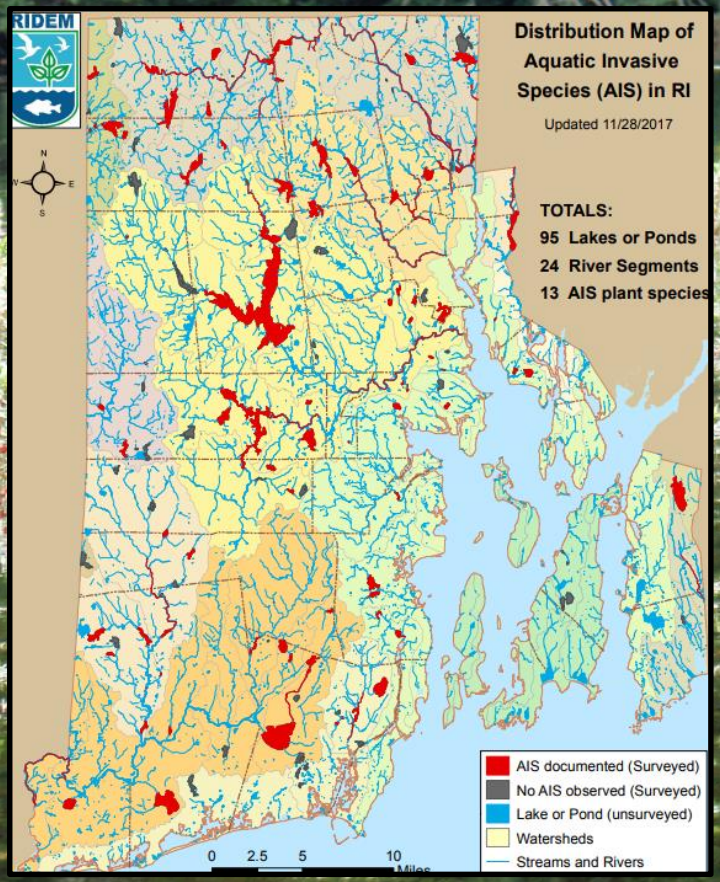
Finding Aquatic Invasive Plants and Planning Lake Management



Katie DeGoosh-DiMarzio

RIDEM Office of Water Resources

Elizabeth Herron

URI Watershed Watch

Today's AIS Workshop: Aquatic Invasive Species

1) Introduction to aquatic plants and AIS
2) How and why are AIS a problem?
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7) AIS Management Goals & Control Strategies

Aquatic Plants

(macrophytes, weeds)

Pawcatuck River, Bradford Landing, RI

Benefits (!!) of Native Aquatic Plants

1. Provide habitat and protection
2. Act as food sources
3. Help recycle oxygen and CO_2
4. Prevent shoreline erosion
5. Help improve water clarity

Belleville Pond, North Kingstown, RI

What are Aquatic Invasive Species?

Usually non-native or "exotic" species

http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/identify.pdf

What are Aquatic Invasive Species?

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How are AIS a problem?

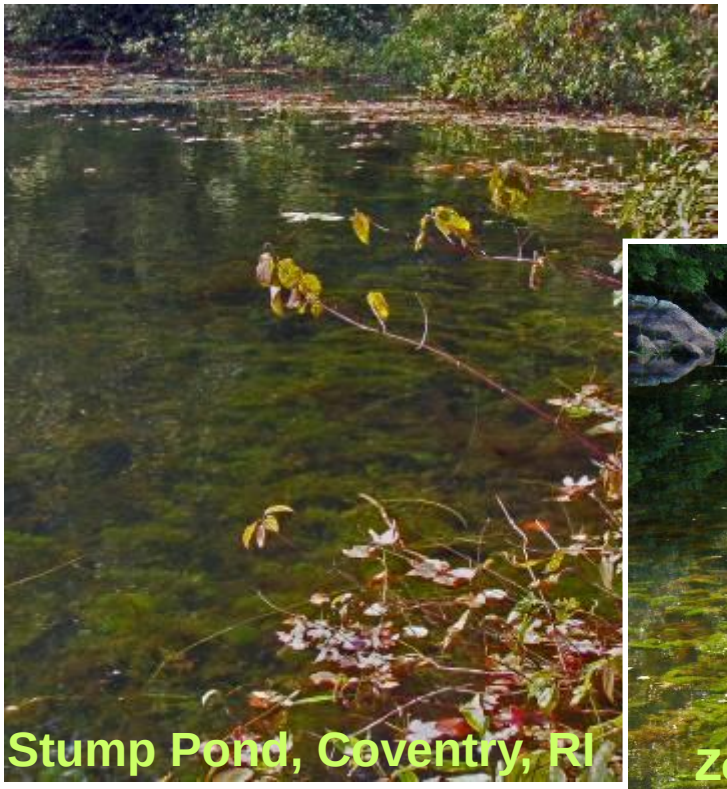
Limit Ecological Function of Lake

- Outcompete beneficial native species
- Decrease biodiversity (and angling opportunities)
- Reduce water quality
- Decompose slowly & reduce O_2
- May degrade conditions for fish

How are AIS a problem?

Impede Recreation

- Reduce aesthetics/visibility


Stump Pond, Coventry, RI


Zeke's Bridge, Coventry, RI

How are AIS a problem?

Impede Recreation

- Reduce aesthetics/visibility
- Become entangled around motors
- Obstruct access to boat ramps/lanes
- Snag fishing lines

How are AIS a problem?

Cause Economic Harm

- Require substantial funds to manage
- May devalue waterfront property
- Threaten tourism/recreation
- Damage infrastructure (shellfish)

POTENTIAL IMPACTS OF EXOTIC OR INVASIVE PLANTS

FISH, WILDLIFE & NATIVE PLANTS

- **Displacement of native plants**
- **Displacement of endangered, threatened or rare aquatic plants**
- **Habitat loss for fish & wildlife**
- **Change in spawning site availability**
- **Change in fish distribution**
- **Reduction in feeding success of predatory fish**
- **Reduction of open-water**

WATER QUALITY

- **Temperature & oxygen fluctuations**
- **Increased phosphorus (nutrient) loading**
- **Alteration in plant and algae communities**
- **Accelerated eutrophication rates**

Source: A report from the Milfoil Study Committee on the Use of Aquatic Herbicides to Control Eurasian Watermilfoil in Vermont. VTDEC, March 1993

POTENTIAL IMPACTS OF EXOTIC OR INVASIVE PLANTS (continued)

RECREATION

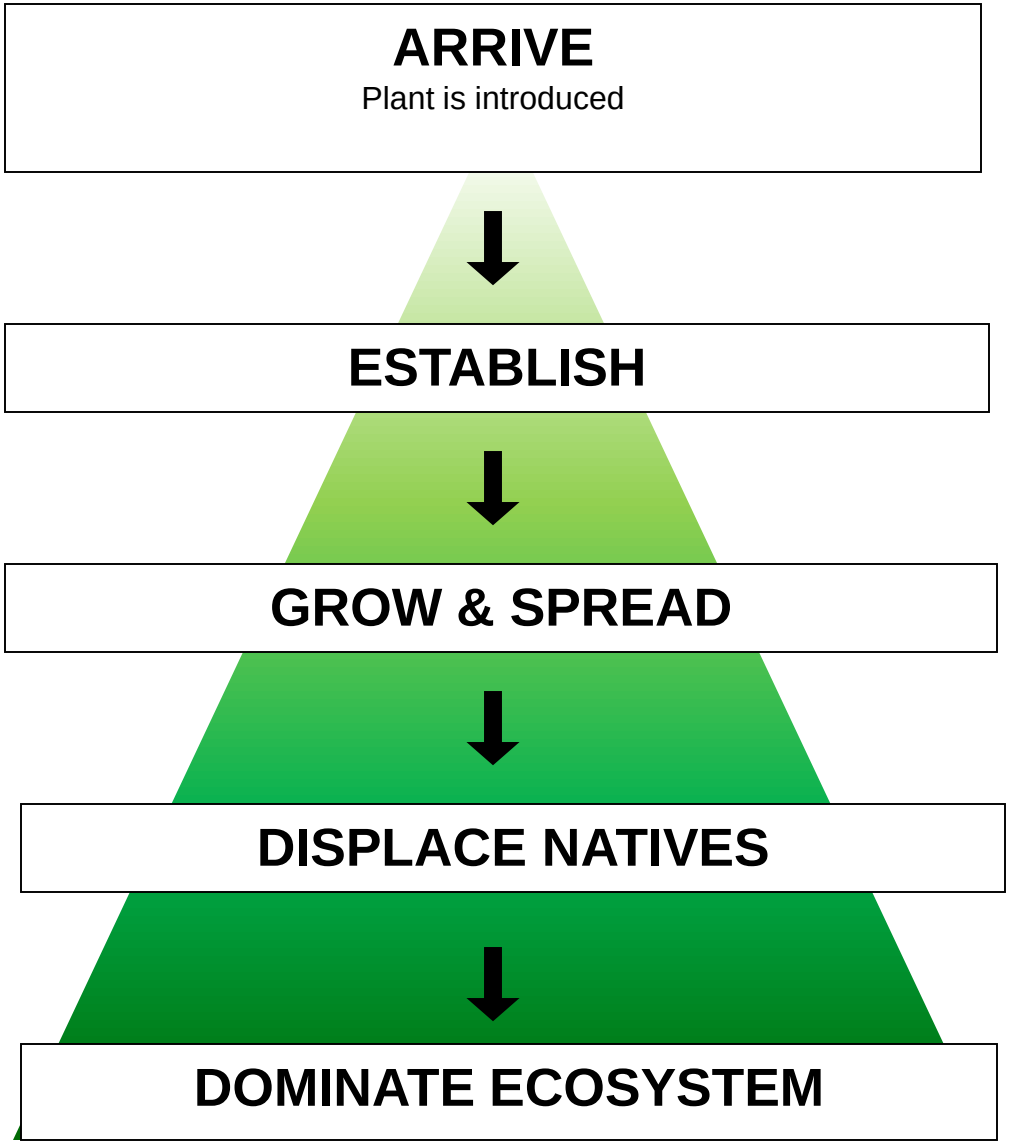
- **Risk of swimmer entanglement**
- **Reduced access for boating & fishing**
- **Reduced aesthetics**

LOCAL COMMERCE & REAL ESTATE

- **Reduced property taxes**
- **Declining property values**
- **Renters fail to return for a second season**
- **Slowed business for marinas, etc.**
- **Declining attendance at lakefront beaches and parks**

Source: A report from the Milfoil Study Committee on the Use of Aquatic Herbicides to Control Eurasian Watermilfoil in Vermont. VTDEC, March 1993

How are AIS a problem?



Stages of an Invasion

ARRIVE
Plant is introduced

ESTABLISH

GROW & SPREAD

DISPLACE NATIVES

DOMINATE ECOSYSTEM

Stages of an Invasion

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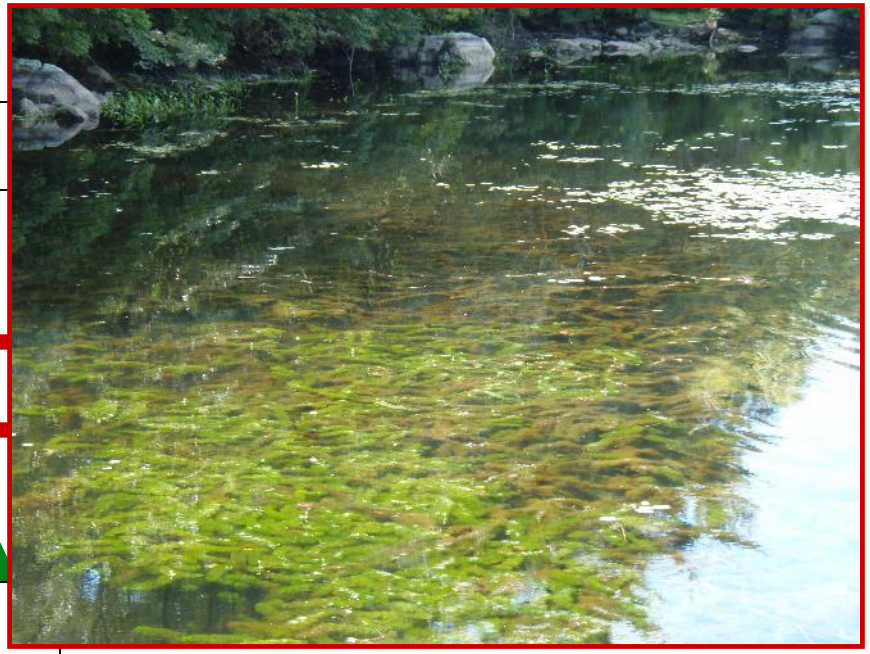

Stages of an Invasion

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Plant is introduced

ESTABLISH

GROW & SPREAD

DISPLACE NATIVES

DOMINATE ECOSYSTEM


Valley Falls Pond, Central Falls, RI

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Where are invasives in RI?

RIDEM AIS Monitoring


Belleville Pond, North Kingstown, RI

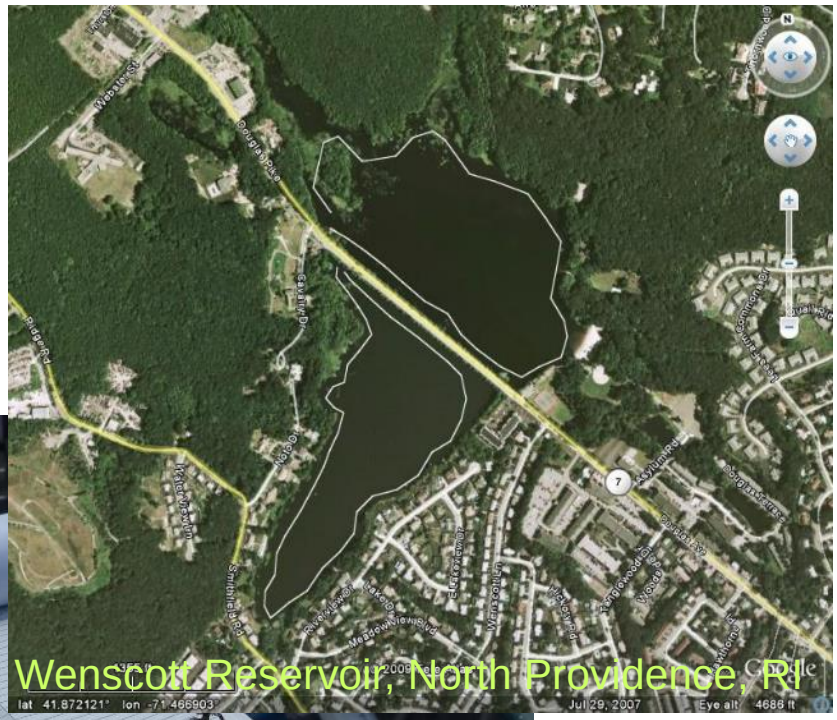

Locustville Pond, Hopkinton, RI

Johnson's Pond, Coventry, RI

Where are invasives in RI?

RIDEM AIS Monitoring

Chapman Pond, Westerly RI



Wenscott Reservoir, North Providence, RI

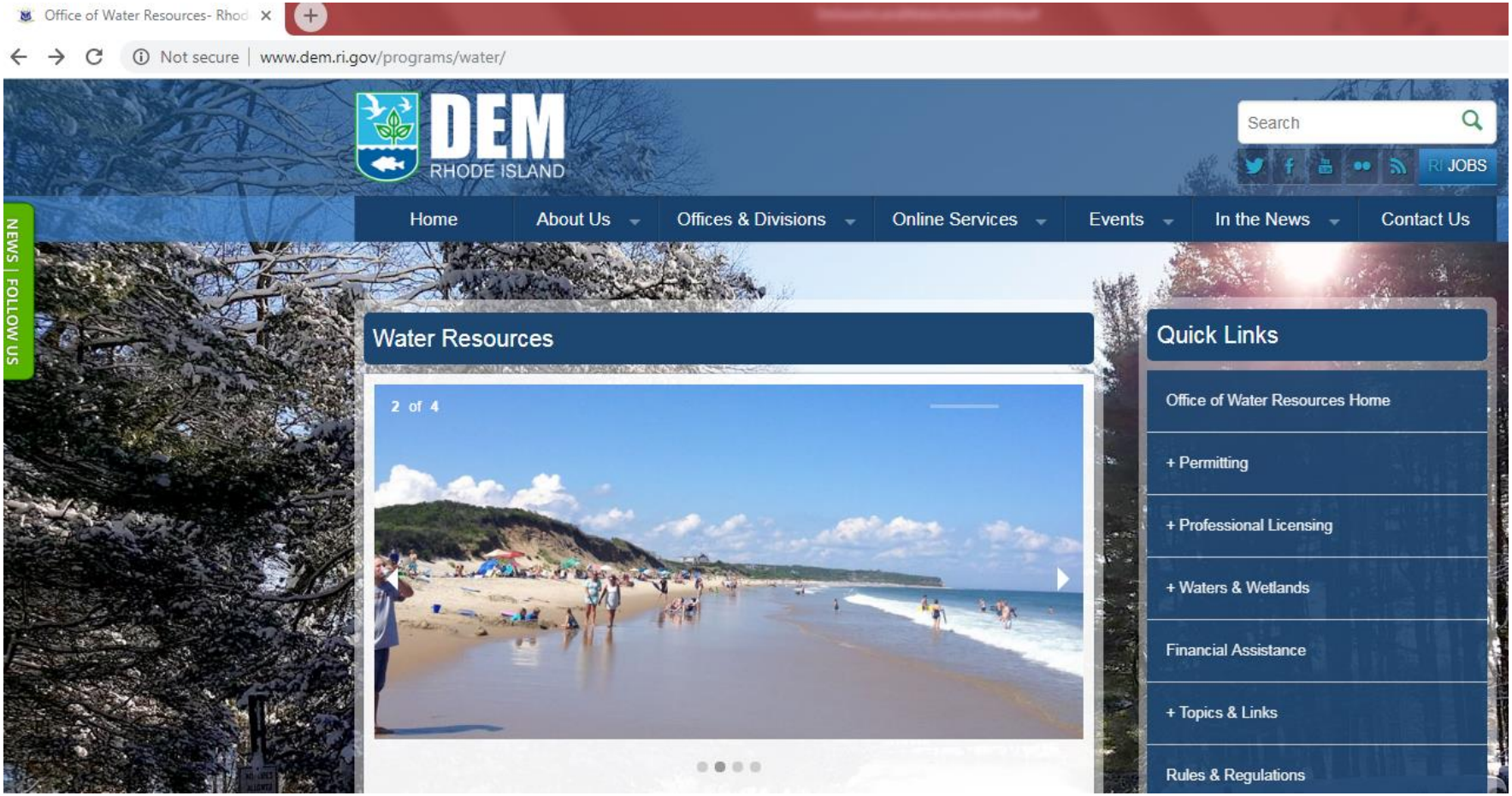
Variable milfoil, RI

Where are invasives in RI?

