# Surveys and Monitoring for the Hiawatha National Forest: FY 2014 Progress Report

Prepared by:
David L. Cuthrell, Michael J. Monfils, Bradford S. Slaughter,
and Peter J. Badra

Michigan Natural Features Inventory
PO Box 13036, Lansing, MI 48901-3036

For:
Hiawatha National Forest
Grant/Agreement #12-CS-11091000-015
Grant/Agreement #14-PA-11091000-020

31 October 2014
Report Number 2014-20

MICHIGAN STATE UNIVERSITY | Extension

Michigan Natural Features Inventory

Suggested Citation:

Cuthrell, D.L., M.J. Monfils, B.S. Slaughter, and P.J. Badra. 2014. Surveys and Monitoring for the Hiawatha National Forest: FY 2014 Progress Report. Michigan Natural Features Inventory Report No. 2014-20 Lansing, MI. 19 pp. + appendix.



Cover photograph: Forest Road 3136 Patterned Fen, Hiawatha National Forest, Chippewa County, MI, 29 August 2014, by David Cuthrell.

**MNFI Progress Report FY2014**

List of projects selected in consultation with Hiawatha National Forest Staff:

1) Niagara Habitat Monitoring - for rare snails and ferns and placement of data loggers (East Unit)
2) Raptor Nest Checks and Productivity Surveys (East and West Units)
3) Assessment of Proposed Sites for Lakeside Daisy Reintroduction (East Unit)
4) Groundwater Dependent Ecosystems – landscape level fen/peatlands (East and West Units)
5) Mussel Surveys (East and West Units) (6) Reconcile databases – MNFI/NRIS

**Niagara Habitat Monitoring – for rare snails and ferns and placement of data loggers (East Unit)**

Vegetation monitoring, as outlined in Alternative 2 of the Niagara EIS, was initiated to develop the methodology needed to understand the changes that may occur in karst feature habitat due to vegetation management. Specifically, this monitoring was designed to address microhabitat conditions within karst feature habitat and how those conditions may be affected by vegetation management with respect to changes in light intensity, ground temperature, relative humidity, and moss cover between treated and untreated sites.

After reviewing the monitoring plan and the prescribed timber sales, sites were selected for sampling with the assistance of HNF staff. Sampling plots were circular and 1/10 of an acre (11.3 m radius; James and Shugart 1970). Sampling included the collection of overall plot level and three 1 $m^2$ plots along the cliff/boulder face where rare ferns typically would be growing or rare land snails were likely to occur. Measurements collected at the overall plot level focused on forest structure and species composition. Tree density and composition was measured in two categories: tree (dbh ≥ 3.5 inches) and subcanopy (dbh < 3.5 inches). Other overall plot level measurements included percent canopy closure, plant species lists and coarse woody debris (CWD) qualitative assessment. Percent canopy closure was estimated along the cardinal directions from the plot center. Ocular tube readings of canopy conditions were taken at paced intervals (~1 m) five times in each cardinal direction. The ratio of hits to misses in the ocular tube gave the percentage canopy cover for that plot. No analyses have been completed at this time but data have been summarized.

To address the changes that may occur after the different forest treatments, during the summer of 2014 we conducted vegetation sampling at a total of 22 sites: year 2 sampling at the 8 Reference sites, the 8 Option 2 sites, and 6 Control sites. The 8 Option 3 sites had not been harvested at the time of sampling (late July), and therefore we were unable to complete year 1 vegetation sampling. In conjunction with the vegetation sampling, we placed data loggers at a total of 30 sites (8 reference sites, 8 Option 1, 8 Option 2, and 6 Control sites). Two data loggers were placed at each site at the plot center. One data logger placed at the top of the cliff or boulder recorded temperature and light intensity while a second data logger placed at the base recorded both temperature and relative humidity. All data loggers were placed in the field during July (15-16) and all were collected on August 24, 2014. Data has been offloaded from the devices and are currently being summarized for preliminary analysis.

We compiled temperature, humidity, and light intensity data gathered by data loggers during 2012 and 2013 into a database to facilitate future analyses. Because the data loggers export information in different formats depending on type (i.e., temperature and relative humidity vs. temperature and light intensity), substantial data manipulation is necessary to produce a consistent format for data

intensity), substantial data manipulation is necessary to produce a consistent format for data summarization and analysis. For 2012 and 2013, we calculated the mean daily average, maximum, and minimum temperatures recorded at both the ground surface and elevated rock structures (i.e., boulders and outcroppings) by year and treatment type (Table 1). Average daily and maximum daily light intensity and average daily relative humidity were estimated by year and treatment (Table 1). We also compared average daily ground surface temperature, elevated structure temperature, relative humidity, and light intensity by year and treatment (Figures 2-8). We downloaded the data collected in 2014 and plan to enter it into the database during winter of 2014-2015.

During both 2012 and 2013, Option 2 stands tended to have greater ground surface temperatures compared to the other treatments. Overall, both Option 1 and 2 treatments had greater surface temperatures than control and reference sites (Figures 2 and 3). During 2012, average elevated temperature was greatest in Option 1 stands compared to the other treatments (Figure 4). Option 2 stands were harvested in the winter of 2012-2013 and had greater mean elevated temperatures compared to the other treatments in 2013 (Figure 5). Similar to the ground surface temperatures, elevated temperatures tended to be greater in the Option 1 and 2 treatments compared to Control and Reference stands. In 2012, relative humidity was greatest in Reference stands, lowest in the Option 2 treatment, and intermediate in Option 1 and Control stands (Figure 6). Relative humidity in 2013 was generally similar among the Control, Option 1, and Reference treatments and greater than Option 2, which again had the lowest mean among the treatments. Average light intensity was similar among the Control, Option 1, and Option 2 treatments in 2012 and greater than reference stands (Figure 8). After conducting harvest management, light intensity in 2013 was greatest in Option 2, again lowest in the reference treatment, and intermediate in Control and Option 1 stands (Figure 9).

**Figure 1.** Boulders containing Walking fern, *Asplenium rhizophyllum*, at Reference site 8.

**Table 1.** Summary of environmental conditions measured with data loggers in Hiawatha National Forest during 2012 and 2013 by treatment.

| Year and Variable | Control | Option 1 | Option 2 | Reference |
|---|---|---|---|---|
| **2012** | | | | |
| Ground Surface Temperature (°F) | | | | |
| Mean Daily Maximum | 70.6 | 77.2 | 76.0 | 72.8 |
| Mean Daily Minimum | 58.3 | 58.8 | 58.8 | 58.3 |
| Mean Daily | 63.3 | 64.2 | 65.2 | 63.0 |
| Elevated Temperature (°F) | | | | |
| Mean Daily Maximum | 84.3 | 91.0 | 83.2 | 77.2 |
| Mean Daily Minimum | 57.9 | 60.0 | 59.1 | 58.7 |
| Mean Daily | 66.5 | 67.4 | 66.8 | 66.1 |
| Mean Daily Relative Humidity (%) | 95.6 | 95.7 | 93.6 | 97.5 |
| Light Intensity (lum/ft2) | | | | |
| Mean Daily Maximum | 7,951 | 13,239 | 9,586 | 3,125 |
| Mean Daily | 607 | 795 | 693 | 484 |
| **2013** | | | | |
| Ground Surface Temperature (°F) | | | | |
| Mean Daily Maximum | 69.7 | 71.9 | 98.7 | 69.3 |
| Mean Daily Minimum | 53.0 | 54.4 | 53.1 | 53.7 |
| Mean Daily | 59.2 | 60.0 | 61.6 | 59.4 |
| Elevated Temperature (°F) | | | | |
| Mean Daily Maximum | 73.7 | 78.7 | 82.7 | 73.6 |
| Mean Daily Minimum | 53.5 | 56.2 | 54.9 | 54.3 |
| Mean Daily | 60.6 | 61.6 | 62.1 | 61.0 |
| Mean Daily Relative Humidity (%) | 97.0 | 96.1 | 95.4 | 97.7 |
| Light Intensity (lum/ft2) | | | | |
| Mean Daily Maximum | 9,000 | 11,025 | 11,882 | 4,953 |
| Mean Daily | 476 | 537 | 929 | 417 |

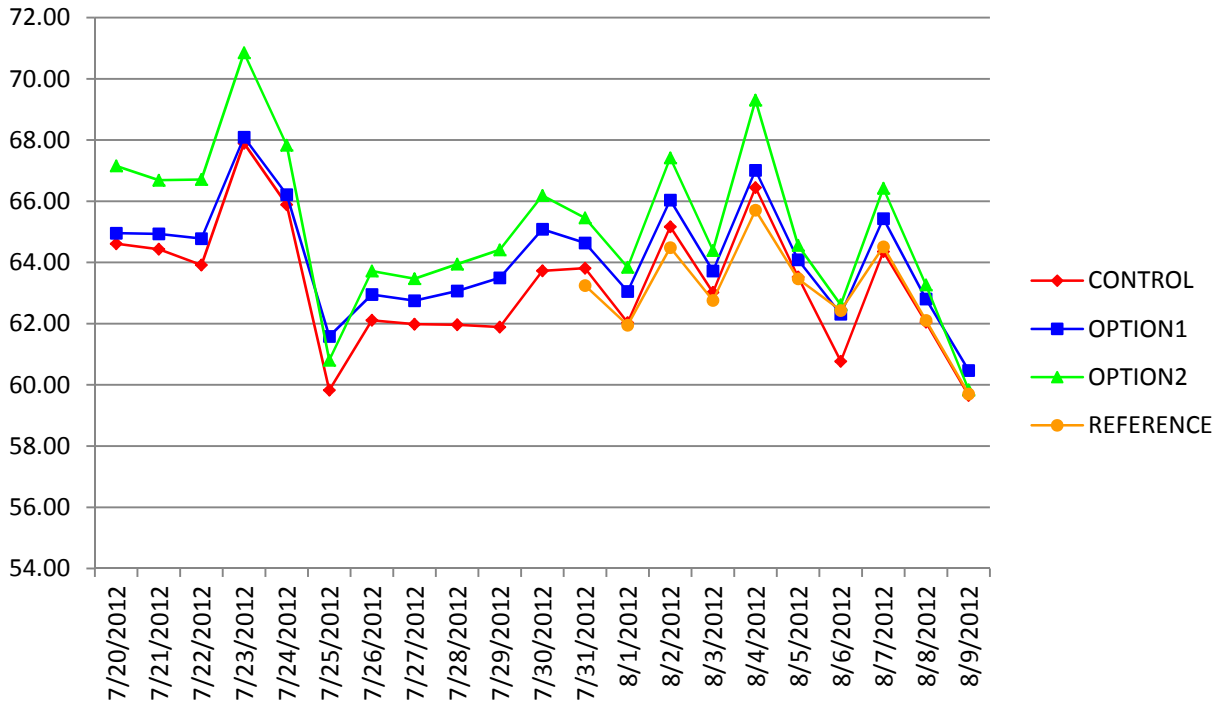


**Figure 2.** Mean ground surface temperature (F°) by day and treatment at data loggers placed in Hiawatha National Forest in 2012.

