January–June, 2016

Vol. 55, Nos. 1–2

THE MICHIGAN BOTANIST

A Journal of Great Lakes Botany

THE MICHIGAN BOTANIST (ISSN 0026-203X) is published four times per year by the Michigan Botanical Club (www.michbotclub.org) and is available online at http://quod.lib.umich.edu/m/mbot/. The subscription rate is $25.00 per year. Periodicals postage paid at Ann Arbor, MI 48103.

On all editorial matters, please contact Michael Huft, 232 Akela Dr., Valparaiso, IN 46385. Phone: (847) 682-5240; email: mhuft@att.net. All articles dealing with botany in the Great Lakes region may be sent to the Editor at the above address. In preparing manuscripts, authors are requested to follow the "Instructions for Authors" on the inside back cover.

For all inquiries about back issues and institutional subscriptions, please contact The Michigan Botanist Business Office, 232 Akela Dr., Valparaiso, IN 46385. Phone: (224) 420-0326; email: michbot.business@gmail.com.

THE MICHIGAN BOTANICAL CLUB

Membership is open to anyone interested in its aims: conservation of all native plants; education of the public to appreciate and preserve plant life; sponsorship of research and publication on the plant life of the state and the Great Lakes area in general, both in the USA and in Canada; sponsorship of legislation to promote the preservation of Michigan's native flora; establishment of suitable sanctuaries and natural areas, and cooperation in programs concerned with the wise use and conservation of all natural resources and scenic features.

Dues are modest, but vary slightly among the chapters. To become a chapter member please contact the chapter presidents listed below. Annual dues include a subscription to *The Michigan Botanist*. Address changes for Chapter Members should go to the Chapter President.

President: Judith Kelly, 18863 Lakewood Circle, Lake Ann, MI 49650; hfcckelly@gmail.com
Treasurer: Bob Kelly, 18863 Lakewood Circle, Lake Ann, MI 49650; rgkelly49@gmail.com
Great Lakes Chapter: Irene Eiseman, 1873 Pierce Road, Chelsea, MI 48118; eisemani@gmail.com
Huron Valley Chapter: Anton Reznicek, University of Michigan Herbarium, 3600 Varsity Drive, Ste. 112, Ann Arbor, MI 48109; reznicek@umich.edu
Southeastern Chapter: Emily A. Nietering, 231 Nash Street, Dearborn, MI 48124-1039; knietering@sbcglobal.net
Southwestern Chapter: Tyler Bassett, 2436 Woodward Ave., Kalamazoo, MI 49004-3481; keepitsimple7@yahoo.com
White Pine Chapter: Dorothy Sibley, 7951 Walnut Avenue, Newaygo, MI 49337; dsibley@mail.riverview.net

Volume 54, Nos. 3–4 was mailed June 28, 2016.

IN THIS ISSUE

Robert Tatina presents the third in a series of studies of forest composition and succession in Berrien County, Michigan, that The Michigan Botanist has been pleased to publish (see TMB 52: 67–79 and 49: 118–131 for previous articles). In this case, the study involved a preserve that had been cleared and cropped in the 1920s and later abandoned. The author notes that this is an ideal situation to study secondary succession, because the plot had been subject to two previous studies, one in 1972, and another in 1986, thereby providing definite historical data that could be extended by the current study.

Emmet Judziewicz has been a frequent contributor to this journal on the topic of the floristics of islands in Lakes Michigan and Superior, including studies of the Apostle Islands National Lakeshore (TMB 32: 43–189), portions of Isle Royale National Park (36: 35–62, 78–87), and the Grand Traverse Islands, which constitute a group of 28 islands, some in Wisconsin's Green Bay and others constituting a chain stretching between Wisconsin's Door Peninsula and Michigan's Garden Peninsula (40: 81–208). At the time of the study of the Grand Traverse Islands, Dr. Judziewicz was unable to visit St. Martin Island, one of the larger islands in the chain between Michigan and Wisconsin. That has been rectified as a result of more recent visits by Dr. Judziewicz and colleagues, and the results of those visits are presented in this issue.

Two sets of Noteworthy Collections make up the second section of this issue. Brad Slaughter, of the Michigan Natural Features Inventory, reports significant recent collections of four species rarely encountered in Michigan, two of them native, and two non-native. Tom Lammers, a botanist at the University of Wisconsin-Oshkosh who has extensive experience collecting throughout the US, provides reports of significant recent collections of both native and non-native species in four states of the Upper Midwest.

The book reviews in this issue include a review by Tony Reznicek of a significant revision of the excellent and popular field guide to Minnesota orchids by Welby Smith, and a review by Neil Harriman of an important new field guide to the natural areas of Michigan. In his second review in this issue, Dr. Harriman demonstrates that Tom Lammers not only is an accomplished field botanist, teacher, and researcher, but also has broader interests that include the writing of delightful small books of botanical fiction, six of which, reviewed here, have been published by the Missouri Botanical Garden Press.

——Michael Huft

FORTY YEARS OF CHANGE IN THE COMPOSITION OF THE FOREST AT ROBINSON WOODS PRESERVE, BERRIEN COUNTY, MICHIGAN

Robert Tatina

Department of Biological Sciences,
Dakota Wesleyan University,
Mitchell, SD 57301
rotatina@dwu.edu

ABSTRACT

Robinson Woods Preserve is a 32.4 ha forest in southwestern Michigan that had been cleared and cropped and then abandoned sometime in the 1920s, at which time secondary succession was initiated. The objective of this study is to describe the current tree species composition and the successional changes that led to it. In 2011 and 2012, the T-square method and the point-centered quarter method were used to determine the current structure and composition of the forest. Data from these methods were compared with similar data from two earlier studies of the same area conducted in 1972 and 1986. Between 1972 and 2011–2012, shade-intolerant trees of *Sassafras albidum* and *Prunus serotina* had decreased in importance by 22% and 82%, respectively, while shade-tolerant trees of *Fagus grandifolia, Quercus rubra* and *Acer rubrum* had increased by 26,790%, 352% and 21%, respectively. Between 1986 and 2011–2012, the density of most species had declined, except for trees of *Fagus grandifolia,* whose density had increased by 44%. In addition, trees of *S. albidum* had been reduced in importance to a subdominant role in the presence of *A. rubrum* and *Q. rubra.* Seedling and sapling densities by size class show that most of the canopy trees are reproducing themselves. However, no *Ulmus americana* and *Fraxinus americana* trees larger than 45 cm dbh were encountered, the former having been killed by Dutch elm disease and the latter by the emerald ash borer. Over the 90 years since abandonment, a hardwood forest has developed, one in which pioneer tree species have been replaced in part by shade-tolerant trees. Based on these results, it is expected that the future forest will likely become an American beech–sugar maple forest, especially in the absence of periodic fire.

KEYWORDS: secondary succession, tree composition, Berrien County

INTRODUCTION

The southeastern edge of Lake Michigan has been a fruitful place to study the development of plant communities. It was there in the late 1800s that Henry Cowles carried out his pioneering research into primary succession and described the process as it occurred from the shore to adjacent coastal dunes (Cowles 1899). Later his work was extended by Olson (1958), who used quantitative measures to describe the various plant communities, their ages, and the rates at which they develop and are replaced. Cain (1935) initiated a series of plant community development studies at Warren Woods State Park, an old growth, beech-maple forest located within a mile of Lake Michigan, and concluded that sugar maple (*Acer saccharum* Marsh) was inexplicably increasing in abundance. Subsequently, the same forest was studied by Brewer and Merritt (1978), who found that gaps caused by wind-throw of canopy trees does not in-

crease the diversity of canopy species, because sugar maple or beech replace the downed tree. Woods (1979) explained the maintenance of codominance of sugar maple and American beech as a process of reciprocal replacement in which a gap left by a maple was filled by a beech, and vice versa. Poulson and Platt (1996) attributed the continued codominance of beech and maple to their specific responses to light intensity in understory shade and in gap openings such that maple is favored by large gaps and beech by small gaps. Brewer et al. (1984), using land survey records, showed that most of pre-settlement southwestern Michigan contained forests of American beech and sugar maple. Finally, Donnelly and Murphy (1987) concluded that the current composition of the old-growth beech–maple forest at Warren Woods State Park had changed little since pre-settlement times. Most of the state has since been logged, but some areas have developed into second-growth hardwood forests, albeit smaller in area and more fragmented (Dickmann and Leefers 2003).

Second growth forests in Berrien County in southwestern Michigan have been the subject of several studies. Wells and Thompson (1982) described the plant communities of the forested sand dunes, concentrating mostly on those of Grand Mere State Park. Smith and Woodland (2007) described the plant communities of the forested dunes at Warren Dunes State Park as a mosaic of plant communities dominated by *Quercus rubra* and *Acer saccharum*. Tatina (2010) described the composition of a small forest inland from the sand dunes, but near Warren Dunes State Park, as one in which *Quercus rubra* dominated drier sites and *Acer rubrum* wetter sites.

Community composition and dynamics have been studied in forests of the Great Lakes region. For example, Abrell and Jackson (1977) reported small changes in density and basal area of trees in an old growth beech-maple forest in Indiana. Abrams and Scott (1989) concluded that disturbance could accelerate rates of succession in forests in northern lower Michigan. Tyrell (2003) reported that fire suppression was responsible for declines in red oak and increases in sugar maple in forests of southeastern Wisconsin. Holmes (2006) showed that sugar maple was increasing and American beech decreasing following large scale disturbance in an old growth forest in Indiana. Most other legacy studies in eastern hardwood forests have shown that the composition of these forests predictably changes over time, resulting in dominance by more shade-tolerant species, especially by *Acer saccharum* or *Fagus grandifolia* or both (Ebinger 1986, Wilder et al. 1999, Galbraith and Martin 2005, Pierce et al. 2008, Pinheiro 2008). Finally, others have shown that once American beech and sugar maple achieve canopy dominance, gap phase replacement results in community development changing from a successional process to dynamic equilibrium (Vankat et al. 1975, Diggins 2013).

Even though the composition of and succession in old growth forests and the composition of second growth forests in southwestern Michigan have been described, none of the reports has examined secondary succession starting from an old field, in spite of the fact that much of the area has been logged, and some of it farmed. Beckwith (1954) and Foster and Gross (1999) did study succession on old fields, but their studies were terminated before the development of forests at these sites.

Robinson Woods Preserve (RWP) provides an ideal opportunity to examine secondary succession, because its past disturbances are known and because its post-disturbance vegetational composition had been described previously. The forest at RWP was first studied in 1972 by Carter (1972), who described 62 plant communities based on the importance values of trees and shrubs. He also included an oral history by a nearby resident who described the land use of the preserve prior to its abandonment. Using floristic data, Riess (1986) repeated the Carter study and described ten plant communities. However, Riess did not connect her findings to Carter's earlier results. The objective of the present study was to trace the development of the forest at RWP by comparing its current composition with those reported by Carter (1972) and by Riess (1986). Studies such as the present one can provide benchmarks to allow detection of effects due to human-induced climate change (Dale et al. 2001, McKenney et al. 2007) and forest fragmentation; it has been predicted that the latter activity will remove 1.2 million acres of forest in the Lake States region by 2030 (Alig and Plantinga 2004). Examples of the consequences of forest fragmentation abound in the literature and include increases in lyme disease (Allan et al. 2003) and in the frequency of invasive non-native species (Yates et al. 2004), selective losses of native species (Tallmon et al. 2003), reduced nutrient cycling, increased soil erosion, and decreases in water quality (Newbold et al. 2016).

MATERIALS AND METHODS

Site Description

Robinson Woods Preserve (Figure 1) is located in the Michigan Lake Plain Ecoregion (USGS 2010) of southwestern Michigan (Berrien County, Chikaming Township, N41°51′, W86°38′) about 2.2 km east of Lake Michigan and 1.6 km directly east of the village of Lakeside. The 32.4 ha second growth forest is owned by Chikaming Open Lands of Sawyer, Michigan, a land conservancy organization.

Carter (1972) described the history of the property beginning in 1912 based on communications with Charles Kull, who lived nearby. Prior to the end of World War I, the land was farmed, and the southern half of the property was planted to orchards and row crops. Shortly after the war, drainage ditches were dug, and an attempt was made to place tiles, but the tiling project was abandoned before completion (Carter 1972). The farm was likely abandoned at that time.

An aerial photo of the area taken in June 1938 shows that most of the southern portion of the preserve contained abandoned cropland (Figure 2). Forested portions existed at the northern end and along part of the eastern border. Cores taken in 2012 of larger oak trees (mean dbh = 76.6 cm ± 8.5 cm, N = 10) in the forested parts of the preserve had a mean age of 100.5 ± 16.6 years, which supports the conjecture that the area had been logged in the late 1800s.

In 1966, Jean C. and William S. Robinson purchased the property and built a cabin at the northern end. Two years later they donated the southern 26.3 ha to The Nature Conservancy (TNC). In 1973, the Robinsons donated the remaining 6.1 ha to TNC, and in 2009, the entire 32.4 ha were transferred by TNC to Chikaming Open Lands.

The climate at RWP, moderated by Lake Michigan, becomes neither very hot nor very cold. Based on data from 1981 to 2010 at South Bend, Indiana, (39 km east-southeast of RWP), the average high temperature of 28.2 °C occurs during July, and the average low of –7.8 °C occurs in January. Precipitation is evenly distributed over the year, averaging 96.5 cm (U. S. Climate Data 2016).

At RWP the elevation varies between 186 m and 201 m, with the lowest areas at the bottom of the ravines running across the northern end and at a creek at the eastern edge of the property. The remainder of the property is level or gently undulating.

Three soil types have been mapped in the preserve (Larson 1980). Oakville fine sand is a shallow, dark brown, acidic soil derived from glacial outwash that is rapidly permeable, producing soils

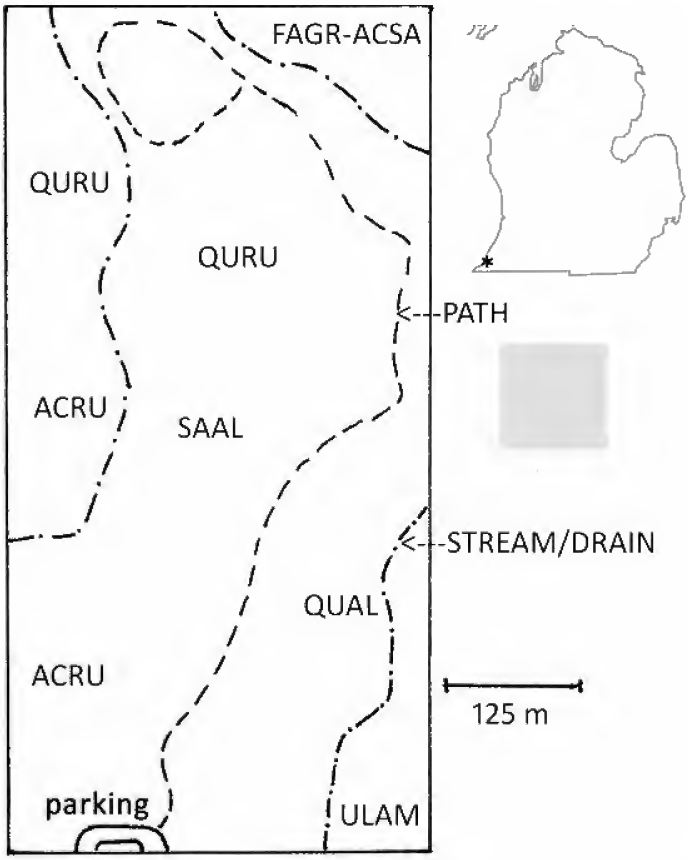

FIGURE 1. Robinson Woods Preserve, Berrien County, Michigan, showing approximate locations for dominant tree species. FAGR-ACSA = *Fagus grandifolia–Acer saccharum*, QURU = *Quercus rubra*, ACRU = *Acer rubrum*, SAAL = *Sasafrass albidu*m, QUAL = *Quercus alba*, ULAM = *Ulmus americana*.

that wet rapidly, but dry quickly. It is found on the higher, drier parts at the northern and south central parts of the preserve and favors a dry southern forest community as described by Kost et al. (2007). Morocco loamy sand is a shallow, dark grayish brown, acidic soil with rapid permeability whose parent material is loamy glacial till. At RWP this type is located where the surface is level and may contain standing water at some time during the year. Rimer loamy fine sand, an acidic to neutral soil of very slow permeability that has developed from sandy glacial and lake deposits, is found in low, level parts of the property and in wet years may remain wet for much of the growing season. Areas of RWP underlain by Morocco and Rimer soils are located on the southeastern and southwestern parts of the property and would favor trees of a mesic southern forest community.

Sampling Methods

Sampling protocols described by Carter (1972) and Riess (1986) were followed to set up 13 south to north transects running the length of the property. The transects were situated 30 m from the prop-

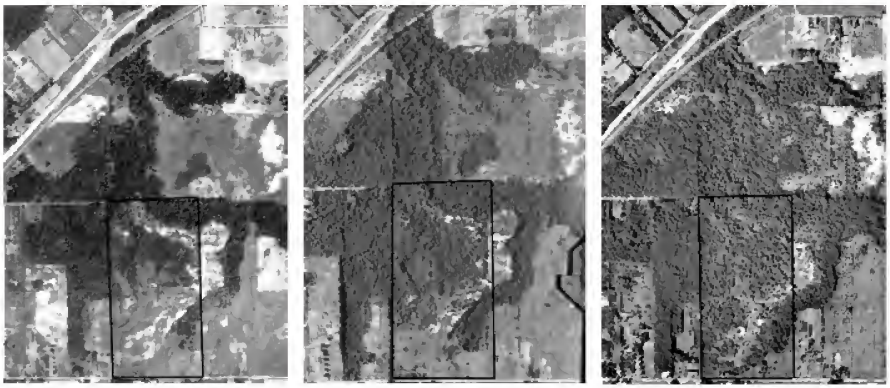

FIGURE 2. Aerial photo images from 1938, 1950 and 1967 (left to right). Robinson Woods Preserve is enclosed by black lines in each photo. The light grey area at the southern half of the preserve in the 1938 photo is probably the part that had been cleared and then planted to row crops and orchards. Over the 29 years these photos span, trees can be seen to fill in much of the area that had been cleared. Photos were provided by RS & GIS Research and Outreach Services, Michigan State University. Used with permission.

erty boundaries and were 30 m apart. In June to September, 2011 and 2012, 650 points were located 15 m apart along these transects, and a table of random numbers was used to select 317 of these points for sampling. This differed from the methods of Carter (1972) and Riess (1986), who used evenly spaced sampling points. Because Carter (1972) included trees ≥ 10 cm dbh (diameter at breast height = 1.5 m above the soil surface) within the southern 26.3 ha only, while Riess (1986) sampled trees > 5 cm dbh within the entire 32.4 ha, two methods were used in this study to sample the trees.

Sampling and Calculations Relative to Carter (1972)

The T-square method (Greenwood 1996) was used to locate two trees ≥ 10 cm in diameter at 1.5 m above ground level, and their circumferences at breast height were recorded by species at sampling points in the southern 26.3 ha of the preserve. The first tree was that nearest the sampling point, and the second was the tree nearest the first but outside a line perpendicular to a line drawn between the first tree and the sampling point. Circumferences were converted to diameters and diameters to basal areas. The number of sampling points for each species was divided by the total for all species and multiplied by 100 to yield the relative frequency value for each species. The number of trees of each species was divided by the total for all species and multiplied by 100 to produce the relative density value for each species. The basal area for each species was divided by the total for all species and multiplied by 100 to calculate the relative dominance value for each species. Finally, the three relative values for each species were summed to yield an importance value for each species. This value allows each species to be compared to the others based on frequency of occurrence, density and basal area. Density of trees was calculated from T-square distance measurements using the following formula: density = $n^2/2.2828\Sigma x\Sigma y$, where n is the number of sampling points, x is the distance to the nearest tree from a sampling point, and y is the distance from the first tree to its nearest neighbor (Greenwood 1996).

Saplings (that is, trees > 30 cm tall and <10 cm dbh) were counted in each of 5 diameter size classes (< 2; ≥ 2 < 4; ≥ 4 < 6; ≥ 6 < 8; ≥ 8 < 10 cm) within a 0.01 ha circular plot centered on each sampling point. These results were used to calculate the relative values, which were then summed to yield importance values. Seedlings (tree species < 30 cm tall) were counted in 0.002 ha circular plots centered on each sampling point. Their numbers were used to calculate seedling density on a per hectare basis.

Tree and sapling densities were compared with the density data reported by Carter (1972). Be-

cause it was impossible to locate the boundaries of the 62 communities of Carter (1972), who described each community by importance values and densities for trees and saplings, his values for these were converted to reflect the entire 26.3 ha. This was done by cutting out each community from a paper copy of his map of the 62 communities (Figure 1 in Carter 1972) and weighing each separately to the nearest mg. Because his delineation of each community is an approximation, it was felt that using optical methods to determine the area of each community would not improve the accuracy of the measurements. All the weights were then totaled, and the proportion of the entire area represented by each community was determined. The sapling and tree densities for each community were each multiplied by the proportion for that community to determine the actual densities, and the sum of all of these densities was divided by 26.3 ha to determine the total density of saplings and trees per hectare. The importance value for each community was multiplied by the appropriate proportion and then summed by species for the entire sampling area. The sum for each species was then divided by the sum for all species and the resulting quotient multiplied by 100 to obtain the importance value.

Sampling and Calculations Relative to Riess (1986)

At 317 sampling points randomly distributed along north-south transects within the entire 32.4 ha, the circumference at breast height of four trees whose dbh > 5 cm and the distance in meters between those trees and the sampling point were measured following the point-centered quarter method of Cottam and Curtis (1956). The number of sampling points at which each tree species occurred was used to determine relative frequency, and the number of trees was used to calculate relative density. The tree density (number of trees per ha) of each species was calculated by the following formula: 10,000 x (number of individuals of the given species / number of individuals of all species) / (mean distance from points to trees)^2. Finally, tree circumferences were summed for each species, and the total of all species was calculated. The sum for each species was then divided by the total for all species and the quotient multiplied by 100 to yield the relative dominance of that species.

RESULTS

A comparison of aerial photos from 1938 to 1967 and of the tree species composition of Robinson Woods Preserve from 1972 to the present shows the changes that have occurred in the vegetation since the property was abandoned.

Changes before 1972

Aerial photos (Figure 2) show that in 1938 the southern half of RWP had not yet developed a cover of trees in the portions of the preserve that had been cleared and cropped. By 1950 a cover of trees is apparent, especially in the northern portion of the cropped area, with isolated clumps of trees scattered throughout the southern portion. In 1967, most of the preserve, except for the southeastern corner, was forested. Current aerial images of RWP, such as those available on Google Earth, show the entire property to be forested.

Changes between 1972 and 2011–12

With importance values (IV) of 74.81, 65.21 and 34.38, respectively, *Acer rubrum* L., *Sassafras albidum* (Nutt.) Nees, and *Prunus serotina* Ehrh. were the most abundant saplings on the southern 26.3 ha in 1972 (Table 1). Of the 62 communities Carter (1972) described, 37 were dominated by *Sassafras albidum* and *Prunus serotina,* and 52 contained these two species as trees and/or saplings. As shown in Table 1, *S. albidum* and *P. serotina* had high importance values as

TABLE 1. Importance values (IV) for saplings and for trees, respectively, and the percentage change in each, for the species recorded at Robinson Woods Preserve in 1972 (calculated from statistics provided in Carter 1972) and in 2011–2012 (this study). An asterisk (*) in the percentage change column indicates that the species was not encountered at sampling points in 1972. The importance values in 1972 do not add up to 300, because Carter excluded species with low values.

	Saplings			Trees		
Species	**IV in 1972**	**IV in 2011–12**	**Percentage Change**	**IV in 1972**	**IV in 2011-12**	**Percentage Change**
Acer rubrum	74.81	56.56	–24	71.48	86.63	21
Quercus rubra	15.00	26.79	79	12.24	55.32	352
Sassafras albidum	65.21	20.39	–69	58.44	45.63	–22
Quercus alba	5.41	19.84	267	21.51	28.34	32
Fagus grandifolia	1.60	74.10	4531	0.10	26.89	26790
Liriodendron tulipifera	3.42	5.27	54	12.61	15.19	20
Nyssa sylvatica	12.05	19.71	64	13.08	8.86	–32
Prunus serotina	34.38	9.42	–73	45.07	8.28	–82
Fraxinus americana	7.58	6.94	–8	4.63	5.45	18
Acer saccharum	1.35	5.81	330	0.50	4.87	874
Ulmus americana	3.51	12.07	244	4.33	3.52	–19
Pinus strobus	0	0	*	0	2.82	100
Populus deltoides	0	0	*	5.52	2.20	–60
Carya ovata	0	10.41	*	0.95	1.58	66
Tilia americana	0.73	0.83	14	0.81	1.49	84
Quercus palustris	3.30	4.24	28	1.49	0.96	–36
Populus grandidentata	10.94	0	–100	9.97	0.51	–95
Amelanchier arborea	0.28	5.34	1807	0	0.49	100
Cornus florida	2.00	3.69	85	0	0.49	100
Quercus muehlenbergii	0	0	*	0	0.49	100
Populus tremuloides	2.37	0	–100	1.21	0	–100
Carpinus caroliniana	1.35	7.42	450	0	0	0
Pyrus malus	0	0	*	3.17	0	–100
Rhus typhina	0	0	*	0.11	0	–100
Salix sp.	0	0	*	0.44	0	–100
Ostrya virginiana	1.18	1.77	50	0	0	0
Crataegus sp.	3.23	2.19	–32	0.32	0	–100
Acer saccharinum	0	0.18	*	1.39	0	–100
Hamamelis virginiana	0	2.97	*	0	0	0
Asimina triloba	0	0.25	*	0	0	0
Cornus sp.	0	0.84	*	0	0	0
Viburnum lentago	0	0.24	*	0	0	0
Rhus copallina	0.29	0	–100	0	0	0
Betula papyrifera	0.21	0	–100	0	0	0
Ulmus rubra	1.78	0	–100	0	0	0
Prunus pensylvanica	0	2.73	*	0	0	0
Totals	251.96	300		269.37	300.01	
Indviduals/ha	1042	948	–9	527	466	–12

saplings and as trees, second only to *Acer rubrum*, which was the dominant tree in 20 communities and a dominant sapling in 19 (Carter 1972). Between 1972 and 2011–2012, 10 species of saplings had declined in importance (Table 1). These included *Acer rubrum* (–24%), *Sassafras albidum* (–69%), *Prunus serotina* (–73%), and *Fraxinus americana* (-8%). Thirteen species of saplings

had increased in importance. These included *Quercus rubra* L. (79%), *Quercus alba* L. (267%), and *Fagus grandifolia* Ehrh. (4531%). Five species present as saplings in 1972, including *Populus tremuloides* Michx., *Rhus copallina* L. and *Betula papyrifera* Marsh., were not recorded in 2011 and 2012. Seven sapling species not previously noted were recorded in samples in 2011 and 2012; among these were *Carya ovata* (Mill.) K. Koch, *Hamamelis virginiana* L., *Asimina triloba* (L.) Dunal, and *Prunus pensylvanica* L.f.

