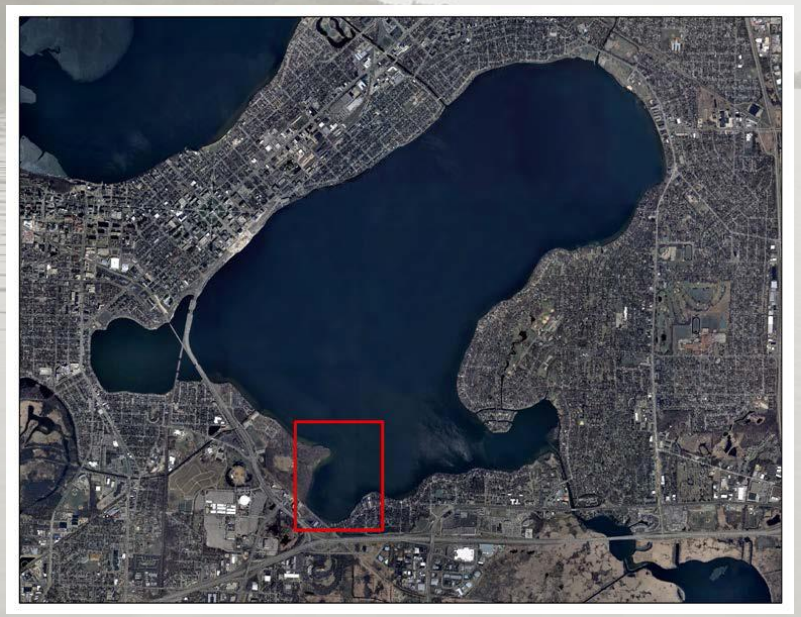
Early Season 2,4-D Herbicide and Deep Harvesting Treatment Effects on Eurasian Watermilfoil (*Myriophyllum spicatum*) and Native Macrophytes in Turville Bay, Lake Monona, Dane County, Wisconsin



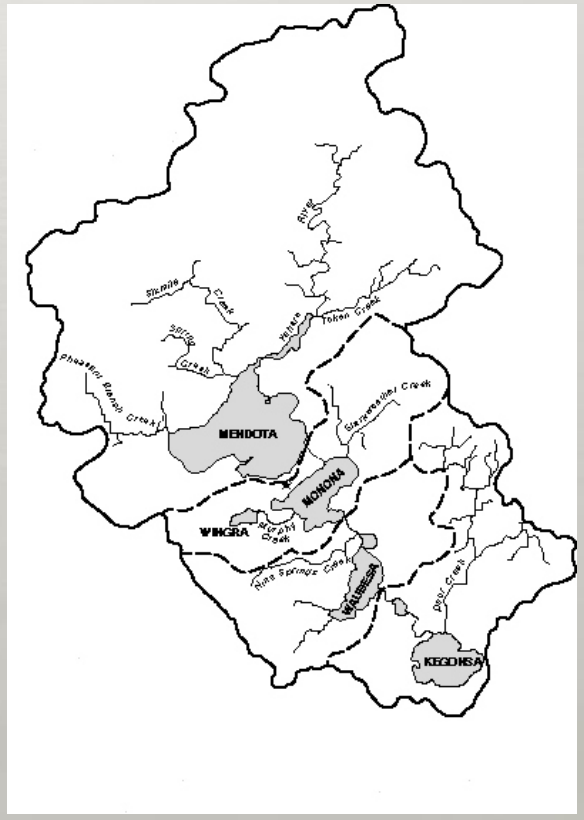
Martha Barton, **Alison Mikulyuk**, **Michelle Nault**, **Kelly Wagner**, **Jennifer Hauxwell**, **Scott van Egeren**, **Tim Asplund**, **John Skogerboe**, **Susan Jones**, **Jim Leverance**, and **Susan Graham**

