

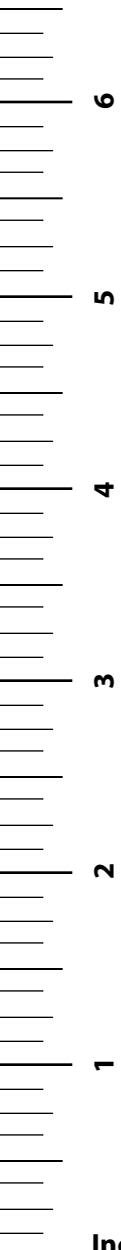
A Field Guide to

Invasive Plants

of Aquatic and Wetland Habitats
for Michigan

Suzan Campbell, Phyllis Higman, Brad Slaughter and Ed Schools

2010



Photographs used in this field guide were generously made available for educational use by their photographers.

Reproduction for commercial purposes is strictly prohibited.

Cover photo:

Starry stonewort (*Nitellopsis obtusa*)

G. Douglas Pullman, Aquest Corporation

Inches

A Field Guide to
Invasive Plants
of Aquatic and Wetland Habitats
for Michigan

Suzan Campbell, Phyllis Higman, Brad Slaughter and Ed Schools



MICHIGAN STATE
UNIVERSITY
EXTENSION



Michigan
Natural
Features
Inventory

2010

Preface

This booklet was developed to help managers of wetlands and aquatic resources identify invasive plant species that may pose a threat to their management goals. Detecting these plants during the early phase of their invasion is essential to achieving cost effective removal or control. The species in this field guide are included for at least one of the following reasons:

- site managers in Michigan report them as a significant problem;
- there is research literature documenting their adverse impacts on native plant and animal communities within the Great Lakes region;
- they are included in multiple listings of invasive plants and are readily available commercially as aquarium or water garden plants;
- they are listed as restricted or prohibited under Michigan's Natural Resources and Environmental Protection Act 451 of 1994, Section 324.41301.

Inclusion in this guide does NOT imply legal status as a prohibited or restricted species under Michigan law. Only a few of the included species are prohibited or restricted by law and in these cases restrictions are noted. Also, this field guide does not rank individual species by their level of threat—determining the “invasiveness” of each species is a complex process still ongoing for Michigan at the time of publication.

Several of the plants in this guide are readily available in the horticulture or aquaculture trade and this guide makes no recommendations as to their sale, planting, or presence where they may pose little threat. Not all species are equally invasive and in some cases cultivars may not share the invasive traits of their parent species. However, some species, once thought to be benign, are now serious problems in Michigan.

We encourage you to thoughtfully consider the impact of your planting choices on Michigan's aquatic and wetland resources.

Contents

Preface	
Acknowledgements	i
Introduction	iii
Using this field guide	v
Monitoring	viii

Pictorial Key

Using the pictorial key	2
Key	4

Species Accounts

Garlic mustard / <i>Alliaria petiolata</i>	16
Black alder / <i>Alnus glutinosa</i>	17
Giant reed / <i>Arundo donax</i>	18
Japanese barberry / <i>Berberis thunbergii</i>	19
Flowering rush / <i>Butomus umbellatus</i>	20
Carolina fanwort / <i>Cabomba caroliniana</i>	21
Pond water-starwort / <i>Callitriche stagnalis</i>	22
Marsh thistle / <i>Cirsium palustre</i>	23
Swamp stonecrop / <i>Crassula helmsii</i>	24
Brazilian water-weed / <i>Egeria densa</i>	25
Common water-hyacinth / <i>Eichhornia crassipes</i>	26
Autumn olive / <i>Elaeagnus umbellata</i>	27
European fireweed / <i>Epilobium hirsutum</i>	28
Glossy buckthorn / <i>Frangula alnus</i>	29
Reed mannagrass / <i>Glyceria maxima</i>	30
Dame's rocket / <i>Hesperis matronalis</i>	31
Japanese hops / <i>Humulus japonicus</i>	32
Hydrilla / <i>Hydrilla verticillata</i>	33
European frog-bit / <i>Hydrocharis morsus-ranae</i>	34
Indian swampweed / <i>Hygrophila polysperma</i>	35
Ornamental jewelweed / <i>Impatiens glandulifera</i>	36
Yellow iris / <i>Iris pseudacorus</i>	37
African oxygen weed / <i>Lagarosiphon major</i>	38

Moneywort / <i>Lysimachia nummularia</i>	39
Garden yellow loosestrife / <i>Lysimachia vulgaris</i>	40
Purple loosestrife / <i>Lythrum salicaria</i>	41
European water-clover / <i>Marsilea quadrifolia</i>	42
Japanese stilt grass / <i>Microstegium vimineum</i>	43
Parrot feather water-milfoil / <i>Myriophyllum aquaticum</i>	44
Eurasian water-milfoil / <i>Myriophyllum spicatum</i>	45
Brittle water-nymph / <i>Najas minor</i>	46
Starry stonewort / <i>Nitellopsis obtusa</i>	47
Yellow floating heart / <i>Nymphoides peltata</i>	48
Wild parsnip / <i>Pastinaca sativa</i>	49
Reed canary-grass / <i>Phalaris arundinacea</i>	50
Non-native phragmites / <i>Phragmites australis</i> subsp. <i>australis</i> ..	51
Water lettuce / <i>Pistia stratiotes</i>	52
Japanese knotweed / <i>Polygonum cuspidatum</i>	53
Giant knotweed / <i>Polygonum sachalinense</i>	54
Curly pondweed / <i>Potamogeton crispus</i>	55
Fig buttercup / <i>Ranunculus ficaria</i>	56
Common buckthorn / <i>Rhamnus cathartica</i>	57
Multiflora rose / <i>Rosa multiflora</i>	58
Giant salvinia / <i>Salvinia molesta</i>	59
Climbing nightshade / <i>Solanum dulcamara</i>	60
Water-chestnut / <i>Trapa natans</i>	61
Narrow-leaved cat-tail / <i>Typha angustifolia</i>	62
Appendix I: Common name - scientific name	64
Appendix II: Scientific name - common name	66
Appendix III: Invasive species - by community	68
Appendix IV: Best survey period	72
Glossary	77
Online resources	83
Selected references	85
Pictorial key photo credits	86
Index	89

Acknowledgements

We would like to thank Michigan's Department of Natural Resources and Environment (DNRE), Water Bureau for funding this field guide as part of a broader study. Many thanks to Gary Kohlhepp, Kay Edly and Michelle Selzer for supporting and recognizing the need for this work. Critical assistance and support for the overall project was also provided by Rick Hobrla, Eric Bacon, Julie Sims, John Riley and Sharon Baker of the Water Bureau; Roger Eberhardt and Emily Finnell from the Office of the Great Lakes; Amy Lounds, Todd Losee, Tracy Collin, and Robyn Schmidt from the Land and Water Management Division; Sue Tangora, Mark Sargent, and Amy Derosier from the Wildlife Division; and Glenn Palmgren, of Parks. Special thanks to Wildlife Biologist Dan Kennedy whose field manager insights influenced the shaping of the monitoring approach.

We appreciate the work of Ryan O'Connor, of Michigan Natural Features Inventory (MNFI) who was instrumental in the development of the project, and Mike Monfils who provided important tips on survey strategies. The substantive work on the classification of Michigan's natural communities by Mike Kost, Dennis Albert, Josh Cohen, Brad Slaughter, Becky Schillo, Chris Weber, and Kim Chapman provided essential context for the project.

Anton Reznicek of the University of Michigan Herbarium generously shared his expertise and insights on a number of species. We greatly appreciate the botanical expertise of Mike Penskar, Lead Botanist here at MNFI. Doug Pearsall, of The Nature Conservancy, provided important regional information and served as the liaison to their ongoing work in the Saginaw Bay study area.

Matt Preisser, Gary Towns and Bob Haas of DNRE, Gary Crawford of Superior Aquatic Environmental Services and Doug Pullman, of Aquest Corporation gave insightful guidance on emerging threats in Michigan waters.

The Bugwood Image Database System, which is supported by the National Park Service and the USDA Forest Service, was the source of most of the photos in this guide. Many of the species that we have included are not yet in Michigan. We truly appreciate the many people who have posted their images there and have made them available for educational use. In particular, Leslie J. Mehrhoff,

Richard Old, and Chris Evans provided many of the images that we needed. In addition, Ann Murray, of the University of Florida and IFAS Center for Aquatic and Invasive Plants shared Indian swamp-weed photos.

Matt Preisser and Todd Losee of DNRE, and Doug Pullman provided photos of several species including starry stonewort, European frogbit and Carolina fanwort that have recently emerged as threats to our state's waters. David Fenwick, Tim Melling, Jenny Neal and Bastiaan Brak shared their photos of species of swamp stonewort and African oxygen weed that were particularly difficult to obtain. Finally, Ian Shackleford, of the USDA Forest Service graciously shared an exemplary invasive plant sites map. We truly appreciate their generosity.

Nancy Toben of MNFI provided critical oversight of all aspects of project management and contractual details. Kraig Korroch, Rebecca Rogers, and Sue Ridge provided important technical and administrative assistance. Finally, we thank our Director, Brian Klatt for his overall support for this project.

Suzan Campbell

Phyllis Higman

30 March, 2010

Introduction

What is an invasive plant?

The National Invasive Species Management Plan, developed in response to Executive Order 13112, defines an invasive species as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health." For the purposes of this field guide, non-native species are those that did not occur in Michigan's ecological communities prior to widespread European settlement.

Only a small fraction of the hundreds of non-native plants that have evolved elsewhere and been brought to Michigan are invasive. The few that are, however, can be very aggressive and spread rapidly once established. In our lakes, streams, rivers, native forests, grasslands, wetlands and dunes, they pose a threat to management goals by displacing native species or altering ecosystem processes. It is these harmful non-native species that are the focus of this field guide.

Impacts of non-native aquatic and wetland invasive plants

With the longest freshwater coastline in the United States, over 11,000 inland lakes, and extensive wetlands, Michigan is particularly vulnerable to the impacts of invasive plants. They pose a significant threat to Michigan's aquatic and wetland resources and their impacts are wide-ranging. Invasive plants reduce overall plant and animal diversity, destroy critical biological resources such as fish nursery habitat, simplify natural communities, reduce property values, restrict fishing, boating and other recreational opportunities, and necessitate large public and private expenditures to mitigate their spread.

Invasive plants have effective reproductive and dispersal mechanisms. Many are capable of spreading by specialized structures such as bulbils or turions and some can produce new plants from tiny root or stem fragments. Species such as non-native phragmites store energy in extensive root systems and can sprout back repeatedly after cutting. Many invasive aquatic and wetland plants produce abundant fruit and seeds that are widely dispersed and remain viable in the substrate for years.

This field guide is intended to help readers identify established, newly

introduced and approaching wetland and aquatic invasive species in order to facilitate a rapid response. Identifying new invaders before they can disperse widely is the most efficient and cost effective method for limiting their destructive effects.

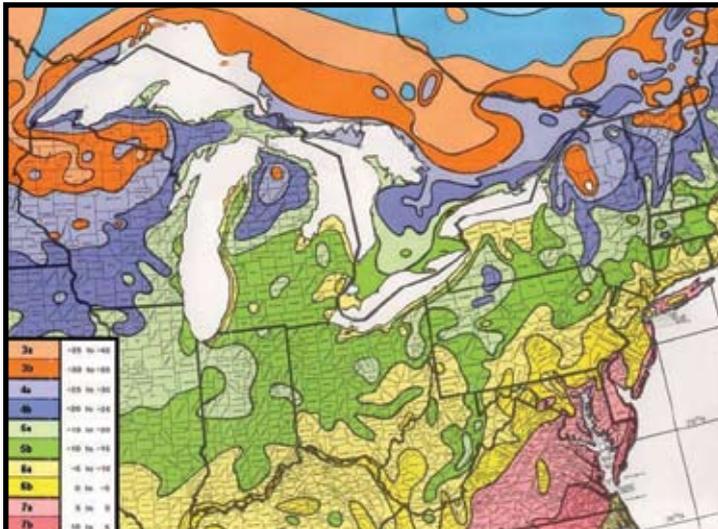
Species selection

Species included in this guide were drawn from regional and national lists of invasive plants, Michigan's listing of prohibited and restricted species and suggestions by MNFI and DNRE field staff. Most are obligate wetland or aquatic species but several upland species were included as they appear to be spreading in wetlands.

Eleven of the species are not yet known from Michigan, two are suspected but unconfirmed and another nine have only limited distribution. It is difficult to predict which species will become a problem here, but given Michigan's range of hardiness zones, our coastlines appear to be particularly vulnerable. Lake-moderated climates along the Lake Michigan shoreline, Saginaw Bay, the Thumb, Lake St. Clair, and western Lake Erie are much milder than those in the state's interior. As the USDA hardiness zone map below indicates, these areas have the potential to harbor species typically found far south of Michigan.

USDA Hardiness Zone Map

Cathey, H.M., USDA Miscellaneous Publication No. 1475.1990.



Using this field guide



The guide is organized into two major sections:

- A pictorial key based on simple characteristics such as leaf type and arrangement; and
- Species accounts, which are arranged alphabetically by scientific name.

Species accounts for each of the invasive plants described in this booklet include common and scientific names, photographs, legal restrictions where applicable, a brief description of each

plant's characteristics, habitat information, dispersal modes and the best times for survey. Common names are utilized in the index and the table of contents.

The guide also includes an introductory section with monitoring guidance. Appendices include common name–scientific name crosswalks, a summary table showing which natural communities each species has invaded to date, and best survey periods by species. Additional resources include a glossary, a listing of useful online resources, selected references and an index.

General habitat codes

Many of the species included can thrive in a broad range of water depths or moisture availability. Color coded bars on each page indicate the general habitats where a particular species might be found. The following codes are used:

- A** — **Aquatic** - lake, pond, river or stream; includes floating and submergent vegetation.
- S** — **Shoreline and shallow aquatic**; emergent vegetation and occasional fragments of species from deeper waters.
- I** — **Isolated open wetland** - shallow water or at least seasonally saturated soils; NOT immediately adjacent to open water.
- F** — **Forested wetland**.

Invasive distribution, abundance and legal status

A map indicating known distribution (as of 2010), abundance and legal status is located in the upper right-hand corner of the text portion of each species account. The map divides the state into 4 regions: Western Upper Peninsula, Eastern Upper Peninsula, Northern Lower Peninsula and Southern Lower Peninsula.



Within each region, abundance is indicated by the following colors:

-  — Not known from this region.
-  — Isolated occurrences known from this region.
-  — Local populations present in this region.
-  — The species is widespread in this region.

At the time of publication (2010) the Natural Resources and Environmental Protection Act 451 of 1994, Section 324.41301, defines 11 prohibited plant species and 5 restricted plant species. All have been included in this field guide. A **P** or **R** next to the distribution map on a species account indicates that the species is legally prohibited or restricted.

Pictorial key

The pictorial key helps users focus on likely species quickly and efficiently. Since it relies on readily observable features such as leaf type and arrangement rather than taxonomic relationships, unrelated and somewhat dissimilar species may key out to the same area. It provides a tentative identification only.

This key is designed only for the species featured in this guide. Identification should always be confirmed by the use of a technical key (several are listed in the references) or by consultation with an expert.

It is important to note that species that do not key out here are probably native, rather than invasive.



What the field guide WON'T tell you . . .

