

Aquatic Invasive Plants and Their Look-Alikes

A specimen-based guide to identification
in the Great Lakes Region





Aquatic Invasive Plants and Their Look-Alikes

A specimen-based guide to identification
in the Great Lakes Region

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Andrew Hipp
Kenneth Cameron



This identification guide was written to assist landowners, land managers, and citizen scientists in identifying aquatic invasive species. To provide accurate reports to facilitate Early Detection Rapid Response, we must first accurately identify invading species.

With this guide, you can be confident in knowing the differences between aquatic invasive species and their look-alikes in the Great Lakes Region.

This resource was created as part of Thematic Collections Network National Science Foundation Award #1405396 to The Morton Arboretum and 1410683 to The University of Wisconsin, Madison.

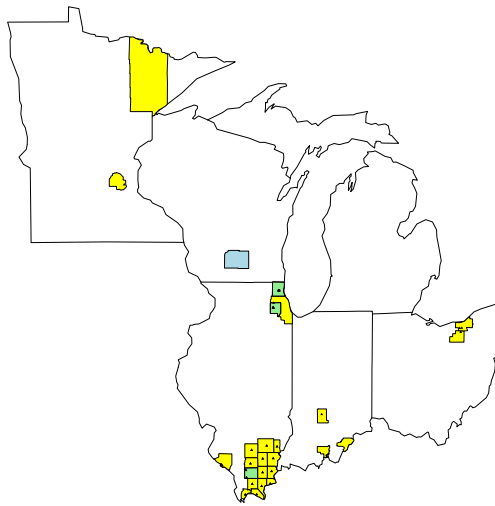
Whenever possible, this resource makes use of herbarium specimens and their associated data. Photos used include live and pressed plants. Distribution maps for each species were created from occurrence and collection records and may not reflect the entire geographic range of every species.

In this guide, invasive species appear in red and native species in black. 'Aquatic' refers to emergent and submersed plants, as well as those that grow at the water's edge.

To see more digitized specimens of aquatic invaders and their look-alikes, please visit the Great Lakes Invasives Network portal at www.greatlakesinvasives.org.

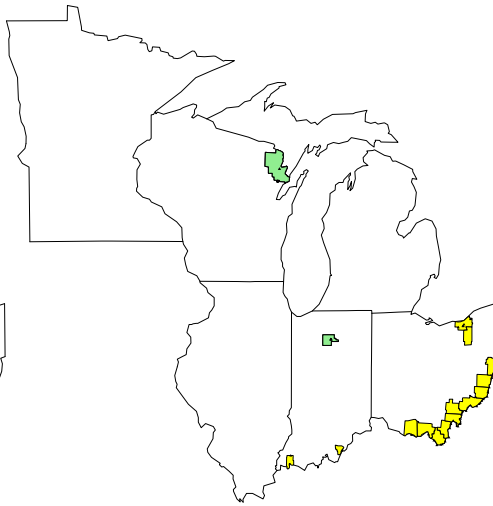
Invasive Brazilian waterweed

Egeria densa Planch.



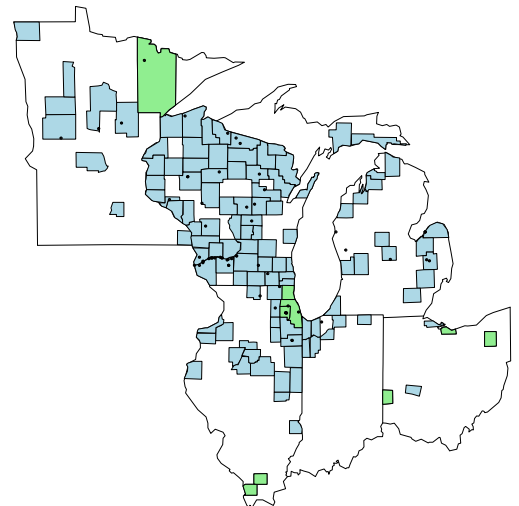
Invasive Hydrilla

Hydrilla verticillata (L. f.) Royle



Native Common Waterweed

Elodea canadensis Mich.



■ Counties present in EDDMapS only
■ Counties present in SEINet only
■ Counties present in both EDDMapS and SEINet
■ Georeferenced specimens, SEINet
▲ Georeferenced observations, EDDMapS

Date downloaded January and February 2017, and May 2018. Maps v2.

Example Population



General Form



Brazilian waterweed

Egeria densa Planch.

Hydrilla

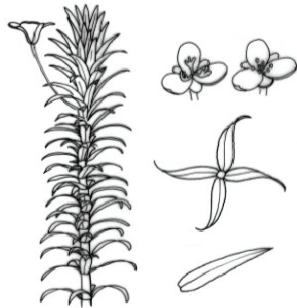
Hydrilla verticillata (L. f.) Royle

Common Waterweed

Elodea canadensis Mich.

Easy ID

Native waterweed (right) has whorls of three leaves and is less densely leafy than Brazilian waterweed or hydrilla.



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Hydrilla Comparison

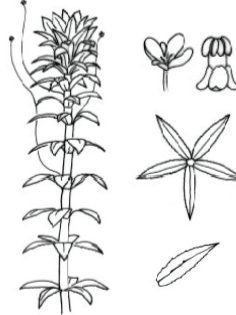


Image was modified from original format (line drawings were moved to fit title headers for the species, and flowers and leaves were moved from original line drawing to enlarge the drawings).

Brazilian Waterweed	Hydrilla	Common Waterweed
Leaves in whorls of 4 to 8	Leaves in whorls of 4 to 8	Leaves in whorls of 3
Leaf undersides with smooth midvein	Leaf undersides with sharply toothed midvein	Leaf undersides with smooth midvein
No turions	Can reproduce via turions	Can reproduce via turions

Prevention and Removal

Hydrilla and common waterweed can reproduce from turions (top).

Hydrilla can also reproduce via tubers (bottom).

Neither Brazilian nor common waterweed produce tubers.



Hydrilla turions



Robert Vidéki, Doronicum Kft., Bugwood.org

Hydrilla tubers

Watch for and remove fragments of hydrilla and Brazilian waterweed caught on boat propellers, accidentally pumped into livewells, and entwined in boating equipment. All three species described above can reproduce from stem fragments.

For this reason, mechanical removal is not recommended. To control patches of Brazilian waterweed, carefully remove them manually, making sure to collect all fragments, or if permitted, cover the plants with opaque fabric to block out any light.