By 2011–2012, 13 species of trees had increased in importance (Table 1), most notably *Acer rubrum* (21%), *Quercus rubra* (352%), *Quercus alba* (32%), and *Fagus grandifolia* (26,790%). Trees of *Sassafras albidum* and *Prunus serotina* had decreased in importance by 22% and 82%, respectively.

During the 40 years between sampling dates, the density of saplings had decreased by 9% and that of trees by 12% (Table 1). In 1972 the dominant tree species were the same as the dominant sapling species; of these, only trees of *Acer rubrum* retained their dominant position in 2011 and 2012.

Changes between 1986 and 2011–12

Twenty-seven species were recorded in 1986 and 25 in 2011 and 2012 (Table 2). Over the 25 or 26 years between sampling events, the density of most species declined, except for trees of *Fagus grandifolia,* whose density had increased by 77%.

In 1986 the species with the greatest importance values were *Sassafras albidum* (IV = 71.53), *Acer rubrum* (IV = 59.96), and *Quercus rubra* (IV = 50.61) (Riess 1986 and Table 2). By 2011 and 2012, trees of *S. albidum* (IV = 33.29) had been reduced to a subdominant role in the presence of *A. rubrum* (IV = 71.33) and *Q. rubra* (IV = 63.97), whereas trees of both of the latter species showed increases in importance values, even though the density of *Q rubra* had declined from 198 to 132 trees per hectare. An additional 15 species increased in importance values over the 25- to 26-year period (Table 2). Trees of *Fagus grandifolia* had a large increase in importance value (from 12.55 to 27.22) due to a 76.75% increase in density. *Liriodendron tulipifera* L. (27%), *Quercus alba* (24%), *Nyssa sylvatica* Marsh. (42%), and *Acer saccharum* (46%) likewise exhibited increases in their importance values; of these, *L. tulipifera* (–49%) and *Q. alba* (-41%) decreased in density, while trees of *N. sylvatica* (6%) and *A. saccharum* (2%) increased slightly. Finally, the trees of 13 species decreased in importance values, most notably, *Sassafras albidum* (–75%), *Prunus serotina* (-71%), and *Fraxinus americana* L. (–75%).

Current Composition

Compositional statistics for trees and for saplings and seedlings on the 32.4 ha are presented in Appendices A and B for use in future legacy studies. In 2011–2012, 17 species of trees were measured producing a total density of 431.51 trees per hectare. *Quercus rubra* (IV = 72.61) and *Acer rubrum* (IV = 71.46) were the two most important species (Appendix A), *Q. rubrum* on well drained soils and *Acer rubrum* on poorly drained soils. Seedling and sapling den-

TABLE 2. Density and importance values of trees (>5 cm dbh) at Robinson Woods Preserve in 1986 and in 2011–12. Density values for 1986 are calculated from statistics in Riess (1986); importance values for 1986 are takes from Riess (1986).

	Density (trees/ha)			Importance Value		
Species	**1986**	**2011–12**	**Percentage Change**	**1986**	**2011-12**	**Percentage Change**
Sassafras albidum	328	82.707	–75	71.53	33.291	–53
Acer rubrum	271	175.618	–35	59.96	71.328	19
Quercus rubra	198	132.116	–33	50.61	63.968	26
Liriodendron tulipifera	57	29.001	–49	18.87	23.982	27
Quercus alba	65	38.131	–41	18.69	23.252	24
Prunus serotina	50	14.501	–71	14.13	6.391	–55
Fagus grandifolia	43	76.262	77	12.55	27.218	117
Fraxinus americana	41	10.204	–75	9.51	3.894	–59
Nyssa sylvatica	33	34.909	6	9.15	12.948	42
Acer saccharum	29	29.538	2	6.74	9.863	46
Cornus florida	24	3.222	–87	5.51	1.225	–78
Ulmus americana	18	16.649	–8	4.23	5.340	26
Quercus palustris	13	8.056	–38	3.51	3.403	–3
Carpinus caroliniana	9	6.445	–28	2.27	2.014	–11
Tilia americana	7	1.611	–77	2.27	0.669	–71
Ostrya virginiana	7	4.834	–31	1.54	1.802	17
Hamamelis virginiana	7	0.537	–92	1.44	0.203	–86
Populus grandidentata	5	1.611	–68	1.35	0.916	–32
Populus tremuloides	5	0.000	–100	1.21	0.000	–100
Crataegus sp.	6	2.685	–55	1.07	0.789	–26
Carya ovata	3	4.834	61	0.95	1.955	106
Amelanchier arborea	4	3.759	–6	0.83	2.627	216
Populus deltoides	2	2.148	7	0.7	1.211	73
Betula papyrifera	2	0.000	–100	0.45	0.000	–100
Asimina triloba	2	1.074	–42	0.36	0.287	–20
Pinus sylvestris	2	0.000	–100	0.36	0.000	–100
Acer saccharinum	0	1.074	*	0	0.511	*
Quercus muehlenbergii	0	0.537	*	0	0.214	*
Pinus strobus	0	1.074	100	0	0.701	*
Totals	1232	683.136	–45	300	300.000	

sities by size class (Appendix B) show that most of the canopy trees are reproducing themselves. However, no *Ulmus americana* and *Fraxinus americana* trees larger than 45 cm dbh were encountered.

DISCUSSION

When RWP was abandoned after having been logged and then cleared in part for row crops and an orchard, the forest began to recover in the process of secondary succession. While there is no record of the nature of the plant communities that followed immediately after abandonment in the early 1920s and until 1972, studies of old field succession from nearby areas offer clues as to the likely series of stages and their dominant plant species. Beckwith (1954) described

four stages within the first 25 years following abandonment of cropped land in Washtenaw County, Michigan, about 240 km east-northeast of RWP: an annual–biennial stage, followed by a grass and perennial herb stage, which is replaced by a mixed herbaceous perennial stage. The fourth stage, which is dominated by shrubs, may be initiated by propagules of wind-dispersed species followed by propagules of bird-dispersed species (Foster and Gross 1999). While the duration of each stage depends on the specific type of agricultural practice that had occurred on the land (Beckwith 1954), Evans and Dahl (1955) and Weigert and Evans (1964) have found that the herbaceous perennial stage of old fields in Michigan may persist for longer than 50 years. Beckwith (1954) and Huberty et al. (1998) each provide a list of possible plant species that dominate each stage.

Although the first 50 years of secondary succession at RWP can only be presumed as a matter of extrapolation from nearby old fields, the record shows that after those 50 years, it had the characteristics of a young forest, one where dominance was shared by shade-intolerant pioneer species as documented by Carter (1972).

Oliver and Larson (1996) describe forest development as a sequence of four stages: 1) a stand initiation stage, 2) a stem exclusion stage, 3) an understory re-initiation stage, and 4) an old growth stage. If the stand development described by Oliver and Larson (1996) is fitted to the aforementioned description, then the forest in 1972 was late in the first stage (stand initiation) of forest development, in which pioneer species, developing from propagules carried into the area or from saplings and or a seed bank that had survived the clearing of the land, were the dominants, and new species were continually entering. At that time, the short stature of the trees lent a scrubby appearance to the forest (J. Carter pers. comm. 2012).

In the 40 years since the Carter (1972) study, the forest has changed markedly. Sapling and tree densities declined as competition for sunlight, water, and soil nutrients (Coomes and Grubb 2000) winnowed out the less adapted, most of which were trees of shade-intolerant species. Gains were made by saplings of shade-tolerant species, most notably *Hamamelis virginiana* and *Asimina triloba*, two species commonly present in the understory of nearby old growth forests (Cain 1935). *Acer rubrum* trees, already important in 1972, were among the dominants in 2011 and 2012. Shade-intolerant species disappeared from the canopy as the area started to resemble a mature forest with abundant oaks. Although they were still not dominant in 2011 and 2012, trees of *Fagus grandifolia* and *Acer saccharum* showed large gains in importance values, perhaps foreshadowing their position in the future. Where disturbance was greater due to plowing, the portion of the forest where row crops had been planted is currently in the stem exclusion stage of Oliver and Larson (1996), in which canopy closure begins to eliminate shade-intolerant species, and the portion where disturbance had been limited to logging is in the understory re-initiation stage, which is characterized by advance regeneration of shade tolerant species.

Riess's (1986) study of the same area allows for a corroborating look at and fine tuning of those stages of forest development that have occurred since 1986. By 1986, *Sassafras albidum* and *Acer rubrum* were still dominants, as they were

in the Carter (1972) study, but trees of *Quercus rubra* had increased in importance value, either through recruitment from advance reproduction or because more oaks were included with the additional 15 acres that Riess (1986) had sampled. However, of the nine forested communities she described, only two contained *Sassafras albidum* trees as a dominant; the others had shade-tolerant species (e.g., *Acer rubrum* and *Quercus rubra, Fagus grandifolia,* and *Acer saccharum)* as dominants. Thus, by about 65 years after abandonment, the forest had already entered the understory re-initiation stage of Oliver and Larson (1996). Since then the changes that have occurred have paralleled those described earlier in the comparison between 1972 and 2011-2012. From 1986 to 2011-2012, species diversity remained constant, total tree density declined, and dominance shifted from *Sassafras albidum* to *Acer rubrum* and *Quercus rubra*. In addition, there was a noteworthy increase in the density and importance value of *Fagus grandifolia.*

Abrams (1998) has shown that the number of *Acer rubrum* trees has been increasing in eastern deciduous forest since pre-settlement times and can effectively compete for both wet and dry sites, while *Acer saccharum* will do the same on mesic sites. *Acer saccharum* has also been shown to replace oaks in the absence of fire (Abrams 2003). If the trends observed in the composition of the forest at RWP continue, and the predictions of Abrams (1998, 2003) are taken into account, then the forest at RWP may come to look more like a *Fagus grandifolia–Acer saccharum–Acer rubrum* forest. However, in light of recent predictions about global climate change, determining the future of any forest must be considered to be extremely tentative.

The present forest, which is in a mid-successional stage, is undergoing further development as shown in the size class distributions of its trees (Appendix B). Interpretation of these leads to the hypothesis that the shade-tolerant species will continue to replace themselves, with the wetter parts dominated by *Acer rubrum* trees, and the drier parts becoming an oak forest of *Quercus rubra* and *Q. alba*. Exclusion of fire will probably favor sugar maple to the detriment of the oaks, as has been found in many other eastern deciduous forests (Abrams 2003) and thus the drier forest may become a beech-maple forest. Thus, as the forest at RWP develops to the old growth stage, its composition and dynamics may resemble that of two nearby forests. One is Warren Woods State Park, located 2.6 km east-southeast from RWP. It has been described as an old growth beech-maple forest that is sustaining itself through gap-phase replacement of *Fagus grandifolia* and *Acer saccharum* (Brewer and Merritt 1978; Woods 1979; Donnelley and Murphy 1987; Poulson and Platt 1996). Size class distributions (Appendix B) of trees at RWP show that both *Fagus grandifolia* and *Acer saccharum* are increasing and, in the absence of major disturbance, may become the dominants in an old growth beech-maple forest. A similar, albeit smaller, beech-maple forest, Toumey Woodlot, 200 km northeast, which had been protected from timbering and grazing for 92 years, has been shown to be changing as sugar maple was increasing and American beech was decreasing slightly (Schneider 1966). In it, tree density increased over the most recent 20-year period. At RWP, tree density decreased by almost 50% as a consequence of the loss of pioneer species. It is interesting to speculate that if the pattern at Toumey Woodlot is the norm for old growth

forests in this area, then at some point in time the downward trend in density at RWP may be reversed.

Future trends extrapolated from past events assume that environmental conditions remain relatively constant, a condition which may not hold as a consequence of global climate change. The predicted increases in average temperatures will cause a northern shift in the distribution of some tree species (McKenney et al. 2007). While none of the species at RWP appear to be at risk of extirpation due to a northern shift (see Woodall et al. 2010), changes in temperature may alter competitive interactions favoring an unpredictable change in species composition. Climate change is also predicted to be accompanied by changes in the duration and frequency of disturbances, such as drought, fire, storms, insect outbreaks and invasions of alien species (Dale et al. 2001). If such disturbances create large gaps in the current forest, *Acer saccharum* may be favored over *Fagus grandifolia* (Poulson and Platt 1996). If droughts are prolonged with or without increased frequency of forest fire, oaks may be favored over beech and maples (Abrams 2003) and the entire forest might become a *Quercus rubra—Q. alba* stand.

ACKNOWLEDGMENTS

Thanks are extended to Chikaming Open Lands for permission to study the forest at RWP and to Peg Kohring, Midwest Regional Director, The Conservation Fund, Pamela Smith, CSU Colorado Natural Heritage Program, Nancy Baird, and an anonymous reviewer for their careful reading of earlier versions of this manuscript and for their suggestions which improved it.

LITERATURE CITED

Abrams, M. (2003). Where have all the white oaks gone? BioScience 53: 927–939.

Abrams, M. D. (1998). The red maple paradox. Bioscience 48: 355–364.

Abrams, M. D., and M. L. Scott. (1989). Disturbance-mediated succession in two Michigan forest types. Forest Science. 35: 42–49.

Abrell, D. B., and M. T. Jackson. (1977). A decade of change in an old growth beech-maple forest in Indiana. American Midland Naturalist 98: 23–32.

Allan. B. F., F. Keesing, and R. S. Ostfeld. (2003). Effect of forest fragmentation on Lyme disease risk. Conservation Biology 17: 267–272.

Alig, R., and A. J. Plantinga. (2004). Future forestland area: Impacts from population growth and other factors that affect land values. Journal of Forestry 102: 19–24.

Beckwith, S. L. (1954). Ecological succession on abandoned farm lands and its relationship to wildlife management. Ecological Monographs 24: 349–376.

Brewer, L. G., T. W. Hodler, and H. A. Raup. (1984). Presettlement vegetation of southwestern Michigan. The Michigan Botanist 23: 153–156.

Brewer, R., and P. G. Merritt. (1978). Wind throw and tree replacement in a climax beech-maple forest. Oikos 30: 149–152.

Cain, S. A. (1935). Studies on virgin hardwood forest: III. Warren's Woods, a beech-maple climax forest in Berrien County, Michigan. Ecology 16: 500–513.

Carter, J. (1972). A floristic analysis and mapping study in the Robinson Preserve. M.A. thesis, Andrews University, Berrien Springs, Michigan.

Coomes, D. A., and P. J. Grubb. (2000). Impacts of root competition in forests and woodland: a theoretical framework and review of experiments. Ecological Monographs 70: 171–207.

Cottam, G., and J. T. Curtis. (1956). The use of distance measures in phytosociological sampling. Ecology 37: 451–460.

Cowles, H. C. (1899). The ecological relations of the vegetation on the sand dunes of Lake Michigan. Botanical Gazette 28: 95–117, 167–202, 281–308, 361–391.

Dale, V. H., L. A. Joyce, S. McNulty, R. P. Nielson, M. P. Ayres, M. D. Flannigan, P. J. Hanson, et al. (2001). Climate change and forest disturbances. BioScience 51: 723–734.

Dickmann, D. I., and L. A. Leefers. (2003). The forests of Michigan. University of Michigan Press, Ann Arbor.

Diggins, T. P. (2013). A 300-year successional sequence in an Eastern United States riparian hardwood forest. Journal of the Torrey Botanical Society. 140: 65–88.

Donnelley, G. T., and P. G. Murphy. (1987). Warren Woods as forest primeval: A comparison of forest composition with pre-settlement beech-sugar maple forests of Berrien County, Michigan. The Michigan Botanist 26: 17–24.

Ebinger, J. 1986. Sugar maple, a management problem in Illinois forests? Transactions of the Illinois Academy of Science 79: 25–30.

Evans, F. C., and E. Dahl. (1955). The vegetational structure of an old field community in southeastern Michigan and its relation to environmental factors. Ecology 36: 685–706.

Foster, B. L., and K. L. Gross. (1999). Temporal and spatial patterns of woody plant establishment in Michigan old fields. American Midland Naturalist 132: 229–243.

Galbraith, S. L., and W. H. Martin. (2005). Three decades of overstory and species change in a mixed mesophytic forest in eastern Kentucky. Castanea 70: 115–128.

Greenwood, J. J. D. (1996). Basic techniques. Pp. 60–62 in Ecological census techniques, W. J. Sutherland, editor. Cambridge University Press, New York, N.Y.

Holmes, T. (2006). Four decades of change on old growth beech-maple forest in Indiana. M.A. thesis, University of Missouri-Columbia., Columbia, Missouri. Available at https://mospace.umsystem.edu/xmlui/bitstream/handle/10355/4567/public.pdf?sequence=1&isAllowed=y. (Accessed October 18, 2012).

Huberty, L. F., K. I. Gross and C. J. Miller. (1998). Effects of nitrogen addition on successional dynamics and diversity in Michigan old fields. Journal of Ecology 86:794–803.

Kost, M.A., D.A. Albert, J.G. Cohen, B.S. Slaughter, R.K. Schillo, C.R. Weber and K.A. Chapman. (2007). Natural communities of Michigan. Michigan Natural Features Inventory, Report Number 2007-21, Lansing, Michigan.

Larson, J. D. (1980). Soil survey of Berrien County, Michigan. USDA Soil Conservation Service, Washington, D.C.

McKenney, D. W., J. H. Pedlar, K. Lawrence, K. Campbell, and M. F. Hutchinson. (2007). Potential impacts of climate change on the distribution of North American trees. BioScience 57: 939–948.

Newbold, T., L. N. Hudson, A. P. Arnell, S. Contu, A. De Palma, S. Ferrier, S. L. L. Hill, et. al. (2016). Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment. Science 353: 288–291.

Oliver, C. D., and B. C. Larson. (1996). Forest stand dynamics (Update edition). Wiley and Sons, New York, New York.

Olson, J. S. (1958). Rates of succession and soil changes on southern Lake Michigan sand dunes. Botanical Gazette 119: 125–169.

Pierce, A. R., W. R. Bromer, and K. N. Rabenold. (2008). Decline of *Cornus florida* and forest succession in a *Quercus-Carya* forest. Plant Ecology 195: 45–53.

Pinheiro, N. R. (2008). Composition, structure and stand development of old-growth and second-growth beech-maple stands of Crall woods, north-central Ohio. M.S. thesis, Ohio State University, Columbus, Ohio. Available at http://www.oardc.ohio-state.edu/ferel/theses/N.%20Thesis%20Pinheiro%20Thesis%20Final.pdf. (Accessed October 12, 2012).

Poulson, T. L., and W. J. Platt. (1996). Replacement patterns of beech and sugar maple in Warren Woods, Michigan. Ecology 77: 1234–1253.

Riess, A. H. (1986). A floristic study of the Robinson Preserve, Chikaming Township, Berrien County, Michigan. M.A. thesis, Andrews University, Berrien Springs, Michigan.

Schneider, G. (1966). A 20-year investigation in a sugar maple-beech stand in southern Michigan. Research Bulletin 15. Agriculture Experiment Station, Michigan State University. Lansing.

Smith, P. F., and D. W. Woodland. (2007). Forest composition study of the Great Lakes coastal forest at Warren Dunes State Park, Berrien County, Michigan. The Michigan Botanist 46: 33–62.

Tallmon, D. A., E. S. Jules, and N. J. Radke. (2003). Of mice and men: Cascading effects of forest fragmentation. Ecological Applications 13: 1193–2103.

Tatina, R. (2010). Tree composition and demography of a second growth hardwood forest in Berrien County, Michigan. The Michigan Botanist 49: 118–131.

Tyrell, C. D. (2003). Twenty-five years of change in a dry-mesic forest of south eastern Wisconsin. The Michigan Botanist 42: 95–102.

U. S. Climate Data. 2016. Available at www.usclimaedata.com/climate/south-bend/indiana/unitedstates/usin0624. (Accessed July 12, 2016).

USGS. (2010). Level II and IV Ecoregions of Michigan. Available at ftp://newftp.epa.gov/EPADAtaCommons/ORD/Ecoregion/mi/mi_eco.pdf. (Accessed July 14, 2016).

Vankat, J. W., W. H. Blackwell, Jr., and W. E. Hopkins. (1975). The dynamics of Hueston Woods and a review of the successional status of the southern beech-maple forest. Castanea 40: 290–308.

Weigert, R. G., and F. C. Evans. (1964). Primary production and the disappearance of dead vegetation on an old field in southeastern Michigan. Ecology 45: 49–51.

Wells, J. R., and P. W. Thompson. (1982). Plant communities of the sand dunes region of Berrien County. The Michigan Botanist 21: 3–38

Wilder, C. M., F. W. Holtzclaw, Jr., and E. E. C. Clebesch. (1999). Succession, sapling density and growth in canopy gaps along a topographic gradient in a second growth east Tennessee forest. American Midland Naturalist 142: 201–212.

Woodall, C. W., C. M. Oswalt, J. A. Westfall, C. H. Perry, M. D. Nelson, and A. O. Finley. (2010). Selecting tree species for climate change migration hypotheses using forest tree inventory data. Forest Ecology and Management 259: 778–785.

Woods, K. D. (1979). Reciprocal replacement and the maintenance of co-dominance in a beech-maple forest. Oikos 33: 31–39.

Yates, E. D., D. F. Lewis, Jr., and C. L. Williams. (2004). Recruitment of three non-native invasive plants into a fragmented forest in southern Illinois. Forest Ecology Management 190: 119–130.

APPENDIX A. Density, basal area per hectare, relative frequency, relative density, relative dominance, and importance value for trees (> 10 cm dbh) of each species at Robinson Woods Preserve, derived from measurements taken at 317 random points sampled in 2011–2012.

Species	Density (trees/ha)	Basal Area per Hectare	Relative Frequency	Relative Density	Relative Dominance	Importance Value
Quercus rubra	101.109	11.870	22.917	23.428	26.262	72.606
Acer rubrum	114.681	8.991	25.000	26.572	19.892	71.464
Sassafras albidum	76.680	3.190	16.458	17.767	7.057	41.283
Quercus alba	29.179	4.275	7.083	6.761	9.457	23.302
Fagus grandifolia	23.072	8.807	5.417	5.346	19.483	30.246
Liriodendron tulipifera	23.750	4.935	6.458	5.503	10.919	22.880
Acer saccharum	14.929	1.217	2.917	3.459	2.692	9.068
Nyssa sylvatica	12.215	0.260	3.542	2.830	0.576	6.947
Prunus serotina	10.179	0.501	2.917	2.358	1.108	6.383
Fraxinus americana	7.464	0.199	2.083	1.730	0.441	4.254
Ulmus americana	4.750	0.094	1.458	1.101	0.207	2.766
Pinus serotina	2.714	0.377	0.417	0.629	0.835	1.880
Populus deltoides	2.036	0.249	0.625	0.472	0.550	1.647
Carya ovata	2.036	0.060	0.625	0.472	0.133	1.230
Tilia americana	2.036	0.112	0.417	0.472	0.247	1.135
Ostrya virginiana	0.679	0.014	0.417	0.157	0.031	0.605
Amelanchier arborea	0.679	0.009	0.208	0.157	0.020	0.386
Quercus palustris	1.357	0.014	0.417	0.314	0.031	0.762
Populus grandidentata	0.679	0.016	0.208	0.157	0.035	0.400
Cornus florida	0.679	0.009	0.208	0.157	0.019	0.385
Quercus muehlenbergii	0.679	0.007	0.208	0.157	0.015	0.380
Totals	431.58	45.2	100	100	100	300.000

APPENDIX B. Sapling (9, 7, 5, 3, and 1 cm size class midpoints) and seedling densities (stems per hectare) for 32.4 ha of Robinson Woods Preserve (2011–2012) from 317 sampling points.

