



# Aquatic Invaders

## Outreach to Water Gardeners and Aquarium Hobbyists

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PRAIRIE RESEARCH INSTITUTE



# What are aquatic invaders?





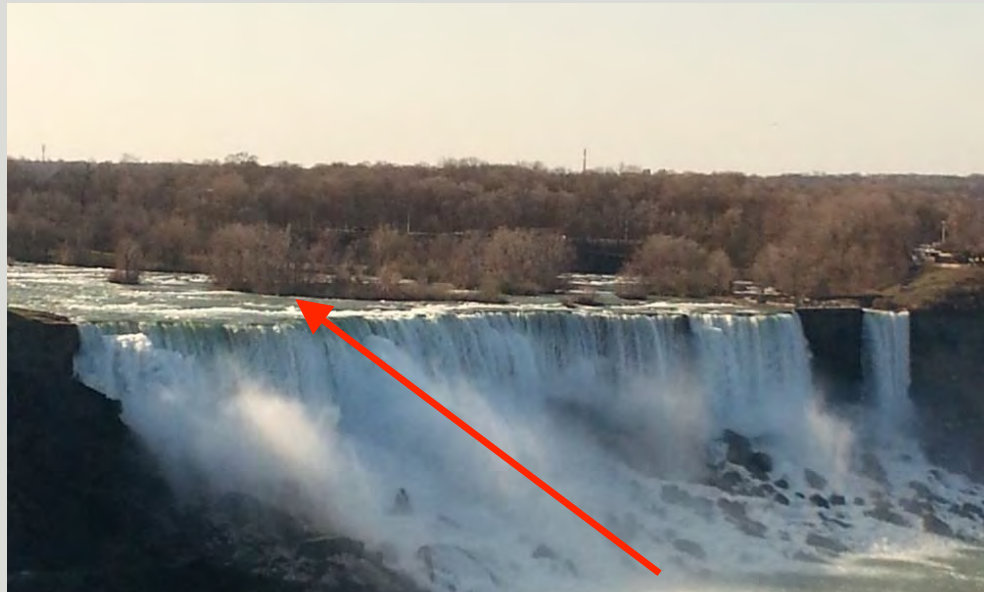
# Aquatic invaders

- Introduced outside natural geographic range
  - Intentionally
  - Accidentally



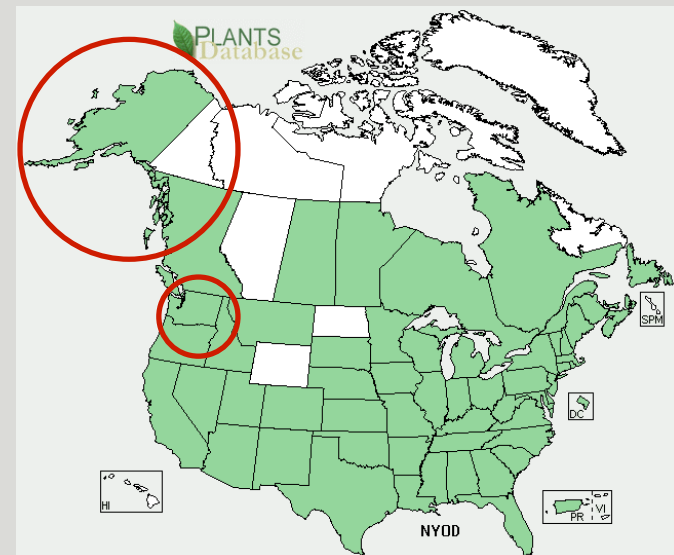
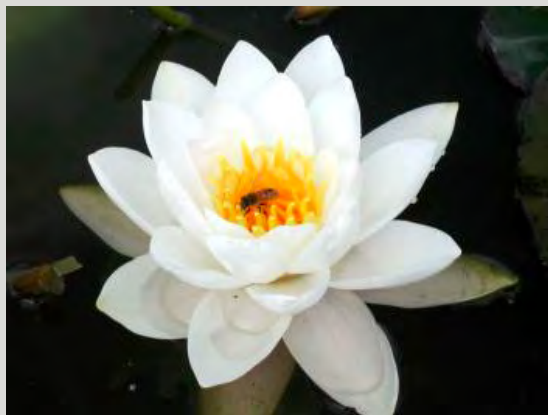
# Natural geographic range

- Natural barriers restricts species movement
  - Oceans, mountains, deserts, etc.
  - Temperature, salinity, etc



# Natural geographic range

- Native to North America is not native all over North America
- Regionally specific – example:  
white waterlily (*Nymphaea odorata*)