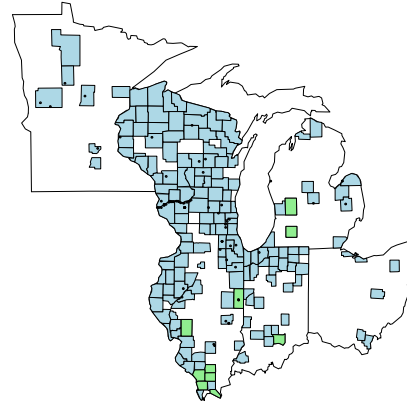
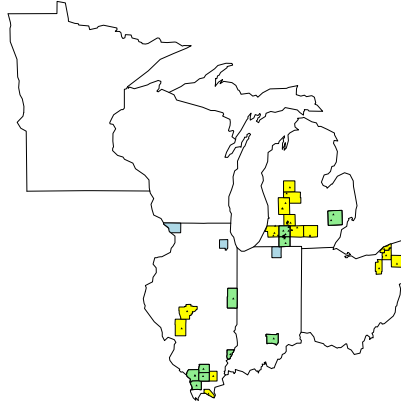
Report sightings:

www.eddmaps.org

Invasive
Fanwort
Cabomba caroliniana Gray

Native
Coontail
Ceratophyllum demersum L.

Distribution



■ Counties present in EDDMapS only
 ■ Counties present in SEINet only
 ■ Counties present in both EDDMapS and SEINet
 ■ Georeferenced specimens, SEINet
 ▲ Georeferenced observations, EDDMapS
Data downloaded January and February 2017, and May 2018. Maps v2.

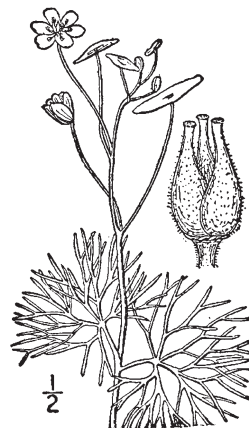
Example Populations



General Form



Leaf variations



Britton, N.L., and A. Brown, USDA PLANTS Database

Illustration provided by:
PAK, Center for Aquatic Plants
University of Florida, Gainesville, 1996

Fanwort

Cabomba caroliniana Gray

Easy ID



Fanwort is most easily recognizable by its emergent, elliptic leaves. Coontail does not have any floating or emergent leaves.

Coontail

Ceratophyllum demersum L.

Note: Other submerged aquatics that have similar feathery leaves to fanwort and coontail are compared in the table below to help distinguish between species.

Similar species	Easy ID characters
White water crowfoot <i>Ranunculus aquatilis</i>	Leaf petioles absent or delicate Leaves alternately arranged
Milfoil <i>Myriophyllum</i> spp.	Leaf petioles absent Leaves pinnately compound
Fanwort (this ID guide) <i>Cabomba caroliniana</i>	Leaves palmately compound Stalks relatively long
Coontail (this ID guide) <i>Ceratophyllum demersum</i>	Leaves toothed along one side
Water marigold <i>Megaladonta</i>	Leaves heavily serrated/lobed edges
Lake cress <i>Neobeckia aquatica</i>	Leaves many-branching

Fanwort	Coontail
Flowers have white petals	Flowers have green scales
Emergent elliptic leaves sometimes present	No emergent leaves
Submerged leaves have smooth margins	Submerged leaves have teeth along one side
Leaves have petioles	Leaves do not have petioles



Robert Vidéki, Doronicum Kft., Bugwood.org 5396782
Fanwort stem, petioles, and leaves

Prevention and Removal

Fanwort, as with all aquatic invasive plants, is best managed by prevention. Fanwort can reproduce from small fragments. Watch for and remove fragments caught in boating equipment and in ballast water.

Mechanical removal works in the short term, but it is unlikely that all fragments will be effectively removed. Fanwort becomes brittle at the end of the growing season, so mechanical removal is not recommended late into the summer.

Report any sightings:

www.eddmaps.org

Invasive

European Frogbit

Hydrocharis morsus-ranae L.

Native

Water-shield

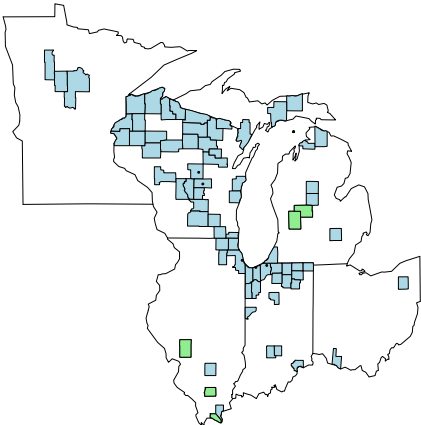
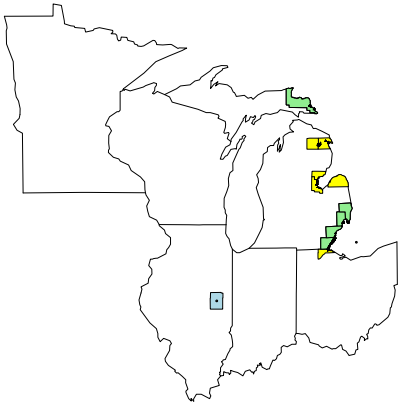
Brasenia schreberi Gmel.

Distribution

Example Populations

General Form

Flowers / Inflorescence



Counties present in EDDMapS only

Counties present in SEINet only

Counties present in both EDDMapS and SEINet

Georeferenced specimens, SEINet

Georeferenced observations, EDDMapS

Data downloaded January and February 2017, and May 2018. Maps v2.



European Frogbit

Hydrocharis morsus-ranae L.



Leslie Mehrhoff, University of Connecticut, Bugwood.org

UGA5272032

Water-shield

Brasenia schreberi Gmel.

Easy ID

European frogbit has clefted, heart- or kidney-shaped leaves. Water-shield has entire, oval or football-shaped leaves.

European Frogbit	Water-shield
Reproduces by stolons	Reproduces by rhizomes
Flowers white	Flowers purple to pink
Leaves to 6 cm diameter	Leaves to 12 cm diameter

Prevention and Removal



MDNR-Wildlife Division

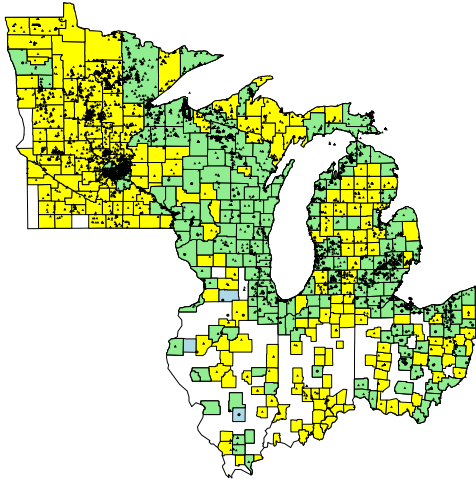
Few control strategies have proven successful against European frogbit. Small groups of plants can be carefully pulled by hand if all fragments are gathered. Shading out small infestations may be possible at the risk of shading out native species.

One European frogbit plant can produce 100 turions each year! Prevention and early detection are crucial to its management. Watch for fragments caught in boating equipment and ballast water.