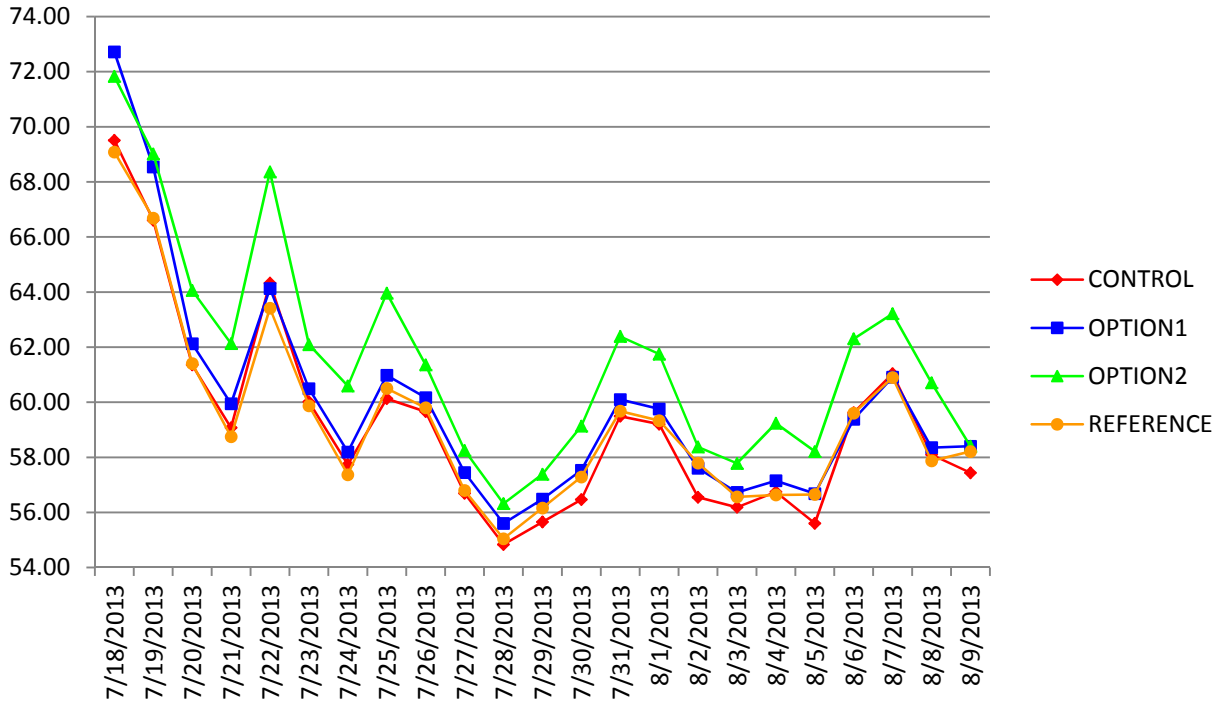


**Figure 3.** Mean ground surface temperature (F°) by day and treatment at data loggers placed in Hiawatha National Forest in 2013.

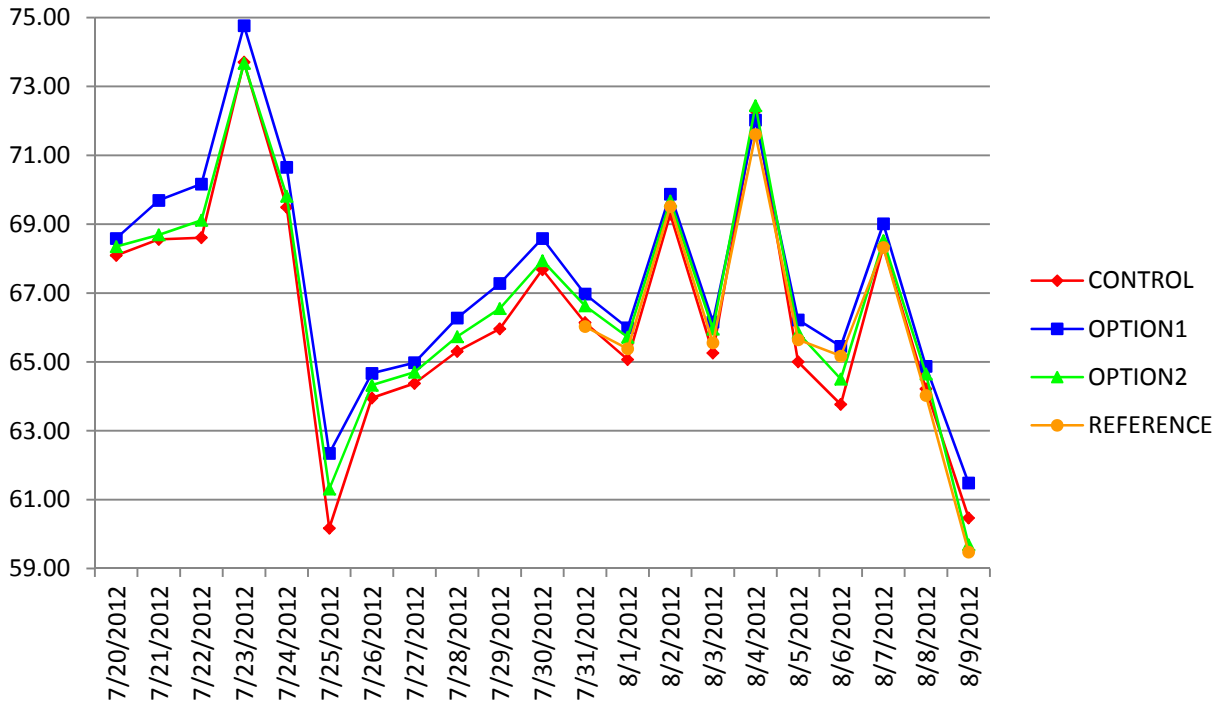


**Figure 4.** Mean elevated surface temperature (F°) by day and treatment at data loggers placed in Hiawatha National Forest in 2012.

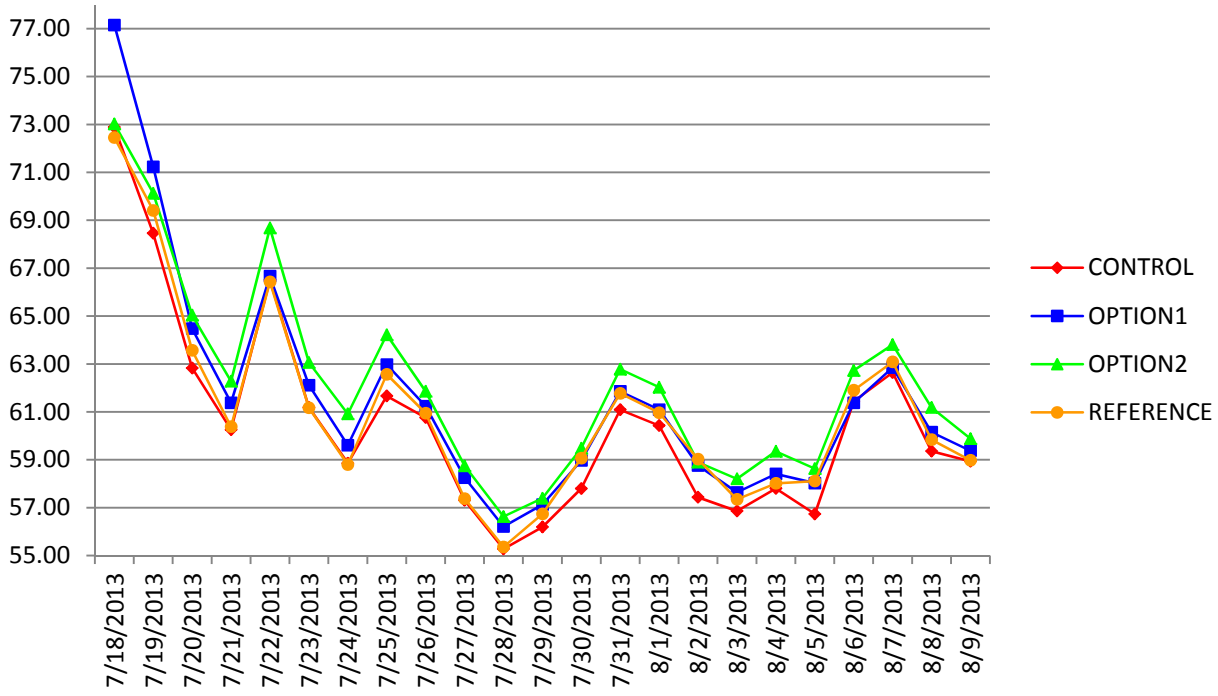


**Figure 5.** Mean elevated surface temperature (F°) by day and treatment at data loggers placed in Hiawatha National Forest in 2013.

