

# ARCTIC-ALPINE DISJUNCTS ON ISLE ROYALE AND THE KEWEENAW PENINSULA OF MICHIGAN'S UPPER PENINSULA



PREPARED BY:

BRADFORD S. SLAUGHTER AND JANET K. MARR

MICHIGAN NATURAL FEATURES INVENTORY

PO Box 13036

LANSING, MI 48901-3036

FOR:

HANES TRUST FOUNDATION

1 APRIL 2015

REPORT No. 2015-09



Funding for this project was provided by the Hanes Trust Foundation.

**Suggested Citation:**

Slaughter, B.S., and J.K. Marr. 2015. Arctic-Alpine Disjuncts on Isle Royale and the Keweenaw Peninsula of Michigan's Upper Peninsula. Michigan Natural Features Inventory, Report No. 2015-09, Lansing, MI. 16 pp.

Copyright 2015 Michigan State University Board of Trustees.

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

Cover photograph: *Draba arabisans* (rock whitlow-grass), Keweenaw Co., MI, 22 June 2014.  
Photo by Janet Marr.

## TABLE OF CONTENTS

|                                  |          |
|----------------------------------|----------|
| <b>INTRODUCTION</b> .....        | <b>1</b> |
| <b>METHODS</b> .....             | <b>2</b> |
| <b>RESULTS</b> .....             | <b>3</b> |
| <b>DISCUSSION</b> .....          | <b>4</b> |
| <i>Database updates</i> .....    | 4        |
| <i>Conservation trends</i> ..... | 4        |
| <i>Significant finds</i> .....   | 6        |
| <i>Future surveys</i> .....      | 7        |
| <b>ACKNOWLEDGMENTS</b> .....     | <b>7</b> |
| <b>LITERATURE CITED</b> .....    | <b>8</b> |

## LIST OF TABLES

|  |          |
|--|----------|
| <b>Table 1.</b> Rare plant taxa surveyed in summer 2014..... | <b>3</b> |
|--|----------|

## LIST OF FIGURES

|  |          |
|--|----------|
| <b>Figure A.</b> Centroids of documented EOs of state-listed vascular plants in Keweenaw County..... | <b>2</b> |
| <b>Figure B.</b> Spatial representations of vascular plant EOs in Keweenaw County .....              | <b>4</b> |
| <b>Figure C.</b> <i>Chamaerhodos nuttallii</i> .....   | <b>5</b> |
| <b>Figure D.</b> <i>Carex media</i> .....  | <b>6</b> |
| <b>Figure E.</b> <i>Erigeron hyssopifolius</i> .....   | <b>7</b> |

## APPENDICES

|  |           |
|--|-----------|
| <b>Appendix 1.</b> MNFI Special Plant Survey Form .....              | <b>10</b> |
| <b>Appendix 2.</b> List of Vascular Plant EOs Surveyed in 2014 ..... | <b>15</b> |

