



INVASIVE WATER CHESTNUT LESSONS FROM WATERSHED MONITORING & MANAGEMENT

OARS

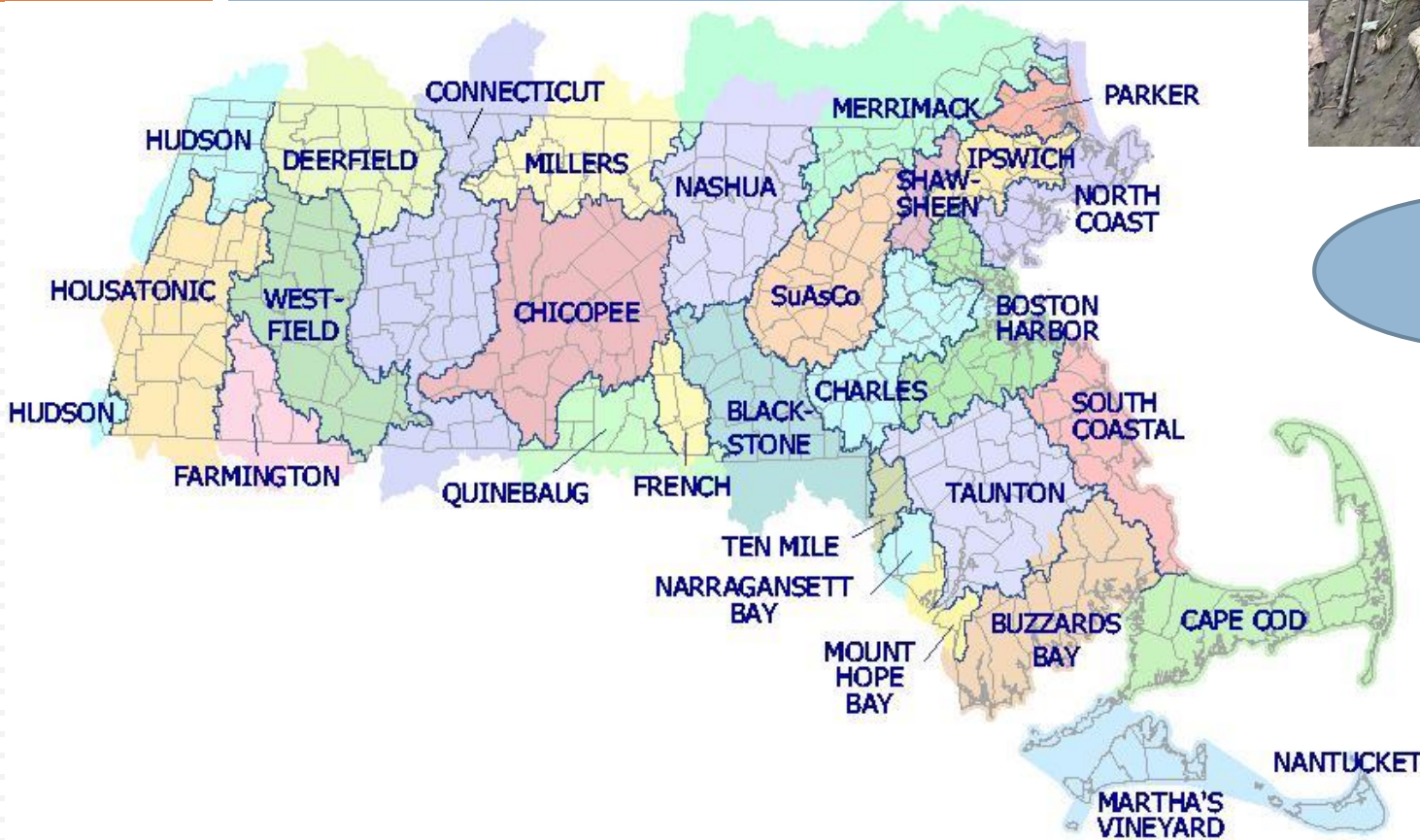
Alison Field-Juma, OARS – October 2018

Beloved

Our catadromous fish



What dam?



Water Chestnut (*Trapa natans*)

Origin and introduction

Mapping 3 ways

Control Management 3 ways

Permitting 2 ways

Collaboration in so many ways!