This field guide does not provide detailed information on control methods or specific herbicides. Any control efforts should reflect careful planning and consideration of all of the organisms that may be affected by changes to the community—both plant and animal. Land and water managers are responsible for obtaining any necessary licenses or permits, as well as determining that particular herbicides are registered in Michigan, and approved by their agency. Permits are required for any herbicide application in or adjacent to water bodies. For information, see DNRE's Aquatic Nuisance Control website at:

www.michigan.gov/deqinlandlakes

Water-hyacinth in the Detroit River



Robert Burns, Riverkeeper
Friends of the Detroit River

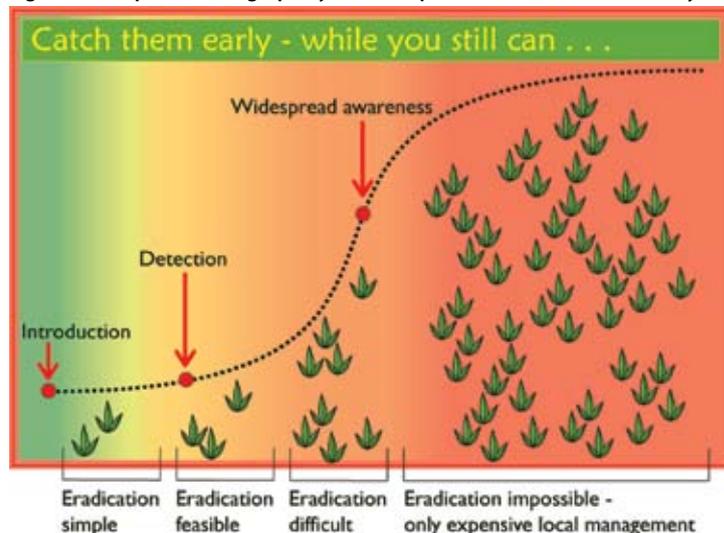
Monitoring

Why monitor?

Plant invasions begin with one or a few individuals. The initial infestation typically persists at low levels until a threshold is reached, and then it expands rapidly. The window for potential eradication or effective long-term control is, with rare exception, during the early phases of infestation. As an invasive plant species' population expands, the feasibility of its eradication or control goes down, while costs escalate.

Invasive species are usually not detected and/or treated until they are well established. Periodic monitoring for the invasive plant species that are most likely to invade a given area can increase the likelihood of their detection during the critical early stages, and increase the potential for their successful eradication or control.

Figure 1. Adapted from a graph by Ellen Jacquart, The Nature Conservancy



Monitoring efforts vary widely, ranging from a private landowner's periodic walks through his own property or volunteer lake and stream monitoring programs to formal monitoring programs carried out by professionals such as DNRE's Procedure 51. Often, monitoring for invasive plants is only a small part of a larger effort.

Developing a monitoring plan

1. Identify your area of interest.

2. Develop a target list:

Using existing records of invasive species distribution, make a list of the invasive plant species that:

- are already in your area;
- are approaching your area.

Note the habitats that they invade, their optimal survey period and learn to identify them.

3. Identify high value aquatic and wetland sites within your area of interest and prioritize them for monitoring.

4. Identify and map high risk sites:

- Map known populations of target species in or near your area of interest and update as needed.
- Identify and map potential dispersal pathways for the species that you've identified in your area.

5. Initiate a regular monitoring program in high value/high risk sites.

6. Occasionally monitor sites that appear to be at lower risk to assess whether or not your assumptions are accurate.

7. Report occurrences to local landowners/land managers and regional or national data repositories.

8. Update monitoring strategy—sites, target species, monitoring frequency—as needed in response to new information.

Identify your area of interest

Typically, monitoring programs are carried out within a defined area—whether within an administrative district or on a particular piece of private property. Site perimeters and access points such as parking lots or boat launches are important both for defining sites and also as dispersal pathways.

Whether you are monitoring one site or multiple sites, it is important to consider the context. Knowledge of the surrounding area is useful both for identifying target species for monitoring and for planning control efforts with a high likelihood of success.

Develop a target list

Once you have determined your area of interest, develop a target list of the invasive plant species that are already in your area. Because knowledge of invasive plant distribution is evolving, the maps that are included in the field guide's species accounts present a coarse scale picture. The "Online resources" section in this field guide contains several sources of additional distribution data.

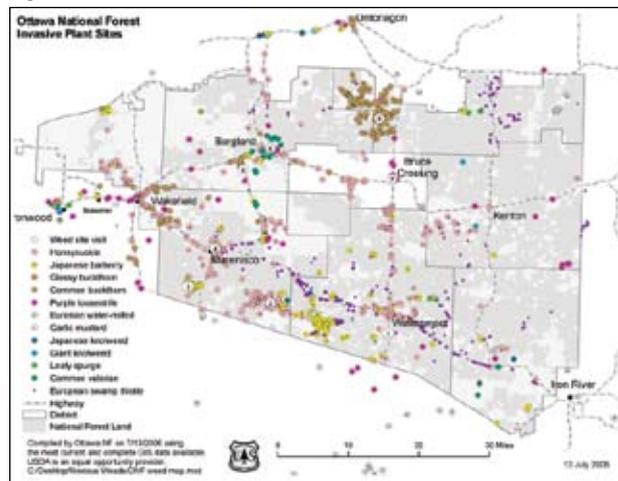
Your own observations as you drive to and from your sites are also an invaluable resource. Do you see glossy buckthorn along the forest edge? Are the ditches filled with phragmites or purple loosestrife? Is that mass of green in a neighboring lake valuable fish habitat? Or an invasive species, poised at your doorstep?

For each species on your target list, note the habitat that it invades and the best time to survey for it. Learn to identify the species on your target list, preferably through field-based training.

Identify high value aquatic and wetland sites

Identify the high value aquatic and wetland sites in your area of interest. What values are you trying to preserve? Do you value sites with high biological diversity and many conservative plant species? Do sites provide habitat for economically important game species? Rare animals? Do they provide critical nursery habitat for fish? Are the sites important for recreational boating or fishing?

Figure 2. Ottawa National Forest, Invasive Plant Sites - USDA Forest Service



Identify and map high risk sites

While ships, recreational boaters and waterfowl may transport invasive plants over long distances, in many cases, the most likely source of new invasive plant populations on your site is existing populations that are already there. A second source is populations nearby. Mapping these occurrences is critical for identifying risks to high value sites, or high value areas within your site. An incomplete picture of existing invasive populations on a site is one of the primary reasons that control efforts fail.

Mapping approaches range from the use of simple, readily accessible tools such as Google Earth to GPS based custom software. A number of invasive species mapping software programs are currently available, with varying capabilities, and many are free.

Dispersal pathways

It is also extremely useful to consider dispersal pathways when mapping areas of high risk. Dispersal paths vary considerably with the species in question and the particular habitats that they invade. Species such as garlic mustard or purple loosestrife that produce enormous quantities of seed are often spread in soils by boots or vehicles. Accordingly, they spread along paths, roadways and high traffic areas, although deer and other animals may spread small quantities into more remote areas.

Species with bird dispersed fruits, such as glossy buckthorn or

Non-native phragmites in Sleeper State Park



autumn olive, in contrast, are dispersed more randomly, across a broad front. Similarly, the seeds of Japanese stilt grass have long awns which cling to animal fur and may be dispersed throughout woodlands. For aquatic species that reproduce by fragmentation and are spread by boats, boat launches are a major vector for dispersal.

Water dispersed species may spread along shorelines, in ditches or canals and concentrate in secluded coves. Species such as water hyacinth or Carolina fanwort, that are commonly used in water gardens or aquaria, are most likely to appear initially near developed areas.

By mapping known occurrences of species on your target list, and identifying their likely dispersal pathways, you can begin to create a map of high risk sites that will provide a crucial element in a monitoring program.

Initiate a monitoring program in high value/high risk sites

Survey methods may vary depending on whether the site can be traversed on foot or if a boat is needed. On terrestrial sites, sweep surveys—that utilize a number of people to form a line and sweep an entire site—can be an effective method for detecting most invasive species on a site. Meander surveys that focus on likely dispersal pathways and habitat heterogeneity associated with the habitat requirements of target species can still capture the majority of new infestations. Parking lots, campsites and other high use areas often provide an excellent snapshot of what can be expected throughout a site.

Similarly, for aquatic sites, regularly spaced transects may cover an entire site, or survey efforts may focus on high-risk features such as boat launches, shorelines and sheltered coves. Ditches and drains that empty into water bodies can be a significant vector for the spread of species such as non-native phragmites, reed canarygrass and purple loosestrife. Survey methods should reflect both the nature of the site and the characteristics of the target species.

For many aquatic species, surveys in the littoral zone, where light can penetrate, will be adequate. Typically, these areas extend from the shore to depths of up to about 5 m (~16.5 ft), although in lakes with high water clarity, they may be deeper. Free-floating species,

such as water hyacinth or water lettuce may be found outside this area, however. Similarly, starry stonewort has been found at depths of up to 9 m (~30 ft). Survey efforts should focus on the species most likely to be present—typically those that are found nearby.

Monitoring programs may be extensive or relatively simple, depending on what resources are available. Regular monitoring over long periods of time can improve the chances of detecting invasive plant species, even with relatively simple surveys.

Detailed protocols for surveying sites are available online from many organizations including the Michigan Clean Water Corps and Maine's Volunteer Lake Monitoring Program. Links are provided in the "Online resources" of this guide.

Occasionally monitor sites that appear to be at lower risk

While pristine sites may resist invasion for long periods of time, they can eventually become invaded. Aquatic invasive plants may eventually turn up in isolated lakes with no boating access. Periodic monitoring can catch problems while they are still manageable. In addition, it can provide valuable feedback on assumptions about dispersal pathways and species' rates of spread.

Reporting

Once new invasive plant species have been identified in the region, or new populations of known invasive plants have been noted, it is critical to map their extent and report them to the local land owner, land manager or other appropriate agency.

New invasive plant species or new occurrences of known invasive species in Michigan can be reported to several different organizations, though they do not all accept information for all species.

The Michigan Invasive Species Information Network (MISIN) offers online training modules for ten common invasive plants. Observers who have passed a simple online test as part of this training can easily map and report the the location of occurrences of these species at:

<http://www.misin.msu.edu/report/>

Species can be reported by Lat/Lon coordinates, or by simply placing a marker on a Google map. Reporting capability for additional species reporting is expected to increase over time.

The Nonindigenous Aquatic Species (NAS) information resource for the United States Geological Survey is also developing rapidly. It has been established as a central repository for spatially referenced biogeographic accounts of nonindigenous aquatic species including plants, fish and other taxonomic groups throughout the United States. Species can be reported at:

<http://nas.er.usgs.gov/SightingReport.aspx>

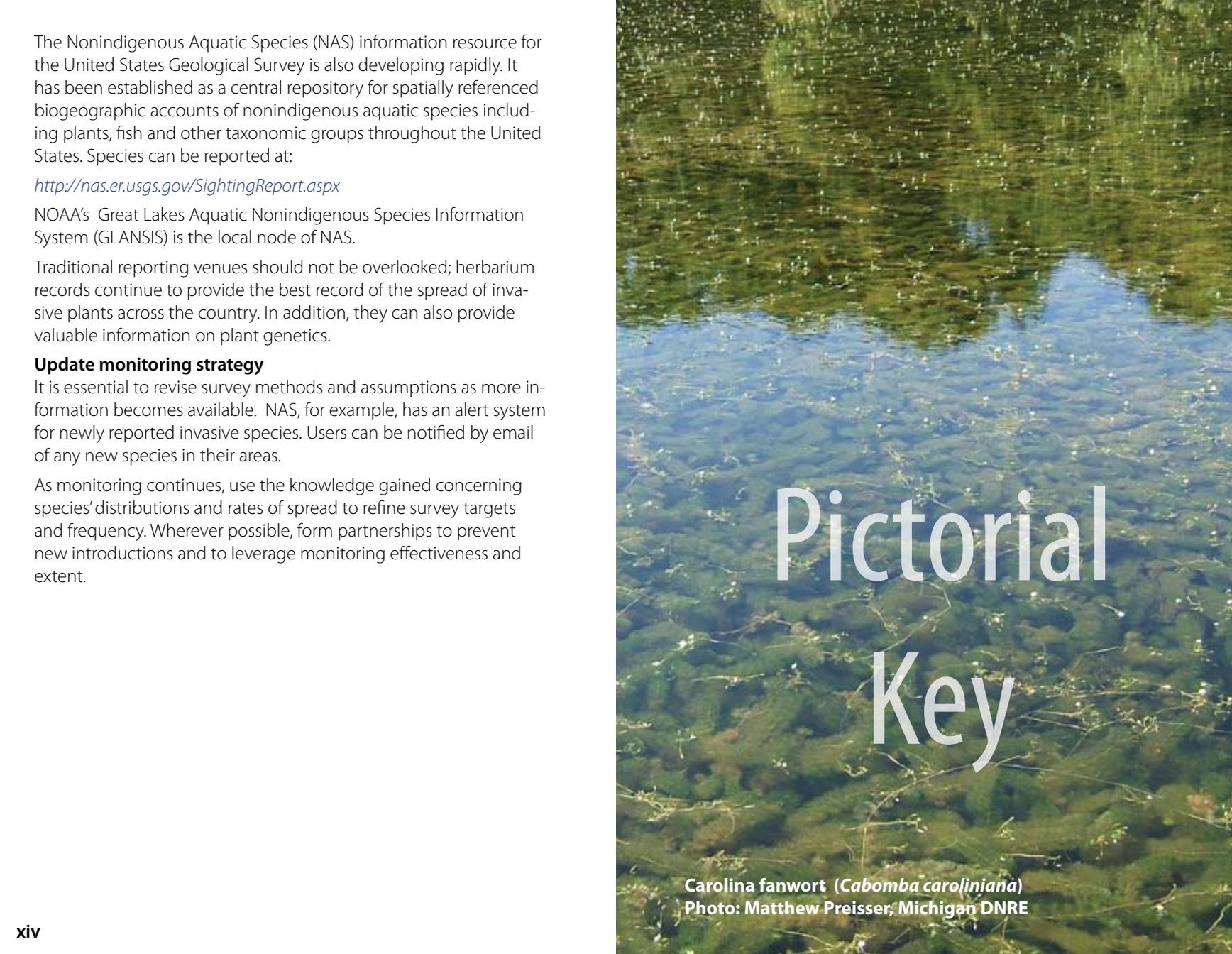
NOAA's Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS) is the local node of NAS.

Traditional reporting venues should not be overlooked; herbarium records continue to provide the best record of the spread of invasive plants across the country. In addition, they can also provide valuable information on plant genetics.

Update monitoring strategy

It is essential to revise survey methods and assumptions as more information becomes available. NAS, for example, has an alert system for newly reported invasive species. Users can be notified by email of any new species in their areas.

As monitoring continues, use the knowledge gained concerning species' distributions and rates of spread to refine survey targets and frequency. Wherever possible, form partnerships to prevent new introductions and to leverage monitoring effectiveness and extent.

An aerial photograph showing a vast expanse of water almost completely covered by a dense carpet of bright green aquatic plants, identified as Carolina fanwort. The plants are small and numerous, creating a textured, almost solid green surface that reflects the sunlight. The water is visible in small, irregular patches between the plants.

Pictorial Key

Carolina fanwort (*Cabomba caroliniana*)
Photo: Matthew Preisser, Michigan DNRE

Using the pictorial key

Plant keys provide an efficient method for narrowing down possibilities when trying to identify a particular plant. This pictorial key consists of a series of paired questions, each labeled with the same letter. It relies on simple, readily identifiable features such as leaf type and arrangement to narrow choices down to a short list of species, so that users can choose between several pictures. Once a tentative identification is obtained, the user can compare additional details in the appropriate species account. Species accounts are in alphabetical order by scientific name. Crosswalks between scientific name and common name are included in the appendices.

Some of these species are similar to common native species, particularly the aquatic species. Since this guide only covers a limited number of species, you may need to seek assistance elsewhere.