## INTRODUCTION

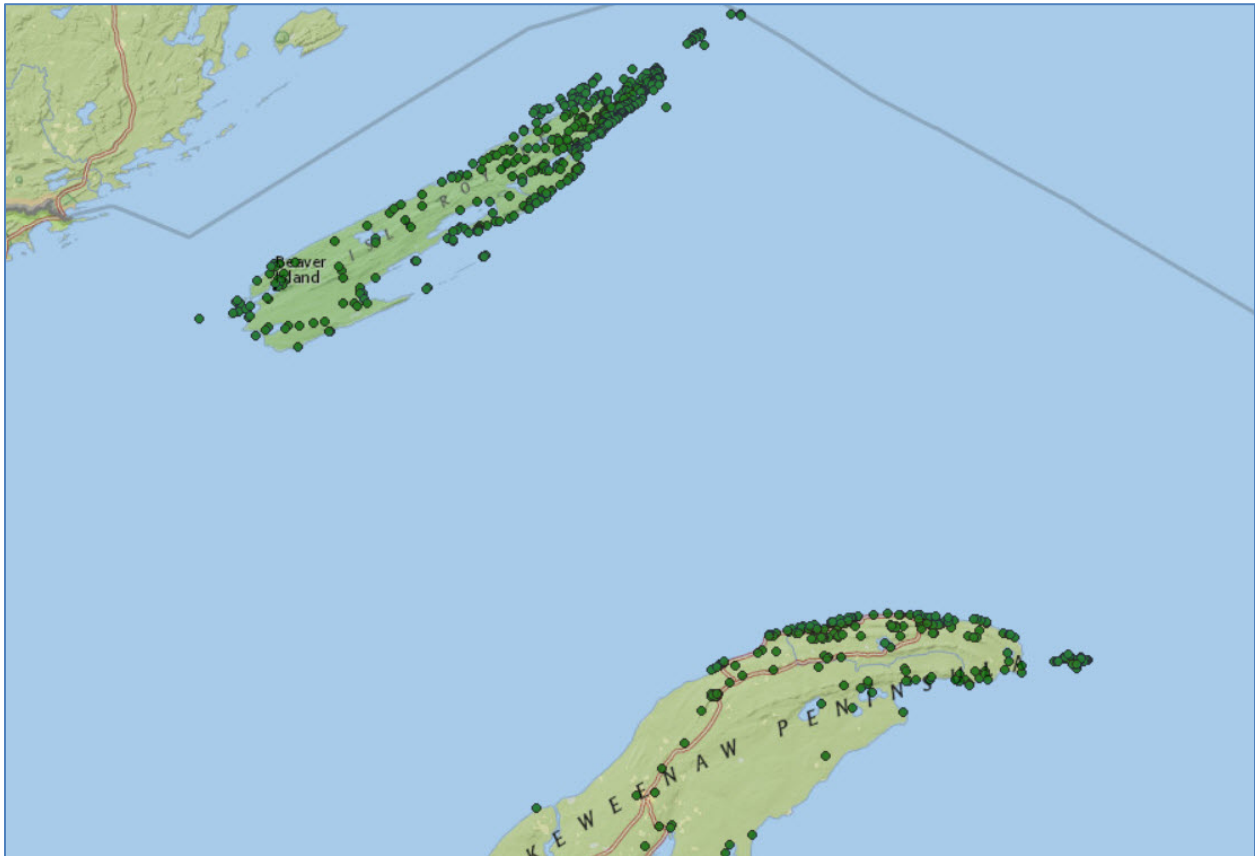
The Keweenaw County mainland and Isle Royale (also part of Keweenaw County) collectively support 97 of Michigan's 413 state-listed vascular plant taxa (23%). Among these taxa, 35 are considered critically imperiled (S1 or S1S2), 38 are imperiled (S2 or S2S3), and 15 are considered vulnerable (S3 or S3S4). Two of the 97 taxa are known only from historical records (SH), and seven taxa are considered extirpated (SX). Among taxa considered extant, 12 are listed as state endangered (E), 53 are threatened (T), and 25 are considered to be of special concern (SC) and are tracked but not protected. Of particular note are 40 state-listed taxa that are restricted in Michigan to the Keweenaw County mainland and/or Isle Royale (Michigan Natural Features Inventory [MNFI] 2007; Reznicek et al. 2011). Many of these species are disjunct from their contiguous ranges in the western United States or, particularly, boreal and arctic-alpine regions of Canada and Alaska (MNFI 2007; Voss and Reznicek 2012).

The arctic-alpine element of the Keweenaw – Isle Royale flora has attracted particular attention (Wells and Thompson 1974; Given and Soper 1981; Reschke 1985; Slavick and Janke 1987; Albert et al. 1997; Judziewicz 1997a-c; Judziewicz et al. 1997; Marr et al. 2009). Thought to be elements of a previously widespread periglacial flora, these species persist locally, primarily in the immediate vicinity of Lake Superior where moist, cool microhabitats impacted by snow and ice and developed on thin soils over bedrock prevent the encroachment of boreal forest communities and provide local refugia from desiccation (Given and Soper 1981). In particular, concentrations of arctic-alpine species along Lake Superior appear to be closely associated with mid-summer surface water temperatures, with these species sparsely distributed or absent from those stretches of the shoreline where summer surface water temperatures exceed 15°C (59°F).

The short-term and long-term viability of populations of arctic-alpine plants along Lake Superior is threatened by anthropogenic climatic warming, which may increase summer surface water temperatures in Lake Superior by as much as 6°C (11°F) by 2100 (Trumpickas et al. 2009). Projected changes in Lake Superior water levels (e.g., MacKay and Seglenieks 2013) may also impact populations of arctic-alpine plants, for example through direct impacts such as inundation or indirect impacts such as a reduction of suitably cool, moist microhabitats or potentially the invasion of early successional habitats by woody species (Lesica and McCune 2004) if water levels drop.

In order to monitor the impacts of climate change and habitat changes on populations of boreal and arctic-alpine vascular plant taxa, we require quantitative data on population sizes, areas of occupancy, and precise locations. To date, MNFI tracks information on 786 total element occurrences (EOs; corresponding to populations or groups of interacting populations) of state-listed vascular plants in Keweenaw County including Isle Royale (Figure A). Unfortunately, 348 (44%) of these EOs were last observed or surveyed prior to 1990 (MNFI 2015), and nearly all of them (734 occurrences, or 93% of the total) were last observed or surveyed prior to 2000 (MNFI 2015), before the widespread adoption of highly accurate portable GPS units, GIS technology, and high resolution aerial imagery. In addition to the lack of precise locational data, population estimates are often coarse or absent, and threats or potential threats to these populations are often not adequately addressed.

In March 2014, the authors were awarded a grant by the Hanes Trust Foundation to address some of these data gaps by surveying and collecting data for at least 25 rare vascular plant EOs on the Keweenaw mainland. The following sections report the results of our 2014 field surveys.



**Figure A.** Centroids of documented EOs of state-listed vascular plants in Keweenaw County (including Isle Royale). Note concentrations of points along the northern shore of the Keweenaw Peninsula and the northeastern shores of Isle Royale, corresponding to areas of cool mid-summer surface water temperatures (Given and Soper 1981).