# Paths of introduction

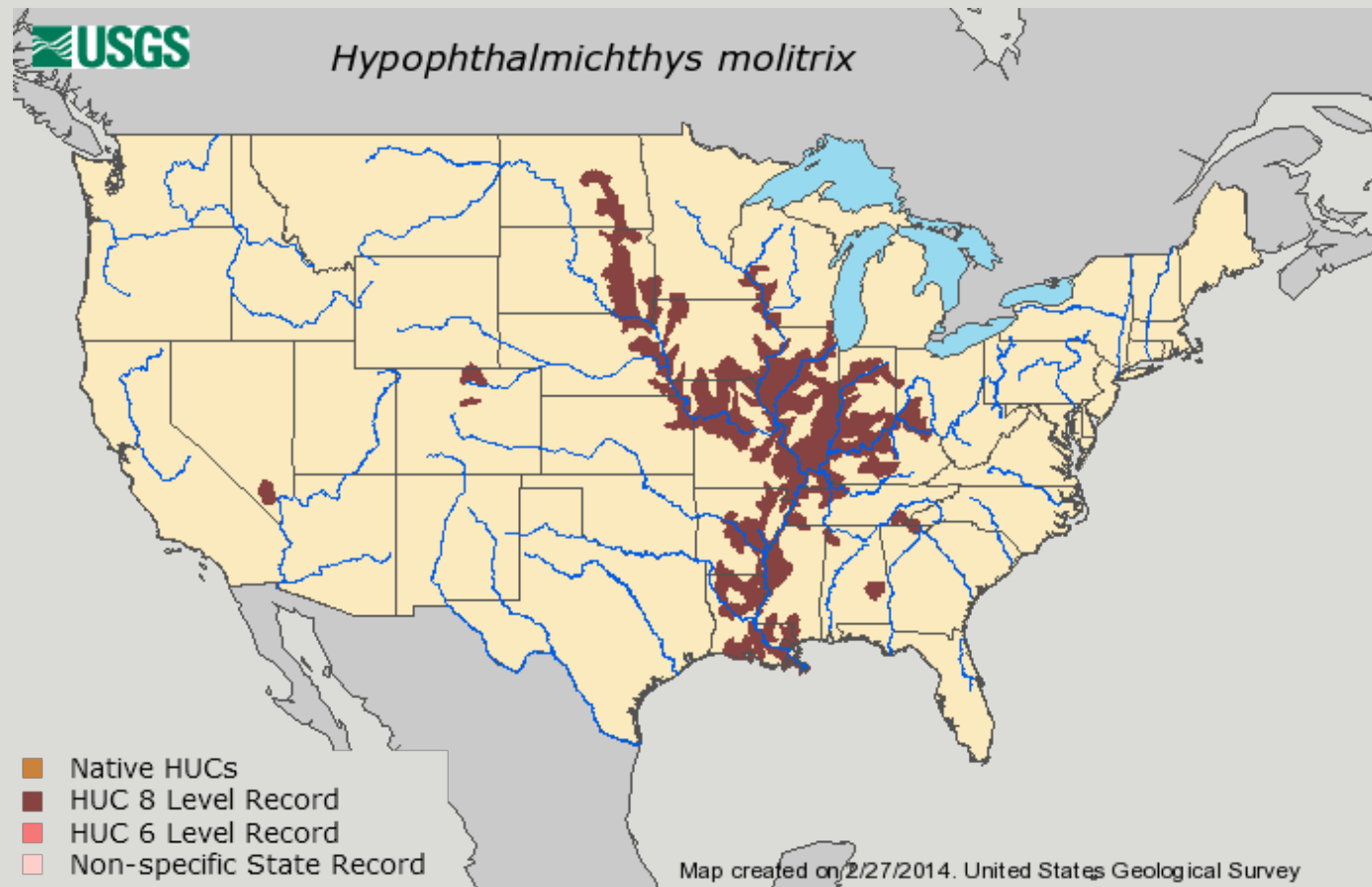
- Aquariums
- Shipping industry
- Boating
- Fish stocking
- Water gardens
- Others





# Aquatic ecosystems connectivity

- Aids the rapid spread of invasives once in a system



# Ecosystem impacts

- Compete with regionally native species
- Threatened and endangered species
- Reduce species diversity
- Change animal community interactions



# Ecosystem impacts

- Degrade water quality
- Increase debris buildup
- Change sediment chemistry
- Impede water flow and movement

# Economic impacts

- Impair recreation
- Changes in flooding
  - Impedes drainage
- Decrease property values
- Create habitat for mosquitos
- Reduce waterfowl habitat



# Economic impacts

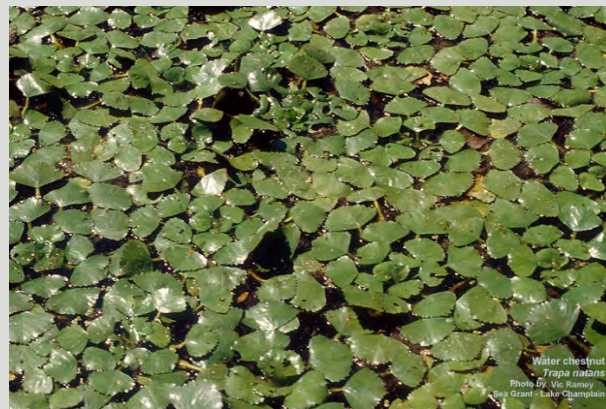
- Removal cost
  - \$100,000,000 annually in the 1990's
  - \$29,700,000 in Florida 2008-2009





# Examples of aquatic invasive plants

- Purple loosestrife- *Lythrum salicaria*
- Water chestnut - *Trapa natans*
- Hydrilla - *Hydrilla verticillata* -