Size class	*Quercus rubra*	*Acer rubrum*	*Sassafras albidum*	*Quercus alba*
9 cm	13.21	21.07	5.97	5.66
7 cm	12.26	30.50	11.64	6.60
5 cm	21.07	35.22	11.95	12.89
3 cm	19.18	50.31	16.98	23.27
1 cm	82.39	95.28	1023.27	137.74
Seedling	1778.30	3477.00	2654.00	277.30

Size class	*Fagus grandifolia*	*Liriodendron tulipifera*	*Acer saccharum*	*Nyssa sylvatica*
9 cm	11.32	0.94	2.83	5.66
7 cm	25.79	1.26	3.46	5.66
5 cm	73.27	3.77	7.55	14.15
3 cm	263.21	5.03	10.06	21.70
1 cm	1026.10	52.83	23.27	56.29
Seedling	104.30	197.80	69.30	592.80

Size class	*Prunus serotina*	*Fraxinus americana*	*Ulmus americana*	*Pinus strobus*
9 cm	4.72	2.52	4.40	0.00
7 cm	3.46	3.14	3.46	0.00
5 cm	4.72	3.14	10.69	0.00
3 cm	8.49	6.29	10.69	0.00
1 cm	239.62	380.19	13.21	0.31
Seedling	1680.80	547.60	4.50	0.00

Size class	*Populus deltoides*	*Carya ovata*	*Tilia americana*	*Acer saccharinum*
9 cm	0.00	5.66	0.31	0.00
7 cm	0.00	1.89	0.31	0.00
5 cm	0.00	1.57	0.63	0.31
3 cm	0.00	12.58	1.90	0.00
1 cm	0.94	68.87	0.00	0.00
Seedling	0.00	50.20	0.00	0.00

Size class	*Ostrya virginiana*	*Amelanchier arborea*	*Quercus palustris*	*Populus grandidentata*
9 cm	0.63	0.00	1.26	0.00
7 cm	1.57	0.63	2.20	0.00
5 cm	3.14	2.52	4.40	0.00
3 cm	6.29	12.89	0.94	0.00
1 cm	26.42	427.99	5.03	2.52
Seedling	7.60	609.30	7.00	0.00

Size class	*Cornus florida*	*Prunus pensylvanica*	*Carpinus caroliniana*	*Hamamelis virginiana*
9 cm	0.00	3.77	0.94	0.00
7 cm	3.77	0.00	1.57	0.00
5 cm	5.03	0.00	4.09	6.29
3 cm	6.29	1.26	17.30	17.92
1 cm	22.64	24.21	58.81	67.61
Seedling	66.80	44.50	37.50	124.00

Size class	*Asimina triloba*	*Picea pungens*	*Dirca palustris*	*Cornus spp.*
9 cm	0.00	0.00	0.00	0.00
7 cm	0.31	0.00	0.00	0.00
5 cm	0.94	0.00	0.00	0.63
3 cm	1.89	0.00	0.00	2.20
1 cm	60.38	0.00	3.14	15.41
Seedling	23.50	0.63	0.00	22.90

Size class	*Juniperus virginiana*	*Viburnum lentago*	*Crataegus sp.*	*Carya cordiformis*
9 cm	0.00	0.00	0.31	0.00
7 cm	0.00	0.00	3.14	0.00
5 cm	0.00	0.00	0.94	0.00
3 cm	0.00	0.31	0.94	0.00
1 cm	0.31	16.67	0.63	0.31
Seedling	0.00	7.60	0.00	0.00

VASCULAR PLANTS OF ST. MARTIN ISLAND, DELTA COUNTY, MICHIGAN

Emmet J. Judziewicz[1]
Department of Biology
University of Wisconsin-Stevens Point

Gary Fewless
Cofrin Center for Biodiversity
University of Wisconsin-Green Bay

Michael Grimm
The Nature Conservancy
Door Peninsula & Green Bay Watershed
242 Michigan St., Suite B103
Sturgeon Bay, WI 54235

ABSTRACT

A botanical survey of St. Martin Island, Delta County, Michigan was conducted from 2013 to 2014. This 523 ha, relatively low and flat Lake Michigan island, located 15 km south of the tip of the Garden Peninsula, is underlain by Niagara dolomite. The predominant vegetation types are second- and third-growth mesic hardwood and mixed conifer-hardwood forests harboring several understory species at their northern range limits. There are also significant dolomite cliff communities on the west coast, alkaline rockshore communities on the south coast, and a small but significant ephemeral pond-hardwood swamp in the interior. Five state of Michigan and one Federally listed plant species occur (or have occurred in the past) on the island. Herbivory by white-tailed deer has been and continues to be a threat to many vascular plant species on the island. A total of 405 species vascular plant species have now been recorded from St. Martin Island.

KEYWORDS: Biodioversity, St. Martin Island, Delta County, Michigan, Lake Michigan islands, vascular plants.

INTRODUCTION

The Grand Traverse Islands chain stretches from Michigan's Garden Peninsula south to Wisconsin's Door Peninsula (see map in Judziewicz 2001). From 1997 to 1999, the first author visited all of the major islands save one—St. Martin Island, which he was unable to visit—and made 1,550 collections documenting the vascular flora of the archipelago (Judziewicz 2001). . Through 1990, only 183 vascular plant species had been documented on St. Martin Island (Forzley et al. 1993; Judziewicz 2001), as compared with 333 species on nearby Rock Island, Wisconsin, which is much smaller, but also much better surveyed. In the years since Forzley's work, St. Martin Island has been the object of several visits

[1] Author for correspondence (emmet.judziewicz@uwsp.edu)

TABLE 1. Airline distances in km between St. Martin Island and nearby islands or the mainland peninsulas of Michigan and Wisconsin. In each case, the distance is measured from St. Martin Island to the nearest point on the given peninsula or island.

Locality	Distance (km)
Mainland Peninsulas	
Upper Peninsula of Michigan	32
Stonington Peninsula of Michigan	21
Garden Peninsula of Michigan	15
Door Peninsula of Wisconsin	21
Islands	
Summer Island, Michigan	10
Poverty Island, Michigan	7
Gull Islands, Michigan	3
Rock Island, Wisconsin	7
Washington Island, Wisconsin	10

by ecologists and botanists, and, based on our field work, a substantially more complete picture of its vascular flora is here presented. The number of vascular plant species now known from St. Martin Island has been increased by 183 to a total of 405.

St. Martin Island (45°30′N, 86°46′W in Delta County, Michigan), along with Rock Island, is one of most remote islands in chain, nearly 10 miles from the nearest mainland point. The airline distances in kilometers from St. Martin Island to nearby islands and to the mainland peninsulas of Michigan and Wisconsin are given in Table 1.

The island is just over 4 km long and 2.5 km wide, covers 523 ha, and has a high point of 28 m (92 ft) above Lake Michigan. It has generally flat to rolling terrain and is underlain by Niagara dolomite (Dorr & Eschman 1984; Albert et al. 1995, 1997) that is exposed as prominent, vertical cliffs up to 25 m high on the western coast. Elsewhere the land slopes more gradually to the shore, with the exception of a small outcropping of 10 m tall cliffs on the eastern shore. Interior dolomite escarpments, which are well-developed on nearby Rock and Washington Islands, occur on St. Martin Island, but are only 1–2 m tall and poorly developed.

St. Martin Island is uninhabited and has been so since the late 19th century, when a short-lived fishing village was established on the southwest bay (Coppess 1981; McDonald 1984); its ruins were still evident in 2014. There is also an historic lighthouse on the northeastern part of the island (Hyde 1995) that was occupied by keepers and their families into the early 20th century. Finally, there are some seasonal cabins, built sometime in the early to mid-20th century, and a modern dock on the south bay of the island; a "trans-island" trail connects these with the lighthouse area. The island was held privately until 2013, when nearly all of it was conveyed to The Nature Conservancy.

PLANT COMMUNITIES

The plant communities discussed below follow Judziewicz (2001).

Mesic forests

The island's interior, including roughly two-thirds of its total area, is dominated by mesic deciduous forests dominated by sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and red oak (*Quercus rubra*), although some areas have successional stands of white birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and big-toothed aspen (*P. grandidentata*). As Fuller (1926) noted, "[t]he moderating effects of Lake Michigan (cool summers, mild winters) favor the persistence of southern and eastern species in the islands' beech-sugar maple forests." Minor components include basswood (*Tilia americana*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), and hop-hornbeam (*Ostrya virginiana*). Hemlock (*Tsuga canadensis*) is known from only one tree. In a description of his 1926 visit to the island, Fuller (1927) notes that "In the uncut portions of the island are magnificent sugar maples, yellow birches, and white cedars . . . ." But significant logging in the succeeding decades has apparently eliminated many of the older trees, since observers from 1989 on have noted the dominance of regenerating stands sugar maple, beech, white birch, aspen, and other tree species.

Fuller's observation that "The floor of the woods is covered with the native yew [*Taxus canadensis*]" was echoed by all biological visitors to the island up through the visit by the second and third authors in 2006 (Figure 1). However, by 2009, white-tailed deer populations had expanded (Smith, 2009) sufficiently to have a tremendous impact on the forest understory vegetation of the island. By 2014, essentially no Canada yew (Figure 2) and very little else was able to survive in the understory, except for a few deer-dispersed herbs with burlike fruits, such as common hound's-tongue (*Cynoglossum boreale*) and stickseed (*Hackelia virginiana*). Neither of these species had been documented on the island prior to 2013. The forest understory appeared to have recovered a bit from deer browsing in 2014. Besides a formerly dense growth of yew, the mesic forest understory has the remnants of a very rich spring ephemeral and "summer green" herb display. Regionally common species in this community are listed in Table 2.

Forests on the island face a number of threats from exotic plant species. The European helleborine (*Epipactis helleborine*) is our only weedy orchid and appears to be becoming more common in nearly all mesic forest communities. Common hound's-tongue (*Cynoglossum officinale*) is becoming more common and is easily spread by deer, and wood bluegrass (*Poa nemoralis*) has appeared on the island and can form solid stands in the deep shade of mesic forests. Garlic mustard (*Alliaria petiolata*) is fortunately not yet present on St. Martin Island.

Coniferous and mixed forests

Near the southwestern and northeastern corners of the island, and comprising about one-quarter of its total area, are forests dominated by white cedar (*Thuja occidentalis*) mixed with deciduous species such as maples and other conifers

FIGURE 1. Second growth mesic forest of sugar maple (*Acer saccharum*) and white birch (*Betula papyrifera*) with dense understory of Canada yew (*Taxus canadensis*). June 1–3, 2006. Photo by Michael Grimm.

such as balsam-fir (*Abies balsamea*) and (rarely) white spruce (*Picea glauca*) (Figure 3). Here the understory was not as rich as in the mesic forests, but does include the species listed in Table 3, many of which have obligate relationships with fungi.

Ephemeral pond and green ash swamp

Vernal mesic woodland ponds and associated hardwood swamps that are inundated in the spring, but that are often dry by late summer, occur in a only a few places in the Grand Traverse Islands archipelago, such as on Chambers, Summer,

FIGURE 2. Forest lane through beech (*Fagus grandifolia*)–sugar maple (*Acer saccharum*) forest in interior; note thickets of dead Canada yew (*Taxus canadensis*) in the understory. July 17, 2013. Photo by Emmet Judziewicz.

TABLE 2. Regionally common species in mesic forests on St. Martin Island. The species denoted by an asterisk (*) have not been observed more recently than 1990; those with a section sign (§) are at the northernmost or westernmost edges of their range. A question mark (?) indicates that no voucher was located.

Actaea pachypoda	*Galium triflorum*
Allium tricoccum	*Heracleum maximum*
Aralia nudicaulis	*Hydrophyllum virginianum*§
Aralia racemosa	*Lonicera canadensis*
Botrychium virginianum	*Lonicera dioica*
Carex arctata	*Lonicera hirsuta**
Carex communis	*Luzula multiflora*
Carex deweyana	*Maianthemum racemosum*
Carex laxiflora	*Milium effusum*
Carex ormostachya	*Mitella diphylla**
Carex peckii	*Osmorhiza claytonii*
Carex rosea	*Persicaria virginiana* (?)*§
Claytonia caroliniana	*Phlox divaricata subsp. laphamii**§
Conopholis americana	*Polygonatum pubescens*
Cornus rugosa	*Ribes americanum**
Corylus cornuta	*Sanguinaria canadensis**
*Cryptotaenia canadensis**§	*Solidago flexicaulis*
Cypripedium pubescens	*Trillium grandiflorum*
Epifagus virginiana	*Uvularia grandiflora**
Erigeron philadelphicus	*Viburnum acerifolium*
Erythronium americanum	*Viola affinis*
Galium aparine	*Viola pubescens*
Galium concinnum§	

FIGURE 3. Mixed conifer-hardwoods on trans-island trail. July 16, 2013. Photo by Emmet Judziewicz.

TABLE 3. Native understory species in coniferous and mixed forests on St. Martin Island. The species denoted by an asterisk (*) have not been observed more recently than 1990.

Adlumia fungosa	*Huperzia lucidula*
*Actaea rubra**	*Linnaea borealis* subsp. *longiflora*
*Calypso bulbosa**	*Maianthemum canadense*
Cardamine diphylla	*Melampyrum lineare*
Carex pedunculata	*Milium effusum*
Chimaphila umbellata subsp. *cisatlantica**	*Mitchella repens*
Clintonia borealis	*Mitella nuda*
*Coeloglossum viride**	*Orthilia secunda*
Comandra umbellata	*Petasites frigidus var. palmatus*
Corallorhiza striata	*Platanthera huronensis*
*Corallorhiza trifida**	*Polygala paucifolia*
*Cypripedium reginae**	*Pteridium aquilinium*
Dendrolycopodium obscurum	*Pyrola chlorantha*
Diervilla lonicera	*Rubus parviflorus*
Dryopteris carthusiana	*Sambucus racemosa* subsp. *pubens*
Dryopteris intermedia	*Spinulum annotinum*
Equisetum scirpoides	*Streptopus lanceolatus*
Eurybia macrophylla	*Trientalis borealis*
Gymnocarpium dryopteris	*Viburnum lentago*
Halenia deflexa	*Viola renifolia*

FIGURE 4. Ephemeral pond 0.3 km west of lighthouse; trees are green ash (*Fraxinus pennsylvanica*). July 16, 2013. Photo by Emmet Judziewicz.

FIGURE 5. Green ash (*Fraxinus pennsylvanica*) swamp 0.3 km west of lighthouse. July 16, 2013. Photo by Emmet Judziewicz.

TABLE 4. Native plant species present in the ephemeral pond and green ash swamp on St. Martin Island.

Alisma triviale	*Ilex verticillata*
Calamagrostis canadensis	*Iris versicolor*
Campanula aparinoides	*Lathyrus ochroleucus*
Carex bebbii	*Leersia oryzoides*
Carex disperma	*Lycopus uniflorus*
Carex hystricina	*Lysimachia thyrsiflora*
Carex interior	*Mentha canadensis*
Carex intumescens	*Osmunda regalis*
Carex lupulina	*Persicaria amphibia*
Carex pseudocyperus	*Pilea pumila*
Carex retrorsa	*Poa palustris*
Carex stricta	*Rubus pubescens*
Carex utriculata	*Schoenoplectus tabernaemontani*
Cinna latifolia	*Scirpus cyperinus*
Cornus amomum	*Scutellaria lateriflora*
Epilobium ciliatum	*Sium suave*
Epilobium coloratum	*Sphenopholis intermedia*
Equisetum arvense	*Thelypteris palustris* var. *pubescens*
Fraxinus nigra	*Urtica dioica* subsp. *gracilis*
Fraxinus pennsylvanica	*Viburnum lentago*
Galium brevipes	*Viburnum opulus*
Glyceria striata	

and Washington Islands (Judziewicz, 2001). There is a small (ca. 10 ha) but excellent example of this community present on St. Martin Island about 0.3 km west (inland from) the lighthouse, at 45°30′13″N, 86°45′43″W (Figures 4 and 5). It is dominated by a broken canopy of green ash (*Fraxinus pennsylvanica*) and has an understory of Canada bluejoint (*Calamagrostis canadensis*), a sedge (*Carex utriculata*), water smartweed (*Persicaria amphibia*), common spikerush (*Eleocharis palustris*), and yellow water crowfoot (*Ranunculus flabellaris*). These habitats provide important breeding sites for amphibians. Table 4 lists the plant species present in this habitat. Forty-three species are found in and around the pond and nowhere else on the island.

Great Lakes alkaline rockshore

Creviced, coastal, horizontal exposures of dolomite near lake level are best developed on the south coast of St. Martin Island between the dock and the southernmost point of the island (Figures 6 and 7); they are also present, but narrower and not as well-developed, along the southwest bay and along the eastern coast. In aggregate, this community occupies only around 5–10 ha or 1–2% of the island's area, yet it is one of the most dynamic and diverse types on the island. Fuller (1927) noted that "On the broad stony beach [presumably on the east coast south of the lighthouse, where he landed] the native primrose [*Primula mistassinica*] is abundant . . . .", and he also collected climbing fumitory, golden corydalis (*Corydalis aurea*), dwarf lake iris, and small-flowered grass-of-Parnas-

FIGURE 6. Great Lakes alkaline rockshore on south bay 1 km east of dock. July 17, 2013. Photo by Emmet Judziewicz.

sus (*Parnassia parviflora*) from the island in this area. Native species occurring in this community are listed in Table 5.

Sixty-three species are found on alkaline rockshore (Table 5) and nowhere else on the island. Rockshores are threatened by several invasives, including, in particular, gold-moss stonecrop (*Sedum acre*). Other threats are reed canary grass (*Phalaris arundinacea*), the invasive ecotype of common reed (*Phragmites australis*), Canada and European swamp thistles (*Cirsium arvense* and *C. palustre*), water-speedwell (*Veronica anagallis-aquatica*), narrow-leaved cattail (*Typha angustifolia*), and purple loosestrife (*Lythrum salicaria*).

Coastal dolomite cliffs–white cedar forest

Sheer, white, essentially dry coastal dolomite cliffs up to 25 meters high or more occur on the west coast (Figures 8 and 9). Here, white cedar is the dominant tree, although balsam fir (*Abies balsamea*) may also occur. Not only is this habitat important for rare plants such as Laurentian bladder fern (*Cystopteris laurentiana*) and hoary whitlow-grass (*Draba cana*), but it also needs to be surveyed for rare land snails. Common understory associates that grow on the lip and in rock crevices may include ebony sedge (*Carex eburnea*), buffaloberry (*Shepherdia canadensis*), slender cliffbrake (*Cryptogramma stelleri*), smooth rock-brake (*Pellaea glabella*), climbing fumitory (*Adlumia fungosa*), columbine (*Aquilegia canadensis*), harebell (*Campanula rotundifolia*), herb robert (*Geranium robertianum*), white camas (*Anticlea elegans*), and rough goldenrod (*Sol-*

FIGURE 7. Great Lakes alkaline rockshore near southern tip of island; clump of little bluestem (*Schizachyrium scoparium*) in foreground, large clump of common reed (*Phragmites australis*) in background, and Rock Island, Wisconsin on horizon. July 17, 2013. Photo by Emmet Judziewicz.

idago hispida). This community often serves as a plant refuge from herbivory, since deer have difficulty accessing this habitat. Cliff communities are threatened by common hound's-tongue (*Cynoglossum officinale*), a coarse non-native herb with burlike fruits that are abundantly dispersed on the fur of deer. Gold-moss stonecrop (*Sedum acre*) is also a troublesome weed in this habitat (Figure 10). The native species occurring in this habitat are listed in Table 6.

TABLE 5. Native species occurring on Great Lakes alkaline rockshores on St. Martin Island.

Agalinis purpurea	*Iris lacustris*
Agrostis scabra	*Juncus alpinoarticultus*
Anemone virginiana	*Juncus balticus* subsp. *littoralis*
Aquilegia canadensis	*Juncus dudleyi*
Arabis pycnocarpa	*Juncus effusus*
Bidens frondosus	*Lathyrus palustris*
Bromus ciliatus	*Lobelia kalmii*
Calamagrostis canadensis	*Lycopus americanus*
Calamagrostis stricta subsp. *inexpansa*	*Lysimachia quadriflora*
Campanula rotundifolia	*Mimulus ringens*
Carex aquatilis	*Parnassia parviflora*
Carex aurea	*Physocarpus opulifolius*
Carex crawei	*Platanthera huronensis*
Carex garberi	*Populus balsamifera*
Carex hystericina	*Populus deltoides* subsp. *monilifera*
Carex viridula	*Potentilla anserina*
Castilleja coccinea	*Primula mistassinica*
Clinopodium arkansanum	*Rudbeckia hirta* var. *pulcherrima*
Cornus sericea	*Salix spp.*
Deschampsia cespitosa	*Schizachyrium scoparium*
Dichanthelium acuminatum	*Schoenoplectus pungens*
Eleocharis acicularis	*Selaginella eclipes*
Eleocharis quinqueflora	*Shepherdia canadensis*
Elymus canadensis	*Sisyrinchium montanum*
Epilobium ciliatum	*Sphenopholis intermedia*
Equisetum variegatum	*Symphoricarpos albus*
Euthamia graminifolia	*Symphyotrichum ciliolatum*
Festuca saximontana	*Symphyotrichum pilosum* var. *pringlei*
Galium labradoricum	*Thuja occidentalis*
Gentianopsis procera	*Triglochin palustris*
Geum aleppicum	*Viola nephrophylla*
Hypericum kalmianum	

Dune and beach

A small sandy beach occurs along the shores of the south bay in the vicinity of the dock, with a very small dune (about 1.5 m high) extending up to about 20 meters inland (Figure 11). The dominant plants are scattered small trees of white cedar, and ebony sedge (*Carex eburnea*) occurs in the understory. Perhaps reports of western ragweed (*Artemisia psilostachya*), rock sandwort (*Minuartia michauxii*), and smooth aster (*Symphyotrichum laeve*) are referable to this area. Other native species present are listed in Table 7. Spotted knapweed (*Centaurea stoebe*) and Canada bluegrass (*Poa compressa*) are the biggest invasive threats in open, sandy areas.

Anthropogenic communities

Anthrogenic communities on St. Martin Island include a 0.5 ha clearing at the site of several seasonal cabins near the south bay dock (Figure 12), various mowed trails throughout the interior of the island (most all of them overarched by a forest canopy), and a 0.3 ha clearing around the lighthouse, including a 300 m long tramway leading from the lighthouse to adock (Figure 13). Although in total these disturbed areas constitute only about 1 ha or 0.2% of the island's area,

FIGURE 8. Cobble beach, southwest bay, with dolomite bluffs in distance. Sadie O'Dell of the U.S. Fish and Wildlife Service on right. July 17, 2013. Photo by Emmet Judziewicz.

FIGURE 9. Low dolomite bluff, east coast, with blooming harebell (*Campanula rotundifolia*), herb robert (*Geranium robertianum*), columbine (*Aquilegia canadensis*), and invasive gold-moss stonecrop (*Sedum acre*). July 17, 2013. Photo by Emmet Judziewicz.

FIGURE 10. Low dolomite bluff, east coast, with white cedar (*Thuja occidentalis*) and invasive gold-moss stonecrop (*Sedum acre*) on top of boulder on right. July 17, 2013. Photo by Emmet Judziewicz.

they represent concentrations of many of the 82 exotic plant species present. The most threatening weeds of these areas include *Rosa rubiginosa* (eglantine rose), *Centaurea stoebe* (spotted knapweed), *Poa compressa* (Canada bluegrass), *Poa nemoralis* (Wood bluegrass), *Cirsium palustre* (European swamp thistle), and *Cynoglossum officinale* (Common hound's-tongue)

TABLE 6. Native species occurring in dolomite cliff communities on St. Martin Island. The species denoted by an asterisk have not been observed more recently than 1990.

Adiantum pedatum	*Dryopteris marginalis*
Adlumia fungosa	*Geranium robertianum*
Anticlea elegans	*Goodyera tesselata*
Aquilegia canadensis	*Gymnocarpium dryopteris*
Arabis pycnocarpa	*Lilium philadelphicum*
Aralia nudicaulis	*Lonicera canadensis*
Campanula rotundifolia	*Pellaea glabella*
*Capnoides sempervirens**	*Physocarpus opulifolius*
Carex eburnea	*Polygonatum pubescens*
Chenopodium capitatum	*Polypodium virginianum*
Corydalis aurea	*Ribes lacustre*
Cryptogramma stelleri	*Sambucus racemosa* subsp. *pubens*
Cystopteris laurentiana	*Shepherdia canadensis*
*Cystopteris tenuis**	*Solidago hispida*
Diervilla lonicera	*Sorbus decora*
Draba arabisans	*Viola renifolia*
*Draba cana**	

FIGURE 11. South bay dunes, with slender wheatgrass (*Elymus trachycaulus*) under white birch (*Betula papyrifera*) and white cedar (*Thuja occidentalis*). July 16, 2013. Photo by Emmet Judziewicz.

TABLE 7. Additional native species present in dune and beach communities on St. Martin Island. A question mark (?) indicates species that were not relocated in 2013–14.

Agrostis scabra	*Euphorbia polygonifolia*
Ambrosia psilostachya (?)	*Hieracium kalmii*
Arabidopsis lyrata	*Hieracium scabrum*
Cakile edentula	*Maianthemum stellatum*
Campanula rotundifolia	*Minuartia michauxii* (?)
Danthonia spicata	*Oenothera oakesiana*
Elymus trachycaulus	*Symphyotrichum laeve* (?)

CHANGES IN THE FLORA

Up to and including 1990, 183 vascular plant species had been documented on St. Martin Island. Field work from 2004 through 2014 added 221 species to increase that total to 405 species Of this total, only 256 species were recorded during the period from 2004 to 2014; 64 of the species recorded between 1926 and 1990 have not been observed again after 1990. Factors that might have contributed to the loss of species include increased deer herbivory, climatic warming, shoreline degradation (e.g., *Cladophora* blooms, lower lake levels, or competition with exotic species such as *Sedum acre*), and community succession to more shaded habitats. While it is not possible, based on the data available, to determine which of these factors is most critical in the apparent loss of any given species from the island, we offer the following list of species that have not been

FIGURE 12. South bay clearing. July 16, 2013. Photo by Emmet Judziewicz.

FIGURE 13. Tramway and trail from lighthouse dock to lighthouse; habitat of common juniper (*Juniperus communis*) and bearberry (*Arctostaphylos uva-ursi*). July 16, 2013. Photo by Emmet Judziewicz.

since 1990, for which we suspect excessive deer herbivory may be possibly be a contributing factor in their disappearance:

Calypso bulbosa
Chimaphila umbellata subsp. *cisatlantica*
Coeloglossum viride
Cryptotaenia canadensis
Cypripedium reginae
Orthilia secunda
Phlox divaricata subsp. *laphamii*

Climatic warming could possibly be a contributing factor in the decline of *Calypso bulbosa, Orthilia secunda*, and *Parnassia parviflora*. Shoreline degradation might have been be an additional factor in the decline of *Parnassia parviflora*. Community succession could have been a contributing factor in the decline of *Artemisia psilostachya, Minuartia michauxii,* and *Symphyotrichum laeve.*

SPECIES NEW TO THE GRAND TRAVERSE ISLANDS AND/OR DELTA COUNTY, MICHIGAN

Several of the species observed in 2013 and 2014 are newly recorded for the Grand Traverse Islands archipelago and/or Delta County, Michigan. These are listed in Table 8.