## METHODS

Prior to field surveys, we reviewed the MNFI database of rare vascular plant EOs documented from mainland Keweenaw County and prioritized EO revisits based on dates of last survey, data gaps, precision of mapped distributions, public access, and other factors. Field surveys were conducted between June and September 2014. For each EO visited, we documented population sizes (counts or estimates, depending on the species and site), recorded area(s) of occupancy using GPS points and tracks, described occupied habitats, and identified threats and potential threats to each EO. We collected the same data for new EOs discovered during this process. Voucher specimens were collected where necessary and deposited at the University of Michigan Herbarium (MICH), which manages the Michigan Flora website (Reznicek et al. 2011). Data for each EO were transcribed on MNFI Special Plant

Survey Forms (Appendix 1) and processed and entered into the MNFI natural heritage database in winter and spring 2014 – 2015 (MNFI 2015).

Following data entry, new EO conservation ranks were assigned to each occurrence following standard Natural Heritage Methodology (NatureServe 2002). These ranks are designed to assess vulnerability and viability of each occurrence, taking into consideration population size and demographics, spatial extent, and habitat conditions, among other factors. Ranks are in general assigned on an A – D spectrum, with A-ranked occurrences considered to have excellent viability, and D-ranked occurrences considered to have poor viability (NatureServe 2002). Recent EOs (in general, documented within the past 40 years) for which there are no population data are assigned a rank of E (extant). EOs that are >40 years old are considered historical (H), unless there is reason to believe they are extirpated (X) due to habitat loss or other factors. If a survey fails to document a previously identified EO, but there is reason to believe the EO may still be extant, a rank of F (failed to find) is assigned, pending additional surveys.

## RESULTS

A total of 37 element occurrences were revisited or newly documented in 2014, comprising ca. 17% of the 219 documented EOs from the Keweenaw County mainland, and ca. 21% of the 175 EOs of extant species with enough location data to make targeted surveys feasible (Table 1). Fourteen of these EOs are of arctic-alpine disjunct taxa; the remaining taxa are of more general boreal distribution or are disjunct from western North American (MNFI 2007). Among the 37 EOs surveyed, 27 (73%) were reconfirmed, six (16%) were not rediscovered, and four (11%) were new discoveries (Table 1).

**Table 1.** Rare plant taxa surveyed in summer 2014. Taxa marked with an asterisk\* are listed as arctic-alpine disjuncts by Given and Soper (1981).

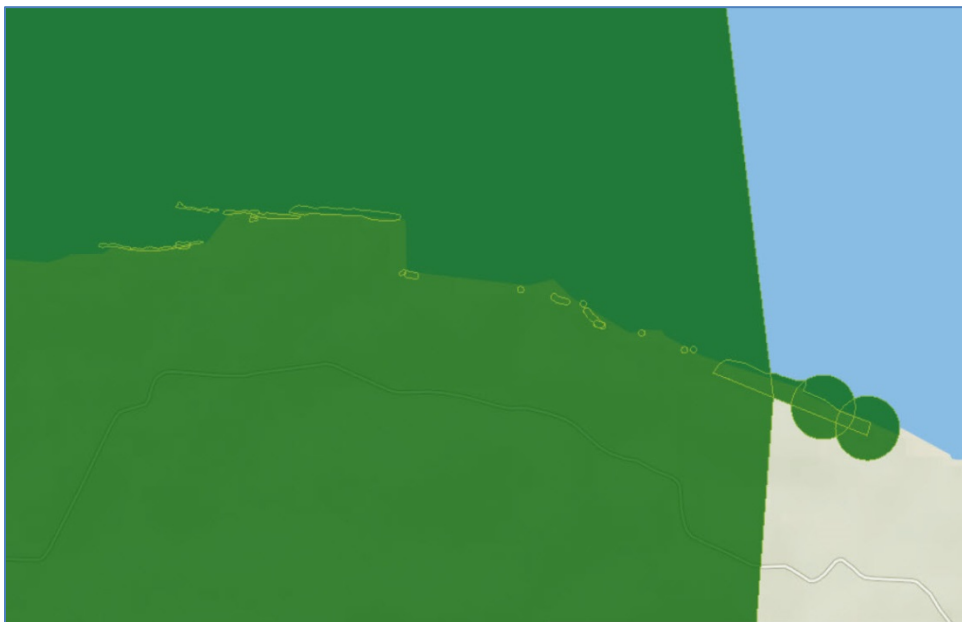
| Species                             | Common Name              | State Status | # EOs Surveyed | #EOs Located |
|-------------------------------------|--------------------------|--------------|----------------|--------------|
| <i>Arnica cordifolia</i>            | heart-leaved arnica      | E            | 1              | 1            |
| <i>Asplenium viride</i>             | green spleenwort         | SC           | 1              | 1            |
| <i>Bistorta vivipara</i> *          | Alpine bistort           | T            | 1              | 1            |
| <i>Calypso bulbosa</i>              | calypso                  | T            | 1              | 0            |
| <i>Carex media</i>                  | sedge                    | T            | 1              | 1            |
| <i>Carex rossii</i>                 | sedge                    | T            | 1              | 1            |
| <i>Castilleja septentrionalis</i> * | northern paintbrush      | T            | 4              | 4            |
| <i>Chamaerhodos nuttallii</i>       | Keweenaw rock-rose       | E            | 1              | 1            |
| <i>Clematis occidentalis</i>        | purple clematis          | SC           | 3 (1 new)      | 1 (1 new)    |
| <i>Crataegus douglasii</i>          | black hawthorn           | SC           | 3 (1 new)      | 3 (1 new)    |
| <i>Cypripedium arietinum</i>        | ram's head lady-slipper  | SC           | 1              | 1            |
| <i>Draba arabisans</i>              | rock whitlow-grass       | SC           | 2              | 2            |
| <i>Empetrum nigrum</i> *            | black crowberry          | T            | 1              | 0            |
| <i>Erigeron hyssopifolius</i>       | hyssop-leaved fleabane   | T            | 1 (new)        | 1 (new)      |
| <i>Littorella uniflora</i>          | American shore-grass     | SC           | 1              | 0            |
| <i>Neottia auriculata</i>           | auricled twayblade       | SC           | 1              | 1            |
| <i>Packera indecora</i>             | rayless mountain ragwort | T            | 2 (1 new)      | 2 (1 new)    |
| <i>Pinguicula vulgaris</i> *        | butterwort               | SC           | 4              | 4            |
| <i>Potentilla litoralis</i>         | prairie cinquefoil       | T            | 1              | 0            |
| <i>Pterospora andromedea</i>        | pine-drops               | T            | 2              | 2            |
| <i>Trisetum spicatum</i> *          | downy oat grass          | SC           | 4              | 4            |

