2 | 44.940380 | -85.208109 |
| <i>Carex pseudocyperis</i> | sedge | DELANGE | 44.916788 | -85.223876 |
| <i>Cirsium vulgare</i> | bull thistle | BELLMORE | 44.923461 | -85.244131 |
| <i>Dichanthelium depauperatum</i> | panic grass | AUSTIN | 44.928447 | -85.213080 |
| <i>Epilobium palustre</i> | marsh willow-herb | NSHC #1 | 44.965102 | -85.219144 |
| <i>Iris pseudacorus</i> | yellow flag | DELANGE | 44.916083 | -85.223983 |
| <i>Lonicera morrowii</i> | morrow honeysuckle | GORSUCH H #1B | 44.909849 | -85.233629 |
| <i>Lycopus uniflorus</i> | northern bugle weed | NSHC #1 | 44.966693 | -85.215332 |
| <i>Lysimachia nummularia</i> | moneywort | ASB #1 | 44.940998 | -85.208506 |
| <i>Phragmites australis</i> subsp. <i>americanus</i> | common reed | DELANGE #1B | 44.916022 | -85.223933 |
| <i>Phragmites australis</i> subsp. <i>americanus</i> | common reed | NOLD | 44.929429 | -85.244669 |
| <i>Picea pungens</i> | blue spruce | NOLD | 44.931312 | -85.246101 |
| <i>Rumex orbiculatus</i> | great water dock | DELANGE | 44.917170 | -85.221498 |
| <i>Schoenoplectus tabernaemontani</i> | soft-stem bulrush | DELANGE | 44.916788 | -85.223876 |
| <i>Solidago canadensis</i> | Canada goldenrod | AUSTIN #1A, MI #1C | 44.936081 | -85.213705 |
| <i>Solidago gigantea</i> | late goldenrod | DEWEY | 44.904690 | -85.221300 |
| <i>Symphyotrichum firmum</i> | smooth swamp aster | NHSC #1 | 44.967146 | -85.218826 |
| <i>Symphyotrichum lanceolatum</i> | panicled aster | MI #1D | 44.918174 | -85.222412 |
| <i>Typha angustifolia</i> | narrow-leaved cat-tail | NHSC #1 | 44.965102 | -85.219144 |
| <i>Typha angustifolia</i> | narrow-leaved cat-tail | DELANGE #1B | 44.916875 | -85.222533 |
| <i>Utricularia minor</i> | small bladderwort | AUSTIN | 44.932097 | -85.212142 |
| <i>Verbena hastata</i> | blue vervain | NOLD | 44.931155 | -85.245552 |

Appendix 14. Native species of interest (e.g., orchids, carnivorous plants, parasitic plants, coral fungus) found during surveys and their coordinates in decimal degrees or parcel. To see a complete list of native and non-natives species, see Appendices 1-11.

| Scientific name | Common name | Parcel | Latitude | Longitude | Photo |
|--|-------------------------|----------------|-------------|--------------|----------|
| <i>Arethusa bulbosa</i> | arethusa/dragon's mouth | | 44.917289 | -85.237428 | |
| <i>Calopogon tuberosus</i> | grass-pink | GORSUCH, H #1B | 44.91276255 | -85.23255155 | DSC04139 |
| <i>Calopogon tuberosus</i> | grass-pink | GORSUCH, H #1B | 44.91276255 | -85.23255155 | DSC04140 |
| <i>Calopogon tuberosus</i> | grass-pink | GORSUCH, H #1B | 44.91276255 | -85.23255155 | DSC04141 |
| <i>Calopogon tuberosus</i> | grass-pink | GORSUCH, H #1B | 44.91276255 | -85.23255155 | DSC04142 |
| <i>Calopogon tuberosus</i> | grass-pink | GORSUCH, H #1B | 44.91276255 | -85.23255155 | DSC04143 |
| <i>Calopogon tuberosus</i> | grass-pink | GORSUCH, H #1B | 44.91276255 | -85.23255155 | DSC04144 |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | NSHC #1 | 44.96435435 | -85.21799386 | DSC04305 |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | NSHC #1 | 44.96435435 | -85.21799386 | DSC04306 |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | NSHC #1 | 44.96435435 | -85.21799386 | DSC04307 |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | NSHC #1 | 44.96677335 | -85.21883559 | |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | MI #2A | 44.92658449 | -85.20676932 | |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | MI #2A | 44.92499011 | -85.20684415 | |
| <i>Clavulinopsis spp. likely C. fusiformis</i> | yellow coral fungus | DELANGE #1A | 44.91753417 | -85.22110938 | |
| <i>Corallorhiza trifida</i> | early coralroot orchid | NSHC #2 | 44.96896254 | -85.21945658 | DSC04040 |