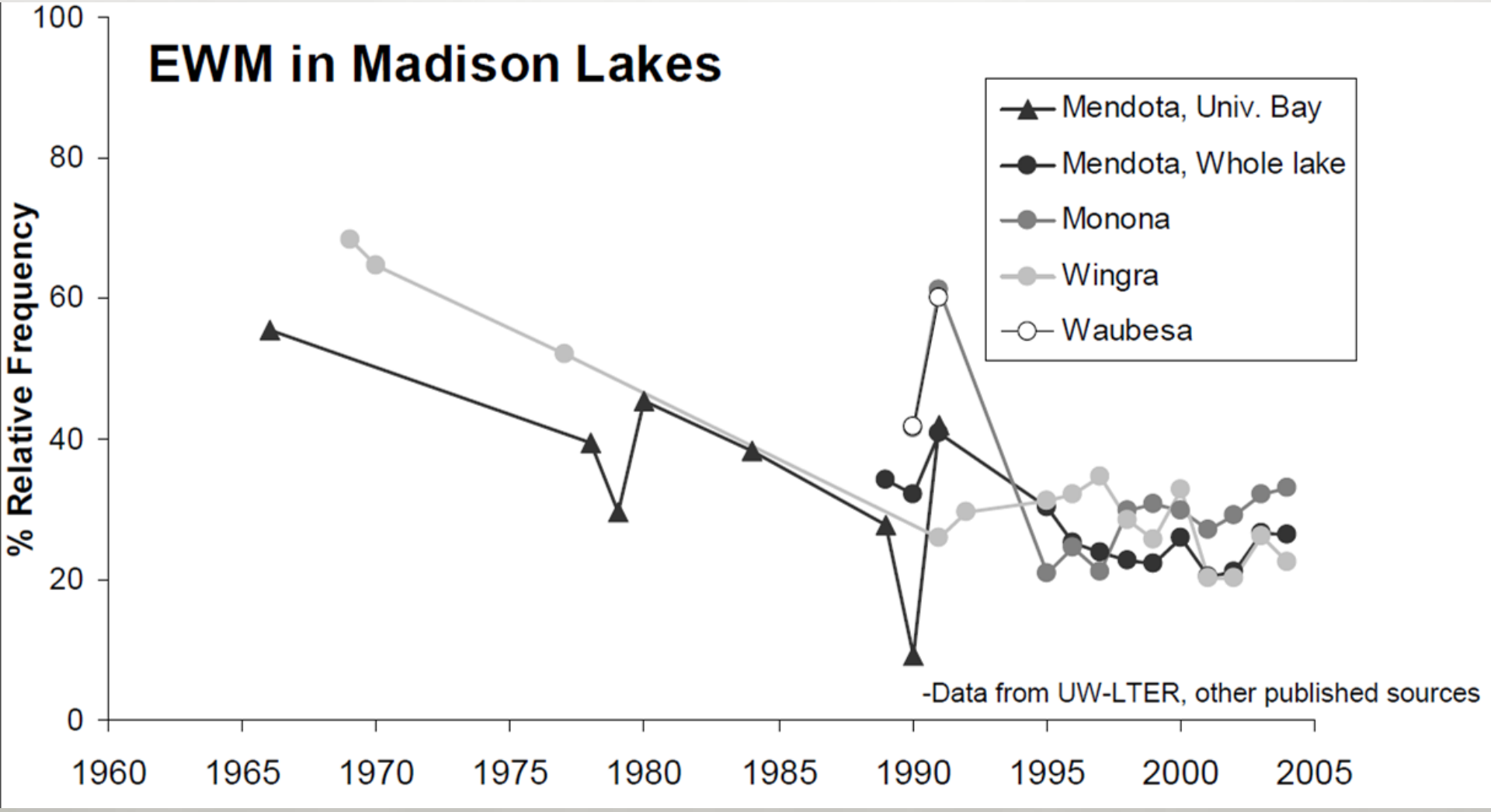
Project Collaborators

- Dane County, Wisconsin
  Susan Jones, Jim Leverance
- U.S. Army Corps of Engineers
  John Skogerboe
- Wisconsin Department of Natural Resources
  Jennifer Hauxwell, Tim Asplund, Alison Mikulyuk, Michelle Nault, Kelly Wagner, Scott van Egeren and Susan Graham