TABLE 8. Species collected on St. Martin Island during the 2013–2014 survey that are new to the Grand Traverse Islands, to Delta County, Michigan, or to both. Presence is indicated by an X; introduced species are indicated by an asterisk (*).

Name of species	New to Grand Traverse Islands	New to Delta County
*Acer negundo**		X
*Allium schoenoprasum**	X	
*Atocion armeria**		X
*Cerastium semidecandrum**	X	
Draba arabisans		X
Euphorbia polygonifolia		X
Galium concinnum†	X	X
Hackelia virginiana	X	X
Hieracium scabrum	X	X
*Lapsana communis**	X	X
Luzula multiflora	X	X
Minuartia michauxii	X	X
*Oxalis dillenii**	X	X
*Populus alba**		X
*Portulaca oleracea**		X
Ranunculus flabellaris		X
*Silene coronaria**		X
*Stellaria media**		X
Stuckenia pectinata	X	
*Typha angustifolia**	X	X
*Veronica persica**	X	
Viola affinis	X	
Xanthium strumarium		X

†New to the Upper Peninsula of Michigan.

COMPARITIVE BIODIVERSITY OF ST. MARTIN ISLAND

As the result of the 2013–2014 field work, the vascular flora of St. Martin Island is now known as well as that of any other island in the Grand Traverse Islands archipelago. Based on the species-area curve presented for the chain by Judziewicz (2001: 116), it is apparent that St. Martin Island has a floristic diversity (factoring in island size) that is comparable to that of Detroit, Plum, and Rock Islands, and significantly greater (again, taking island size into account) than that of Chambers, Summer, and Washington Islands. Washington Island, by far the largest island in the chain, has, at 611 species, the most species of plants of any island in the chain, followed by St. Martin Island with 405 species, then Summer Island with 376 species. Although both Chambers Island, at 1050 ha, and Summer Island, at 891 ha, are considerably larger than St. Martin Island (523 ha), they have fewer plant species—Chambers Island has 358 species, and Summer Island has 376—than St. Martin Island. This difference can probably be accounted for by the greater diversity of habitats present on St. Martin Island, which has both a significant interior wetland (with 36 distinctive species) and significant alkaline rockshore habitat (with 46 distinctive species), whereas Chambers Island lacks alkaline rockshore (although it has an interior wetland) and Summer Island lacks a significant interior wetland (although it has extensive alkaline rockshore).

MICHIGAN SPECIES OF CONCERN

The Michigan Natural Features Inventory (MNFI) tracks "species of concern" (Michigan Natural Features Inventory 2016), categorizing each under "State Status" as either Endangered (E), Threatened (T), Probably Extirpated (X), or of Special Concern (SC), and, for plants on St. Martin;s Island, under "State Rank" as either Critically Imperiled (S1), Imperiled (S2), or Vulnerable (S3); if the rank is uncertain, a range is given, such as S1S2. The following species that are or were found on St. Martin Island are included on the MFNI list:

Adlumia fungosa: Special Concern; State Rank = S3; seen by all visitors since Fuller; in July, 2014, it was locally abundant and in profuse flower throughout forests on island.

Calypso bulbosa: Threatened; State Rank = S2; not seen since a 1926 collection by Fuller. He presumably found it under large white cedars, perhaps near the lighthouse; presumed extirpated.

Cystopteris laurentiana: Special Concern; State Rank = S1S2; not searched for in 2013; Fewless found it to be common in 2006 in its cliff habitat, and it was still common on the West Coast cliffs in 2014.

Draba cana: Threatened; State Rank = S1; several collections from 1989 and 1990. Not relocated in 2013–2014, but likely still possible on steep vertical

West Coast cliffs. *Draba arabisans* was present and locally common on these cliffs in 2014, but was not noted in 1989-1990.

Iris lacustris: Threatened; State Rank = S3; also Federally listed as Threatened; long known from a 1926 sight record by Albert Fuller "near the lighthouse" (Fuller, 1927) and not relocated until 2014, when three small colonies were discovered in Great Lakes alkaline rockshore habitat along the southern coast.

CHECKLIST OF VASCULAR PLANTS OF ST. MARTIN ISLAND

The checklist is arranged in alphabetical order by family, genus, and species under three main headings: Pteridophytes (ferns and fern-allies), Gymnosperms (conifers), and Angiosperms (flowering plants), except that Angiosperms are further divided into Monocots and Dicots. The nomenclature and family circumscriptions follow MICHIGAN FLORA ONLINE (2011) for Pteridophytes and Voss & Reznicek (2012) for Gymnosperms and Angiosperms, except for grasses (Poaceae), which follows Judziewicz et al. (2014).. Whenever a name in this checklist differs from the name used for the same taxon in Judziewicz (2001), the earlier name is given in square brackets. Voucher specimens (herbarium collections) are indicated by the name(s) of the collector(s) and collection numbers in italics; sight records are indicated by the name of the observer in roman letters.

A prefix of "CI-OU 89-" or " CI-OU 90-" before the collection number indicates a collection by the joint Cranbrook Institute-Oakland University Expedition of 1989 or 1990, which is deposited at BLH. The collectors for that expedition included James Wells, Paul Thompson, Kathleen Forzley, Thaddeus Grudzien, Phyllis Higman, and several other people.

Albert M. Fuller's collections were made in 1926 and are deposited at the Milwaukee Public Museum (MIL); Gary Fewless's collections were made in 2006 and are deposited at UWGB (University of Wisconsin-Green Bay); 276 collections made in 2013 and 2014 with Judziewicz as first collector are deposited in the Robert W. Freckmann Herbarium (UWSP; University of Wisconsin-Stevens Point). Information about previous and current collectors and observers of vascular plants on St. Martin Island and their collections is presented in Table 9.

The University of Michigan (MICH) herbarium was thoroughly searched by the first author in 1999 for St. Martin Island collections.

The checklist includes 24 pteridophytes, 9 conifers, 103 monocots, and 269 dicots for a total of 405 species; island size alone would predict 335 species for the island (Judziewicz, 2001: 85). The largest familes are the Asteraceae (43 species), Cyperaceae (34 species), Poaceae (33 species), and Rosaceae (20 species). *Carex*, with 27 species, is the largest genus. Eighty-seven species, or 21% of the flora, are considered to have been introduced; this is consistent with an average of 21% for the entire archipelago. Fifty-three species (13% of the flora) were noted from 2006 or earlier, but not from the 2013–2014 field work; these are denoted by the boldface phrase "Not noted in 2013–2014."

TABLE 9. Collectors and observers of vascular plants on St. Martin Island, their institutional affiliations, dates of visit to the island, collection numbers on the island, and the herbarium in which the collections are deposited. Herbarium acronyms are as follows: MIL (Milaukee Public Museum), MSC (Michigan State University), BLH (Cranbrook Institute of Science), UWGB (University of Wisconsin-Green Bay), UWSP (University of Wisconsin-Stevens Point).

Collector or observer	Institutional affiliation of the first-named collector or observer	Range of collection numbers	Date of visit	Herbarium
Albert M. Fuller	Milwaukee Public Museum	about 15 in the 1600s range	July 26, 1926	MIL
Eric Bourdo, Jr.	Ford Forestry Center	few in the 20000s range	August 9–11, 1969	MSC
James Wells, Paul Thompson, Kathleen Forzley, Phyllis Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	over 100 in approximate range of 89–025 to 89–188	July 6–11, 1989	BLH
J. Wells, P. Thompson, K. Forzley, P. Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	over 100 in approximate range of 80–311 to 80–761	July 9–12, 1990	BLH
Michael Grimm	The Nature Conservancy	sight records	June 7, 2004	
Gary Fewless, Michael Grimm	University of Wisconsin-Green Bay	13929–13995	June 1–3, 2006	UWGB
Michael Grimm	The Nature Conservancy	sight records	August 14, 2008	
Michael Grimm	The Nature Conservancy	sight records	September 11, 2008	
Michael Grimm, Sadie O'Dell	The Nature Conservancy	sight records	May 13–16, 2013	
Emmet Judziewicz, Sadie O'Dell	University of Wisconsin-Stevens Point	16032–16157	July 16–17, 2013	UWSP
Emmet Judziewicz, Gary Fewless, Michael Grimm, Kari Hagenow	University of Wisconsin-Stevens Point	16159–16236	June 21–22, 2014	UWSP
Emmet Judziewicz, Sadie O'Dell, Michael Grimm, Joanne Kline	University of Wisconsin-Stevens Point	16238–16311	August 18–20, 2014	UWSP

Frequently cited localities are indicated by the following abbreviations: "GLAR" for Great Lakes alkaline rockshore; "MT" for Main trans-insular trail from South Dock to Lighthouse; "Pond" for Vernal woodland pond centered 300 meters west of the lighthouse; and "SV" for South Village clearing and dunes.

PTERIDOPHYTES

ATHYRIACEAE (Lady Fern Family)

Athyrium filix-femina (L.) Roth var *angustum* (Willd.) G. Lawson, lady fern. *CI-OU 90-599*; Grimm (2004), Judziewicz (2014).

CYSTOPTERIDACEAE (Bladder Fern Family)

Cystopteris laurentiana (Weath.) Blasdell, Laurentian bladder fern. **SPECIAL CONCERN (MI)**. West Coast Cliffs, locally abundant; *CI-OU 89-188*; *Fewless 13942, 13946, 13947*; East Coast Cliffs, locally common; occasional, interior escarpments; Judziewicz (2014).

C. tenuis (Michx.) Desv., MacKay's brittle fern. *CI-OU 89-077* (as *C. fragilis* (L.) Bernh.). **Not noted in 2013-2014.**

Gymnocarpium dryopteris (L.) Newm., common oak fern. Uncommon in coniferous woods. Fewless, Grimm (2004); *Judziewicz & Fewless 16207*.

DENNSTAEDTIACEAE (Bracken Family)

Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desvaux) A. Heller, bracken fern. *CI-OU 90-331*. **Not noted in 2013-2014.**

DRYOPTERIDACEAE (Wood Fern Family)

Dryopteris carthusiana (Vill.) H.P Fuchs, spinulose wood fern. *Fewless 13949*.

D. intermedia (Willd.) A. Gray, intermediate wood fern. *CI-OU 90-512*.

D. marginalis (L.) A. Gray, marginal wood fern. *Fewless 13965*.

EQUISETACEAE (Horsetail Family)

Equisetum arvense L., field horsetail. *Fewless 13972*. Locally common in drying Pond bottom, *Judziewicz & O'Dell 16298*.

E. hyemale L. subsp. *affine* (Engelm.) Calder & Roy L. Taylor, common scouring rush. *CI-OU 89-129*. Fairly common, GLAR. Judziewicz (2014).

E. scirpoides Michx., dwarf scouring rush. *Fewless 13986*. Occasional in 2014 (Judziewicz).

E. variegatum Schleich., variegated scouring rush. Uncommon, alkaline rockshore, south coast, *Judziewicz & O'Dell 16137*.

LYCOPODIACEAE (Clubmoss Family)

Dendrolycopodium obscurum (L.) A. Haines, flat-branched clubmoss. *CI-OU 90-553*, *Fewless 13993*. **Not noted in 2013-2014.**

Huperzia lucidula (Michx.) R. Trevis., shining clubmoss. *CI-OU 90-587*, *Fewless 13992*. **Not noted in 2013-2014.**

Spinulum annotinum (L.) A. Haines [*Lycopodium annotinum*], bristly clubmoss. *Fewless 13952*. **Not noted in 2013-2014.**

OPHIOGLOSSACEAE (Grape-Fern Family)

Botrypus virginianus (L.) Michx., rattlesnake fern. CI-OU, Fewless, Grimm (2004, 2013), uncommon, trail margins, *Judziewicz & O'Dell 16067*.

ONOCLEACEAE (Sensitive Fern Family)

Onoclea sensibilis L., sensitive fern. *Fewless 13971*. Pond.

OSMUNDACEAE (Flowering-Fern Family)

Osmunda regalis L. var. *spectabilis* (Willd.) A. Gray, royal fern. Local, drying pond bottom, *Judziewicz & O'Dell 16293*.

POLYPODIACEAE (Polypody Family)

Polypodium virginianum L., common polypody. *CI-OU 90-500*, Fewless, Grimm (2013).

PTERIDACEAE (Maidenhair Fern Family)

Adiantum pedatum L., maidenhair fern. *CI-OU 90-318*. Uncommon, shaded mossy cliffs, Judziewicz (2014).

Cryptogramma stelleri (Gmel.) Prantl, slender cliff brake. Cliffs, *CI-OU 90-687*, *Fewless 13945*. Locally common, Judziewicz (2014).

Pellaea glabella Kuhn, smooth cliff brake. Rare, cliffs, Sec. 16, *CI-OU 90-503*. **Not noted in 2013–2014.**

SELAGINELLACEAE (Spikemoss Family)

Selaginella eclipes W.R. Buck, northern meadow spikemoss. Locally common, GLAR, *Fewless 13930*, *Judziewicz & O'Dell 16144*.

THELYPTERIDACEAE (March Fern Family)

Thelypteris palustris Schott var. *pubescens* (Lawson) Fernald, marsh fern. Locally abundant, Pond, *Fewless 13969, Judziewicz & O'Dell 16106*.

GYMNOSPERMS

CUPRESSACEAE (Cypress family)

Juniperus communis L. var. *depressa* Pursh, common juniper. *CI-OU 89-116*, Judziewicz & O'Dell (2013) near lighthouse dock and along tramway; occasional, GLAR.

J. horizontalis Moench, creeping juniper. *CI-OU 89-112*. **Not noted in 2013–2014.**

Thuja occidentalis L., northern white cedar. Common, CI-OU, Fewless, Grimm, Judziewicz & O'Dell (2014).

PINACEAE (Pine Family)

Abies balsamea (L.) Mill., balsam fir. Fairly common, *CI-OU 89-071*, Fewless, Grimm, Judziewicz & O'Dell (2014).

Picea glauca (Moench) Voss, white spruce. Fewless, Grimm (2008).

Pinus resinosa Aiton, red pine. Rare tree; in 2014, seen along MT near cemetery (Judziewicz) and in blowdown near southern end of island (Grimm).

Pinus strobus L., white pine. *CI-OU 90-330;* Judziewicz & O'Dell, near lighthouse (2013).

Tsuga canadensis (L.) Carrière, hemlock. A single 12" dbh tree along MT near cemetery, *Judziewicz & O'Dell 16228.*

TAXACEAE (Yew Family)

Taxus canadensis Marshall, Canada yew. Fuller (1927) reported it as very abundant in 1926; still locally abundant in 1989, *CI-OU 89-037*, Grimm (2004), Fewless (2006); apparently scarce by 2009, and almost absent in 2014 (Grimm, Judziewicz), with just a few healthy individuals observed on steep, shaded cliffs.

ANGIOSPERMS

MONOCOTS

ALISMATACEAE (Water-Plantain Family)

Alisma triviale Pursh, northern water-plantain. Occasional, Pond, *Judziewicz & O'Dell 16109.*

ALLIACEAE (Onion Family)

**Allium schoenoprasum* L., chives. Recorded by Fuller in 1926 near the lighthouse; also noted by CI-OU in 1989-1990. Persisting at lighthouse (*Judziewicz & O'Dell 16085*) in 2013, where abundant only a couple of meters from buildings and almost certainly a relict of cultivation.

A. tricoccum Aiton, wild leek. Mesic forests, *CI-OU 90-595*, Grimm (2004, 2013).

CONVALLARIACEAE (Lily-of-the-Valley Family)

Clintonia borealis (Aiton) Raf., bluebead, corn-lily. Upland mixed forest, *CI-OU 89-075*, Grimm (2004). **Not noted in 2013–2014.**

Maianthemum canadense Desf., Canada mayflower. Upland mesic to mixed forest, occasional, *CI-OU 90-514b*, Fewless, Grimm (2004, 2013), Judziewicz & O'Dell (2013).

M. racemosum (L.) Link [*Smilacina racemosa*], false Solomon's-seal. *CI-OU 89-121*. Rare in 2014.

M. stellatum (L.) Link [*Smilacina stellata*], starry false Solomon's-seal. *CI-OU 90-025*. Uncommon.

Polygonatum pubescens (Willd.) Pursh, Solomon's-seal. Upland mesic forest, *CI-OU 90-072*, Fewless, Grimm (2004, 2013). Uncommon, restricted to shaded cliffs.

Streptopus lanceolatus (Aiton) Reveal [*Streptopus roseus*], rosy twisted-stalk. Upland mesic forest, *CI-OU 89-067*, *Fewless 13955*; Grimm (2004, 2013). Rare.

Uvularia grandiflora Sm., great-flowered bellwort. Mesic forest, Grimm (2013). **Not noted in 2013–2014.**

CYPERACEAE (Sedge Family)

Carex aquatilis Wahlenb., water sedge. GLAR, *Fewless 13966*; Judziewicz & O'Dell (2013).

C. arctata Boott, drooping woodland sedge. *CI-OU 90-529*, near cemetery; *Fewless 13959*, Grimm (2013), *Judziewicz & O'Dell 16250.*

C. aurea Nutt., golden sedge. Occasional, GLAR, *CI-OU 90-523*, *Fewless 13929;* fire pit margin, south bay, *Judziewicz & O'Dell 16158*.

C. bebbii (L.H. Bailey) Fernald, Bebb's sedge. *CI-OU 90-311*; common, Pond, GLAR, *Judziewicz & O'Dell 16090, 16100, 16114, 16266, 16290*.

C. communis L.H. Bailey, fibrous-root sedge. *CI-OU 90-526*), *Fewless 13962,* Uncommon, mesic forest, Judziewicz & O'Dell, *Judziewicz & Fewless 16200*.

C. concinna R.Br., beautiful sedge. Fewless (2006); in white cedar glade south of Pond. **Not noted in 2013–2014.**

C. crawei Dewey, Crawe's sedge. GLAR, occasional. *Fewless 13932, Judziewicz & O'Dell 16150.*

C. deflexa Hornem. Rare, MT. *Judziewicz & Fewless 16173.*

C. deweyana Schwein., Dewey's sedge. *CI-OU 90-761*, *Fewless 13958*; abundant, trails and clearings, *Judziewicz & O'Dell 16042.*

C. disperma Dewey, two-seeded bog sedge. Uncommon, west side of Pond. *Judziewicz & O'Dell 16103*.

C. eburnea Boott, ebony sedge. Common on cliffs and dunes under white cedar; *CI-OU 89-051*, Grimm (2013), *Fewless 13981*, Judziewicz & O'Dell (2013).

C. garberi Fernald, elk sedge. GLAR, uncommon; *Fewless 13931, Judziewicz & O'Dell 16149*, *Judziewicz & Fewless 16229.*

C. hystericina Willd., bottlebrush sedge. GLAR, common; CI-OU (1990), Grimm (2008); *Judziewicz & O'Dell 16051, 16129, 16297*.

C. interior L.H. Bailey. Boggy margin of pond, *Judziewicz & Fewless 16221*.

C. intumescens Rudge. Margin of pond, *Judziewicz & Fewless 16215*.

C. laxiflora Lam., beech woods sedge. Fairly common, upland mesic forests, *CI-OU 89-045*, *Judziewicz & O'Dell 16078, Judziewicz & Fewless 16198, 16200a*.

C. lupulina Willd., hop sedge. *CI-OU 90-321.* **Not noted in 2013–2014.**

C. ormostachya Wiegand Mesic woods, MT, uncommon. *Judziewicz & Fewless 16172*.

C. peckii Howe, Peck's sedge. *Fewless 13950, 13961*; uncommon, upland mixed forests, *Judziewicz & O'Dell 16120*.

C. pedunculata Willd., long-stalked sedge. *Fewless 13980*. **Not noted in 2013–2014.**

C. pseudo-cyperus L. Edge of Pond, *Judziewicz & Fewless 16223*.

C. retrorsa Schwein., retrorse sedge. *CI-OU 90-302*; common, Pond, *Judziewicz & O'Dell 16099, 16107, 16265.*

C. rosea Willd., star sedge. *CI-OU 90-593* (as *C. convoluta* Mack.); occasional, mesic forests and trail margins, Judziewicz & O'Dell, *Judziewicz & Fewless 16161, 16201*.

C. stricta Lam., tussock sedge. Locally common, Pond, *Judziewicz & O'Dell 16146.*

C. tetanica Schkuhr, sedge. GLAR, *Fewless 13960*. **New to the Grand Traverse Islands.**

C. utriculata Boott, bladder sedge. Abundant and dominant in Pond, *Fewless 13982, Judziewicz & O'Dell 16271.*

C. viridula Michx., little green sedge. Common, alkaline rockshore, *Fewless 13939, Judziewicz & O'Dell 16154.*

Eleocharis acicularis (L.) Roem. & Schult., needle spikerush. Rare, GLAR, south coast, Judziewicz & O'Dell (2013).

E. palustris (L.) Roem. & Schult., common spikerush. Locally common, Pond, *CI-OU 90-306*, *Judziewicz & O'Dell 16108, 16269a*.

E. quinqueflora (Hartmann) O. Schwarz, few-flowered spikerush. Rare, GLAR, *Fewless 13937*. **Not noted in 2013–2014.**

E. rostellata (Torr.) Torr., beaked spikerush. Cited by Forzley et al. (1993), but no voucher specimen located at either BLH or MICH in 1999, and not otherwise recorded from the Grand Traverse Islands. **Not noted in 2013–2014.**

Schoenoplectus pungens (Vahl) Palla, three-square bulrush. Uncommon, alkaline rockshore, south coast, *Judziewicz & O'Dell 16142*.

S. tabernaemontani (C.C. Gmel.) Palla, soft-stem bulrush. Uncommon, Pond, *Judziewicz & O'Dell 16268*.

Scirpus cyperinus (L.) Kunth, wool-grass. Uncommon, Pond, *Judziewicz & O'Dell 16267*.

IRIDACEAE (Iris Family)

Iris lacustris Nutt., dwarf lake iris. Fig. 49. **THREATENED (MI). FEDERALLY LISTED.** Reported from near the lighthouse on the northeast coast by Fuller (1927), but apparently not supported by a voucher and not noted there since. In 2014, three small colonies found on GLAR on south coast, Judziewicz.

I. versicolor L., northern blue flag. Abundant, Pond, Fewless, Judziewicz & O'Dell.

Sisyrinchium montanum Greene, mountain blue-eyed grass. Uncommon, GLAR; trails; *Fewless 13933, Judziewicz & O'Dell 16136*.

JUNCACEAE (Rush Family)

Juncus alpinoarticulatus Chaix subsp. *nodulosus* (Wahlenb.) Hamet-Ahti, northern green rush. Fairly common, GLAR, *Fewless 13934; Judziewicz & O'Dell 16125, 16285*.

J. balticus Willd. subsp. *littoralis* (Engelm.) Snogerup [*Juncus arcticus* subsp. *littoralis*], baltic rush. Abundant, dominant, GLAR; *CI-OU 90-590*, Fewless, Grimm (2008, 2013), Judziewicz & O'Dell.

J. dudleyi Wiegand, Dudley's rush. Fairly common, wet alkaline rockshores, Fewless, Judziewicz & O'Dell (2013).

J. effusus L., common rush. Occasional, GLAR, Grimm (2013).

J. tenuis Willd., path rush. Rare; *Judziewicz & O'Dell 16120a, 16257*.

Luzula multiflora (Erhr.) Lej., wood rush. Grimm (2013). **New to the Grand Traverse Islands.**

JUNCAGINACEAE (Arrow-Grass Family)

Triglochin palustris L., marsh bog-arrow grass. Local, shallow pool on alkaline rockshore, south coast; Grimm (2008), *Judziewicz & O'Dell 16141*, *Kline s.n.*, 2014.

LILIACEAE (Lily Family)

Erythronium americanum Ker Gawl, yellow trout-lily. Mesic forest, Grimm (2004, 2013).

Lilium philadelphicum L., wood lily. *CI-OU 89-022;* Rare; in cliff crevice, east coast, one plant in flower, Judziewicz & O'Dell (2013); also cedar glade between tramway and lake, Judziewicz (2014).

MELANTHIACEAE (Bunchflower Family)

Anticlea elegans (Pursh.) Rydb. [*Zigadenus glaucus*], white camas. Under white cedar at the margin of a dolomite cliff, west coast, *Judziewicz & Fewless 16175, 16252*; edge of GLAR on south coast, Grimm (2014).

ORCHIDACEAE (Orchid Family)

Calypso bulbosa (L.) Oakes, calypso orchid. **THREATENED (MI).** There is a 1926 Fuller record; the species has not been seen since then. **Not noted in 2013–2014.**

Coeloglossum viride (L.) Hartm., long-bracted green orchid. Old village site, *CI-OU 90-543*. **Not noted in 2013–2014.**

Corallorhiza striata Lindl., striped coralroot. Fewless. Uncommon in 2014; *Judziewicz & Fewless 16178*.

C. trifida Châtel., early coralroot. *CI-OU 90-554*. **Not noted in 2013–2014.**

Cypripedium parviflorum Salisb. var. *makasin* (Farw.) Sheviak [*Cypripedium parviflorum*], small yellow lady's-slipper. Six flowering plants in cobbles under white cedar near lighthouse tramway (2014).

C. parviflorum Salisb. var. *parviflorum* [*Cypripedium pubescens*], large yellow lady's-slipper. Near pond west of lighthouse, *CI-OU 90-328*, Grimm (2004). **Not noted in 2013–2014.**

C. reginae Walter, showy lady's-slipper. *CI-OU 89-049*. **Not noted in 2013–2014.**

**Epipactis helleborine* (L.) Crantz, helleborine orchid. Widespread (but not yet common) weed throughout in mesic woods, not noted prior to 2013; *Judziewicz & O'Dell 16071, 16303*.