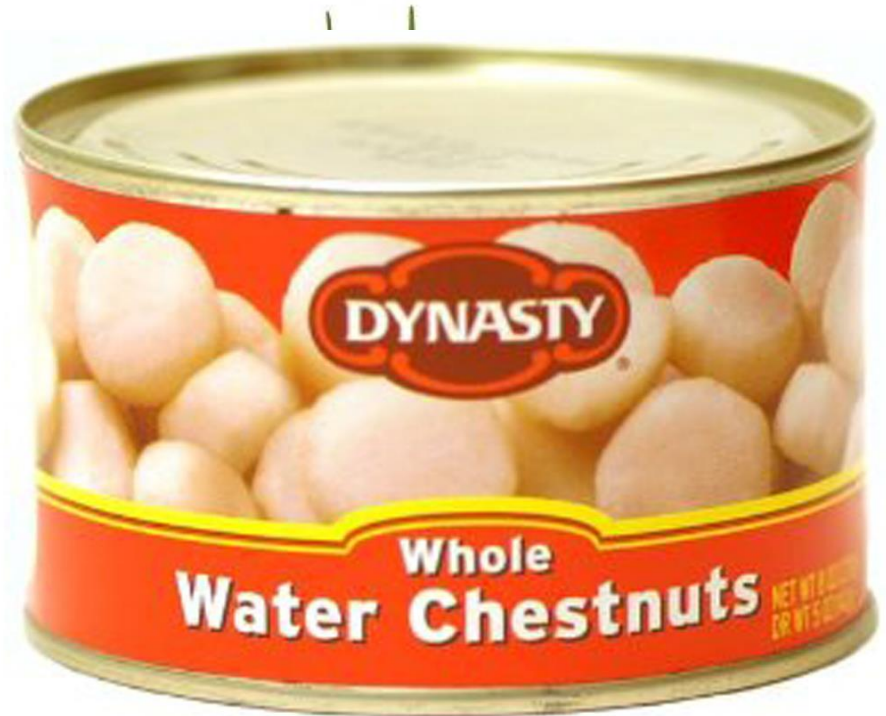


Trapa natans ≠ *Eleocharis dulcis*

□ *Trapa natans*



□ *Eleocharis dulcis*



Origins: Eurasia and Africa

“Devil’s Pod”

- Native to temperate Europe, Asia & Africa
- Several species: *T. natans*, *T. bicornis*, and *T. rossica*
- *T. natans* and *T. bicornis* valued as a food-plant in Eurasia and Europe until the beginning of the 20th century.
- Current status:
 - ▣ Endangered in Europe
 - ▣ Invasive in North America and Australia

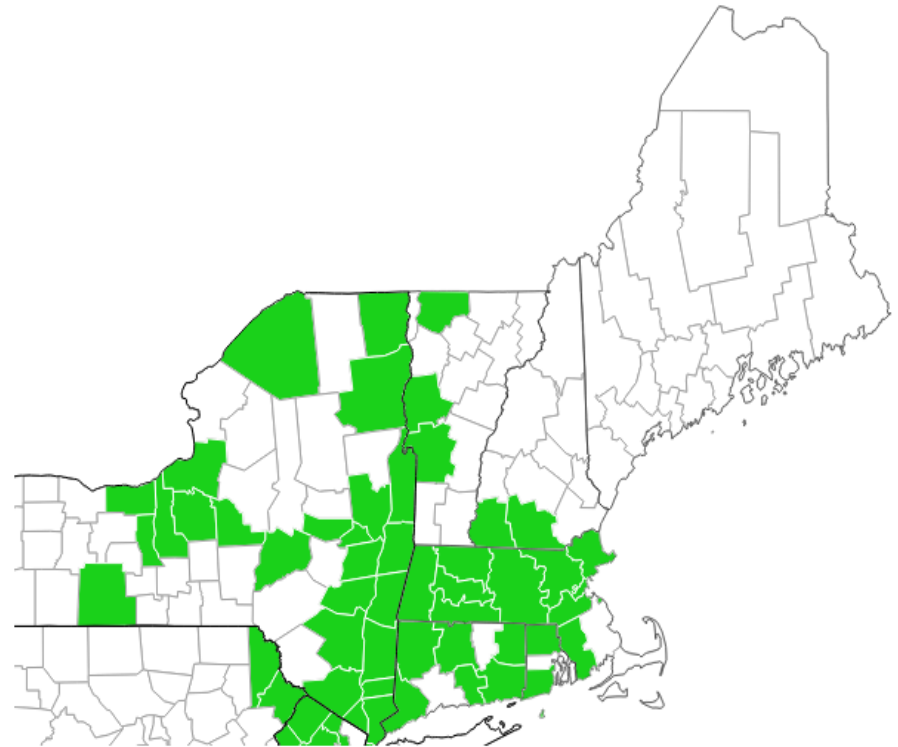


Trapa natans in cultivation: 2009 Tainan City

Citations: http://en.wikipedia.org/wiki/Trapa_natans
www.eattheweeds.com/water-chestnut-water-caltrop/
http://www.eddmaps.org/ipane/ipanespecies/aquatics/Trapa_natans.htm
Torreya, Volumes 12-14; Torreya Botanical Club, 1912
RAI and SINHA, 2001. Environmental Monitoring and Assessment 70: 241–252.

Introduction & Spread in N. America

- **1874:** introduced at Harvard's botanical gardens (purportedly).
- **1879:** found by near Concord
- Intentionally introduced to a pond near Sudbury River other ponds including Fresh Pond in Cambridge.
- **1884:** found in Sanders Lake near Schenectady, NY
- **1920:** reached western Mass
- **1923:** two-acre patch on the Potomac near Washington D.C.
- **2018:** Listed as a noxious weed in AL, AZ, CT, ID, IN, MA, ME, MI, MN, OR, SC, VT, WA.



IPANE: *T. natans* distribution in NY / New England

Impacts

“It is like trying
to canoe
through a
salad!”