Conservation ranks were upgraded for three EOs, stable for 10 EOs, and downgraded for 11 EOs (Appendix 2). Ten EOs were newly ranked, either because they were newly discovered (four EOs) or because they were considered extant (E) but not rankable (six EOs). Two historical EOs were redocumented and received letter ranks, and one historical record was not redocumented and is maintained as a historical record. For all redocumented or newly documented EOs, spatial data were updated within the MNFI statewide conservation database (MNFI 2015).

## DISCUSSION

### *Database Updates*

The 2014 surveys resulted in significant updates to 17% of the vascular plant EO records documented from the Keweenaw mainland. Among these improvements are updated population estimates, more descriptive habitat assessments, threats assessments, improved and updated EO ranks, and greatly improved spatial data (MNFI 2015). In several cases, the documentation of populations with hand-held GPS units resulted in the replacement of generalized spatial data (often encompassing thousands of hectares) with precise spatial representations of populations (Figure B).



**Figure B.** Spatial representations of vascular plant EOs in Keweenaw County. Yellow-bordered areas (left-central portion of the image) are updated representations following 2014 field surveys. The large green area over the left 80% of the image is representative of general spatial representations for EOs that lack detailed locational information.

### *Conservation Trends*

For most species, too few records were surveyed in 2014 to assess population viability trends. However, three species appear to be critically imperiled on the Keweenaw mainland based on survey results:

*Potentilla litoralis* (prairie cinquefoil) was known historically from three locations on the Keweenaw mainland, and was known from Brockway Mountain at least into the 1980s (MNFI 2015). A thorough survey of the Brockway Mountain population was conducted in 2014, and the species was not relocated. The area in which this species occurred is significantly disturbed by recreational use, including the parking of vehicles, and road maintenance. Invasive species are prevalent. Prairie cinquefoil may now be restricted in Michigan to the Isle Royale archipelago.

*Chamaerhodos nuttallii* (Keweenaw rock-rose) is known in Michigan only from Brockway Mountain, where it is disjunct from the west (Reznicek et al. 2011). In 2014, only a single plant was located (Figure C). This short-lived monocarpic perennial was represented by 100s of individuals as recently as the 1980s, with a steadily declining population since that time (MNFI 2015). The area that supported the originally documented colony is infested with spotted knapweed (*Centaurea stoebe*), which may have contributed to its local extirpation. Although there may be more plants in difficult to survey areas of the cliffs along Brockway Mountain Drive, this only known EO, and thus likely the species, is nearly extirpated from Michigan.



**Figure C.** *Chamaerhodos nuttallii* (Keweenaw rock-rose) is known from one site on Brockway Mountain. Photo by B. Slaughter, 13 July 2014.

*Carex media* is locally frequent in the Isle Royale archipelago, but is known from the Keweenaw mainland only from a small stretch of shoreline in Agate Harbor (MNFI 2015). 2014 surveys found no plants on the mainland, and only one small colony on nearby Silver Island, down from several hundred plants in the mid-1980s (Figure D). This population may have been reduced by ice scour or other



changes on its lakeshore cliff habitat. Silver Island is the only easily accessible population of *C. media* remaining in the Keweenaw Peninsula, the next closest populations being on Manitou Island off Keweenaw Point.