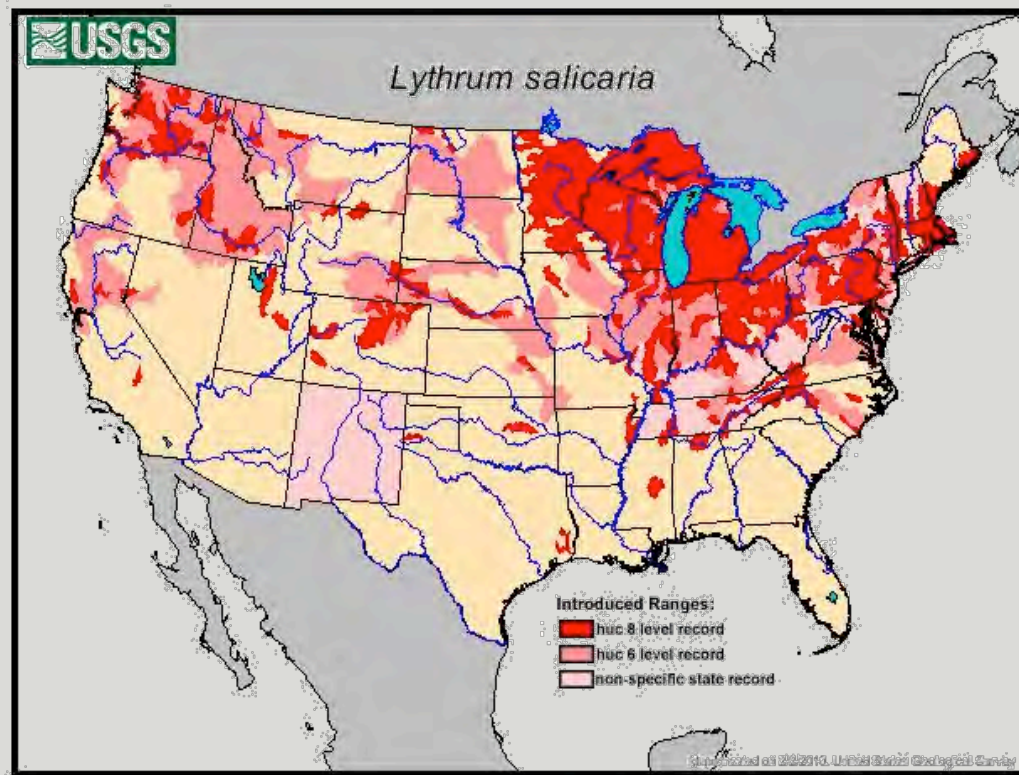
# Purple loosestrife

- *Lythrum salicaria*
- European
- Ornamental in 1800's
  - $\leq 10'$  tall
  - $\leq 50$  stems/plant
  - $\leq 3,000,000$  seeds/year



# Purple loosestrife

- Pastures to shallow water
- Spreads through seeds and vegetatively





# Purple loosestrife

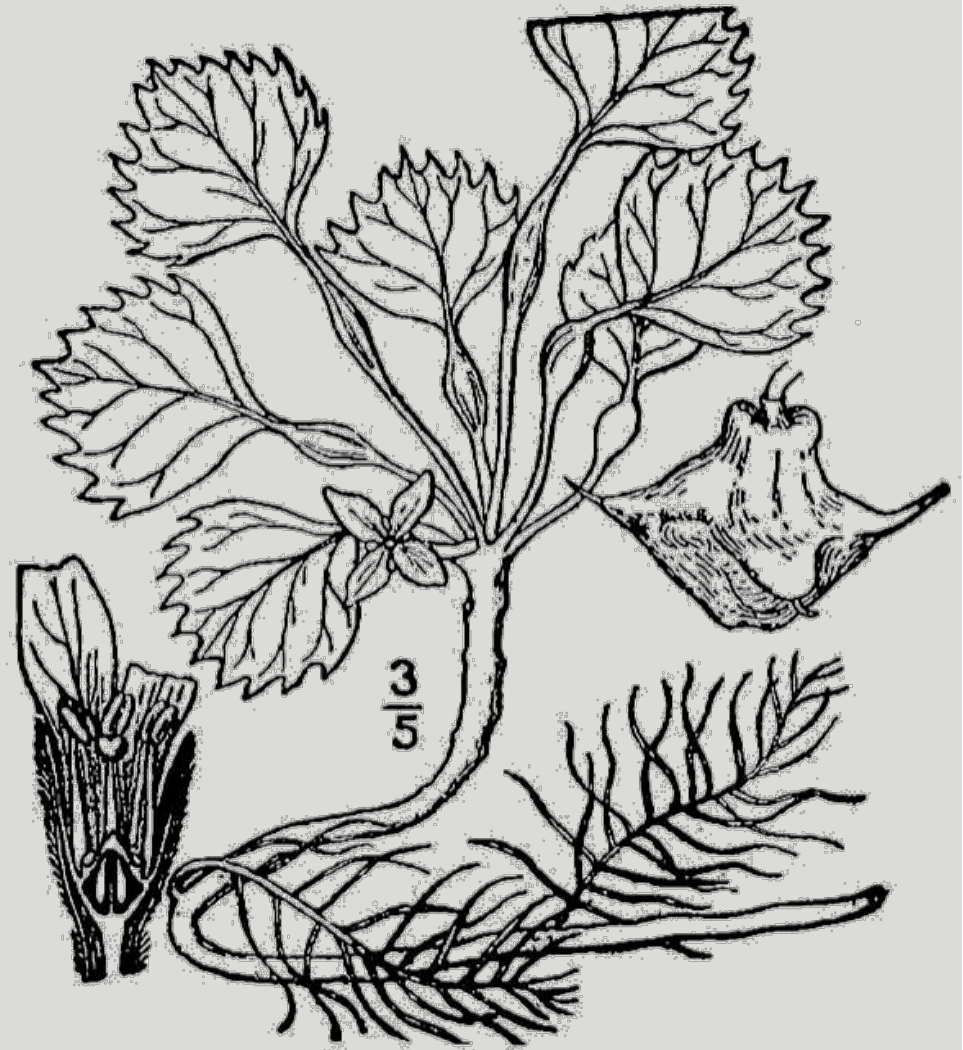
- Loss of high quality bird habitat
- Reduce plant diversity
- Change sediment nutrients
- Change wetland function
- Annual loss of 200,000 acres of wetlands each year

# Purple loosestrife

- Costs \$48,000,000 annually
  - Control cost
  - Loss of forage
  - Waterfowl habitat loss
  - Irrigation system damage
  - Wild rice loss