RIDEM AIS Monitoring
(includes cleaning off boats!)

Where are invasives in RI?

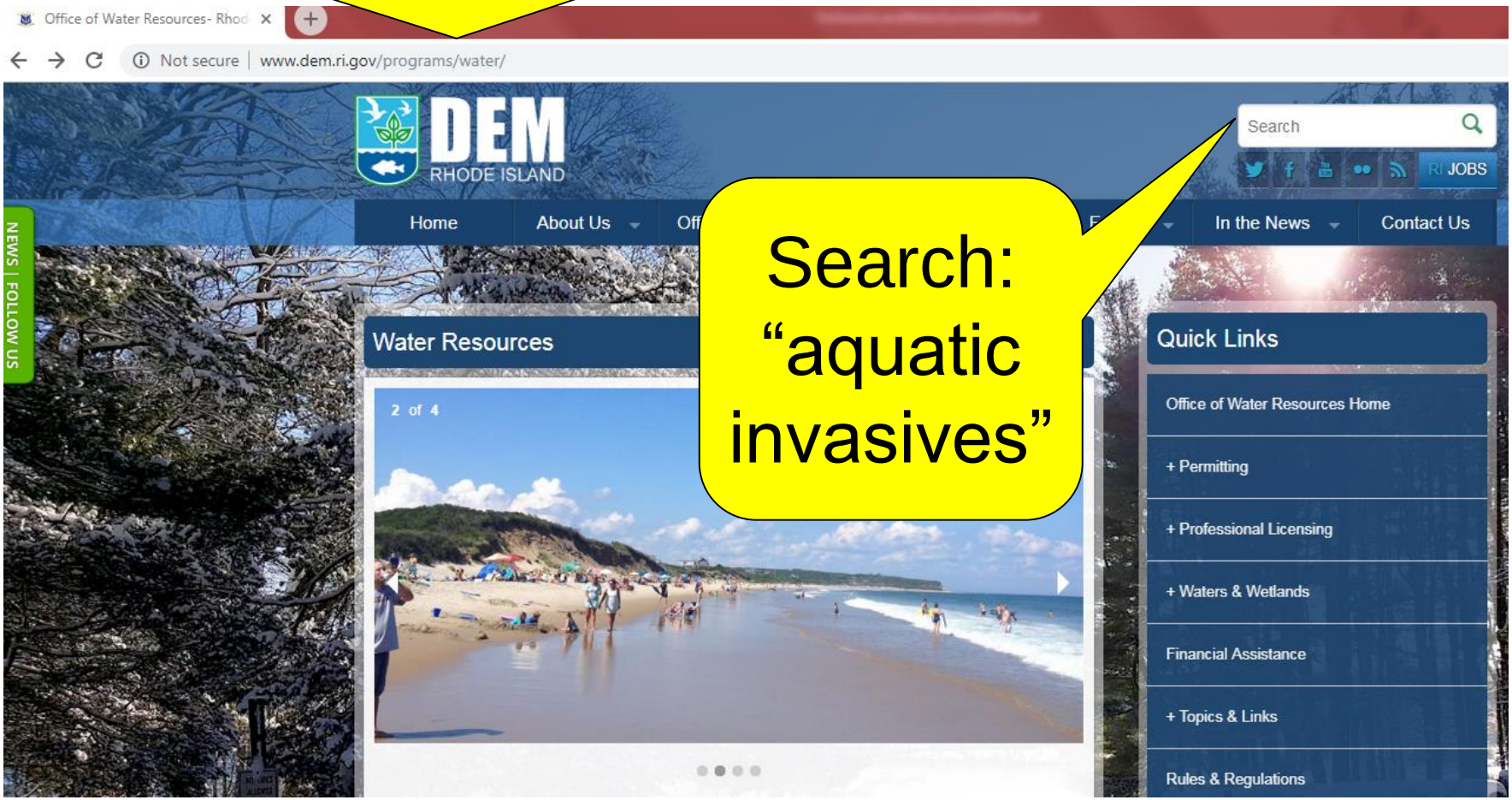
RIDEM AIS Monitoring and MAPPING



Where are invasives in RI?

RIDEM AIS Monitoring and MAPPING

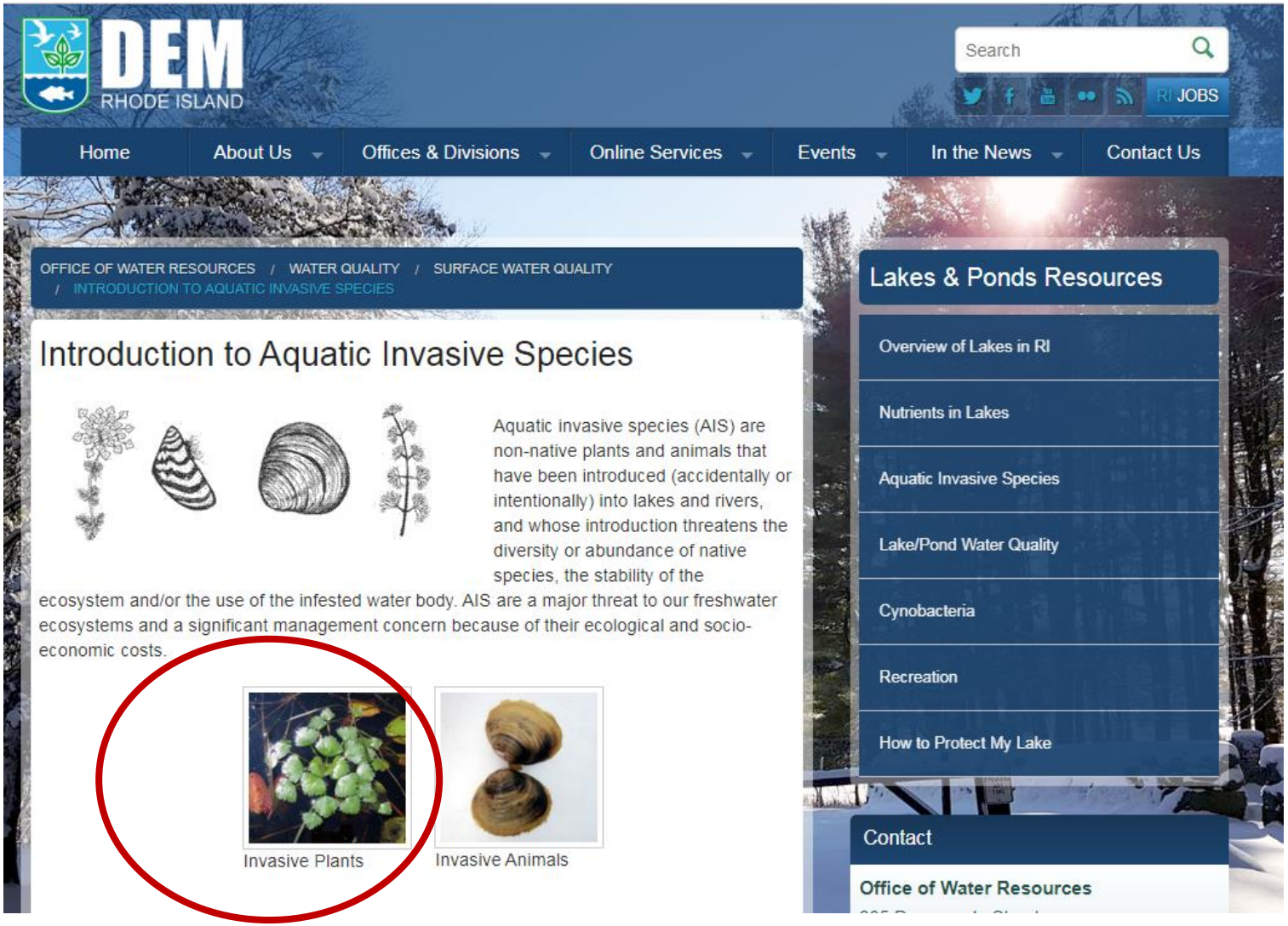
www.dem.ri.gov/programs/water



Where are invasives in RI?

RIDEM AIS Monitoring and MAPPING

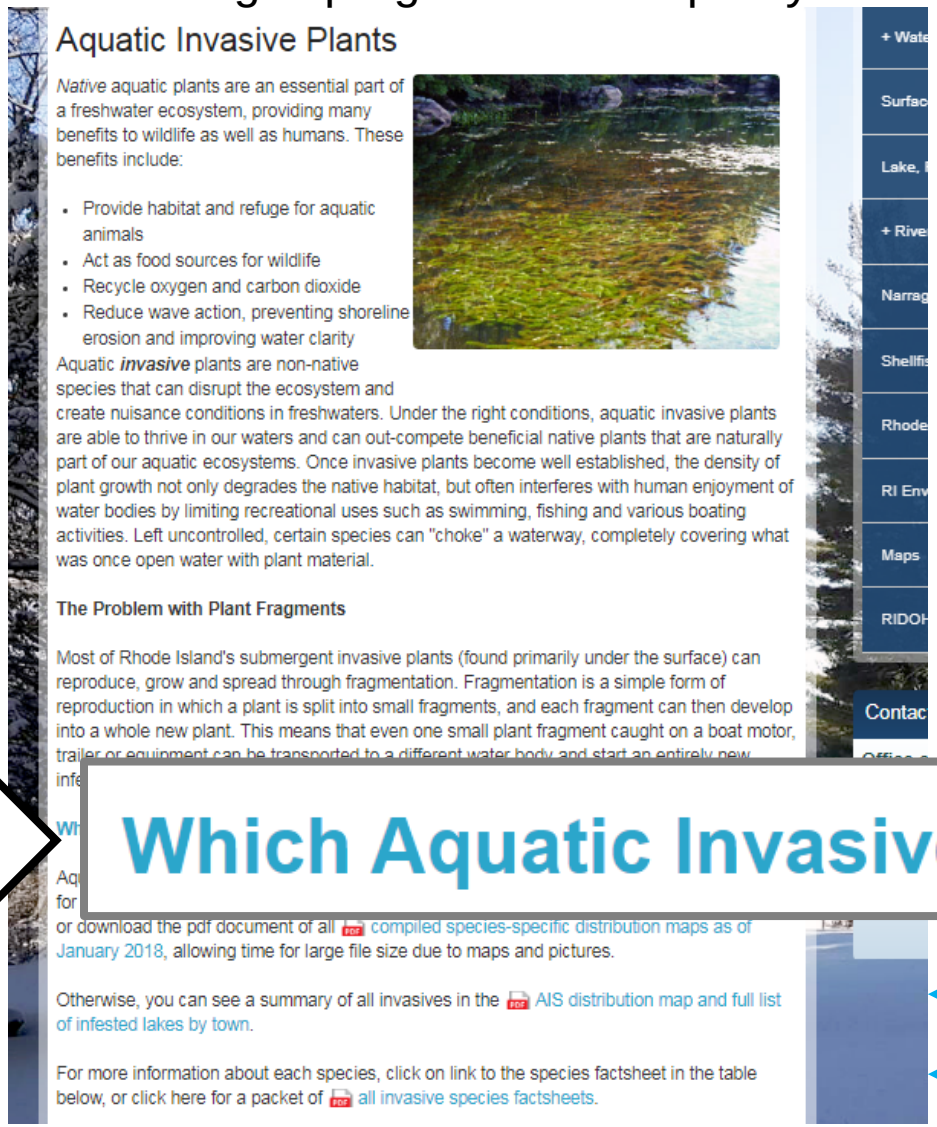
www.dem.ri.gov/programs/water/quality/surface-water/aquatic-invasive-species.php



Where are invasives in RI?

RIDEM AIS Monitoring and MAPPING

www.dem.ri.gov/programs/water/quality/surface-water/aisplant.php



Aquatic Invasive Plants

Native aquatic plants are an essential part of a freshwater ecosystem, providing many benefits to wildlife as well as humans. These benefits include:

- Provide habitat and refuge for aquatic animals
- Act as food sources for wildlife
- Recycle oxygen and carbon dioxide
- Reduce wave action, preventing shoreline erosion and improving water clarity

Aquatic ***invasive*** plants are non-native species that can disrupt the ecosystem and create nuisance conditions in freshwaters. Under the right conditions, aquatic invasive plants are able to thrive in our waters and can out-compete beneficial native plants that are naturally part of our aquatic ecosystems. Once invasive plants become well established, the density of plant growth not only degrades the native habitat, but often interferes with human enjoyment of water bodies by limiting recreational uses such as swimming, fishing and various boating activities. Left uncontrolled, certain species can "choke" a waterway, completely covering what was once open water with plant material.

The Problem with Plant Fragments

Most of Rhode Island's submergent invasive plants (found primarily under the surface) can reproduce, grow and spread through fragmentation. Fragmentation is a simple form of reproduction in which a plant is split into small fragments, and each fragment can then develop into a whole new plant. This means that even one small plant fragment caught on a boat motor, trailer or equipment can be transported to a different water body and start an entirely new

+ Wate
Surfac
Lake,
+ Rive
Narrag
Shellfis
Rhode
RI Env
Maps
RIDOH
Contac

Which Aquatic Invasive Plants are in RI?

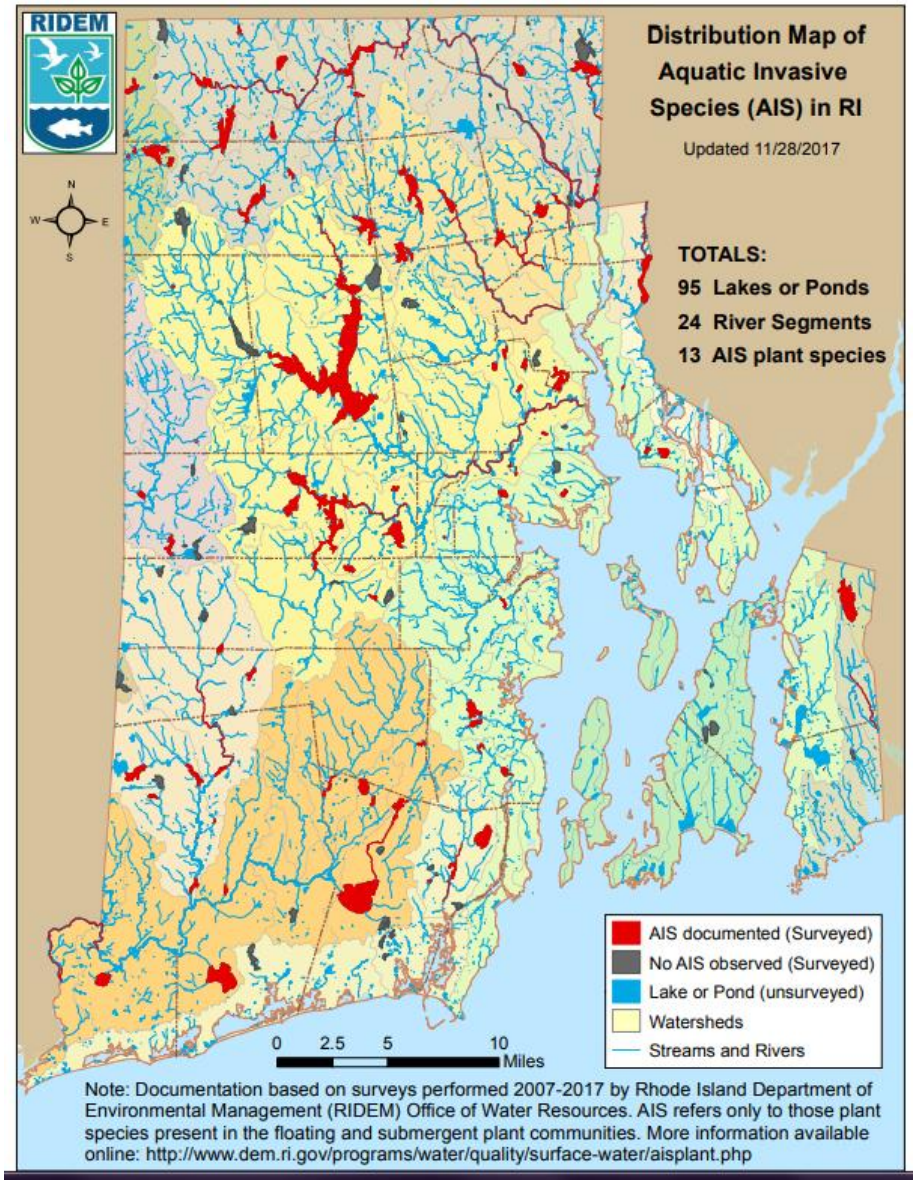
or download the pdf document of all compiled species-specific distribution maps as of January 2018, allowing time for large file size due to maps and pictures.

Otherwise, you can see a summary of all invasives in the AIS distribution map and full list of infested lakes by town.

For more information about each species, click on link to the species factsheet in the table below, or click here for a packet of all invasive species factsheets.