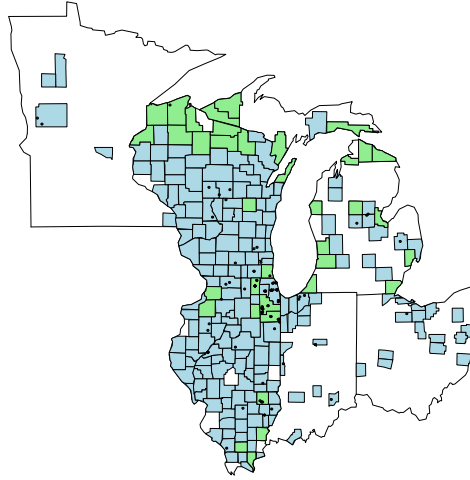
Report any sightings:

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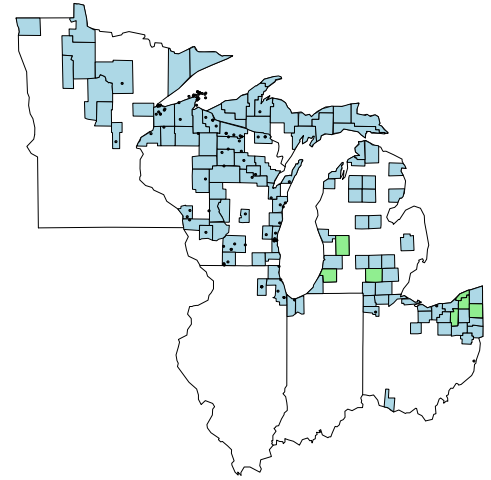
Invasive
Purple Loosestrife
Lythrum salicaria L.



Native
Blue Vervain
Verbena hastata L.



Native
Fireweed
Chamerion angustifolium (L.) Holub



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Example Populations



Photo by D. Busemeyer, swbiodiversity.org



Steve Dewey,
Utah State University, Bugwood.org UGA1459830



Dave Powell, USDA Forest Service (retired), Bugwood.org

UGA1210017

Flowers and Inflorescence



Herbarium of The Morton Arboretum (MOR)



© Leonel Velasquez, EOL.org



Herbarium of The Morton Arboretum (MOR)

Flowers and fruits pictured

Purple Loosestrife

Lythrum salicaria L.

Blue Vervain

Verbena hastata L.

Fireweed

Chamerion angustifolium (L.) Holub

Leaf

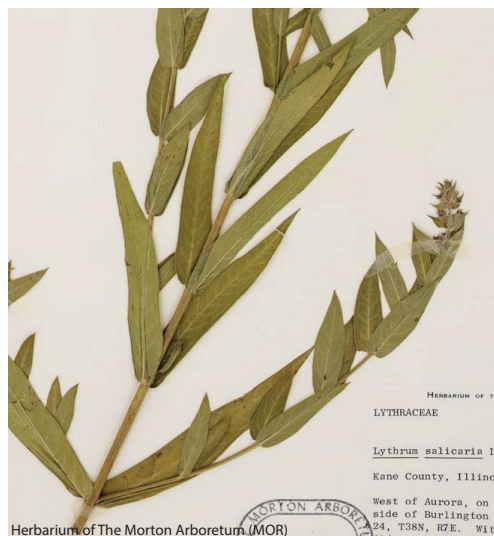


Photo by W. C. Burger, swbiodiversity.org

Purple Loosestrife	Blue Vervain	Fireweed
Flowers with 5-7 distinct petals	Flowers with 5 fused petals	Flowers with 4 distinct petals and 4 smaller sepals
Flowers magenta	Flowers purplish blue	Flowers magenta
Plants to 3m tall	Plants to 1.5m tall	Plants to 1.5m tall

Easy ID

Purple loosestrife grows to be much taller than blue vervain or fireweed. Look for 5-7 distinct petals, not fused, to confirm identification.

swbiodiversity.org

Prevention and Removal

Purple loosestrife can reproduce via underground buds so cutting stems is not an effective removal strategy. Small populations of purple loosestrife can be halted by hand pulling before the plants set seed. Be sure to remove the entire root system and underground stems.

Report any sightings:

www.eddmaps.org

Invasive
Eurasian Watermilfoil

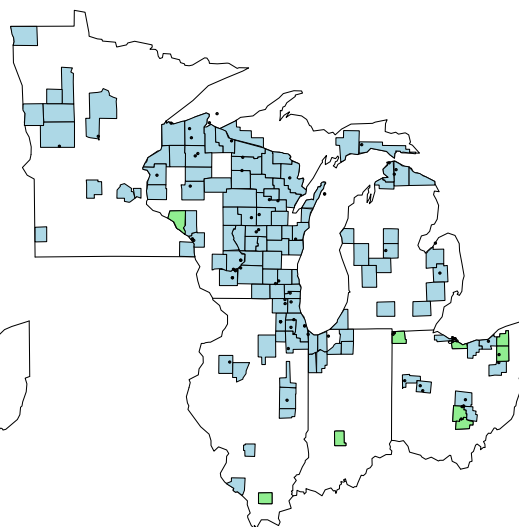
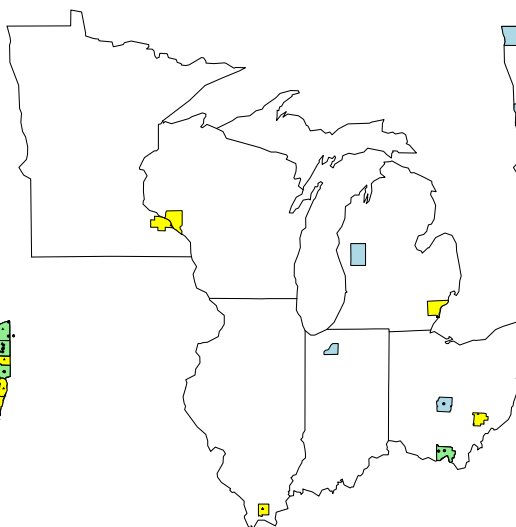
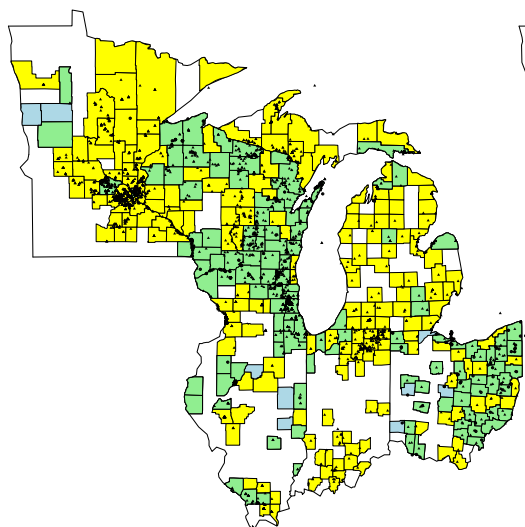
Myriophyllum spicatum L.

Invasive
Parrotfeather

Myriophyllum aquaticum
(Vell.) Verdc.

Native
Northern Watermilfoil

Myriophyllum sibiricum Kom.



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● Georeferenced specimens, SEINet
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Date downloaded January and February 2017, and May 2018. Maps v2.