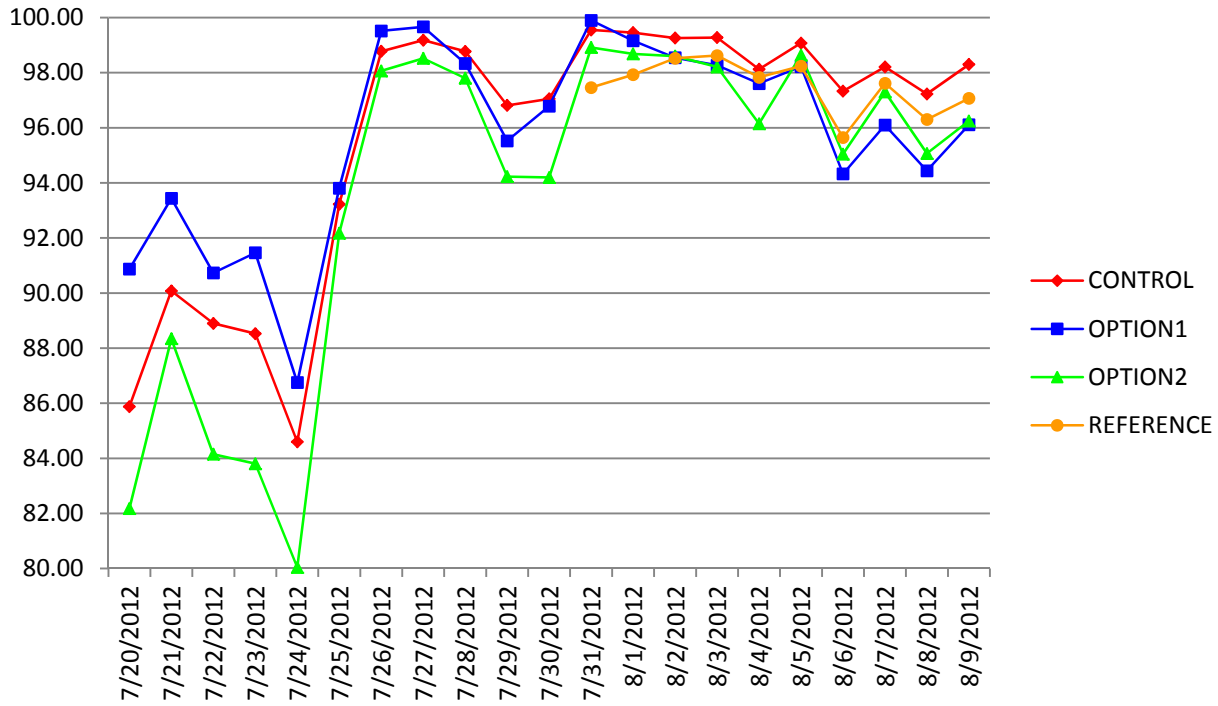


**Figure 6.** Mean relative humidity by day and treatment at data loggers placed in Hiawatha National Forest in 2012.

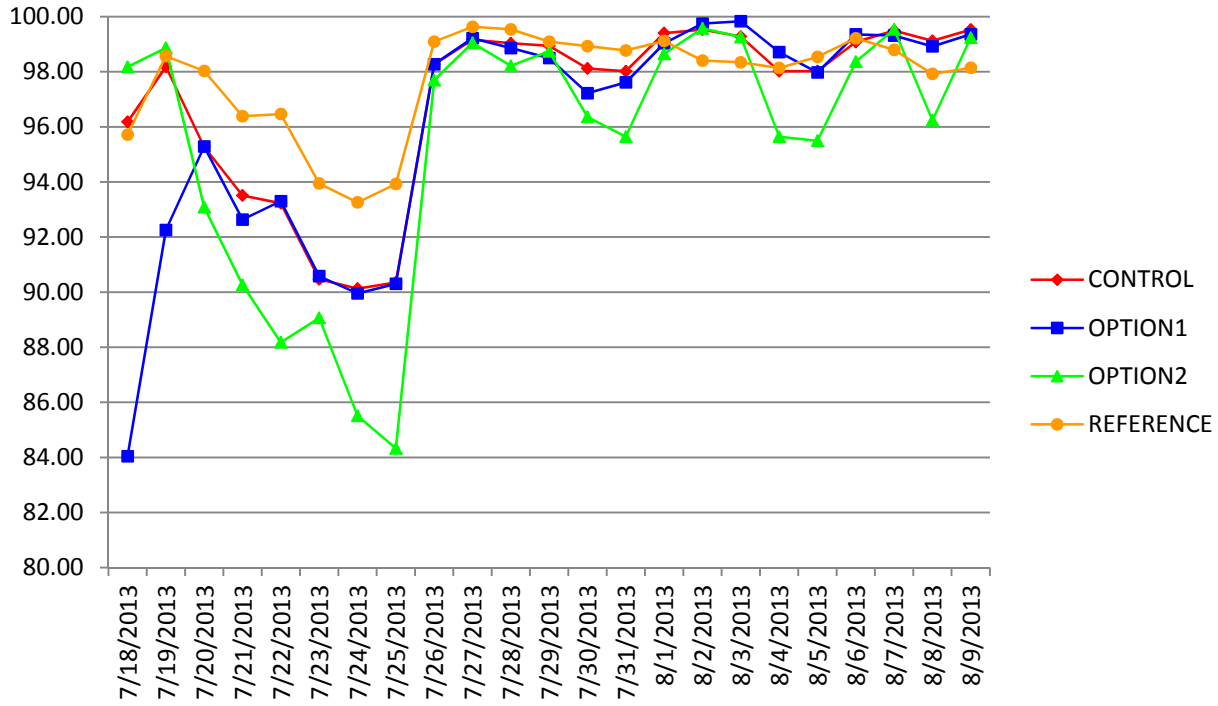


**Figure 7**. Mean relative humidity by day and treatment at data loggers placed in Hiawatha National Forest in 2013.

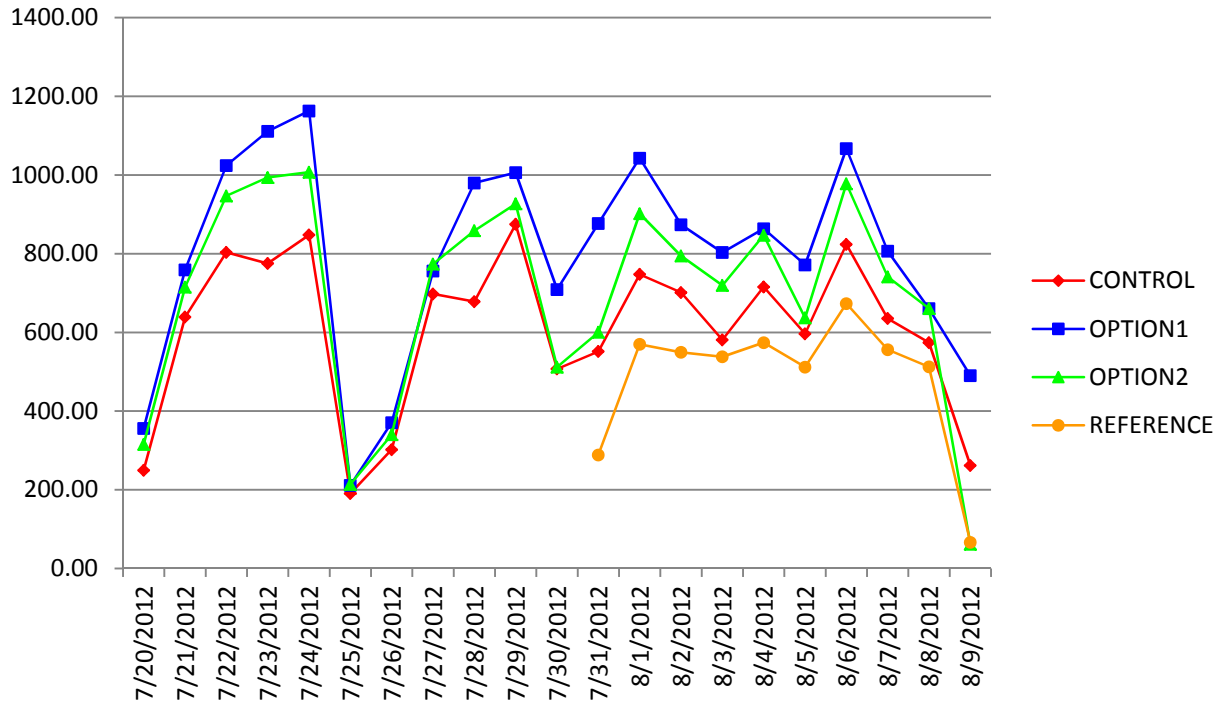


**Figure 8.** Mean light intensity (lum/ft$^2$) by day and treatment at data loggers placed in Hiawatha National Forest in 2012.

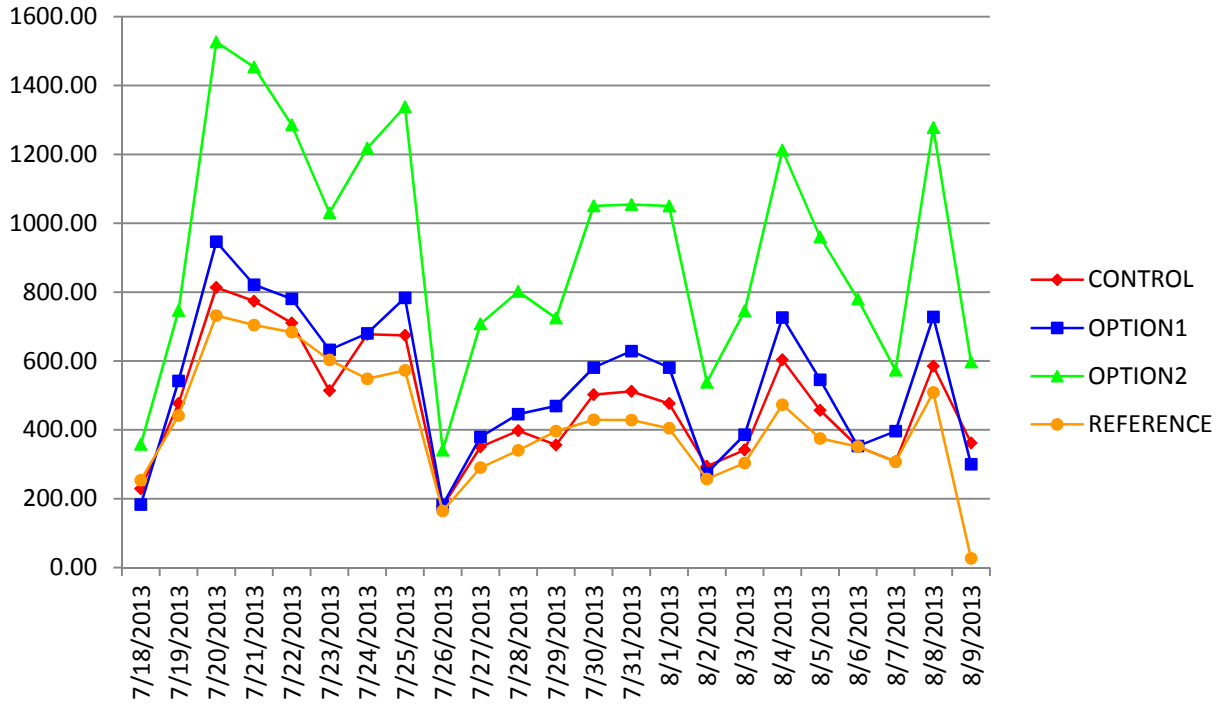


**Figure 9.** Mean light intensity (lum/ft$^2$) by day and treatment at data loggers placed in Hiawatha National Forest in 2013.

**Raptor Nest Checks and Productivity Surveys (East and West Units)**

Both the Red-shouldered Hawk (*Buteo lineatus*, state threatened) and Northern Goshawk (*Accipiter gentilis*, special concern) are Regional Forester Sensitive Species (RFSS) with known nesting occurrences within the east and west units of the Hiawatha National Forest (HNF). During the 2014 surveys a total of 109 nests or old nesting territories (54 East, 55 West) were checked for breeding use with a subset of those (active or possibly active nests) visited a second time for nest productivity.

In the East Unit, we visited 54 nests to check for breeding use. Initial nest checks and conspecific call broadcasts were conducted during May 7-22. During the first visit, MNFI staff found 11 active or potentially active (i.e., decorated nest but adult not observed) Red-shouldered Hawk nests and one active Northern Goshawk nest. Biologists from the USFS found an additional 16 active nests (15 Red-shouldered Hawk, 1 Northern Goshawk) during their first round of surveys. Staff from MNFI revisited all 28 active and potentially active (26 Red-shouldered Hawk, 2 Northern Goshawk) nests in June to assess nest success and productivity. Productivity surveys were done during June 16-20 using a telescoping fiberglass pole and video camera to inspect nests. Both of the active Northern Goshawk nests found during the first round of surveys were successful, with one nest having two chicks and the second at least two chicks (the nest was too high to check with the pole, but one chick was seen and a second heard). We observed 88% of the Red-shouldered Hawk nests to be successful and counted 47 chicks total (1.88 young per active nest, 2.14 young per successful nest).