State AIS Distribution Map & List

http://www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/invasive.pdf



Rhode Island Freshwaters with Aquatic Invasive Plants

rivers listed first, then lakes listed by city or town, alphabetically

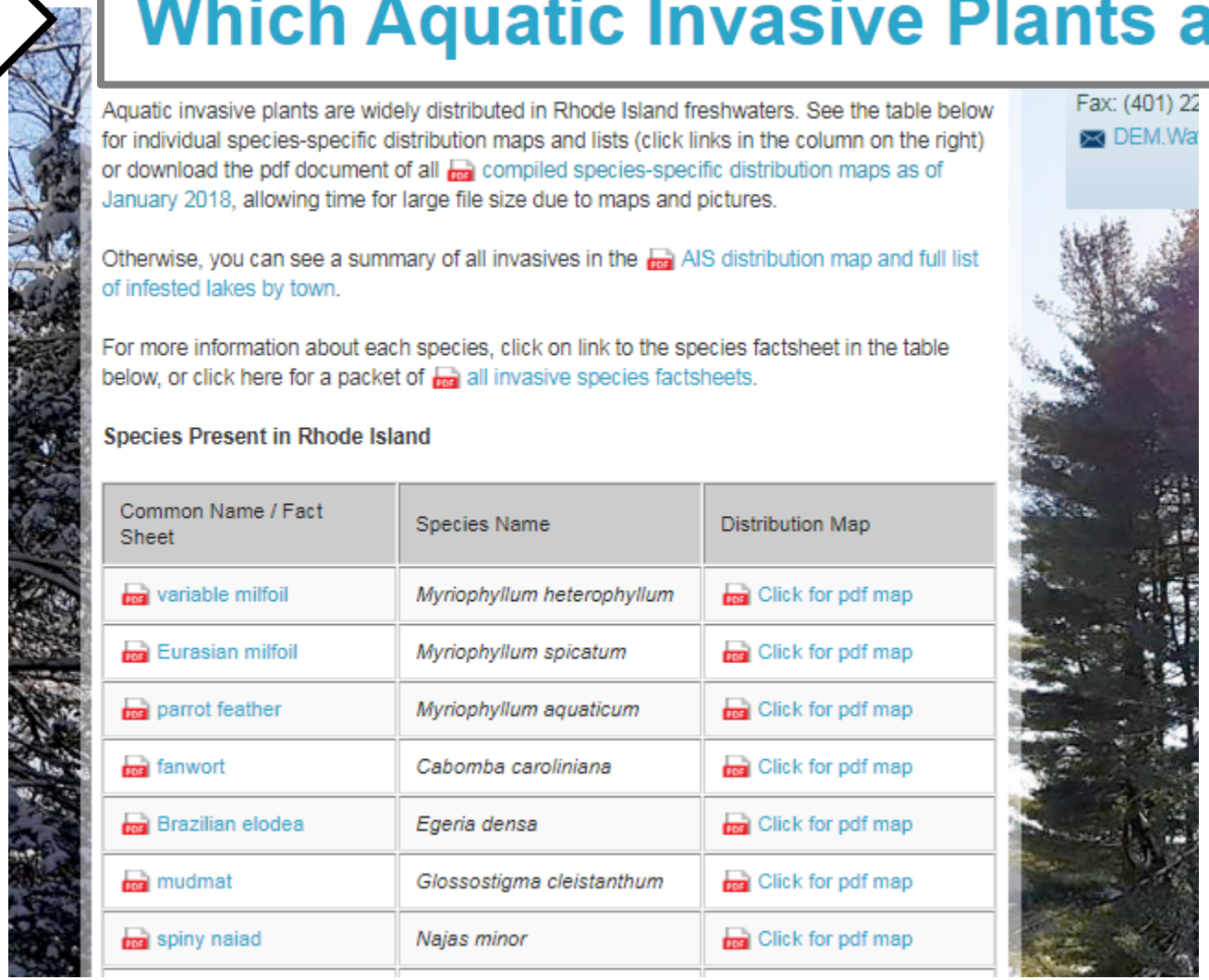
	Town	Waterbody	Common Name
29		Spring Lake (Herring Pond)	fanwort inflated bladderwort variable milfoil
30		Sucker Pond	fanwort
31		Wakefield Pond	fanwort
32		Wilson Reservoir	inflated bladderwort
	Central Falls		
33		Valley Falls Pond	Eurasian milfoil fanwort variable milfoil water chestnut
	Charlestown		
34		Watchaug Pond	inflated bladderwort
	Coventry		
35		Arnold Pond	Brazilian elodea
36		Carbuncle Pond	fanwort mudmat variable milfoil
37		Coventry Reservoir (Stump Pond)	variable milfoil
38		Flat River Reservoir (Johnson Pond)	fanwort inflated bladderwort variable milfoil
39		Maple Root Pond	fanwort
40		Tiogue Lake	fanwort spiny naiad variable milfoil

Where are invasives in RI?

RIDEM AIS Monitoring and MAPPING

www.dem.ri.gov/programs/water/quality/surface-water/aisplant.php

Which Aquatic Invasive Plants are in RI?



Aquatic invasive plants are widely distributed in Rhode Island freshwaters. See the table below for individual species-specific distribution maps and lists (click links in the column on the right) or download the pdf document of all compiled species-specific distribution maps as of January 2018, allowing time for large file size due to maps and pictures.

Otherwise, you can see a summary of all invasives in the AIS distribution map and full list of infested lakes by town.

For more information about each species, click on link to the species factsheet in the table below, or click here for a packet of all invasive species factsheets.

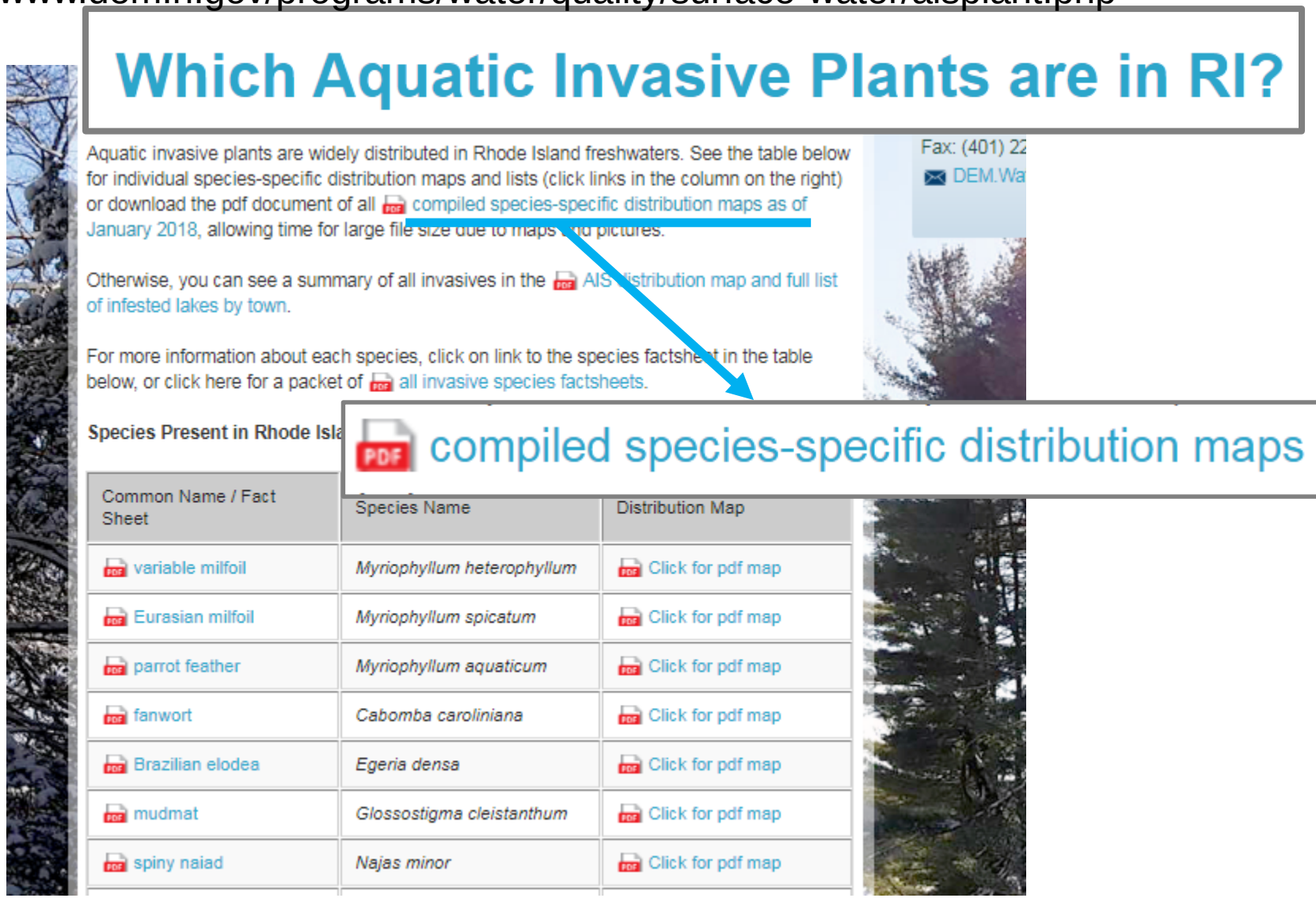
Species Present in Rhode Island

Common Name / Fact Sheet	Species Name	Distribution Map
variable milfoil	*Myriophyllum heterophyllum*	Click for pdf map
Eurasian milfoil	*Myriophyllum spicatum*	Click for pdf map
parrot feather	*Myriophyllum aquaticum*	Click for pdf map
fanwort	*Cabomba caroliniana*	Click for pdf map
Brazilian elodea	*Egeria densa*	Click for pdf map
mudmat	*Glossostigma cleistanthum*	Click for pdf map
spiny naiad	*Najas minor*	Click for pdf map

Where are invasives in RI?

RIDEM AIS Monitoring and MAPPING

www.dem.ri.gov/programs/water/quality/surface-water/aisplant.php



Compiled Species-Specific Distribution Map

http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/aisridist.pdf

Freshwater Aquatic Invasive Species in Rhode Island

Species-specific Statewide Distributions January 2018

Rhode Island Department of Environmental Management
Office of Water Resources
235 Promenade Street – Room 200
Providence, RI 02908

Overview and Contents

Between 2007 and 2017 the Rhode Island Department of Environmental Management, Office of Water Resources (OWR) has been documenting the presence of aquatic invasive species (AIS) in lakes, ponds and rivers, statewide. RIDEM OWR monitors approximately 20 lakes or ponds during the summer season by visually surveying for invasives, and as resources allow, may visit additional ponds in response to public concerns. To date, RIDEM has visited 157 lakes or ponds, and visited hundreds of sites on streams.

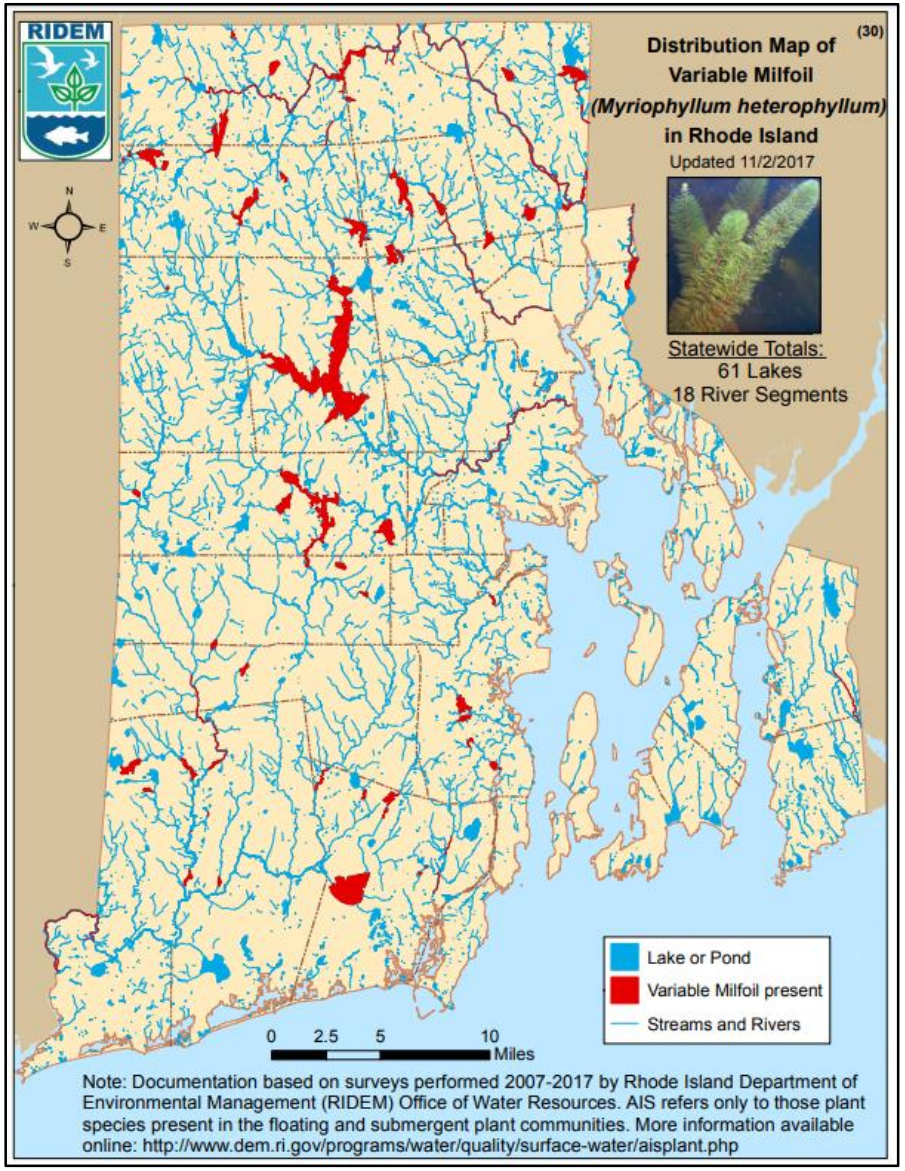
As of November 2017, at least one invasive species was documented by RIDEM staff at 98 lakes or ponds (62% of the visited locations) in addition to invasives found at sites along 24 distinct rivers. A map of this data and list of each location by town, with the invasives species that were identified can be downloaded here: http://www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/invasive.pdf. Provided herein are maps showing the species-specific statewide distribution of 15 different invasive species (see page number below) accompanied by a list of locations where the species was documented (plants in order below from least to most common).

Number of Documented Freshwaters with Invasive Species
(as of December 1, 2017)

Invasive Species	Lakes/Ponds	Rivers	Total	Page Number
1. Parrot Feather *(Myriophyllum aquaticum)*	1	0	1	(1)
2. American Lotus *(Nelumbo lutea)*	2	0	2	(3)
3. Yellow Floating Heart *(Nymphoides peltata)*	3	0	3	(5)
4. Brazilian Elodea *(Egeria densa)*	4	0	4	(7)
5. Water Hyacinth *(Eichhornia crassipes)*	4	1	5	(9)
6. Inflated Bladderwort *(Utricularia inflata)*	6	0	6	(11)
7. Water Chestnut *(Trapa natans)*	8	0	8	(13)
8. Spiny Naiad *(Najas minor)*	9	0	9	(15)
9. Mudmat *(Glossostigma cleistanthum)*	9	1	10	(17)
10. Eurasian milfoil *(Myriophyllum spicatum)*	8	2	10	(19)
11. Curly-leaf Pondweed *(Potamogeton crispus)*	12	5	17	(21)
12. Fanwort *(Cabomba caroliniana)*	55	12	67	(24)
13. Variable Milfoil *(Myriophyllum heterophyllum)*	61	18	79	(30)
14. Asian Clam *(Corbicula fluminea)*	11	3	14	(36)
15. Chinese Mystery Snail *(Cipangopadula chinensis)*	14	1	15	(38)
Total waterbodies with at least one invasive*	98	24	*some waterbodies have more than one invasive species; therefore, total reflects distinct waterbodies	

Compiled Species-Specific Distribution Map

http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/aisridist.pdf



(31)

Distribution of variable milfoil (M. heterophyllum) in RI

river segments listed first alphabetically; then lakes listed by city or town

	Town	Waterbody Name	First documented	Last Surveyed
	RIVERS			
1		Abbott Run Brook North & Tribs	5/13/2009	7/7/2009
2		Adamsville Brook & Tribs	9/7/2012	9/7/2012
3		Blackstone River (Seg A)	7/22/2009	8/2/2017
4		Branch River & Tribs (Seg A)	7/15/2009	7/20/2009
5		Branch River & Tribs (Seg B)	7/15/2009	7/15/2009
6		Clear River & Tribs (Seg C)	8/1/2007	6/11/2010
7		Clear River (Seg D)	8/1/2007	8/1/2007
8		Pawcatuck River & Tribs	8/6/2009	9/6/2012
9		Pawtuxet River (Main Stem)	6/28/2010	9/18/2015
10		Saugatucket River & Tribs	7/20/2010	7/20/2010
11		Tarkiln Brook & Tribs (Seg A)	7/20/2009	7/20/2009
12		Tarkiln Brook & Tribs (Seg B)	5/20/2009	7/20/2009
13		Ten Mile River & Tribs	8/10/2007	6/30/2011
14		Wood River & Tribs (Seg A)	7/9/2009	7/10/2009
15		Wood River (Seg B)	9/30/2008	8/2/2011
16		Woonasquatucket River & Tribs (Seg B)	6/1/2009	6/1/2009
17		Woonasquatucket River & Tribs (Seg C)	6/1/2009	8/25/2009
18		Woonasquatucket River (Seg D)	6/17/2009	6/17/2009
	Burrillville			
19		Echo Lake (Pascoag Reservoir)	9/12/2008	9/13/2012

RI lakes and river segments with variable milfoil as of 1/17/2018

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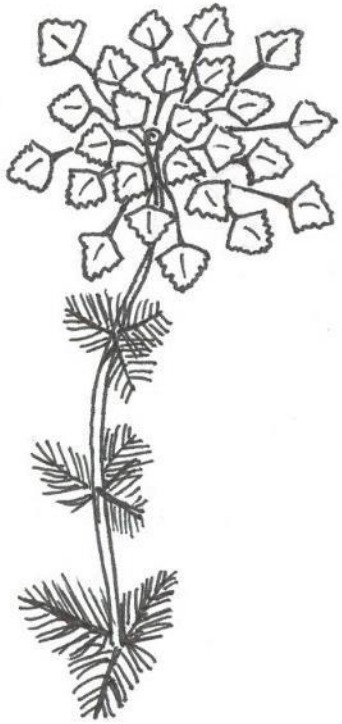
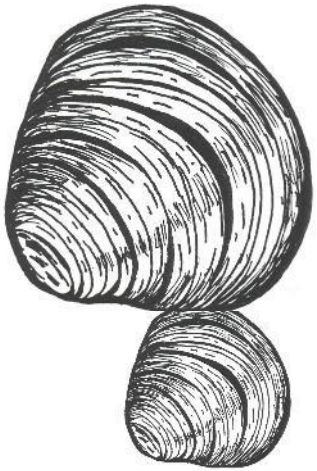
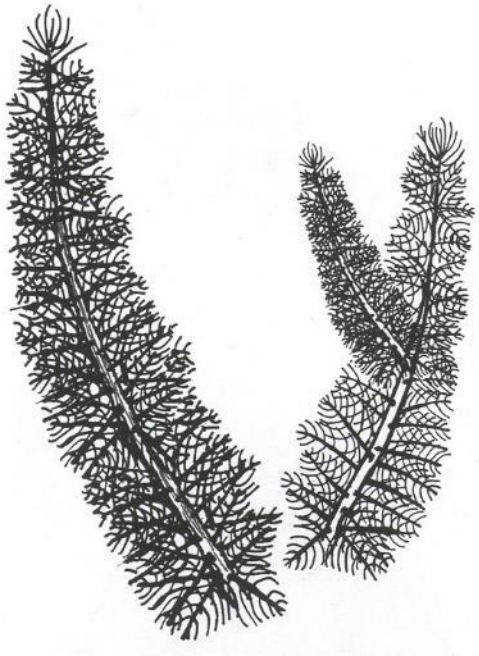
What can you do?