Example Populations/Habitat



Andrea Miller, The Morton Arboretum



MDNR Wildlife Division



Andrea Miller, The Morton Arboretum

General Form



Paul Skawinski, University of Wisconsin-Stevens Point, image rotated



Paul Skawinski, University of Wisconsin-Stevens Point, image rotated



Paul Skawinski, University of Wisconsin-Stevens Point, image rotated

Eurasian Watermilfoil

Myriophyllum spicatum L.

Parrotfeather

Myriophyllum aquaticum
(Vell.) Verdc.

Northern Watermilfoil

Myriophyllum sibiricum Kom.

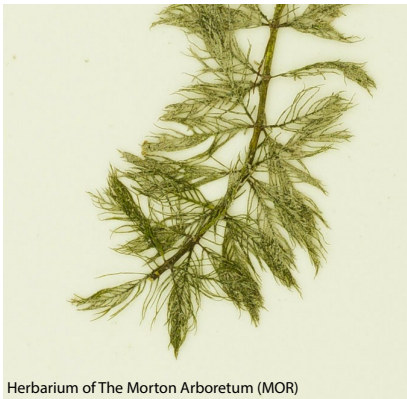
Leaves



Paul Skawinski, University of Wisconsin-Stevens Point

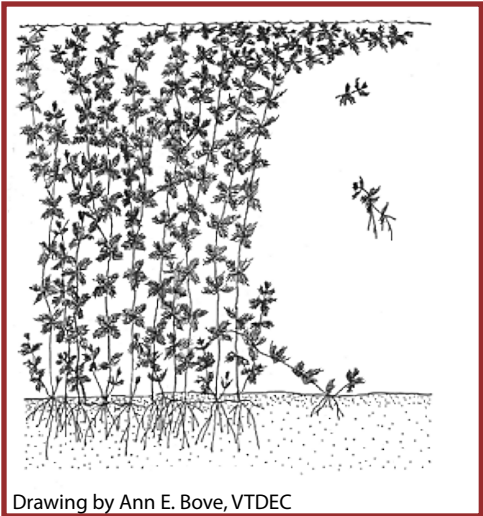


Phyllis Higman, MNFI



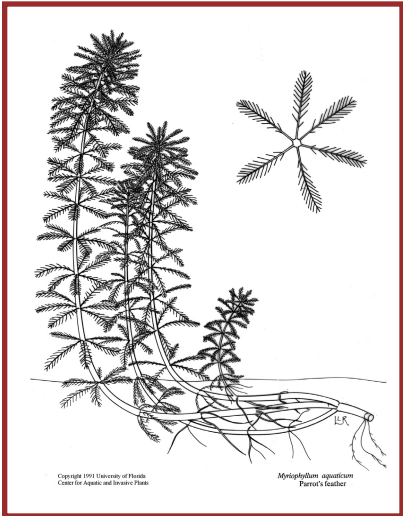
Herbarium of The Morton Arboretum (MOR)

Eurasian Watermilfoil	Parrotfeather	Northern Watermilfoil
Branches numerous near surface of water	Branches numerous near surface of water	Branches few
Leaflets in 12 or more pairs per leaf	Leaflets in 10-15 pairs per leaf	Leaflets in 5-12 pairs per leaf



Drawing by Ann E. Bove, VTDEC

Eurasian watermilfoil habit and fragments



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Center for Aquatic and Invasive Plants

Myriophyllum aquaticum
Parrot's Feather

Parrotfeather habit and leaves

Eurasian Watermilfoil

Myriophyllum spicatum L.

Parrotfeather

Myriophyllum aquaticum
(Vell.) Verdc.

Northern Watermilfoil

Myriophyllum sibiricum Kom.

Easy ID



Andrea Miller, The Morton Arboretum

Eurasian watermilfoil leaves lose their shape when held out of the water.



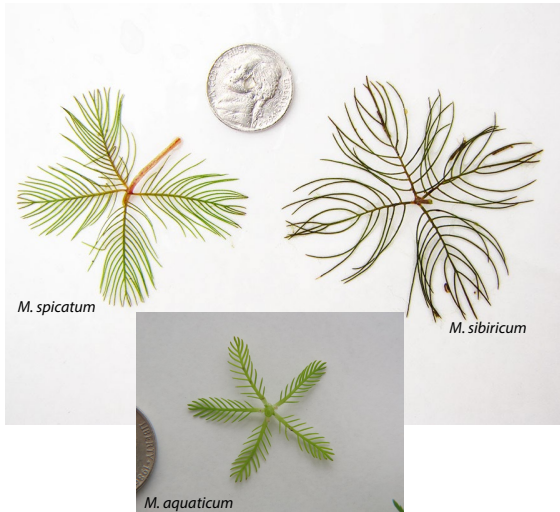
Leslie J. Mehrhoff,
University of Connecticut, Bugwood.org 5456187

While Eurasian and northern milfoil have emergent flowers, only parrotfeather has emergent stems and leaves.



Andrea Miller, The Morton Arboretum

Northern watermilfoil leaves remain rigid when held out of the water.



M. spicatum

M. sibiricum

M. aquaticum

Paul Skawinski, University of Wisconsin-Stevens Point

Myriophyllum spicatum (top left) has four leaves/whorl, *M. sibiricum* (top right) has four leaves/whorl, and *M. aquaticum* (bottom center) has five leaves/whorl.

Prevention and Removal

Watch for and remove fragments of milfoil or parrotfeather caught on boat propellers, accidentally pumped into livewells, and entwined in boating equipment.

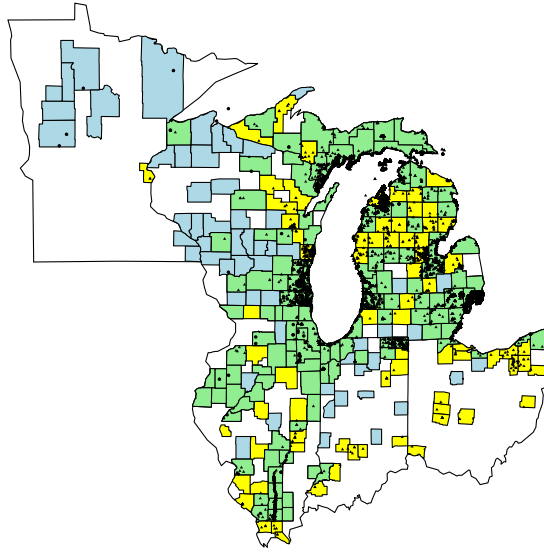
Eurasian watermilfoil and parrotfeather stems easily fragment. These tiny bits can reproduce and propagate so mechanical pulling of large populations is not recommended. If the population is small, carefully pull each plant out by hand.

Report any sightings:

www.eddmaps.org

Invasive *Phragmites*

Phragmites australis (Cav.) Trin ex Steud.



Native *Phragmites*

Phragmites australis subsp. *americanus* Saltonstall

Because invasive and native *Phragmites* are so similar in appearance, the creation of an accurate map from EDDMapS and SEINet occurrence records was not possible.