**Figure D.** *Carex media* on Silver Island. Photo by J. Marr, 22 June 2014.

### ***Significant Finds***

During an EO revisit in July 2014, the second author discovered a colony of *Erigeron hyssopifolius* (hyssop-leaved fleabane), a species previously known from Keweenaw County (and the western Upper Peninsula) only from an 1890 collection by O.A. Farwell (Reznicek et al. 2011) (Figure E). *E. hyssopifolius* is otherwise localized in Michigan to a few marl fens in Mackinac County (MNFI 2015).



**Figure E.** *Erigeron hyssopifolius* (hyssop-leaved fleabane), documented on a seepy bedrock shoreline in 2014 by J. Marr. Previously known from Keweenaw County only from an 1890 collection. Photo by J. Marr, 16 July 2014.

### ***Future Surveys***

The majority of vascular plant EOs in Keweenaw County have not been assessed since at least 1990 (MNFI 2015). Surveys to address these significant data gaps should continue over the next several years. Following completion of surveys on the Keweenaw mainland, EO revisits and de novo surveys should be conducted in the Isle Royale archipelago, which harbors many taxa, including many arctic-alpine disjuncts, that do not occur elsewhere in Keweenaw County or Michigan (Reznicek et al. 2011; MNFI 2015). Updated and improved population data will permit the long-term monitoring of these taxa and populations, many of which are threatened by climate change (e.g., Lesica and McCune 2004) and other disturbances.

### **ACKNOWLEDGMENTS**

The authors thank Erin Victory, Scott Namestnik, Bob Marr, Mark Jindrich, and Emily Newhouse for assisting with field surveys. We thank landowners who allowed us to access their properties for surveys,

especially William and Nanno Rose (Silver Island). Tony Reznicek (University of Michigan) confirmed several species identifications. This effort was made possible by the Hanes Trust Foundation, and we thank the trustees and especially Dennis Woodland for their support throughout the duration of the grant.

#### LITERATURE CITED

- Albert, D., P. Comer, D. Cuthrell, D. Hyde, W. MacKinnon, M. Penskar, and M. Rabe. 1997. Great Lakes bedrock shores of Michigan. Michigan Natural Features Inventory, Lansing, MI. 58 pp.
- Given, D.R., and J.H. Soper. 1981. The arctic-alpine element of the vascular flora at Lake Superior. Publications in Botany, No. 10, National Museum of Natural Sciences, Ontario, CA. 70 pp.
- Judziewicz, E.J. 1997a. Vegetation and flora of Passage Island, Isle Royale National Park, Michigan. Michigan Botanist 36: 35-62.
- Judziewicz, E.J. 1997b. Franklin's phacelia (*Phacelia franklinii* (R. Br.) A. Gray) (Hydrophyllaceae) on Isle Royale (Michigan) and in the Lake Superior Region. Michigan Botanist 36: 73-77.
- Judziewicz, E.J. 1997c. Michigan's farthest north: A botanical visit to the Gull Islands, Isle Royale National Park. Michigan Botanist 36: 78-87.
- Judziewicz, E.J., F.H. Utech, and W. Mackinnon. 1997. *Prosartes (Disporum) trachycarpa* (Liliaceae) in Isle Royale National Park: New to Michigan and the eastern United States. Michigan Botanist 36: 63-72.
- Lesica, P., and B. McCune. 2004. Decline of arctic-alpine plants at the southern margin of their range following a decade of climatic warming. Journal of Vegetation Science 15: 679-690.
- MacKay, M., and F. Seglenieks. 2013. On the simulation of Laurentian Great Lakes water levels under projections of global climate change. Climatic Change 117: 55-67.
- Marr, J.K., Penskar, M.R., and D.A. Albert. 2009. Rare plant species and plant community types of Manitou Island and Gull Rock, Keweenaw County, Michigan. Michigan Botanist 48: 97-120.
- Michigan Natural Features Inventory (MNFI). 2007. Rare Species Explorer (Web Application). Available online at <http://mnfi.anr.msu.edu/explorer> [Accessed Feb 5, 2014]
- Michigan Natural Features Inventory (MNFI). 2015. Biotics database. Michigan Natural Features Inventory, Lansing, MI.
- NatureServe. 2002. Element occurrence data standard. Available [http://downloads.natureserve.org/conservation\\_tools/element\\_occurrence\\_data\\_standard.pdf](http://downloads.natureserve.org/conservation_tools/element_occurrence_data_standard.pdf) (Accessed: 31 March 2015).
- Reschke, C. 1985. Vegetation of the conglomerate rock shoreline of the Keweenaw Peninsula, northern Michigan. Unpublished M.S. thesis, University of Wisconsin-Madison, Madison, WI. 118 pp.