Goodyera tesselata Lodd., checkered rattlesnake-plantain. Near cliff faces, *CI-OU-90-514*. **Not noted in 2013–2014.**

Platanthera huronensis (Nutt.) Lindl. [*Platanthera hyperborea*], tall northern green orchid. Four collections, *CI-OU 89-117*; Grimm (2004); one seen near South Dock, Judziewicz (2014).

POACEAE (Grass Family)

**Agrostis gigantea* Roth, redtop. Occasional, lanes and clearings, *Judziewicz & O'Dell 16077*.

A. scabra Willd. [*Agrostis hyemalis*] Occasional, GLAR, *Judziewicz & O'Dell 16130*.

**Alopecurus aequalis* Sobol., short-awned foxtail. Fairly common, Pond, *CI-OU 90-307, Judziewicz & O'Dell 16269*.

Bromus ciliatus L., fringed brome. Old village site, *CI-OU 90-522*; GLAR, southwest point, *Judziewicz & O'Dell 16112*.

Calamagrostis canadensis (Michx.) P. Beauv., Canada bluejoint. Fairly common, Pond; occasional, GLAR, *Judziewicz & O'Dell 16102*.

C. stricta (Timm) Koeler subsp. *inexpansa* (A. Gray) C.W Greene, slim-stemmed reed grass. Uncommon, GLAR, *Judziewicz & O'Dell 16132, 16240*.

Cinna latifolia (Goepp.) Griseb., drooping wood-reed. Rare near Pond, *Judziewicz & O'Dell 16305*.

**Dactylis glomerata* L., orchard grass. Common weed, SV, *Judziewicz & O'Dell 16065*.

Danthonia spicata (L.) Roem. & Schult., poverty oat grass. Occasional, SV, *Judziewicz & O'Dell 16037*.

Deschampsia cespitosa (L.) P. Beauv., tufted hair grass. Locally common, GLAR, south and east coasts, *Judziewicz & O'Dell 16133*.

Dichanthelium acuminatum (Sw.) Gould & C.A. Clark [*Panicum acuminatum*], western panic grass. Abundant, GLAR, Grimm (2008); *Judziewicz & O'Dell 16052, 16138*.

Elymus canadensis L., Canada wild rye. Locally common, GLAR margin near south point, *Judziewicz & O'Dell 16244*.

**E. repens* (L.) Gould [*Elytrigia repens*], quackgrass. Weed, lighthouse, SV, *Judziewicz & Fewless 16212*.

E. trachycaulus (Link) Shinners, slender wheat grass. Locally common, SV dunes, also rockshores; *CI-OU 90-326*, *Judziewicz & O'Dell 16117*.

Festuca saximontana Rydb., Rocky Mountain fescue. Locally common, GLAR near south point, *Judziewicz & O'Dell 16135, 16239*.

F. subverticillata (Pers.) E.B. Alexeev, nodding fescue. Uncommon, mesic woods near Pond, *Judziewicz & Fewless 16218*.

**F. trachyphylla* (Hack.) Krajina, hard fescue. Weed around lighthouse, *Judziewicz & Fewless 16211*.

Glyceria striata (Lam.) Hitchc., fowl manna grass, Pond, SV, *Judziewicz & Fewless 16193*.

Leersia oryzoides (L.) Sw., rice cut-grass. Uncommon, Pond, *Judziewicz & O'Dell 16294*.

**Lolium pratense* (Huds.) Darbysh., meadow fescue. Lanes and clearings, *CI-OU, 90-576*, Judziewicz & O'Dell (2013).

Milium effusum L., wood millet. Probably in mesic forests, *CI-OU 90-547*. Along trail through mixed forest 0.5 km west of SV (2014).

Oryzopsis asperifolia Michx., rough-leaved rice grass. *Fewless 13985*. **Not noted in 2013–2014.**

**Panicum capillare* L., witch grass. *Fuller 1627*; South Dock, *Judziewicz & O'Dell 16284*.

**Phalaris arundinacea* L., reed canary grass. Occasional, Pond, GLAR, *Judziewicz & O'Dell 16061*.

**Phleum pratense* L., timothy. Occasional, lanes and clearings, *CI-OU 89-032*, Judziewicz & O'Dell.

Phragmites australis (Cav.) Steud., giant reed. Occasional, GLAR, Grimm (2008; "native"); *Judziewicz & O'Dell 16153*.

**Poa annua* L., annual bluegrass. Common, lanes, *CI-OU 90-572*, *Judziewicz & O'Dell 16046, 16119*; *Judziewicz & Fewless 16188*.

**P. compressa* L., Canada bluegrass. Common, SV, GLAR, *CI-OU 90-501*, *Fewless 13940*, *Judziewicz & O'Dell 16254a*.

**P. nemoralis* L., wood bluegrass. Abundant, lanes, widely spreading into forests, *CI-OU 90-511* (as *P. glauca* Vahl), *Fewless 13944; Judziewicz & O'Dell 16043*.

P. palustris L., fowl meadow grass. Occasional, Pond, GLAR, *CI-OU 89-098*, Judziewicz & O'Dell (2013).

**P. pratensis* L., Kentucky bluegrass. Locally common, clearings, *CI-OU 89-100, Fewless 13963; Judziewicz & O'Dell 16039*.

Schizachyrium scoparium (Michx.) Nash, little bluestem. Locally common, GLAR on south and east coasts, *Judziewicz & O'Dell 16131*. Otherwise known in the Grand Traverse Islands only on Chambers Island and at Jackson Harbor, Washington Island.

Sphenopholis intermedia (Rydb.) Rydb., slender wedge grass. Common, GLAR; *Judziewicz & O'Dell 16050*.

POTAMOGETONACEAE (Pondweed Family)

Stuckenia pectinata (L.) Börner, sago pondweed. Rhizomatous bed in 1 meter deep water of Lake Michigan sheltered by South Dock, *J. Kline s.n.*, 2014, as *Judziewicz & O'Dell 16308*.

TRILLIACEAE (Trillium Family)

Trillium grandiflorum (Michx.) Salisb., great-flowered trillium. Uncommon, forests, *CI-OU 89-057*, Fewless, Grimm (2004, 2014).

TYPHACEAE (Cat-Tail Family)

Typha angustifolia L., narrow-leaved cat-tail. Uncommon, GLAR, and just east of South Dock, *Judziewicz & O'Dell 16301*. A Delta County record.

DICOTS

ADOXACEAE (Moschatel Family)

Sambucus racemosa L. subsp. *pubens* (Michx.) House, red-berried elder. Fairly common, forests and cliffs, *CI-OU 90-208*), Fewless, Judziewicz & O'Dell (2013).

Viburnum acerifolium L., maple-leaved viburnum. Grimm (2004). **Not noted in 2013–2014.**

V. lentago L., nannyberry. *Fewless 13974*. Large fruiting plants on west side of Pond, Judziewicz (2014).

**V. opulus* L., highbush-cranberry. *CI-OU 90-003, Fewless 13975*. Large fruiting plants on west side of Pond, Judziewicz (2014).

AMARANTHACEAE (Amaranth Family)

**Chenopodium album* L., lamb's-quarters. Occasional weed, SV; Judziewicz & O'Dell (2013).

C. capitatum (L.) Ambrosi, strawberry blite. One fruiting plant on margin of East Coast Cliff, under white cedar, *Judziewicz & O'Dell 16304*.

**C. simplex* (Torr.) Raf., maple-leaved goosefoot. Rare weed in mesic woods, *Judziewicz & Fewless 16217*.

ANACARDIACEAE (Cashew or Sumac Family)

Rhus typhina L. [*Rhus hirta*], staghorn sumac. *CI-OU 89-010*. **Not noted in 2013–2014.**

Toxicodendron rydbergii (Rydb.) Greene., western poison-ivy. CI-OU. *Judziewicz & Fewless 16219*. A small patch under cedars near Pond, Judziewicz (2014).

APIACEAE (Carrot Family)

Cryptotaenia canadensis (L.) DC., honewort. Rare, presumably from mesic upland forests, *CI-OU 89-043*. **Not noted in 2013-2014.**

**Daucus carota* L., Queen Anne's-lace, wild carrot. Rare weed in clearing, *Judziewicz & O'Dell 16056.*

Heracleum maximum Bartram [*Heracleum lanatum*], cow-parsnip. Grimm (2004). Occasional, woods, *Judziewicz & Fewless 16190*.

Osmorhiza claytonii (Michx.) C.B. Clarke, hairy sweet-cicely. Occasional, forests, *CI-OU 89-061,* Fewless, Grimm (2004, 2013).

Pastinaca sativa* L., wild parsnip. *CI-OU 89-046*. **Not noted in 2013–2014.

Sium suave Walter, water-parsnip. *CI-OU 90-310*, *Fewless 13970*. Common in Pond, Judziewicz (2014).

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium L., spreading dogbane. Grimm (2004). *Judziewicz & Fewless 16208*.

Asclepias incarnata L., swamp milkweed. Uncommon, alkaline rockshore, southwest bay, *Judziewicz & O'Dell 16115*.

A. syriaca L., common milkweed. *CI-OU 90-573*, Common, clearings, alkaline rockshore, Grimm (2008), Judziewicz & O'Dell (2013).

AQUIFOLIACEAE (Holly Family)

Ilex verticillata (L.) A. Gray, winterberry holly. Local, Pond, *Judziewicz & O'Dell 16110*.

ARALIACEAE (Ginseng Family)

Aralia nudicaulis L., wild sarsaparilla. *CI-OU 89-058*, Grimm (2004). Uncommon, shady mossy cliffs under cedars, Judziewicz (2014).

A. racemosa L., spikenard. *CI-OU 90-314*, Grimm (2004). **Not noted in 2013-2014.**

ASTERACEAE (Aster Family)

Achillea millefolium L., yarrow. Common, SV, CI-OU, *Judziewicz & O'Dell 16049*.

**Ambrosia artemisiifolia* L., common ragweed. Occasional weed, SV, *Judziewicz & Fewless 16224*.

A. psilostachya* DC. western ragweed. Perhaps on dunes at south bay; *CI-OU 89-028*. **Not noted in 2013–2014.

Anaphalis margaritacea (L.) Benth., pearly everlasting. Rare along MT, *Judziewicz & Fewless 16167*.

Antennaria howellii Greene, pussytoes. Rare along MT, *Judziewicz & Fewless 16163*.

**Arctium minus* Bernh., common burdock. Weed, SV, CI-OU, *Judziewicz & O'Dell 16054*; also at dump site near Pond.

Bidens frondosa L. [*Bidens frondosus*], common beggar-ticks. Occasional, alkaline rockshore, south coast, *Judziewicz & O'Dell 16116, 16276*.

**Centaurea stoebe* L. [*Centaurea biebersteinii*], spotted knapweed. Locally common, lighthouse dock, uncommon, SV, *Judziewicz & O'Dell 16082*.

**Cirsium arvense* (L.) Scop., Canada thistle. Common weed, GLAR, Grimm (2008, 2013), Judziewicz & O'Dell (2013).

**C. palustre* (L.) Scop., European swamp thistle. Common weed, lanes and clearings, *Judziewicz & O'Dell 16040*.

**C. vulgare* (Savi) Ten., bull thistle. Occasional weed, GLAR, Grimm (2008), Judziewicz & O'Dell (2013).

Conyza canadensis (L.) Cronquist, horseweed. Fairly common, lanes and clearings, *Judziewicz & O'Dell 16057*.

Doellingeria umbellata (Mill.) Nees [*Aster umbellatus*], flat-topped aster. Rare, upland woods near Pond, *Judziewicz & O'Dell 16104*.

Erechtites hieraciifolius (L.) DC. [*Erechtites hieracifolia*], burnweed. Uncommon, dump/burned area near Pond, *Judziewicz & O'Dell 16093*.

Erigeron annuus (L.) Pers., annual fleabane. Uncommon, lanes, *CI-OU 90-583*, Judziewicz & O'Dell (2013).

E. philadelphicus L., marsh fleabane. CI-OU. Occasional, SV and elsewhere, *Judziewicz & Fewless 16159*.

E. strigosus Willd., daisy fleabane. Occasional, GLAR, CI-OU, Judziewicz & O'Dell (2013).

Eupatorium perfoliatum L., boneset. Rare, GLAR, West Bay, *Judziewicz & O'Dell 16279.*

Eurybia macrophylla (L.) Cass. [*Aster macrophyllus*], big-leaved aster. Upland forest, *CI-OU 90-530*, Grimm (2004, 2013).

Euthamia graminifolia (L.) Nutt., grass-leaved goldenrod. Occasional, GLAR, Grimm (2008); *Judziewicz & O'Dell 16148*.

**Hieracium aurantiacum* L., orange hawkweed. Occasional, lanes and clearings, CI-OU, Judziewicz & O'Dell. *Judziewicz & Fewless 16227*.

H. kalmii L., rough hawkweed. SV dunes, Judziewicz sight record, 2014.

**H. pilosellodes* Vill., glaucous king-devil. Common, lanes and clearings, CI-OU, *Judziewicz & O'Dell 16036*.

H. scabrum Michx., rough hawkweed. SV dunes, *Judziewicz & Fewless 16197, 16292*. A Delta County record.

Lactuca canadensis L., Canada lettuce. Occasional, lanes and GLAR, *Judziewicz & O'Dell 16113, 16241*.

**Lapsana communis* L., nipplewort. Locally common weed in cut across southwest point; South Dock; MT near Lighthouse, *Judziewicz & Fewless 16231, 16277*. A Delta County record.

**Leucanthemum vulgare* Lam., ox-eye daisy. Common weed. CI-OU, Grimm (2004), Judziewicz & O'Dell. *Judziewicz & Fewless 16183*.

**Matricaria discoidea* DC., pineapple-weed. Weed at South Dock, *Judziewicz & O'Dell 16278*.

Petasites frigidus (L.) Fries var. *palmatus* (Aiton) Cronquist, northern sweet colt's-foot. *Fewless 13967*. Forests; rare in 2014 (Grimm).

Prenanthes alba L., rattlesnake-root. Uncommon, lanes and forest margins, Grimm (2004, 2013), *Judziewicz & O'Dell 16032*.

Rudbeckia hirta L. var. *pulcherrima* Farw., black-eyed susan. Fairly common, alkaline rock-shores, *CI-OU 89-036*, Grimm, Judziewicz & O'Dell (2013).

Solidago canadensis L., Canada goldenrod. *CI-OU 89-083*. **Not noted in 2013–2014.**

S. flexicaulis L., zigzag goldenrod. *CI-OU 89-083*, Grimm (2004). Rare in 2014 (Grimm).

S. hispida Willd., hairy goldenrod. Local, SV dunes, cliffs, *CI-OU 90-322*, *Judziewicz & O'Dell 16126, 16306*.

**Sonchus arvensis* L., common sow-thistle. Rare weed, GLAR at West Bay, *Judziewicz & O'Dell 16286*.

Symphyotrichum ciliolatum (Lindl.) Á. Löve & D. Löve [*Aster ciliolatus*], Lindley's aster. *CI-OU 90-566;* Occasional, SV, GLAR, *Judziewicz & O'Dell 16260*.

S. laeve (L.) Á. Löve & D. Löve [*Aster laevis*], smooth aster. CI-OU, not noted by later observers, and not common in the Grand Traverse Islands, where known only from Chambers Island and Jackson Harbor Ridges, Washington Island; presumably from GLAR. **Not noted in 2013–2014.**

S. lanceolatum (Willd.) G.L. Nesom [*Aster lanceolatus*], panicled aster. Uncommon, GLAR, Pond, *Judziewicz & O'Dell 16299*.

S. pilosum (Willd.) G.L. Nesom var. *pringlei* (A. Gray) G.L. Nesom [*Aster pilosus* var. *pringlei*], Pringle's frost aster. Common, GLAR, Grimm (2008), *Judziewicz & O'Dell 16145, 16242*.

Tanacetum vulgare* L., common tansy. *CI-OU 90-542*. **Not noted in 2013–2014.

**Taraxacum officinale* F.H. Wigg., common dandelion. Occasional weed, Grimm (2004, 2013), Judziewicz & O'Dell (2014).

**Tragopogon dubius* Scop., goat's-beard. CI-OU, Judziewicz & O'Dell. *Judziewicz & Fewless 16210*.

**Xanthium strumarium* L., cocklebur. One plant in wet sand at South Dock. *Judziewicz & O'Dell 16274*. County record.

BALSAMINACEAE (Jewelweed Family)

Impatiens capensis Meerb., orange jewelweed or touch-me-not. Occasional, cobble shorelines, *Judziewicz & O'Dell 16288*.

BETULACEAE (Birch Family)

Betula alleghaniensis Britton, yellow birch. Common, mesic forests; *Fuller 1632*, Fewless, Grimm (2013), Judziewicz & O'Dell (2013).

B. papyrifera Marshall, white or paper birch. Locally common, mesic forests; Fewless, Grimm, Judziewicz & O'Dell (2014).

Corylus cornuta Marshall, beaked hazelnut. Fairly common shrub, upland forests, *CI-OU 90-524, Judziewicz & O'Dell 16118.*

Ostrya virginiana (Mill.) K. Koch, eastern hop-hornbeam. Common, mesic forests in interior, *CI-OU 89-120*, *Judziewicz & O'Dell 16073.*

BORAGINACEAE (Borage Family)

**Cynoglossum officinale* L., common hound's-tongue. Fairly common weed, lanes and mesic forest interiors; Grimm (2013), *Judziewicz & O'Dell 16067.*

Hackelia virginiana (L.) I.M. Johnst., stickseed. Common, lanes and mesic forest interiors, *Judziewicz & O'Dell 16033; Judziewicz & Fewless 16171.* **New to the Grand Traverse Islands.**

Hydrophyllum virginianum L., Virginia waterleaf. *Fewless 13994*. Also found on nearby Rock Island, but nowhere else in the archipelago. **Not noted in 2013–2014.**

**Lithospermum officinale* L., gromwell. Locally common in clearing cut across southwest tip of island, *Judziewicz & Fewless 16230.*

**Myosotis arvensis* (L.) Hill, forget-me-not. Locally common along southern trans-island trail in 2014 (*Judziewicz & Fewless 16166*); not noted there in 2013.

BRASSICACEAE (Mustard Family)

Arabidopsis lyrata (L.) O'Kane & Al-Shehbaz [*Arabis lyrata*], sand cress. Locally common, dunes and clearing, south bay, lighthouse dock, *CI-OU 89-115*, *Fewless 13953*.

Arabis pycnocarpa M. Hopkins [*A. hirsuta*], hairy rock-cress. Local, lighthouse dock area, cliffs, CI-OU, Fewless, *Judziewicz & O'Dell 16081.*

Boechera grahamii (Lehmann) Windham & Al-Shehbaz [*Arabis divaricarpa*] spreading-pod rock-cress. *CI-OU 89-026*. *Judziewicz & Fewless 16206*, in gravelly soil near lighthouse dock.

B. stricta (Graham) Al-Shehbaz [*Arabis drummondii*] Drummond's rock-cress. Cited by Forzley et al. (1993), but no voucher specimen located at either BLH or MICH in 1999; and otherwise not known from the Grand Traverse Islands. *Judziewicz & Fewless 16233,* on cobble shoreline.

Cakile edentula (Bigelow) Hook., American sea-rocket. Uncommon, shores, West Bay and in sand at South Dock, *Judziewicz & O'Dell 16282.*

**Capsella bursa-pastoris* (L.) Medik., shepherd's-purse. Uncommon weed, *Judziewicz & O'Dell 16074.*

Cardamine diphylla (Michx.) Alph. Wood, broad-leaved toothwort. Mesic forest, Grimm (2004, 2013). *Judziewicz & Fewless 16187.*

C. pensylvanica Willd., bitter-cress. Uncommon along forest trails, *Judziewicz & Fewless 16189.*

**Descurainia pinnata* (Walter) Britton subsp. *brachycarpa* (Richardson) Detling, green tansy mustard. Weed at lighthouse, *CI-OU 89-009*, *Judziewicz & O'Dell 16086, 16259.*

Draba arabisans Michx., rock whitlow-grass. Locally common under cedar at edge of sheer dolomite cliffs on west coast, *Judziewicz & Fewless 16176, 16253*. A Delta County record.

D. cana Rydb., hoary whitlow-grass. **THREATENED (MI).** Cliffs on the west coast: *CI-OU 89-103, 90-502*. Observed by James Wells on 7 July 1990, "Steep cliffs, pockets among rock faces supporting few species . . . about 10 clones, sterile . . . with *Pellaea glabella*, *Poa compressa*, *Maianthemum canadensis*, *Quercus rubra*, *Thuja occidentalis*, *Prunus virginiana*, *Lonicera dioica*, *Polypodium vulgare*." **Not noted in 2013–2014 (but vertical cliff faces not searched).**

**Erysimum cheiranthoides* L., wormseed mustard. Weed, lighthouse, *CI-OU 90-570, Judziewicz & O'Dell 16270.*

**Lepidium campestre* (L.) W.T. Aiton, pepper-grass. Weed at lighthouse, *Judziewicz & O'Dell 16214.*

**L. densiflorum* Schrad., pepper-grass. Occasional weed, *Judziewicz & O'Dell 16055.*

Rorippa palustris (L.) Besser, yellow cress. Rare in wet sand near South Dock, *Judziewicz & O'Dell 16275.*

CAMPANULACEAE (Bellflower Family)

Campanula aparinoides Pursh, marsh bellflower. Uncommon, Pond, *Judziewicz & O'Dell 16291.*

C. rotundifolia L., harebell. Fairly common, cliffs, dunes, and rockshores, *CI-OU 89-099*, Judziewicz & O'Dell (2013).

Lobelia kalmii L., brook lobelia. Common, GLAR, Grimm (2008), *Judziewicz & O'Dell 16151.*

CAPRIFOLIACEAE (Honeysuckle Family)

Lonicera canadensis Marshall, Canada fly honeysuckle. *CI-OU 89-004*, Grimm (2004). Seen on East Coast Cliffs, Judziewicz (2014).

L. dioica L., red honeysuckle. *CI-OU 89-081*. Occasional, Judziewicz (2014).

L. hirsuta Eaton, hairy honeysuckle. *CI-OU 89-139*. On MT near lighthouse, Judziewicz (2014).

Symphoricarpos albus (L.) S.F. Blake, snowberry. Local, GLAR, Grimm (2014).

CARYOPHYLLACEAE (Pink Family)

**Arenaria serpyllifolia* L., thyme-leaved sandwort. Occasional, lanes. *CI-OU 90-515*), *Judziewicz & O'Dell 16035, 16044.*

**Atocion armeria* (L.) Raf. [*Silene armeria*], sweet-william catchfly. Rare weed on MT in interior of island, *Judziewicz & O'Dell 16256.* A Delta County record.

**Cerastium fontanum* Baumg. subsp. *vulgare* (Hartm.) Greuter & Burdet, mouse-ear chickweed. Fairly common weed; *CI-OU 89-064*, *Fewless 13935, Judziewicz & O'Dell 16034.*

C. semidecandrum* L., chickweed. *Fewless 13991*. **New to the Grand Traverse Islands. Not noted in 2013–2014.

Minuartia michauxii (Fenzl) Farwell [*Arenaria stricta* subsp. *dawsonensis*], rock sandwort. Presumably from dunes on south bay, *Fewless 13943.* A Delta County record. **Not noted in 2013–2014.**

**Silene antirrhina* L., sleepy-catchfly. Rare weed. *Judziewicz & O'Dell 16053.*

S. coronaria* (L.) Clairv. [*Lychnis coronaria*], maiden-pink. A rare escape from cultivation (Fuller, 1927). A Delta County record. **Not noted in 2013–2014.

**S. latifolia* Poir., evening lychnis. Uncommon weed on trail, *Judziewicz & Fewless 16164*.

**S. vulgaris* (Moench) Garcke, bladder campion. Uncommon weed on trail, *Judziewicz & Fewless 16165*.

**Stellaria graminea* L., stitchwort. Occasional, trails and forest understories, *Judziewicz & O'Dell 16084, 16254*.

**S. media* (L.) Vill., common chickweed. Fairly common trailside and forest weed, *Judziewicz & Fewless 16177*. A Delta County record.

CORNACEAE (Dogwood Family)

Cornus alternifolia L.f., alternate-leaved dogwood. Rare, mesic woods, *Judziewicz & Fewless 16225*.

C. amomum Mill., silky dogwood. Rare, near Pond, *Judziewicz & O'Dell 16295.*

C. rugosa Lam., round-leaved dogwood. Occasional, upland woods, *CI-OU 89-020*, Judziewicz & O'Dell (2013).

C. sericea L. [*Cornus stolonifera*], red-osier dogwood. Uncommon, alkaline rockshores, *CI-OU 89-131*, Grimm (2008), *Judziewicz & O'Dell 16111.*

CRASSULACEAE (Stonecrop Family)

Hylotelephium telephium* (L.) Ohba, live-forever. CI-OU, doubtlessly a relict of cultivation. **Not noted in 2013-2014.

**Sedum acre* L., gold-moss stonecrop. Abundant weed, alkaline rockshore and cliffs, *CI-OU 89-034*, Fewless, Grimm (2008).

DIERVILLACEAE (Bush-Honeysuckle Family)

Diervilla lonicera Mill., northern bush-honeysuckle. *CI-OU 89-044*, Grimm (2004). North coast cliffs, Judziewicz (2014).

ELAEAGNACEAE (Oleaster Family)

Shepherdia canadensis (L.) Nutt., buffalo-berry. Occasional, east coast cliffs, *CI-OU 89-014*, *Fewless 13937*, Judziewicz & O'Dell, 2013.

ERIACEAE (Heath Family)

Arctostaphylos uva-ursi (L.) Spreng., bearberry. Local, near lighthouse and its dock, *CI-OU 89-012*, *Judziewicz & O'Dell 16087.*

Chimaphila umbellata (L.) W.P.C. Barton susbp. *cisatlantica* (S.F. Blake) Hultén, pipsissewa. *CI-OU 90-513*. **Not noted in 2013–2014.**

Monotropa uniflora L., Indian-pipes. Rare, interior mesic forest, *Judziewicz & O'Dell 16248.*

Orthilia secunda (L.) House, one-sided shinleaf. *CI-OU 89-079*. **Not noted in 2013–2014.**

Pyrola chlorantha Sw., green-flowered wintergreen. CI-OU, *Fewless 13976*. Several small populations near north coast, Judziewicz (2014).

