

# **VASCULAR PLANT SPECIES CHECKLIST FOR FISH LAKE FIELD STATION, LAPEER COUNTY, MICHIGAN**

Marguerite I. Bunker and Margaret M. Hanes\*

Eastern Michigan University

Department of Biology

Ypsilanti, Michigan, USA 48197

Email: [mkoopma2@emich.edu](mailto:mkoopma2@emich.edu)

## ABSTRACT

A checklist is presented of the vascular plant species at the Kresge Environmental Education Center (Eastern Michigan University) in Lapeer County, Michigan. The property consists of 240 acres and its location along the tension zone makes for a unique and diverse flora comprising the northern and southern limits of many species. A total of 344 species (in 222 genera and 91 families) have been recorded. These values suggest that 39.3% of species in Lapeer County are present at field station and that 12.1% of species in the state are represented. One hundred twenty-three species have a Coefficient of Conservation score of five or higher (sixteen species have a score of 10) and four are listed as threatened or endangered. Representative vouchers for 335 species are deposited at EMC, most of which have been published as a checklist on Symbiota. Most specimens have been also been imaged and georeferenced. Eight additional taxa have been recently planted in a seed sowing experiment in a prairie restoration project. Sixty-one new county records were recovered. For more than 50 years, the Kresge Environmental Education Center has provided students and faculty with an excellent opportunity for place base education and research.

Keywords: Eastern Michigan University, Fish Lake, flora of Michigan, Lapeer County, species Checklist

## INTRODUCTION

Eastern Michigan University owns a field station in Lapeer, Michigan called the Kresge Environmental Education Center, also known as Fish Lake. For more than 50 years, Fish Lake has provided students and faculty with a wide variety of habitats to explore biodiversity, learn field skills, conduct long-term research and collaborate across disciplines. A variety of biology field courses are offered at Fish Lake, including Plant Evolution and Classification, Aquatic Plants, and Trees and Shrubs where students learn to identify plants and are responsible for collecting and pressing their own plant collections.

The property consists of 240 acres and is situated in an area geologically known as an interlobate or kettle-moraine region. Interlobate zones usually exhibit a number of glacial features in a small area. For example the field station includes kettles (Fish Lake and the bog), recessional moraines, outwash plains, delta kames, till plains and eskars. This glaciated region was once dominated by Beech-Sugar Maple and Mixed Hardwoods forest types. Today the field station has a unique and diverse flora comprising the northern and southern limits of many species due to its proximity to the tension zone. The property contains eight distinct plant community types (as defined by Cohen et al. 2015): a 9,600 year-old floating bog (Figure 1; Bailey and Ahearn 1981), submergent marsh, emergent marsh, southern wet meadow, southern shrub-carr, inundated shrub-swamp, dry mesic mix of northern and southern forest, and pine forest (Figure 2). The property also has examples of old fields, early successional forests, mature hardwood forests, pine plantations, a 17-acre lake (Fish Lake), a 10-acre pond with beaver lodges (Mussing Pond), forested wetlands, and woodland vernal pond ecosystems (Figure 2).

The Kresge Environmental Education Center is nestled between two units (approximately 2,000 acres each) of Michigan's Lapeer State Game Area (LSGA, a ~9,000 acre

property administered by the Michigan Department of Natural Resources) that further safeguards the field station from development and invasive plants. A checklist of the LSGA was completed recently (Springer and Parfitt 2010).

The herbarium at Eastern Michigan University (EMC) has recently digitally imaged a majority of their collection and made it available on the voucher-based biodiversity portal Symbiota through the Midwest Consortium of Herbaria (Gries et al. 2014). The portal provides the means to create a species checklist whereby each species is linked to a vouchered herbarium specimen. A species checklist of vascular plants at the Fish Lake field station was created with specimens at EMC, cross-listed with a historical inventory list and supplemented with fieldwork.

#### HISTORICAL INFORMATION

In the late 19<sup>th</sup> century Lapeer County was heavily wooded and known for its high quality white pine. Between 1865 and 1886 one of the largest lumber mills in the county was in operation on Fish Lake (Ellis 1978). A second lumbering village was set up at Five Lakes, two miles to the north of Fish Lake. To transport milled products, the Detroit and Bay City Railway built a rail line from Lapeer to the mills in 1873 (Ellis 1978). By 1880 most of the large timber in the area was depleted and the Fish Lake mill closed in 1886. All traces of the buildings are long gone but evidence of production remains. To the north end of Fish Lake there is a large (ca. 2 acres) chip pile and some lumber trails (Figure 2).