| <i>Corallorhiza trifida</i> | early coralroot orchid | NSHC #2 | 44.96896254 | -85.21945658 | DSC04041 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91418094 | -85.22991036 | DSC04163 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91418094 | -85.22991036 | DSC04164 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91418094 | -85.22991036 | DSC04165 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91418094 | -85.22991036 | DSC04166 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91418094 | -85.22991036 | DSC04167 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91716933 | -85.2133761 | DSC04190 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91716933 | -85.2133761 | DSC04191 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91730006 | -85.21329197 | DSC04192 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91730006 | -85.21329197 | DSC04193 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1B | 44.91730006 | -85.21329197 | DSC04194 |
| <i>Cypripedium parviflorum</i> | yellow lady-slipper | DELANGE #1A | 44.91899839 | -85.21124726 | |
| <i>Cypripedium reginae</i> | showy lady-slipper | GORSUCH, H #1B | 44.90763764 | -85.23316679 | DSC04112 |
| <i>Cypripedium reginae</i> | showy lady-slipper | GORSUCH, H #1B | 44.90763764 | -85.23316679 | DSC04113 |
| <i>Cypripedium reginae</i> | showy lady-slipper | GORSUCH, H #1B | 44.90763764 | -85.23316679 | DSC04114 |

| Scientific name | Common name | Parcel | Latitude | Longitude | Photo |
|--------------------------------------|----------------------------|----------------|-------------|--------------|----------|
| <i>Cypripedium reginae</i> | showy lady-slipper | GORSUCH, H #1B | 44.90763764 | -85.23316679 | DSC04115 |
| <i>Cypripedium spp.</i> | lady-slipper | DELANGE #1B | 44.91578033 | -85.21519834 | DSC04185 |
| <i>Cypripedium spp.</i> | lady-slipper | DELANGE #1B | 44.91578033 | -85.21519834 | DSC04186 |
| <i>Cypripedium spp.</i> (likely) | lady-slipper | Delange #1B | 44.91488098 | -85.22354932 | DSC03927 |
| <i>Cypripedium spp.</i> (likely) | lady-slipper | Delange #1B | 44.91488098 | -85.22354932 | DSC03928 |
| <i>Drosera rotundifolia</i> | round-leaf sundew | DELANGE #1B | 44.91473738 | -85.22788631 | |
| <i>Drosera rotundifolia</i> | round-leaf sundew | NSHC #2 | 44.96902347 | -85.21932107 | DSC04038 |
| <i>Drosera rotundifolia</i> | round-leaf sundew | NSHC #2 | 44.96902347 | -85.21932107 | DSC04039 |
| <i>Drosera rotundifolia</i> | round-leaf sundew | NSHC #1 | 44.96735518 | -85.2188896 | |
| <i>Drosera rotundifolia</i> | round-leaf sundew | BELMOOR | 44.92258065 | -85.24460206 | |
| <i>Drosera rotundifolia</i> | round-leaf sundew | DELANGE #1B | 44.91644054 | -85.22758609 | |
| <i>Drosera rotundifolia</i> fruiting | round-leaf sundew | MI #3 | 44.92007734 | -85.22734127 | |
| <i>Goodyera pubescens</i> | downy rattlesnake plantain | DELANGE #1B | | | |
| <i>Hypopitys monotropa</i> | pinemap | BAGINSKI #1B | 44.92379823 | -85.21834425 | DSC04320 |
| <i>Hypopitys monotropa</i> | pinemap | BAGINSKI #1B | 44.92379823 | -85.21834425 | DSC04321 |
| <i>Platanthera huronensis</i> | Lake Huron green orchid | GORSUCH H #1E | | | |
| <i>Platanthera psycodes</i> | purple fringed orchid | MI #2A | 44.92511886 | -85.20854741 | DSC04351 |
| <i>Platanthera psycodes</i> | purple fringed orchid | MI #2A | 44.92511886 | -85.20854741 | DSC04352 |
| <i>Platanthera psycodes</i> | purple fringed orchid | MI #2A | 44.92511886 | -85.20854741 | DSC04353 |
| <i>Platanthera psycodes</i> | purple fringed orchid | MI #2A | 44.92494415 | -85.2085501 | DSC04356 |
| <i>Platanthera psycodes</i> | purple fringed orchid | MI #2A | 44.92494415 | -85.2085501 | DSC04357 |
| <i>Platanthera psycodes</i> | purple fringed orchid | | | | DSC04383 |
| <i>Platanthera psycodes</i> | purple fringed orchid | OLESKY | 44.91745646 | -85.23785412 | DSC04400 |