In the West Unit, we visited 55 nests to check for breeding use. Initial nest checks and conspecific call broadcasts were conducted during May 22-24. During first visit, MNFI staff found 9 active or potentially active (i.e., decorated nest but adult not observed) Red-shouldered Hawk nests and one active Northern Goshawk nest. We revisited all 9 active and potentially active raptor nests in June to assess nest success and productivity. Productivity surveys were done during June 21-23 using a telescoping fiberglass pole and video camera to inspect nests. The active Northern Goshawk nest found during the first round of surveys was unsuccessful as the nest was found on the ground at the base of the nest tree. We observed 44 % of the Red-shouldered Hawk nests to be successful and counted 9 chicks total (1.00 young per active nest, 2.25 young per successful nest).

Overall nest success appeared to be high compared to previous years; however, we started surveys later than normal because of the late spring, so it is possible that we missed failed early season nests, making our estimate greater than the true nest success value.

**Table 2. 2014 Season Summary of nesting raptors in the Hiawatha National Forest.**

| Raptor Species | Active Nests | Successful Nests | Number of young | young/ active | young/ successful | |
|---|---|---|---|---|---|---|
| **RSHA** | **34** | **26** | **56** | **1.65** | **2.15** | **77 % of nests successful** |
| East | 25 | 22 | 47 | 1.88 | 2.14 | 88 % of nests successful |
| West | 9 | 4 | 9 | 1.00 | 2.25 | 44 % of nests successful |
| **NOGO** | **3** | **2** | **4** | **1.33** | **2.00** | **75 % of nests successful** |
| East | 2 | 2 | 4 | 2.00 | 2.00 | 100 % of nests successful |
| West | 1 | 0 | 0 | 0.00 | 0.00 | Failed, nest out of tree |

**Assessment of Proposed Sites for Lakeside Daisy Introduction (East Unit)**

In early June 2014, MNFI conducted surveys to assist USFS planning efforts to introduce the federally threatened lakeside daisy (*Tetraneuris herbacea*) to one or more areas of appropriate habitat within the HNF. This work took the form of (1) resurveying, remapping, and updating the EO record for the existing population of lakeside daisy on Michigan Nature Association property in Mackinac County and three small populations that were introduced across the road on HNF lands; (2) surveying a population on HNF land near Hessel that was deliberately introduced from seed collected at the original Mackinac County locality; (3) conducting field surveys of potentially appropriate habitats on HNF lands at Pontchartrain Point and St. Martin Point in Mackinac Coungy. (Figures 10 and 11); and (4) driving surveys to identify potentially appropriate habitat on HNF lands west of Kenneth. Field surveys consisted of habitat characterization and the compilation of vascular plant species lists to compare potential introduction sites to the existing occupied site.

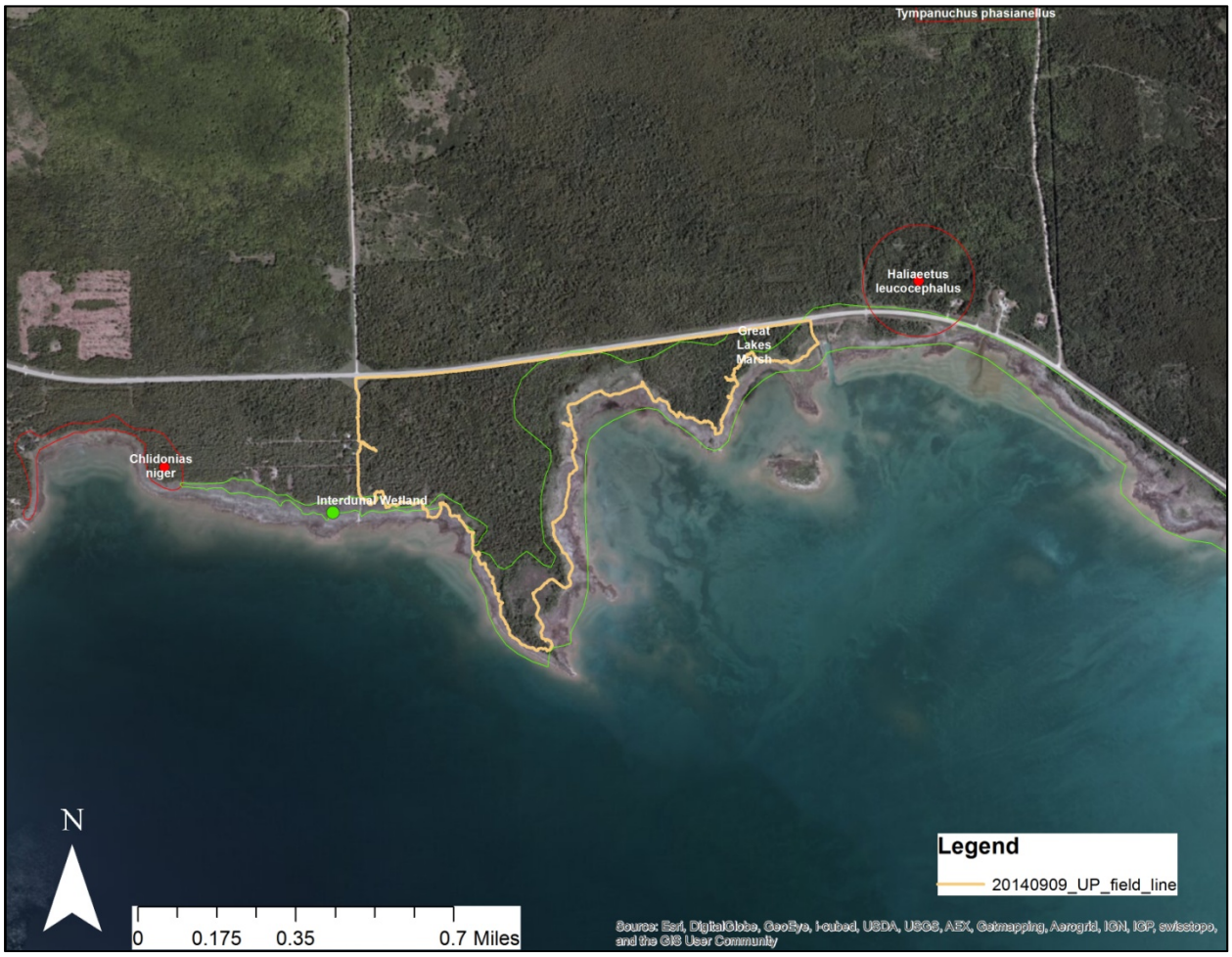


**Figure 10.** Survey track at Pontchartrain Point, 3 June 2014.

Areas of the Lake Huron shoreline at both Pontchartrain Point and St. Martin Point appeared to support potentially suitable habitat for lakeside daisy, although long-term success will likely require the plants to be introduced above the high water line and wave wash/ice scour zone. Surveys at St. Martin Point also documented a new occurrence of the state special concern ram's-head lady-slipper (*Cypripedium arietinum*). See Appendix I for vascular plant lists and natural communities identified at Pontchartrain

Point and St. Martin Point. A driving survey of the HNF near Kenneth found predominantly forested habitats, with potentially suitable habitat for lakeside daisy apparently limited to the vicinity of the adjacent Michigan Nature Association Fred Dye Nature Sanctuary.


**Figure 11.** Survey track and point for ram's-head lady-slipper at St. Martin Point, 4 June 2014.

**Groundwater-dependent Ecosystems (GDE) Level I Inventory**

In spring 2013, MNFI identified approximately 35 peatlands on Hiawatha National Forest lands for potential surveys using high resolution aerial imagery and other resources. In August 2014, we performed Forest Service GDE Level I field inventories for three sites, all in the eastern unit of the HNF (Table X) (USDA Forest Service 2012a, b). In addition, we revisited two sites first surveyed in 2013, focusing on rare species surveys. Over the past two years (2013 – 2014), we have completed Level I inventories, ecological assessments, vegetation inventories, and meander surveys for T, E, and SC vascular plants and dragonflies at a total of 13 sites (corresponding to peatland element occurrences, or EOs) on the HNF (eight in the eastern unit and five in the western unit).

Surveys in 2014 resulted in one new EO each for poor fen, northern fen (Figure 12), and patterned fen (Table 3). Revisits to two sites surveyed in 2013 failed to detect previously documented occurrences of the state threatened moor rush (*Juncus stygius*), but considerable suitable habitat persists. No other rare plant species were noted on HNF lands, although a new population of the federally threatened

Houghton's goldenrod (*Solidago houghtonii*) was documented on private land adjacent to the Pointe aux Chenes fen complex (Table 3).

**Figure 12.** Marl flats at Satago Lake northern fen, Mackinac Co., 27 August 2014.

Following completion of peatland surveys, MNFI staff will complete and distribute Forest Service GDE Level I Inventory field forms, vascular plant species lists, and rare species data to Hiawatha NF staff. After a sufficient number of GDE sites have been surveyed, we plan to work with Hiawatha NF staff to implement Level II monitoring protocols at selected sites representative of a diversity of GDE types.

**Table 3.** List of 2014 GDE Field Survey Sites and Associated Element Occurrences.

| Site | Unit | County | Central TRS | EOs |
|---|---|---|---|---|
| **Pointe aux Chenes** | E | Mackinac | T41N R04W S29 | Patterned fen (update); Poor fen (new); *Solidago houghtonii* (new); *Somatochlora incurvata* (update); *Juncus stygius* (negative survey) |
| **Satago Lake** | E | Mackinac | T42N R04W S36 | Northern fen (new); *Somatochlora incurvata* (new) |
| **Forest Road 3136** | E | Chippewa | T45N R04W S34 | Patterned fen (new) |
| **Eighteen Mile Lake** | W | Delta | T43N R20W S17 | *Juncus stygius* and *Somatochlora incurvata* (negative surveys) |

**Mussel Surveys (West Unit)**

Mussel surveys in 2014 focused on lakes within the west unit of Hiawatha National Forest. Little documentation of mussel populations from these lakes was available previously. These surveys are part of an ongoing effort to provide baseline mussel occurrence data while the Upper Peninsula is still relatively unaffected by zebra mussels (*Dreissena polymorpha*).

Unionid mussel surveys were performed to determine the presence/absence and abundance of each species at each site. A measured search area was used to standardize sampling effort among sites and allow unionid density estimates to be made. Typically 128 $m^2$ provides a good compromise between amount of search effort per site and the number of sites to be completed within the timeline of the project. A transect line was used to delineate the search area within each lake. Only wadable habitats were surveyed, i.e. waist deep and shallower. Survey of deeper habitats is possible with the use of dive equipment, but this was outside the scope of this survey. Zebra mussels and other aquatic invasives are often inadvertently transported on boats, trailers, and other recreation/fishing gear. Boat ramps or access points are likely point of entry into lakes for zebra mussels. Sample sites were located adjacent to boat access points when they were present to maximize chances of detecting any zebra mussels. GPS units were used to document the location of survey sites. Latitude and longitude of each site was recorded.