Eurasian Water Milfoil (EWM) in the Madison Lakes

- Non-native, invasive
- Found in lake Mendota in 1962
- Most dominant plant in the 1960s
- Decrease over time




EWM in Madison Lakes
% Relative Frequency
100
80
60
40
20
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Mendota, Univ. Bay
Mendota, Whole lake
Monona
Wingra
Waubesa
-Data from UW-LTER, other published sources

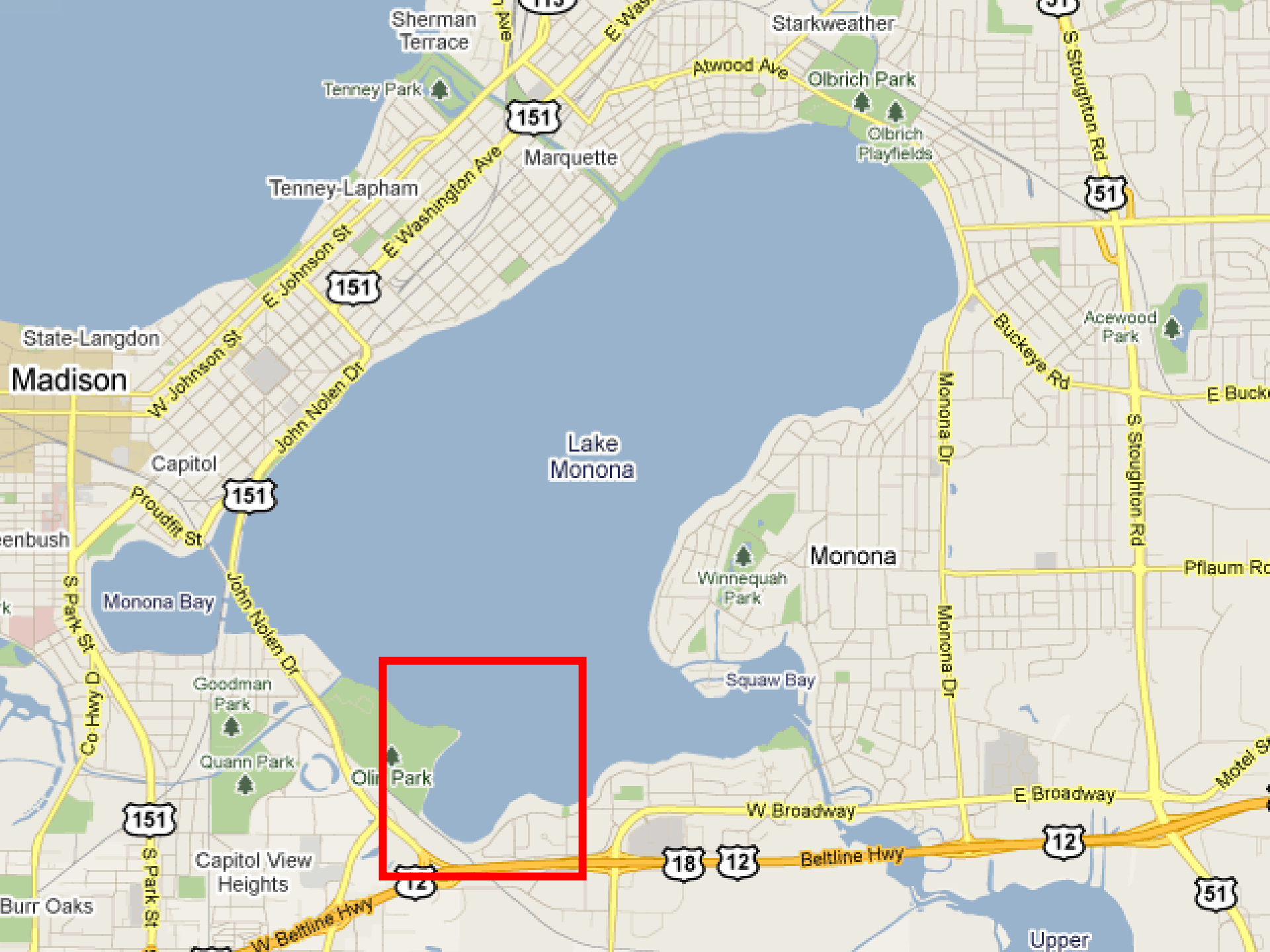
Project Goals

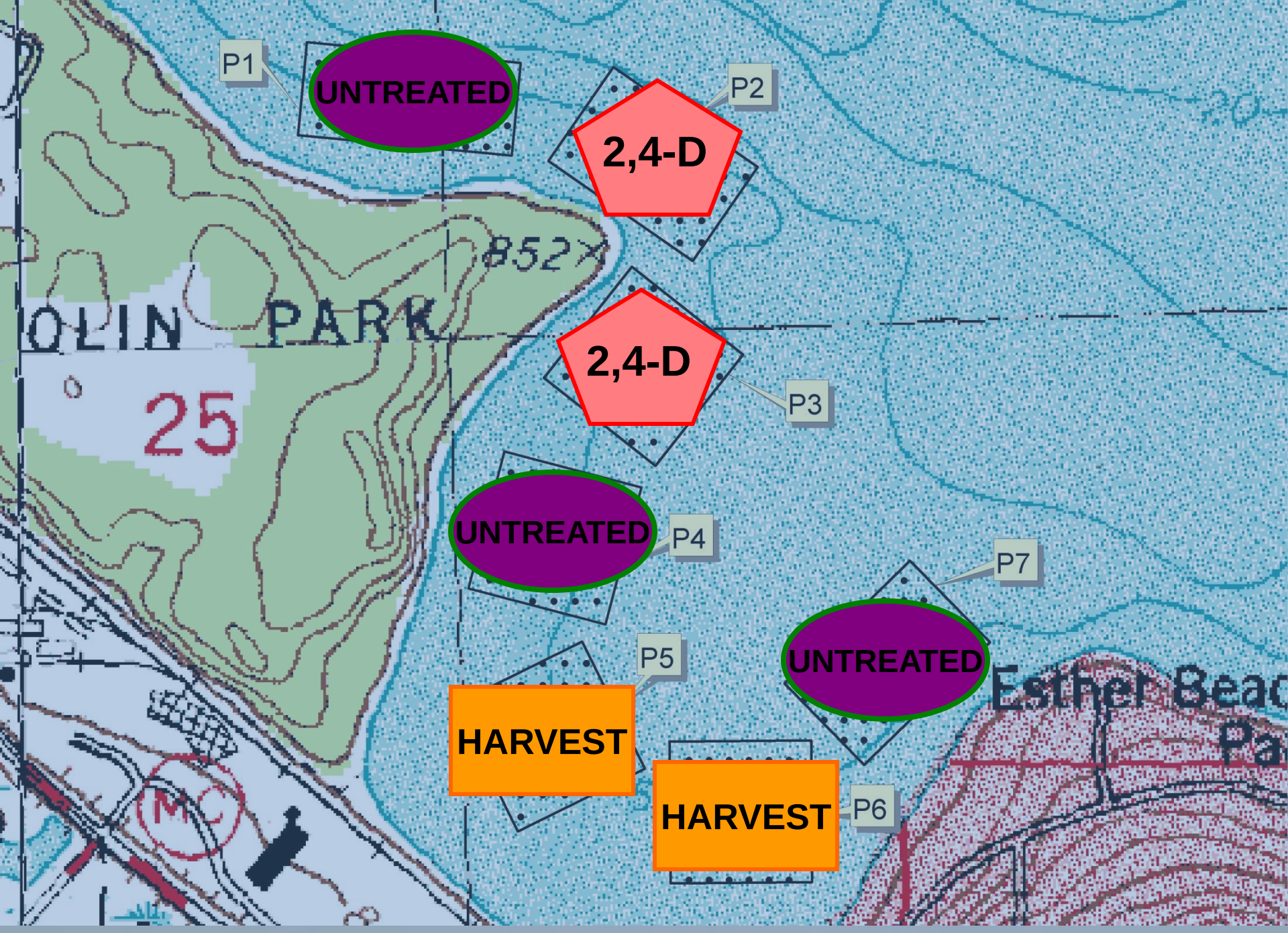
- To determine if early season herbicide or early mechanical harvesting treatments are effective control measures
- Strategic planning increased selectivity for exotics
- Improve habitat for native plant species