*Framingham
resident*

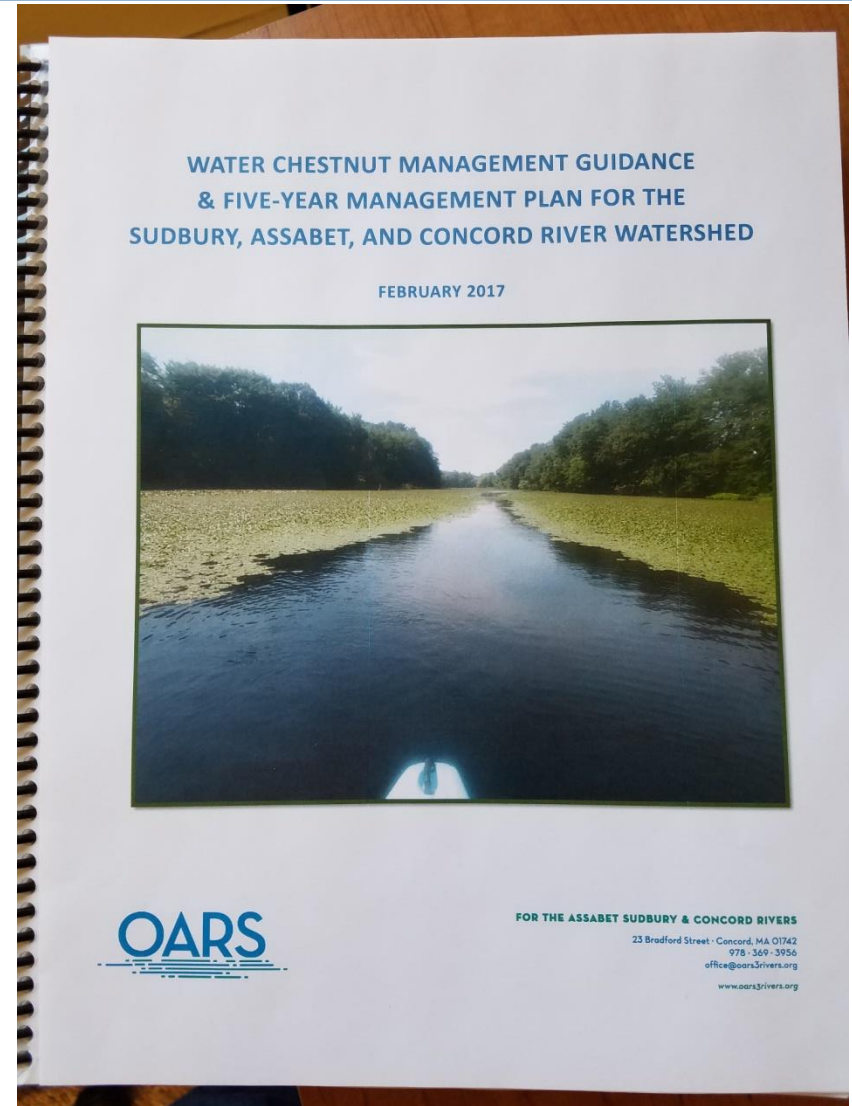
“I can’t
breathe under
there!!”

*Billerica large mouth
bass*



Management Planning

- Literature/experience review
- Mapping/monitoring
- Management
- Permitting
- Five-Year Plan for the SuAsCo
 - ▣ Mapping
 - ▣ Controls
 - ▣ Collaboration