Live unionids and shells were located with a combination of visual and tactile means. Glass bottom buckets were used to facilitate visual searches. Water clarity was generally very good in the lakes sampled, allowing for effective visual detection of mussels. Occasional tactile searches through the substrate were made to help ensure that buried unionids were not being overlooked. Live individuals were identified to species and planted back into the substrate anterior end down (siphon end up) in the immediate vicinity of where they were found. Shells were also identified to species. Presence/absence was recorded for zebra mussel and Asian clam (*Corbicula fluminea*). In cases where zebra mussels are found attached to live native unionid mussels, the number attached to each is counted. Zebra mussels attached to live unionid mussels are removed by hand before the unionid is placed back in the substrate.

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

No zebra mussels were detected in the 12 lakes surveyed. A total of three native mussel species were found. Nine of the twelve lakes had native mussels. The highest density of mussels was found in Iron Jaw Lake (0.30 indvs./$m^2$), followed by Corner Lake (0.17 indvs./$m^2$), and Thunder Lake (0.11 indvs./$m^2$). The highest number of species, three, was found in Thunder Lake (Figure 13). No mussels were found at sites surveyed in Wolf, Little Bass, and Tom's Lake. One live individual was found outside the measured search area in Swan Lake. The area surveyed at each site is a small fraction of the available habitat in each lake. Surveying additional sites within these lakes could reveal extant populations. Locations of mussel survey sites are given in Table 4, and number of individuals found, by species, are provided in Table 5.

Young giant floater were found in Gooseneck Lake (Site 2). One individual had one annular ring and the other had two, indicating successful reproduction within the past two years (Figure 14). Several individuals exhibited slow growth judging by their size relative to number of annular rings, the giant floater (*Pyganodon grandis*) found at Site 3 in Lymon lake is an example of this (Figure 15). Very few mussels were found in water less than about 40cm deep. This may be due to ice scour, wave action, or a combination of the two, although mussels are able to move on the order of a few meters per day. Aquatic snails found incidentally were collected and could be identified to species and reported at a later date.

Two of the four survey sites with zero mussels had the three lowest conductivity, alkalinity, and hardness measures of all 12 sites. Physical and chemical habitat measures are provided in Table 6.

**Figure 13.** Three mussel species found at Site 8 in Thunder Lake. Fatmucket, *Lampsilis siliquoidea* (top 12 individuals.); Giant floater, *Pyganodon grandis* (bottom right six); Cylindrical papershell, *Anodontoides ferussacianus* (bottom left three)

**Table 4.** Locations of sites surveyed for mussels in Hiawatha National Forest, Summer 2014.

| Site # | Waterbody | Access Road | Latitude (N) | Longitude (W) |
|---|---|---|---|---|
| 1 | Wolf Lake | 2696 | 46.05391 | -86.51744 |
| 2 | Gooseneck Lake | Gooseneck Rd. | 46.07133 | -86.55098 |
| 3 | Lymon Lake | 2770 | 46.07358 | -86.52912 |
| 4 | Little Bass Lake | 2213 | 46.16187 | -86.45019 |
| 5 | Bass Lake | 2633 | 46.17200 | -86.46564 |
| 6 | Triangle Lake | 437/Thunder Lake Rd. | 46.16682 | -86.49741 |
| 7 | Minevera Lake | 437/Thunder Lake Rd. | 46.14481 | -86.47935 |
| 8 | Thunder Lake | Mintonye | 46.09510 | -86.47400 |
| 9 | Iron Jaw Lake | 2733 | 46.17176 | -86.54853 |
| 10 | Swan Lake | Trail 2013 | 46.16542 | -86.57834 |
| 11 | Corner Lake | 440/42.5 | 46.15378 | -86.60879 |
| 12 | Tom's Lake | 2259K | 46.15959 | -86.59362 |

**Figure 14.** Young giant floater (*Pyganodon grandis*)(top two shells), bell-mouth ram's horn (*Planorbella campanulata*)(bottom left) , and a fingernail clam (Sphaeriidae)(bottom right) from Site 2 in Gooseneck Lake.

**Figure 15.** A giant floater (*Pyganodon grandis*) from Site 3 in Lymon Lake. The size of this individual in relation to number of annular rings indicates slow growth.

Considering that mollusks process minerals from the environment to make shells, there may be a threshold level of conductivity, alkalinity, and hardness to support mussel populations. However, in this survey native mussels were found in lakes with very low levels (especially Swan and Triangle Lake). There is some evidence the level of calcium required to support zebra mussels is greater than that for native unionid mussels, and that this may allow native mussels refuge from zebra mussels in certain inland lakes in Michigan with <28mg/L calcium concentration (Hollandsworth et al. 2011). If this is the case, it's possible some lakes within Hiawatha NF with low alkalinity values may be refugia for native mussels in the future.

**Table 5.** Numbers of unionid mussels (#), relative abundance (RA), and density (D, indvs./m2) recorded at each survey site, Summer 2014. Presence/absence of non-native bivalves, aquatic snails, and fingernail clams are noted.

| | | Wolf Lake | Gooseneck Lake | | | Lymon Lake | | | Little Bass Lake | Bass Lake | | | Triangle Lake | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | | | 3 | | | 4 | 5 | | | 6 | | |
| Common Name | Species | # | # | RA | D | # | RA | D | # | # | RA | D | # | RA | D |
| Slippershell | *Alasmidonta viridis* (T) | | | | | | | | | | | | | | |
| Cylindrical papershell | *Anodontoides ferussacianus* | | | | | | | | | | | | | | |
| Eastern elliptio | *Elliptio complanata* | | | | | | | | | | | | | | |
| Spike | *Elliptio dilatata* | | | | | | | | | | | | | | |
| Fatmucket | *Lampsilis siliquoidea* | | | | | | | | | | | | | | |
| Creek heelsplitter | *Lasmigona compressa* | | | | | | | | | | | | | | |
| Giant floater | *Pyganodon grandis* | | 2 | 1.00 | 0.02 | 1 | 1.00 | 0.01 | | 2[A] | 1.00 | 0.01 | 1 | 1.00 | 0.01 |
| Strange floater | *Strophitus undulatus* | | | | | | | | | | | | | | |
| | Total # individuals and density | 0 | 2 | | 0.02 | 1 | | 0.01 | 0 | 2 | | 0.01 | 1 | | 0.01 |
| | # species live | 0 | 1 | | | 1 | | | 0 | 1 | | | 1 | | |
| | # species live or shell | 0 | 1 | | | 1 | | | 0 | 1 | | | 1 | | |
| | Area searched ($m^2$) | 128 | 128 | | | 128 | | | 128 | 336 | | | 200 | | |
| Asian clam | *Corbicula fluminea* | | | | | | | | | | | | | | |
| Zebra mussel | *Dreissena polymorpha* | | | | | | | | | | | | | | |
| Aquatic snails | Gastropoda | | X | | | X | | | X | X | | | X | | |
| Fingernail clams | Sphaeriidae | | X | | | | | | | X | | | X | | |

[A] An additional five giant floater were found outside of the measured search area at Site 5.

**Table 5.** (continued)

| | | Minevera Lake | | | Thunder Lake | | | Iron Jaw Lake | | | Swan Lake | Corner Lake | | | Tom's Lake |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | | | 8 | | | 9 | | | 10 | 11 | | | 12 |
| Common Name | Species | # | RA | D | # | RA | D | # | RA | D | # | # | RA | D | # |
| Slippershell | *Alasmidonta viridis* (T) | | | | | | | | | | | | | | |
| Cylindrical papershell | *Anodontoides ferussacianus* | | | | 3 | 0.14 | 0.02 | | | | | | | | |
| Eastern elliptio | *Elliptio complanata* | | | | | | | | | | | | | | |
| Spike | *Elliptio dilatata* | | | | | | | | | | | | | | |
| Fatmucket | *Lampsilis siliquoidea* | | | | 12 | 0.57 | 0.06 | | | | | 11 | 0.50 | 0.09 | |
| Creek heelsplitter | *Lasmigona compressa* | | | | | | | | | | | | | | |
| Giant floater | *Pyganodon grandis* | 2 | 1.00 | 0.02 | 6 | 0.29 | 0.03 | 38 | 1.00 | 0.30 | [B] | 11 | 0.50 | 0.09 | |
| Strange floater | *Strophitus undulatus* | | | | | | | | | | | | | | |
| | Total # individuals and density | 2 | | 0.02 | 21 | | 0.11 | 38 | | 0.30 | 0 | 22 | | 0.17 | 0 |
| | # species live | 1 | | | 3 | | | 1 | | | 0 | 2 | | | 0 |
| | # species live or shell | 1 | | | 3 | | | 1 | | | 0 | 2 | | | 0 |
| | Area searched ($m^2$) | 128 | | | 200 | | | 128 | | | 128 | 128 | | | 128 |
| Asian clam | *Corbicula fluminea* | | | | | | | | | | | | | | |
| Zebra mussel | *Dreissena polymorpha* | | | | | | | | | | | | | | |
| Aquatic snails | Gastropoda | X | | | X | | | X | | | X | X | | | |
| Fingernail clams | Sphaeriidae | X | | | X | | | X | | | X | X | | | |

[B] One giant floater was found outside the measured search area at Site 10.

**Table 6.** Physical and chemical habitat measures taken at mussel survey sites.

| Site # | Waterbody | Boulder | Cobble | Pebble | Gravel | Sand | Silt | Fine Organic Material | Aquatic Vegetation | Woody Debris | pH | Conductivity (µS) | Alkalinity (mg/l CaCO3) | Hardness (mg/l) | Water temp. (C) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wolf Lake | | | | | 40 | 20 | 40 | Y | N | 6.96 | 12.5 | 24 | 40 | 26.0 |
| 2 | Gooseneck Lake | | | | | 70 | 20 | 10 | Y | N | 7.04 | 135.0 | 68 | 100 | 23.2 |
| 3 | Lymon Lake | | | | | 80 | 20 | | Y | N | 8.78 | 128.6 | 64 | 80 | 21.5 |
| 4 | Little Bass Lake | | | | | 40 | 30 | 30 | Y | N | 7.54 | 110.4 | 54 | 80 | 20.9 |
| 5 | Bass Lake | | | | | 100 | | | Y | Y | 8.83 | 148.2 | 72 | 100 | 21.7 |
| 6 | Triangle Lake | | | | | 90 | 10 | | N | Y | 8.27 | 94.0 | 46 | 60 | 22.0 |
| 7 | Minevera Lake | | | | | | | 100 | Y | Y | 8.61 | 161.5 | 70 | 120 | 22.0 |
| 8 | Thunder Lake | | | | | 80 | 20 | | Y | Y | 9.02 | 185.0 | 100 | 140 | 22.4 |
| 9 | Iron Jaw Lake | | | | | 80 | 20 | | Y | Y | 8.17 | 123.6 | 56 | 80 | 21.3 |
| 10 | Swan Lake | | | | | 40 | 60 | | Y | N | 8.09 | 14.2 | 12 | 20 | 22.8 |
| 11 | Corner Lake | | | | | 90 | 10 | | N | Y | 8.53 | 210.0 | 116 | 160 | 21.7 |
| 12 | Tom's Lake | | | | | 60 | 40 | | Y | Y | 8.22 | 13.8 | 40 | 20 | 23.2 |

**Reconcile databases – MNFI/NRIS**

Rebecca Rogers, GIS Specialist and Database Administrator for MNFI, in June 2014 provided a training session on the Biotics Database for biologists and others at the St. Ignace office of the Hiawatha National Forest. MNFI continues to update the Biotics Database after every field season and we have been making changes to web-based subscription access. This fall and winter we plant to update and newly transcribe several rare fern records, peatland sites, and raptor nesting records on the Hiawatha National Forest. We are also currently reviewing access requirements/rates with several agencies and groups of data users and have provided the Hiawatha National Forest access to the full shape file level.