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■ Georeferenced specimens, SEINet
▲ Georeferenced observations, EDDMapS

Data downloaded January and February 2017, and May 2018. Maps v2.

Example Populations



Andrea Miller, The Morton Arboretum



Rob Routledge, Sault College, Bugwood.org

5501491

Stem



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

1559069



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

5500849

Introduced *Phragmites*

Phragmites australis (Cav.) Trin ex Steud.

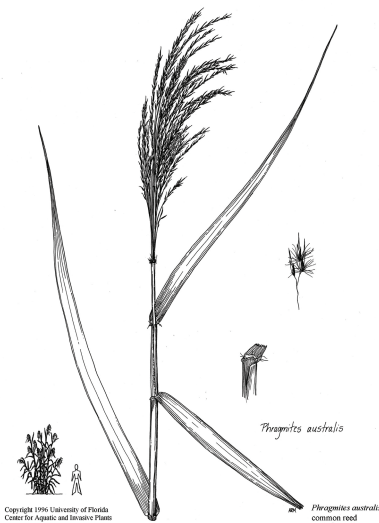


Herbarium of The Morton Arboretum (MOR)

Inflorescence



Herbarium of The Morton Arboretum (MOR)



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Center for Aquatic and Invasive Plants

Introduced <i>Phragmites</i>	Native <i>Phragmites</i>
Stem matte (dull), tan or green	Stem lustrous (glossy), red or green
Leaves blue-green	Leaves light, bright green
Plant to 6m tall	Plant to 2m tall
Forming dense stands, to 200 stems per m ²	Not forming dense stands, individuals scattered

Easy ID

Invasive *Phragmites* have green or tan colored stems. *Phragmites* with a red, shiny stem are native.

Native *Phragmites*



Daniel Boone

Prevention and Removal

Invasive *Phragmites* reproduces clonally via underground stems, or rhizomes. Rhizomes store energy from season to season. Mowing late in the season over multiple years has been found effective at controlling *Phragmites*. Mowing early in the growing season will result in more stems.

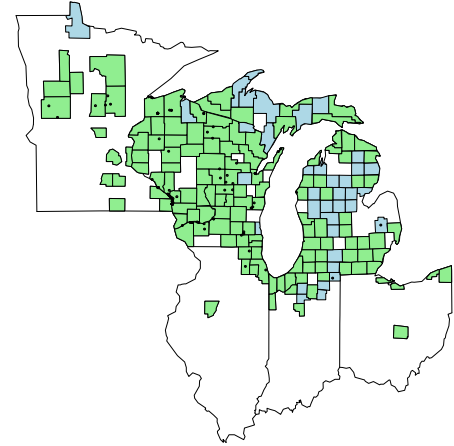
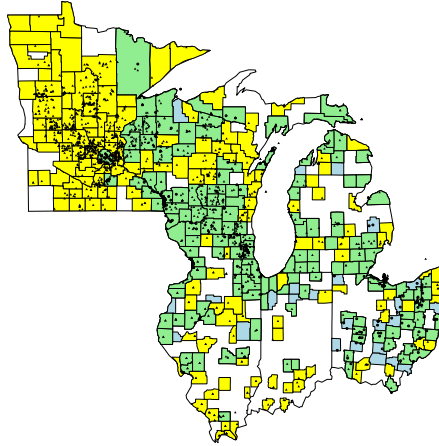
Report any sightings:

www.eddmaps.org

Invasive
Curly Pondweed
Potamogeton crispus L.

Native
Flat-stemmed Pondweed
Potamogeton zosteriformis Fern.

Distribution

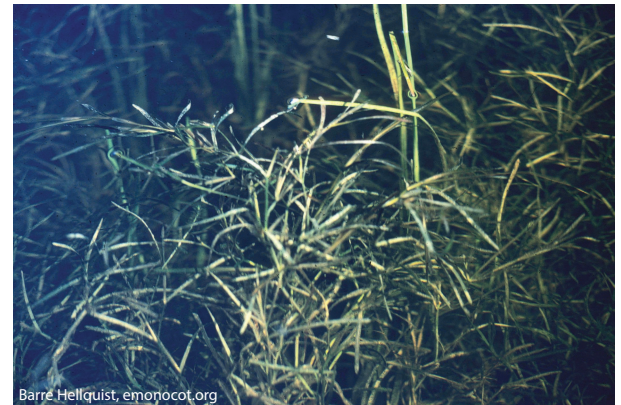
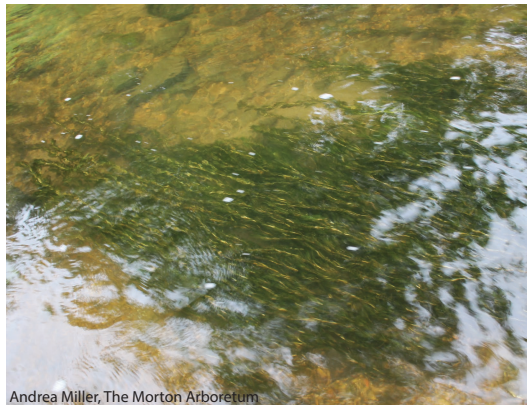


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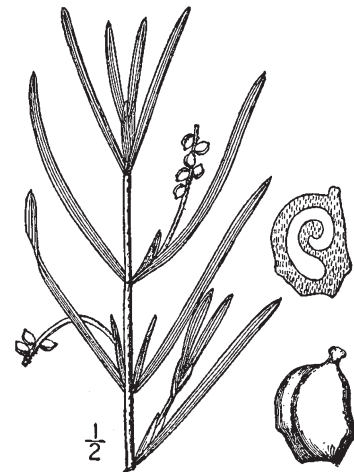
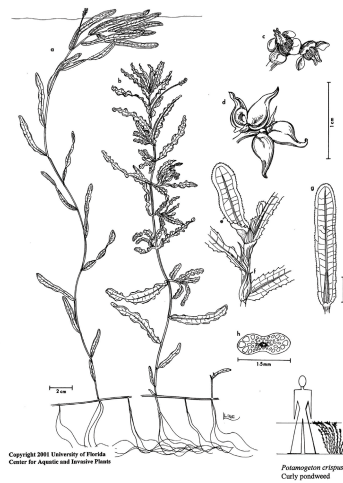
■ Georeferenced specimens, SEINet
▲ Georeferenced observations, EDDMapS

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Example Populations



General Form



Leaves



Curly Pondweed

Potamogeton crispus L.

Flat-stemmed Pondweed

Potamogeton zosteriformis Fern.

Easy ID



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

UGA5274005

The leaves of curly pondweed are wavy, like narrow lasagna noodles.



Donald Cameron, <https://gobotany.newenglandwild.org/>

The leaves of flat-stemmed pondweed are linear.