This key effectively divides the included species into three main groups:

- Floating leaf plants
- Submergent plants
- Emergent and terrestrial plants

Floating leaf plants are shown on one page. Species with submergent leaves are first divided between those with finely divided leaves and those with undivided leaves. Then, they are further divided on the basis of leaf arrangement; alternate, opposite, or whorled.

The next section of the key first addresses woody plants and then grasses before splitting the remaining species between those with basal leaves, opposite or whorled leaves and alternate-leaved species.

Because the key relies on common characteristics, rather than taxonomic relationships, very different species may key out to the same sub-group. Very large plants, for example, may appear on the same page as much smaller ones.

Any identifications that are made using this key should be considered preliminary; publications with technical keys are included in the "Selected references" section on page 85.

Keying out plants

Begin by considering two questions, each identified with the same letter. If the first question is true for the plant under consideration, drop to the line directly beneath it where you will find either directions to a specific page, or a new pair of questions to answer.

Key

- A. Does the plant have floating leaves?
..... go to page 5
- A. The plant does NOT have floating leaves.
 - B. Is the plant submergent?
 - C. Are the leaves finely divided?
..... go to page 6
 - C. The leaves are NOT finely divided.
 - D. Are the leaves opposite or alternate?
..... go to page 7
 - D. Are the leaves whorled?
..... go to page 8
 - B. The plant is NOT submergent - the plant is emergent or terrestrial.

If the question is NOT true for your plant, drop down until you reach the second question that is labeled with the same letter. Continue until you are directed to a page of photos. Of course, the key only works for species that are included in this guide.

Once you've made a tentative identification, be sure to check the species account for additional characteristics. Species accounts are in alphabetical order by scientific name.

If the plant you are examining does not appear in the key, it is most likely a similar native species. Resources such as the *Maine Field Guide to Invasive Aquatic Plants and Their Common Native Look Alikes* can be helpful in identifying beneficial native species. It is available online at:

<http://www.mainevolunteerlakemonitors.org/mciap/FieldGuide.pdf>

Key

- A. Does the plant have floating leaves?
..... go to page 5
- A. The plant does NOT have floating leaves.
 - B. Is the plant submergent?
 - C. Are the leaves finely divided?
..... go to page 6
 - C. The leaves are NOT finely divided.
 - D. Are the leaves opposite or alternate?
..... go to page 7
 - D. Are the leaves whorled?
..... go to page 8
 - B. The plant is NOT submergent - the plant is emergent or terrestrial.
 - E. Is the plant woody?
..... go to page 9
 - E. The plant is NOT woody.
 - F. Is the plant a grass?
..... go to page 10
 - F. The plant is NOT a grass.
 - G. Are all of the leaves basal - do they arise from the base?
..... go to page 11
 - G. The leaves are NOT all basal - at least some of them arise from the stem.
 - H. Does the plant have opposite or whorled leaves?
..... go to page 12
 - H. The plant does NOT have opposite or whorled leaves. Its leaves are alternate.
..... go to page 13

Floating plants

Floating leaves:

-  Pond water-starwort, p. 22
Callitriche stagnalis
-  Water hyacinth, p. 26
Eichhornia crassipes
-  European frog-bit, p. 34
Hydrocharis morsus-ranae
-  European water-clover, p. 42
Marsilea quadrifolia
-  Water lettuce, p.52
Pistia stratiotes
-  Yellow floating heart, p. 48
Nymphoides peltata
-  Giant salvinia, p. 59
Salvinia molesta
-  Water-chestnut, p. 61
Trapa natans

Submergent plants with finely divided leaves

Opposite submergent leaves (a few alternate floating):



..... Carolina fanwort, p. 21
Cabomba caroliniana

Whorled leaves:



..... Parrot feather water-milfoil, p. 44
Myriophyllum aquaticum



..... Eurasian water-milfoil, p. 45
Myriophyllum spicatum

Carolina fanwort leaves and stem



Matthew Preisser, Michigan DNRE

Submergent plants with undivided leaves

Alternate leaves:



..... African oxygen weed*, p. 38
Lagarosiphon major



..... Curly pondweed, p. 55
Potamogeton crispus

* African oxygen weed's leaves alternate in a spiral fashion and may appear whorled at first glance.

Opposite leaves:



..... Swamp stonecrop, p. 24
Crassula helmsii



..... Indian swampweed, p. 35
Hygrophila polysperma

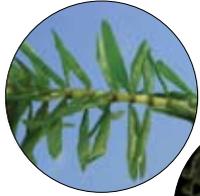


..... Brittle water-nymph, p. 46
Najas minor

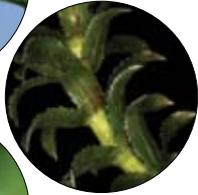
Submergent plants with undivided leaves

(continued)

Whorled leaves:



..... Brazilian water-weed, p. 25
Egeria densa



... Hydrilla, p. 33
Hydrilla verticillata



..... Starry stonewort, p. 47
Nitellopsis obtusa

Starry stonewort with star-shaped bulbils



G. Douglas Pullman, Aquest Corporation

Woody plants

Opposite or sub-opposite leaves:



..... Common buckthorn, p. 57
Rhamnus cathartica

Alternate leaves:



..... Black alder, p. 17
Alnus glutinosa



... Japanese barberry, p. 19
Berberis thunbergii



..... Autumn Olive, p. 27
Elaeagnus umbellata



... Glossy buckthorn, p. 29
Frangula alnus



..... Multiflora rose, p. 58
Rosa multiflora

Emergent and terrestrial plants

Grasses:



..... Giant reed, p. 18
Arundo donax



..... Reed mannagrass, p. 30
Glyceria maxima



..... Japanese stiltgrass, p. 43
Microstegium vimineum



..... Reed canary-grass, p. 50
Phalaris arundinacea



..... Non-native phragmites, p. 51
Phragmites australis subsp. *australis*

Emergent and terrestrial plants

(continued)

Basal leaves:



..... Flowering rush, p. 20
Butomus umbellatus



..... Yellow iris, p. 37
Iris pseudacorus



..... Fig buttercup, p. 56
Ranunculus ficaria



..... Narrow-leaved cat-tail, p. 62
Typha angustifolia

Emergent and terrestrial plants

(continued)

Opposite or whorled leaves:

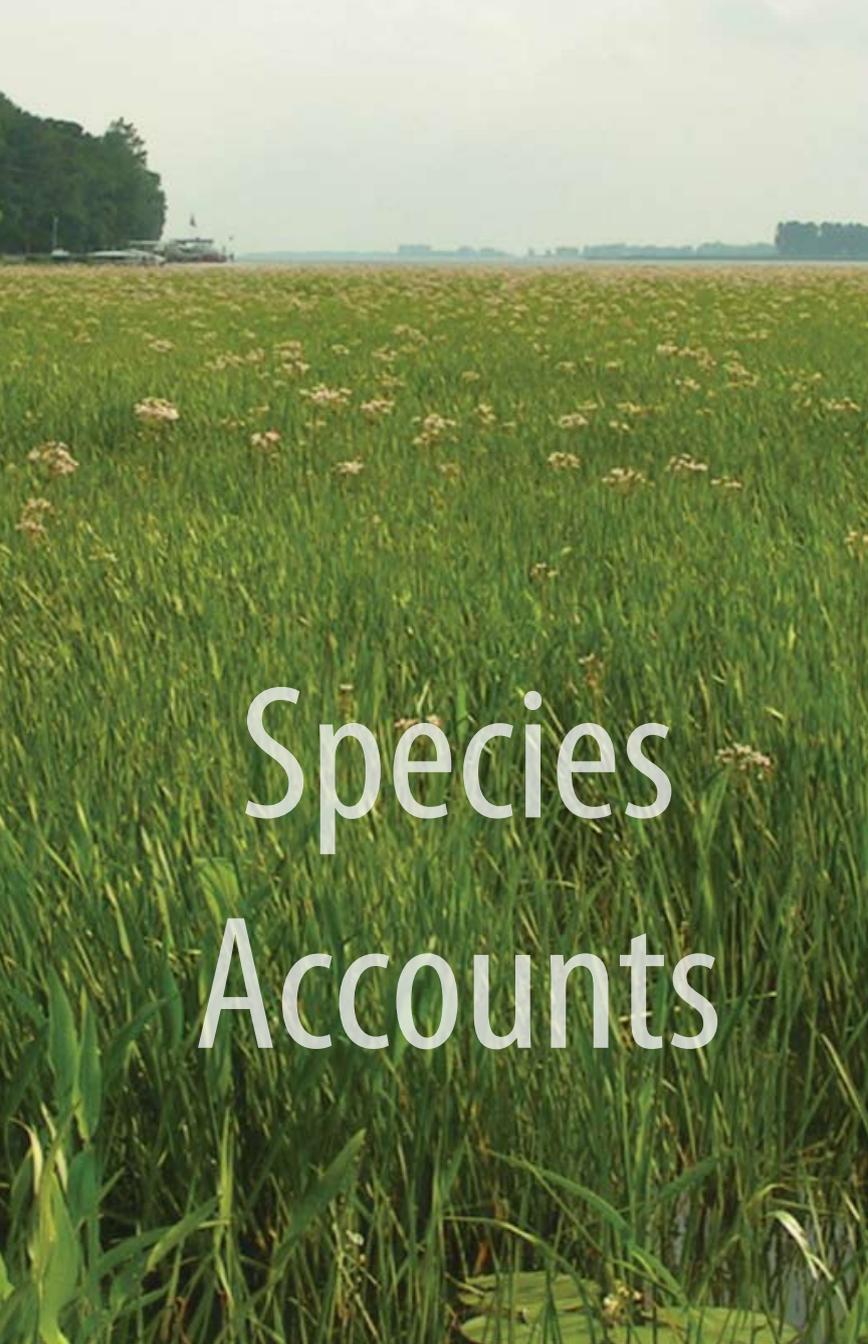
-  Swamp stonecrop, p. 24
Crassula helmsii
-  European fireweed, p. 28
Epilobium hirsutum
-  Japanese hops, 32
Humulus japonicus
-  Indian swampweed, p. 35
Hygrophila polysperma
-  Ornamental jewelweed, p. 36
Impatiens glandulifera
-  Moneywort, p. 39
Lysimachia nummularia
-  Purple loosestrife, 41
Lythrum salicaria

Emergent and terrestrial plants

(continued)

Alternate leaves:

-  Garlic mustard, p. 16
Alliaria petiolata
-  Marsh thistle, p. 23
Cirsium palustre
-  Dame's rocket, p. 31
Hesperis matronalis
-  European water-clover, p. 42
Marsilea quadrifolia
-  Wild parsnip, p. 49
Pastinaca sativa
-  Japanese knotweed, p. 53
Polygonum cuspidatum
-  Giant knotweed, p. 54
Polygonum sachalinensis
-  Climbing nightshade, p. 60
Solanum dulcamara



Species Accounts



Suzan Campbell, MNFI



Suzan Campbell, MNFI



Chris Evans, River to River CWMA,
Bugwood.org



Suzan Campbell, MNFI

Garlic mustard

Alliaria petiolata (M. Bieb.) Cavara & Grande



Description:

Herbaceous biennial, up to 1.3 m (~4 ft) in height. Stem leaves alternate, triangular with toothed margins. Small, white four-petaled flowers. Forms round basal rosette the first year, flowers the second year and dies. Fruit a long, narrow capsule with tiny dark seeds. Crushed leaves smell like garlic.

Habitat:

Forests, particularly floodplain forest, open wetlands, parking lots, campgrounds, paths, roadsides.

Mode of spread:

Produces abundant seed; spread by floodwaters, dispersed in soil on boots, vehicles, and equipment and by animals such as deer.

Survey:

Survey in spring before natives emerge or later, when in bloom. Also recognizable in fall—crushed leaves smell like garlic.



Paul Wray, Iowa State University,
Bugwood.org



Paul Wray, Iowa State University,
Bugwood.org



Paul Wray, Iowa State University,
Bugwood.org



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Black alder

Alnus glutinosa (L.) Gaertn.



Description:

Tree, often multi-stemmed with narrow crown; up to 20 m (66 ft) in height. Leaves alternate, toothed, rounded with a truncated or notched tip. Male flowers on long, narrow catkins; female flowers borne on woody, pinecone-like structure in which the seeds will develop.

Habitat:

Streambanks, floodplain forest, roadsides, forest edge.

Mode of spread:

Produces abundant seed, sometimes water-dispersed.

Survey:

Recognizable during the growing season when its blunt-tipped leaves distinguish it from relatives with similar cone-like woody catkins such as tag alder, which has pointed leaf tips.

S

I

F



David J. Moorhead, University of Georgia, Bugwood.org

James H. Miller, USDA Forest Service, Bugwood.org

Chuck Barger, University of Georgia, Bugwood.org

Chris Evans, River to River CWMA, Bugwood.org

Giant reed

Arundo donax L.



Description:

Large, clump-forming perennial grass growing from 2-8 m (6.5-26 ft) tall, with stems 1-8 cm (0.25-2 in) thick. Short distance between nodes results in crowded appearance. Leaf bases are clasp and hairy tufted. Seedhead a large panicle, up to 0.9 m (3 ft) long. Forms dense monotypic stands.

Habitat:

Invades shallow stream and river banks, marshes, other open wetlands and ditches; salt-tolerant.

Mode of spread:

Spreads by its thick, knotty rhizomes, and fragments, which may be carried by water currents; viable seed rare in North America.

Survey:

Persistent stalks should be identifiable year round; its clasp leaf bases distinguish it from similar grasses.



James H. Miller, USDA Forest Service, Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Suzan Campbell, MNFI

Suzan Campbell, MNFI

Japanese barberry

Berberis thunbergii DC.



Description:

Spiny, deciduous shrub ranging from 1-2 m (~3-6.5 ft) in height. Spoon-shaped leaves are arranged in alternate clumps. Small, yellow six-petaled flowers hang singly or in small clusters; bright red egg-shaped berries. Some cultivars have reddish or bright green leaves; invasiveness varies.

Habitat:

Occurs in woodlands, streambanks, open and forested wetlands, roadsides and old fields. Frequently establishes in forest understory.

Mode of spread:

Seeds dispersed by birds which eat its fruit; branches root at tips.

Survey:

Small, spoon-shaped leaves and spiny branches are distinctive throughout the growing season.



Suzan Campbell, MNFI



Suzan Campbell, MNFI



Suzan Campbell, MNFI



Suzan Campbell, MNFI

Flowering rush

Butomus umbellatus L.



Description:

Aquatic, rooted perennial, growing in water up to 2 m (6.5 ft) deep. Leaves triangular in cross-section, twisting slightly at the tips; arise from the base. Pinkish flowers with 3 petals and 3 petal-like sepals; arranged in an umbel. Dark brown fruit splits to expose seeds.

Habitat:

Grows along shorelines in freshwater lakes, rivers and streams.

Mode of spread:

Spreads by its floating seeds and vegetatively by rhizomes; not all populations flower although Michigan populations typically do.

Survey:

Flowering rush is most visible when in bloom in July and August. Non-blooming plants can be distinguished from *Sparganium* by their twisting leaf tips.



Troy Evans, Eastern Kentucky University, Bugwood.org



Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org



Troy Evans, Eastern Kentucky University, Bugwood.org



Matt Preisser, Michigan DNRE

Carolina fanwort

Cabomba caroliniana A. Gray



Description:

Aquatic, submergent perennial; stems may reach 2 m (6.5 ft) in length. Leaf types vary: submergent leaves opposite, palmately finely dissected; floating leaves alternate, entire, small. White flowers with 3 petals and 3 petal-like sepals; flowers emergent. Typically grows in water depths ranging from 1-3 m (3-10 ft).