EUPHORBIACEAE (Spurge Family)

**Euphorbia maculata* L. [*Chamaesyce maculata*], wartweed. Rare weed, dock, south bay. *Judziewicz & O'Dell 16080.*

E. polygonifolia L. [*Chamaesyce polygonifolia*], seaside spurge. About a dozen young "mats" on South Bay beach, 18 August 2014; not noted there in 2013; *Judziewicz & O'Dell 16255.* A Delta County record, and only second county record for Upper Peninsula of Michigan.

**E. virgata* Waldst. & Kit. [*Euphorbia esula*], leafy spurge. Common weed, lighthouse. *CI-OU 89-006*, Judziewicz & O'Dell. *Judziewicz & Fewless 16205.*

FABACEAE (Bean or Pea Family)

Lathyrus ochroleucus Hook., pale vetchling. Rare, twining on shrub in Pond, *Judziewicz & O'Dell 16262.*

L. palustris L., marsh vetchling. Rare, GLAR, southwest point, *Judziewicz, Fewless & Grimm 16185.*

**Medicago lupulina* L., black medick. Occasional weed, lanes, clearings, *CI-OU 89-141*, Judziewicz & O'Dell (2013).

**Melilotus albus* Medik., white sweet clover. Local weed at lighthouse, *Judziewicz & O'Dell 16258.*

**Trifolium pratense* L., red clover. Occasional weed, *CI-OU 89-007*, Grimm (2004), Judziewicz & O'Dell (2013).

**T. repens* L. white clover. Occasional weed, *CI-OU 90-540*, Judziewicz & O'Dell (2013).

FAGACEAE (Beech Family)

Fagus grandifolia Ehrh., beech. Common, mesic forests, *CI-OU 89-070*), Fewless, Grimm (2004, 2013), Judziewicz & O'Dell (2013).

Quercus rubra L., red oak. Locally common, upland forests, *CI-OU 90-506*, *Judziewicz & O'Dell 16251.*

GENTIANACEAE (Gentian Family)

Gentianopsis virgata (Raf.) Holub [*Gentianopsis procera*], lesser fringed gentian. Occasional, GLAR, alkaline rockshore, Grimm (2008), *Judziewicz & O'Dell 16245.*

Halenia deflexa (Sm.) Griseb., spurred-gentian. Common, MT, clearings, *Judziewicz & O'Dell 16063.*

GERANIACEAE (Geranium Family)

Geranium robertianum L., herb-Robert. Common, cliffs, GLAR, *CI-OU 89-111*, Grimm (2004), Judziewicz & O'Dell (2013).

GROSSULARIACEAE (Gooseberry Family)

Ribes americanum Mill., American black currant. *CI-OU 89-093*. **Not noted in 2013–2014.**

R. cynosbati L., pasture gooseberry. Uncommon, GLAR, *Judziewicz & Fewless 16181.*

R. lacustre (Pers.) Poir., bristly black currant. Cited by Forzley et al. (1993), but no voucher specimen located at either BLH or MICH in 1999. In 2014, seen near base of west coast cliffs, and collected at north base of lighthouse keeper's building, *Judziewicz & Fewless 16209.*

HALORAGACEAE (Water-Milfoil Family)

Myriophyllum sibiricum Komarov, common water-milfoil. Commonly washed up on shores. *Judziewicz & O'Dell 16289.*

HYPERICACEAE (St. John's-wort Family)

Hypericum kalmianum L., Kalm or shrubby St. John's-wort. Locally abundant, GLAR; Grimm (2008), *Judziewicz & O'Dell 16147.*

**H. perforatum* L., common St. John's-wort. Uncommon weed on trail, SV, *Judziewicz & Fewless 16168.*

LAMIACEAE (Mint Family)

Clinopodium arkansanum (Nutt.) House [*Calamintha arkansana*], low calamint. Locally common, GLAR; *Judziewicz & O'Dell 16152.*

**C. vulgare* L., wild-basil. Fairly common weed, *CI-OU 89-048*, *Judziewicz & O'Dell 16138.*

**Glechoma hederacea* L., gill-over-the-ground. Local weed, *CI-OU 90-537*, Judziewicz & O'Dell (2013).

Lycopus americanus W.P.C. Barton, common water-horehound. Uncommon, GLAR. Grimm (2008), Judziewicz & O'Dell. *Judziewicz & Fewless 16179.*

L. uniflorus Michx., northern bugleweed. Locally common, Pond, GLAR, *Judziewicz & O'Dell 16097, 16105.*

Mentha canadensis L. [*Mentha arvensis* var. *canadensis*], wild mint. Local, Pond, *Judziewicz & O'Dell 16095.*

**Nepeta cataria* L., catnip. Local, upland forest at dump/pond west of lighthouse, GLAR. *Judziewicz & O'Dell 16083.*

Prunella vulgaris L., heal-all. Occasional, lanes, clearings; *CI-OU 89-029*, *Judziewicz & O'Dell 16064.*

Scutellaria lateriflora L., mad-dog skullcap. Fairly common, Pond, *Judziewicz & O'Dell 16089.*

LINNAEACEAE (Twinflower Family)

Linnaea borealis L. subsp. *longiflora* (Torr.) Hultén, twinflower. *CI-OU 89-040*; Grimm (2004). One tiny colony seen in 2014 (Judziewicz), along MT in conifer woods near lighthouse.

LYTHRACEAE (Loosestrife Family)

**Lythrum salicaria* L., purple loosestrife. A small infestation on the east side of the South Dock in August, 2014, *Judziewicz & O'Dell 16302*. Since 1998 fieldwork (Judziewicz, 2004), this is only the second location (besides Chambers Island) known in the Grand Traverse Islands.

MALVACEAE (Mallow Family)

Tilia americana L., basswood. Occasional, mesic forests, *CI-OU 89-118*, *Judziewicz & O'Dell 16072.*

MONTIACEAE (Blinks Family)

Claytonia caroliniana Michx., Carolina spring-beauty. Mesic forest, *Fewless 13954*, Grimm (2013).

MYRSINACEAE (Myrsine Family)

Lysimachia quadriflora Sims, narrow-leaved loosestrife. Locally common, GLAR; *Judziewicz & O'Dell 16143.*

L. thyrsiflora L., tufted loosestrife. Locally common, Pond, *Judziewicz & Fewless 16222.*

Trientalis borealis Raf., starflower. *CI-OU 89-074*, Fewless, Grimm (2004). Uncommon in 2014 (Judziewicz).

OLEACEAE (Olive Family)

Fraxinus americana L., white ash. Local, mesic forest on MT just north of center of island, *Judziewicz & O'Dell 16079.*

F. nigra Marshall, black ash. Occasional at edge of Pond, *Judziewicz & Fewless 16216.*

F. pennsylvanica Marshall, green ash. Dominant, Pond, *CI-OU 90-531*, Judziewicz & O'Dell (2013).

**Syringa vulgaris* L., lilac. *CI-OU 90-534*; still persisting and slightly spreading from cultivation at lighthouse in 2014.

ONAGRACEAE (Evening-Primrose Family)

Chamerion angustifolium (L.) Holub [*Epilobium angustifolium*], fireweed. Rare along MT, *Judziewicz & Fewless 16169*.

Circaea alpina L., smaller enchanter's-nightshade. Rare in blown-down forest in southeast part of island; Kari Hagenow sight record and photo, 2014.

Epilobium ciliatum Raf., willow-herb. Occasional, GLAR, Pond, *Judziewicz & O'Dell 16101, 16124*.

E. coloratum Biehler, willow-herb. Rare, Pond, *Judziewicz & O'Dell 16263*.

Oenothera oakesiana (A. Gray) S. Watson & Coult., Oakes' evening-primrose. Occasional, SV dunes and rockshore, *CI-OU 90-581* (as *O. biennis* L.), Judziewicz & O'Dell (2013).

OROBANCHACEAE (Broom-Rape Family)

Agalinis purpurea (L.) Pennell, purple false foxglove. Occasional, GLAR, Grimm (2008), *Judziewicz & O'Dell 16246*.

Castilleja coccinea (L.) Spreng., Indian paintbrush. Occasional, GLAR; *CI-OU 90-582*, *Judziewicz & O'Dell 16139*.

Conopholis americana (L.) Wallr., American cancer-root. Rare, woods; a parasite on red oak roots; *Fewless 13995*. **Not noted in 2013–2014.**

Epifagus virginiana (L.) W.P.C. Barton, beech-drops. Rare in forest interior, *Grimm s.n. (16311)* in 2014.

Melampyrum lineare Desr., cow-wheat. Rare on cobbles under white cedar south of Lighthouse and in cedar glade between tramway and lake, *Judziewicz & Fewless 16213*.

OXALIDACEAE (Wood-Sorrel Family)

Oxalis dillenii Jacq. Uncommon weed; *Judziewicz & O'Dell 16157*. A Delta County record. **New to the Grand Traverse Islands.**

O. stricta L., common yellow oxalis. Uncommon weed; *CI-OU 90-569* (as *O. fontana* Bunge).

PAPAVERACEAE (Poppy Family)

Adlumia fungosa (Aiton) Britton, Sterns & Poggenb., Allegheny-vine or climbing fumitory. **SPECIAL CONCERN (MI).** Locally abundant throughout the island in all types of forests where bedrock is at or near the surface; the seeds remain in the seedbank for many years and populations may appear suddenly after burning or excavation; *Fuller 1635,* several CI-OU collections, Fewless, Grimm (2013), *Judziewicz & O'Dell 16091, 16281*.

Capnoides sempervirens (L.) Borkh. [*Corydalis sempervirens*], pale corydalis. Ledges and gravel near lighthouse; *Fuller 1623*. **Not noted in 2013–2014.**

Corydalis aurea Willd., golden corydalis. Near lighthouse; *Fuller 1622*. A few plants on cobbles in cedar woods in southern part of island, *Judziewicz & Fewless 16191*.

Sanguinaria canadensis L., bloodroot. *CI-OU 90-560*. **Not noted in 2013–2014.**

PARNASSIACEAE (Grass-of-Parnassus Family)

Parnassia parviflora DC., small-flowered grass-of-parnassus. Ledges near lighthouse; *Fuller 1631*, in 1926, and not seen since. **Not noted in 2013–2014.**

PHRYMACEAE

Mimulus ringens L., monkey-flower. Rare, GLAR, West Bay, *Judziewicz & Fewless 16182*.

PLANTAGINACEAE (Plantain Family)

**Linaria vulgaris* Mill., butter-and-eggs. Weed at SV, *Judziewicz & O'Dell 16059*.

**Plantago major* L., common plantain. Occasional weed, *Judziewicz & O'Dell 16068*.

**Veronica anagallis-aquatica* L., water-speedwell. Uncommon, GLAR, *Judziewicz & O'Dell 16098*; Pond, *Judziewicz & Fewless 16220, Judziewicz & O'Dell 16296*.

**V. arvensis* L., corn speedwell. Uncommon weed, SV, *Fewless 13957; Judziewicz & O'Dell 16041*.

**V. officinalis* L., common speedwell. Fairly common weed, trails and mesic forest understories; *CI-OU 89-122*, Judziewicz & O'Dell (2013).

V. persica* Poir., speedwell. Occasional weed, SV, and spreading into mesic woods in western half of island; *Judziewicz & O'Dell 16070*. **New to the Grand Traverse Islands.

**V. serpyllifolia* L., thyme-leaved speedwell. Occasional weed, lanes; *Judziewicz & O'Dell 16048*.

POLEMONIACEAE (Phlox Family)

Phlox divaricata L. subsp. *laphamii* (A.W. Wood) Wherry, blue phlox. *CI-OU 89-126, 90-598*. The only known site in the Grand Traverse Islands; slightly disjunct from farther south. **Not noted in 2013–2014.**

POLYGALACEAE (Milkwort Family)

Polygala paucifolia Willd., fringed polygala. Occasional, mixed woods; *CI-OU 89-140*, Fewless, Grimm (2013), Judziewicz & O'Dell (2014).

POLYGONACEAE (Smartweed Family)

Fallopia cilinodis (Michx.) Holub [*Polygonum cilinode*], false fringed bindweed. Rare in forest lane; *Judziewicz & O'Dell 16249*.

F. convolvulus (L.) Á. Löve [*Polygonum convolvulus*], black bindweed. Rare in forest lane; *Judziewicz & O'Dell 16121*.

Persicaria amphibia (L.) Delarbre [*Polygonum amphibium*], water smartweed. Common, Pond, *CI-OU 90-313*, Judziewicz & O'Dell (2013).

P. lapathifolia (L.) Delarbre [*Polygonum lapathifolium*], curly-top knotweed. Rare, wet sand at South Dock, *Judziewicz & O'Dell 16280*.

**P. maculosa* Gray [*Polygonum persicaria*], lady's-thumb. Occasional, lakeshore, *Judziewicz & O'Dell 16283*.

P. pensylvanica (L.) M. Gómez [*Polygonum pensylvanicum*], bigseed smartweed. Rare, lakeshore, *Judziewicz & O'Dell 16309*.

P. virginiana (L.) Gaertn., jumpseed. Cited by Forzley et al. (1993), but no voucher specimen located at either BLH or MICH in 1999, and otherwise not known from the Grand Traverse Islands; a southern species of mesic and floodplain forests. **Not noted in 2013-2014.**

**Rumex acetosella* L., sheep sorrel. Weed, SV, *Judziewicz & O'Dell 16300*.

**R. crispus* L., curly dock. Uncommon weed, GLAR, *Judziewicz & O'Dell 16156*.

R. triangulivalvis (Danser) Rech. f. [*Rumex salicifolius* var. *mexicanus*], willow dock. Rare, West Bay shore, *Judziewicz & O'Dell 16243*.

PORTULACEAE (Purslane Family)

**Portulaca oleracea* L., purslane. Weed, SV, *Judziewicz & O'Dell 16058*.

PRIMULACEAE (Primrose Family)

Primula mistassinica Michx., bird's-eye primrose. Locally common, GLAR, south bay, Fuller (1927), Grimm (2008), *Fewless 13938; Judziewicz & O'Dell 16134*.

RANUNCULACEAE (Buttercup Family)

Actaea pachypoda Elliott, white baneberry. *CI-OU 89-119*, Grimm (2004). **Not noted in 2013–2014.**

A. rubra (Aiton) Willd., red baneberry. *CI-OU 89-137*. Rare, East Coast Cliff (Judziewicz, 2014). **Not noted in 2013–2014.**

Anemone canadensis L., Canada anemone. *CI-OU 89-130*.

A. quinquefolia L., wood anemone. Rare in mesic woods, *Judziewicz & Fewless 16226*.

A. virginiana L., thimbleweed. *CI-OU 90-580*. Along lighthouse tramway, Judziewicz (2014).

Aquilegia canadensis L., columbine. Occasional, south bay clearing, cliffs, *CI-OU 89-024*, Fewless, Grimm (2013), Judziewicz & O'Dell.

Hepatica acutiloba DC. [*Anemone acutiloba*], sharp-lobed hepatica. Upland woods; *CI-OU 90-538*, Grimm (2013).

Ranunculus abortivus L., small-flowered buttercup. Upland forest, MT, *CI-OU 89-059*, Grimm (2013), Judziewicz (2014).

**R. acris* L., common buttercup. Occasional along trails, *Judziewicz & Fewless 16162*.

R. flabellaris Raf., yellow water buttercup. Locally dominant in deepest part of Pond, *CI-OU 90-305, Fewless 13968, Judziewicz & O'Dell 16096*. A Delta County record.

R. recurvatus Poir., hooked buttercup. Forest, Grimm (2013). *Judziewicz & Fewless 16199*.

RHAMNACEAE (Buckthorn Family)

Frangula alnus Mill. [*Rhamnus frangula*], glossy buckthorn. Rare; one small seedling collected by Joanne Kline along MT in interior of island, 19 Aug. 2014, *Judziewicz & O'Dell 16273.*

ROSACEAE (Rose Family)

Amelanchier laevis Wiegand, smooth serviceberry. *CI-OU 90-533*. **Not noted in 2013-2014.**

A. sanguinea (Pursh) DC., low shadblow. Uncommon, upland forests; *CI-OU 90-324*, Judziewicz & O'Dell (2013).

Fragaria vesca L. subsp. *americana* (Porter) Staudt, hillside strawberry. *CI-OU 89-096*.

F. virginiana Mill., wild strawberry. Occasional, lanes, clearings, GLAR, *CI-OU 89-089*, Fewless, Grimm, Judziewicz & O'Dell (2014).

Geum aleppicum Jacq., yellow avens. Perhaps from GLAR; *CI-OU 90-525*. Photograph by J. Kline, 2014.

G. canadense Jacq., white avens. Rare in interior mesic forest; J. Kline photograph, 2014.

**Malus pumila* Mill., apple. Long-persisting from cultivation at lighthouse, *CI-OU 90-563*, Judziewicz & O'Dell, seedlings near South Dock, 2014.

Physocarpus opulifolius (L.) Maxim., ninebark. Locally common, East Coast Cliffs, *Judziewicz & O'Dell 16127*.

P. anserina L. [*Argentina anserina*], silverweed. Common and characteristic of GLAR; *CI-OU 89-091*, Grimm (2004), Judziewicz & O'Dell (2013).

**Potentilla argentea* L., silvery cinquefoil. Occasional weed, lanes and clearings, lighthouse area, *89-011*, *Judziewicz & O'Dell 16066*.

P. norvegica L., rough cinquefoil. Uncommon weed, lanes and clearings. *Judziewicz & O'Dell 16094*.

P. simplex Michx., old-field cinquefoil. *CI-OU 90-567*. SV, 2014.

Prunus pensylvanica L.f., fire or pin cherry. *CI-OU 90-561*. Fairly common, Judziewicz (2014).

P. virginiana L., chokecherry. Fairly common, forests; *CI-OU 89-013*, Judziewicz & O'Dell.

Rosa blanda Aiton, smooth rose. *CI-OU 89-038*. Occasional in open areas, 2014.

**R. rubiginosa* L., eglantine [*R. eglanteria*]. Occasional weed near lighthouse, also at SV, *Judziewicz & O'Dell 16045.*

Rubus parviflorus Nutt., thimbleberry. This species appears to be declining on the outer islands of three northern Great Lakes islands archipelagoes (Judziewicz & Koch, 1993; Judziewicz, 1999, 2001). On Rock Island, it was present in 1972 but gone by 1997; on St. Martin Island is was collected in 1989-1990 (*CI-OU 89-015*), and then as a depauperate colony along the main trail near the lighthouse in 2014, *Judziewicz & Fewless 16203*.

R. pubescens Raf., dwarf red raspberry. *Fewless 13973*. **Not noted in 2013–2014.**

R. strigosus Michx., red raspberry. *CI-OU 89-090*. Occasional, Judziewicz (2014).

Sorbus decora (Sarg.) C.K. Schneid., showy mountain-ash. Local in crevices in coastal cliffs, *CI-OU 89-023*, *Judziewicz & O'Dell 16128*.

RUBIACEAE (Bedstraw Family)

Galium aparine L., cleavers. *Fewless 13956*. Near dump/pond, Judziewicz (2014).

G. brevipes Fernald & Wiegand, limestone swamp bedstraw. Occasional Pond, *Judziewicz & O'Dell 16088, 16264*. On nearby Summer Island, it was found on an upturned ash tree in a dried woodland pond (Judziewicz, 2001).

G. concinnum Torr. & A. Gray, beautiful bedstraw. Uncommon, upland forests; *Judziewicz & O'Dell 16076*. **New to the Grand Traverse Islands and Upper Peninsula of Michigan.**

G. labradoricum (Wiegand) Wiegand, Labrador bedstraw. Occasional on south coast GLAR, *Judziewicz & Fewless 16184, 16192*. **New to the Grand Traverse Islands.**

G. palustre L., marsh bedstraw. Cited by Forzley et al. (1993), but no voucher specimen located at either BLH or MICH in 1999; and otherwise not known from the Grand Traverse Islands. **Not noted in 2013–2014.**

G. triflorum Michx., sweet-scented bedstraw. *CI-OU 89-060*. Occasional, Judziewicz (2014).

Mitchella repens L., partridgeberry. Upland forest, Grimm (2013).

SALICACEAE (Willow Family)

**Populus alba* L., white poplar. Interior, *CI-OU 90-589*; persisting and spreading near lighthouse, Judziewicz & O'Dell (2013). A Delta County record.

P. balsamifera L., balsam-poplar. Occasional; often on shores. CI-OU, Fewless, Grimm (2008), Judziewicz & O'Dell. *Judziewicz & Fewless 16196.*

P. deltoides L. subsp. *monilifera* (Aiton) Eckenw., plains cottonwood. Occasional, shores; CI-OU, Judziewicz & O'Dell. *Judziewicz & Fewless 16235.*

P. grandidentata Michx., big-toothed aspen. Locally common, upland forests; Grimm (2004), Judziewicz & O'Dell (2013).

P. tremuloides Michx., quaking aspen. Locally abundant, upland forests, CI-OU, Fewless, Grimm (2004), Judziewicz & O'Dell (2013).

Salix amygdaloides Andersson, peached-leaved willow. CI-OU; a single 7 m tall tree at edge of GLAR near south point, *Judziewicz & O'Dell 16238.*

S. bebbiana Sarg., Bebb willow. Tree on cobble GLAR, West Bay, *Judziewicz & Fewless 16180.*

S. discolor Muhl., pussy willow. Occasional as seedlings on GLAR, *Judziewicz & Fewless 16232.*

S. exigua Nutt., sandbar willow. Seedling on GLAR, south coast, *Judziewicz & Fewless 16234.*

S. lucida Muhl., shining willow. Occasional, GLAR; *Fewless 13936*, Judziewicz & O'Dell, 2013.

S. petiolaris Sm., slender willow. CI-OU. **Not noted in 2013–2014.**

SANTALACEAE (Sandalwood Family)

Comandra umbellata (L.) Nutt., bastard-toadflax. *CI-OU 90-575*, Fewless. A few plants noted near SV and lighthouse in 2014.

SAPINDACEAE (Soapberry Family)

Acer negundo L., box elder. Sapling on alkaline rockshore, Southwest Bay, *Judziewicz & Fewless 16194.* A Delta County record.

A. rubrum L., red maple. Common tree; *CI-OU 89-138*; Judziewicz & O'Dell.

A. saccharum Marshall, sugar maple. Abundant, mesic forests. *CI-OU 89-069*, Fewless, Grimm (2013), Judziewicz & O'Dell.

A. spicatum Lam., mountain maple. Common, forests, Fewless, *Judziewicz & O'Dell 16069.*

SAXIFRAGACEAE (Saxifrage Family)

Mitella diphylla L., bishop's-cap. *Fuller 1633*. **Not noted in 2013–2014.**

M. nuda L., naked mitrewort. *Fewless 13941*. **Not noted in 2013–2014.**

SCROPHULARIACEAE (Figwort Family)

**Verbascum thapsus* L., common mullein. Occasional weed, lanes, dunes, clearings, *CI-OU 89-008*, Grimm (2013), Judziewicz & O'Dell.

SOLANACEAE (Nightshade Family)

Physalis heterophylla Nees, clammy ground-cherry. Kline sight record, 2014.

**Solanum dulcamara* L., bittersweet nightshade. Occasional weed, GLAR, *Judziewicz & O'Dell 16123*.

**S. ptycanthum* Dunal, black nightshade. Occasional weed, shaded forest lanes, *Judziewicz & O'Dell 16122*.

URTICACEAE (Nettle Family)

Pilea pumila (L.) A. Gray, clearweed. Fairly common, moist lanes, Pond, GLAR, *Judziewicz & O'Dell 16075*.

Urtica dioica L. subsp. *gracilis* (Aiton) Selander, stinging nettle. Uncommon, Pond, GLAR, forest clearings, *Judziewicz & O'Dell 16092.*

VIOLACEAE (Violet Family)

Viola affinis Le Conte, *Fewless 13979*. **New to the Grand Traverse Islands. Not noted in 2013–2014.**

V. labradorica Schrank, dog violet. *Fewless 13978*. SV dunes, *Judziewicz & Fewless 16160.*

V. nephrophylla Greene, northern bog violet. Locally common, GLAR, south coast, *Judziewicz & O'Dell 16140*.

V. pubescens Aiton, yellow violet. *CI-OU 89-052*, Grimm (2004). **Not noted in 2013–2014.**
V. renifolia A. Gray, kidney-leaved violet. Grimm (2013). North Coast Cliffs, *Judziewicz & Fewless 16174.*

VITACEAE (Grape Family)
Parthenocissus inserta (A. Kern.) Fritsch [*Parthenocussus vitacea*], Virginia creeper. Rare; sprawling on relict cultivated lilac near lighthouse, *Judziewicz & Fewless 16204.*
Vitis riparia Michx., riverbank grape. Occasional, trails, shores, Pond, *CI-OU 90-320*, Judziewicz & O'Dell (2013).

ACKNOWLEDGMENTS

For logistical support during visits to individual islands, we thank the following people: from the U.S. Fish and Wildlife Service: Sadie O'Dell, Connie Rose, and Steve Lenz; from The Nature Conservancy: Kari Hagenow; Martha Luber Pelrine for boat transportation; Joanne Kline, Virginia Freire and Karsten Crouse for assistance with field work; and editor Michael Huft and reviewers Anton Reznicek and Thomas Lammers for their generous help.

LITERATURE CITED

Albert, D. A., P. J. Comer, R. A. Corner, D. L. Cuthrell, M. R. Penskar, and M. L. Rabe. (1995). Bedrock shoreline survey of the Niagaran escarpment in Michigan's Upper Peninsula: Mackinac County to Delta County. Report prepared by Michigan Natural Features Inventory for Michigan Department of Natural Resources.

Albert, D. A., P. J. Comer, D. L. Cuthrell, D. Hyde, W. MacKinnon, M. R. Penskar, and M. L. Rabe. (1997). Great Lakes bedrock shores of Michigan. Report prepared by Michigan Natural Features Inventory.