Curly Pondweed	Flat-stemmed Pondweed
Veins 3-5 per leaf	Veins to 35 per leaf
Leaves to 10 cm long x 1 cm wide	Leaves to 20 cm long x 5 mm wide
Leaf apex rounded	Leaf apex pointed
Leaf margins serrated	Leaf margins smooth



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

UGA5274006

Both curly and flat-stemmed pondweed overwinter by creating turions, or winter buds. This bur-shaped winter bud belongs to curly pondweed.

Prevention and Removal

To manage curly pondweed, cut stems at their very bottom along the sediment level. Curly pondweed can reproduce by fragments so it is important to capture any freed leaf or stem pieces.

Report any sightings:

www.eddmaps.org

Invasive Reed Canary Grass

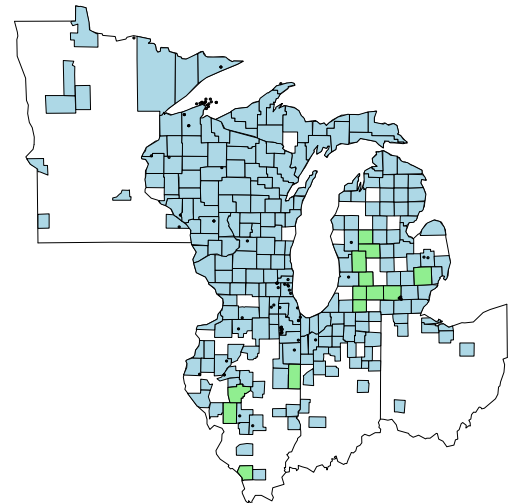
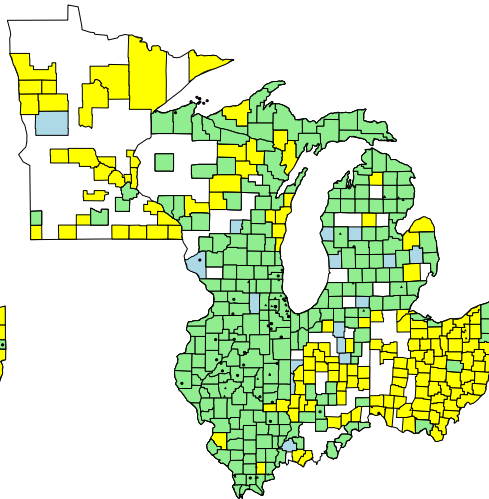
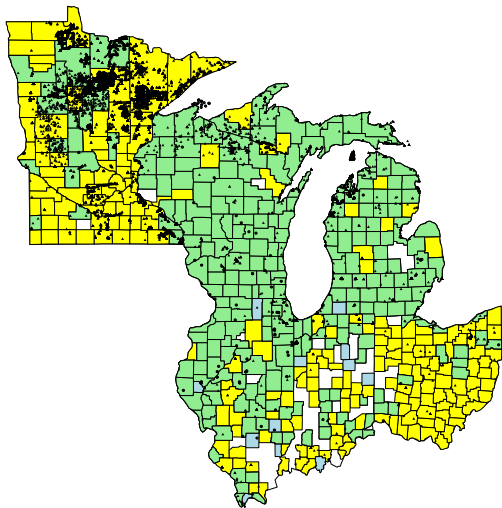
Phalaris arundinacea L.

Invasive Orchard Grass

Dactylis glomerata L.

Native Bluejoint

Calamagrostis canadensis (Michx.) P. Beauv.



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Example Populations



Flowers/Inflorescence



Reed Canary Grass

Phalaris arundinacea L.

Orchard Grass

Dactylis glomerata L.

Bluejoint

Calamagrostis canadensis (Michx.) P. Beauv.



Andrea Miller, The Morton Arboretum

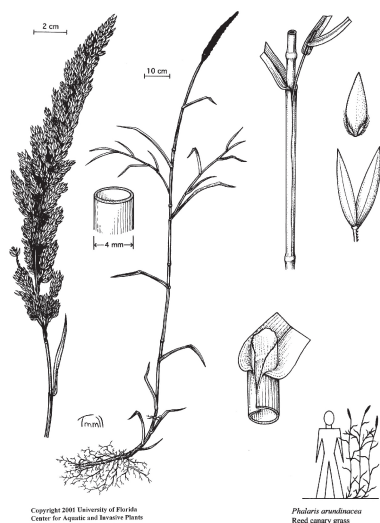
Easy ID

Reed canary grass is rough to the touch while bluejoint is smoother.

Orchard grass grows in drier, upland habitats while reed canary grass and bluejoint often grow in wetlands where the soil is frequently saturated.



Reed Canary Grass	Orchard Grass	Bluejoint
Wide and robust leaves (10-20 mm wide)	Narrow leaves (~4-10 mm wide)	Narrow and delicate leaves (4-8 mm wide)
Auricles present on leaves	Auricles present on leaves	Auricles not present on leaves
2 tufts of hairs under the florets	No hairs under the florets	Ring of hairs under the florets
Inflorescence cylindrical	Inflorescence branches straight, diverging from a central axis, with large clusters of spikelets attached	Inflorescence feathery



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Phalaris arundinacea
Reed canary grass

Prevention and Removal

To control reed canary grass, approaches may vary among sites. For more information, contact your local DNR office or an agricultural extension specialist for best practices in your area.

Small patches of orchard grass can be dug up and removed. Dig to a depth of at least 3 inches and refill the hole immediately. To prevent weeds from establishing, either re-seed or plant sod in the open area.

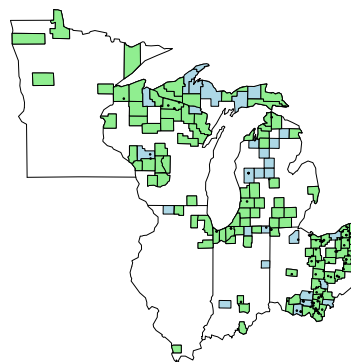
Report any sightings:

www.eddmaps.org

Invasive
Water Soldier
Stratiotes aloides L.

Native
American Bur-reed
Sparganium americanum Nutt.

According to current records from EDDMapS and SEINet, water soldier is present in Ontario, Canada but has not yet entered the United States.



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■ Counties present in SEINet only ▲ Georeferenced observations, EDDMapS
■ Counties present in both EDDMapS and SEINet

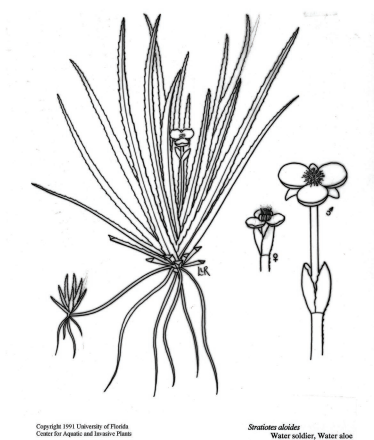
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Malcolm Storey, EOL.org

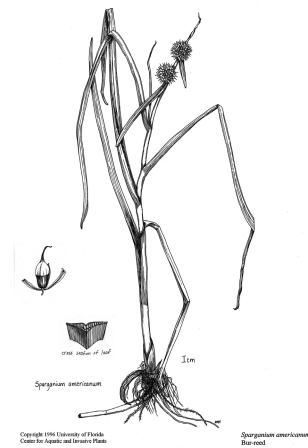


Glen Mittelhauser, mainenaturalhistory.org



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Stratiotes aloides
Water soldier, Water alone



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Sparganium americanum
Bur-reed



Christian Fischer, EOL.org



Robert H. Mohlenbrock,
plants.usda.gov, Cropped.