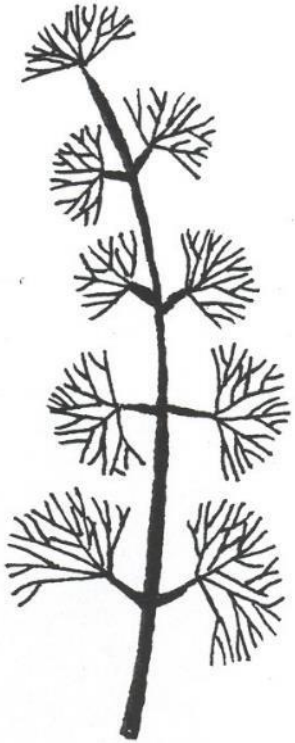
1. Identify problem

Know your enemy!









http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/identify.pdf

What's in MY Lake?

URIWW Invasives Monitoring Materials

- Plant Monitoring Protocol (manual)
- Aquatic Plant Identification Handbook
- Glossary of terms
- Key to Non-native and invasive species
- How to use the Key
- RIDEM Guide to Keying Out Plants

https://web.uri.edu/watershedwatch/learning-about-aquatic-invasive-species/#

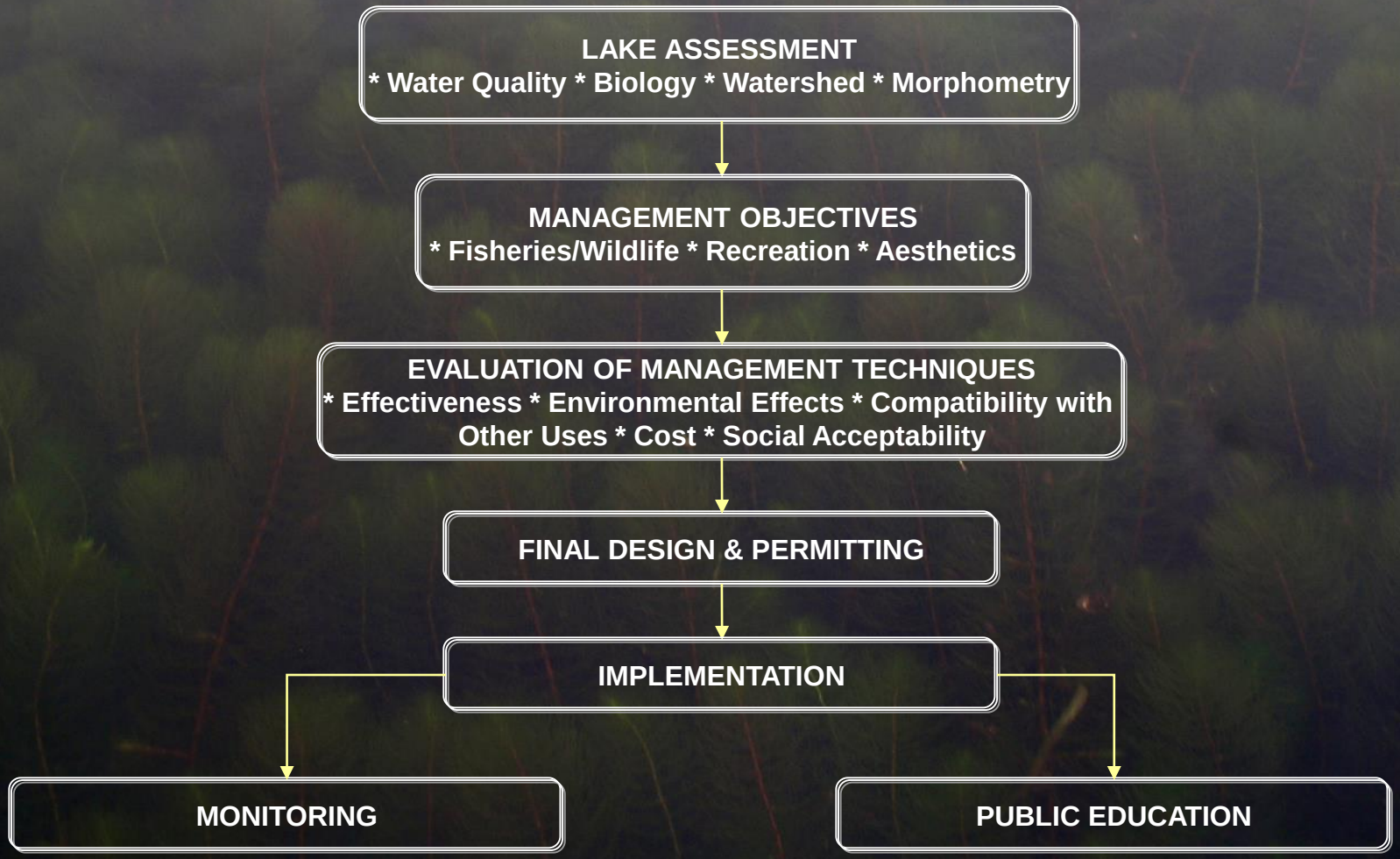
What can you do?

2. GET ORGANIZED!

Lake Management Plans

	• Written document for specific lake
	• Outlines & prioritizes specific goals of management (eradicate or control)
	• lists factors at a particular lake that contribute to a specific plant problem
	• Provides options and recommends strategies for specific goals
	• Names which people will complete management strategies
	• Provides a specific, measurable timeframe with quantifiable endpoints

DEVELOPMENT OF A COMPREHENSIVE AQUATIC VEGETATION MANAGEMENT PLAN



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Aquatic Plant Requirements

NUTRIENTS

* Nutrients promote plant growth

NUTRIENTS

<u>Sources of Nutrients in a Watershed</u>

- Surface & storm water runoff
- Lawn or agricultural fertilizers
- Leaking septic systems
- Wastewater treatment facilities
- Animal waste
- Atmospheric deposition

<u>Work to reduce nutrient loading in a watershed! →</u>

Watershed Management Plan

Source Reduction

- Agricultural Best Management Practices
- Bank and Slope Stabilization
- Behavior Modifications
- Stormwater / Wastewater Management
- Zoning and Land Use Planning

Transport Mitigation

- Buffer Strips
- Catch Basins and Street Sweeping
- Created Wetlands for Infiltration
- Detention Ponds and Infiltration Systems

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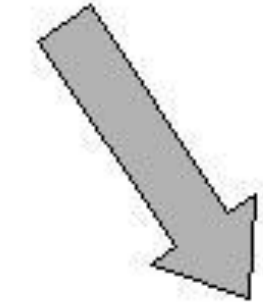
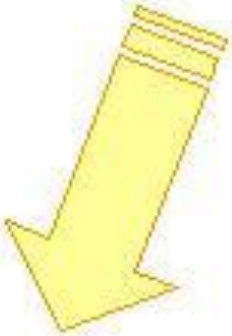
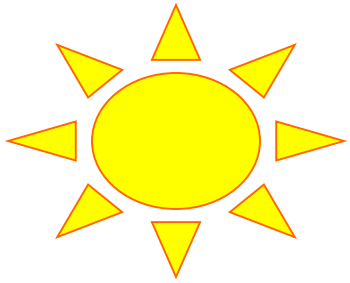
Plant Requirements: In-lake considerations

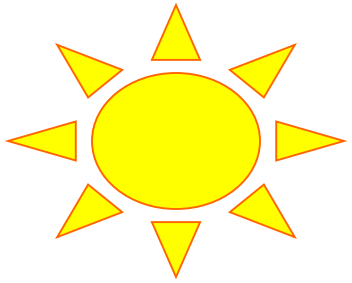
NUTRIENTS

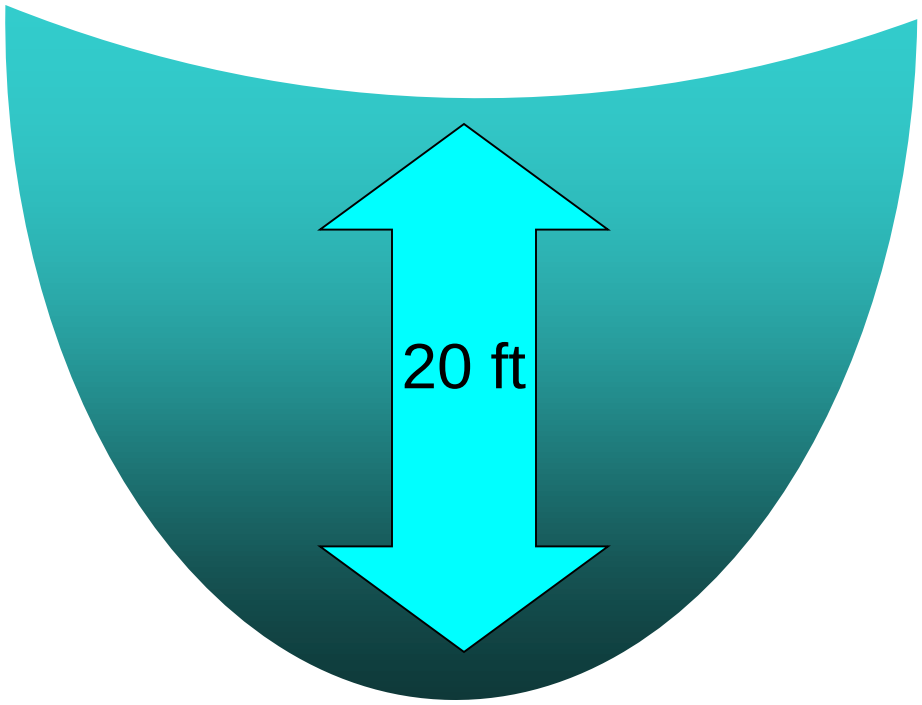


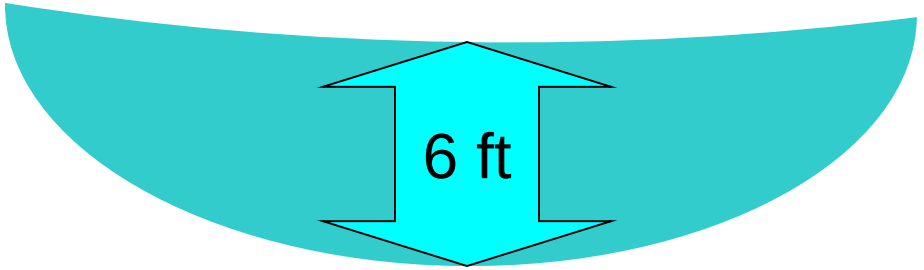


* Bathymetry (depth) – morphometry: important factor concerning sunlight exposure

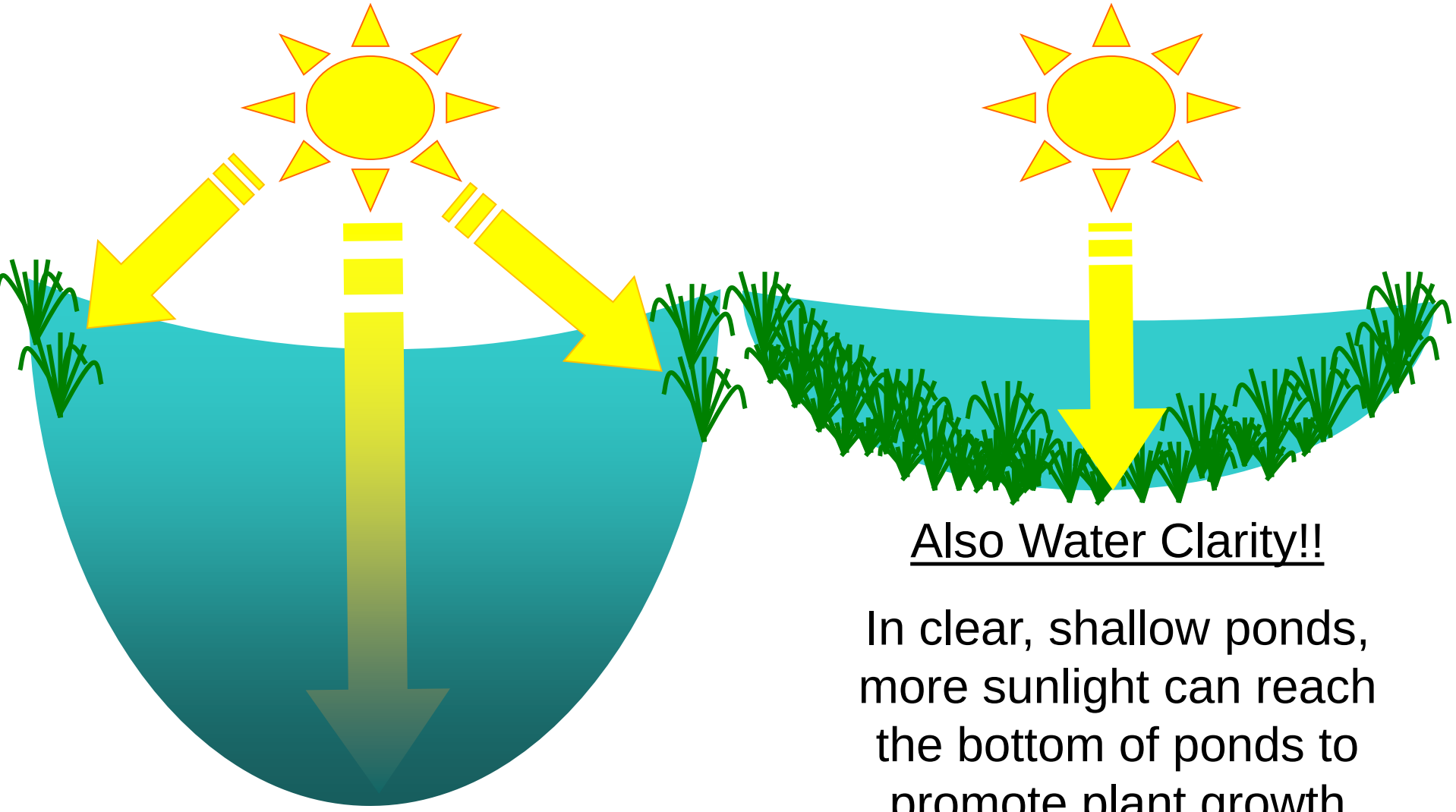








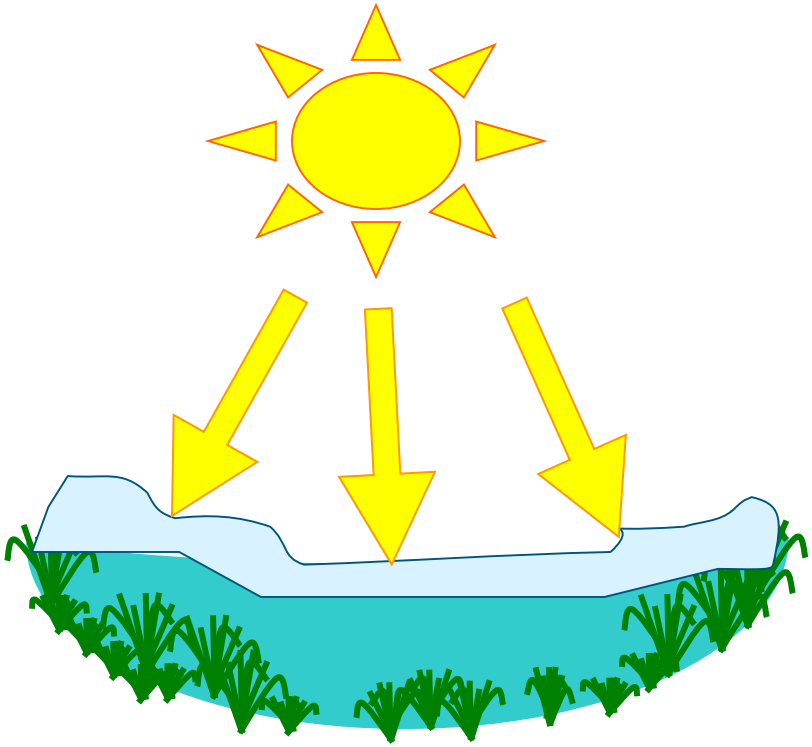
* Bathymetry (depth) is an important factor concerning sunlight exposure



Also Water Clarity!!