Coppess, M. (1981). Island story: The history of Michigan's St. Martin Island. Mid-Peninsula Cooperative, Iron Mountain, Michigan.

Dorr, J. A., Jr., and D. F. Eschman. (1984). Geology of Michigan. University of Michigan Press, Ann Arbor.

Forzley, K. C., T. A. Grudzien, and J. R. Wells. (1993). Comparative floristics of seven islands in northwestern Lake Michigan. The Michigan Botanist 32: 3–21.

Fuller, A. M. (1927). A botanist afield on Washington Island. Milwaukee Public Museum Year Book 6: 66–78.

Hyde, C. K. (1995). The northern lights: Lighthouses of the Upper Great Lakes. Wayne State University Press.

Judziewicz, E. J. (1999). Vegetation and flora of Passage Island, Isle Royale National Park, Michigan. The Michigan Botanist 36: 35–62.

Judziewicz, E. J. (2001). Flora and vegetation of the Grand Traverse Islands (Lake Michigan), Wisconsin and Michigan. The Michigan Botanist 40: 81–208.

Judziewicz, E. J., and R. G. Koch. (1993). Flora and vegetation of the Apostle Islands National Lakeshore and Madeline Island, Ashland and Bayfield Counties, Wisconsin. The Michigan Botanist 32: 43–189.

McDonald, R. E. (1984). Four islands: A history of Detroit, Rock, St. Martin, and Washington Islands. Wolfsong Publications, Sturtevant, Wisconsin.

MICHIGAN FLORA ONLINE. A. A. Reznicek, E. G. Voss, & B. S. Walters. (2011). University of Michigan. Available at http://michiganflora.net/information.aspx. (Accessed August 8, 2016).

Michigan Natural Features Inventory. (2016). Michigan's Special Plants. Available at http://mnfi.anr.msu.edu/data/specialplants.cfm. (Accessed January 30, 2016)

Miller, N. G., and R. L. Halbert. (1971). A collection of bryophytes from Summer Island, Delta County, Michigan. The Michigan Botanist 10: 3–13.

Smith, P. A. (2009). Deer bust on St. Martin Island. Milwaukee Journal-Sentinel, December 16, 2009.

Voss, E. G., and A. A. Reznicek. (2012). Field manual of Michigan flora. University of Michigan Press, Ann Arbor.

NOTEWORTHY COLLECTIONS

REPORTS OF FOUR RARE PLANTS IN MICHIGAN, INCLUDING TWO NON-NATIVE SPECIES

Bradford S. Slaughter
Michigan Natural Features Inventory
Michigan State University Extension
P.O. Box 13036
Lansing, MI 48901-3036
slaugh14@msu.edu

Eurybia furcata (E. S. Burgess) G. L. Nesom
Asteraceae
Forked aster.

Significance of the Report. The first reports from Michigan since 1934.

Previous knowledge. *Eurybia furcata* (previously known as *Aster furcatus* E. S. Burgess) is a regional endemic aster of open forests, bluffs, riverbanks, and ledges in the midwestern United States, where it is known from Michigan, Wisconsin, Iowa, Illinois, Indiana, Missouri, and Arkansas (Swink and Wilhelm 1994; Kartesz 2013; NatureServe 2014). The species is of conservation concern in all of these states, with fewer than 100 populations documented rangewide. Because of its apparent rarity and the apparently limited number of genotypes, the species is considered globally vulnerable (G3) by NatureServe (2014).

Discussion. Three populations of *Eurybia furcata* were documented in summer 2014 along the Tittabawassee and Chippewa Rivers in Midland County. The species was previously known in Michigan from two collections, one from the south bank of the River Raisin in Monroe Co. (*S. Alexander s.n.*, September 28, 1906, MICH) and one from the vicinity of a Boy Scout cabin on the Chippewa River in Midland County (*R.R. Dreisbach 8359*, September 3, 1934, MICH). Prior to this report, the 1934 collection was the last record of *Eurybia furcata* in the state, and the species is listed as critically imperiled (S1) and state threatened (Michigan Natural Features Inventory 2007). These new records, complete with lists of associated plant species (given below in the Specimen Citations), should foster surveys for additional populations along the Tittabawassee, Chippewa, and Pine Rivers.

Diagnostic Characters. *Eurybia furcata* is a large, distinctive aster. It can easily be distinguished from *E. macrophylla* (L.) Cass, the only other species of *Eurybia* in Michigan, by its stems that have unreduced leaves all the way to the inflorescence and by the multicellular, pointed, non-glandular white hairs on its pedicels and inflorescence bracts (Figure 1). In contrast, *E. macrophylla* has leaves that are much reduced below the inflorescence and pedicels and the un-

FIGURE 1. The leaves of *Eurybia furcata* are unreduced below the inflorescence. Photo by Bradford S. Slaughter.

dersides of inflorescence bracts that are densely pubescent with stalked glands (Voss and Reznicek 2012). Two other species of *Eurybia* that are distributed primarily east of Michigan, *E. divaricata* (L.) G. L. Nesom and *E. schreberi* (Nees) Nees, can be distinguished from *E. furcata* by the glabrous or sparsely hairy (vs. scabrous and spreading-hairy) leaves of *E. divaricata* and by the presence of tufts of basal leaves on separate short shoots in *E. schreberi* (Gleason and Cronquist 1991). *Eurybia furcata* can be distinguished from asters in the genus *Symphyotrichum* by its corymbiform inflorescence, relatively long involucres, and relatively wide phyllaries (Voss and Reznicek 2012). The shallowly cordate or truncate petiolate leaves of *E. furcata* distinguish it from the other non-*Symphyotrichum* asters in Michigan, namely *Aster tataricus* L. f., *Canadanthus modestus* (Lindl.) G. L. Nesom, *Doellingeria umbellata* (Mill.) Nees, and *Oclemena nemoralis* (Aiton) Greene (Voss and Reznicek 2012).

Specimen Citations. Michigan. Midland County: NW¼ Sec. 34, T15N R1E. Averill Preserve. Locally common in clearing on mesic terrace along Tittabawassee River at mouth of L & B Drain. Another small colony noted in floodplain forest along river ca. 200 m SW of this area. Rays light lavender-white. 43.663125°N 84.344164°W. Associates: *Anemone canadensis*, *Carpinus caroliniana*, *Clematis virginiana*, *Cornus sericea*, *Daucus carota*, *Euthamia graminifolia*, *Fraxinus pennsylvanica*, *Helianthus decapetalus*, *Lobelia*

siphilitica, *Monarda fistulosa*, *Panicum virgatum*, *Physocarpus opulifolius*, *Populus deltoides*, *Rhamnus cathartica*, *Solidago gigantea*, *Teucrium canadense*, *Thalictrum dasycarpum*, *Tilia americana*, *Verbena urticifolia*, *Vitis riparia*. August 11, 2014. *Slaughter 1295* (MICH, MSC).

Midland County: NW¼ Sec. 24, T14N R1E. Chippewa Nature Center. Uncommon in very small colonies at several locations along southern bank of Chippewa River N of River Point Trail. Most plants on eroded low banks below densely vegetated openings. Rays light lavender-white. 43.604937°N 84.305790°W. Associates: *Acer negundo*, *Clematis virginiana*, *Elymus riparius*, *Maianthemum stellatum*, *Matteuccia struthiopteris*, *Menispermum canadense*, *Rhamnus cathartica*, *Rubus occidentalis*, *Solidago gigantea*, *Teucrium canadense*, *Urtica dioica*. August 12, 2014. *Slaughter 1304* (MICH).

Midland County: SW¼ Sec. 2, T14N R1E. Riverview Natural Area. Locally common on eroded, slumping riverbank adjacent to isolated patch of floodplain forest along Tittabawassee River in E portion of preserve. Rays whitish. 43.644569°N 84.323746°W. Associates: *Amphicarpaea bracteata*, *Anemone canadensis*, *Celastrus scandens*, *Clematis virginiana*, *Fraxinus pennsylvanica*, *Lonicera morrowii*, *Maianthemum racemosum*, *Parthenocissus quinquefolia*, *Quercus rubra*, *Rubus occidentalis*, *Solidago altissima*, *Symphyotrichum cordifolium*, *Tilia americana*, *Vitis riparia*. September 8, 2014. *Slaughter 1365* (MICH, MSC).

Scleria pauciflora Willd.
Cyperaceae
Few-flowered nut-rush.

Significance of the Report. One of very few contemporary records from Michigan and likely the northernmost documented population rangewide.

Previous Knowledge. *Scleria pauciflora* is a widespread species of principally the southern United States, where it is concentrated primarily in the Atlantic and Gulf coastal plains (Kartesz 2013). The species occurs in a variety of open habitats, including barrens, pine flatwoods, pond margins, and prairies (Reznicek et al. 2002; NatureServe 2014). Although *S. pauciflora* is considered globally secure (G5), it is rare and local in the northeastern portion of its range, where it is listed as critically imperiled (S1) in Ontario, Michigan, Massachusetts, and West Virginia; imperiled (S2) in Illinois, Ohio, and Pennsylvania; and vulnerable (S3) in Indiana (NatureServe 2014).

Discussion. A small population of *Scleria pauciflora* was documented from a coastal plain marsh in northern Lake County in summer 2014. Previously, the species was known from seven counties in Michigan (Reznicek et al. 2011), and there have been only four known collections from three counties (Kalamazoo, Wayne, Muskegon) since 1920. This report documents the northernmost collection from Michigan (ca. 75 km N of the previous northernmost site) and likely the northernmost documented population of the species in its North American range (Kartesz 2013). The population is also notable for its association with two coastal plain disjunct species that are here at or near their northern range limits:

FIGURE 2. *Scleria pauciflora* is distinguished from other species of *Scleria* in Michigan by the combination of its papillose-roughened achenes and pubescent culms and leaves. Photo by Bradford S. Slaughter.

Eleocharis melanocarpa Torr. and *Rhynchospora macrostachya* A. Gray (Reznicek 1994; Reznicek et al. 2011; Kartesz 2013).

Diagnostic Characters. *Scleria pauciflora* is easily distinguished from the three other species of *Scleria* in Michigan by its combination of papillose-roughened achenes and pubescent culms and leaves (Figure 2). Although *S. reticularis* Michx. and *S. verticillata* Willd. have similarly papillose-roughened achenes, they are essentially glabrous. *Scleria triglomerata* Michx. is a coarser, larger plant with smooth achenes (Reznicek et al. 2011).

Specimen Citation. Michigan. Lake County: SE¼ Sec. 20, T20N R14W. Manistee National Forest. Duck Marsh. Very local on slightly elevated sandy shore of marsh ca. 250 m N of W 8 Mile Rd. 44.107811°N 86.009339°W. Associates: *Agrostis scabra, Chamaedaphne calyculata, Dichanthelium implicatum, Hypericum boreale, Lechea intermedia, Pinus strobus, Pteridium aquilinum,*

Rubus hispidus, Spartina pectinata, Viola lanceolata. August 21 2014. *Slaughter & Victory 1312* (MICH).

Carex bushii Mack.
Cyperaceae
Bush's sedge.

Significance of the Report. The second documented Michigan population of this sporadically distributed species of *Carex* not native to the region.

Previous Knowledge. *Carex bushii* is a widespread sedge of prairies and other primarily open habitats across much of the southern and eastern United States, with a center of distribution in the Central Plains and Ozark regions of Kansas, Oklahoma, Texas, Missouri, and Arkansas (Ball and Reznicek 2002; Smith and Waterway 2008; Kartesz 2013). The species also occurs sporadically as introduced populations in scattered counties of Minnesota, Wisconsin, Illinois, Michigan, and South Carolina (Swink and Wilhelm 1994; Smith and Waterway 2008; Voss and Reznicek 2012; Kartesz 2013; Wisconsin State Herbarium, University of Wisconsin-Madison 2015).

Discussion. *Carex bushii* was collected from a two-track through an old field in the Osceola-Missaukee Grasslands State Game Area in Osceola County in summer 2014. Previously, the species was known in Michigan from only one site in dry sandy soil at the margins of Egg Lake Bog on Beaver Island, Charlevoix County (July 11, 1985, *Menapace 16*, MICH). and the population in Osceola County occurs in a similarly disturbed habitat. Collectors are alerted to the potential presence of this species on disturbed soils elsewhere in the state, including in counties outside the documented range of the similar native *C. hirsutella* Mack.

Diagnostic Characters. *Carex bushii* is one of five species of *Carex* sect. *Porocystis* Dumort. known from Michigan, and one of three species of those five that have glabrous perigynia (Voss and Reznicek 2012), the others being *C. pallescens* L. and *C. hirsutella* Mack. *Carex bushii* is differentiated from *C. pallescens* by the pistillate apices of its terminal spikes and strongly nerved, obovoid-orbicular, compressed perigynia, and from the otherwise similar *C. hirsutella* by its relatively long pistillate scales (surpassing the perigynia) with awns 0.5–2 mm long, versus the short, awnless or short-awned scales of *C. hirsutella* (Voss and Reznicek 2012). Two other species in sect. *Porocystis*, *C. caroliniana* Schweinitz and *C. complanata* Torrey & Hooker, occur in adjacent or nearby states, and they can also be differentiated from *C. bushii* by their awnless or short-awned pistillate scales (Ball and Reznicek 2002; Kartesz 2013).

Specimen Citation. Michigan. Osceola County: NW¼ Sec. 2, T20N R7W. Osceola-Missaukee Grasslands State Game Area, Unit 1. Local; several clumps on two-track in low moist spot through old field ca. 320 m E of 20th Ave. Associates: *Carex gracillima, Juncus tenuis, Potentilla simplex, Rubus flagellaris, Scirpus atrovirens, Trifolium pratense, T. repens*. June 20, 2014. *Slaughter & Victory 1173* (MICH).

Acer campestre L.
Sapindaceae
Hedge maple.

Significance of the Report. The second report of this non-native species growing wild in Michigan and the first documenting its spread into a high-quality natural area.

Previous Knowledge. *Acer campestre* is a medium-sized maple with a native range concentrated in western Europe, extending east to southwestern Asia and south very locally to northern Africa (Utorova et al. 2014). The species is grown in North America as an ornamental tree, and it has escaped from cultivation and is considered naturalized at scattered locations primarily in the northeastern and midwestern United States (Sorrie 2005; Kartesz 2013).

Discussion. *Acer campestre* was noted in and adjacent to the Sanford Natural Area on the campus of Michigan State University in Ingham County in the summer of 2013. The species was first collected in Michigan in 2002 (*Walters & Caderat 7855*, MICH) from disturbed forests and forest edges in Monroe County, where it occurred as mature trees, saplings, and seedlings in association with several weedy native and non-native species. This is the second report in the state, and the first from a high-quality native habitat, a mature *Fagus grandifolia–Acer saccharum* mesic forest protected by Michigan State University as a natural area. At this location, individuals were scattered throughout the natural area, primarily at the forest margin adjacent to West Holmes Hall and McDonell Hall and occasionally along trails in the interior of the forest. Most individuals were small saplings, but at least one fruiting tree, from which the collection was made, was noted at the forest margin. The presence of individuals of *A. campestre* in several size classes at both Michigan sites and its presence in a high quality-natural habitat at Sanford Natural Area suggest that this species may have invasive potential in Michigan and likely warrants monitoring.

Diagnostic Characters. *Acer campestre* can be distinguished from other species of *Acer* in Michigan by a combination of its relatively small stature and simple leaves with entire sinuses between the principal leaf lobes, which are rounded-obtuse at their apices (Voss and Reznicek 2012).

Specimen Citation. Michigan. Ingham County: SE¼ Sec. 16, T4N R1W. Sanford Natural Area. Occasional escape along south margin of woodlot and scattered within forest, especially along trails. 42.727075°N 84.464694°W. Associates: *Acer saccharum, Parthenocissus quinquefolia, Quercus rubra*. July 3, 2013. *Slaughter 953* (MICH).

LITERATURE CITED

Ball, P. W., and A. A. Reznicek. (2002). *Carex*. Pp. 254–572 in Flora of North America, volume 23. Magnoliophyta: Commelinidae (in part); Cyperaceae. Flora of North America Editorial Committee, editors. Oxford University Press, New York.

Gleason, H. A., and A. Cronquist. (1991). Manual of vascular plants of northeastern United States and adjacent Canada. 2nd edition. The New York Botanical Garden, Bronx, N.Y.

Kartesz, J. T. The biota of North America program (BONAP). (2013). North American plant atlas. Chapel Hill, North Carolina [maps generated from Kartesz, J.T. 2013. Floristic synthesis of North

America, Version 1.0. Biota of North America program (BONAP). (in press)]. Available at http://bonap.net/napa. (Accessed October 10, 2014).

Michigan Natural Features Inventory. (2007). Rare species explorer. Available at http://mnfi.anr.msu.edu/explorer. (Accessed October 10, 2014).

NatureServe. (2014). NatureServe explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Available at http://explorer.natureserve.org. (Accessed October 10, 2014).

Reznicek, A. A. (1994). The disjunct coastal plain flora in the Great Lakes region. Biological Conservation 68: 203-215.

Reznicek, A. A., J. F. Fairey III, and A. T. Whittemore. (2002). *Scleria*. Pp. 242-251 in Flora of North America, volume 23. Magnoliophyta: Commelinidae (in part); Cyperaceae. Flora of North America Editorial Committee, editors. Oxford University Press, New York.

Reznicek, A. A., E. G. Voss, and B. S. Walters. (2011). Michigan flora online. University of Michigan, Ann Arbor, Michigan. Available at http://www.michiganflora.net/home.aspx. (Accessed October 28, 2014).

Smith, T. W., and M. J. Waterway. (2008). Evaluating species limits and hybridization in the *Carex complanata* complex using morphology, amplified fragment length polymorphisms, and restriction fragment analysis. Botany 86: 809-826.

Sorrie, B. A. (2005). Alien vascular plants in Massachusetts. Rhodora 107: 284-329.

Swink, F., and G. Wilhelm. (1994). Plants of the Chicago region, 4th edition. Indiana Academy of Science, Indianapolis.

Utorova, Y. N., A. A. Khapugin, and T. B. Silaeva. (2014). About ecology of *Acer campestre* L. (Aceraceae) on north-eastern limit of the range. Environment and Ecology Research 2: 8-13.

Wisconsin State Herbarium, University of Wisconsin – Madison. (2015). Online virtual flora of Wisconsin. Available at http://wisflora.herbarium.wisc.edu.

Voss, E. G., and A. A. Reznicek. (2012). Field manual of Michigan flora. University of Michigan Press, Ann Arbor.

Wisconsin State Herbarium, University of Wisconsin – Madison. (2015). Flora of Wisconsin: Consortium of Wisconsin herbaria. Available at http://wisflora.herbarium.wisc.edu/index.php. (Accessed August 7, 2015).

NOTEWORTHY COLLECTIONS

SIGNIFICANT DISTRIBUTIONAL RECORDS FOR THE UPPER MIDWEST

Thomas G. Lammers
Neil A. Harriman Herbarium
Department of Biology
University of Wisconsin Oshkosh
Oshkosh, Wisconsin 54901-8640
lammers@uwosh.edu

ILLINOIS

Dinebra panicoides (J. Presl) P. M. Peterson & N. Snow
Poaceae
Amazon Spangle-top.

Significance of the Report. Northernmost population in the Mississippi valley of an invasive neotropical species.

Previous Knowledge. This annual C4 grass was formerly assigned to the genus *Leptochloa* P. Beauv. (Snow 2003, Gleason and Cronquist 2004, Mohlenbrock 2014). Native to the neotropics and warm temperate areas from Brazil northward to the southern United States, Amazon spangle-top commonly grows on seasonally exposed mudflats as well as in other mesic sites (Snow 2003, Peterson et al. 2012). Although it is native to the lower Mississippi valley, its presence upriver has been noted only in recent decades (Yatskievych 1999, Buthod and Hoagland 2011). It was not found in Missouri until 1955 (Steyermark 1963, as *Diplachne halei* Nash) nor in Illinois until 1963 (Mohlenbrock 2001, 2014). It has spread extensively in the former state since then but in the latter has been documented from only Calhoun and Pike Counties in the west and Alexander, Massac, and Pulaski Counties in the south (Mohlenbrock 2001, 2014; BONAP 2015; ILPIN 2015; USDA, NRCS 2015).

Discussion. The population reported here is in north-central Illinois, more than 150 miles upstream from the nearest known population. Elsewhere, the species extends no farther north than southeastern Oklahoma, central Missouri, southern Indiana, and southern Virginia (BONAP 2015; USDA, NRCS 2015), making this the northernmost extent of the species' distribution. This is the first report within USDA Plant Hardiness Zone 5 (USDA, ARS 2012), which suggests a capacity for further migration northward. At this locality, *Dinebra panicoides* was associated with other species characteristic of riverine mudflats, including *Amaranthus tuberculatus* (Moq.) Sauer, *Ammannia robusta* Heer & Regel, *Bidens cernua* L., *B. tripartita* L., *Cyperus erythrorhizos* Muhl., *C. odor-*

atus L., *Echinochloa crusgalli* (L.) P. Beauv., *Eragrostis hypnoides* (Lam.) Britton, Sterns & Poggenb., *E. pectinacea* (Michx.) Nees, *Ipomoea lacunosa* L., *Lindernia dubia* (L.) Pennell var. *dubia*, *Persicaria pensylvanica* (L.) M. Gómez, *Rorippa sylvestris* (L.) Bess., *Sagittaria montevidensis* Cham. & Schlecht. subsp. *calycina* (Engelm.) Bogin, *Spermacoce glabra* Michx., and *Xanthium strumarium* L. Additional populations should be sought downstream along the Illinois River between this locality and the river's mouth.

This species is similar to mucronate sprangle-top, *Dinebra panicea* (Retz.) P. M. Peterson & N. Snow, which occurs in similar habitats in the southern part of the state; both are annuals with racemose panicle branches. The two may be distinguished by the moderately to densely papillose-pubescent sheaths of *D. panicea* (vs. glabrous sheaths in *D. panicoides*). The spikelets of the former are also a bit shorter than those of the latter: 2–4 vs. 4–5 mm. It too might be expected to spread farther north in the future.

Specimen Citation. Illinois. Marshall Co.: Lacon Twp., on the left bank of the Illinois River in Weber Park, at the State Hwy 17 bridge in Lacon, common on wet mudflats, October 6, 2011, *T. G. Lammers & D. L. Lammers 13540* (ILLS, ISC, OSH).

Koelreuteria paniculata Laxm.
Sapindaceae
Golden Rain-tree.

Significance of the Report. Second collection from Illinois of a cultivated ornamental tree but rarely naturalized in the Midwest.

Previous Knowledge. This deciduous tree, a native of eastern Asia, was introduced to Western horticulture circa 1750 via the Imperial Academy of Sciences and Arts in St. Petersburg, Russia, and the Jardin du Roi in Paris, France; from Europe it was introduced to North America by Thomas Jefferson in 1809 (Meyer 1976). Golden rain-tree is highly ornamental, with its pinnate leaves and large terminal panicles of four-petaled yellow flowers that develop into large inflated capsules. It has spread from plantings only sporadically on this continent, primarily in the southeastern and western United States; in Illinois, it has been reported from only Jackson County (BONAP 2015; ILPIN 2015; USDA, NRCS 2015).

Discussion. Golden rain-tree is thoroughly naturalized at this locality, which extends along the river bluffs for over two miles. Plants of all age classes were abundant, from seedlings to flowering specimens 10 m tall.

Specimen Citation. Illinois: Madison Co.: along State Hwy 100 (Great River Road) beginning 1 mile northwest of Alton and continuing almost to the Piasa Creek bridge, common among deciduous trees at base of steep mesic slopes and vertical limestone escarpments lining the Mississippi River, June 11, 2012, *T. G. Lammers & D. L. Lammers 13693* (ILLS, NA, NY, OSH).

IOWA

Rumex stenophyllus Ledeb.
Polygonaceae
Narrow-leaf Dock.

Significance of the Report. First report from the southeastern quarter of Iowa of an invasive species rarely collected east of the Great Plains.

Previous Knowledge. This perennial is native to Eurasia and is widely naturalized in western North America (Mosyakin 2005). In Iowa, narrow-leaf dock has been documented only from Boone County by Thompson et al. (2009) and Thompson (2010), although BONAP (2015) maps it in Bremer, Harrison, and Story Counties as well.

Discussion. Narrow-leaf dock is very similar in appearance to the ubiquitous curly dock, *Rumex crispus* L.; both are tall weedy perennials with crisped or undulate leaf-margins. The two differ in the margins of their inner tepals: denticulate with 4-10 acute teeth in *R. stenophyllus,* entire or nearly so in *R. crispus.* One would expect narrow-leaf dock to become more common in the state in coming years.

Specimen Citation. Iowa. Van Buren Co.: Van Buren Twp., T69N R10W S36 SE¼, left bank of the Des Moines River along Front St. in Keosauqua, scarce among brushy rip-rap on riverbank, August 21, 2014, *T. G. Lammers & D. L. Lammers 14942* (ISC, OSH).

MICHIGAN

Gentianopsis crinita (Froel.) Ma
Gentianaceae
Greater Fringed Gentian.

Significance of the Report. First collections of a native annual from Michigan's Upper Peninsula.

Previous Knowledge. *Gentianopsis crinita* is indigenous to northeastern North America as far west as central North Dakota, northwestern Iowa, central Indiana, and southern Ohio, south in the Appalachians to northeastern Georgia (Iltis 1965; BONAP 2015; USDA, NRCS 2015). Though widespread in Wisconsin and in Michigan's Lower Peninsula, greater fringed gentian has not been reported from the Upper Peninsula prior to these collections (Iltis 1965; Voss 1996; BONAP 2015; USDA, NRCS 2015).