Habitat:

Lakes, ponds, occasionally slow-moving rivers or streams.

Mode of spread:

Southern species, sold in aquarium trade. Germination of seed less likely in north; spreads by vegetative parts which adhere to boats and waterfowl; may also be dispersed by currents.

Survey:

Blooms in summer and fall. Can be distinguished by its opposite, finely dissected submergent leaves.



S Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Pond water-starwort

Callitriche stagnalis Scop.



Description:

Aquatic perennial with stems growing from 10-30 cm (~4-12 in). Leaves tiny, opposite, entire. Forms vary: floating leaves spatulate; submergent leaves linear. Tiny flowers in leaf axils.

Habitat:

Shallow waters of ponds, marshes or in protected areas in lakes or streams with slow-moving water.

Mode of spread:

Reproduces by seed and clonally, dispersed by boats, vehicles, and animals—the latter both by fragments and ingested seed. Not all populations flower or produce seed.

Survey:

Pond water-starwort is difficult to distinguish from other *Callitriche* species unless fruit is present; survey in late summer and fall. It can be distinguished by its fruits, which are almost round (orbicular).



Steve Garske, Great Lakes Indian Fish and
Wildlife Commission

Dan Tenaglia, www.missouriplants.com

Steve Garske, Great Lakes Indian Fish and
Wildlife Commission

Steve Garske, Great Lakes Indian Fish and
Wildlife Commission

Marsh thistle

Cirsium palustre (L.) Scop.



Description:

Herbaceous biennial growing from 0.5-1.5 m (1.6-5 ft) tall. Leaves alternate, deeply divided into pinnate segments with matted hairs and spiny teeth along margins. Stems are spiny with lengthwise wings. Densely clustered purple flower heads are 1-1.5 cm (0.4-0.6 in) across—smaller than those of other thistle species.

Habitat:

Prefers moist soils; occurs in fens, forested or partially forested wetlands, disturbed sites including roadsides and ditches.

Mode of spread:

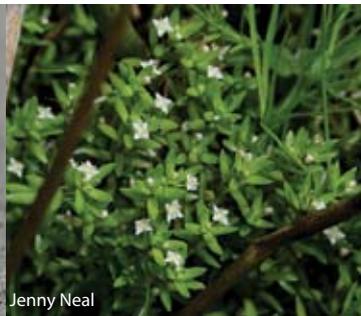
Reproduces by its wind-dispersed seeds, which may also be transported on animals.

Survey:

Best surveyed in summer and fall. In combination, its small flowers/seedheads and spiny stems distinguish it from other thistles.



Bastiaan Brak



Jenny Neal



Tim Melling



Tim Melling

Swamp stonecrop

Crassula helmsii A. Berger



Description:

Aquatic or semi-terrestrial evergreen, succulent perennial that may form a carpet at waters edge, or grow completely submerged in deeper water, where it develops elongated stems. Tiny, white, four-petaled flowers. Leaves are opposite and narrow with parallel sides.

Habitat:

Water bodies with still or slow-moving water; tolerates alkaline, acidic or slightly salty water. Grows at depths of up to 3 m (10 ft).

Mode of spread:

May be spread by tiny stem fragments; available in some areas as an oxygenating plant for water gardens and aquaria.

Survey:

Flowers from June to September; evergreen.



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



Richard Old, XID Services, Inc.,
Bugwood.org



Ann Murray, University of Florida,
Bugwood.org



William T. Haller, University of Florida,
Bugwood.org

Brazilian water-weed

Egeria densa Planch.



Description:

Aquatic, submergent, rooted perennial with stems ranging from 0.3-0.6 m (1-2 ft); occasionally to 6 m (20 ft). White, three-petaled flowers are 3 cm (0.75 in) across; petals much larger than sepals. Held above the water on slender stems. Leaves oblong or broadly linear, in whorls of 4-6. Stems may be simple or branched.

Habitat:

Brazilian water-weed grows in still or slow-moving waters, including ponds, lakes, rivers and streams. Reported but unconfirmed in MI.

Mode of spread:

Popular aquarium plant; reproduces by fragments, which are dispersed by waterfowl and boats.

Survey:

Most easily surveyed in summer and fall, when its flowers, which distinguish it from *Elodea* and *Hydrilla*, are present.

P ?



Suzan Campbell, MNFI

Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



John D. Byrd, Mississippi State University,
Bugwood.org

Suzan Campbell, MNFI

Common water-hyacinth

Eichhornia crassipes (Mart.) Solms



Description:

Aquatic, free-floating perennial. Leaves thick and waxy; leaf stems are spongy with inflated air bladders. Flowers showy, lavender-blue six-petaled with a violet blotch and yellow center on one petal; arranged in a short panicle. Fruit a many seeded capsule. Can rise almost 1 m (~3 ft) above the water's surface.

Habitat:

Common water garden plant; grows in lakes, ponds, streams, and rivers. Survives mild winters in SE MI; not considered winter-hardy.

Mode of spread:

Popular water garden plant. Reproduces by seed, stolons, and fragments. Dispersed by boats and water currents.

Survey:

Water-hyacinth leaves and inflated petioles are distinctive throughout the growing season; flowers July-August.



Suzan Campbell, MNFI

Suzan Campbell, MNFI



Suzan Campbell, MNFI

Suzan Campbell, MNFI

Autumn olive

Elaeagnus umbellata Thunb.



Description:

Deciduous shrub or small tree reaching up to 6 m (20 ft) in height and 9 m (30 ft) in width. Simple, alternate leaves are gray-green above and silvery-scaly below; twigs and bark with brownish scales. Fragrant, tubular four-petaled cream or yellow flowers. Fruit a speckled red drupe.

Habitat:

Autumn olive tolerates a variety of soils, occurring in fens, tamarack swamps, open woods, forest edges, old fields, roadsides, fence rows, meadows, dunes and disturbed areas.

Mode of spread:

Seed dispersed by birds, which eat its abundant fruits.

Survey:

Autumn olive can be distinguished year round by its scaly leaves and twigs.



Suzan Campbell, MNFI



Richard Old, XID Services, Inc.
Bugwood.org



Suzan Campbell, MNFI



Suzan Campbell, MNFI

European fireweed

Epilobium hirsutum L.



Description:

Herbaceous perennial, with coarse, spreading rhizomes and erect, fuzzy leaves and stems; grows from 0.5-2 m (1.6-6.5 ft) in height. Numerous flowers with four-cleft stigma and four notched pink, purple or white petals; 3 cm (0.75 in) across. Leaves mostly opposite, hairy, lanceolate and slightly clasping. Fruit a linear, elongate capsule, splitting to reveal seeds with tufts of fine hairs.

Habitat:

Occurs in wet soils, in open wetland to semi-aquatic settings; grows in meadow, marsh, and edges of lakes, ponds, streams, and rivers.

Mode of spread:

Spreads primarily by rhizomes although it also reproduces by wind-dispersed seed.

Survey:

Most readily surveyed from July-September while in bloom.



Suzan Campbell, MNFI



Suzan Campbell, MNFI



Steve Manning, Invasive Plant Control,
Bugwood.org



Suzan Campbell, MNFI

Glossy buckthorn

Frangula alnus Mill. (*Rhamnus frangula* L.)



Description:

Deciduous shrub or multi-stemmed small tree reaching 6 m (20 ft) in height. Shiny, dark green, entire leaves are simple, mostly alternate, oblong, 2.5-6 cm (1-2.4 in) long. Leaf veins curve as they approach leaf margins. Five-petaled, small greenish-white flowers. Abundant pea-sized fruits ripen from red to blackish dark purple. Bark with prominent lenticels.

Habitat:

Fens, open and forested wetlands, woodland edges, roadsides and paths.

Mode of spread:

Widely planted as a hedge; spreads via its bird-dispersed fruits.

Survey:

Recognizable in early spring and late fall as it leafs out before natives; also recognizable in fruit from July through September.



S Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

S Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



I F Robert Vidéki, Doronicum Kft.,
Bugwood.org

I F Robert Vidéki, Doronicum Kft.,
Bugwood.org

Reed mannagrass

Glyceria maxima (Hartm.) Holmb.



Description:

Herbaceous, semi-aquatic perennial grass that grows to 2.5 m (8 ft) with spreading rhizomes. Inflorescence an open panicle, 15-30 cm (6-12 in) long. Leaf margins and inflorescence branches have short stiff hairs that are rough to the touch.

Habitat:

Occurs in open wetlands including marsh, meadow and shrub-carr, tolerate light shade.

Mode of spread:

Reduced primarily vegetatively by rhizomes; also by seed although little seed appears to be produced.

Survey:

Best surveyed from late June through August when in flower. Can be distinguished from similar natives by its height as it grows up to 2.5 m (8 ft) tall.



Mark Frey, The Presidio Trust ,
Bugwood.org



Richard Old, XID Services, Inc.,
Bugwood.org



Mark Frey, The Presidio Trust ,
Bugwood.org



Richard Old, XID Services, Inc.,
Bugwood.org

Dame's rocket

Hesperis matronalis L.



Description:

Showy biennial or short-lived perennial growing up to 1 m (~3 ft) tall. Leaves simple, alternate, downy, with toothed margins, becoming smaller higher on the stem. Pink, purple or white four-petaled flowers in terminal cluster. Fruits are long, narrow capsules with abundant tiny seeds.

Habitat:

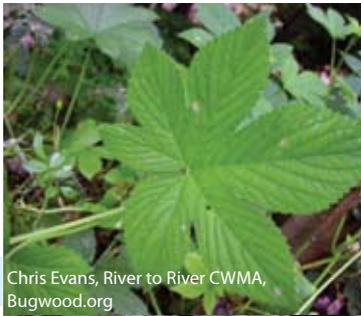
Roadsides, woodlands, floodplains, wetlands, old fields and other disturbed areas. Tolerates light shade and alkaline soils.

Mode of spread:

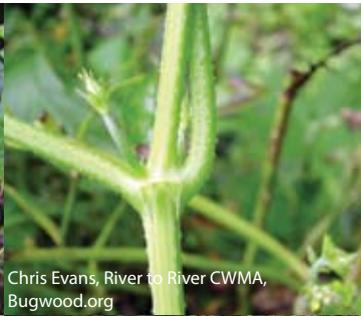
Commonly planted; spreads by seed; up to 20,000 seeds per plant.

Survey:

Dame's rocket is easiest to identify by its four-petaled flowers in May and June but can also be identified by its foliage and long, narrow seed capsules. Similar Phlox species have five petals.



S Chris Evans, River to River CWMA, Bugwood.org



Chris Evans, River to River CWMA, Bugwood.org



I Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



F Chris Evans, River to River CWMA, Bugwood.org

Japanese hops

Humulus japonicus Siebold & Zucc.



Description:

Annual vine that grows from 0.5-2.5 m (1.5-8 ft) in length. Individual plants have separate male and female flowers, which bloom in summer. Its opposite leaves are toothed and palmately lobed with v-shaped sinuses and cordate bases. Leaf petioles may be longer than the leaves. Stems and leaves are very rough, with hooked hairs that aid in twining.

Habitat:

Occurs on open disturbed sites, including roadsides, old fields, and river and streambanks.

Mode of spread:

Reproduces by seed; dispersed by wind and moving water.

Survey:

Best surveyed in summer and fall, but can be recognized by its distinctive leaves and long petioles throughout the growing season.



Chris Evans, River to River CWMA, Bugwood.org



Turions

A Tim Murphy, University of Georgia, Bugwood.org



S Robert Vidéki, Doronicum Kft., Bugwood.org



Chris Evans, River to River CWMA, Bugwood.org

Hydrilla

Hydrilla verticillata (L. f.) Royle



Description:

Aquatic, submergent perennial, at depths of up to 6 m (20 ft); forms dense mats. Upper leaves in whorls of 4-8; finely serrate margins. Leaf midribs are reddish and may have raised teeth or glands on the underside in dioecious populations. Monoecious form less robust.

Habitat:

Occurs in slow-moving water of lakes, ponds, streams and rivers; tolerates a wide range of water quality.

Mode of spread:

Spread vegetatively, by fragments and tubers (turions); dispersed by waterfowl and boats.

Survey:

Survey in late spring, summer or fall. Its whorls of 4-8 leaves per node on the upper stem distinguish it from native *Elodea* spp., which have 3 leaves per whorl and no teeth on their margins.

P



Katie Bonjour, Huron-Clinton MetroParks



Todd Losee, Michigan Department of Environmental Quality



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Suzan Campbell, MNFI

European frog-bit

Hydrocharis morsus-ranae L.



Description:

Aquatic, floating, herbaceous annual reaches 20 cm (8 in) in length, with strong, cord-like stolons. Forms large colonies, creating dense mats. Kidney-shaped leaves resemble tiny water lilies, 1-6 cm (0.5-2.25 in) across. White, three-petaled flowers with yellow at base; bloom mid-summer.

Habitat:

Grows in open, still waters; found in lakes, ponds, ditches and along the sheltered edges of streams and rivers.

Mode of spread:

Reproduces by vegetative buds (turions), limited seed production. Spreads rapidly by stolons; dispersed by boats, water.

Survey:

Best surveyed in summer and fall; its tiny water lily-type leaves are distinctive throughout the growing season.



Ann Murray, ©1999 University of Florida Center for Aquatic and Invasive Plants



Ann Murray, ©1999 University of Florida Center for Aquatic and Invasive Plants



Ann Murray, ©1999 University of Florida Center for Aquatic and Invasive Plants



Ann Murray, ©1999 University of Florida Center for Aquatic and Invasive Plants

Indian swampweed

Hygrophila polysperma (Roxb.) T. Anderson



Description:

Herbaceous perennial, rooted, primarily aquatic. Rare terrestrial form in moist soils. Square stems reach almost 2 m in length. Leaves opposite, sparsely hairy, elliptic to oblong, up to 6 cm (1.5 in) long and 2 cm (0.5 in) wide; emergent leaves smaller, narrower.

Habitat:

Occurs in lakes, streams and rivers, still and moving water, up to 3 m (10 ft) in depth. Grows from bottom to water surface.

Mode of spread:

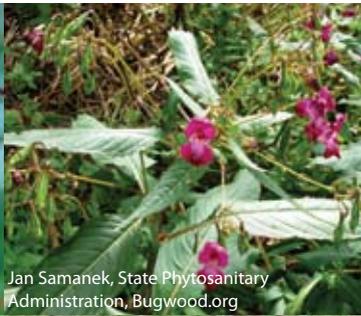
Introduced through aquarium trade; reproduces vegetatively, by small stem and leaf fragments, possibly by seed; spread by mechanical harvesters, boats and water currents.

Survey:

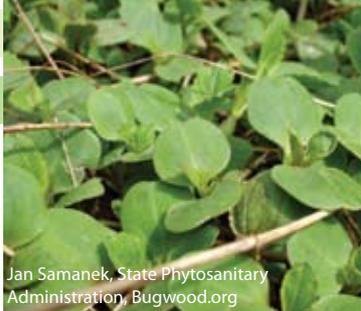
In the southern states, it grows throughout the year; unknown in northern climates. Square stems may aid identification.



S Barbara Tokarska-Guzik, University of Silesia, Bugwood.org



Jan Samanek, State Phytosanitary Administration, Bugwood.org



I F Jan Samanek, State Phytosanitary Administration, Bugwood.org



Michael Shephard, USDA Forest Service, Bugwood.org

Ornamental jewelweed *Impatiens glandulifera* Royle



Description:

Herbaceous annual, reaching 2 m (6.5 ft) in height. Lanceolate leaves mostly opposite or whorled with serrate margins. Glandular leaves mostly opposite or whorled with serrate margins. Glandular leaves mostly opposite or whorled with serrate margins. Irregular flowers may be purple, magenta, pink, blue, or even white. Stems six-sided in cross-section.