Milo Pyne, plants.usda.gov

Flowers

Late season fruits

Water Soldier

Stratiotes aloides L.



Meneerke Bloem, EOL.org

American Bur-reed

Sparganium americanum Nutt.

Easy ID

Water soldier has **sharp teeth** along the edges of its leaves. Native bur-reeds do not have serrated edges.

Water Soldier	American bur-reed
Leaf margins serrate	Leaf margins smooth
Leaves fragile and rigid	Leaves flexible
Flowers showy and uncommon	Flowers densely packed in spherical heads

Water soldier looks like the common houseplant, aloe vera.



Andrea Miller, The Morton Arboretum

Prevention and Removal

If you spot water soldier while boating, slow down to reduce wake. Disruption can dislodge plants and send them floating to new areas.

To remove water soldier, rake up the floating plants, bag, and take to a landfill. Watch for and remove any floating pieces. Water soldier is fragile and can reproduce by fragments. Wear arm and leg protection to prevent skin injury.

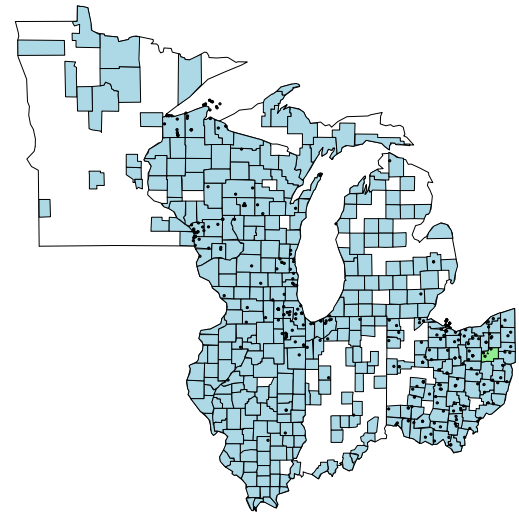
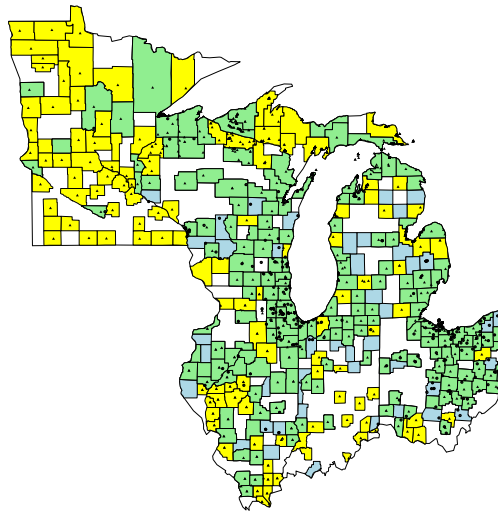
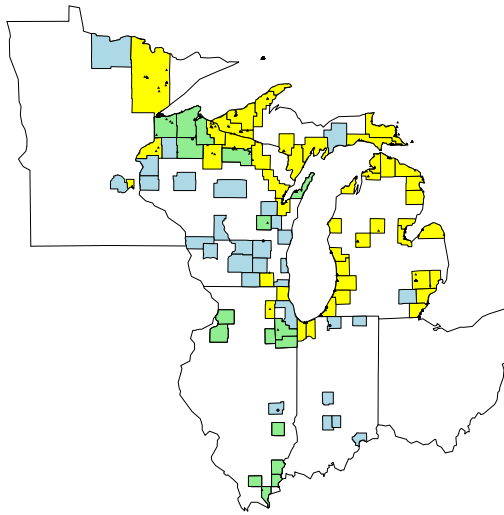
Report any sightings:

www.eddmaps.org

Invasive
Hybrid Cattail
Typha xglauca Godr.

Invasive
Narrowleaf Cattail
Typha angustifolia L.

Native
Broadleaf Cattail
Typha latifolia L.

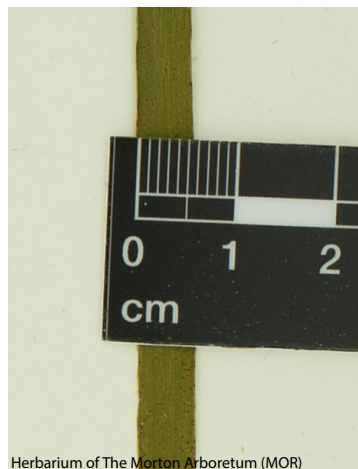


■ Counties present in EDDMapS only
■ Counties present in SEINet only
■ Counties present in both EDDMapS and SEINet
■ Georeferenced specimens, SEINet
▲ Georeferenced observations, EDDMapS
Data downloaded January and February 2017, and May 2018. Maps v2.

Example Populations



Leaf Width



Hybrid Cattail

Typha xglauca Godr.

Narrowleaf Cattail

Typha angustifolia L.

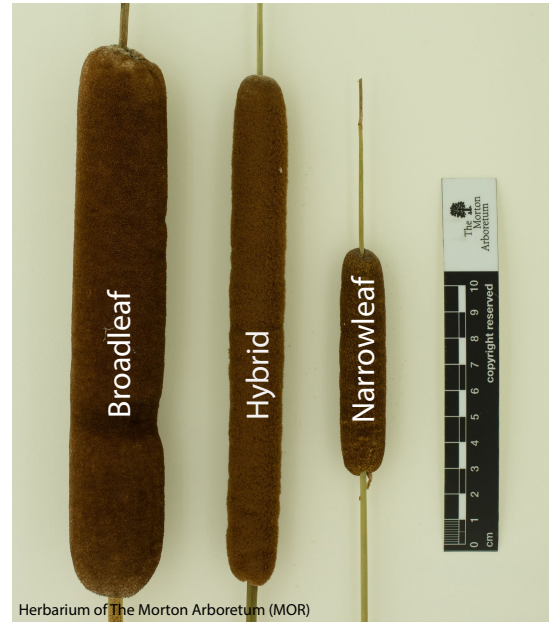
Broadleaf Cattail

Typha latifolia L.

Flower Inflorescence (spike)



Late season, male flowers dropped



Late Season Inflorescence



The hybrid cattail, *T. xglauca*, is produced by frequent crosses between the native broadleaf and the non-indigenous narrowleaf.

Hybrid Cattail

Typha xglauca Godr.

Narrowleaf Cattail

Typha angustifolia L.

Broadleaf Cattail

Typha latifolia L.