Discussion. At the site west of Carney, *Gentianopsis crinita* grew with species typical of fens, including *Bromus ciliatus* L., *Campanula aparinoides* Pursh, *Carex flava* L., *Chelone glabra* L., *Cicuta bulbifera* L., *Doellingeria umbellata* (Mill.) Nees subsp. *pubens* (A. Gray) Á. Löve & D. Löve, *Epilobium leptophyllum* Raf., *Equisetum variegatum* Schleich. ex F. Weber & D. Mohr, *Geum aleppicum* Jacq., *Hypericum ascyron* L., *Juncus alpinoarticulatus* Chaix, *Liparis loeselii* (L.) L. C. Rich., *Lobelia kalmii* L., *Muhlenbergia glomerata* (Muhl.) Trin., *Rhynchospora capillacea* Torr., *Scirpus atrovirens* Willd., *S. pendulus*

Muhl., *Scutellaria galericulata* L., *Spiranthes cernua* (L.) L. C. Rich., *Symphyotrichum firmum* (Nees) G. L. Nesom, *Thelypteris palustris* Schott, and *Viola cucullata* Ait.

At the site north of Menominee, however, greater fringed gentian grew in a far drier prairie habitat, with *Pycnanthemum tenuifolium* Schrad., *Schizachyrium scoparium* (Michx.) Nash, *Silphium terebinthinaceum* Jacq., *Solidago nemoralis* Ait., and *Symphyotrichum oolentangiense* (Riddell) G. L. Nesom. The only species common to both sites besides the gentian were *Euthamia graminifolia* (L.) Nutt. and *Symphyotrichum urophyllum* (Lindl. ex DC.) G. L. Nesom.

Greater fringed gentian is very similar in appearance and ecology to the lesser fringed gentian, *Gentianopsis virgata* (Raf.) Holub. The two are best distinguished by the narrower leaves of the latter: less than 1 cm wide and 6–21 times as long as wide vs. more than 1 cm wide and/or less than 4 times as long as wide in *G. crinita.* See Voss (1996) for additional comments on distinguishing these two species in Michigan.

Specimen Citations. Michigan. Menominee Co.: along County Hwy G18, 2.2 miles west of its jct. at Carney with US Hwy 41, frequent in small open fen on west side of road, September 5, 2010, *T. G. Lammers & D. L. Lammers 13100* (MICH, OSH); along railroad tracks paralleling US Hwy 41, 8¼ miles north of the bridge over the Menominee River between the cities of Menominee and Marinette, scattered in dry prairie, August 31, 2011, *T. G. Lammers 13510* (MICH, MU, OSH).

WISCONSIN

Lycopodium lagopus (Laest. ex C. Hartm.) G. Zinserl. ex Kuzen.
Lycopodiaceae
One-cone Club-moss.

Significance of the Report. First collection from the southern half of Wisconsin, and the second most southerly population west of the Great Lakes.

Previous Knowledge. This prostrate-stemmed lycopod is circumboreal in its distribution, in the Western Hemisphere extending south to southeastern Washington, northwestern Montana, southern Michigan, and northern West Virginia (Wagner and Beitel 1993; BONAP 2015; USDA, NRCS 2015). In Wisconsin, it is reported only from the northwestern portion of the state, in Bayfield, Burnett, Douglas, and Taylor Counties (Wisconsin State Herbarium 2015). The population reported here lies 75 miles or more to the south of the nearest of these. It is the southernmost locality west of Lake Michigan with the exception of a population some 230 miles farther south in Will County, Illinois (Mohlenbrock 1983, ILPIN 2015).

Discussion. Other species noted on the dry open sand were *Artemisia caudata* Michx., *Euphorbia corollata* L., *Hieracium longipilum* Torr. ex Hook., *Liatris aspera* Michx., and *Solidago speciosa* Nutt. var. *rigidiuscula* Torr. & A. Gray.

One-cone clubmoss is very similar to running clubmoss, *Lycopodium clavatum* L., and has sometimes been treated as *L. clavatum* var. *megastachyon* Fern. & Bissell. Both have surficial horizontal shoots, pedunculate strobili, and hairs

1–4 mm long at the tips of their leaves. Running club-moss differs in having 2–5 strobili per peduncle (vs. 1), leaves spreading to slightly ascending (vs. ascending to appressed), and 4–6 oblique branches (vs. 2–3 erect branches).

Specimen Citation. Wisconsin. Juneau Co.: Town of Armenia, T19N R4E S2 NW¼, sand plains west of the Wisconsin River along 8th St., 0.4 mi E of its jct. with 20th Ave., 12 mi (by air) south-southwest of Nekoosa, infrequent in large moss mat on margin of pine-oak forest and dry open sand, July 26, 2012, *T. G. Lammers 13884* (MU, OSH).

Senecio viscosus L.
Asteraceae
Sticky Ragwort.

Significance of the Report. Non-native species known from only four other counties in the Midwest.

Previous Knowledge. This viscid malodorous annual, native of Eurasia, has been only sparingly naturalized in the United States. It is most common in the Northeast with a few reports from the Pacific Northwest. In the Midwest, it is reported from only Douglas County, Wisconsin, and adjacent St. Louis County, Minnesota, and from Cook and Jackson Counties, Illinois (BONAP 2015; ILPIN 2015; USDA, NRCS 2015; Wisconsin State Herbarium 2015).

Discussion. The population consists of several dozen plants in an urban alley. The only associated species were *Chenopodium album* L., *Lactuca serriola* L., and *Parietaria pensylvanica* Muhl. ex Willd. Several surrounding blocks of the downtown were searched and the only other plants of *Senecio viscosus* found were one block west on Algoma Blvd. among planted shrubs at the edge of a parking lot at the corner of Brown Street.

Sticky Ragwort might be mistaken for the common groundsel, *Senecio vulgaris* L., another annual with dissected leaves, which is more common in the state. However, that species lacks the glandular-viscid indument and resulting fetid scent of *S. viscosus*.

Specimen Citation. Wisconsin. Winnebago Co.: City of Oshkosh, dead-end alley between 110 Algoma Blvd. and 415–423 North Main St., common in cracks in pavement along building foundations, August 12, 2015, *T. G. Lammers & D. L. Lammers 15261* (KSC, MICH, MO, MU, NY, OSH).

LITERATURE CITED

BONAP. (2015). The Biota of North America Program, North American Vascular Flora. Available at http://www.bonap.org. (Accessed September 15. 2015).

Buthod, A. K., and B. W. Hoagland. (2011). New to Oklahoma: *Leptochloa panicoides* (Poaceae). Phytoneuron 2011-55: 1–2.

Gleason, H. A., and A. Cronquist. (2004). Manual of the vascular plants of northeastern United States and adjacent Canada, 2nd edition, seventh printing. The New York Botanical Garden, Bronx, N.Y.

ILPIN. (2015). Illinois Plant Information Network. Available at http://www.nrs.fs.fed.us/data/il/ilpin. (Accessed September 15, 2015).

Iltis, H. H. (1965). The genus *Gentianopsis* (Gentianaceae): Transfers and phytogeographic comments. Sida 2: 129–154.

Meyer, F. G. (1976). A revision of the genus *Koelreuteria* (Sapindaceae). Journal of the Arnold Arboretum 57: 129–166.

Mohlenbrock, R. H. (1983). Additions to *The Illustrated Flora of Illinois.* II. Ferns. Erigenia 3: 23–52.

Mohlenbrock, R. H. (2001). The illustrated flora of Illinois, grasses, *Panicum* to *Danthonia*, 2nd edition. Southern Illinois University Press, Carbondale.

Mohlenbrock, R. H. (2014). Vascular flora of Illinois, a field guide, 4th edition. Southern Illinois University Press, Carbondale.

Mosyakin, S. L. (2005). *Rumex*. Pp. 489–533 in Flora of North America, volume 5, Caryophyllidae, part 2, Flora of North America Editorial Committee, editors. Oxford University Press, New York.

Peterson, P. M., K. Romaschenko, N. Snow, and G. Johnson. (2012). A molecular phylogeny and classification of *Leptochloa* (Poaceae: Chloridoideae: Chlorideae) *sensu lato* and related genera. Annals of Botany 109: 1317–1330.

Snow, N. (2003). *Leptochloa*. Pp. 51–60 in Flora of North America, volume 25, Magnoliophyta: Commelinidae (in part): Poaceae, part 2, Flora of North America Editorial Committee, editors. Oxford University Press, New York.

Steyermark, J. A. (1963). Flora of Missouri. The Iowa State University Press, Ames.

Thompson, J. D., W. R. Norris, and D. Q. Lewis. (2009). The vascular plants of Ledges State Park (Boone County, Iowa) revisited: Revelations and recommendations. Castanea 74: 390—423.

Thompson, J. D. (2010). The vascular flora of Boone County, Iowa (2005-2008). Journal of the Iowa Academy of Science 117: 9–46.

USDA, ARS. (2012). USDA plant hardiness zone map. Available at http://planthardiness.ars.usda.gov. (Accessed April 9, 2015).

USDA, NRCS. (2015). The PLANTS database. Available at http://plants.usda.gov. (Accessed September 15, 2015).

Voss, E. G. (1996). Michigan flora, part III: Dicots (Pyrolaceae–Compositae). Cranbrook Institute of Science and University of Michigan Herbarium, Ann Arbor.

Wagner, W. H., Jr., and J. M. Beitel. (1993). Lycopodiaceae. Pp. 18–37 in Flora of North America, volume 2, Pteridophytes and Gymnosperms, Flora of North America Editorial Committee, editors. Oxford University Press, New York.

Wisconsin State Herbarium. (2015). Wisflora: Wisconsin vascular plant species. Available at http://www.botany.wisc.edu/wisflora. (Accessed September 15, 2015).

Yatskievych, G. (1999). Steyermark's flora of Missouri, volume 1, revised edition. Missouri Botanical Garden Press, St. Louis.

BOOK REVIEW

Welby R. Smith. 2012. *Native Orchids of Minnesota* [revision of *Orchids of Minnesota* by Welby R. Smith]. University of Minnesota Press, Minneapolis, London. xxxi + 254 pp. ISBN 978-0-8166-7823-5. Paperback. $34.95.

Orchids are arguably the most popular element of our Great Lakes flora for keen amateur botanists, so having too many orchid books is an impossibility. Minnesota is a state that has a restricted but interesting orchid flora, perhaps the most notable species being the legendary bog adder's mouth, *Malaxis paludosa*, which occurs in the eastern United States in only a few counties in northern Minnesota. But, of course, the state wildflower is also an orchid, the showy lady's-slipper, *Cypripedium reginae*! So it seems only fitting that Minnesota have a sumptuous, well-illustrated orchid book; and in fact this review is for the revision of the book first issued in 1993.

At first sight, this edition, published 19 years after the original, would seem to need few changes for a group as well studied as orchids. In fact, however, this time period corresponds to the great flourish of new understanding of plant relationships brought about by molecular systematics, so, as noted in the introduction, ". . . it soon became apparent that any new edition would have to be entirely re-written in order to accommodate recent scientific advances and the ever growing expectations of the public." In fact, even in a state as well known as Minnesota, species new to the state flora are still occasionally being discovered (e.g., *Spiranthes casei* in 2000), and one species, *Calopogon oklahomensis*, was not even described until 1995—two years after the publication of the first edition! And now, the title of the book is not quite accurate, as it includes one wild but non-native orchid species, the helleborine orchid, *Epipactis helleborine*, discovered in Minnesota in 1993!

This book succeeds admirably in meeting ". . . the ever growing expectations of the public." There are 46 species treated in the book, three with two varieties (the varieties also then treated in detail and mapped also, for a total of 49 entities treated). All entities are keyed, and salient features used in some of the difficult keys (e.g., *Spiranthes*) are illustrated on the facing page. Every entity is described in detail, and, for each species, additional details about the plant and its habitat and occurrence in Minnesota are presented in a discussion of varying length.

The book is sumptuously illustrated, most species having beautiful line drawings (most are by Vera Ming Wong; six are by Bobbi Angell) as well as photos. The photos, most of them by the author, include not only commonly illustrated parts like flowers, but also less frequently illustrated portions such as capsules and roots and rhizomes. Every entity treated is mapped for the state with dots showing exact localities on a county outline map of Minnesota. These are each accompanied by a smaller map showing the distribution of the entity in North America as a whole, thereby increasing the value of this book for users in other

Great Lakes states. An illustration of the amount of new data in this edition is that in the first edition, the maps were based on 2,915 specimens examined, but for the second, 4435 specimens were examined, a huge increase. The maps are also coded by date—open circles for collections from 1965 or earlier, solid dots for post-1965 collections, thereby providing a small glimpse into potential trends in species occurrence. Other helpful information is provided, such as the phenology chart at the end of the book and a fairly comprehensive glossary.

Some interesting, and sad, tidbits about Minnesota orchids are that three entities appear to have died out in the state, including *Calopogon oklahomensis*, which was apparently extirpated from Minnesota before it was even described! The others are *Listera convallarioides* and *Spiranthes lacera* var. *gracilis*. Another interesting element for Michiganders is that some species that range all the way to the southern edge of Michigan are restricted in Minnesota to the northern part of the state. Notable among these are *Arethusa bulbosa*, *Cypripedium acaule*, *Malaxis monophyllos*, *Platanthera orbiculata*, and *Spiranthes romanzoffiana*. And a few things go much farther north in Minnesota, such as *Cypripedium candidum* and *Spiranthes magnicamporum*. This may be due to the influence of the prairie-forest border on plant distributions, but it makes for interesting comparisons

So what might be criticisms of the book? Very few indeed. One small thing is that there is no mention that the genus *Listera* is now subsumed by many authors into *Neottia*. Also, though the maps with the dots differentiated by date show some species with very few recent records in the south of the state (most strikingly *Platanthera hookeri*), there is little comment on this. But these are small quibbles.

This is a very well done, comprehensive book, based on the author's own knowledge and experience, and not on secondary sources. It is a valuable and reliable source of scientific information, but is also well illustrated and very suitable for an interested naturalist. It belongs on the shelf of every Great Lakes region orchidophile.

——A.A. Reznicek
University of Michigan Herbarium
3600 Varsity Drive
Ann Arbor, MI 48108

BOOK REVIEW

Joshua G. Cohen, Michael A. Kost, Bradford S. Slaughter, and Dennis A. Albert. 2015. *A Field Guide to the Natural Communities of Michigan*. Michigan State University Press. xlii + 362 pp., paperback. ISBN: 978-1-61186-134-1. $34.95 (also available as an ebook: PDF).

It appears that serious efforts to characterize the natural plant communities of Michigan began with K. A. Chapman, 1986, "Michigan Natural Community Types." This was apparently a "publication" of the Michigan Natural Features Inventory. It transpires that at least some of the earlier foundational works have been removed from various websites—therefore, I have no idea what Chapman had to say. A search for a print copy of the Chapman paper was equally in vain. This makes it difficult to get a grasp of the evolution of the current understanding of Michigan's natural plant communities.

Yet another antecedent to the current volume has the same authors (but in different order) and the same title; it was "published" in 2010, with 189 pages, according to the "References" segment of the present book. Again, it appears to have vanished into the ether: it is not to be found at the website of the Michigan Natural Resources Inventory (the alleged "publisher"), nor have I succeeded in finding a print copy of it. It's an oddity of the digital age that authors can cite references that, in a manner of speaking, no longer exist.

In any case, the work over so many years now culminates in the present book, which recognizes 77 natural plant communities in Michigan. The book stems from "Natural Communities of Michigan: Classification and Description," by Kost et al., 30 September 2007, Report Number 2007-21, Version 1.2, last updated: 9 July 2010, available at http://mnfi.anr.msu.edu/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf. Its 317 pages contain detailed listings of all the plants and animals, and far more technical detail, than the present field guide. It is unillustrated.

The full-color cover illustration is of a volcanic escarpment in the Porcupine Mountains Wilderness State Park. It is a beautiful picture, and it sets the tone for the rest of the book, which is adorned with many hundreds of color photographs, all beautifully reproduced. The pictures seem to convey the essence of the various plant communities; each is faithfully captioned; and the hand of man is nowhere detectable. The photographers are credited on page ix; they have contrived to picture Michigan as if it were a pristine wilderness. Oddly, the title-page photograph, both recto and verso, is uncaptioned; it is apparently a sedge meadow of some sort, but it does not recur within the book.

The book begins with a [Table of] Contents, representing pages vi and vii. I make this point because the reader will want to refer to it regularly, given that there is no index at the back. The contents page is color coded, consonant with the tabs on recto pages throughout the book.

The 77 communities are grouped into five classes: Palustrine (aquamarine),

Terrestrial (green), Palustrine/Terrestrial (brown), Primary (blue), and Subterranean/Sink (black). I infer that the Primary class is short for "primary succession," in that it includes communities that occupy sites where little or no soil development has occurred—sand dunes, cobbles, and the like.

There is a dichotomous key to all the recognized community types. I think this is intended as an organizational device, rather than as a literal key as would appear in a flora or a monograph. It functions to tell the reader how the authors have made some fine distinctions, but it is hard to imagine even the most avid community ecologist using it: there he stands in the hot sun with biting insects buzzing about his face, trying to decide whether the wetland is minerotrophic or ombrotrophic (terms defined in the glossary, pp. 343–358).

For 74 of the 77 recognized communities, the authors provide a segment called "Places to Visit." The three omitted communities are extinct in Michigan, or nearly so: bur oak plains, mesic prairie, and oak openings. The places are very largely sites open to the public, such as national forests, DNR lands, and the like. They are listed by county, alphabetically. There is no county outline map of the state provided, but such maps are abundantly available elsewhere.

For each recognized community, the authors provide a landscape ecoregion map as a kind of guide to where such a community might be found. The numbering system on the maps is not explained, but it's probably not important.

The 77 recognized plant communities of Michigan are subject to revision, as the authors make clear (pp. xxi and xxii in the Introduction). In addition, there are problems of terminology. If one compares the labels for prairies alone, between this book and Hoffman, 2002, *Wisconsin's Natural Communities*, the differences in language are obvious:

Cohen et al.: Hillside, Dry Sand, Dry-Mesic, Mesic, and Mesic Sand
Hoffman: Dry, Dry-Mesic, Mesic, Wet Mesic, and Wet

Even where the terms happen to be congruent, the explicit intent of the authors may not be. The complexity of plant communities is what attracts many to this field of study. Equally, one suspects, it is simply too daunting for others.

The authors have made a major contribution to conservation, preservation, and appreciation. They and Michigan DNR are to be congratulated. Nature lovers of all stripes will want to add this book to their shelves.

——Neil A. Harriman
Biology Department
University of Wisconsin-Oshkosh
Oshkosh, Wisconsin 54901
harriman@uwosh.edu

BOOK REVIEW

SIX SMALL WORKS OF BOTANICAL FICTION

Neil A. Harriman
Biology Department
University of Wisconsin-Oshkosh
Oshkosh, Wisconsin 54901
harriman@uwosh.edu

The author of all of these works is Thomas G. Lammers (1955–), Professor of Biology and Curator of the Herbarium, Department of Biology, University of Wisconsin-Oshkosh. His curriculum vitae is available at http://www.uwosh.edu/biology/faculty-and-staff/faculty/lammers. His professional expertise is in the Campanulaceae (including Lobeliaceae); he has published extensively on the family. He and his wife, Diane, are Iowa natives. For this reason, Tom has sited his stories in Iowa, with some intrusions into neighboring states. He has exhaustively researched historical minutiae and used them as a framework for his tales, all with a botanical angle. All six titles, center-stapled paperbacks, are available from Missouri Botanical Garden Press at $7.00 each. The sequence below is chronological, from each title's first printing.

Augustus Green and the Lair of the Pye-A-Saw. April 2009. 64 pp. (The second printing, September, 2009, is at hand, which the author revised slightly and to which he added reference to the next title in the series, as given below.) The botanical exploring expeditions of the early 19th century largely ignored Iowa. Here, the author creates an early botanist and spins a tale of how his manuscript journal and specimens came to be found—and lost. The Pye-A-Saw is a very large raptorial bird, not wholly of Lammers' imagination, as he explains at the very end of the book, p. 60. Lammers has great fun in suggesting how many novelties to science Green might have named—plants of Iowa that were subsequently named (from other localities) by the early explorers, like Michaux. The ash with "utterly square twigs" (p. 30), is of course *Fraxinus quadrangulata* Michaux, 1803. I leave it to the reader to discover the other novelties Augustus Green found, but never published.

Obadiah Gray and the Mystery of the Centurion's Testament. September 2009. 65 pp. Friends of Lammers know that he was once an avid coin collector. The mystery here turns on a Roman coin from 62 BC found in an Iowa cornfield. All of this centers around Burlington, Iowa, in 1852. (Lammers was born and raised there, just over a century later.) There's little botany in this one, but lots of intrigue and insights into the origin of the Mormon religion, along with Roman and Biblical history.

Obadiah Gray and the Witch of Half-Moon Swamp. May 2010. 64 pp. The author has told me more than once, "Everything in my little books is true, except for the parts I make up." What's made up here is only the dialogue; the rest of it is firmly grounded in botanical science. This one can scarcely be summarized without giving away the plot and spoiling the fun for readers. There are several mentions in the book of the fortress-like cabin where the alleged witch resides. But its existence, deep in the swamp and far from nearby towns, is never explained (see below).

Obadiah Gray and the Search for the Elusive Eponym. October 2011. 68 pp. An eponym is a person after whom a thing is named. This book is dedicated to *Centropogon dianae* Lammers (Campanulaceae), native to Peru, "the loveliest eponym in the entire plant kingdom." Tom Lammers and Diane Seebach met at Iowa State University, and she became Diane S. Lammers on June 19, 1976. There are two children of the marriage, Valerie and Michael. The dedication is particularly fitting because the plot of this book turns on Obadiah Gray's wish to name a botanical novelty for his wife, Annabelle. There is an impassioned argument as to why such a thing was unthinkable—see pp. 25–28. Ultimately, Gray's efforts to find a new plant he could name for his wife failed. Lammers' efforts in real life succeeded.

Obadiah Gray and the Beast of Stony Hollow. June 2011. 64 pp. Here, it is made explicit that Obadiah Gray is the second cousin of Asa Gray, ". . . a professor of some renown at Harvard." Perhaps, but Lammers invented this, after having made an effort to construct a family tree for Asa Gray, to no avail. This story, light on botany, turns on the possibility that there may have existed into historical times relict populations of ancient fauna, including an earlier species of *Homo*.

The Pye-A-Saw War. July 2013. 72 pp. This book is dedicated to Valerie (see above). This is a sequel to the first of these six titles. The action here jumps from New Orleans to Santa Fe, from Washington, D.C., to St. Louis, Paris, and beyond. For the purposes of pursuing and killing the Pye-A-Saw, the soldiers built Fort Chicaqua in the vicinity of what would later be Burlington, Iowa (p. 49). The fort exists only in this book, historians should rest assured. Its main building, massively constructed of the felled trunks of large oaks and walnuts, figured in later years as the home of the so-called witch of Half-Moon Swamp.

Great fun, marvelous botanical, geological, and historical tidbits, warmly recommended.

INSTRUCTIONS TO AUTHORS

Refer to http://quod.lib.umich.edu/m/mbot/submit for more detailed instructions, especially for formatting, style conventions, literature cited, and voucher specimen requirements. Please contact the editor with any questions.

1. Create text in 12-point Times New Roman font and double space paragraphs throughout. Research articles should be organized as follows: Title, Author(s) and address(es), Abstract with up to 5 keywords, Introduction, Materials and Methods, Results, Discussion, Acknowledgements, Literature Cited, Tables, Figure Legends, and Figures. Sections may be omitted if not relevant. All pages should be numbered.

2. For noteworthy collections, manuscripts should be formatted as follows. The title, "Noteworthy Collections," should begin each submitted manuscript, followed on the next line by the State or Province for the species reported. The next line should list the taxon of interest using the following format: Species Author(s) (Family). Common name. The rest of the manuscript should include the following named sections: (i) Significance of the Report, (ii) Previous Knowledge, (iii) Discussion, (iv) Diagnostic Characters (if desired), (v) Specimen Citations, (vi) Acknowledgements (if desired), and (vii) Literature Cited. Each of these sections is largely self-explanatory; however, the "Significance of the Report" section should be limited to a brief sentence or phrase indicating the significance of the collection(s), and this may be expanded upon in the "Discussion" section; the "Specimen Citations" section should include the relevant label data from the voucher specimen(s) including location data, collector(s), collection number, etc., as well as the Index Herbariorum acronym(s) of the herbarium or herbaria where the specimen(s) are deposited. The manuscript should end with the name and address of the author(s).

3. Non-research articles, such as book reviews, letters to the editor, notices, biographies and other general interest articles can be formatted as general text without the specific sections listed above. However, literature cited and any tables or figures should be formatted as described below.

4. Create tables either as an MS Word table or using a tab-delimited format. Each table is to be submitted as a separate file. Table captions should be placed at the top of the table. Any footnotes should appear at the bottom of the table. Please do not insert tables within the body of the text.

5. Send each figure as a separate file in a high-resolution format—eps, jpg, or tif. Figures like bar graphs that gain their meaning with color won't work—use coarse-grained cross-hatching, etc. Create figure legends as a separate text file, and the typesetter will insert them as appropriate. Please do not insert the figure in the body of the text file.

6. Citations: Please verify that all references cited in the text are present in the literature cited section and vice versa. Citations within the text should list the author's last name and publication year (e. g. Smith 1990). For works with more than 2 authors, use "et al.", and separate multiple citations with a semicolon.

7. Literature Cited: List citations alphabetically by author's last name. The first author's name is to be listed with surname first, followed by initials (e.g. Smith, E. B.), and subsequent authors are to be listed with initials first.Separate author's initials with a single space. The year of publication should appear in parentheses immediately before the title of the citation. The entire journal name or book title should be spelled out. Please put a space after the colon when citing volume number and page numbers.

8. Italicize all scientific names. Voucher specimens must be cited in floristic works and in any other study whose results depend on the identity of the plant(s). Papers citing plant records without documenting vouchers are generally not acceptable.

9. Manuscripts must be submitted electronically to the email address of the editor. All manuscripts will be reviewed by at least two referees.

CONTENTS

On the cover: Forked aster, *Euryba furcata,* Midland County, Michigan.
Photo by Bradford S. Slaugher