- Reznicek, A.A., E.G. Voss, and B.S. Walters. 2011. *MICHIGAN FLORA ONLINE*. University of Michigan. Available online at <http://michiganflora.net/home.aspx> [Accessed Feb 5, 2014].
- Slavick, A.D., and R.A. Janke. 1987. The vascular flora of Isle Royale National Park. *Michigan Botanist* 26: 91-134.
- Trumpickas, J., B.J. Shuter, and C.K. Minns. 2009. Forecasting impacts of climate change on Great Lakes surface water temperatures. *Journal of Great Lakes Research* 35: 454-463.
- Voss, E. G., and A. A. Reznicek. 2012. *Field manual of Michigan flora*. The University of Michigan Press, Ann Arbor, MI. 990 pp.
- Wells, J.R., and P.W. Thompson. 1974. Vegetation and flora of Keweenaw County, Michigan. *Michigan Botanist* 13: 107-151.

**Appendix 1. MNFI Special Plant Survey Form.**

## ELEMENT IDENTIFICATION

Data sensitive?  Yes  No

Name (scientific and/or common): \_\_\_\_\_ EO Rank: \_\_\_\_\_ EOID: \_\_\_\_\_ EO #: \_\_\_\_\_

## VERIFICATION

Photo/slide taken?  Yes  No Name and location of photo? \_\_\_\_\_

Specimen collected?  Yes  No Collection # and repository: \_\_\_\_\_

Identification problems?  Yes  No

If necessary, describe the important plant characteristics **you** used for identification:

## SURVEY INFORMATION

Survey date: \_\_\_\_\_ Time: from \_\_\_\_\_  AM  PM to \_\_\_\_\_  AM  PM Sourcecode: \_\_\_\_\_

Surveyors (principal surveyor first, include first & last name):

Revisit needed?  Yes  No Why? \_\_\_\_\_

## LOCATIONAL INFORMATION

Survey site name: \_\_\_\_\_ Quadcode: \_\_\_\_\_

Managed area name: \_\_\_\_\_ Quad name: \_\_\_\_\_

Township/Range/Section: \_\_\_\_\_ County name: \_\_\_\_\_

DIRECTIONS: Provide detailed directions to the observation (rather than the survey site). Include landmarks, roads, towns, distances, compass directions.

Was a GPS used?  Yes  No Type of unit: \_\_\_\_\_ Unit number: \_\_\_\_\_

Waypoint name/#: \_\_\_\_\_ File name and location: \_\_\_\_\_

Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

Feature Information: (mandatory) Conceptual feature type:  Point: < 9 m in both dimensions  Line: > 9 m in one dimension  Polygon: > 9 m in both dimensions

Source feature:  Single Source EO  Multiple Source EO

## OWNERSHIP INFORMATION

Landowner type:  Public  Private  Other: \_\_\_\_\_

Landowner Name - Contact Information: \_\_\_\_\_

Notes: \_\_\_\_\_

## POPULATION DATA

Abundance (total size of the occurrence): \_\_\_\_\_ Type of measurement (check one):

# Ramets (total # of stems): \_\_\_\_\_  Precise count  Estimate

# Genets (total # of groups): \_\_\_\_\_  Precise count  Estimate

Population distribution (e.g., widely scattered, dense clumps, evenly distributed throughout):

Area of occupancy (fill in one): \_\_\_\_\_ Meters \_\_\_\_\_ Acres \_\_\_\_\_ Miles      Type of measurement (check one):  Precise  Estimate

Phenology: Indicate the number observed in each category (or X if numbers are unknown):

\_\_\_\_\_ In leaf    \_\_\_\_\_ In bud    \_\_\_\_\_ In flower    \_\_\_\_\_ Immature fruit    \_\_\_\_\_ Mature fruit    \_\_\_\_\_ Seed dispersing    \_\_\_\_\_ Dormant

**CONDITION**

EVIDENCE OF REPRODUCTION?  Yes  No  Unknown    Explain: \_\_\_\_\_

EVIDENCE OF DISEASE/PREDATION: \_\_\_\_\_

ANIMAL POLLINATORS observed on the plant (list species): \_\_\_\_\_

LANDSCAPE DESCRIPTION AND SETTING: Describe the surrounding landform(s) present, natural communities, historic and current human impacts (e.g., logging, agriculture, wetland drainage)

HABITAT DESCRIPTION: Describe the specific habitat or microhabitat where this plant occurs. Convey a mental image of the habitat including landform, vegetation, slope, aspect, soils, ecological processes and natural disturbance (e.g., windthrow, fire, water level fluctuations)

**TOPOGRAPHY**

Elevation: \_\_\_\_\_ ft.

If elevation is a range:

Minimum: \_\_\_\_\_ ft.

Maximum: \_\_\_\_\_ ft.

Aspect:

- N     NE
- E     NW
- S     SE
- W     SW

Slope:

- Flat
- 0-10
- 10-35
- 35+
- Vertical

Light:

- Open
- Partial
- Filtered
- Shade

Position:

- Crest
- Upper slope
- Mid slope
- Lower slope
- Bottom

Moisture:

- Inundated
- Saturated (wet-mesic)
- Moist (mesic)
- Dry-mesic
- Dry (xeric)

**ASSOCIATED SPECIES**

Overstory/Tree Species: \_\_\_\_\_ % cover

Understory Species: \_\_\_\_\_ % cover

Ground cover: \_\_\_\_\_ % cover

|  |  |  |
|--|--|--|
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

THREATS AND HUMAN DISTURBANCES OR IMPACTS to this occurrence: (e.g., grazing, logging, ditching and drainage, ORV use, fire suppression)

INVASIVE SPECIES PRESENT? :  Yes  No If yes, describe their impacts to the occurrence.