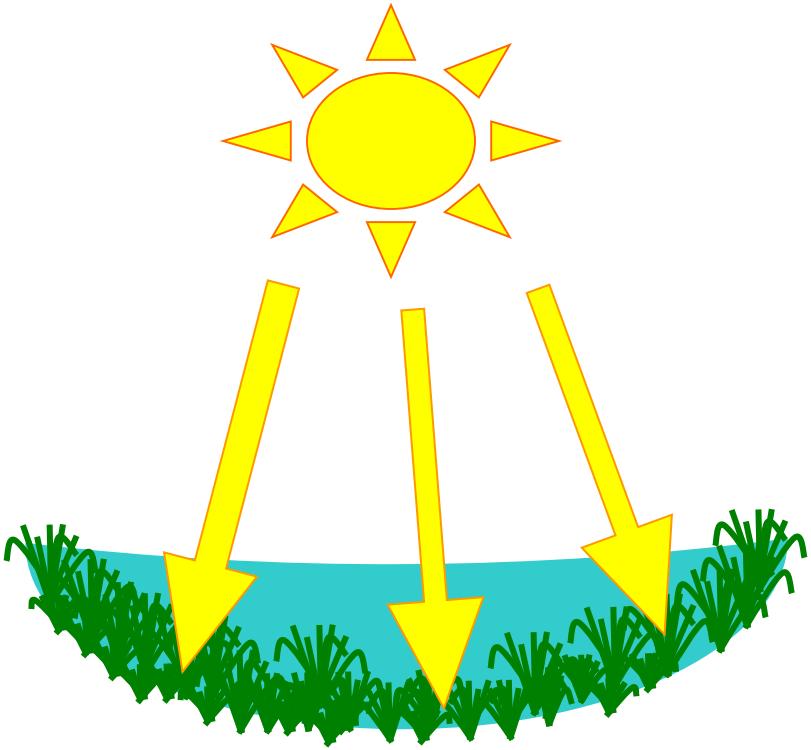
In clear, shallow ponds, more sunlight can reach the bottom of ponds to promote plant growth

* Winter ice/snow is also an important factor concerning sunlight exposure



Colder Winters

Ice & snow accumulate & provide shade

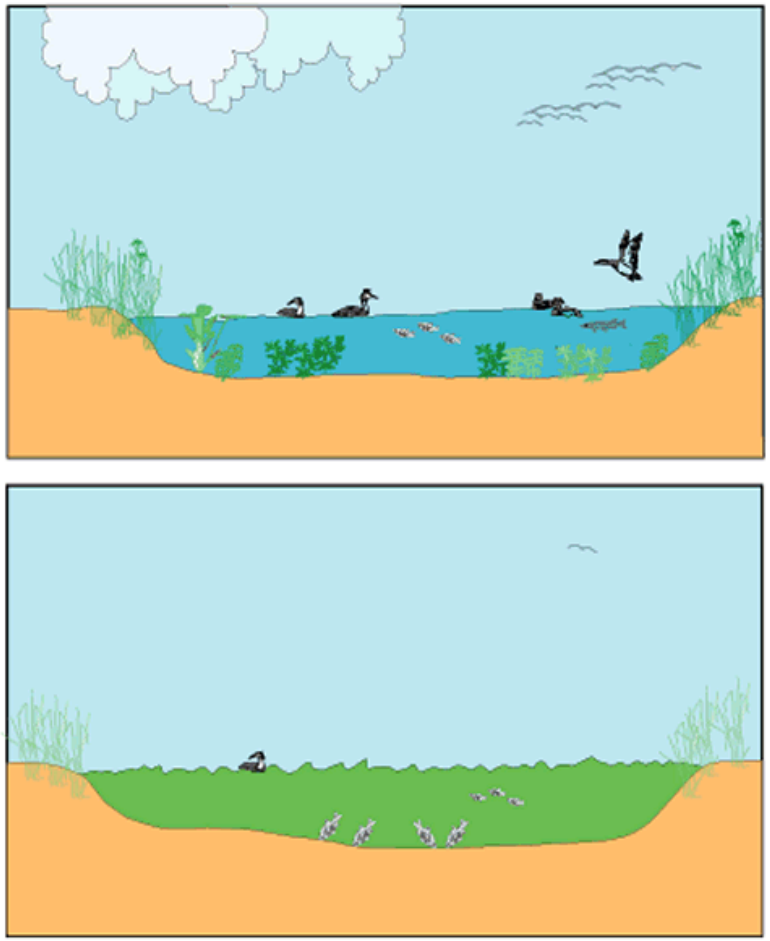


Milder Winter

Plants have longer time to access sunlight

Shallow Lake Alternative States

- Nutrients drive growth
- In shallow lakes (< 10 m) where sunlight can reach the bottom
  - Plant dominated
  - Algae dominated
- Understand that we need to manage expectations & nutrients



Lake Management Plans

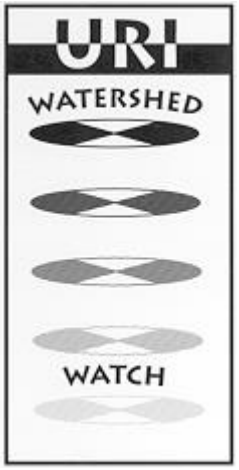
What is the problem?

Curly-leaf pondweed, RI

Requires Data to describe:

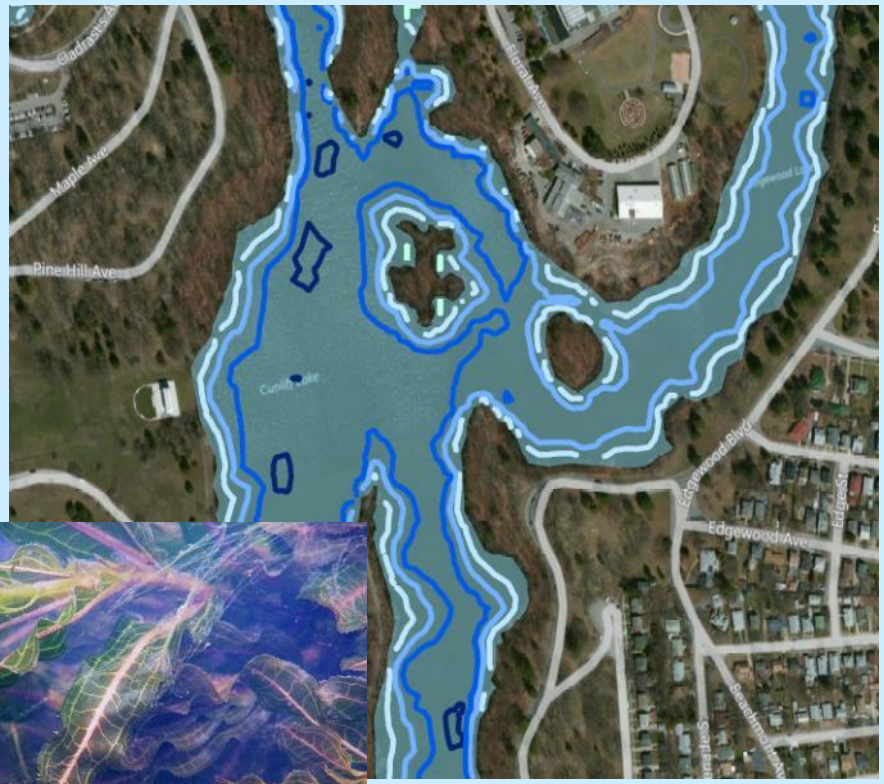
- Target species information
- Plant distribution maps
- Plant abundance/coverage
- Lake information

Water quality



Lake Management Plans

What is the problem?




Curly-leaf pondweed, RI

Requires Data to describe:

- Target species information
- Plant distribution maps
- Plant abundance/coverage
- Lake information

Water quality

Bathymetry

Size

Water volume/level

Flushing rate/method

Connectivity? Ramps?

Lake Management Plans

What is the problem?

Where in the lake?

What is the goal?

Lake Management Plans

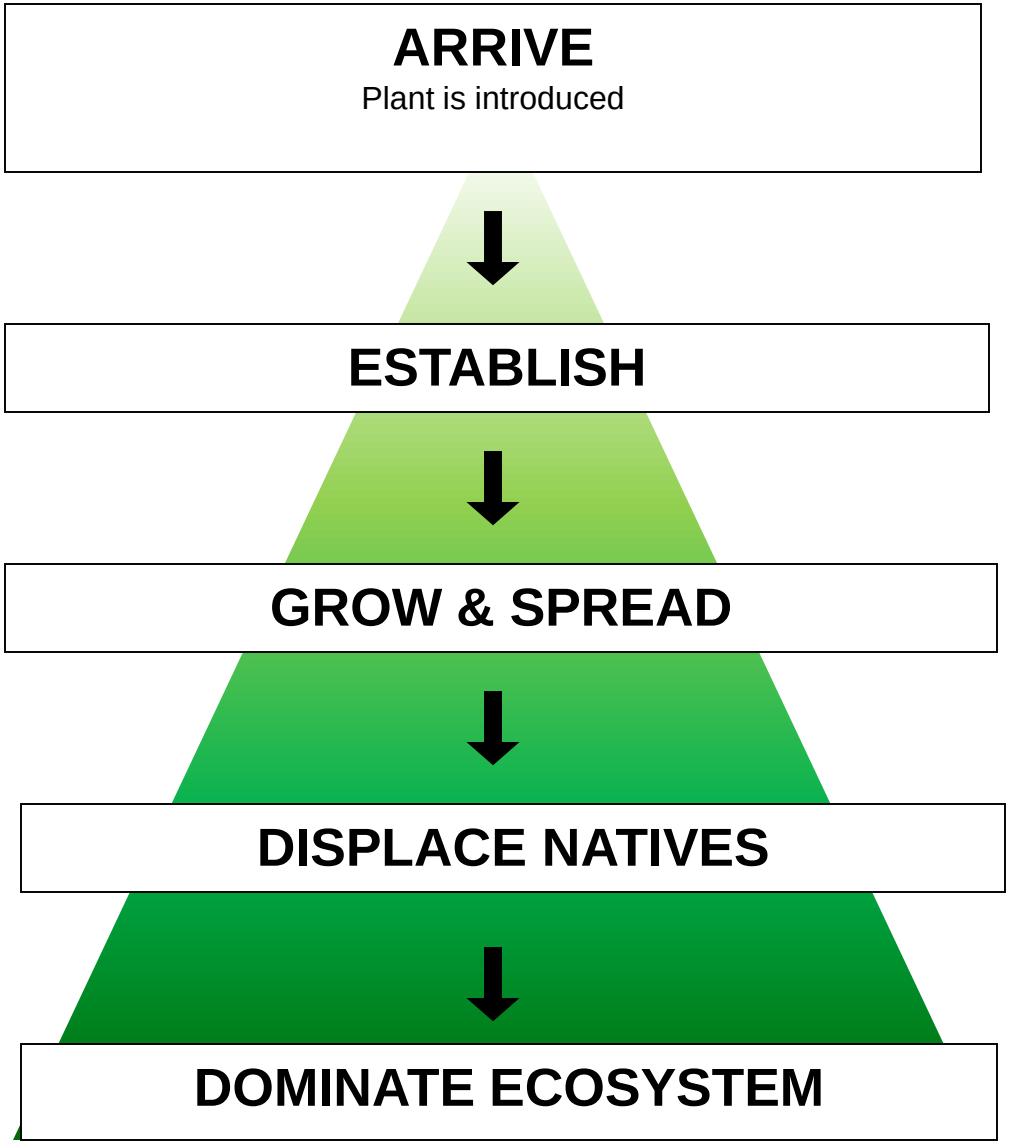
Where? How big is the population?

August 2014

Meshanticut Pond, Cranston, RI

August 2017

Plan based on size of population:



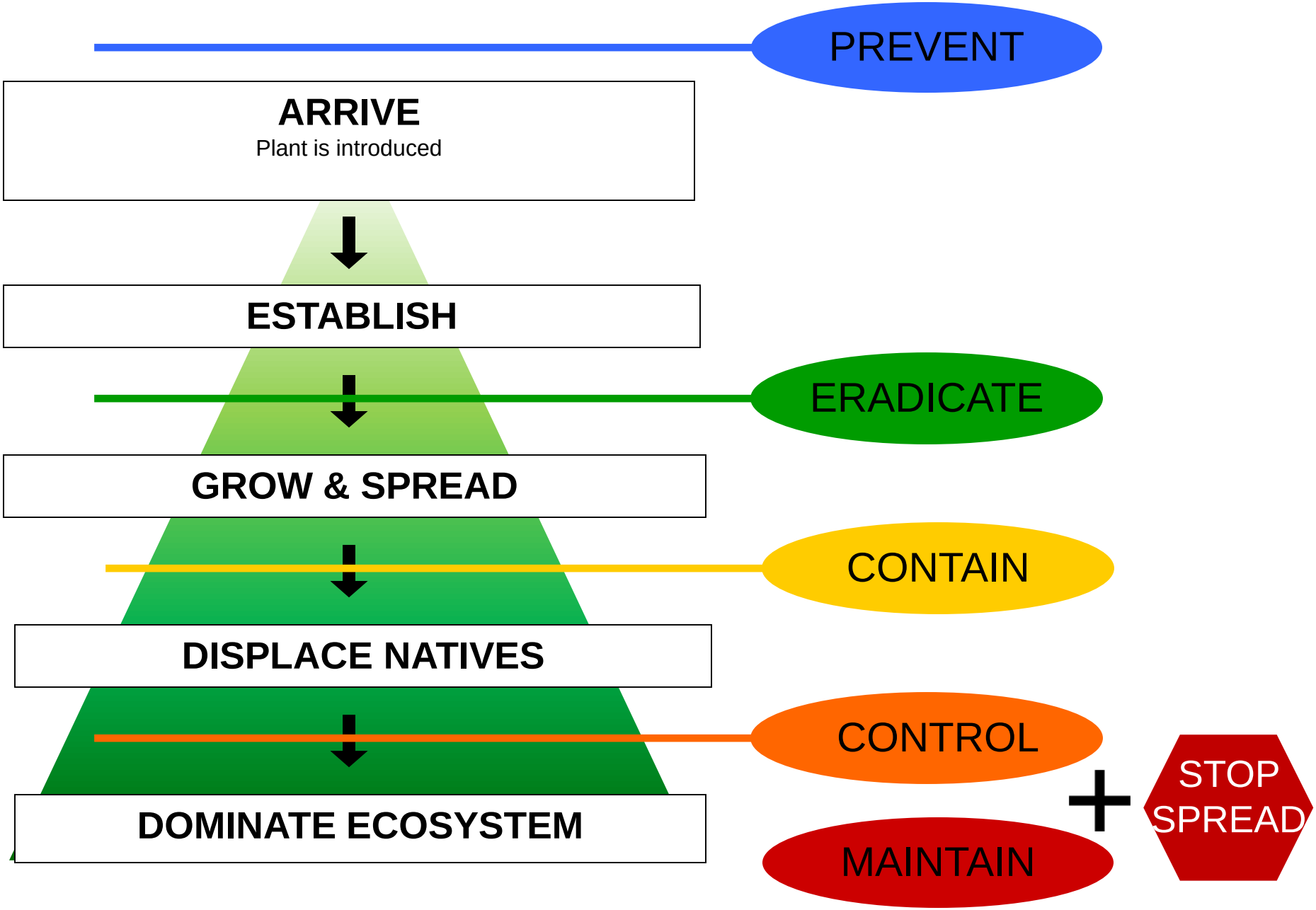
Lake Management Plans

What is the problem?

Where in the lake?

What is the goal?

Identify the Stage, Goal & then plan



Lake Management Plans

What is the problem?

Where in the lake?

What is the goal?

Who will do what?

Lake Management Plans

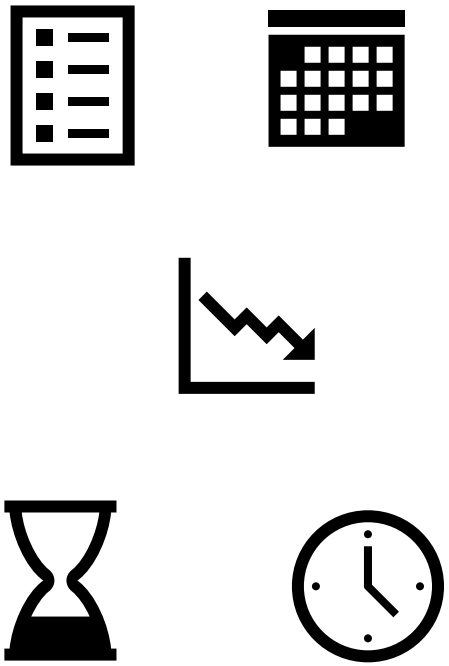
What is the problem?

Where in the lake?

What is the goal?

Who will do what?

When will it happen?



Lake Management Plans

What is the problem?

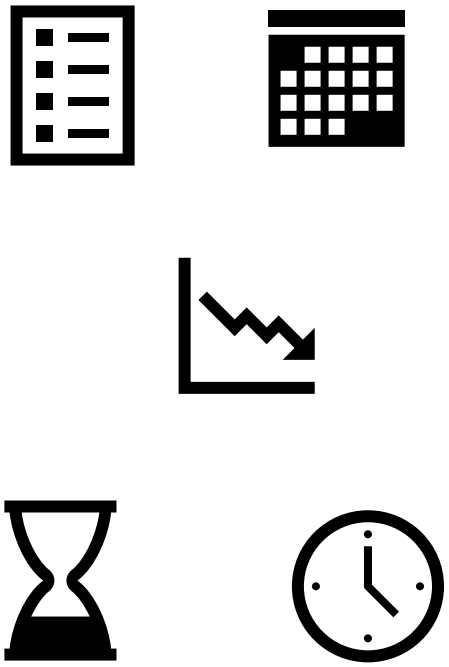
Where in the lake?

What is the goal?

Who will do what?

When will it happen?