| <i>Platanthera psycodes</i> | purple fringed orchid | OLESKY | 44.91745646 | -85.23785412 | DSC04401 |
| <i>Platanthera psycodes</i> | purple fringed orchid | OLESKY | 44.91745646 | -85.23785412 | DSC04402 |
| <i>Platanthera psycodes</i> | purple fringed orchid | GORSUCH, H #1B | 44.91741767 | -85.23555096 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | OLESKY | 44.91632138 | -85.23662011 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | GORSUCH, H #1B | 44.91525477 | -85.23266286 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | GORSUCH, H #1B | 44.9151987 | -85.23397307 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.91567738 | -85.22658065 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.91639452 | -85.22749226 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.9156883 | -85.22820346 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | GORSUCH, H #1B | 44.91489891 | -85.2339686 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.91660826 | -85.22859008 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.91660826 | -85.22859008 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.91473738 | -85.22788631 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | DELANGE #1B | 44.9157137 | -85.22677871 | |
| <i>Platanthera psycodes</i> | purple fringed orchid | OLESKY | 44.91738577 | -85.23777437 | DSC04403 |
| <i>Pogonia ophioglossoides</i> | rose pogonia | Delange #1B | 44.91590531 | -85.2262001 | DSC03919 |

| Scientific name | Common name | Parcel | Latitude | Longitude | Photo |
|------------------------------------|----------------------|----------------|-------------|--------------|----------|
| <i>Pogonia ophioglossoides</i> | rose pogonia | Delange #1B | 44.91590531 | -85.2262001 | DSC03921 |
| <i>Pogonia ophioglossoides</i> | rose pogonia | GORSUCH, H #1B | 44.91401999 | -85.23278336 | |
| <i>Pogonia ophioglossoides</i> | rose pogonia | DELANGE #1B | | | DSC04158 |
| <i>Pogonia ophioglossoides</i> | rose pogonia | DELANGE #1B | | | DSC04159 |
| <i>Pogonia ophioglossoides</i> | rose pogonia | DELANGE #1B | | | DSC04156 |
| <i>Pogonia ophioglossoides</i> | rose pogonia | DELANGE #1B | | | DSC04157 |
| <i>Ramariopsis kunzei</i> (likely) | white coral fungus | DEWEY, W | 44.90620883 | -85.22456067 | DSC04447 |
| <i>Sarracenia purpurea</i> | pitcher plant | GORSUCH, H #1B | 44.91489891 | -85.2339686 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91660826 | -85.22859008 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91660826 | -85.22859008 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91473738 | -85.22788631 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.9157137 | -85.22677871 | |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91687689 | -85.22316002 | DSC03874 |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91687689 | -85.22316002 | DSC03875 |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91687689 | -85.22316002 | DSC03876 |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91687689 | -85.22316002 | DSC03877 |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91696781 | -85.22527705 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91618173 | -85.22544699 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91592095 | -85.22547261 | |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91503538 | -85.22372583 | DSC03923 |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91503538 | -85.22372583 | DSC03924 |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91503538 | -85.22372583 | DSC03925 |
| <i>Sarracenia purpurea</i> | pitcher plant | Delange #1B | 44.91503538 | -85.22372583 | DSC03926 |
| <i>Sarracenia purpurea</i> | pitcher plant | MI #2C | 44.9233363 | -85.20993195 | |
| <i>Sarracenia purpurea</i> | pitcher plant | GORSUCH, H #1B | 44.91245591 | -85.23249808 | |
| <i>Sarracenia purpurea</i> | pitcher plant | NSHC #1 | 44.96629055 | -85.21874413 | |