Habitat:

Grows in moist habitats including stream and riverbanks, ditches, meadows, swamps and floodplain forest.

Mode of spread:

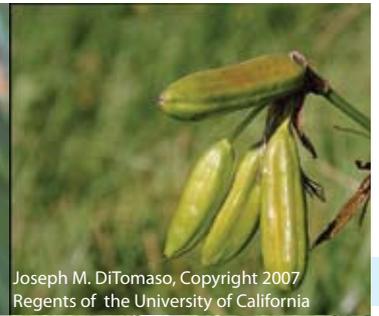
Reproduces by abundant, explosive seed, which also spreads in water.

Survey:

Survey in summer and fall; blooms in summer. Can also be distinguished vegetatively from native jewelweeds, which have alternate leaves.



Nancy Loewenstein, Auburn University, Bugwood.org



S I F Joseph M. DiTomaso, Copyright 2007 Regents of the University of California



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Yellow iris

Iris pseudacorus L.



Description:

Herbaceous perennial, ranging from 0.5-1 m (1.5-3 ft) in height. Leaves swordlike, stiff and erect. Yellow flowers with three downward-spreading petal-like sepals and three upward-pointing petals. Sepals often with irregular dark markings. Fruit a six-angled capsule that splits to release chunky brown seeds.

Habitat:

Occurs along the edges of lakes, ponds, rivers, streams and floodplain forest; grows in water depths of up to 25 cm (10 in).

Mode of spread:

Reproduces by floating seed, vegetatively by rhizomes; dispersed by water and gardeners.

Survey:

Survey in May-June while in bloom. Its six-angled capsule distinguishes it from blue flag (three-angled capsule) later in the season.



David Fenwick, www.a-p-h-o-t-o.com

David Fenwick, www.a-p-h-o-t-o.com



Michael Shephard, USDA Forest Service, Bugwood.org

Michael Shephard, USDA Forest Service, Bugwood.org

African oxygen weed

Lagarosiphon major (Ridley) Moss



Description:

Aquatic, perennial, submerged, growing in depths of up to 6 m (20 ft). Forms dense, floating mats. Narrow curling leaves with tapering tips spiral densely. Sparsely branched stems. Tiny, three-petaled clear-white flowers. Attaches to substrate with numerous fine roots that arise from the stems, and stolons.

Habitat:

Inhabits freshwater lakes and slow-moving streams. Prefers cool waters, high light levels. Tolerates high or low nutrient conditions, high alkalinity and low CO₂ levels.

Mode of spread:

Aquarium plant; reproduces vegetatively; spread by water currents and boats. Only female plants known outside of native range.

Survey:

Its alternate leaves gradually curl through the season.



Richard Old, XID Services, Inc., Bugwood.org

Richard Old, XID Services, Inc., Bugwood.org



Richard Old, XID Services, Inc., Bugwood.org

Suzan Campbell, MNFI

Moneywort

Lysimachia nummularia L.



Description:

Herbaceous, creeping perennial, stems reaching 60 cm (1.3 ft). Forms dense low mats ranging from 5-10 cm (2- in) in height. Leaves opposite, rounded. Yellow flowers with five petals (occasionally six) that unite at their bases; arise singly in leaf axils. Often does not flower. Fruit a small capsule.

Habitat:

Grows in open wetlands, floodplain forest, wet meadows, and along lakes, ponds, rivers and streams.

Mode of spread:

Spreads vegetatively by stems, unknown mechanism for dispersing over longer distances; fragments may be dispersed by water.

Survey:

Blooms from June-August if it produces flowers; rounded leaves and creeping habitat distinctive throughout growing season.



Richard Old, XID Services, Inc., Bugwood.org



Gil Wojciech, Polish Forest Research Institute, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Garden yellow loosestrife

Lysimachia vulgaris L.



Description:

Herbaceous perennial reaching 1 m (3.25 ft) in height; with long rhizomes that can extend 10 m (33 ft). Leaves whorled or opposite, lanceolate with hairs and small glands below. Yellow five-petaled flowers held in a terminal panicle. Calyx lobes with red margins. Fruit a small capsule.

Habitat:

Grows in moist soils including wet meadows, fens, floodplain forest, stream and riverbanks, and along the edges of lakes and ponds.

Mode of spread:

Reproduces by seed and by spreading rhizomes; seed may be water-dispersed.

Survey:

Survey in summer; blooms June-September; can be distinguished from related natives by its red-margined calyx.



Joseph M. DiTomaso, University of California-Davis, Bugwood.org



Theodore Webster, USDA Agricultural Research Service, Bugwood.org



Joseph M. DiTomaso, University of California-Davis, Bugwood.org



Suzan Campbell, MNFI

Purple loosestrife

Lythrum salicaria L.



Description:

Herbaceous wetland perennial that grows from 0.5-1.5 m (1.6-5 ft) in height. Lanceolate leaves opposite or in whorls of three, interspersed with leafy bracts. Reddish-purple flowers with five to seven petals are held in dense terminal cluster.

Habitat:

Occurs in moist soils, in wet meadows and prairies, shallow marsh, ditches, waste areas and along lakes, ponds, streams and rivers.

Mode of spread:

Reproduces through prolific seed production; dispersed by water, waterfowl or in soil carried by humans, vehicles.

Survey:

Survey while in bloom from July through September. Native winged loosestrife (*L. alatum*) has single flowers in leaf axils; can be distinguished from other similar natives by its 5-7 petaled flowers.

R



S Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Chris Evans, River to River CWMA,
Bugwood.org



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Chris Evans, River to River CWMA,
Bugwood.org

European water-clover

Marsilea quadrifolia L.



Description:

Aquatic, rooted fern that grows at depths of up to 30 cm (1 ft); forms monotypic stands. Roots at and between the nodes. Leaves on long petioles, resemble those of four-leafed clover; may be floating or emergent.

Habitat:

Still or slow-moving waters in ponds, lakes, rivers, streams, ditches.

Mode of spread:

Reproduces vegetatively and by its sporocarps which may be dispersed by waterfowl and other animals; available as a water garden and aquarium plant.

Survey:

Best surveyed in summer and fall.



Chuck Barger, University of Georgia,
Bugwood.org

Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



Nancy Loewenstein, Auburn University,
Bugwood.org

Chris Evans, River to River CWMA,
Bugwood.org

Japanese stilt grass

Microstegium vimineum (Trin.) A. Camus



Description:

Annual, grass, reaching 1 m (3.25 ft) in length. Lies on ground and roots at nodes along stems; upright branches look like individual plants. Leaves alternate, lanceolate, slightly pubescent, 5-8 cm (1.25-2 in) long, with a silvery line along the center of the blade.

Habitat:

Shade tolerant/does not tolerate full sun or standing water; stream and riverbanks, moist forest, roadsides, ditches on moist soils.

Mode of spread:

Spreads by abundant seed which attaches to animals, clothing; appears to be dispersed by deer. Seed persists in the seed bank for a long time.

Survey:

Monitor shady paths, roadsides, moist sites in fall; fruits from late September through early October.



Richard Old, XID Services, Inc., Bugwood.org

Nancy Loewenstein, Auburn University, Bugwood.org



Alison Fox, University of Florida, Bugwood.org

Alison Fox, University of Florida, Bugwood.org

Parrot feather water-milfoil

Myriophyllum aquaticum (Vell.) Verdc.



Description:

Herbaceous, aquatic perennial that can grow from 2-5 m (6.5-16.5 ft) in length, may emerge 30 cm (1 ft) out of the water; forms monotypic stands. Stout, bluish-green stems. Leaves densely whorled, pinnately divided. Submerged leaves with 10-18 segments on each side, 2-5 cm (0.5-1.25 in) long. Only female plants in the US.

Habitat:

Lakes, ponds, slow streams and mudflats, where the emergent form is found. Tolerates water level fluctuations and thrives in high nutrient sites. Reported but unconfirmed in MI.

Mode of spread:

Fragments dispersed by boats and currents; all US plants appear to be female; common water garden and aquarium plant.

Survey:

Best surveyed in summer and fall.



Richard Old, XID Services, Inc., Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Alison Fox, University of Florida, Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Eurasian water-milfoil

Myriophyllum spicatum L.



Description:

Submergent, aquatic perennial, reaches 1-3.5 m (3-10 ft) or more in length; forms dense mats. Stems green, brown or pinkish white. Olive green leaves whorled, pinnately divided with 12-20 fine segments on each side. Leaves lie parallel with water surface. Male and female flowers on the same inflorescence.

Habitat:

Ponds, lakes and low-energy zones in rivers and streams, in depths of 1-3.5 m (3-12 ft).

Mode of spread:

Vegetatively by fragmentation and runners; seed viable but not an important mechanism; dispersed by boats and currents.

Survey:

Can be distinguished through the growing season by the 12-20 leaflets on each side of its compound leaves, hybrid forms may vary.



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Troy Evans, Eastern Kentucky University,
Bugwood.org

Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Brittle water-nymph

Najas minor All.



Description:

Herbaceous, rooted, aquatic annual; brittle. Forms dense, bushy stands. Stems reach 1.2 m (4 ft) in length. Dark green, opposite, leaves are about 3.5 cm (1 in) long and very narrow with 7-15 teeth on each side, and distinctive serrate basal lobes.

Habitat:

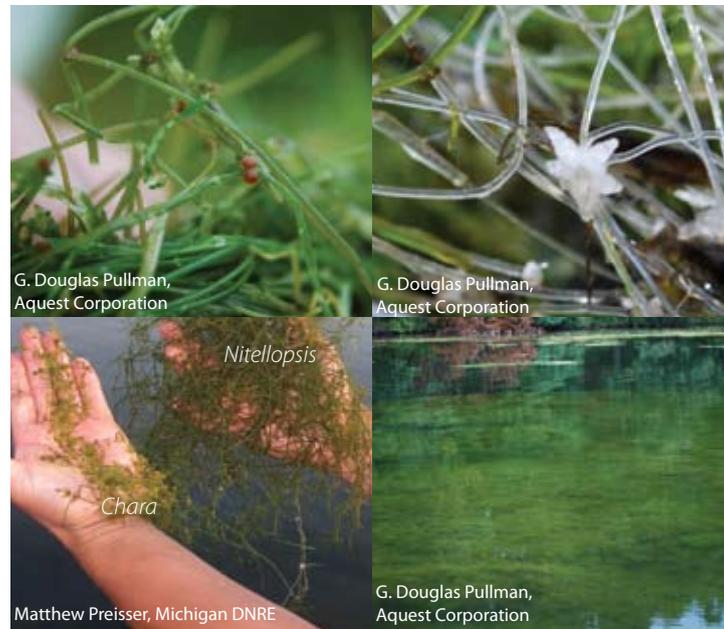
Ponds, lakes and slow-moving waters; in depths up to 4.5 m (15 ft).

Mode of spread:

Reproduces by abundant seeds which are eaten by waterfowl; fragments dispersed by boats and currents.

Survey:

Best surveyed in summer and fall. Brittle water-nymph's opposite leaves distinguish it from coontail, which has whorled leaves; its spiny leaf margins and basal lobes, which are visible without a hand lens, distinguish it from native *Najas* species.



G. Douglas Pullman,
Aquest Corporation

G. Douglas Pullman,
Aquest Corporation

Matthew Preisser, Michigan DNRE

G. Douglas Pullman,
Aquest Corporation

Starry stonewort

Nitellopsis obtusa (Desvaux in Loiseleur) J. Groves



Description:

Aquatic macroalga with smooth, irregular branches, rootlike rhizoids. Forms dense mats that cover lake bottoms. Stems may reach 80 cm (33 in) in length. Whorls of 5-8 fine, uneven-length branches arise at an acute angle from nodes. Contents can be squeezed out of tube-like cell wall when cut. Distinctive star-like bulbils; dark reddish gametangia.

Habitat:

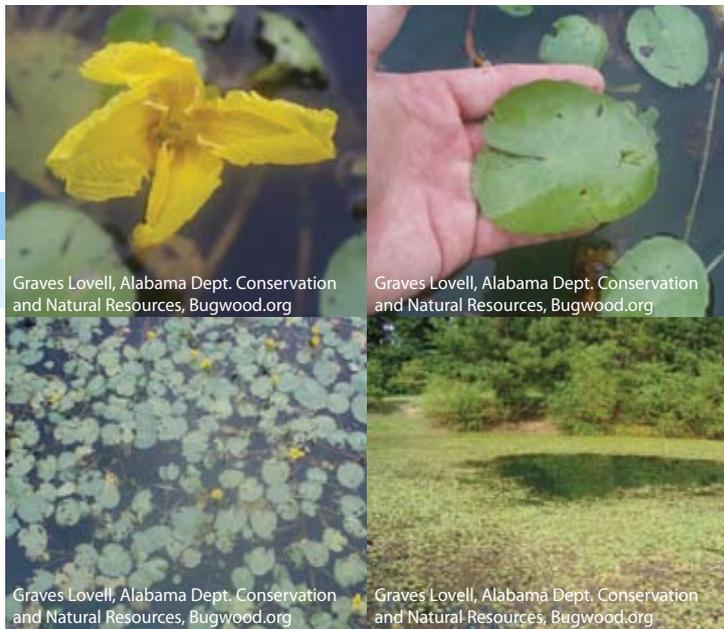
Still or slow-moving waters; grows at depths ranging from 1m (39 in) to 30 m (~93 ft).

Mode of spread:

Probably introduced in ballast water. Dispersed by boats, waterfowl.

Survey:

Survey in fall, as it appears in July and increases through October. Feels gelatinous, unlike *Chara*, which feels brittle and scaly.



Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org

Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org

Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org

Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org

Yellow floating heart

Nymphaoides peltata (S.G. Gmel.) Kuntze



Description:

Aquatic, rooted perennial with floating leaves. Forms dense patches; grows at depths of up to 1 m (3.25 ft). Leaves heart-shaped to almost round; 3-10 cm (0.75-4 in) long; opposite, arising on long stalks from underwater rhizomes. Yellow four-petaled flowers with fringed margins; held above the water. Fruit a capsule.

Habitat:

Lakes, ponds, slow-moving rivers and streams; grows at depths of up to 4 m (13 ft); can also survive on mudflats.

Mode of spread:

Water garden plant. Reproduces by its floating seed; vegetatively by plant fragments; dispersed by waterfowl.

Survey:

Best surveyed in summer and fall when in bloom. Its showy fringed yellow flower petals distinguish it from native water lilies.



Suzan Campbell, MNFI

Suzan Campbell, MNFI

Suzan Campbell, MNFI

Suzan Campbell, MNFI

Wild parsnip

Pastinaca sativa L.



Description:

Herbaceous biennial reaching 1.5 m (5 ft) in height; long, thick taproot. Stems thick, hairy and grooved. Leaves alternate, coarse, pinnately compound, forming a basal rosette during the first year. Numerous small, yellow, five-petaled flowers found in flat terminal umbels up to 15 cm (6 in) wide.

Habitat:

Open habitats including prairies, savannas, fens, roadsides, paths and disturbed areas.

Mode of spread:

By seed; may be carried in soil by boots, maintenance equipment.

Survey:

Blooms in June and July; its yellow flowers distinguish it from similar large natives. With experience, it can be distinguished by its coarse, pinnately compound leaves and basal rosette.



Chris Evans, River to River CWMA, Bugwood.org

Richard Old, XID Services, Inc., Bugwood.org



Jamie Nielsen, University of Alaska Fairbanks, Cooperative Extension Service, Bugwood.org

Jamie Nielsen, University of Alaska Fairbanks, Cooperative Extension Service, Bugwood.org

Reed canary-grass

Phalaris arundinacea L.