POTENTIAL THREATS to this occurrence:

### MANAGEMENT AND PROTECTION

**Management** ( including stewardship and restoration) for the Element at this location (e.g., burn periodically, open the canopy, control invasives, remove drainage ditches, clear blocked culvert, break drain tile, reduce deer densities, study effects of herbivore impacts)

**Monitoring and Research Needs** for the Element at this location (e.g., study effect of herbivore impacts, etc.)

**Protection Needs** for the Element at this location (e.g., protect the entire marsh, the slope and crest of slope, the fen and upland, ban ORVs, etc.)

### MAP (mandatory)

1. Attach appropriate part of a USGS topographic map or map showing exact locations of species. Image can be uploaded into the Map Insert field located at the end of this form or clearly associated with this form once completed.
2. Indicate on the map the exact location of the observation(s):
  - a. When the observation area is **no larger than a pen point** on the map (i.e., only a small number of individuals or extremely small patches), place small points on the map indicating the location(s) of the individuals or patches, and label each point with an arrow so they are more easily seen.
  - b. When the observed area is **larger than a pen point** on the map. (e.g., a population of plants, foraging birds):
    - (1) Draw a thin solid boundary line showing the extent of the observed area occupied by the individuals.
    - (2) Indicate disjunct patches (polygons) by drawing the boundary for each patch separately.
    - (3) If the boundary follows the edge of a lake, stream, road, marsh or other feature, draw the boundary precisely on the edge of the feature.
    - (4) When needed, add notes to the map with instruction on where the boundary line is located or if the boundary is shared with other observations.
3. A hand drawn sketch may be included for finer details.

#### LOCATIONAL CERTAINTY

Is your depiction of the observed area on the map within 4.5 m (approx. 15ft) of its actual location on the ground?  Yes  No

If No, complete the following:

- a. Estimate of uncertainty distance: based on landmarks, elevation, etc., the location of the observed area on the map is accurate to within

\_\_\_\_\_  Meters  Kilometers  Feet  Miles of its actual location on the ground.

- b. Is the observed area known to be located within some feature(s) on the map (e.g., wetland boundary, lake, road, trail, highway, contour lines)?  Yes  No  
If Yes, indicate the boundary within which the observed area is known to be located on the map line, and if applicable, identify the feature (e.g., marsh).



IMAGE INSERT: **click** on space below and navigate to saved photo, supported formats include BMP, JPG, GIF, PNG, TIF

MAP INSERT: **click** on space below and navigate to saved map file, supported formats include BMP, JPG, GIF, PNG, TIF