# Water chestnut

- *Trapa natans*
- Not Chinese water chestnut (*Eleocharis dulcis*)
- Europe, Africa, Asia
- Ornamental in 1877
  - Shallow, still water  $\leq 15'$  deep - mostly 6'





# Water chestnut

- Annual species
- Reproduces through four-pronged nutlet with barbs
- Loss of recreational activities



*Trapa natans*  
Water chestnut  
Photo by Vic Ramey  
© 2002 University of Florida

# Water chestnut

- Dense surface canopies
  - 17,000 lbs of dry biomass/acre
  - Light penetration -95%





# Water chestnut

- Depletes oxygen
  - Oxygenating species
  - Impacts invertebrates and fish



Water chestnut  
*Trapa natans*  
Photo by Vic Ramey  
Sea Grant - Lake Champlain

# Water chestnut

- Add to sediment loads, turbidity and eutrophication
- Low forage value for waterfowl

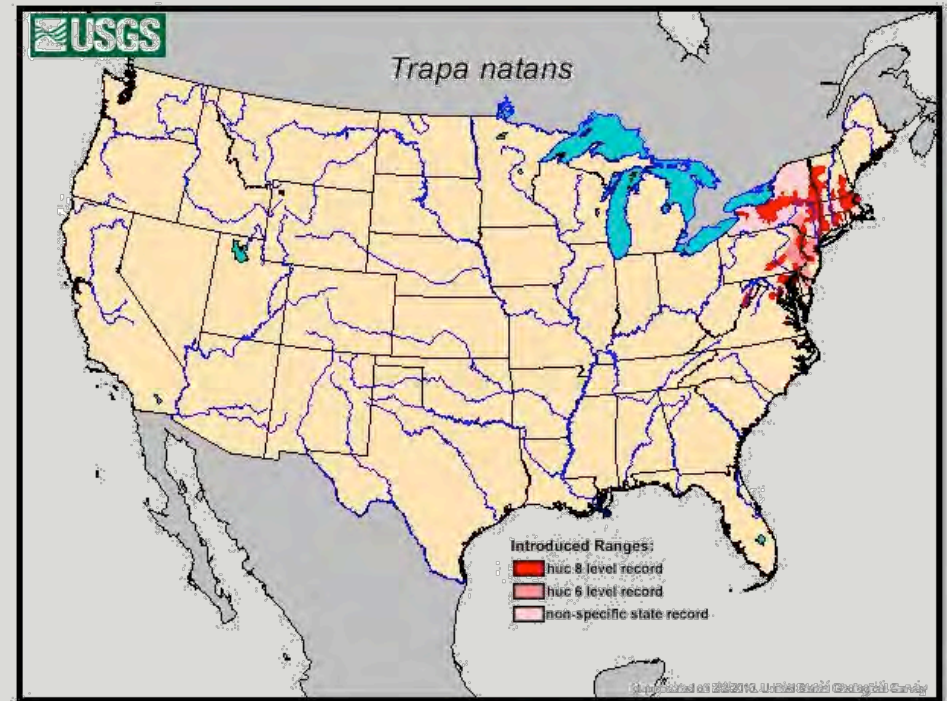


Water chestnut  
*Trapa natans*  
Photo by Vic Ramey  
Sea Grant - Lake Champlain



# Water chestnut

- Cost of removal
  - \$4,597,351
    - 1982-2001
    - Lake Champlain
  - \$3,700,000
    - 1939 – 1945
    - Potomac River



# Hydrilla

- *Hydrilla verticillata*
- Asia
- Oxygenator
- Aquarium plant
  - Contaminate with common water garden plants
- Spread vegetatively through turions and tubers



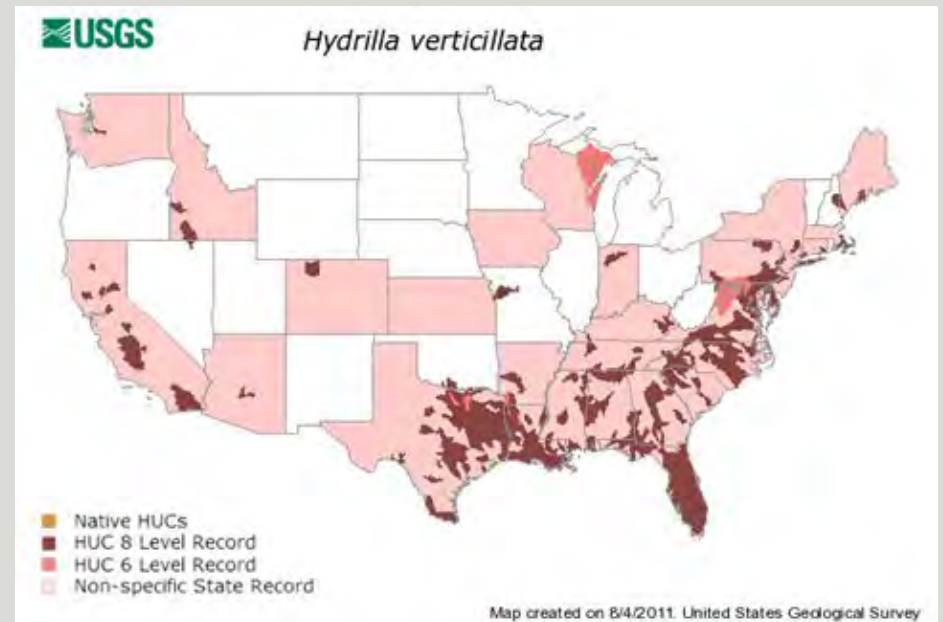
# Hydrilla

- Can grow in deep water where other plants cannot
  - 20' Hydrilla vs. 8' natives
  - 80% of biomass 1-2' from surface
  - Shades out native species