~~Easy ID~~

There is no easy, reliable field identification for these taxa. In pure populations, narrowleaf and hybrid cattails have a gap between the male and female flowers, broadleaf cattails do not.

Invasive



Native



Due to hybridization, backcrossing to one of the parental species, and introgression, all *Typha* in the Great Lakes region may be invasive. Recent genetic work on *Typha* has suggested that morphological measurements alone may not be enough to confidently ID these species.

Hybrid Cattail	Narrowleaf Cattail	Broadleaf Cattail
Stem 2-3 m tall	Stem 1-3 m tall	Stem 1-3 m tall
Leaf 6-15 mm wide	Leaf 4-10 mm wide	Leaf 14-23 mm wide
Spike longer than 15 cm	Spike shorter than 15 cm	Spike shorter than 15 cm
Gap between male/female flowers 0.5-4 cm	Gap between male/female flowers 2-8 cm	No gap between male/female flowers

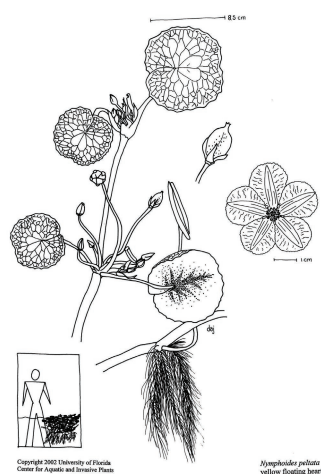
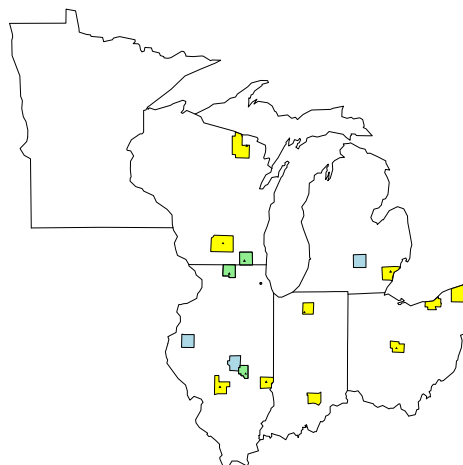
Prevention and Removal

The most effective way to control cattail populations is to repeatedly cut shoots below water level. This can be done in late summer or early autumn. Cutting stems too early will result in increased growth.

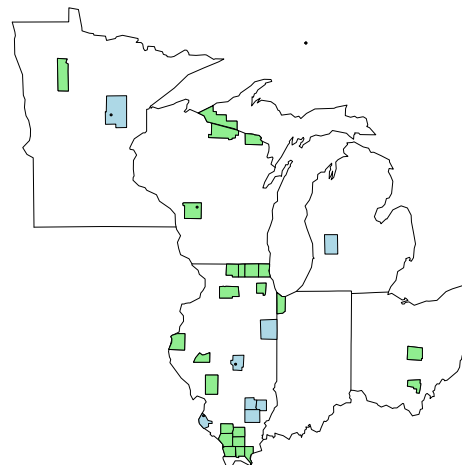
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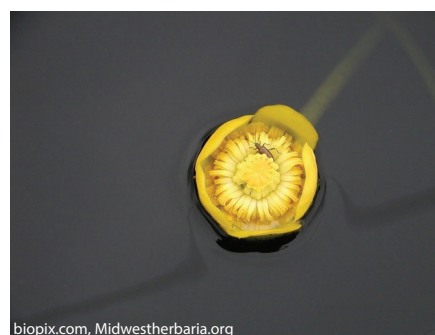
Invasive
Yellow Floating Heart
Nymphoides peltata (Gmel.) Kuntze



Native
Yellow Pond Lily
Nuphar lutea (L.) Sm.



■ Counties present in EDDMapS only
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Yellow Floating Heart

Nymphoides peltata (Gmel.) Kuntze

Yellow floating heart can be distinguished most easily by its wavy leaf margins. It might also be confused with European frogbit, but yellow floating heart has much larger leaves. (13cm vs. 6cm across)



Yellow Pond Lily

Nuphar lutea (L.) Sm.

Easy ID



Yellow Floating Heart	Yellow Pond Lily
Leaves to 13 cm diameter	Leaves to 40 cm diameter
Leaf margins wavy	Leaf margins smooth
Flowers unscented	Flowers scented
Flower petal margins fringed	Flower sepal margins smooth

Prevention and Removal



Small patches of yellow floating heart can be controlled by hand-pulling if all fragments are gathered. The plant grows from underwater stems called stolons. If a stolon breaks off with a node intact, the fragment can establish a new population.

Watch for and remove fragments of yellow floating heart caught in boating equipment and in ballast water.

Report any sightings:

www.eddmaps.org

Glossary

Auricles - Pair of ear-like or horn-like structures that extend from the leaf sheath and generally wrap around the the culm at the point where the sheath ends meet

Culm - Stem of a grass, sedge, or rush

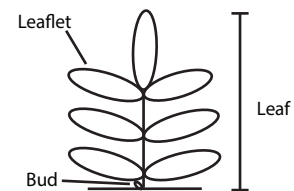
Elliptic - Having an oval shape

Emergent - Growing up from the water's surface, thus growing in part below and in part above the surface

Habit - Pattern of growth form

Inflorescence - Group of flowers

Leaflet - Segment of a compound leaf



Ligule - A flap of tissue, typically thin and membranous, attaching at the point of connection between the leaf blade and the stem in grasses, sedges, *Potamogeton*, and occasional other families

Node - The point at which a leaf starts growing from the stem

Petal - Modified showy leaf around reproductive structures

Petiole - The stalklike structure that connects a leaf to the stem; plants in which this structure is not distinguishable from the leaf blade are said to be sessile

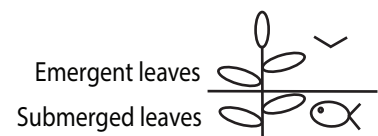
Rhizome - Underground stem, facilitates cloning

Sepal - Modified leaf at base of flower, often green

Spike - Unbranched inflorescence

Stolon - Stem running along surface of substrate, facilitates cloning

Submerged - Growing completely underwater



Tuber - Underground stem, stores starches

Turion - Winter bud, dense leaf tissue, facilitates cloning

Whorl - Leaf arrangement of three or more leaves coming from a node, surrounding the stem in circular pattern



Additional Resources



www.greatlakesinvasives.org

Collections database with plant, fish, and mollusk occurrence records and specimen images.



Early Detection & Distribution Mapping System

www.eddmaps.org

Online and smartphone application to report invasives sightings and create distribution maps.



www.idigbio.org

Collections database with plant and animal occurrence records and specimen images.



www.glerl.noaa.gov/res/Programs/glansis/glansis

Node of the USGS NAS database. Includes nonindigenous, range expansion, and watch-list species.

Consortium of
Midwest
Herbaria

www.midwestherbaria.org

Collections database and hub for plant species information. Focused on the Great Lakes Region.

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Wisconsin Department of Natural Resources - <http://dnr.wi.gov/>

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