**This access is being provided as a direct result of our great working relationship we have established over the past three years and we look forward to continued collaboration on this and future projects!**

**Literature Cited**


Badra, P.J. 2010. Assessment of the status and distribution of native mussels (Unionidae) in Michigan, and results of unionid surveys in the Eastern Upper Peninsula and Huron-Clinton Metroparks. Report number MNFI 2010-11. Report to Michigan Department of Natural Resources and Environment, Water Bureau. Lansing, MI. 71pp.

Hollandsworth, D., R.L. Lowe, P.J. Badra. 2011. Indigenous unionid clam refugia from zebra mussels in Michigan inland lakes. The American Midland Naturalist 166:369-378.

Hynes, H.B.N. 1970. The Ecology of Running Waters. Liverpool University Press, Liverpool, pg. 24.

James, F.C. and H.H. Shugart, Jr. 1970. A quantitative method of habitat description. Audubon Field Notes 24:727- 736.

United States Department of Agriculture (USDA) Forest Service. 2012a. Groundwater-dependent ecosystems: Level I inventory field guide. USDA Forest Service Gen. Tech. Report WO-86a. 191 pp.

United States Department of Agriculture (USDA) Forest Service. 2012b. Groundwater-dependent ecosystems: Level II inventory field guide. USDA Forest Service Gen. Tech. Report WO-86b. 124 pp.


**Acknowledgements**


We would like to thank the staff from the Hiawatha National Forest for their support on this project ranging from helping with the fieldwork, providing maps, guidance on study design, and of course financial support. Additionally, we thank Sue Ridge, Nancy Toben, and Brian Klatt for providing administrative support.

**Appendix 1.**

**FQAs for Pontchartrain Point and St. Martin Point**

**Pontchartrain Point**

06/03/2014

Pontchartrain Point

Mackinac
MI
USA

| | |
|---|---|
| FQA DB Region: | Michigan |
| FQA DB Publication Year: | 2014 |
| FQA DB Description: | Reznicek, A.A., M.R. Penskar, B.S. Walters, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database. Herbarium, University of Michigan, Ann Arbor, MI and Michigan Natural Features Inventory, Michigan State University, Lansing, MI. http://michiganflora.net |
| Practitioner: | Brad Slaughter |
| Latitude: | 46.0298 |
| Longitude: | -84.5769 |
| Weather Notes: | |
| Duration Notes: | |
| Community Type Notes: | Great Lakes Marsh, Sand and Gravel Beach, Limestone Cobble Shore, Boreal Forest |
| Other Notes: | Also: Amelanchier sp., Hieracium sp., Ribes sp., Salix sp. |
| Private/Public: | Private |

| Conservatism-Based Metrics: | |
|---|---|
| Total Mean C: | 4.8 |
| Native Mean C: | 5.3 |
| Total FQI: | 48.5 |
| Native FQI: | 51.1 |
| Adjusted FQI: | 50.6 |
| % C value 0: | 10.8 |
| % C value 1-3: | 21.6 |
| % C value 4-6: | 37.3 |
| % C value 7-10: | 30.4 |
| Native Tree Mean C: | 3.2 |
| Native Shrub Mean C: | 5.7 |

| | | |
|---|---|---|
| Native Herbaceous Mean C: | 5.6 | |
| | | |
| Species Richness: | | |
| Total Species: | 102 | |
| Native Species: | 93 | 91.20% |
| Non-native Species: | 9 | 8.80% |
| | | |
| Species Wetness: | | |
| Mean Wetness: | -0.7 | |
| Native Mean Wetness: | -0.9 | |
| | | |
| Physiognomy Metrics: | | |
| Tree: | 12 | 11.80% |
| Shrub: | 17 | 16.70% |
| Vine: | 0 | 0% |
| Forb: | 54 | 52.90% |
| Grass: | 6 | 5.90% |
| Sedge: | 10 | 9.80% |
| Rush: | 0 | 0% |
| Fern: | 3 | 2.90% |
| Bryophyte: | 0 | 0% |
| | | |
| Duration Metrics: | | |
| Annual: | 1 | 1% |
| Perennial: | 98 | 96.10% |
| Biennial: | 3 | 2.90% |
| Native Annual: | 0 | 0% |
| Native Perennial: | 92 | 90.20% |
| Native Biennial: | 1 | 1% |

**Species:**

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Abies balsamea | Pinaceae | ABIBAL | native | 3 | 0 | tree | perennial | balsam fir |
| Acer rubrum | Sapindaceae | ACERUB | native | 1 | 0 | tree | perennial | red maple |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Acer saccharum | Sapindaceae | ACESAU | native | 5 | 3 | tree | perennial | sugar maple |
| Achillea millefolium | Asteraceae | ACHMIL | native | 1 | 3 | forb | perennial | yarrow |
| Actaea rubra | Ranunculaceae | ACTRUB | native | 7 | 3 | forb | perennial | red baneberry |
| Agrimonia striata | Rosaceae | AGRSTR | native | 3 | 3 | forb | perennial | roadside agrimony |
| Alnus incana; a. rugosa | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| Anemone canadensis | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| Anticlea elegans; zigadenus glaucus | Melanthiaceae | ANTELE | native | 10 | -3 | forb | perennial | white camas |
| Aquilegia canadensis | Ranunculaceae | AQUCAN | native | 5 | 3 | forb | perennial | wild columbine |
| Aralia nudicaulis | Araliaceae | ARANUD | native | 5 | 3 | forb | perennial | wild sarsaparilla |
| Arctostaphylos uva-ursi | Ericaceae | ARCUVA | native | 8 | 5 | shrub | perennial | bearberry |
| Barbarea vulgaris | Brassicaceae | BARVUL | non-native | 0 | 0 | forb | biennial | yellow rocket |
| Betula papyrifera | Betulaceae | BETPAP | native | 2 | 3 | tree | perennial | paper birch |
| Calamagrostis canadensis | Poaceae | CALCAN | native | 3 | -5 | grass | perennial | blue-joint |
| Caltha palustris | Ranunculaceae | CALPAR | native | 6 | -5 | forb | perennial | marsh-marigold |
| Carex aquatilis | Cyperaceae | CXAQUA | native | 7 | -5 | sedge | perennial | sedge |
| Carex buxbaumii | Cyperaceae | CXBUXB | native | 10 | -5 | sedge | perennial | sedge |
| Carex capillaris | Cyperaceae | CXCAPI | native | 9 | -3 | sedge | perennial | sedge |
| Carex castanea | Cyperaceae | CXCAST | native | 6 | -3 | sedge | perennial | sedge |
| Carex eburnea | Cyperaceae | CXEBUR | native | 7 | 3 | sedge | perennial | sedge |
| Carex garberi | Cyperaceae | CXGARB | native | 8 | -3 | sedge | perennial | sedge |
| Carex lasiocarpa | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| Carex pedunculata | Cyperaceae | CXPEDU | native | 5 | 3 | sedge | perennial | sedge |
| Castilleja coccinea | Orobanchaceae | CASCOC | native | 8 | 0 | forb | biennial | indian paintbrush |
| Circaea canadensis; c. lutetiana | Onagraceae | CIRCAN | native | 2 | 3 | forb | perennial | enchanters-nightshade |
| Cirsium palustre | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| Clinopodium arkansanum; calamintha a. | Lamiaceae | CLIARK | native | 10 | -3 | forb | perennial | limestone calamint |
| Clinopodium vulgare | Lamiaceae | CLIVUL | native | 3 | 5 | forb | perennial | wild-basil |
| Clintonia borealis | Convallariaceae | CLIBOR | native | 5 | 0 | forb | perennial | bluebead-lily; corn-lily |
| Comandra umbellata | Santalaceae | COMUMB | native | 5 | 3 | forb | perennial | bastard-toadflax |
| Comarum palustre; potentilla p. | Rosaceae | COMPAL | native | 7 | -5 | forb | perennial | marsh cinquefoil |
| Cornus canadensis | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| Cornus sericea; c. stolonifera | Cornaceae | CORSER | native | 2 | -3 | shrub | perennial | red-osier |
| Cypripedium parviflorum; c. calceolus | Orchidaceae | CYPPAR | native | 5 | 0 | forb | perennial | yellow lady-slipper |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Dasiphora fruticosa; potentilla f. | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| Dichanthelium lindheimeri; panicum l. | Poaceae | DICLID | native | 8 | -5 | grass | perennial | panic grass |
| Eleocharis quinqueflora; e. pauciflora | Cyperaceae | ELEQUI | native | 10 | -5 | sedge | perennial | spike-rush |
| Equisetum hyemale | Equisetaceae | EQUHYE | native | 2 | 0 | fern | perennial | scouring rush |
| Equisetum variegatum | Equisetaceae | EQUVAR | native | 6 | -3 | fern | perennial | variegated scouring rush |
| Eurybia macrophylla; aster m. | Asteraceae | EURMAC | native | 4 | 5 | forb | perennial | big-leaved aster |
| Fragaria virginiana | Rosaceae | FRAVIR | native | 2 | 3 | forb | perennial | wild strawberry |
| Fraxinus pennsylvanica | Oleaceae | FRAPEN | native | 2 | -3 | tree | perennial | red ash |
| Geum rivale | Rosaceae | GEURIV | native | 7 | -5 | forb | perennial | purple avens |
| Hypericum kalmianum | Hypericaceae | HYPKAL | native | 10 | -3 | shrub | perennial | kalms st. johns-wort |
| Iris versicolor | Iridaceae | IRIVER | native | 5 | -5 | forb | perennial | wild blue flag |
| Juncus balticus | Juncaceae | JUNBAL | native | 4 | -5 | forb | perennial | rush |
| Larix laricina | Pinaceae | LARLAR | native | 5 | -3 | tree | perennial | tamarack |
| Leucanthemum vulgare; chrysanthemum leucanthemum | Asteraceae | LEUVUL | non-native | 0 | 5 | forb | perennial | ox-eye daisy |
| Linnaea borealis | Linnaeaceae | LINBOR | native | 6 | 0 | forb | perennial | twinflower |
| Maianthemum canadense | Convallariaceae | MAICAN | native | 4 | 3 | forb | perennial | canada mayflower |
| Maianthemum stellatum; smilacina s. | Convallariaceae | MAISTE | native | 5 | 0 | forb | perennial | starry false solomon-seal |
| Medicago lupulina | Fabaceae | MEDLUP | non-native | 0 | 3 | forb | annual | black medick |
| Myrica gale | Myricaceae | MYRGAL | native | 6 | -5 | shrub | perennial | sweet gale |
| Osmorhiza claytonii | Apiaceae | OSMCLI | native | 4 | 3 | forb | perennial | hairy sweet-cicely |
| Osmunda regalis | Osmundaceae | OSMREG | native | 5 | -5 | fern | perennial | royal fern |
| Petasites frigidus; p. palmatus | Asteraceae | PETFRI | native | 10 | -3 | forb | perennial | sweet-coltsfoot |
| Phalaris arundinacea | Poaceae | PHAARU | native | 0 | -3 | grass | perennial | reed canary grass |
| Physocarpus opulifolius | Rosaceae | PHYOPU | native | 4 | -3 | shrub | perennial | ninebark |
| Picea mariana | Pinaceae | PICMAR | native | 6 | -3 | tree | perennial | black spruce |
| Pinus strobus | Pinaceae | PINSTR | native | 3 | 3 | tree | perennial | white pine |
| Piptatherum racemosum; oryzopsis r. | Poaceae | PIPRAC | native | 8 | 5 | grass | perennial | rice-grass |
| Poa compressa | Poaceae | POACOM | non-native | 0 | 3 | grass | perennial | canada bluegrass |
| Polygala paucifolia | Polygalaceae | POLPAU | native | 7 | 3 | forb | perennial | gay-wings |
| Populus balsamifera | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| Populus tremuloides | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| Potentilla anserina | Rosaceae | POTANS | native | 5 | -3 | forb | perennial | silverweed |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Primula mistassinica | Primulaceae | PRIMIS | native | 10 | -3 | forb | perennial | birds-eye primrose |
| Prunella vulgaris | Lamiaceae | PRUVUL | native | 0 | 0 | forb | perennial | self-heal |
| Prunus pumila | Rosaceae | PRUPUM | native | 8 | 5 | shrub | perennial | sand cherry |
| Pyrola asarifolia | Ericaceae | PYRASA | native | 8 | -3 | forb | perennial | pink pyrola |
| Ranunculus acris | Ranunculaceae | RANACR | non-native | 0 | 0 | forb | perennial | tall or common buttercup |
| Rhamnus alnifolia | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| Rosa acicularis | Rosaceae | ROSACI | native | 4 | 3 | shrub | perennial | wild rose |
| Rubus pubescens | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| Rubus strigosus | Rosaceae | RUBSTR | native | 2 | 0 | shrub | perennial | wild red raspberry |
| Salix candida | Salicaceae | SALCAN | native | 9 | -5 | shrub | perennial | hoary willow |
| Salix petiolaris | Salicaceae | SALPET | native | 1 | -3 | shrub | perennial | slender willow |
| Schizachyrium scoparium; andropogon s. | Poaceae | SCHSCO | native | 5 | 3 | grass | perennial | little bluestem |
| Shepherdia canadensis | Elaeagnaceae | SHECAN | native | 7 | 5 | shrub | perennial | soapberry |
| Solidago altissima | Asteraceae | SOLALT | native | 1 | 3 | forb | perennial | tall goldenrod |
| Solidago ohioensis | Asteraceae | SOLOHI | native | 8 | -5 | forb | perennial | ohio goldenrod |
| Solidago rugosa | Asteraceae | SOLRUG | native | 3 | 0 | forb | perennial | rough-leaved goldenrod |
| Sorbus decora | Rosaceae | SORDEC | native | 4 | 3 | tree | perennial | mountain-ash |
| Spiraea tomentosa | Rosaceae | SPITOM | native | 5 | -3 | shrub | perennial | steeplebush |
| Streptopus lanceolatus; s. roseus | Convallariaceae | STRLAN | native | 5 | 3 | forb | perennial | rose twisted-stalk |
| Symphyotrichum firmum; aster puniceus | Asteraceae | SYMFIR | native | 4 | -3 | forb | perennial | smooth swamp aster |
| Tanacetum vulgare | Asteraceae | TANVUL | non-native | 0 | 3 | forb | perennial | garden tansy |
| Taraxacum officinale | Asteraceae | TAROFF | non-native | 0 | 3 | forb | perennial | common dandelion |
| Thalictrum dasycarpum | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| Thalictrum dioicum | Ranunculaceae | THADIO | native | 6 | 3 | forb | perennial | early meadow-rue |
| Thuja occidentalis | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| Triantha glutinosa; tofieldia g. | Melanthiaceae | TRIGLU | native | 10 | -5 | forb | perennial | false asphodel |
| Trichophorum cespitosum; scirpus c. | Cyperaceae | TRICES | native | 10 | -5 | sedge | perennial | bulrush |
| Trientalis borealis | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| Triglochin maritima | Juncaginaceae | TRIMAR | native | 8 | -5 | forb | perennial | common bog arrow-grass |
| Trillium cernuum | Trilliaceae | TRICER | native | 5 | 0 | forb | perennial | nodding trillium |
| Typha latifolia | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| Veronica officinalis | Plantaginaceae | VEROOF | non-native | 0 | 3 | forb | perennial | common speedwell |
| Viola labradorica; v. conspersa | Violaceae | VIOLAB | native | 3 | 0 | forb | perennial | dog violet |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Viola nephrophylla | Violaceae | VIONEP | native | 8 | -3 | forb | perennial | northern bog violet |
| Viola pubescens | Violaceae | VIOPUB | native | 4 | 3 | forb | perennial | yellow violet |