# Hydrilla

- Annually in FL
  - \$15,000,000 control
  - \$857,000 loss revenue
  - Recreational value
  - Agriculture
  - Flood control
  - Residential property values





# An ounce of prevention is worth a pound of cure

- “Once a species is established, impacts grow over time and space, and are usually irreversible in perpetuity.”
  - David Lodge, Ph.D. University of Notre Dame
- Preventing introduction and spread of aquatic invaders is more cost effective than managing the problems once they happen



**Choose regionally-native or non-weedy plants.**

**Reduces risk to nearby waterways**

**Plants can be unintentionally released  
(wind, animals, flooding, etc.)**

# Risk Assessments

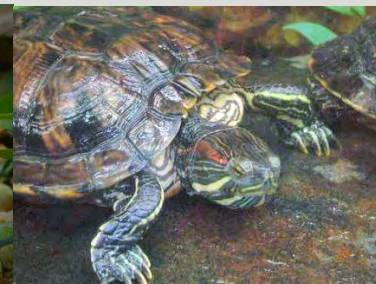
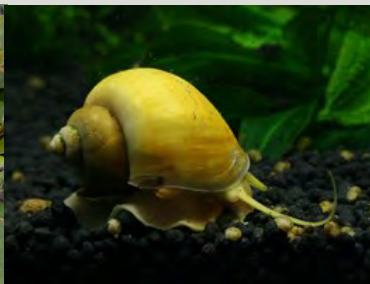
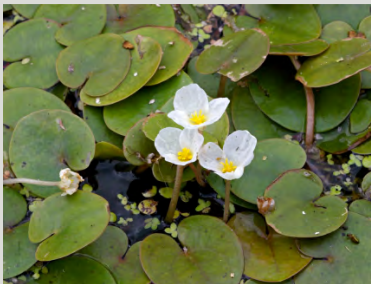
Plants

Mollusks

Fish

Reptiles and Amphibians

Crustaceans



# Risk assessment

- Determine potential for invasion
  - Based on biological factors
  - Gordon et al 2012
- Risk assessment allows for determining the possibility of a species being invasive in a certain environment



# Not invasive yet

- Changes in environment
- Genetic changes
- Introduction of a pollinator or seed disperser
- Humans have failed to recognize an invasion had begun earlier.

# Native and Non-Weedy Alternatives Marginal



*Asclepias incarnata*  
(swamp milkweed)



*Liatris spicata*  
(dense blazing star)



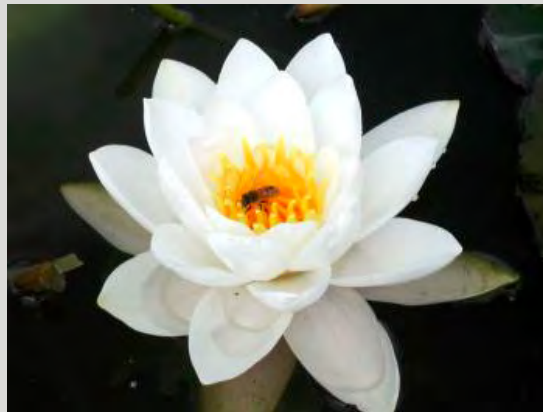
*Decodon verticillatus*  
(swamp loosestrife)

# Native and Non-Weedy Alternatives

## Free and Rooted Floating



*Nuphar advena*  
(yellow pond lily)



*Nymphaea odorata*  
(white water lily)



*Nelumbo lutea*  
(american lotus)



# Native and Non-Weedy Alternatives Submerged (a.k.a. Oxygenators)



*Ceratophyllum demersum*  
(coontail)



*Elodea canadensis*  
(American waterweed)



*Potamogeton pectinatus*  
(sago pondweed)

# If it's such a problem why can I buy it?

- Regulation
  - Allows or prohibits species
- Identification issues
- Not aware of regulations
- Not regulated

# If it's such a problem why can I buy it?

- Education – consumer choice





# What's in a name?

- The importance of scientific names
  - arrowhead, Hawaii arrowhead (*Sagittaria sagittifolia*)
  - broadleaf arrowhead, common arrowhead, and arrowhead (*Sagittaria latifolia*)
- Which one is now regulated in IL?
  - Comfortable with just arrowhead?

# What's in a name?

- Scientific names change
  - *Sagittaria chinensis*
  - *Sagittaria engelmanniana*
  - *Sagittaria esculenta*
  - *Sagittaria latifolia*
  - *Sagittaria latifolia* var. *obtusa*
  - *Sagittaria latifolia* var. *pubescens*
  - *Sagittaria longirostra*
  - *Sagittaria obtusa*
  - *Sagittaria ornithorhyncha*
  - *Sagittaria planipes*
  - *Sagittaria pubescens*
  - *Sagittaria variabilis* Engelm. var. *obtusa*
  - *Sagittaria viscosa*
- USDA Plants Database – a good resource