Much of the property was purchased by Eastern Michigan University in 1963 for \$37,800 from William Mussing. Mr. Mussing carried out extensive conservation practices that included planting trees, creating waterfowl habitat and establishing the site as a wildlife sanctuary. A one-room schoolhouse (known as Fish Lake School) was purchased from a 4-H Club in 1963 for

\$1,200. The 240-acre property was purchased in its totality by Eastern Michigan University in 1973. Field classes were first offered in 1966 and continue to be taught regularly to this day. New buildings on the site, funded by The Kresge Foundation, were completed and put into use on May 7, 1975 and include a dormitory for 64 residents, a classroom, a basic lab and dining facilities for up to 200 visitors.

## BIASES

It has been long documented that botanical collection practices are non-random (Nelson 1990, Meyer et al. 2016). A recent paper summarizes biases in botanical field collection with approximately 5 million herbarium records and concludes that biases exist in five major categories (Daru et al. in preprint). One major category that the authors highlight is that of spatial or geographic biases. Not surprisingly a notable geographic bias exists for botanical collections in Michigan. Moerman et al. (2006) reported that local flowering plant species richness is usually higher in counties that have American universities in contrast to other surrounding counties. In fact, this paper highlights Washtenaw County (home to the University of Michigan and Eastern Michigan University), a county that in 2006 had more species diversity than all surrounding counties. This trend remains true in 2017. Biases also exist in the availability of publicly available data. For example, we went into this project knowing that no county records existed in the Michigan Flora Online for several taxa in Lapeer county, for which we had representatives in our herbarium (EMC), some of which had been collected 40 years ago. To further understand and identify botanical collection and data availability biases in Lapeer County we make comparisons with our floristic checklist at several geographic scales and highlight how this project has ameliorated some of the known biases.

## METHODS

Databased specimens from the EMC collection on the Midwest Consortium of Herbaria were filtered using the locality filter (keywords: 'Fish Lake' and 'Lapeer'). Specimens were georeferenced and added to the Checklist Editor in Symbiota. For specimens from the property that had yet to be databased or imaged, data was entered into the online portal. The online checklist was then compared to an historical species list generated in 1978 and recent lists for teaching purposes. Using this information, we completed a number of field trips to Fish Lake from June 2016 to July 2017 to collect taxa without vouchers or without previous observation. Substantial effort was made to visit all major portions of the property and habitats. Taxonomy and nomenclature was updated according to the Michigan Flora Online (2011). The Michigan DNR Invasive Species Database was used to identify invasive species on the property (Michigan DNR 2016). The Michigan Natural Features Inventory Special Plant List was used to assess state status of rare and endangered plants (Michigan State University Extension 2016). The Michigan Flora was used to assign species a Coefficient of Conservation value (Michigan Flora Online 2011). A Coefficient of Conservation value reflects species tolerance for disturbance and fidelity to a particular pre-settlement plant community type. A value of 10 represents the highest fidelity to a habitat that is likely to represent an intact natural ecosystem. To address collection and data availability biases we compared the species list at the Fish Lake field station to species lists of the adjacent Lapeer State Game Area (Springer and Parfitt 2010), the county and the state. The species list for Lapeer County and the state of Michigan that were used to make species composition comparisons were obtained from Michigan Flora online on April 12, 2017 (Michigan Flora Online 2011). New county records were identified when they were absent in Lapeer county according to the Michigan Flora Online. New county record specimens were

confirmed (or are in the confirmation process) at the University of Michigan Herbarium and incorporated into the Michigan Flora Online.

## RESULTS

The vascular plant species checklist for the Kresge Environmental Education Center comprises 344 species (in 222 genera and 91 families; Table 1, Appendix 1). At present 335 species from the property are vouchered and represented in the EMC herbarium. One individual of *Betula alleghaniensis* stands on the property but is too tall for collection (and thus remains unvouchered). Another six species growing on the property (noted with a \*\* in Appendix 1) were planted in 2015 in a seed sowing experiment to see if soil phosphorus availability affects the establishment of native prairie plants. Individual plants from this seed study remain too small to voucher. 302 species (representing 193 genera and 82 families) have been imaged, databased and georeferenced and are published in the species checklist on the Consortium of Midwest Herbaria, available through the EMC portal, Fish Lake checklist (<http://midwestherbaria.org/portal/checklists/checklist.php?cl=3792&emode=0>).

Nine pteridophyte, two gymnosperm, 15 monocot, and 64 dicot families are represented in the Fish Lake checklist (Table 2). The most species rich family on the property is Asteraceae with 40 species represented (Table 3). The second most species rich family is Cyperaceae with 26 species represented, many of which can be found in the southern wet meadow (Figure 3). The family Potamogetonaceae is also well represented on the property, many species in this family can be found in the submergent marsh (Figure 4). One hundred twenty-three species at Fish Lake have a Coefficient of Conservation score of five or higher (noted with ❖ in Appendix 1) and sixteen species have a score of 10 (Table 4). Four species are listed as plants with special status:

*Lycopus virginicus* (threatened), *Polemonium reptans* (threatened), *Populus heterophylla* (endangered), and *Potentilla canadensis* (special concern). Four Michigan DNR defined invasives are on the property: *Centaurea stoebe*, *Elaeagnus umbellata*, *Potamogeton crispus*, and *Rosa multiflora*. This work uncovered 61 new county records (noted with # in Appendix 1).