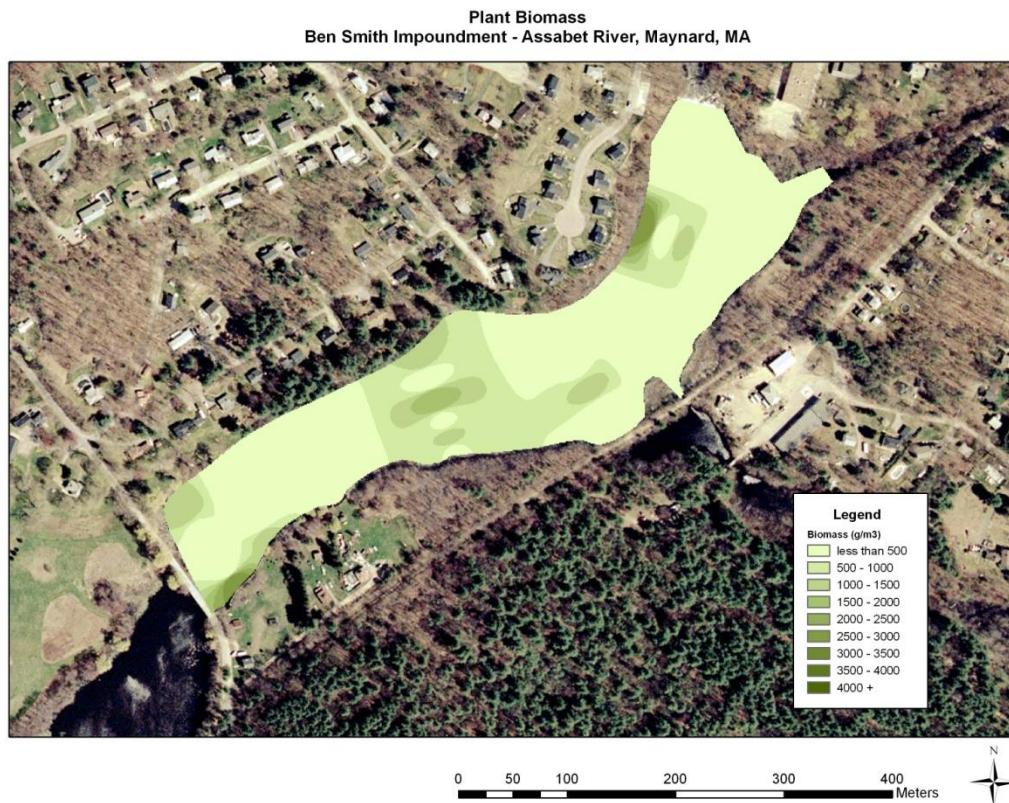
OARS' Water Chestnut Mapping

Built on our experience with biomass mapping since 2005

Goal is to:

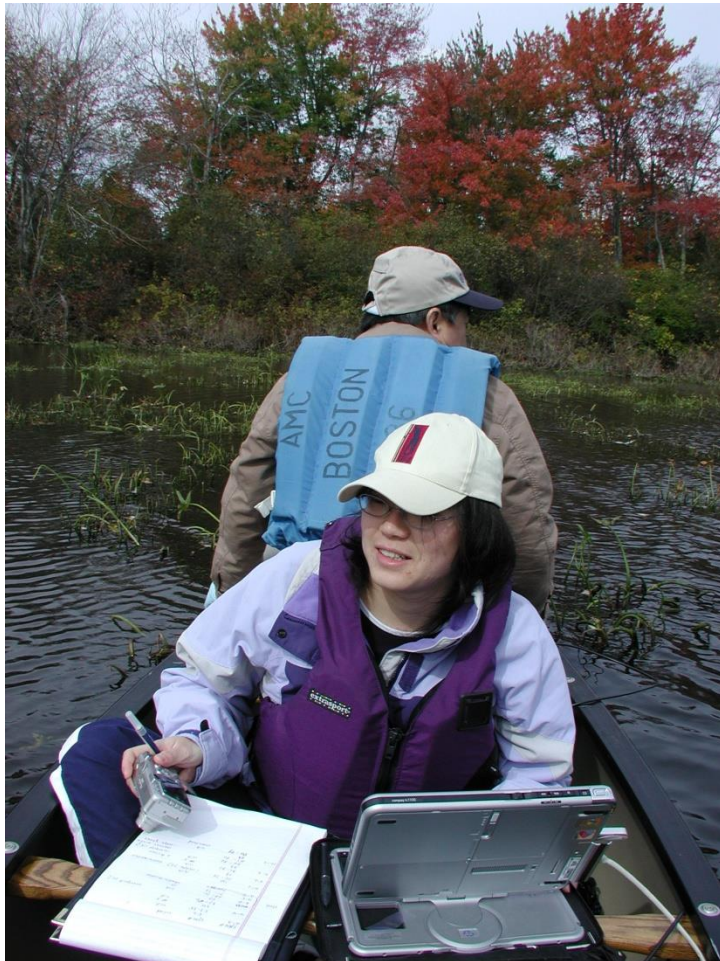
- track the distribution & concentrations for control planning
- assess the effects of control(?) efforts
- find emerging populations to control them before they get too bad

Evolving methods: OARS aquatic plant mapping since 2005



- **2005** point-based observations in the impounded areas by boat & GIS interpolation of data
- Paper maps and visual estimation of location in field
- Time consuming but inexpensive