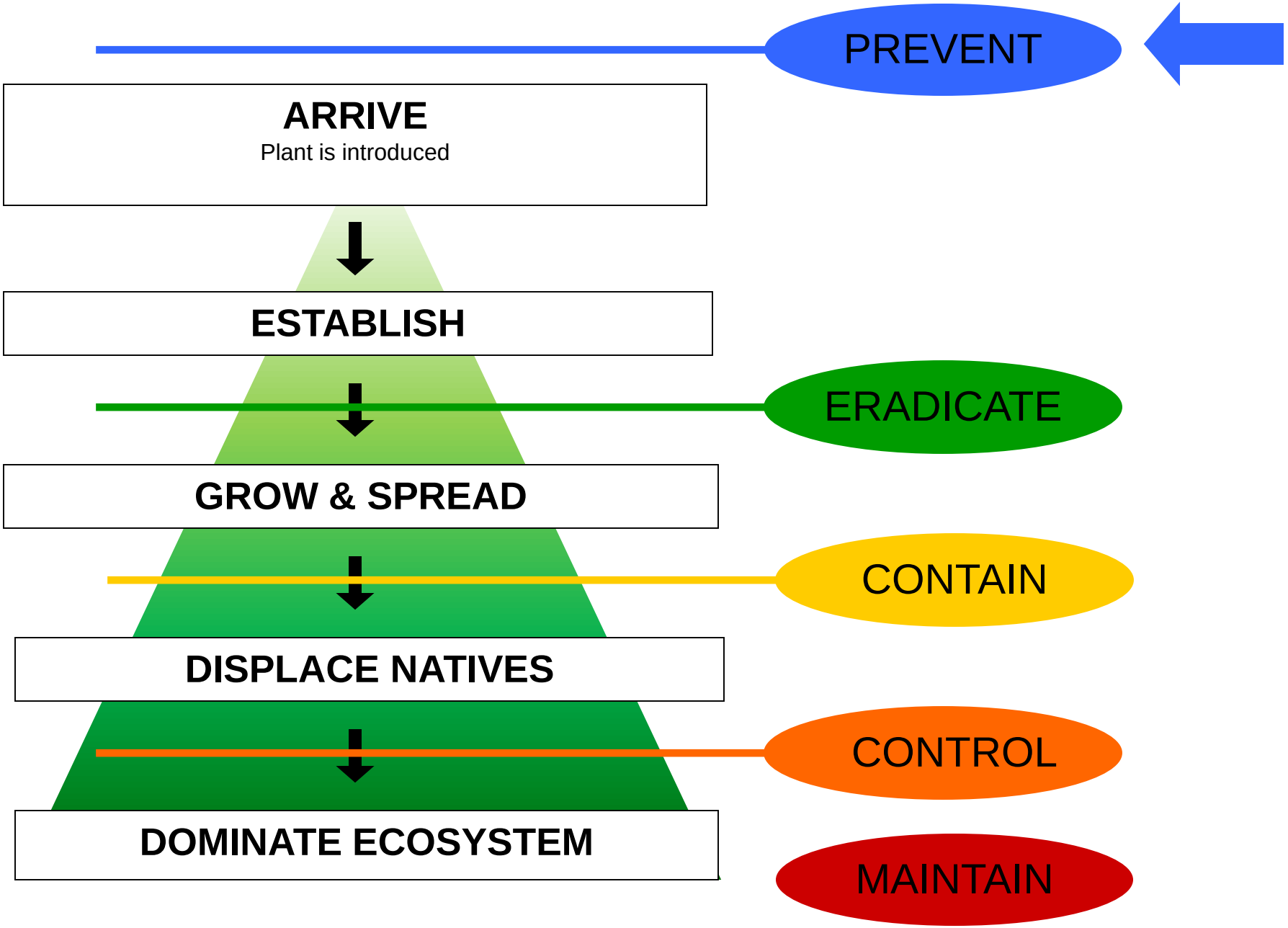
How long will it take?



Today's AIS Workshop: Aquatic Invasive Species

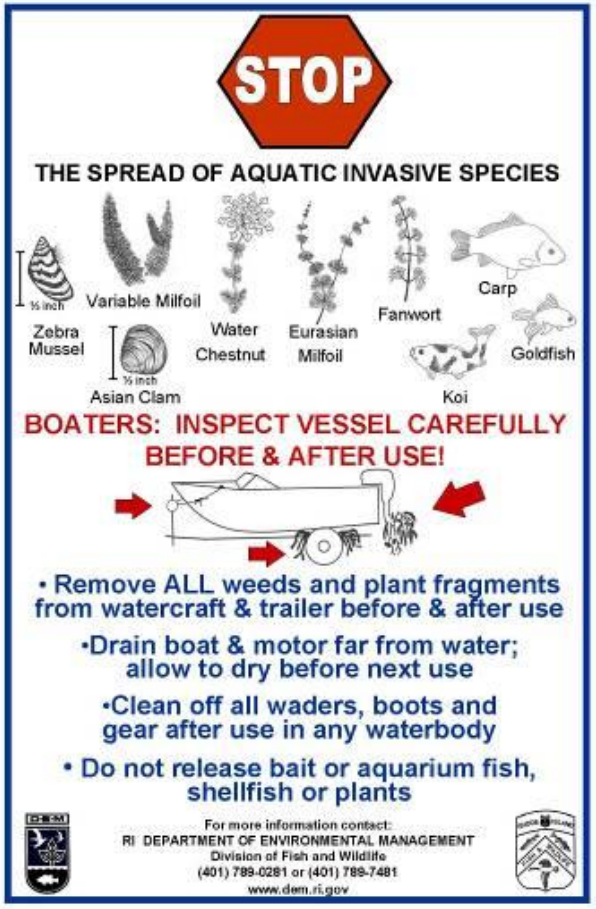
1) Introduction to aquatic plants and AIS
2) How and why are AIS a problem?
3) Finding AIS in Rhode Island
4) What can you do about AIS in your lake?
5) Watershed Management vs Lake Management Plans
6) Lake Management Plan Considerations
7) AIS Management Goals & Control Strategies

AIS Management Goals & Strategies

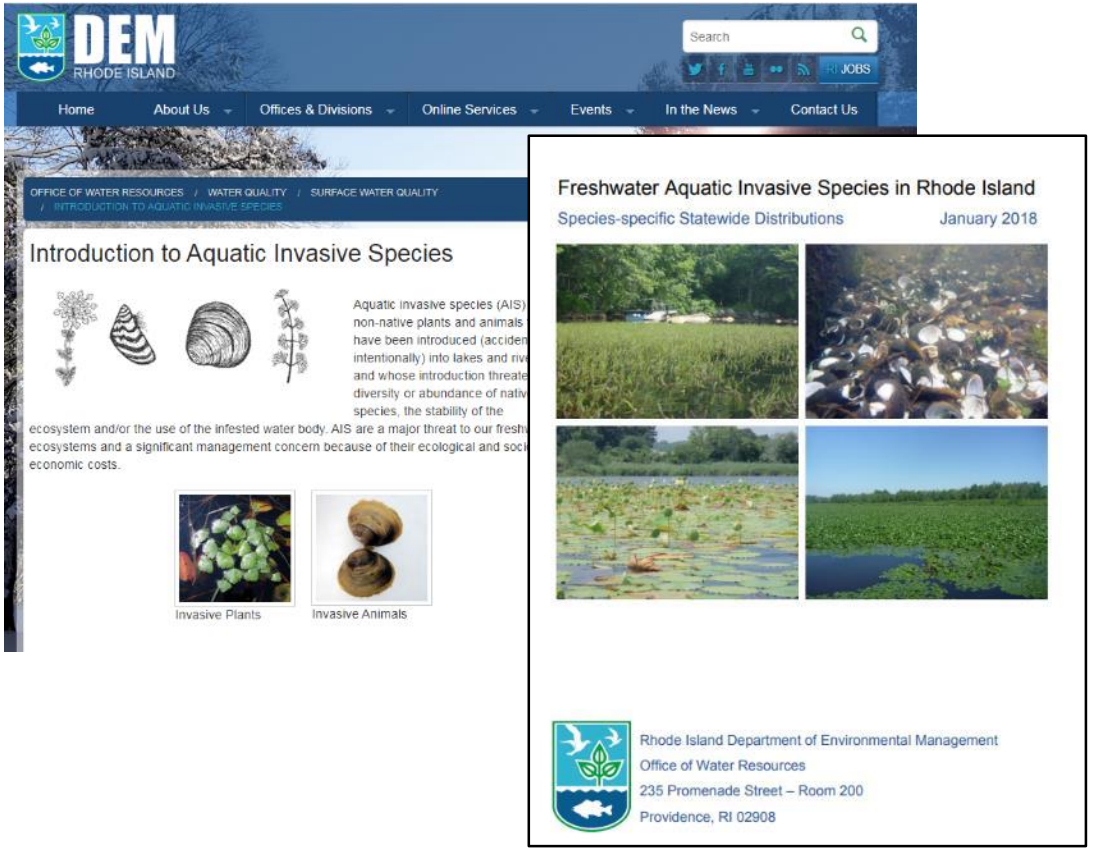


PREVENT = Educate!

Boat Ramp Signs



Website info



www.dem.ri.gov/programs/benviron/water/quality/surfwq

PREVENT = Educate!

G.R.E.A.T. Boaters Program:

Greeting Recreationalists to Empower And Train Boaters

Smith and Sayles Reservior, RI

PREVENT = Monitor!

Contact Katie DeGoosh-DiMarzio

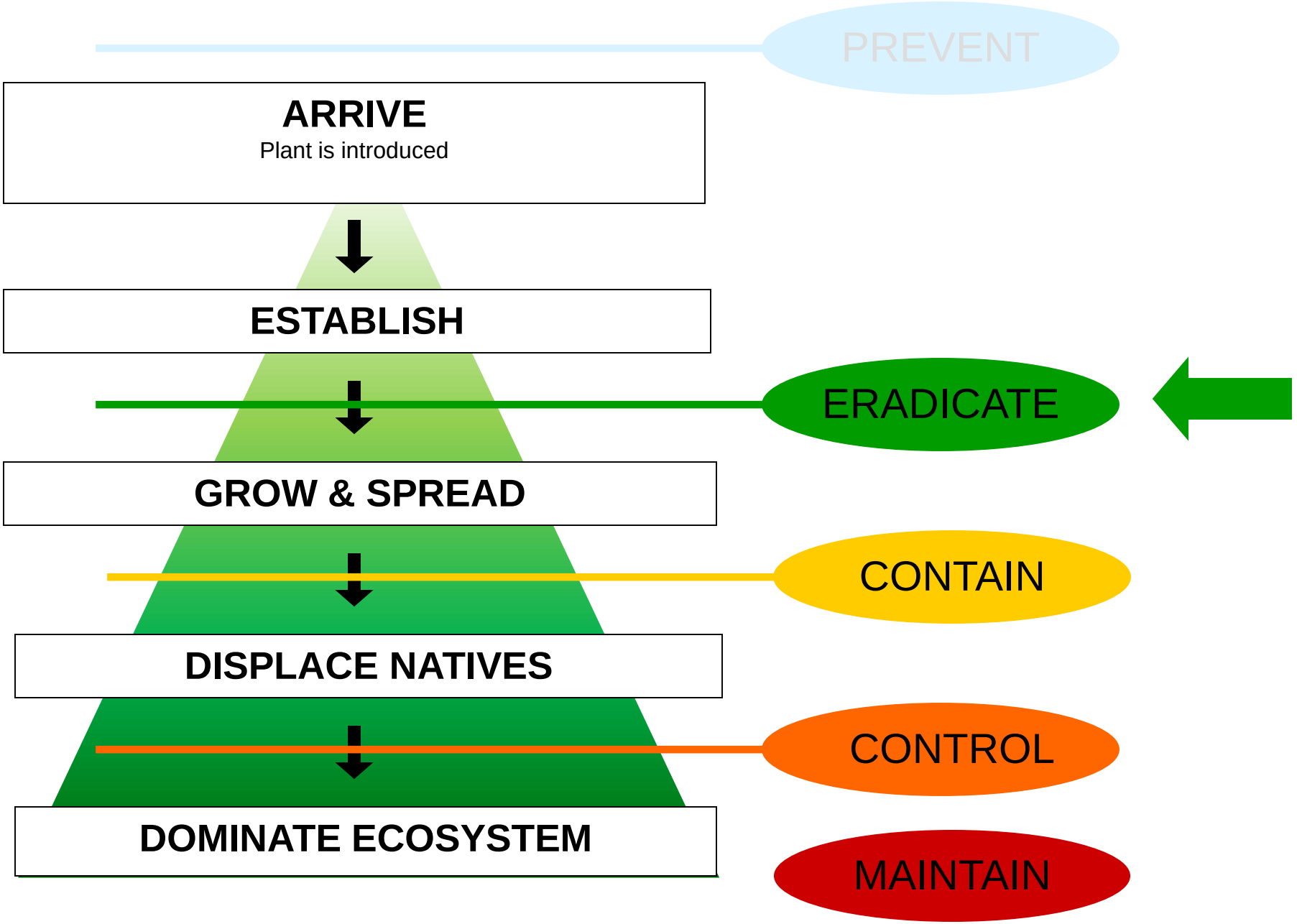
to verify invasive species

401-222-4700 x 7211

Email pictures:

katie.degoosh@dem.ri.gov

AIS Management Goals & Strategies



MANAGEMENT TECHNIQUES

Different Approaches

- **Physical/Manual**
- **Mechanical**
- **Chemical**
- **Biological**

Determining Which One to Use

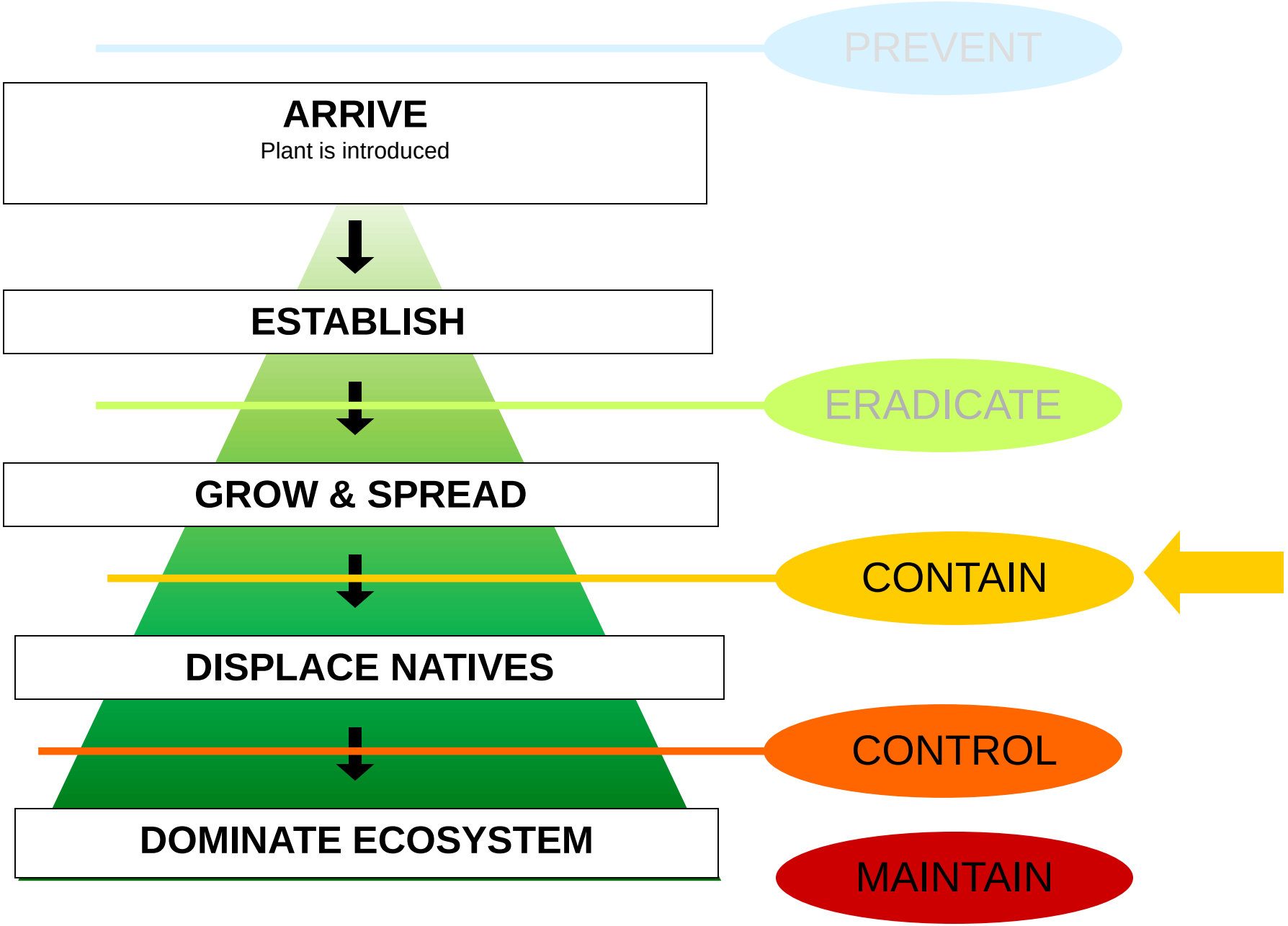
- **Program goals and objectives**
- **Accurate plant identification**
- **Environmental constraints**
- **Social acceptability**
- **Cost $$$**