**St. Martin Point**

06/04/2014

St. Martin Point

Mackinac
MI
USA

| | |
|---|---|
| FQA DB Region: | Michigan |
| FQA DB Publication Year: | 2014 |
| FQA DB Description: | Reznicek, A.A., M.R. Penskar, B.S. Walters, and B.S. Slaughter. 2014. Michigan Floristic Quality Assessment Database. Herbarium, University of Michigan, Ann Arbor, MI and Michigan Natural Features Inventory, Michigan State University, Lansing, MI. http://michiganflora.net |
| Practitioner: | Brad Slaughter |
| Latitude: | 45.9764 |
| Longitude: | -84.516 |
| Weather Notes: | |
| Duration Notes: | |
| Community Type Notes: | Great Lakes Marsh; Sand and Gravel Beach; Limestone Cobble Shore; Coastal Fen; Boreal Forest. |
| Other Notes: | Also noted: Hieracium sp., Oenothera sp., Ribes sp. |
| Private/Public: | Private |

| Conservatism-Based Metrics: | |
|---|---|
| Total Mean C: | 5.1 |
| Native Mean C: | 5.6 |
| Total FQI: | 52.8 |
| Native FQI: | 55.2 |
| Adjusted FQI: | 53.3 |
| % C value 0: | 10.3 |
| % C value 1-3: | 22.4 |
| % C value 4-6: | 33.6 |
| % C value 7-10: | 33.6 |
| Native Tree Mean C: | 3.4 |
| Native Shrub Mean C: | 5.9 |

| | | |
|---|---|---|
| Native Herbaceous Mean C: | 5.9 | |
| | | |
| Species Richness: | | |
| Total Species: | 107 | |
| Native Species: | 97 | 90.70% |
| Non-native Species: | 10 | 9.30% |
| | | |
| Species Wetness: | | |
| Mean Wetness: | -0.3 | |
| Native Mean Wetness: | -0.6 | |
| | | |
| Physiognomy Metrics: | | |
| Tree: | 11 | 10.30% |
| Shrub: | 20 | 18.70% |
| Vine: | 1 | 0.90% |
| Forb: | 57 | 53.30% |
| Grass: | 6 | 5.60% |
| Sedge: | 10 | 9.30% |
| Rush: | 0 | 0% |
| Fern: | 2 | 1.90% |
| Bryophyte: | 0 | 0% |
| | | |
| Duration Metrics: | | |
| Annual: | 0 | 0% |
| Perennial: | 102 | 95.30% |
| Biennial: | 5 | 4.70% |
| Native Annual: | 0 | 0% |
| Native Perennial: | 96 | 89.70% |
| Native Biennial: | 1 | 0.90% |