2008 Remote Sensing

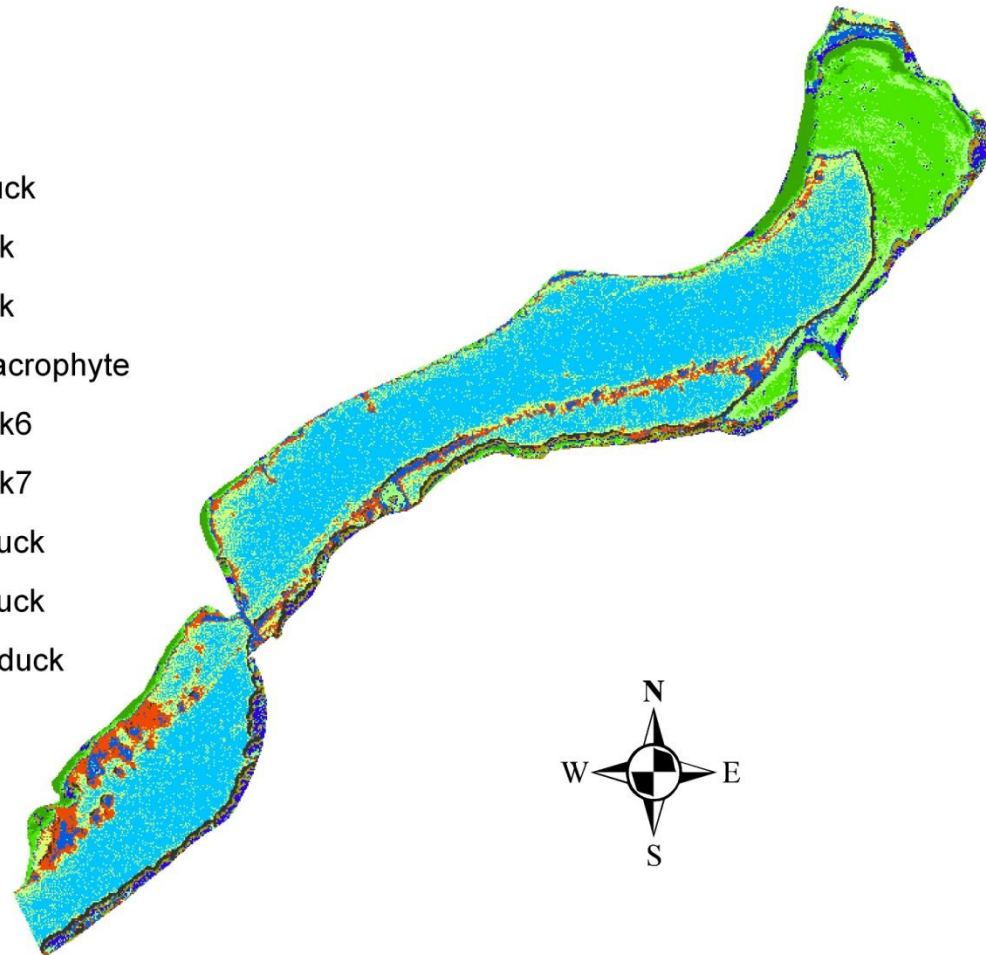


- **2008-2009** worked with USGS & UMass on remote sensing (with **satellite** data) of floating aquatic plants in the impoundments
- \$\$\$- expensive

Collecting ground-truth data: Young Tian and Qian Yu

2008-2009 Remote Sensing - results

Legend



2007-2012 Grid-based system and GIS/GPS field units

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Duckweed Survey - August 13, 2007
Ben Smith Impoundment of the Assabet River, Maynard, MA



Base map from Mass GIS digital ortho photo
Analyst: Organization for the Assabet River

0 35 70 140 210 280
Meters

DUCKWEED SURVEY 2007

- **2007** extended a grid system developed by USGS for MA DEP's duckweed mapping
- Time consuming, some expense in getting and maintaining GIS/GPS units, more accurate

GPS/GIS

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Improvement in 2013:

- ⦿ GPS location in real time!!!
- ⦿ Can paddle around and see the size of the grid



Assabet River, Stow, MA
Water Chestnut Survey - Summer 2013

NORTHBOROUGH

WESTBOROUGH

Route 9

Spot checking
from the
bridges
where the
rivers weren't
boat-able



Water Chestnut Percent Cover

Not assessed
0%
1-10%
10-20%
20-30%
30-40%
40-50%
50-60%
60-70%
70-80%
80-90%
90-100%
Major_Rds
Susasco_towns

1:3,750



2013-2016 Water chestnut mapping by field team

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- Using hand-held mobile mappers for data
- Time consuming and accuracy depends on judgement in the field
- Different team each year
- ArcGIS to map

**WATER CHESTNUT SURVEY
2016**

2018 Drone Pilot Project



Data collection: Phantom 3 Professional

Altitude (meters)	Pixel Resolution	# of Images	Flight Time
50	1.48 cm / 0.58 in	1205	5 min
120	3.41 / 1.34 in	250	9 min