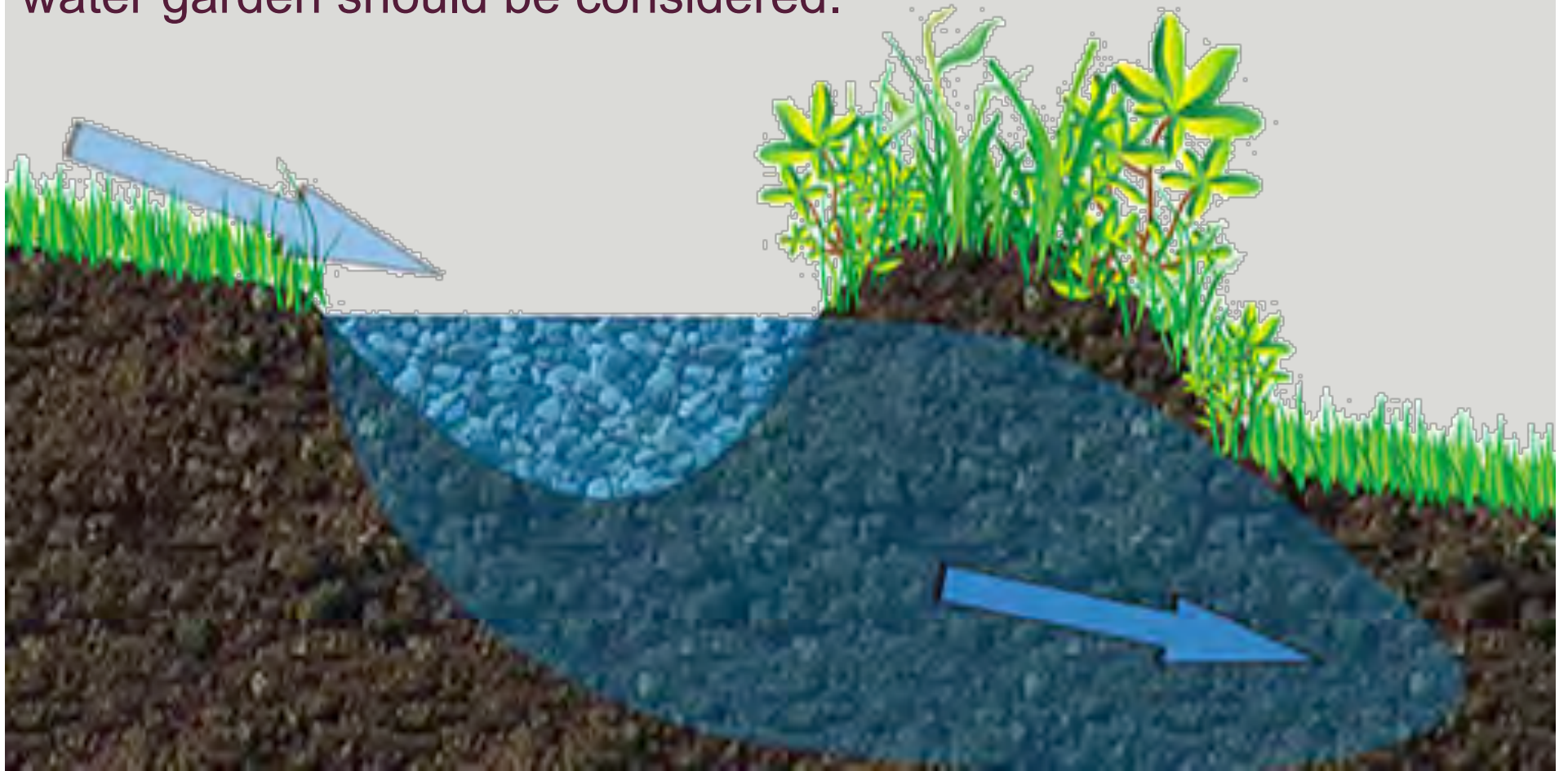


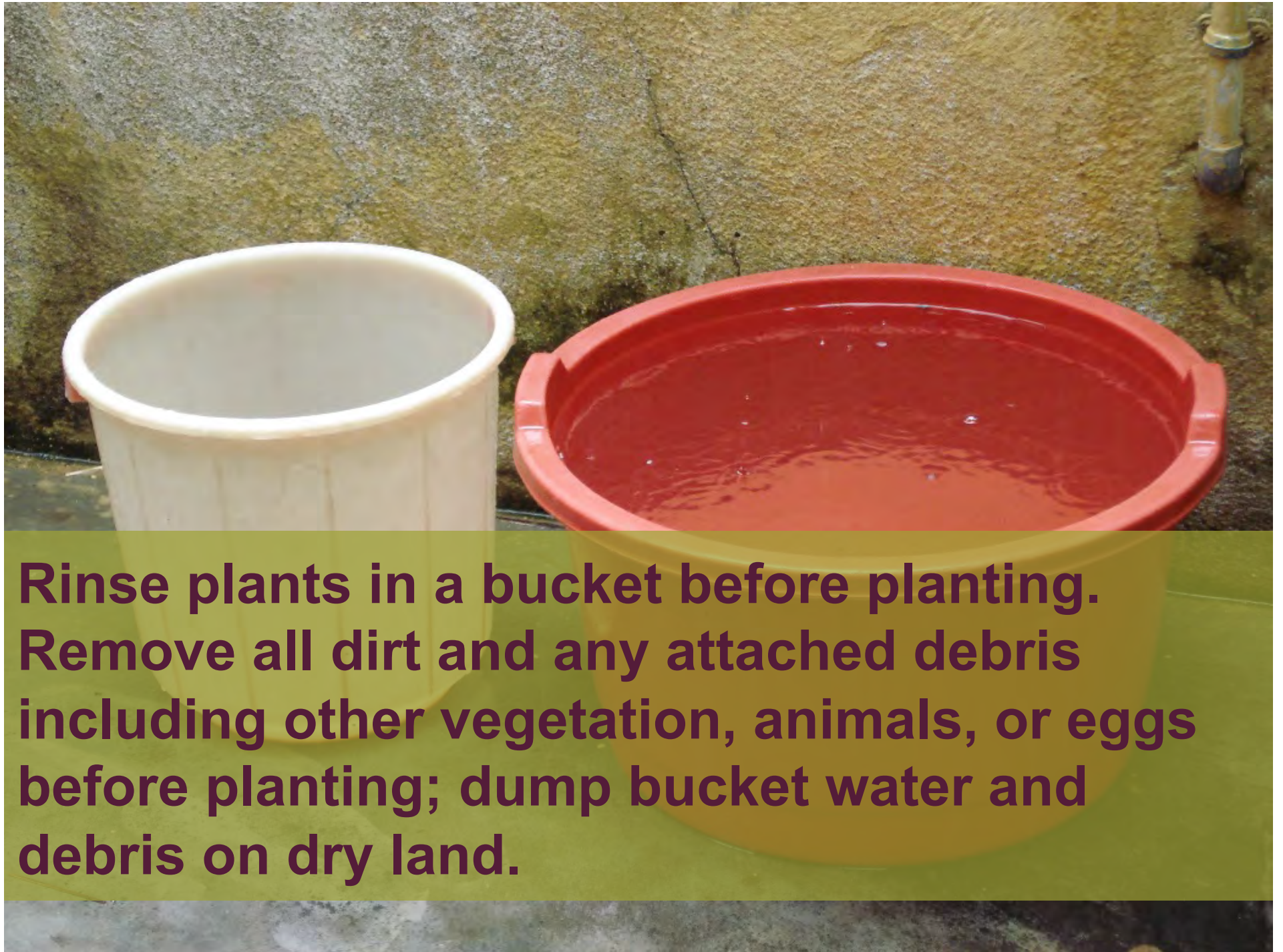
**Choose a location away from natural waterways and flood-prone areas.**