ERADICATE = Removal

Hand Pulling

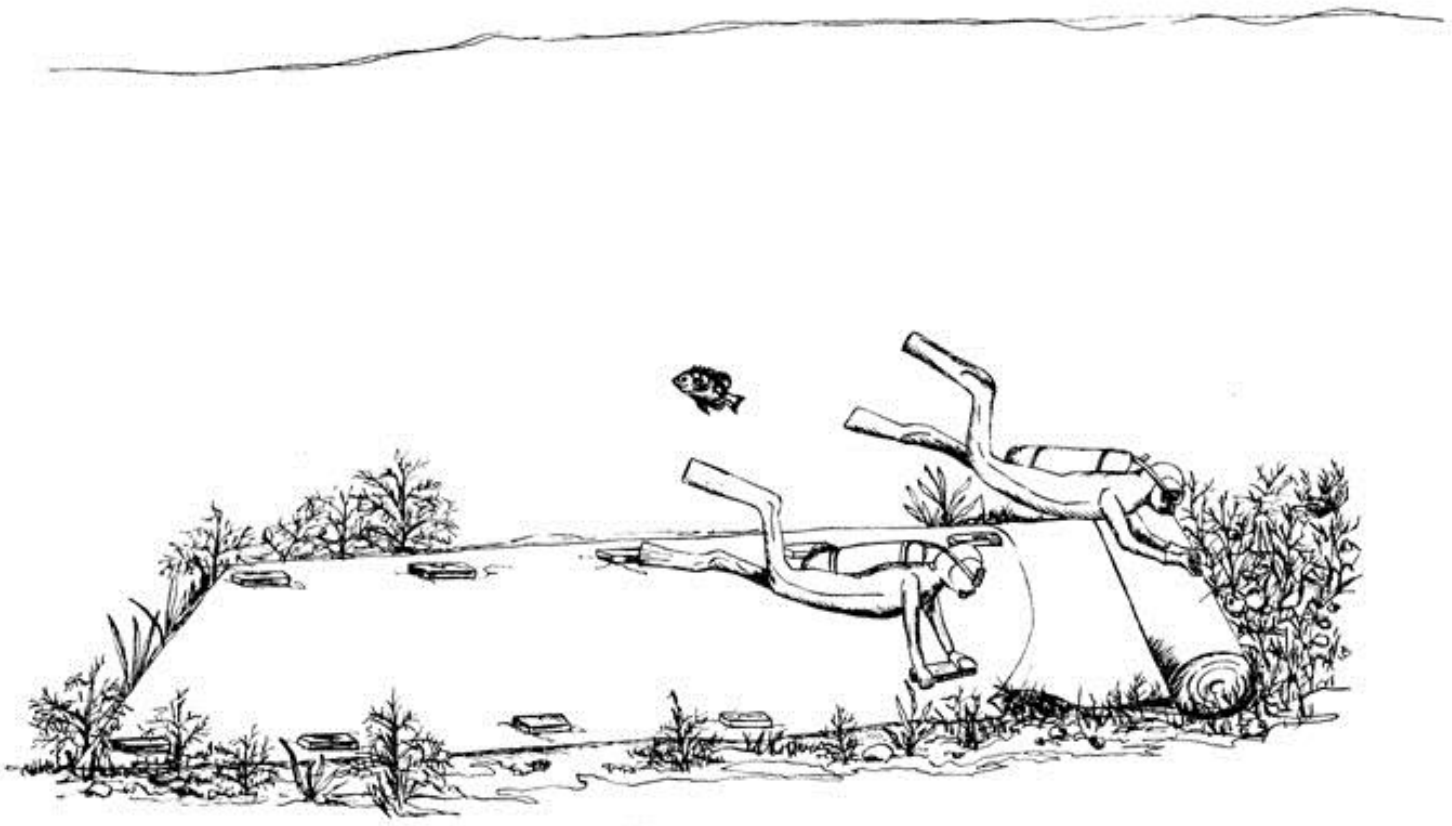
- Completely removes plant
- Timing is important
- Effective on individual plants (small areas)
- Highly specific to target (plant species)
- Least environmentally abrasive option
- May require DEM Wetlands permit

AIS Management Goals & Strategies

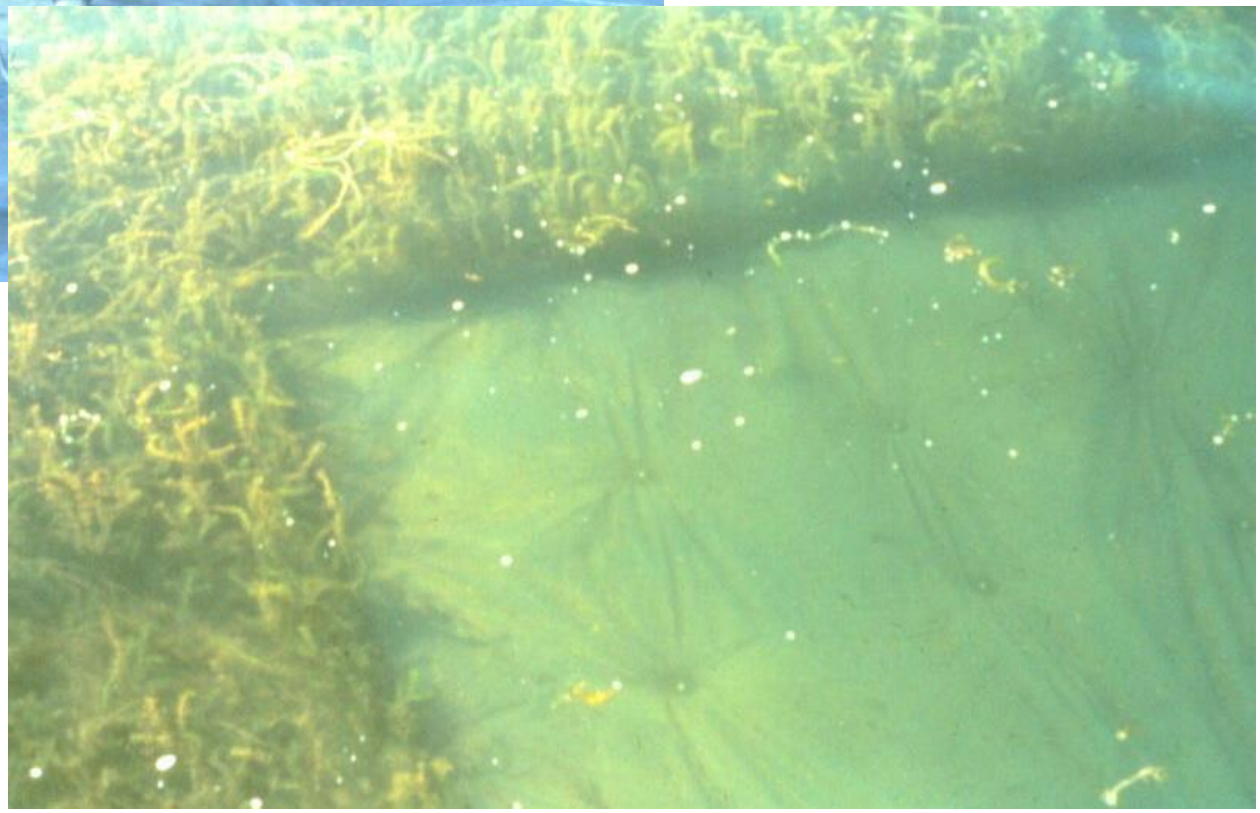


CONTAIN = Enclose Small Area

Benthic Barriers



Bottom barriers



Small areas:

- Beaches
- Docks
- Boat ramps
- Require maintenance

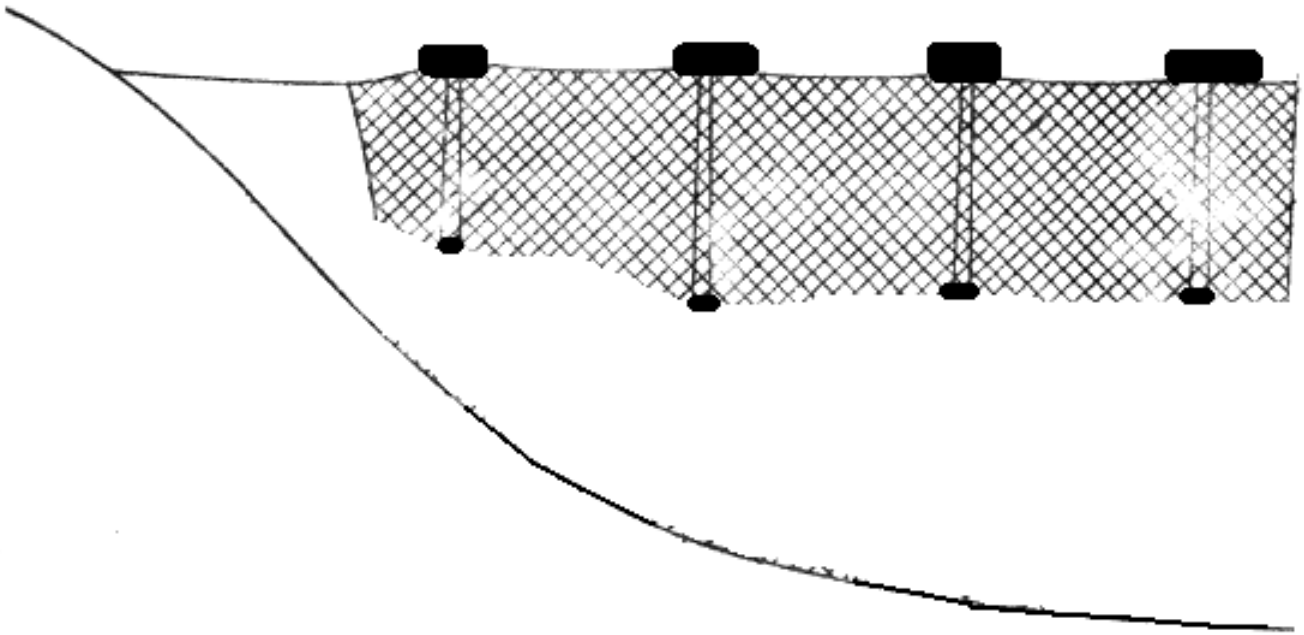
CONTAIN = Enclose Small Area

Benthic Barriers

- Opaque screen/tarp secured to lake bottom
- Blocks sunlight and prevents growth
- Impedes fragmentation
- Not specific to target (plant species)
- Materials may be costly
- Maintenance required

CONTAIN = Enclose Small Area

Floating Nets



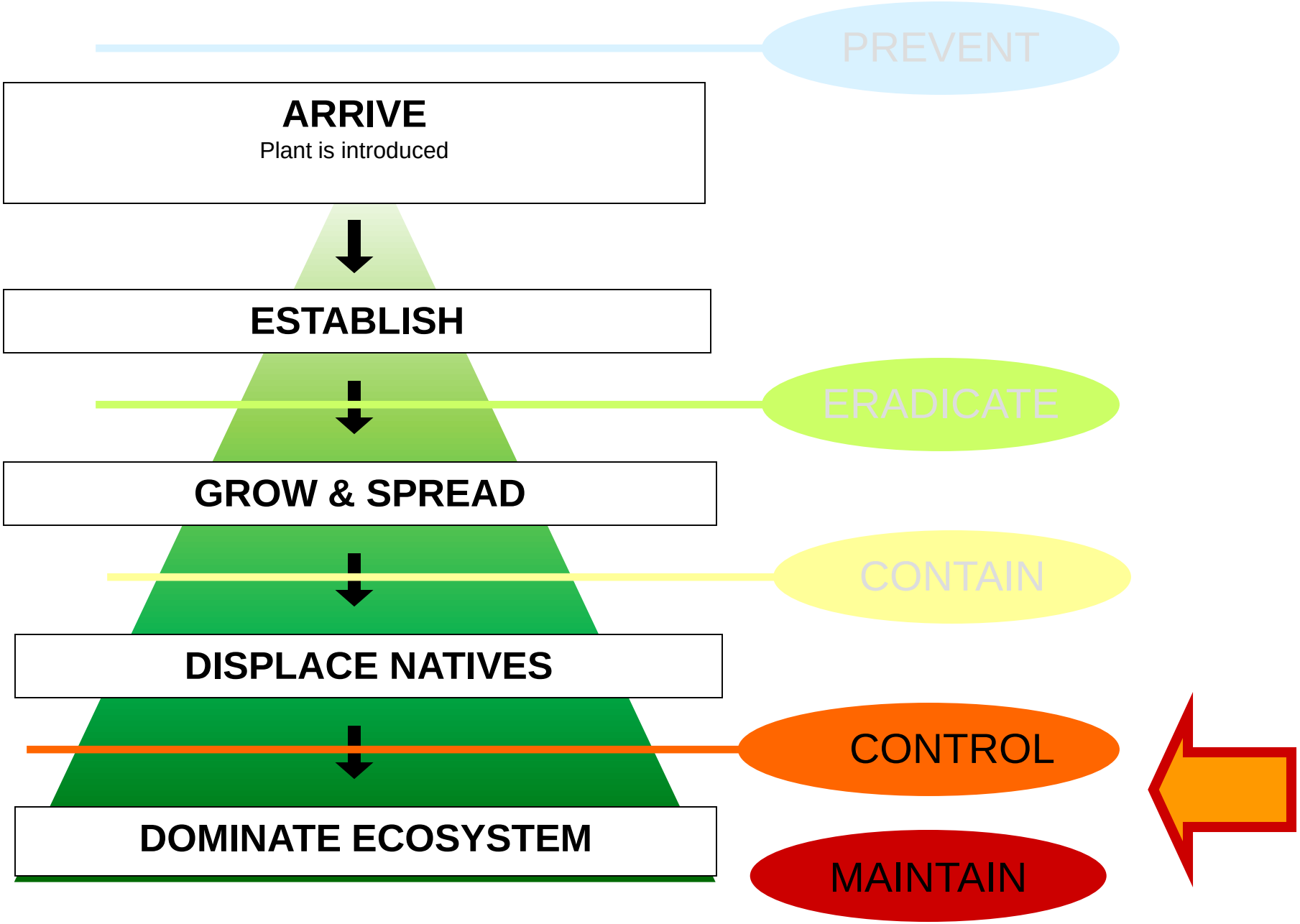
CONTAIN = Enclose Small Area

Floating Nets

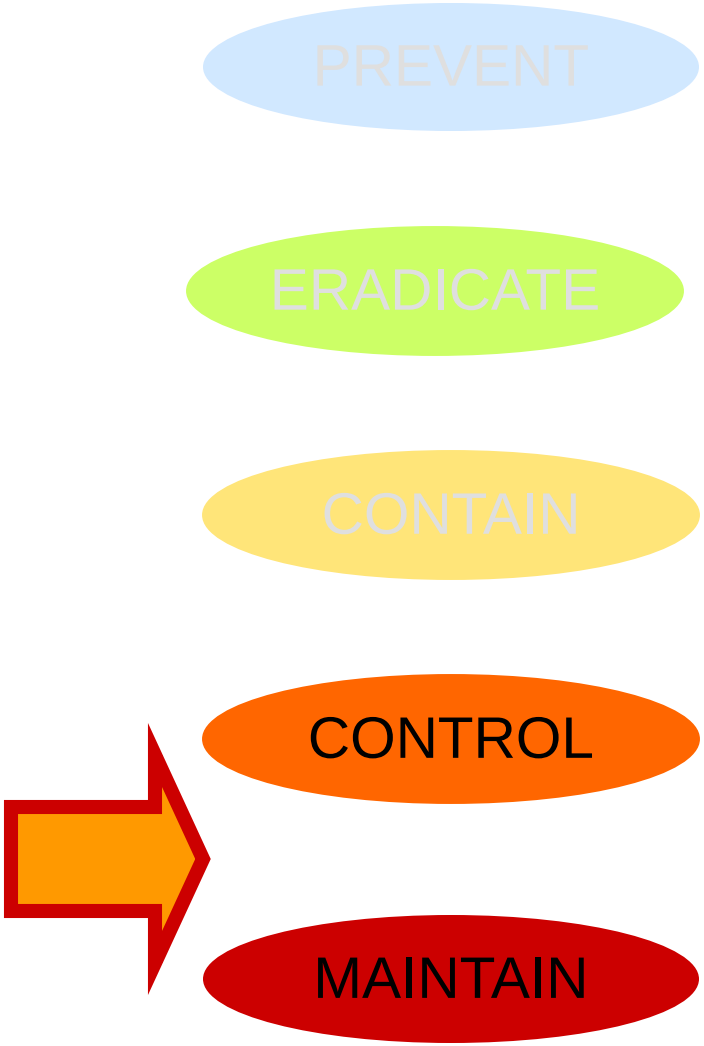
- Drape net across cove or inlet opening
- Inhibits spread of plant fragments
- Not target specific
- Requires proper anchors and maintenance
- May impede boating, swimming

  or fish movement

AIS Management Goals & Strategies



AIS Management Goals & Strategies



Control Types:

- Mechanical Methods
- Physical Habitat Alteration
- Chemical Methods
- Biological Methods

CONTROL

MAINTAIN

Mechanical Options

Mechanical or Suction Harvesting

CONTROL

MAINTAIN

Mechanical Options

Hydro-raking

CONTROL

MAINTAIN

Mechanical Options

Mechanical or Suction Harvesting & Hydroraking

- Machinery used to remove ALL plant material from large area
- Not target-specific; may spread fragments
- Requires follow-up maintenance
- High cost for short term solution
- Disturbs soils & habitats; causes turbidity
- Requires DEM Wetlands Permit

CONTROL

MAINTAIN

Physical Habitat Alteration

Lake-level Drawdowns

CONTROL

MAINTAIN

Physical Habitat Alteration

Lake-level Drawdowns

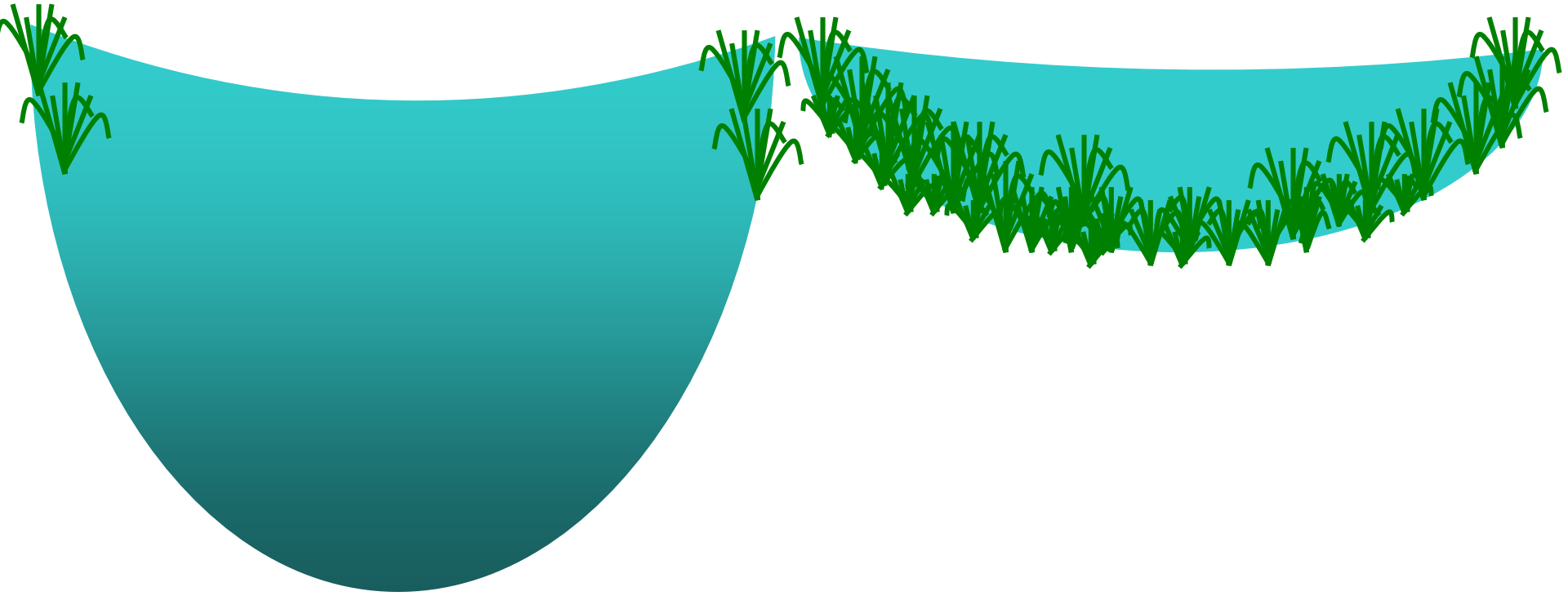
- Lower water level in Fall via dam structures
- Sediments and perimeter plants freeze/dry
- Not target specific; effects all littoral plants
- May effect access to water supplies
- May require DEM Wetlands permit
- Rate integral to avoid fish/frog/mussel kill