The Fish Lake field station and the Lapeer State Game Area share 217 vascular plant species (Table 1). 39.3% of species known from Lapeer County are present at Fish Lake while 12.1% of the species in the state are represented at our small field station (Table 1).

## DISCUSSION

This work represents the first vouchered checklist of the flora of Fish Lake field station. The checklist comprises 344 species (Appendix 1), is available online to the public and will be used regularly in a variety of field botany classes at Fish Lake. This work uncovered 61 new county records, comprising almost 18% of our checklist (Appendix 1 noted with \*). These records include three carnivorous plants (*Sarracenia purpurea*, *Utricularia gibba*, and *Utricularia vulgaris*; Figure 5). Additional examples of new county records include *Iris versicolor*, *Osmundastrum cinnamomeum*, and *Spirodela polyrhiza*. All new county records have been or are in the process of being incorporated into the Michigan Flora. By updating the Michigan Flora Online with new Lapeer County records we are addressing and rectifying some of the data availability biases for a previously under collected county. If we add the 61 new county records to the total Lapeer county numbers available on Michigan Flora online the percent shared between the county and the field station increases to nearly 50% (47.8% from 39.3%; Table 1).



The Fish Lake flora is diverse. Due to the field stations proximity to the Michigan tension zone, we see a mixture of northern and southern species and a lot of species that are at their range limits (Figure 6). For example, *Desmodium paniculatum* (a new county record), is typically a species found in southern Michigan but is found on the property at its most northern range in eastern Michigan. *Pinus banksiana* and *Iris versicolor*, common species in northern Michigan, are found at their most southern limits in the eastern portion of the state at the Fish Lake field station. Springer and Parfitt (2010) compiled a vascular plant species checklist for the 9,000-acre Lapeer State Game Area (LSGA), about half of this property is located directly adjacent to the Fish Lake property. The LSGA property list contains 602 species in 110 families (Springer and Parfitt 2010). Surprisingly only 217 species (36% of the LSGA list) are shared between the two properties (Table 1). Furthermore, one hundred twenty-eight species are found on the Fish Lake property and absent from the LSGA checklist. Additional discrepancies in species overlap may be due to the disjunct nature of the LSGA land that captures additional diversity throughout the county. At the familial level the two properties are more similar and share 89 families when nomenclatural changes in familial affiliation are taken into account. The two families not shared between the two checklists (Bignoniaceae and Dennstaedtiaceae) are only on the Fish Lake property. The Dennstaedtiaceae, represented by *Pteridium aquilinum*, is more than likely on the LSGA and went uncollected. The county distribution of *Catalpa speciosa* (Bignoniaceae) outside of Fish Lake field station is unclear as our work uncovers this taxon as a new county record. Our work further suggests that at least 39.3% of species and 73.4% of families known from Lapeer County are present at Fish Lake (Table 1; but see discussion above). Twelve percent of the species and more than half the families in the state are represented at our small field station (Table 1). Thirty-six percent of species at our field station

have a Coefficient of Conservation score of five or higher (Appendix 1) and almost 5% have a score of 10 ( Table 4) suggesting that the various plant communities on the property represent excellent natural habitat suitable for plants with specific needs. Four species are listed as plants of special concern, threatened, or endangered (Noted with \*\*\* in Appendix 1). We plan to begin to monitor these rare plants to preserve their presence on the property. Four Michigan DNR defined invasives are found on the property (Noted with # in Appendix 1). We plan to create a plan for the eradication of these invasive species in the coming year. Given the large number of wetlands on the property it is encouraging that no invasive *Phragmites* has been documented.

Daru et al. (in preprint) suggest that threatened or endangered species are often severely underrepresented in herbarium collections. Our work suggests that this trend is also true of common weeds. Surprisingly, student collections have long ignored collecting the weeds in the parking lot. Another pattern that Daru et al. (in preprint) recovered is that a majority of the collections were made by only a handful of individuals in all regions studied. Because students in our field botany courses are required to make collections each semester the species represented in our checklist are not dominated by one collector but instead have been collected by many.