This will help ensure that the plants and animals in the water garden will not be carried into local streams, ponds or lakes as a result of heavy rainfall.



**Occasionally check that the water garden remains isolated from natural waterways and areas that flood.** Installation of standard landscape water diverting structures (e.g., water bars, swales) or relocation of the water garden should be considered.

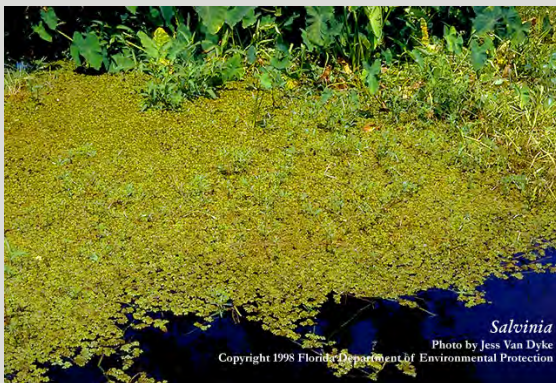




**Rinse plants in a bucket before planting. Remove all dirt and any attached debris including other vegetation, animals, or eggs before planting; dump bucket water and debris on dry land.**



This will help keep unwanted plants and animals from being accidentally introduced into your water garden, and keep these same organisms out of storm drains that might lead to natural waterways.



*Salvinia minima*  
(water spangles)



*Egeria densa*  
(anacharis)



*Hydrilla verticillata*  
(hydrilla)



## Purchase from licensed nurseries.

Many jurisdictions require that the license be posted. If the license isn't clearly visible, ask an employee about their licensing.



**Illinois**  
Department of  
**Agriculture**

**DNR**  
INDIANA DEPARTMENT OF  
NATURAL RESOURCES

The image shows a dense growth of water hyacinth plants in a pond. The plants have bright green, rounded leaves and some yellowish flowers. A semi-transparent green box is overlaid on the top half of the image, containing text. The background is a close-up of the plants, showing their characteristic bulbous leaves and some brown, dried parts.

## **Remove uninvited plants that colonize your pond.**

A plant that moves into your pond and becomes established is likely an invasive species. It should be removed and disposed of properly.



**Freeze unwanted plants in a sealed plastic bag and dispose in the trash.** Unwanted plants should not be composted because their seeds and other reproductive plant parts may remain viable.







**Find a new home for unwanted animals such as a pet retailer, animal shelter, or other water gardener.**

If euthanasia is an option, consult with a veterinarian.

# WHAT'S IN YOUR WATER GARDEN?

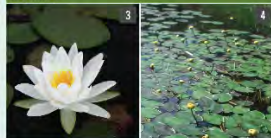


*Choose Non-Invasive Plants for Your Garden*

## SUBMERGED



## FLOATING



## MARGINAL



## INVASIVE



Invasive species can displace native plants and animals, harm ecosystems and create economic loss. For a list of invasive water garden species and their alternatives, visit [www.ifscagrants.org/watergardens](http://www.ifscagrants.org/watergardens)

1 *Ceratophyllum demersum* (Common) Photo by V.G. Ramesh, University of Florida IFAS Center for Aquatic and Invasive Plants. Used with permission.  
 2 *Potamogeton nodosus* (Sparg Waterweed) Photo by Ann Jurek, University of Florida IFAS Center for Aquatic and Invasive Plants. Used with permission.  
 3 *Najasidolus coloratus* (Paganus and Water Lily) Photo by R.W. Lord, Bird Island Wetland Center.  
 4 *Najasidolus coloratus* (Paganus and Water Lily) Photo by R.W. Lord, Bird Island Wetland Center.  
 5 *Sagittaria* Photo by The Ohio State University.  
 6 *Lythrum spicatum* (Rose Hating Star) Photo by R.W. Lord, Bird Island Wetland Center.  
 7 *Najasidolus coloratus* (Paganus and Water Lily) Photo by R.W. Lord, Bird Island Wetland Center.