2018 Drone Project

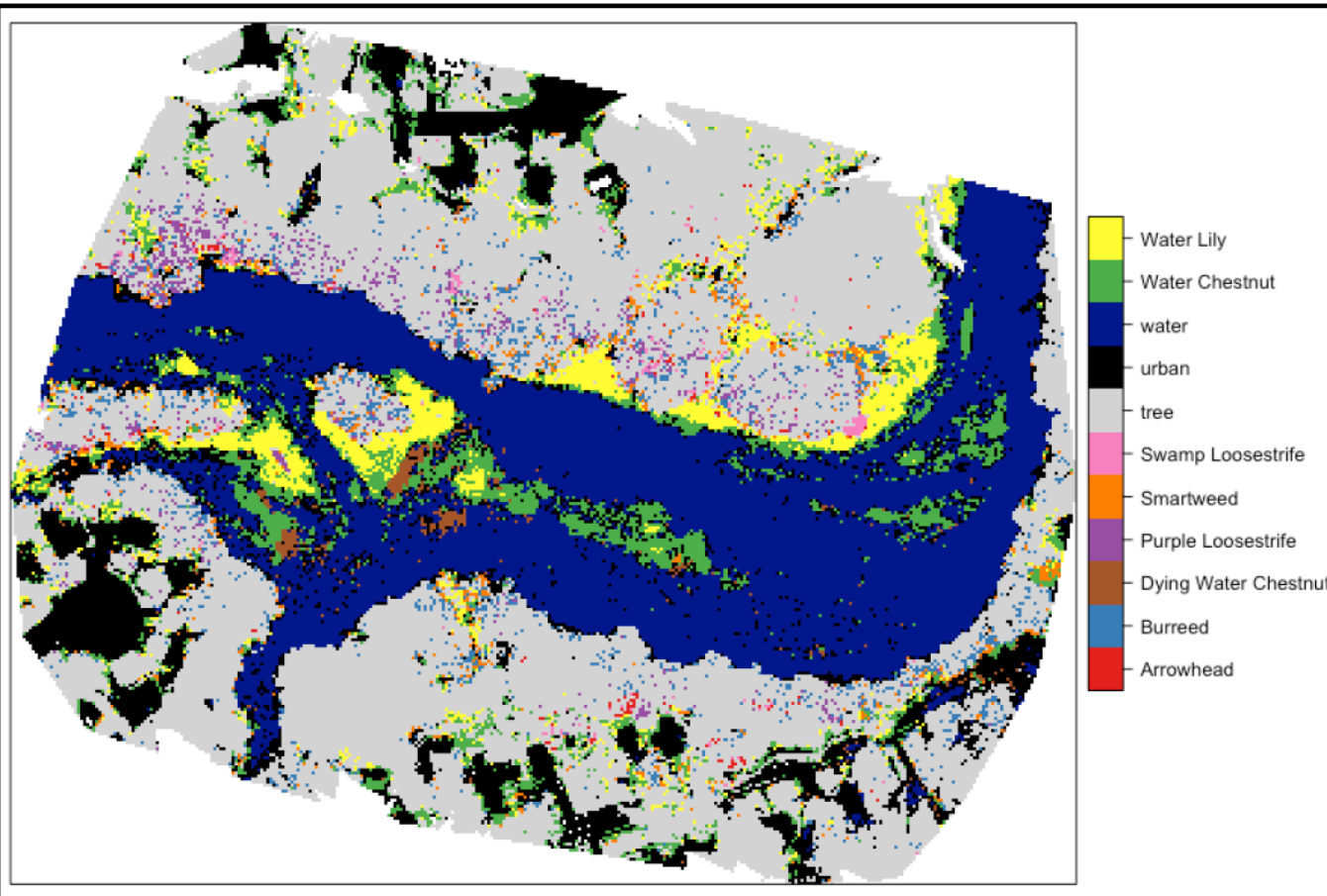


Figure 6. Classified Image at GSD (or pixel scale) of approx. 13 cm (5 in).

- **2018 Drone survey of Saxonville Impoundment of Sudbury River**
- **Faster**
- **Less expensive than satellite data**
- **Analysis methods and costing being developed**


Management Options

TYPE	MODE OF ACTION	ADVANTAGES	DISADVANTAGES
Hand-pulling	Physical removal of plants before seeds drop; hand-pulling from small boats	Highly selective control; limited impact to non-target organisms; good for shallow sites; removes plants from water column; can involve volunteers (lower cost)	Not good for large, dense infestations; labor intensive
Mechanical Harvesting	Physical removal of plants before seeds drop; requires mechanical harvester, conveyor, and truck	Capable of removing large/dense infestations; removes plants from water column	Minimally selective; not useable in shallow sites; fragmentation may spread other invasives; may impact aquatic fauna; requires larger access or use of crane; higher cost
Hydroraking	Physical removal of plants before seeds drop; requires hydrorake, barge, and truck	Capable of operating in shallower areas than mechanical harvester, removes stump and debris	Minimally selective; very disruptive in areas applied; may generate high turbidity; fragmentation may spread other plants; requires larger access or crane
Drawdown	Winter drawdown to kill seeds by freezing; summer drawdown to kill emerging vegetation before seeds set; freezing time & duration are critical	Low cost; opportunity for shoreline cleanup or structure repair; needs outlet control	Non-selective; very disruptive; alteration of flows downstream during drawdown & refill periods; more information needed on effectiveness of summer drawdown
Dredging	Sediment removal to reduce seed bank, reduce nutrient recycling, increase water depth	Removes the soft sediments, deepens the waterbody, effective on all rooted plants	Non-selective; very disruptive; alteration of flows during management; potential release of sediment; high cost
Bethic Barriers	Placement of barrier or bottom cover to prevent growth of rooted plants	Effective on growth of rooted plants in limited areas or create access lanes; complete elimination of plants in area	Non-selective; high cost of installation and maintenance; not suitable for large areas; difficult to install
Herbicides	Absorbed or membrane-active chemicals that disrupt plant metabolism	Limited toxicity depending on chemical; rapid action; selectivity is depends on application method	Potential toxicity to aquatic fauna; water use restrictions for varying time after application; increased oxygen demand from decaying vegetation