Description:

Cool-season, colonial, perennial grass ranging from 0.7-2.4 m (2.5-8 ft) tall. Forms dense stands with thick, fibrous rhizomes. Flat, rough leaf blades; 1.9-2.6 cm (0.75-1 in) wide and up to 45 cm (1.5 ft) long; prominent transparent ligule. Stems bluish green. Inflorescence a panicle that opens in spring for pollination and then closes tightly. Native and non-native ecotypes are likely present in Michigan but are difficult to distinguish morphologically.

Habitat:

Wetlands, lake, stream and pond banks, wet meadows and ditches.

Mode of spread:

Primarily by dense, mat-forming rhizomes, also by seed, which is dispersed by water, animals humans and machinery.

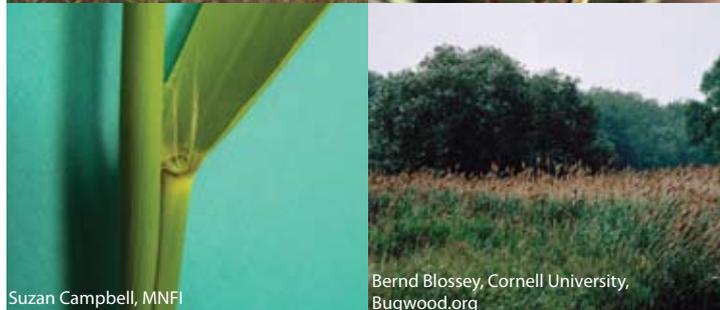
Survey:

Most recognizable in spring, when its panicle opens during pollination.



Jill M. Swearingen, USDI National Park Service, Bugwood.org

Ohio State Weed Lab Archive, The Ohio State University, Bugwood.org



Suzan Campbell, MNFI

Bernd Blossey, Cornell University, Bugwood.org

Non-native phragmites

Phragmites australis subsp. *australis* (Cav.) Steud.-Reed



Description:

Stout, colonial, perennial grass ranging in height from 1.8-3.9 m (6-13 ft). Inflorescence a dense branched cluster on bearded axis at the end of each stem; becoming open and feathery at maturity. Stems dull yellowish; usually covered by the leaf sheath.

Habitat:

Wetlands, stream, river and lake shores, ditches and depressions; tolerates high levels of road salt and nutrients.

Mode of spread:

Reproduces by its spreading rhizomes, fragmentation and seed.

Survey:

Recognizable with experience year-round. Can be distinguished from the native by its lower stems, which are usually covered by the leaf sheath; the lower stems of the native subspecies are usually exposed, shiny and often reddish.



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Karen Brown, University of Florida,
Bugwood.org

USDA APHIS PPO Archive: USDA
APHIS PPO, Bugwood.org

Water lettuce

Pistia stratiotes L.



Description:

Aquatic, free-floating perennial that forms a rosette; feathery roots extend up to 80 cm (32 in) below the water surface. Dull light green leaves are thick and ridged, with short velvety hairs. Inconspicuous flowers on stalk in center of rosette; cluster of male flowers above and single female flower below. Fruit a green berry.

Habitat:

Ponds, lakes, ditches, slow-moving or still water; has been reported in Michigan but not considered winter-hardy.

Mode of spread:

Reproduces vegetatively or by seed; daughter plants form on stolons. Introduced via water gardens; spread by boats, trailers.

Survey:

Best surveyed in summer and fall, can be identified throughout the growing season.



Suzan Campbell, MNFI

Jil M. Swearingen, USDI National Park
Service, Bugwood.org

Suzan Campbell, MNFI

Suzan Campbell, MNFI

Japanese knotweed

Polygonum cuspidatum Siebold & Zucc.
(*Fallopia japonica* (Houtt.) Ronse Decr.)



Description:

Shrub-like herbaceous perennial up to 3 m (10 ft) in height; dies back but bamboo-like stalks persistent. Alternate leaves up to 15 cm (6 in) long with a flat base. Numerous, small, green-white flowers on a slender stalk in leaf axils and near the ends of stems.

Habitat:

Roadsides, stream and riverbanks, wetlands, wet depressions and woodland edges; thrives in full sun but may persist in shade.

Mode of spread:

Reproduces vegetatively or by fragments; forms fertile hybrids with giant knotweed (*P. sachalinense*).

Survey:

Survey in August-September, when in bloom. Its flat leaf bases distinguish it from *P. sachalinense*, which has cordate leaf bases.

P



Richard Old, XID Services, Inc., Bugwood.org

Richard Old, XID Services, Inc., Bugwood.org



Jan Samanek, State Phytosanitary Administration, Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Giant knotweed

Polygonum sachalinense Siebold & Zucc.

(*Fallopia sachalinensis* (F. Schmidt ex Maxim.) Ronse Decr.)



Description:

Shrub-like herbaceous perennial growing up to 4 m (12 ft) each year before dying back to the ground; dead bamboo-like stalks persistent.

Habitat:

Roadsides, stream and river banks, wet depressions and woodland edges; shade intolerant.

Mode of spread:

Spreads through rhizomes, also by plant fragments that are transported by water or in fill; contributes pollen to related invasive species to produce viable seed.

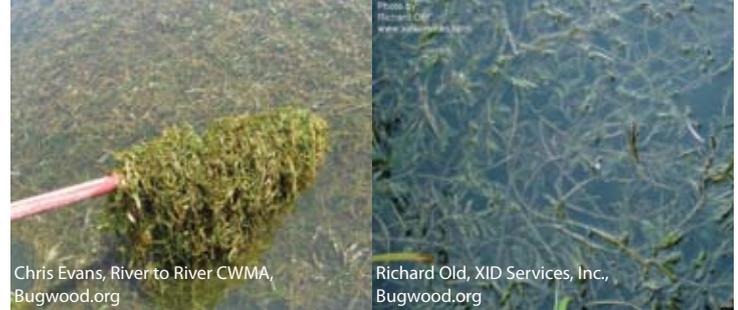
Survey:

Survey in August-September, while in bloom. Its cordate leaf bases distinguish it from *P. cuspidatum*, which has flat leaf bases.



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Chris Evans, River to River CWMA, Bugwood.org

Richard Old, XID Services, Inc., Bugwood.org

Curly pondweed

Potamogeton crispus L.



Description:

Submergent, aquatic perennial; ranges from 30-80 cm (1-2.5 ft) in length; forms dense mats. Leaves alternate, oblong, up to 9 cm (3.5 in) long and 10 cm (4 in) wide, wavy leaf margins with fine teeth. Flowers found on dense cylindrical spikes that rise above the water.

Habitat:

Grows in shallow to deep waters of lakes and rivers; pollution-tolerant; prefers alkaline, nutrient-rich waters.

Mode of spread:

Reproduces by vegetative buds (turions), fragmentation; carried by water, boats. No seed germination has been observed.

Survey:

Survey in spring or early summer as plants decay after fruits and turions are produced; can be distinguished from other pondweeds by its curly, finely toothed leaf margins.



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org



Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org

Fig buttercup

Ranunculus ficaria L.



Description:

Herbaceous ephemeral perennial growing from tuberous roots; 10-30 cm (4-12 in) tall; may form a continuous carpet. Emerges well before native ephemerals. Kidney or heart-shaped leaves in a basal rosette. Yellow flowers usually have eight petals, may have up to twelve. Cream bulblets produced in stem axils.

Habitat:

Floodplain forest, wet meadows, old fields, roadsides.

Mode of spread:

Common garden plant; reproduces primarily by bulblets and tubers; tubers may also be moved by floodwaters, animals or in soil.

Survey:

Survey from March-May; plants mostly gone by June. Similar natives do not have tubers, bulblets, or form a continuous carpet. Pull up plant to confirm presence of tubers.



Robert Vidéki, Doronicum Kft.,
Bugwood.org



Suzan Campbell, MNFI



Chris Evans, River to River CWMA,
Bugwood.org



Suzan Campbell, MNFI

Common buckthorn

Rhamnus cathartica L.



Description:

Deciduous shrub to small tree ranging up to 7.5 m (25 ft) in height. Leaves simple, opposite to sub-opposite with tiny teeth along margins; veins curve from base to tip. Twigs often have small thorns at tips, inner bark bright orange. Inconspicuous green-yellow four-petaled flowers are clustered in leaf axils. Round black berries are found only on female plants.

Habitat:

Widely planted, now occurs along floodplain forest, fens, prairies, old fields; somewhat shade tolerant.

Mode of spread:

Seeds widely dispersed by birds.

Survey:

Survey in late summer and fall when in fruit; can be recognized year-round by its thorn-tipped twigs and orange inner bark.



Suzan Campbell, MNFI



Suzan Campbell, MNFI



Suzan Campbell, MNFI



James H. Miller, USDA Forest Service, Bugwood.org

Multiflora rose

Rosa multiflora Thunb.



Description:

Deciduous, dense, perennial shrub growing up to 3 m (10 ft) tall and 3-4 m (10-13 ft) wide, with long, slender, arching branches and stout, recurved thorns. Alternate, finely toothed, pinnately compound leaves with 5-11 leaflets and a finely fringed stipule at the leaf base. White or slightly pink five-petaled flowers; up to 4 cm (1 in) wide; arranged in a panicle. Fruit a hard, smooth red rose hip.

Habitat:

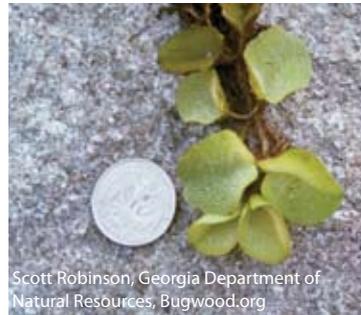
Forests, streambanks, pastures, roadsides.

Mode of spread:

Reproduces also by horizontal stems that root at the node and shoots that root at the tips; hips dispersed by birds and mammals.

Survey:

Blooms May-June; its distinctive fringed stipules are visible throughout the growing season and distinguish it from native roses.



Scott Robinson, Georgia Department of Natural Resources, Bugwood.org



Mic Julien, Commonwealth Scientific and Industrial Research Organization, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Scott Robinson, Georgia Department of Natural Resources, Bugwood.org

Giant salvinia

Salvinia molesta Mitchell



Description:

Free-floating, mat-forming water fern. At each node is a pair of emergent or floating leaf-like green fronds and one brown feather-like frond hanging below, resembling roots. Fronds are densely packed into chains as they grow. Floating fronds are covered with tiny hairs that split and then re-join at their tips. Mats may be up to 0.9 m (3 ft) thick. Believed to be sterile in the US.

Habitat:

Lakes, ponds, ditches and slow-moving waters; intolerant of brackish water.

Mode of spread:

Reproduce vegetatively, dispersed by waterfowl, boats.

Survey:

Best surveyed in summer and fall.

A

S

I

F

P



Mary Ellen (Mel) Harte, Bugwood.org



Mary Ellen (Mel) Harte, Bugwood.org



Richard Old, XID Services, Inc., Bugwood.org



Suzan Campbell, MNFI

Climbing nightshade

Solanum dulcamara L.



Description:

Rhizomatous perennial, erect or sprawling, up to 2 m (6.5 ft) in length. Alternate dark green leaves; lower leaves have three lobes with the terminal lobe much larger than the two lateral lobes. Flowers with five recurved purple petals and bright yellow fused anthers; bloom from May-November. Fruit a shiny red berry.

Habitat:

Low wet woods, fence rows, thickets, roadsides, paths and pond edges; tolerates low light levels.

Mode of spread:

Spreads by its bird-dispersed fruits.

Survey:

Purple flowers with bright, yellow, fused stamens appear from May to November, red berries ripen gradually throughout the season.



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Water-chestnut

Trapa natans L.



Description:

Aquatic, rooted, floating, mat-forming annual in shallow or deep freshwater; grows in depths of up to 4.6 m (15 ft). Its toothed floating leaves have inflated petioles and are arranged in a rosette, while its submerged leaves are feathery. Small, white, four-petaled flowers appear from July through frost; a spiny nut appears in October and November.

Habitat:

Freshwater lakes, ponds, canals and slow waters.

Mode of spread:

Reproduces by floating rosettes and its single-seeded spiny nut, which attaches to boats or animals. The spines can pierce shoes.

Survey:

Water-chestnut's toothed, triangular leaf with inflated petioles is distinctive throughout the growing season.

A
S



S Richard Old, XID Services, Inc.,
Bugwood.org

Mark Frey, The Presidio Trust,
Bugwood.org



I Rebecca S. Schillo, MNFI

Richard Old, XID Services, Inc.,
Bugwood.org

Narrow-leaved and hybrid cat-tail

Typha angustifolia L., *Typha xglauca* Godr.



Description:

Aquatic, emergent perennial, 1.5-3 m (5-10 ft) tall. Leaves are up to 1 m (3 ft) long and 0.6-1.25 cm (0.25-0.5 in) wide. Flowers in dense terminal spike; female flowers dark brown and located below the lighter male flowers; separated by a 2-10 cm (1.75-4 in) gap.

Habitat:

Marshes, lakes, streams, and ditches; tolerates silt, road salt, nutrients.

Mode of spread:

Spreads by seed, also vegetatively by rhizomes.

Survey:

Survey in late summer when gap between male and female flowers is most apparent. Can be distinguished from the native *T. latifolia*, which has wider leaves and no gap between male and female flowers. Their highly invasive hybrid, *T. xglauca*, generally has leaf width and gap size intermediate between the parent species.