| <i>Sarracenia purpurea</i> | pitcher plant | BELMOOR | 44.92309014 | -85.24488663 | |
| <i>Sarracenia purpurea</i> | pitcher plant | GORSUCH, H #1B | 44.91599766 | -85.23644605 | |
| <i>Sarracenia purpurea</i> | pitcher plant | GORSUCH, H #1B | 44.9130507 | -85.23321901 | |
| <i>Sarracenia purpurea</i> | pitcher plant | GORSUCH, H #1B | 44.91556428 | -85.23269691 | |
| <i>Sarracenia purpurea</i> | pitcher plant | GORSUCH, H #1B | 44.91535807 | -85.23407334 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91568917 | -85.22668244 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | 44.91644054 | -85.22758609 | |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | | | DSC04158 |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | | | DSC04159 |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | | | DSC04156 |
| <i>Sarracenia purpurea</i> | pitcher plant | DELANGE #1B | | | DSC04157 |
| <i>S.purpurea f. heterophylla</i> | yellow pitcher pant | GORSUCH, H #1B | 44.91700091 | -85.23624524 | DSC04406 |
| <i>S.purpurea f. heterophylla</i> | yellow pitcher plant | GORSUCH, H #1B | 44.91700091 | -85.23624524 | DSC04407 |

| Scientific name | Common name | Parcel | Latitude | Longitude | Photo |
|--------------------------------|-------------------------|--------------------|-------------|--------------|----------|
| <i>Schizachyrium scoparium</i> | little bluestem | DEWEY, D & STANLEY | 44.90490427 | -85.22127403 | |
| <i>Schizachyrium scoparium</i> | little bluestem | GORSUCH, H #1B | 44.90887485 | -85.23478673 | DSC04465 |
| <i>Schizachyrium scoparium</i> | little bluestem | GORSUCH, H #1B | 44.90887485 | -85.23478673 | DSC04466 |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | MI #1D | 44.91843902 | -85.22098749 | DSC04372 |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | MI #1D | 44.91843902 | -85.22098749 | DSC04373 |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | MI #1D | 44.91843902 | -85.22098749 | DSC04374 |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | OLESKY | 44.91683858 | -85.23680378 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | GORSUCH, H #1B | 44.91739694 | -85.23559925 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | GORSUCH, H #1B | 44.91736177 | -85.23547945 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | GORSUCH, H #1B | 44.91642254 | -85.23611462 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | OLESKY | 44.91702851 | -85.23733336 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | GORSUCH, H #1B | 44.91545882 | -85.2337697 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | DELANGÉ #1B | 44.91522224 | -85.22815423 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | DELANGÉ #1B | 44.9150733 | -85.22816475 | |
| <i>Spiranthes cernua</i> | nodding ladies-tresses | DELANGÉ #1B | 44.91480529 | -85.22812791 | |
| <i>Trichophorium alpinum</i> | alpine bulrush | DELANGÉ #1B | 44.915905 | -85.2262 | DSC03915 |
| <i>Trichophorium alpinum</i> | alpine bulrush | DELANGÉ #1B | 44.915905 | -85.2262 | DSC03918 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03955 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03956 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03957 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03958 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03959 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03960 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03961 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03962 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.93423187 | -85.2077594 | DSC03963 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.932891 | -85.21576 | DSC03964 |
| <i>Utricularia cornuta</i> | horned bladderwort | MI #1A | 44.932891 | -85.21576 | DSC03965 |