**Species:**

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Abies balsamea | Pinaceae | ABIBAL | native | 3 | 0 | tree | perennial | balsam fir |
| Acer saccharum | Sapindaceae | ACESAU | native | 5 | 3 | tree | perennial | sugar maple |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Achillea millefolium | Asteraceae | ACHMIL | native | 1 | 3 | forb | perennial | yarrow |
| Agrimonia striata | Rosaceae | AGRSTR | native | 3 | 3 | forb | perennial | roadside agrimony |
| Alnus incana; a. rugosa | Betulaceae | ALNINC | native | 5 | -3 | shrub | perennial | speckled alder |
| Amelanchier interior | Rosaceae | AMEINT | native | 4 | 5 | shrub | perennial | serviceberry |
| Anaphalis margaritacea | Asteraceae | ANAMAR | native | 3 | 5 | forb | perennial | pearly everlasting |
| Anemone canadensis | Ranunculaceae | ANECAN | native | 4 | -3 | forb | perennial | canada anemone |
| Anticlea elegans; zigadenus glaucus | Melanthiaceae | ANTELE | native | 10 | -3 | forb | perennial | white camas |
| Aralia nudicaulis | Araliaceae | ARANUD | native | 5 | 3 | forb | perennial | wild sarsaparilla |
| Arctostaphylos uva-ursi | Ericaceae | ARCUVA | native | 8 | 5 | shrub | perennial | bearberry |
| Asclepias syriaca | Apocynaceae | ASCSYR | native | 1 | 5 | forb | perennial | common milkweed |
| Betula papyrifera | Betulaceae | BETPAP | native | 2 | 3 | tree | perennial | paper birch |
| Calamagrostis canadensis | Poaceae | CALCAN | native | 3 | -5 | grass | perennial | blue-joint |
| Campanula rotundifolia | Campanulaceae | CAMROT | native | 6 | 3 | forb | perennial | harebell |
| Carex buxbaumii | Cyperaceae | CXBUXB | native | 10 | -5 | sedge | perennial | sedge |
| Carex capillaris | Cyperaceae | CXCAPI | native | 9 | -3 | sedge | perennial | sedge |
| Carex concinna | Cyperaceae | CXCONC | native | 10 | 3 | sedge | perennial | beauty sedge |
| Carex crawei | Cyperaceae | CXCRAE | native | 10 | -3 | sedge | perennial | sedge |
| Carex eburnea | Cyperaceae | CXEBUR | native | 7 | 3 | sedge | perennial | sedge |
| Carex interior | Cyperaceae | CXINTE | native | 3 | -5 | sedge | perennial | sedge |
| Carex lasiocarpa | Cyperaceae | CXLASI | native | 8 | -5 | sedge | perennial | sedge |
| Carex stricta | Cyperaceae | CXSTRI | native | 4 | -5 | sedge | perennial | sedge |
| Castilleja coccinea | Orobanchaceae | CASCOC | native | 8 | 0 | forb | biennial | indian paintbrush |
| Centaurea stoebe; c. maculosa | Asteraceae | CENSTO | non-native | 0 | 5 | forb | biennial | spotted knapweed |
| Cirsium palustre | Asteraceae | CIRPAL | non-native | 0 | -3 | forb | biennial | marsh thistle |
| Cirsium vulgare | Asteraceae | CIRVUL | non-native | 0 | 3 | forb | biennial | bull thistle |
| Clinopodium arkansanum; calamintha a. | Lamiaceae | CLIARK | native | 10 | -3 | forb | perennial | limestone calamint |
| Clinopodium vulgare | Lamiaceae | CLIVUL | native | 3 | 5 | forb | perennial | wild-basil |
| Clintonia borealis | Convallariaceae | CLIBOR | native | 5 | 0 | forb | perennial | bluebead-lily; corn-lily |
| Comandra umbellata | Santalaceae | COMUMB | native | 5 | 3 | forb | perennial | bastard-toadflax |
| Coreopsis lanceolata | Asteraceae | CORLAN | native | 8 | 3 | forb | perennial | sand coreopsis |
| Cornus canadensis | Cornaceae | CORCAA | native | 6 | 0 | shrub | perennial | bunchberry |
| Cornus sericea; c. stolonifera | Cornaceae | CORSER | native | 2 | -3 | shrub | perennial | red-osier |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Cypripedium arietinum | Orchidaceae | CYPARI | native | 10 | -3 | forb | perennial | rams head lady-slipper |
| Cypripedium parviflorum; c. calceolus | Orchidaceae | CYPPAR | native | 5 | 0 | forb | perennial | yellow lady-slipper |
| Danthonia spicata | Poaceae | DANSPI | native | 4 | 5 | grass | perennial | poverty grass; oatgrass |
| Dasiphora fruticosa; potentilla f. | Rosaceae | DASFRU | native | 8 | -3 | shrub | perennial | shrubby cinquefoil |
| Dichanthelium lindheimeri; panicum l. | Poaceae | DICLID | native | 8 | -5 | grass | perennial | panic grass |
| Eleocharis quinqueflora; e. pauciflora | Cyperaceae | ELEQUI | native | 10 | -5 | sedge | perennial | spike-rush |
| Eleocharis rostellata | Cyperaceae | ELEROS | native | 10 | -5 | sedge | perennial | spike-rush |
| Equisetum hyemale | Equisetaceae | EQUHYE | native | 2 | 0 | fern | perennial | scouring rush |
| Eurybia macrophylla; aster m. | Asteraceae | EURMAC | native | 4 | 5 | forb | perennial | big-leaved aster |
| Euthamia graminifolia | Asteraceae | EUTGRA | native | 3 | 0 | forb | perennial | grass-leaved goldenrod |
| Fragaria virginiana | Rosaceae | FRAVIR | native | 2 | 3 | forb | perennial | wild strawberry |
| Fraxinus pennsylvanica | Oleaceae | FRAPEN | native | 2 | -3 | tree | perennial | red ash |
| Galium triflorum | Rubiaceae | GALTRR | native | 4 | 3 | forb | perennial | fragrant bedstraw |
| Geocaulon lividum | Santalaceae | GEOLIV | native | 9 | 0 | forb | perennial | geocaulon |
| Gymnocarpium dryopteris | Cystopteridaceae | GYMDRY | native | 5 | 3 | fern | perennial | oak fern |
| Heracleum maximum | Apiaceae | HERMAX | native | 3 | -3 | forb | perennial | cow-parsnip |
| Hypericum kalmianum | Hypericaceae | HYPKAL | native | 10 | -3 | shrub | perennial | kalms st. johns-wort |
| Iris versicolor | Iridaceae | IRIVER | native | 5 | -5 | forb | perennial | wild blue flag |
| Juncus balticus | Juncaceae | JUNBAL | native | 4 | -5 | forb | perennial | rush |
| Juniperus communis | Cupressaceae | JUNCOI | native | 4 | 3 | shrub | perennial | common or ground juniper |
| Juniperus horizontalis | Cupressaceae | JUNHOR | native | 10 | 3 | shrub | perennial | creeping juniper |
| Larix laricina | Pinaceae | LARLAR | native | 5 | -3 | tree | perennial | tamarack |
| Leucanthemum vulgare; chrysanthemum leucanthemum | Asteraceae | LEUVUL | non-native | 0 | 5 | forb | perennial | ox-eye daisy |
| Lilium philadelphicum | Liliaceae | LILPHI | native | 7 | 0 | forb | perennial | wood lily |
| Linnaea borealis | Linnaeaceae | LINBOR | native | 6 | 0 | forb | perennial | twinflower |
| Lonicera dioica | Caprifoliaceae | LONDIO | native | 5 | 3 | vine | perennial | red honeysuckle |
| Maianthemum canadense | Convallariaceae | MAICAN | native | 4 | 3 | forb | perennial | canada mayflower |
| Maianthemum stellatum; smilacina s. | Convallariaceae | MAISTE | native | 5 | 0 | forb | perennial | starry false solomon-seal |
| Myrica gale | Myricaceae | MYRGAL | native | 6 | -5 | shrub | perennial | sweet gale |
| Orthilia secunda | Ericaceae | ORTSEC | native | 7 | 0 | forb | perennial | one-sided pyrola |
| Parnassia glauca | Parnassiaceae | PARGLA | native | 8 | -5 | forb | perennial | grass-of-parnassus |
| Pastinaca sativa | Apiaceae | PASSAT | non-native | 0 | 5 | forb | biennial | wild parsnip |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Petasites frigidus; p. palmatus | Asteraceae | PETFRI | native | 10 | -3 | forb | perennial | sweet-coltsfoot |
| Picea glauca | Pinaceae | PICGLA | native | 3 | 3 | tree | perennial | white spruce |
| Picea mariana | Pinaceae | PICMAR | native | 6 | -3 | tree | perennial | black spruce |
| Piptatherum racemosum; oryzopsis r. | Poaceae | PIPRAC | native | 8 | 5 | grass | perennial | rice-grass |
| Poa compressa | Poaceae | POACOM | non-native | 0 | 3 | grass | perennial | canada bluegrass |
| Polygala paucifolia | Polygalaceae | POLPAU | native | 7 | 3 | forb | perennial | gay-wings |
| Populus balsamifera | Salicaceae | POPBAL | native | 2 | -3 | tree | perennial | balsam poplar |
| Populus tremuloides | Salicaceae | POPTRE | native | 1 | 0 | tree | perennial | quaking aspen |
| Potentilla anserina | Rosaceae | POTANS | native | 5 | -3 | forb | perennial | silverweed |
| Primula mistassinica | Primulaceae | PRIMIS | native | 10 | -3 | forb | perennial | birds-eye primrose |
| Proserpinaca palustris | Haloragaceae | PROPAL | native | 6 | -5 | forb | perennial | mermaid-weed |
| Prunella vulgaris | Lamiaceae | PRUVUL | native | 0 | 0 | forb | perennial | self-heal |
| Prunus virginiana | Rosaceae | PRUVIR | native | 2 | 3 | shrub | perennial | choke cherry |
| Pyrola asarifolia | Ericaceae | PYRASA | native | 8 | -3 | forb | perennial | pink pyrola |
| Rhamnus alnifolia | Rhamnaceae | RHAALN | native | 8 | -5 | shrub | perennial | alder-leaved buckthorn |
| Ribes hirtellum | Grossulariaceae | RIBHIR | native | 6 | -3 | shrub | perennial | swamp gooseberry |
| Rosa acicularis | Rosaceae | ROSACI | native | 4 | 3 | shrub | perennial | wild rose |
| Rubus pubescens | Rosaceae | RUBPUB | native | 4 | -3 | shrub | perennial | dwarf raspberry |
| Rubus strigosus | Rosaceae | RUBSTR | native | 2 | 0 | shrub | perennial | wild red raspberry |
| Salix candida | Salicaceae | SALCAN | native | 9 | -5 | shrub | perennial | hoary willow |
| Salix myricoides | Salicaceae | SALMYR | native | 9 | -3 | shrub | perennial | blueleaf willow |
| Sarracenia purpurea | Sarraceniaceae | SARPUR | native | 10 | -5 | forb | perennial | pitcher-plant |
| Schizachyrium scoparium; andropogon s. | Poaceae | SCHSCO | native | 5 | 3 | grass | perennial | little bluestem |
| Sedum acre | Crassulaceae | SEDACR | non-native | 0 | 5 | forb | perennial | mossy stonecrop |
| Shepherdia canadensis | Elaeagnaceae | SHECAN | native | 7 | 5 | shrub | perennial | soapberry |
| Solidago altissima | Asteraceae | SOLALT | native | 1 | 3 | forb | perennial | tall goldenrod |
| Solidago houghtonii | Asteraceae | SOLHOU | native | 10 | -5 | forb | perennial | houghtons goldenrod |
| Solidago ohioensis | Asteraceae | SOLOHI | native | 8 | -5 | forb | perennial | ohio goldenrod |
| Sorbus decora | Rosaceae | SORDEC | native | 4 | 3 | tree | perennial | mountain-ash |
| Symphyotrichum puniceum; aster p. | Asteraceae | SYMPUN | native | 5 | -5 | forb | perennial | swamp aster |
| Tanacetum vulgare | Asteraceae | TANVUL | non-native | 0 | 3 | forb | perennial | garden tansy |
| Taraxacum officinale | Asteraceae | TAROFF | non-native | 0 | 3 | forb | perennial | common dandelion |

| Scientific Name | Family | Acronym | Native? | C | W | Physiognomy | Duration | Common Name |
|---|---|---|---|---|---|---|---|---|
| Thalictrum dasycarpum | Ranunculaceae | THADAS | native | 3 | -3 | forb | perennial | purple meadow-rue |
| Thuja occidentalis | Cupressaceae | THUOCC | native | 4 | -3 | tree | perennial | arbor vitae |
| Triantha glutinosa; tofieldia g. | Melanthiaceae | TRIGLU | native | 10 | -5 | forb | perennial | false asphodel |
| Trientalis borealis | Myrsinaceae | TRIBOR | native | 5 | 0 | forb | perennial | star-flower |
| Typha angustifolia | Typhaceae | TYPANG | non-native | 0 | -5 | forb | perennial | narrow-leaved cat-tail |
| Typha latifolia | Typhaceae | TYPLAT | native | 1 | -5 | forb | perennial | broad-leaved cat-tail |
| Vaccinium angustifolium | Ericaceae | VACANG | native | 4 | 3 | shrub | perennial | low sweet blueberry |
| Viola labradorica; v. conspersa | Violaceae | VIOLAB | native | 3 | 0 | forb | perennial | dog violet |
| Viola nephrophylla | Violaceae | VIONEP | native | 8 | -3 | forb | perennial | northern bog violet |