Management Efforts on the Sudbury, Assabet and Concord Rivers

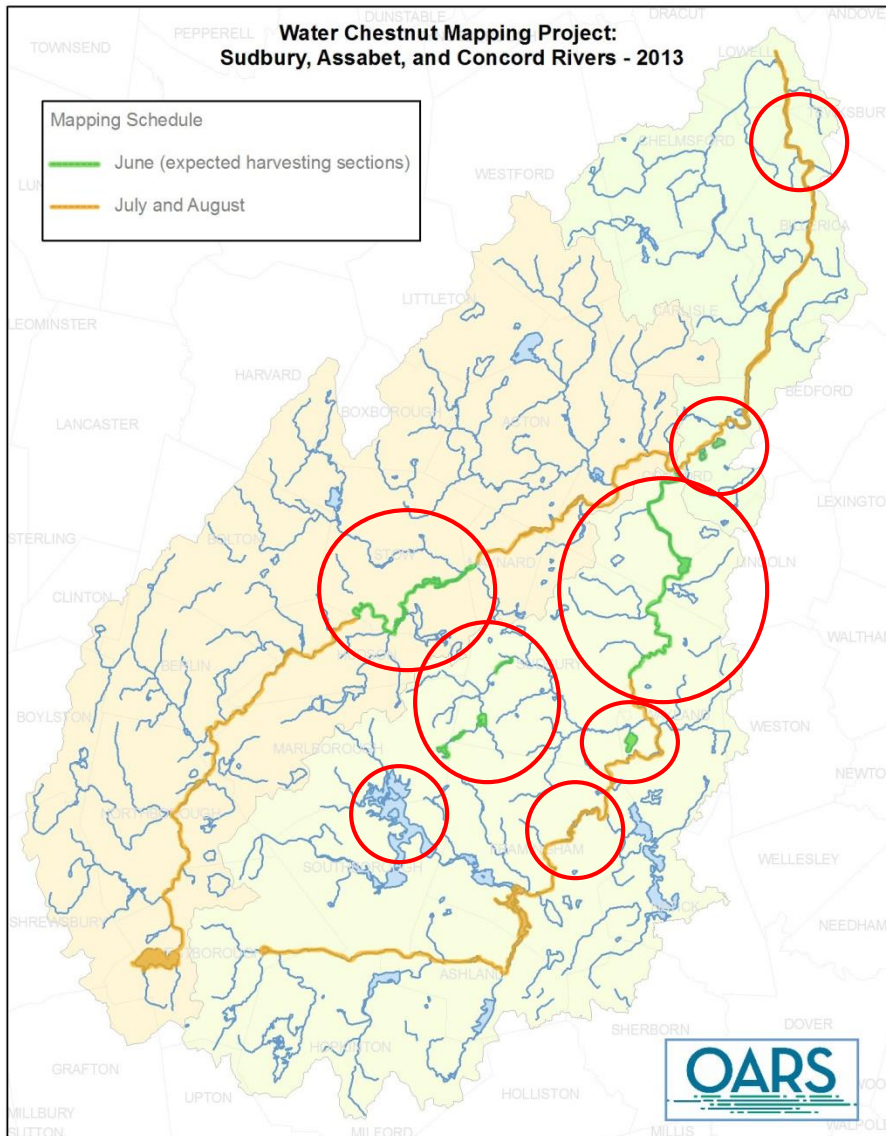


Using a harvester, Bruce McGarry, left, of Concord's Division of Natural Resources, and intern Ross Bodenbergharvest water chestnuts on the Sudbury River in Concord July 20

Ann Ringwood/Wicked Local staff photographer | 

Using a harvester, Bruce McGarry, left, of Concord's Division of Natural Resources, and intern Ross Bodenbergharvest water chestnuts on the Sudbury River in Concord July 20.

Management



- **Sudbury River** Rte 27 to Sherman Bridge Road: USF&W, Town of Lincoln, Concord Land Conservation Trust. Since 2000. Mechanical harvester & hand pulling.
- **Heard Pond:** Wayland Surface Water Quality Committee. 16 years of harvesting. Mechanical & now hand harvesting. SOLitude.
- **Hop Brook Ponds:** Hop Brook Protection Association. Mechanical and hand harvesting.
- **Assabet River:** OARS. Hand harvesting in Stow, Hudson, and Maynard since 2008.
- **Concord Impoundments:** US F&WS. Hand harvesting.
- **Concord River:** OARS. Hand harvesting 2017-2018.
- **Sudbury River, Framingham:** City of Framingham, 5-year adaptive management project using herbicide
- **Framingham Reservoirs:** DCR, 2019.

Hand Pulling – Assabet River

- Hand-pulling effort by OARS since 2008 starting in Stow section
- Hired “Rapid Response Team” in 2015-2018 to pull all along the Assabet
- Reduced populations in Stow by 2018
- New population in Westborough found in 2016





Hand-pulling teams to get in close to the shore where it is too shallow for the harvester