**Appendix 2.** List of Vascular Plant EOs Surveyed in 2014.

| E OID | Species                           | Site                             | Last Survey Date | Last Rank | New Survey Date | New Rank | Surveyor       | Population Notes           |
|-------|-----------------------------------|----------------------------------|------------------|-----------|-----------------|----------|----------------|----------------------------|
| 320   | <i>Arnica cordifolia</i>          | Fort Wilkins Historic State Park | 06/24/1983       | C         | 07/10/2014      | C        | BS             | 3 colonies; 26 fl/ft stems |
| 6638  | <i>Asplenium viride</i>           | Silver River Gorge               | 09/14/1997       | AB        | 08/31/2014      | AB       | JM, MJ, EN     | Ca. 120 clumps             |
| 12247 | <i>Bistorta vivipara</i>          | Horseshoe Harbor                 | 07/08/1999       | C         | 07/10/2014      | CD       | BS             | Ca. 72 plants              |
| 2028  | <i>Calypso bulbosa</i>            | Copper Harbor                    | 1982             | E         | 06/18/2014      | F        | JM             | Not found                  |
| 1823  | <i>Carex media</i>                | Silver Island                    | 6/23/81          | B         | 06/22/2014      | D        | JM             | One clump                  |
| 6476  | <i>Carex rossii</i>               | Silver Island                    | 6/23/81          | AB        | 07/11/2014      | C        | JM, BS, EV, SN | Ca. 18 clumps              |
| 1177  | <i>Castilleja septentrionalis</i> | Dan's Point                      | 06/02/2006       | B         | 07/23/2014      | BC       | JM             | 76 plants                  |
| 8239  | <i>Castilleja septentrionalis</i> | Horseshoe Harbor                 | 07/08/1999       | C         | 07/12/2014      | B        | BS             | 383 plants                 |
| 9705  | <i>Castilleja septentrionalis</i> | Agate Harbor                     | 06/23/1981       | E         | 06/22/2014      | B        | JM             | 35-40 clumps               |
| 12178 | <i>Castilleja septentrionalis</i> | Copper Harbor Lighthouse         | 07/19/1950       | H         | 06/18/2014      | D        | JM             | 2 plants                   |
| 8866  | <i>Chamaerhodos nuttallii</i>     | Brockway Mountain                | 09/15/2012       | CD        | 07/03/2014      | D        | JM, BM         | 1 plant                    |
| 286   | <i>Clematis occidentalis</i>      | Grand Marais Harbor              | 08/21/1981       | C         | 06/25/2014      | F        | JM             | Not found                  |
| 647   | <i>Clematis occidentalis</i>      | Lookout Mountain                 | 1982             | E         | 07/20/2014      | F        | JM             | Not found                  |
| 20176 | <i>Clematis occidentalis</i>      | Esrey Park West                  | new              | new       | 06/19/2014      | CD       | JM             | 2 plants                   |
| 5965  | <i>Crataegus douglasii</i>        | Eagle River                      | 06/11/1972       | E         | 09/06/2014      | B        | JM             | Ca. 20 plants              |
| 6067  | <i>Crataegus douglasii</i>        | Lookout Mountain                 | 07/06/1934       | H         | 07/20/2014      | C        | JM             | 6 clumps                   |
| 20177 | <i>Crataegus douglasii</i>        | Dan's Point                      | new              | new       | 07/23/2014      | C        | JM             | 2 plants                   |
| 932   | <i>Cypripedium arietinum</i>      | Esrey Park                       | 1969             | C         | 06/19/2014      | BC       | JM             | 19 plants                  |
| 6990  | <i>Draba arabisans</i>            | Agate Harbor Islands             | 07/13/1982       | A         | 06/22/2014      | A        | JM             | 1000s plants               |
| 13161 | <i>Draba arabisans</i>            | Lookout Mountain                 | 1981             | B         | 07/20/2014      | B        | JM             | Ca. 800+ plants            |
| 12758 | <i>Empetrum nigrum</i>            | Schlatter Lake                   | 06/28/1949       | H         | 07/03/2014      | F        | JM             | Not found                  |
| 20174 | <i>Erigeron hyssopifolius</i>     | Eagle River West                 | new              | new       | 07/10/2014      | B        | JM             | 100s to >1000 plants       |
| 7188  | <i>Littorella uniflora</i>        | Schlatter Lake                   | 08/19/1976       | B         | 07/03/2014      | F        | JM             | Not found                  |
| 7842  | <i>Neottia auriculata</i>         | Garden City Creek                | 06/24/1984       | B         | 06/19/2014      | BC       | JM             | Ca. 90 plants              |
| 20101 | <i>Packera indecora</i>           | Horseshoe Harbor                 | 08/04/2000       | E         | 07/12/2014      | C        | BS             | 78+ plants                 |
| 20173 | <i>Packera indecora</i>           | Eagle River West                 | new              | new       | 07/10/2014      | C        | JM             | Ca. 22 plants              |
| 4321  | <i>Pinguicula vulgaris</i>        | Cat Harbor                       | 06/22/1981       | A         | 07/10/2014      | A        | JM             | Ca. 1000+ plants           |
| 8799  | <i>Pinguicula vulgaris</i>        | Dan's Point                      | 05/31/1980       | AB        | 07/23/2014      | AB       | JM             | Ca. 2000 plants            |
| 10691 | <i>Pinguicula vulgaris</i>        | Horseshoe Harbor                 | 07/08/1999       | B         | 07/10/2014      | B        | BS             | Ca. 1885+ plants           |
| 12607 | <i>Pinguicula vulgaris</i>        | Eagle River West                 | 07/14/1981       | AB        | 07/10/2014      | AB       | JM             | Ca. 1500+ plants           |
| 5239  | <i>Potentilla litoralis</i>       | Brockway Mountain                | 06/23/1981       | C         | 07/13/2014      | X        | BS, SN, EV     | Not found                  |
| 890   | <i>Pterospora andromedea</i>      | Silver Island                    | 08/15/2003       | C         | 07/11/2014      | C        | JM, BS, EV, SN | 5 plants                   |
| 9444  | <i>Pterospora andromedea</i>      | Grand Marais Harbor              | 08/03/2007       | CD        | 06/25/2014      | C        | JM             | 5 plants                   |
| 1337  | <i>Trisetum spicatum</i>          | Horseshoe Harbor                 | 08/23/1998       | B         | 07/12/2014      | B        | BS             | Ca. 77 plants              |
| 4277  | <i>Trisetum spicatum</i>          | Dan's Point                      | 1982             | E         | 07/23/2014      | C        | JM             | Ca. 10 colonies            |
| 5646  | <i>Trisetum spicatum</i>          | Silver Island                    | 1985             | E         | 07/11/2014      | BC       | JM, BS, EV, SN | >18 clumps                 |
| 10621 | <i>Trisetum spicatum</i>          | Grand Marais Harbor              | 1982             | E         | 06/25/2014      | B        | JM             | 33+ clumps                 |

Surveyors: BS = Brad Slaughter; JM = Janet Marr; MJ = Mark Jindrich; EN = Emily Newhouse; EV = Erin Victory; SN = Scott Namestnik; BM = Bob Marr.