**Notable exceptions:** Six species on the property (noted with a \*\* in Appendix 1) remain unvouchered because they are part of a native prairie plant seed sowing experiment and individual plants are too small to voucher. We have not included these taxa in new county records counts or in our evaluation of Coefficients of Conservation as these taxa are not native to the Fish Lake site. One Yellow Birch individual on the property also remains unvouchered due to its extreme height. A notable vouchered specimen to mention that we do not include on the checklist is *Castanea dentata* (American Chestnut; voucher: Sinclair s.n. 1976). The Michigan Natural Features Inventory and Michigan Flora together report the species from 30 counties in

Michigan, but our voucher is the first to demonstrate that this taxon was also present in Lapeer County, at least until 1976. This highlights how sharing data can shed light on historical distributions of this highly threatened species.

The online checklist introduced here will give students in field botany courses at Eastern Michigan University an excellent resource to learn plant diversity as they explore the many plant communities present on the property (Figures 2- 7). The checklist has inspired rare plant and invasive species monitoring. The vouchered checklist will also serve as confirmation for newly collected specimens and as a guide for future collecting. Field stations are increasingly vulnerable as financial resources are limited at Universities and other institutions. It is important to value the extraordinary field stations that remain in Michigan and throughout the midwest and highlight them as resources that bring many educational opportunities to their communities. It is imperative to use these sites regularly and in diverse and creative ways to ensure their future.

#### ACKNOWLEDGEMENTS

Funding was provided by an award from the EMU Undergraduate Research Stimulus Program and a Dean's Travel Award to MIB. The Small Herbarium Initiative provided funding to digitally image the EMC herbarium. We sincerely thank Ruth B. Alford, a pioneer in the initial collecting at Fish Lake, and to undergraduate students across the decades for their collections. We thank Amber McDermott and Kenny Schutter for their help in the herbarium and in the field on this project. We thank Joshua Springer for sharing data from the Lapeer State Game Area checklist. We are indebted to Gary Hannan for sharing his knowledge about the history and plants of Fish Lake and to Tony Reznicek for checking nomenclatural determinations on some

*Carex* specimens and for confirming new county records. We are ever thankful to the Michigan Flora for being such a valuable resource.

#### LITERATURE CITED

Bailey, R.B. and P. J. Ahearn. (1981). A late and postglacial pollen record from Chippewa Bog, Lapeer Co. Michigan: further examination of white pine and beech immigration into the central Great Lakes Region. In: R.C. Romans (ed.), *Geobotany II*. Plenum Publishing Company., New York. pp. 53–74.

Daru, B.H., D.S. Park, R. Primack, C. G. Willis, D. S. Barrington, T. J. S. Whitfeld, T. S. Seidler, P. W. Sweeney, D. R. Foster, A. M. Ellison, and C. C. Davis. Widespread sampling biases in herbaria revealed from large-scale digitization. In preprint.

Cohen, J., M. Kost, N. Slaughter, and D. Albert. (2015). *A field guide to the natural communities of Michigan*. Michigan State University Press.

Eastern Michigan University (2016). Extended Programs Up North EMU – Fish Lake. Available at <http://www.emich.edu/extended/travel/fishlake.php>. (Accessed February 3, 2016).

Ellis, J. Dee. (1978). *Pioneer families and history of Lapeer County, Michigan: with 15,000 names indexed*. Lapeer, Mich.: Ellis Pub. Co.

Gries C., E. Gilbert, and N. Franz. (2014). Symbiota – A virtual platform for creating voucher-based biodiversity information communities. *Biodiversity Data Journal* 2: e1114.

Meyer C., P. Weigelt, and H. Kreft. (2016). Multidimensional biases, gaps and uncertainties in global plant occurrence information. *Ecology Letters* 19: 992–1006.

- Michigan Departments of Agriculture & Rural Development, Environmental Quality and Natural Resources (2016). Michigan Invasive Species. Available at [http://www.michigan.gov/invasives/0,5664,7-324-68002\\_71240---,00.html](http://www.michigan.gov/invasives/0,5664,7-324-68002_71240---,00.html). (Accessed July 25, 2016).
- Michigan Flora Online. A. A. Reznicek, E. G. Voss, and B. S. Walters (2011). University of Michigan. Available at <http://michiganflora.net/home.aspx>. (Accessed February 3, 2015- June 2017).
- Michigan State University Extension (2016). The Michigan Natural Features Inventory Special Plant List. Available at <https://mnfi.anr.msu.edu/explorer/search.cfm>. (Accessed July 25, 2016).
- Moerman, D. E. and G. F. Eastbrook. (2006). The botanist effect: counties with maximal species richness tend to be home to universities and botanists. *Journal of Biogeography* 33: 1969-1974.
- Nelson, B. W., C. A. C. Ferreira, M. F. da Silva, and M. L. Kawasaki. (1990). Endemism centres, refugia and botanical collection density in Brazilian Amazonia. *Nature*, 345, 714–716.
- Springer, J. C., and B. D. Parfitt. (2010) A checklist of vascular plants of the Lapeer State Game Area, Lapeer County, Michigan, USA. *The Michigan Botanist* 49: 41-72.