Developed by Illinois Invasive Sea Grant & Illinois Natural History Survey, Prairie Research Institute for the Great Lakes Sea Grant Network.







*Nymphaea odorata* Photo by: Ray Matthews Courtesy of Lady Bird Johnson Wildflower Center

### You can help to stop the spread of invasive plants and animals when you:

**Choose** water garden location away from natural waterways and flood-prone areas.

**Purchase** from licensed nurseries.

**Choose** regionally-native or non-weedy plants.

**Rinse** plants in a bucket before planting. Remove all dirt and any attached debris, including other vegetation, animals, or eggs before planting; dump bucket water and debris on dry land.

**Check** that the water garden remains isolated from natural waterways and areas that flood.

**Remove** uninvited plants that colonize your pond.

**Freeze** unwanted plants in a sealed plastic bag and dispose of in the trash.

**Find** a new home for unwanted animals such as a pet retailer, animal shelter, or another water gardener.

**Never release** plants or animals into natural waterways.

### What should I plant? Non-Invasive Plants

#### Marginal

- Asclepias incarnata* (Swamp Milkweed)
- Caltha palustris* (Marsh Marigold)
- Decodon verticillatus* (Swamp Loosestrife)
- Erianthus ravennae* (Hardy Pampas Grass)
- Glyceria canadensis* (Rattlesnake Mannagrass)
- Hibiscus moscheutos* (Rose Mallow)
- Iris versicolor* (Blue Flag Iris)
- Juncus effusus* (Soft Rush)

*Justicia americana* (American Water-Willow)

*Liatris spicata* (Dense Blazing Star)

*Lobelia cardinalis* (Cardinal Flower)

*Mimulus ringens* (Squarestem Monkey Flower)

*Orontium aquaticum* (Golden Club)

*Peltandra virginica* (Arrow Arum)

*Pontederia cordata* (Pickerel Weed)

*Sagittaria latifolia* (Broadleaf Arrowhead)

*Saururus cernuus* (Lizard's Tail)

*Schoenoplectus pungens* (Three Square)

#### Floating

*Lemna minor* (Common Duck Weed)

*Nelumbo lutea* (American Lotus)

*Nuphar advena* (Yellow Pond Lily)

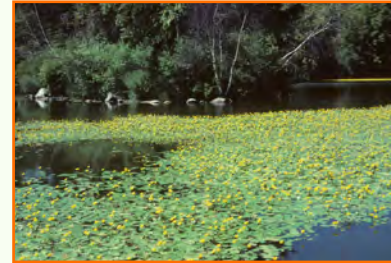
*Nymphaea odorata* (Fragrant Water Lily)

#### Submerged

*Ceratophyllum demersum* (Coontail)

*Elodea canadensis* (American Waterweed)

*Potamogeton pectinatus* (Sago Pondweed)



*Nymphaeoides peltata* Photo by: Howard, R.A. Courtesy of Smithsonian Institution

Some plants and animals available to water gardeners are invasive and cause harm to natural waterways. They can drastically change ecosystems and create inhospitable conditions for native plants and animals. They can also hinder recreational activities such as boating and swimming, and can be costly or near impossible to remove.

You can help to protect our natural waterways by choosing non-invasive plants and animals.

### What plants should I avoid? Potentially Invasive Plants

#### Marginal

- Alternanthera philoxeroides* (Alligator Weed)
- Butomus umbellatus* (Flowering Rush)
- Crassula helmsii* (Swamp Stonecrop)
- Glyceria maxima* (Reed Mannagrass)
- Ludwigia grandiflora* subsp. *Hexapetala*  
(Large-Flower Primrose Willow)
- Lythrum salicaria* (Purple Loosestrife)
- Marsilea quadrifolia* (European Waterclover)
- Phragmites australis* (Common Reed)

#### Floating

- Azolla pinnata* (Mosquito Fern)
- Eichhornia crassipes*  
(Common Water Hyacinth)
- Hydrocharis morsus-ranae* (Common Frogbit)
- Nymphaeoides peltata* (Yellow Floatingheart)

#### Submerged

- Cabomba caroliniana* (Carolina Fanwort)
- Egeria densa* (Brazilian Waterweed)
- Hydrilla verticillata* (Waterthyme)
- Lagarosiphon major* (Oxygen Weed)
- Myriophyllum aquaticum*  
(Parrot Feather Watermilfoil)
- Myriophyllum spicatum*  
(Eurasian Watermilfoil)
- Najas minor* (Brittle Waternymph)
- Potamogeton crispus* (Curly Pondweed)
- Vallisneria spiralis* (Eel Grass)



# Water Garden Webinars

## **“The Science Behind Aquatic Invasive Plants”**

An Overview of Aquatic Invasive Plants

Greg Hitzroth

Assessing the Ecological Risk of Exotic Aquatic Plants

Reuben Keller,

Preventing the Spread of Aquatic Invasive Species

Greg Hitzroth

## **“Building a Better Water Garden”**

Creating Beautiful and Environmentally Responsible  
Water Landscapes

Heidi Natura, Founder and Partner, Living Habitats

Alternatives for Invasive Aquatic Plants

Bob Kirschner, Curator of Aquatic Plant & Urban Lake  
Studies, Chicago Botanic Garden



**Next  
Risk Assessment  
Outreach Tool**



# Website

TakeAIM.org

Regulations database

Pathway information

Local contacts

Other resources



# Thank you!

David Lodge, Reuben Keller,  
Crysta Gantz, Bob Kirschner,  
Kay Havens-Young, Jeremy Fant,  
Jacob Burns, Pat Charlebois, Sarah Zack,  
Danielle Hilbrich, Alice Denny