| <i>Utricularia intermedia</i> | flat-leaved bladderwort | DELANGÉ #1B | 44.9163084 | -85.22528001 | DSC04492 |
| <i>Utricularia intermedia</i> | flat-leaved bladderwort | DELANGÉ #1B | 44.9163084 | -85.22528001 | DSC04493 |
| <i>Utricularia intermedia</i> | flat-leaved bladderwort | DELANGÉ #1B | 44.9163084 | -85.22528001 | DSC04494 |
| <i>Utricularia minor</i> | small bladderwort | | 44.932097 | -85.212142 | |
| <i>Utricularia vulgaris</i> | common bladderwort | MI #1A | 44.93707481 | -85.20910012 | DSC03967 |
| <i>Utricularia vulgaris</i> | common bladderwort | MI #1A | 44.93707481 | -85.20910012 | DSC03968 |
| <i>Utricularia vulgaris</i> | common bladderwort | MI #1A | 44.93707481 | -85.20910012 | DSC03969 |
| <i>Utricularia vulgaris</i> | common bladderwort | MI #1A | 44.93707481 | -85.20910012 | 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 |
|------------------------------|--------------------|--------------------|-------------|--------------|----------|
| <i>Alliaria petiolata</i> | garlic mustard | SKINNER | | | |
| <i>Berberis thunbergii</i> | Japanese barberry | NSHC #2 | 44.96919034 | -85.21919718 | DSC04035 |
| <i>Berberis thunbergii</i> | Japanese barberry | NSHC #2 | 44.96919034 | -85.21919718 | DSC04036 |
| <i>Berberis thunbergii</i> | Japanese barberry | NSHC #2 | 44.96919034 | -85.21919718 | DSC04037 |
| <i>Berberis thunbergii</i> | Japanese barberry | NSHC #1 | 44.96499542 | -85.21482845 | |
| <i>Berberis thunbergii</i> | Japanese barberry | KOWALL #1, 2, 3 | 44.9285999 | -85.20661813 | |
| <i>Berberis thunbergii</i> | Japanese barberry | NOLD | 44.92993987 | -85.24572514 | |
| <i>Centaurea stoebe</i> | spotted knapweed | NSHC #2 | 44.97111284 | -85.21817808 | DSC04021 |
| <i>Centaurea stoebe</i> | spotted knapweed | NSHC #2 | 44.97111284 | -85.21817808 | DSC04022 |
| <i>Cirsium arvense</i> | Canada thistle | | | | |
| <i>Cirsium palustre</i> | marsh thistle | | | | |
| <i>Cirsium palustre</i> | marsh thistle | AUSTIN #1A, MI #1C | 44.93490822 | -85.21424554 | |
| <i>Cirsium vulgare</i> | bull thistle | | | | |
| <i>Cirsium vulgare</i> | bull thistle | MI #2A | 44.92626327 | -85.20626153 | |
| <i>Cirsium vulgare</i> | bull thistle | DELANGE #1B | 44.91410799 | -85.22567634 | |
| <i>Elaeagnus umbellata</i> | autumn olive | GAGE | 44.90500031 | -85.21487387 | DSC04074 |
| <i>Elaeagnus umbellata</i> | autumn olive | GAGE | 44.90482231 | -85.21522581 | DSC04075 |
| <i>Elaeagnus umbellata</i> | autumn olive | DELANGE #1B | 44.91522303 | -85.21591605 | DSC04184 |
| <i>Elaeagnus umbellata</i> | autumn olive | SKINNER #1A | 44.92599784 | -85.24988303 | DSC04418 |
| <i>Elaeagnus umbellata</i> | autumn olive | GORSUCH, H #1B | 44.91182556 | -85.23422572 | |
| <i>Elaeagnus umbellata</i> | autumn olive | GORSUCH, H #1B | 44.91195904 | -85.23410419 | |
| <i>Elaeagnus umbellata</i> | autumn olive | GORSUCH, H #1B | 44.91290743 | -85.23340935 | |
| <i>Elaeagnus umbellata</i> | autumn olive | SKINNER #1A | 44.9258191 | -85.24947817 | DSC04420 |
| <i>Phalaris arundinacea</i> | canary reed grass | SKINNER #1A | 44.9258191 | -85.24947817 | DSC04420 |
| <i>Euphorbia virgata</i> | leafy spurge | NSHC #1 | 44.95977838 | -85.21435472 | DSC04014 |
| <i>Euphorbia virgata</i> | leafy spurge | NSHC #1 | 44.95977838 | -85.21435472 | DSC04015 |
| <i>Euphorbia virgata</i> | leafy spurge | NSHC #1 | 44.95977838 | -85.21435472 | DSC04016 |
| <i>Lonicera morrowii</i> | morrow honeysuckle | DEWEY, W | 44.90419573 | -85.22337101 | |
| <i>Lonicera morrowii</i> | morrow honeysuckle | GORSUCH, H #1B | 44.90984852 | -85.23362853 | DSC04386 |
| <i>Lonicera x bella</i> | hybrid honeysuckle | NOLD | | | DSC04387 |
| <i>Lonicera x bella</i> | hybrid honeysuckle | NOLD | | | |
| <i>Lysimachia nummularia</i> | moneywort | ASB #2 | | | |
| <i>Lysimachia nummularia</i> | moneywort | SWAN | | | |

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