Lake-level Drawdowns

* Bathymetry is important

Lake A: deep

Lake B: shallow

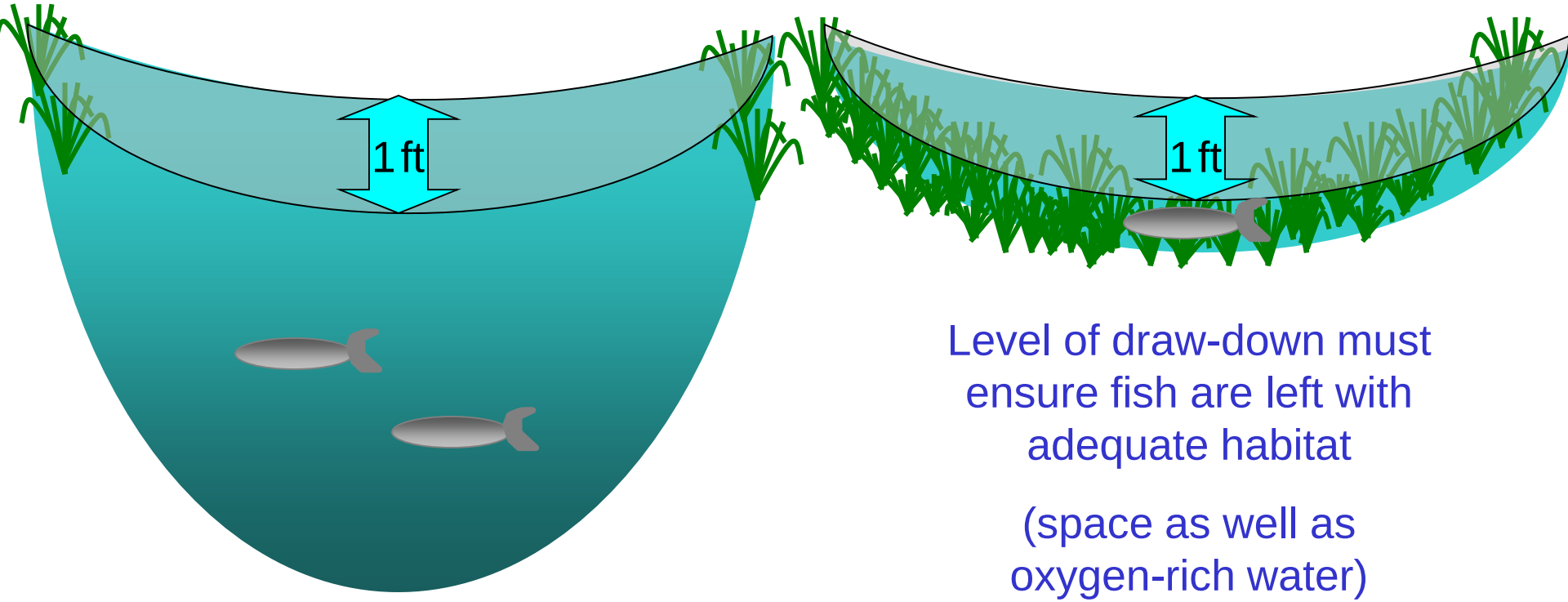


Lake-level Drawdowns

* Bathymetry is important

Lake A: deep

Lake B: shallow



Level of draw-down must ensure fish are left with adequate habitat

(space as well as oxygen-rich water)

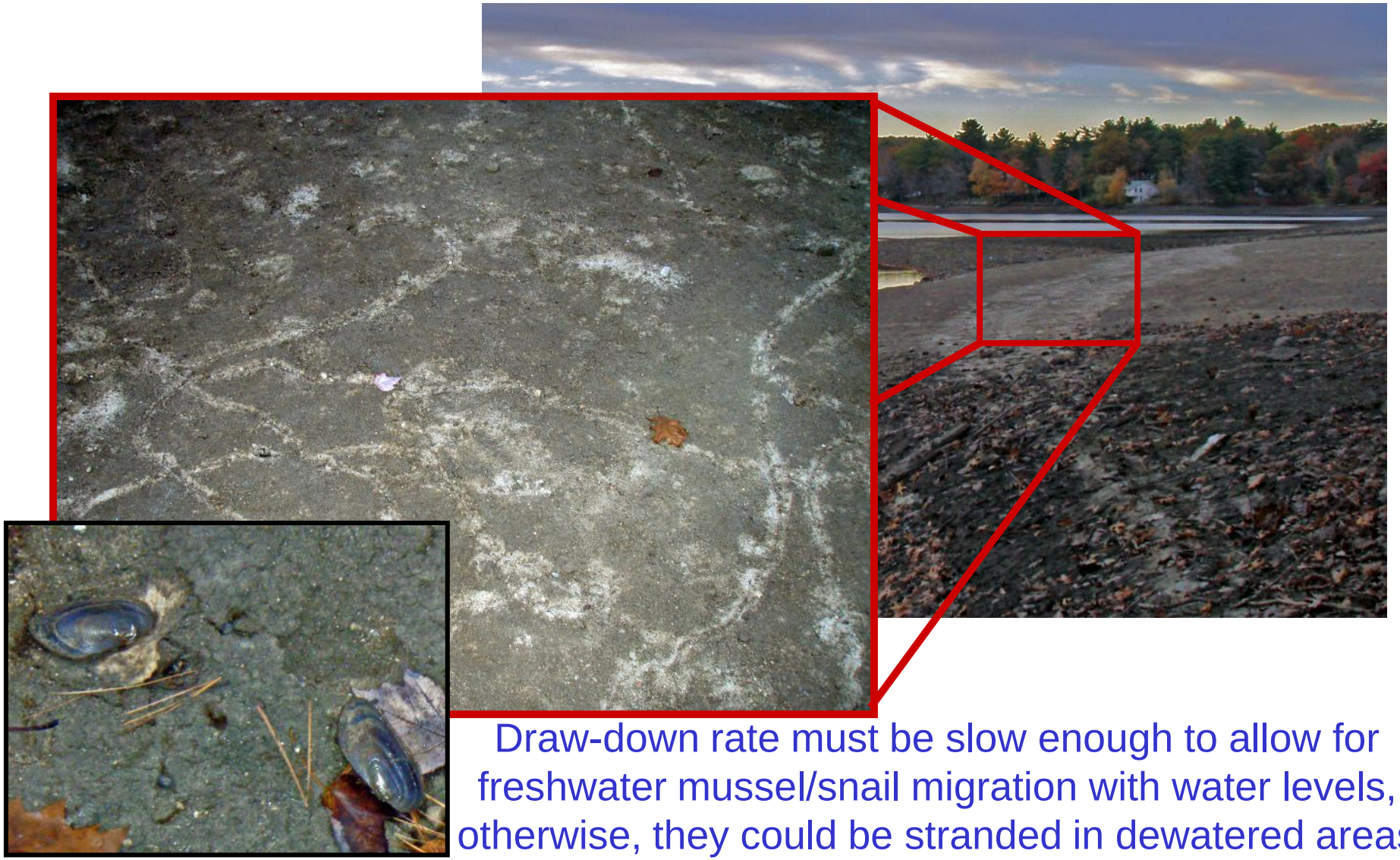
Lake-level Drawdowns

* Release Rate & Timing is important

Optimal time in October

Lake-level Drawdowns

* Release Rate & Timing is important



Draw-down rate must be slow enough to allow for freshwater mussel/snail migration with water levels, otherwise, they could be stranded in dewatered areas

CONTROL

MAINTAIN

Physical Habitat Alteration

Dredging

Suction dredging

Also suction harvesting

CONTROL

MAINTAIN

Physical Habitat Alteration

Dredging

- Total removal of plants and sediments
- Complete alteration of lake ecology
- Not target specific
- Impacts all plants & wildlife
- May cause water quality problems
- Costly; Requires DEM Wetlands Permit

CONTROL

MAINTAIN

Chemical Options

Herbicide Applications

CONTROL

MAINTAIN

Chemical Options

Herbicide Applications

- Many new safe and effective products
- Often very target specific
- High cost, but cover large areas, and results may be seen in 1-3 years
- DEM permit required from Fish & Wildlife

FACTORS FOR HERBICIDE SELECTION…

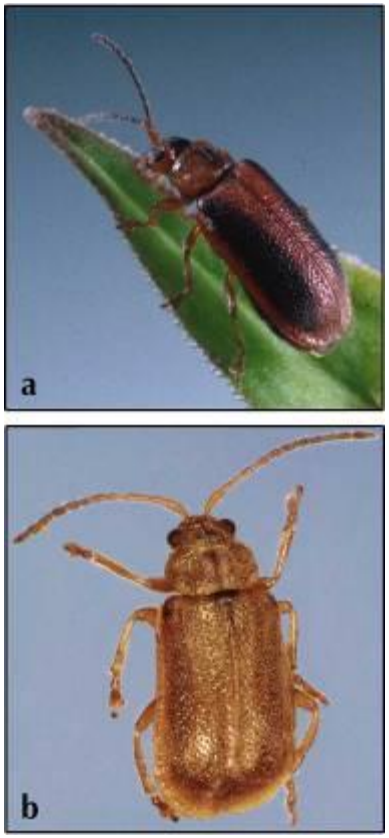
- Target species
- Size & configuration of treatment area
- Selectivity desired or required
- Water uses
- Flow considerations
- Timing
- Cost ($$$)

CONTROL

MAINTAIN

Biological Control

Introduce Natural Predators



Purple Loosestrife Beetle

Milfoil weevil

CONTROL

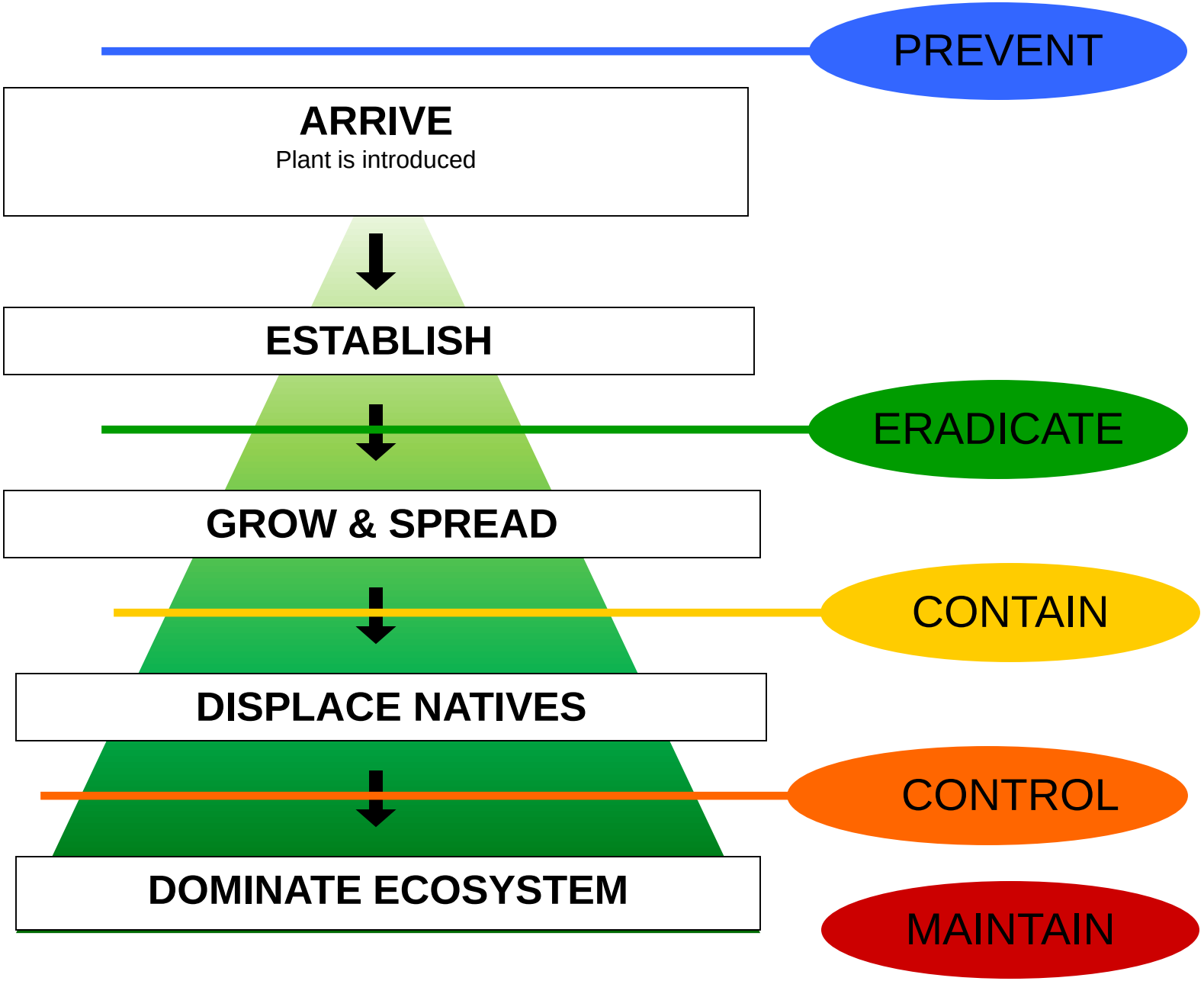
MAINTAIN

Biological Control

Introduce Natural Predators

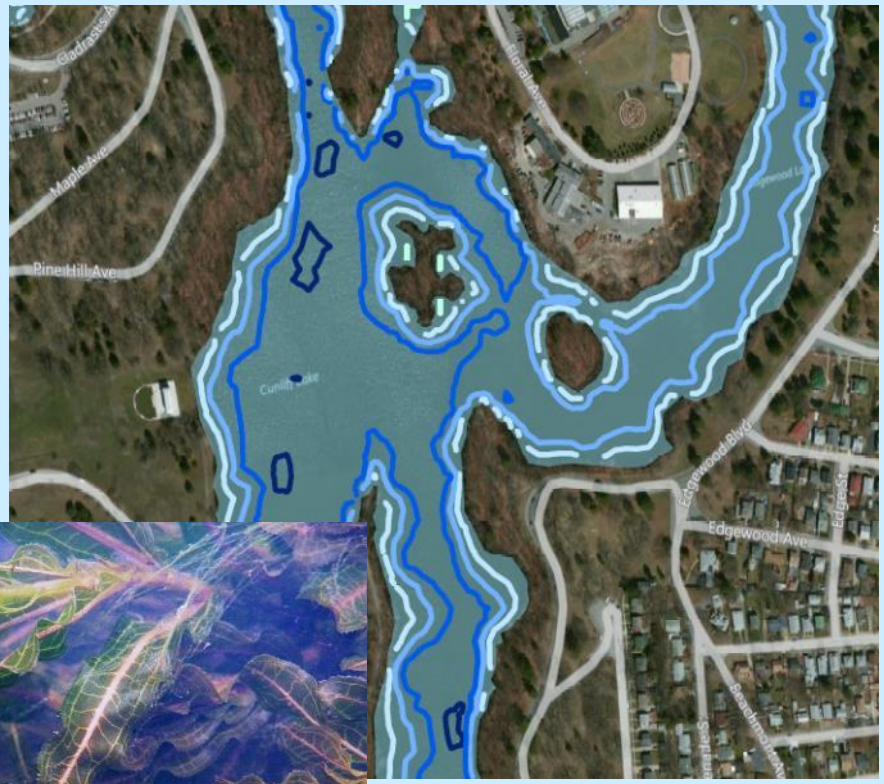
- Natural predators control plant populations
- Often highly specific to target plant
- May be experimental or problematic
- Release projects must be permitted by DEM Fish and Wildlife

AIS Management Goals & Strategies



Lake Management Plans

What is the problem?



Requires Data to describe:

- Target species information
- Plant distribution maps
- Plant abundance/coverage
- Lake information

Water quality

Bathymetry

Size

Water volume/level

Flushing rate/method

Connectivity? Ramps?

Lake Management Planning

What is the problem?

Where in the lake?

What is the goal?

Who will do what?

When will it happen?

How long will it take?

Lake Management Plans

	• Written document for specific lake
	• Outlines & prioritizes specific goals of management (eradicate or control)
	• lists factors at a particular lake that contribute to a specific plant problem
	• Provides options and recommends strategies for specific goals
	• Names which people will complete management strategies
	• Provides a specific, measureable timeframe with quantifiable endpoints

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Questions?

Katie DeGoosh-DiMarzio

RIDEM Office of Water Resources

katie.degoosh@dem.ri.gov

http://www.dem.ri.gov/programs/water/quality/surface-water/aisplant.php

Elizabeth Herron

URI Watershed Watch

eherron@uri.edu

https://web.uri.edu/watershedwatch/learning-about-aquatic-invasive-species

Prepared for RI Land & Water Summit, March 2019