Appendix I: Common name - scientific name

African oxygen weed.....*Lagarosiphon major*
 Autumn olive.....*Elaeagnus umbellata*
 Brazilian waterweed.....*Egeria densa*
 Black alder.....*Alnus glutinosa*
 Brittle water-nymph.....*Najas minor*
 Carolina fanwort.....*Cabomba caroliniana*
 Climbing nightshade.....*Solanum dulcamara*
 Common buckthorn.....*Rhamnus cathartica*
 Common water hyacinth.....*Eichhornia crassipes*
 Curly pondweed.....*Potamogeton crispus*
 Dame's rocket.....*Hesperis matronalis*
 Eurasian watermilfoil.....*Myriophyllum spicatum*
 European fireweed.....*Epilobium hirsutum*
 European frog-bit.....*Hydrocharis morsus-ranae*
 European waterclover.....*Marsilea quadrifolia*
 Fig buttercup.....*Ranunculus ficaria*
 Flowering rush.....*Butomus umbellatus*
 Garden yellow loosestrife.....*Lysimachia vulgaris*
 Garlic mustard.....*Alliaria petiolata*
 Giant knotweed.....*Polygonum sachalinense, Fallopia sachalinensis*
 Giant reed.....*Arundo donax*
 Giant salvinia.....*Salvinia molesta*
 Glossy buckthorn.....*Frangula alnus, Rhamnus frangula*
 Hydrilla.....*Hydrilla verticillata*
 Indian swampweed.....*Hygrophila polysperma*
 Japanese barberry.....*Berberis thunbergii*
 Japanese hop.....*Humulus japonicus*
 Japanese knotweed.....*Polygonum cuspidatum, Fallopia japonicum*

Japanese stilt grass.....*Microstegium vimineum*
 Marsh thistle.....*Cirsium palustre*
 Moneywort.....*Lysimachia nummularia*
 Multiflora rose.....*Rosa multiflora*
 Narrowleaf cat-tail.....*Typha angustifolia*
 Non-native phragmites.....*Phragmites australis* subsp. *australis*
 Ornamental jewelweed.....*Impatiens glandulifera* Royle
 Parrot feather watermilfoil.....*Myriophyllum aquaticum*
 Pond water-star-wort.....*Callitriche stagnalis*
 Purple loosestrife.....*Lythrum salicaria*
 Reed canary grass.....*Phalaris arundinacea*
 Reed mannagrass.....*Glyceria maxima*
 Starry stonewort.....*Nitellopsis obtusa*
 Swamp stonecrop.....*Crassula helmsii*
 Water chestnut.....*Trapa natans*
 Water lettuce.....*Pistia stratiotes*
 Wild parsnip.....*Pastinaca sativa*
 Yellow floating heart.....*Nymphoides peltata*
 Yellow iris.....*Iris pseudacorus*

Appendix II: Scientific name - common name

Alliaria petiolata Garlic mustard
Alnus glutinosa Black alder
Arundo donax Giant reed
Berberis thunbergii Japanese barberry
Butomus umbellatus Flowering rush
Cabomba caroliniana Carolina fanwort
Callitriche stagnalis Pond water-starwort
Cirsium palustre Marsh thistle
Crassula helmsii Swamp stonecrop
Egeria densa Brazilian water-weed
Eichhornia crassipes Common water-hyacinth
Elaeagnus umbellata Autumn olive
Epilobium hirsutum European fireweed
Fallopia japonica Japanese knotweed
Fallopia sachalinensis Giant knotweed
Frangula alnus Glossy buckthorn
Glyceria maxima Reed mannagrass
Hesperis matronalis Dame's rocket
Humulus japonicus Japanese hops
Hydrilla verticillata Hydrilla
Hydrocharis morsus-ranae European frog-bit
Hygrophila polysperma Indian swampweed
Impatiens glandulifera Ornamental jewelweed
Iris pseudacorus Yellow iris
Lagarosiphon major African oxygen weed
Lysimachia nummularia Moneywort
Lysimachia vulgaris Garden yellow loosestrife
Lythrum salicaria Purple loosestrife

Marsilea quadrifolia European water-clover
Microstegium vimineum Japanese stilt grass
Myriophyllum aquaticum Parrot feather water-milfoil
Myriophyllum spicatum Eurasian water-milfoil
Najas minor Brittle water-nymph
Nitellopsis obtusa Starry stonewort
Nymphoides peltata Yellow floating heart
Pastinica sativa Wild parsnip
Phalaris arundinacea Reed canary-grass
Phragmites australis subsp. *australis* Non-native phragmites
Pistia stratiotes Water lettuce
Polygonum cuspidatum Japanese knotweed
Polygonum sachalinense Giant knotweed
Potamogeton crispus Curly pondweed
Ranunculus ficaria Fig buttercup
Rhamnus cathartica Common buckthorn
Rhamnus frangula Glossy buckthorn
Rosa multiflora Multiflora rose
Salvinia molesta Giant salvinia
Solanum dulcamara Climbing nightshade
Trapa natans Water-chestnut
Typha angustifolia Narrow-leaved cat-tail
Typha xglauca Hybrid cat-tail

Appendix III: Invasive species - by community

Common name	Scientific name	Natural Communities													
		Submergent Marsh	Emergent Marsh	Great Lakes Marsh	Wet Meadow	Wet Prairie	Fen	Shrub Swamp	Floodplain Forest	Deciduous Swamp	Coniferous Swamp	Bog/Muskeg	Deciduous Forest		
Garlic mustard	<i>Alliaria petiolata</i>									■	■	■			■
Black alder	<i>Alnus glutinosa</i>									■	■	■			
Giant reed	<i>Arundo donax</i>					■	■	■	■	■					
Japanese barberry	<i>Berberis thunbergii</i>										■	■			■
Flowering rush	<i>Butomus umbellatus</i>		■	■	■										
Carolina fanwort	<i>Cabomba caroliniana</i>		■	■											
Pond water-starwort	<i>Callitriche stagnalis</i>		■	■	■										
Marsh thistle	<i>Cirsium palustre</i>					■		■	■	■	■	■			■
Swamp stonecrop	<i>Crassula helmsii</i>		■	■	■										
Brazilian water-weed	<i>Egeria densa</i>		■	■	■										
Common water-hyacinth	<i>Eichhornia crassipes</i>		■	■	■										
Autumn olive	<i>Elaeagnus umbellata</i>							■	■	■					■
European fireweed	<i>Epilobium hirsutum</i>			■	■	■	■	■	■						
Glossy buckthorn	<i>Frangula alnus</i>			■	■	■	■	■	■	■	■	■	■	■	■
Reed mannagrass	<i>Glyceria maxima</i>			■	■	■				■	■				
Dame's rocket	<i>Hesperis matronalis</i>										■	■			■
Japanese hops	<i>Humulus japonicus</i>			■	■					■	■				
Hydrilla	<i>Hydrilla verticillata</i>		■		■										
European frog-bit	<i>Hydrocharis morsus-ranae</i>		■	■	■					■					
Indian swampweed	<i>Hygrophila polysperma</i>		■	■	■										
Ornamental jewelweed	<i>Impatiens glandulifera</i>			■	■	■	■				■	■			■
Yellow iris	<i>Iris pseudacorus</i>			■	■	■	■				■	■			■
African oxygen weed	<i>Lagarosiphon major</i>		■	■	■										
Moneywort	<i>Lysimachia nummularia</i>			■	■	■				■	■	■			■

Common name	Scientific name	Natural Communities												
		Submergent Marsh	Emergent Marsh	Great Lakes Marsh	Wet Meadow	Wet Prairie	Fen	Shrub Swamp	Floodplain Forest	Deciduous Swamp	Coniferous Swamp	Bog/Muskeg	Deciduous Forest	
Garden yellow loosestrife	<i>Lysimachia vulgaris</i>		■	■	■	■	■	■	■	■	■	■		■
Purple loosestrife	<i>Lythrum salicaria</i>		■	■	■	■	■	■	■	■	■	■		
European water-clover	<i>Marsilea quadrifolia</i>	■	■	■										
Japanese stilt grass	<i>Microstegium vimineum</i>									■	■			■
Parrot feather water-milfoil	<i>Myriophyllum aquaticum</i>	■	■	■										
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>	■	■	■										
Brittle water-nymph	<i>Najas minor</i>	■	■	■										
Starry stonewort	<i>Nitellopsis obtusa</i>	■	■	■										
Yellow floating heart	<i>Nymphoides peltata</i>	■	■	■										
Wild parsnip	<i>Pastinica sativa</i>				■	■	■							
Reed canary-grass	<i>Phalaris arundinacea</i>		■	■	■	■	■	■	■	■	■	■	■	■
Non-native phragmites	<i>Phragmites australis</i> subsp. <i>australis</i>		■	■	■	■	■	■	■	■	■	■	■	
Water lettuce	<i>Pistia stratiotes</i>	■	■	■										
Japanese knotweed	<i>Polygonum cuspidatum</i>				■				■	■				■
Giant knotweed	<i>Polygonum sachalinense</i>				■					■				■
Curly pondweed	<i>Potamogeton crispus</i>	■	■	■										
Fig buttercup	<i>Ranunculus ficaria</i>				■					■	■			■
Common buckthorn	<i>Rhamnus cathartica</i>				■	■	■			■	■			■
Multiflora rose	<i>Rosa multiflora</i>							■	■	■				■
Giant salvinia	<i>Salvinia molesta</i>	■	■	■										
Climbing nightshade	<i>Solanum dulcamara</i>		■	■	■	■	■	■	■	■	■	■		■
Water-chestnut	<i>Trapa natans</i>	■	■	■										
Narrow-leaved, hybrid cat-tail	<i>Typha angustifolia</i> , <i>T. x glauca</i>		■	■	■	■	■	■	■	■	■	■	■	

Appendix IV: Best survey period

Common name	Scientific name	Month											
		January	February	March	April	May	June	July	August	September	October	November	December
Garlic mustard	<i>Alliaria petiolata</i>			■	■	■	■			■	■	■	
Black alder	<i>Alnus glutinosa</i>						■	■	■	■	■	■	
Giant reed	<i>Arundo donax</i>	■	■	■	■	■	■	■	■	■	■	■	■
Japanese barberry	<i>Berberis thunbergii</i>				■	■	■	■	■	■	■	■	
Flowering rush	<i>Butomus umbellatus</i>								■	■			
Carolina fanwort	<i>Cabomba caroliniana</i>								■	■	■	■	
Pond water-starwort	<i>Callitriche stagnalis</i>									■	■	■	■
Marsh thistle	<i>Cirsium palustre</i>									■	■	■	■
Swamp stonecrop	<i>Crassula helmsii</i>							■	■	■	■		
Brazilian water-weed	<i>Egeria densa</i>								■	■	■	■	
Common water-hyacinth	<i>Eichhornia crassipes</i>							■	■	■	■	■	■
Autumn olive	<i>Elaeagnus umbellata</i>	■	■	■	■	■	■	■	■	■	■	■	■
European fireweed	<i>Epilobium hirsutum</i>									■	■	■	
Glossy buckthorn	<i>Frangula alnus</i>				■	■	■	■	■	■	■	■	
Reed mannagrass	<i>Glyceria maxima</i>							■	■	■			
Dame's rocket	<i>Hesperis matronalis</i>						■	■					
Japanese hops	<i>Humulus japonicus</i>							■	■	■	■	■	
Hydrilla	<i>Hydrilla verticillata</i>							■	■	■	■	■	
European frog-bit	<i>Hydrocharis morsus-ranae</i>							■	■	■	■	■	
Indian swampweed	<i>Hygrophila polysperma</i>							■	■	■	■	■	
Ornamental jewelweed	<i>Impatiens glandulifera</i>									■	■	■	
Yellow iris	<i>Iris pseudacorus</i>						■	■	■	■	■	■	
African oxygen weed	<i>Lagarosiphon major</i>							■	■	■	■	■	
Moneywort	<i>Lysimachia nummularia</i>							■	■	■	■	■	

Appendix IV: Best survey period (continued)

Common name	Scientific name	Month												
		January	February	March	April	May	June	July	August	September	October	November	December	
Garden yellow loosestrife	<i>Lysimachia vulgaris</i>						■	■	■	■				
Purple loosestrife	<i>Lythrum salicaria</i>							■	■	■				
European water-clover	<i>Marsilea quadrifolia</i>							■	■	■	■			
Japanese stilt grass	<i>Microstegium vimineum</i>									■	■			
Parrot feather water-milfoil	<i>Myriophyllum aquaticum</i>							■	■	■	■			
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>						■	■	■	■	■	■		
Brittle water-nymph	<i>Najas minor</i>							■	■	■	■			
Starry stonewort	<i>Nitellopsis obtusa</i>							■	■	■	■	■		
Yellow floating heart	<i>Nymphoides peltata</i>							■	■	■	■			
Wild parsnip	<i>Pastinica sativa</i>						■	■						
Reed canary-grass	<i>Phalaris arundinacea</i>					■	■							
Non-native phragmites	<i>Phragmites australis</i> subsp. <i>australis</i>	■	■	■	■	■	■	■	■	■	■	■	■	■
Water lettuce	<i>Pistia stratiotes</i>						■	■	■	■	■			
Japanese knotweed	<i>Polygonum cuspidatum</i>								■	■				
Giant knotweed	<i>Polygonum sachalinense</i>								■	■				
Curly pondweed	<i>Potamogeton crispus</i>				■	■	■	■						
Fig buttercup	<i>Ranunculus ficaria</i>			■	■	■								
Common buckthorn	<i>Rhamnus cathartica</i>								■	■	■	■	■	■
Multiflora rose	<i>Rosa multiflora</i>					■	■	■	■	■	■			
Giant salvinia	<i>Salvinia molesta</i>							■	■	■	■			
Climbing nightshade	<i>Solanum dulcamara</i>					■	■	■	■	■	■	■		
Water-chestnut	<i>Trapa natans</i>						■	■	■	■	■			
Narrow-leaved, hybrid cat-tail	<i>Typha angustifolia</i> , <i>T. x glauca</i>								■	■				

Glossary

acidic - having a pH of less than 7; increasing the concentration of H⁺ ions when dissolved in water; the opposite of basic or alkaline.

alkaline - having a pH of greater than 7; increasing the concentration of OH⁻ ions when dissolved in water; the opposite of acidic.

alternate - arranged with one per node, as in leaves on a stem.

annual - a plant that germinates, flowers, sets seed and dies in one year.

anther - the pollen-bearing part of a stamen.

aquatic - growing in water.

axil - the position where a leaf or branch joins the stem.

backwater - a body of water that is out of the main current of a larger body of water, such as in inlet or bay.

ballast water - water held in a tank on a ship to improve stability; the source of many invasive species, as it is typically drawn directly from surrounding waters and discharged elsewhere.

basal - at the base or ground level.

bearded - with a clump of hairs.

berry - a fleshy fruit with several seeds, derived from a single ovary such as a blueberry or elderberry.

biennial - a plant that lives only two years; flowering, producing seed and dying in the second year.

brackish - salty, as in water; a mixture of saltwater and freshwater.

bract - a specialized leaf-like structure, from which a flower or flower stalk grows; some may be very small.

bulbil - a small new bulb that grows around a parent bulb or a bulb-like structure that grows in the leaf axil.

calyx - the sepals, collectively.

capsule - a dry fruit that splits along two or more lines, usually with several or many seeds.

carpel - a simple pistil (the female, seed-producing part of a flower) or one part of a compound pistil.

clasping - without a stalk and slightly surrounding the stem.

clonal - growing as part of a clone; a group of plants that arise vegetatively from a single plant.

colonial - forming colonies.

compound leaf - with multiple distinct subunits or leaflets.

cultivar - a cultivated variety.

drawdown - lowered water level.

drupe - a fleshy fruit with a hard structure derived from the lining of the ovary wall that encloses the seed such as a peach or almond.

emergent - referring to an aquatic plant that extends above the water's surface.

entire - without teeth, as in a leaf margin.

ephemeral - lasting for a short time; as in spring ephemerals, which flower, produce seed and go dormant before summer.

fen - a wetland community that is continuously fed by mineral-rich groundwater.

fern - a non-flowering plant with fronds that reproduces by spores rather than seeds.

fertile hybrid - offspring of individuals of two different species that can produce offspring; many hybrids are sterile.

fibrous - containing fibers.

floating - on the water's surface; neither under nor rising above.

floodplain - a low plain along a river that is subject to flooding.

forest - a natural community that is dominated by trees.

fragmentation - breaking into smaller pieces; production of a new

individual from a piece of the original plant.

fringed - with a border of fine strands, as in a fringed ligule.

frond - the leaf of a fern; also the large compound leaf of a palm.

gametangia - an reproductive organ or cell in an alga or fern.

glandular - having glands.

herbaceous - referring to a plant, with the stems dying back to the ground at the end of the season.

inflorescence - the entire flower cluster.

lanceolate - lance-shaped, much longer than wide and tapering to each end, broadest below the middle.

lenticel - a small, dot-like area of corky tissue on bark.

ligule - an appendage at the top of a leaf sheaf.

littoral zone - area within a lake where sunlight penetrates to the bottom, permitting rooted plants to grow; typically along the shoreline at depths up to about 15 feet, depending on water clarity.

limnetic zone - open, surface waters in a lake, where it is too deep for sunlight to penetrate to the bottom; located above the profundal zone.

lobe - a projection or extension, usually rounded.

macroalgae - large algae; algae are organisms that photosynthesize but are not classed as plants.

marsh - a wetland dominated by herbaceous plants on mineral soils.

wet meadow - a wetland dominated by sedges and other herbaceous plants and influenced by groundwater.

monotypic stand - area dominated by plants of a single species.

mudflat - coastal wetlands that form when mud is deposited by tides or river currents.

naturalized - in reference to plants; a species that was introduced

to an area and is now part of a self-sustaining population.