2018 Water Chestnut – A1



Herbicide Treatment - Saxonville



August 2018

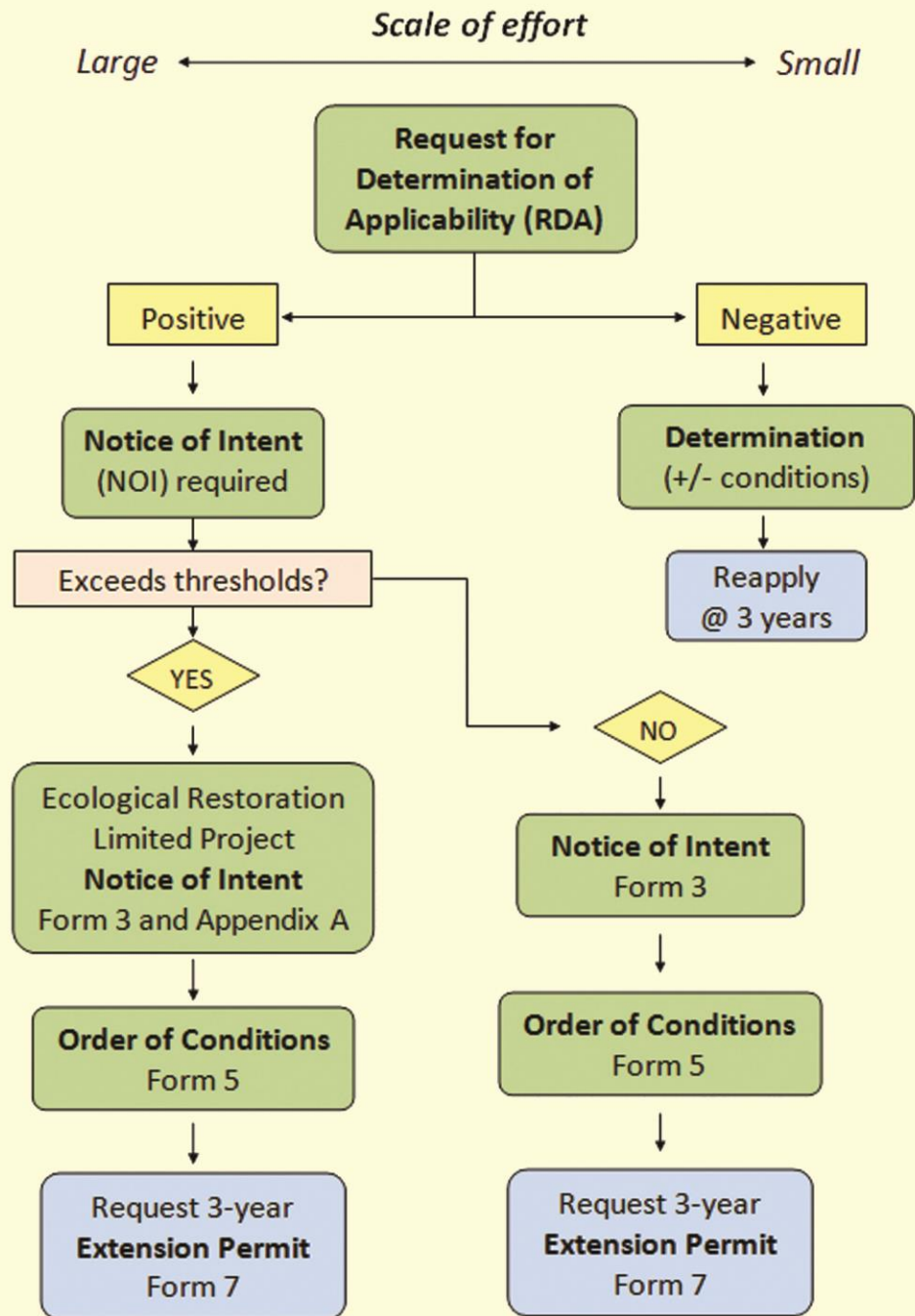
Mechanical Harvesting - Fairhaven Bay

- ❑ Mechanical Harvesting starting in 2001
- ❑ Project of Fish & Wildlife, Lincoln, Concord, and Concord Land Conservation Trust
- ❑ By 2012 reduced population to levels controllable by hand-pulling
- ❑ 2018: resurgence of water chestnut populations downstream of Fairhaven Bay
- ❑ Success, but have to keep pulling!



Permitting

Wetlands Protection Act



Where do we go from here?



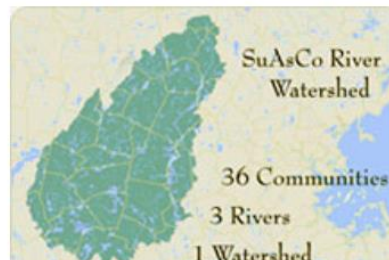
Study
Monitor
Plan
Collaborate
Engage
Convince (\$)
Lobby (\$)

Partners



SuAsCo CISMA

The SuAsCo CISMA (Cooperative Invasive Species Management Area) is a partnership of organizations that intend to manage and control invasive species defined by the geography of the Sudbury, Assabet, and Concord (SuAsCo) watershed. Thirty-six towns are part



Watershed groups

Land Trusts

Town/City

DCR

USF&W

NPS

CISMAs

Herring Network!

Public education and engagement

Corporate volunteer days

Abutter volunteer pulls

Presentations

Information cards



Invasive Aquatic Plant: Water Chestnut



Water chestnut (*Trapa natans*) is an invasive aquatic plant found in the Assabet, Sudbury, and Concord Rivers and local streams & ponds.

Problem:

- The plants grow into dense, floating mats.
- Mats reduce oxygen in the water, and damage habitat for fish and wildlife.
- Boating and fishing become impossible.
- Re-seeds from nuts for up to 12 years.

Identification:

- Floating clusters of leaves form a rosette.
- Surface leaves are triangular with toothed edges, glossy tops and an inflated leaf stem.
- Nuts with four sharp, barbed spines.
- Submerged leaves are feathery and whorled around the stem.

What To Do:

- Pull them up gently by hand.
- Take most of the stem to prevent regrowth.
- Compost plants away from a river or lake.
- Tell us where you found them.



Get Out and Pull!



QUESTIONS?