node - place on the stem where a leaf or branch has attached.

nut - a large, hard, dry fruit, usually one-seeded, that does not split open on its own.

oblong - longer than wide, with parallel sides, but broad, rather than narrow.

old field - land that was formerly farmed or grazed but has been abandoned.

open wetland - a wetland that is dominated by herbaceous plants or shrubs such as a marsh, wet meadow or shrub-carr.

opposite - arranged directly across from each other at the same point or level, as in two leaves at a single node.

orbicular - circular in outline.

ornamental - in reference to plants; cultivated for its decorative qualities.

palmate - with subunits or lobes arising from a single point.

panicle - a branching inflorescence or flower cluster that is broad at the base and tapers towards the top.

petal - one of the inner series of parts that make up a flower.

petiole - the stalk portion of a leaf.

pinnate - arranged in two rows along an axis, like barbs on a feather.

pollination - transfer of pollen from the anther to the stigma of a plant.

prairie - a natural community that is dominated by grasses.

profundal zone - deep portion of a lake or other waterbody; beneath the depth where light can penetrate in sufficient amounts to support plant growth.

pubescent - with hairs of any sort.

recurved - curved backward.

rhizoid - rootlike, but without xylem and phloem.

rhizome - a creeping underground stem.

rosette - a cluster of leaves or other plant parts arranged in a circle, often at the base.

runner - a long, creeping stem, that roots at its tips and nodes.

savanna - a grassland with scattered trees.

scale - a small thin or flat structure.

semi-aquatic - adapted to living in or near water.

sepal - one of the outer series of parts that make up a flower; may be petal-like.

serrate - with sharp, forward pointing teeth.

sheath - plant part that wraps around another plant part.

shrub-carr - a wetland community that is dominated by shrubs.

spike - an elongate flower cluster.

spore - a small, usually single-celled reproductive body that is produced by non-flowering organisms including ferns and fungi.

sporocarp - structure in which spores are formed.

stamen - the male organ of a flower.

stipule - one of a pair of appendages at the base of a leaf.

stolon - an elongate, creeping stem above ground.

submergent - growing below the water's surface.

subspecies - a taxonomic group that is part of a species, often isolated geographically.

swamp - a wetland that is dominated by trees.

taproot - the main or central root.

terminal - at the tip or end position.

toothed - with teeth, as in the margin of a leaf.

tuber - a thickening of a rhizome, functioning as a form of food storage and/or for reproduction.

turion - a small bulb-like structure.

vegetative reproduction - asexual reproduction, in which new individuals develop from vegetative parts such as stem or root tissue, rather than seeds or spores.

whorl - a ring of 3 or more similar structures, i.e. leaves, that originate at a single point or node.

Online resources

General information

Aquatic Nuisance Species Task Force

<http://www.anstaskforce.gov/default.php>

(Accessed: 3/30/2010)

Michigan Sea Grant - Aquatic Invasive Species

<http://www.miseagrant.umich.edu/ais/>

(Accessed: 3/30/2010)

National Invasive Species Information Center - Aquatics

<http://www.invasivespeciesinfo.gov/aquatics/main.shtml>

(Accessed: 3/30/2010)

Species descriptions

Center for Invasive Species and Ecosystem Health

Invasive.org - invasive and exotic plants

<http://www.invasive.org/species/weeds.cfm>

(Accessed: 3/30/2010)

Great Lakes Aquatic Nonindigenous Species Information System

<http://www.glerl.noaa.gov/res/Programs/ncrais/glansis.html>

(Accessed: 3/30/2010)

IFAS Center for Aquatic and Invasive Plants

University of Florida

<http://plants.ifas.ufl.edu/>

(Accessed: 3/30/2010)

Invasive Plant Atlas of New England

<http://nbii-nin.ciesin.columbia.edu/ipane/>

(Accessed: 3/30/2010)

Ontario Stewardship - Field Guide to Aquatic Invasive Species:

http://www.ontariostewardship.org/councils/duff-simcoe/files/invading_species_field_guide.pdf

(Accessed: 3/30/2010)

USGS - Nonindigenous Aquatic Species

<http://nas.er.usgs.gov/>

(Accessed: 3/30/2010)

Wisconsin DNR - Aquatic Invasive Species

<http://www.dnr.state.wi.us/invasives/aquatic/>

(Accessed: 3/30/2010)

Species distribution

Michigan Invasive Species Information Network

<http://www.misin.msu.edu/>

(Accessed: 3/30/2010)

Invasive Plant Atlas

<http://www.invasiveplantatlas.org/>

(Accessed: 3/30/2010)

USDA Plants database

<http://plants.usda.gov/>

(Accessed: 3/30/2010)

Monitoring programs

Citizen Lake Monitoring Network - UW Extension

<http://www.uwsp.edu/cnr/uwexlakes/CLMN/publications.asp>

Aquatic Invasive Species Monitoring Procedures

<http://www.uwsp.edu/cnr/uwexlakes/CLMN/AIS-Manual/AISmanualFULL-7-13-09forWEB.pdf>

(Accessed: 3/30/2010)

Maine Volunteer Lake Monitoring Program

<http://www.mciap.org/>

VLMP Invasive Aquatic Plant Screening and Mapping Procedures

http://www.mainevolunteerlakemonitors.org/mciap/Section3_ScreeningSurveys.pdf#page=1

(Accessed: 3/30/2010)

Michigan Clean Water Corps - monitoring protocols

<http://www.micorps.net/documents/ExoticAqPlantPROC-10.pdf>

(Accessed: 3/30/2010)

USEPA: Volunteer Wetland Monitoring

<http://www.epa.gov/wetlands/monitor/volmonitor.pdf>

(Accessed: 3/30/2010)

Aquatic Invasive Control

Biology and Control of Aquatic Plants:

A Best Management Practices Handbook

http://plants.ifas.ufl.edu/misc/pdfs/AERF_handbook.pdf

(Accessed: 3/30/2010)

Selected references

Crow, G.E., and C. B. Hellquist. 2000. *Aquatic and Wetland Plants of Northeastern North America. A Revised and Enlarged Edition of Norman C. Fassett's A Manual of Aquatic Plants. Volume 1. Pteridophytes, Gymnosperms, and Angiosperms: Dicotyledons*. The University of Wisconsin Press. Madison, Wisconsin.

Crow, G.E., and C. B. Hellquist. 2000. *Aquatic and Wetland Plants of Northeastern North America. A Revised and Enlarged Edition of Norman C. Fassett's A Manual of Aquatic Plants. Volume 2. Angiosperms: Monocotyledons*. The University of Wisconsin Press. Madison, Wisconsin.

Gettys L.A., W.T. Haller and M. Bellaud, eds. 2009. *Biology and Control of Aquatic Plants: A Best Management Practices Handbook*. Aquatic Ecosystem Restoration Foundation, Marietta, GA.

Gleason, H.A. and A. Cronquist. 1991. *Manual of Vascular Plants of the Northeastern United States and Adjacent Canada*. Second Edition. The New York Botanical Garden, Bronx, New York.

Herman, L. 2009. *Aquatic Invasive Species Monitoring Procedures*. Citizen Lake Monitoring Network Coordinator, UW-Extension Lakes, University of Wisconsin-Stevens Point. Available online at: <http://www.uwsp.edu/cnr/uwexlakes/clmn/AIS-Manual/AISmanualFULL-7-13-09forWEB.pdf> (Accessed: 3/30/2010)

Hill, R., S. Williams. 2007. *Maine Field Guide to Invasive Aquatic Plants and Their Common Native Look Alikes*. Maine Center for Invasive Plants, Maine Volunteer Lake Monitoring Program, Auburn, Maine. Available online at: <http://www.mainevolunteerlakemonitors.org/mciap/FieldGuide.pdf> (Accessed: 3/30/2010)

Lui, K., M. Butler, M. Allen, J. DaSilva, and B. Brownson. 2008. *Field Guide to Aquatic Invasive Species Identification, collection and reporting of aquatic invasive species in Ontario waters*. Queen's Printer for Ontario. Available online at: http://www.ontariostewardship.org/councils/duff-simcoe/files/invading_species_field_guide.pdf (Accessed: 3/30/2010)

Pictorial key photo credits

Floating plants, p. 5

Pond water-starwort - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Water hyacinth - Suzan Campbell, MNFI

European frog-bit - Katie Bonjour, Huron-Clinton MetroParks

European water-clover - Chris Evans, River to River CWMA, Bugwood.org

Water lettuce - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Yellow floating heart - Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org

Giant salvinia - Scott Robinson, Georgia Department of Natural Resources, Bugwood.org

Water-chestnut - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Submergent plants with finely divided leaves, p. 6

Carolina fanwort - Graves Lovell, Alabama Dept. Conservation and Natural Resources, Bugwood.org

Parrot feather water-milfoil - Richard Old, XID Services, Inc., Bugwood.org

Eurasian water-milfoil - Richard Old, XID Services, Inc., Bugwood.org

Submergent plants with undivided leaves, p. 7 & 8

African oxygen weed - Robert Vidéki, Doronicum Kft., Bugwood.org

Curly pondweed - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Swamp stonecrop - Jenny Neal

Indian swampweed - Ann Murray, ©1999 University of Florida

Brittle water-nymph - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Brazilian water-weed - Richard Old, XID Services, Inc., Bugwood.org

Hydrilla - Robert Vidéki, Doronicum Kft., Bugwood.org

Starry stonewort - G. Douglas Pullman, Aquest Corporation

Woody plants, p. 9

Common buckthorn - Suzan Campbell, MNFI

Black alder - Paul Wray, Iowa State University, Bugwood.org

Japanese barberry - Suzan Campbell, MNFI

Autumn Olive - Suzan Campbell, MNFI

Glossy buckthorn - Suzan Campbell, MNFI

Multiflora rose - Suzan Campbell, MNFI

Emergent and terrestrial plants: Grasses, p. 10

Giant reed - Chuck Barger, University of Georgia, Bugwood.org

Reed mannagrass - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Japanese stiltgrass - Chuck Barger, University of Georgia, Bugwood.org

Reed canary-grass - Jamie Nielsen, University of Alaska Fairbanks, Cooperative Extension Service, Bugwood.org

Non-native phragmites - Jil M. Swearingen, USDI National Park Service, Bugwood.org

Emergent and terrestrial plants: Basal leaves, p. 11

Flowering rush - Suzan Campbell, MNFI

Yellow iris - Nancy Loewenstein, Auburn University, Bugwood.org

Fig buttercup - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Narrow-leaved cat-tail - Rebecca S. Schillo, MNFI

Emergent and terrestrial plants: Opposite or whorled leaves, p. 12

Swamp stonecrop - Jenny Neal

European fireweed - Suzan Campbell, MNFI

Japanese hops - Chris Evans, River to River CWMA, Bugwood.org

Indian swampweed - Ann Murray, ©1999 University of Florida

Ornamental jewelweed - Barbara Tokarska-Guzik, University of Silesia, Bugwood.org

Moneywort - Richard Old, XID Services, Inc., Bugwood.org

Purple loosestrife - Suzan Campbell, MNFI

Emergent and terrestrial plants: Alternate leaves, p. 13

Garlic mustard - Suzan Campbell, MNFI

Marsh thistle - Steve Garske, Great Lakes Indian Fish and Wildlife Commission, www.glifwc.org

Dame's rocket - Richard Old, XID Services, Inc, Bugwood.org

European water-clover - Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Wild parsnip - Suzan Campbell, MNFI

Japanese knotweed - Suzan Campbell, MNFI

Giant knotweed - Tom Heutte, USDA Forest Service, Bugwood.org

Climbing nightshade - Mary Ellen (Mel) Harte, Bugwood.org

Index

A

African oxygen weed, 38

Alliaria petiolata, 16

Alnus glutinosa, 17

Arundo donax, 18

Autumn olive, 27

B

Berberis thunbergii, 19

Black alder, 17

Brazilian water-weed, 25

Brittle water-nymph, 46

Butomus umbellatus, 20

C

Cabomba caroliniana, 21

Callitriche stagnalis, 22

Carolina fanwort, 21

Cirsium palustre, 23

Climbing nightshade, 60

Common buckthorn, 57

Common water-hyacinth, 26

Crassula helmsii, 24

Curly pondweed, 55

D

Dame's rocket, 31

E

Egeria densa, 25

Eichhornia crassipes, 26

Elaeagnus umbellata, 27

Epilobium hirsutum, 28

Eurasian water-milfoil, 45

European fireweed, 28

European frog-bit, 34

European water-clover, 42

F

Fallopia japonica, 53

Fallopia sachalinensis, 54

Fig buttercup, 56

Flowering rush, 20

Frangula alnus, 29

G

Garden yellow loosestrife, 40

Garlic mustard, 16

Giant knotweed, 54

Giant reed, 18

Giant salvinia, 59

Glossy buckthorn, 29

Glyceria maxima, 30

H

Hesperis matronalis, 31

Humulus japonicus, 32

Hydrilla, 33

Hydrilla verticillata, 33

Hydrocharis morsus-ranae, 34

Hygrophila polysperma, 35

I

Impatiens glandulifera, 36

Indian swampweed, 35

Iris pseudacorus, 37

J

Japanese barberry, 19
 Japanese hops, 32
 Japanese knotweed, 53
 Japanese stilt grass, 43

L

Lagarosiphon major, 38
Lysimachia nummularia, 39
Lysimachia vulgaris, 40
Lythrum salicaria, 41

M

Marsh thistle, 23
Marsilea quadrifolia, 42
Microstegium vimineum, 43
 Moneywort, 39
 Multiflora rose, 58
Myriophyllum aquaticum, 44
Myriophyllum spicatum, 45

N

Najas minor, 46
 Narrow-leaved and hybrid cat-tail, 62
Nitellopsis obtusa, 47
 Non-native phragmites, 51
Nymphoides peltata, 48

O

Ornamental jewelweed, 36

P

Parrot feather water-milfoil, 44
Pastinaca sativa, 49
 Phalaris arundinacea, 50
Phragmites australis subsp. *australis*, 51

Pistia stratiotes, 52
Polygonum cuspidatum, 53
Polygonum sachalinense, 54

Pond water-starwort, 22
Potamogeton crispus, 55
 Purple loosestrife, 41

R

Ranunculus ficaria, 56
 Reed canary-grass, 50
 Reed mannagrass, 30
Rhamnus cathartica, 57
Rhamnus frangula, 29
Rosa multiflora, 58

S

Salvinia molesta, 59
Solanum dulcamara, 60
 Starry stonewort, 47
 Swamp stonecrop, 24

T

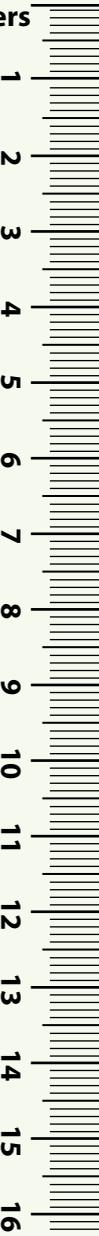
Trapa natans, 61
Typha angustifolia, 62
Typha xglauca, 62

W

Water-chestnut, 61
 Water lettuce, 52
 Wild parsnip, 49

Y

Yellow floating heart, 48
 Yellow iris, 37

Centimeters



An invaluable resource for professionals and amateurs alike, *A Field Guide to Invasive Plants of Aquatic and Wetland Habitats for Michigan* includes photos and descriptions of 47 invasive plant species. Aquatic and wetland species are included, along with a number of upland species that commonly venture into wetland habitats.

This field guide is available for download from:

<http://web4.msue.msu.edu/mnfi/pub/publications.cfm>



MICHIGAN STATE
UNIVERSITY
EXTENSION



Michigan
Natural
Features
Inventory