Early-Season Control Strategies

- 2,4-D herbicide treatment
  - Semi-selective
  - Dicots: EWM, Coontail, Water marigold
- Deep mechanical harvesting
  - Non-selective

- Can treating early increase selectivity?


Sherman Terrace
Starkweather
Tenney Park
Atwood Ave
Olbrich Park
Olbrich Playfields
151
Marquette
Tenney-Lapham
E Washington Ave
E Johnson St
W Johnson St
State-Langdon
Madison
John Nolen Dr
Capitol
Proudfit St
Lake Monona
Monona
Winnequah Park
Monona Bay
Goodman Park
Quann Park
Squaw Bay
Monona Dr
Buckeye Rd
Acewood Park
S Stoughton Rd
51
Pflaum Rd
S Park St
Co Hwy O
W Broadway
E Broadway
Beltline Hwy
18
12
Capitol View Heights
Burr Oaks
Upper


P1
UNTREATED
P2
2,4-D
852
OLIN PARK
25
2,4-D
P3
UNTREATED
P4
P7
P5
UNTREATED
HARVEST
HARVEST
P6
Esther Beac
Pa

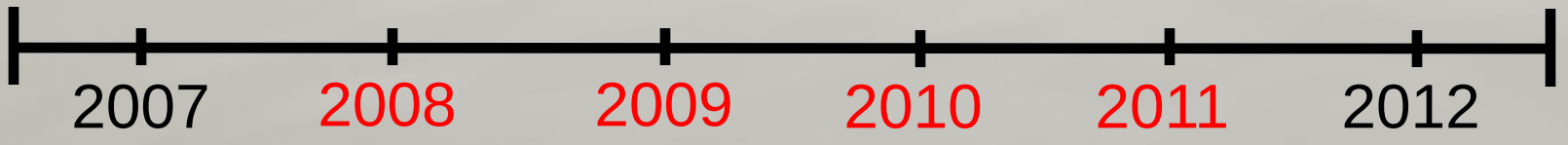
Herbicide Treatment

- Granular 2,4-D as Navigate®
- 2008
  - 100 - 150 lbs/acre (by depth)
- 2009 and 2010
  - 150 lbs/acre

2007 2008 2009 2010 2011 2012

Mechanical harvesting

- Deep harvesting
- 2008
  - high water levels prevented harvesting until later in the season (July)
- 2009 (early June) and 2010 (25 May)
  - timing was based on start of EWM growth
- 2011 (July 5 - 7)
  - Plant growth slower than usual, waited until within one foot of surface before harvesting

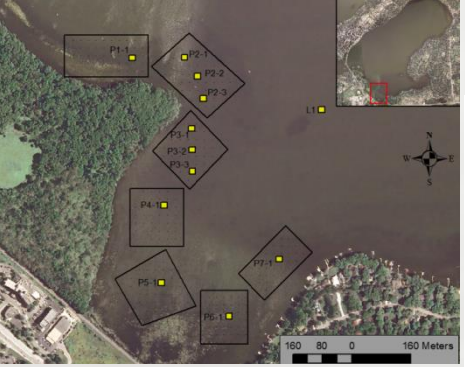


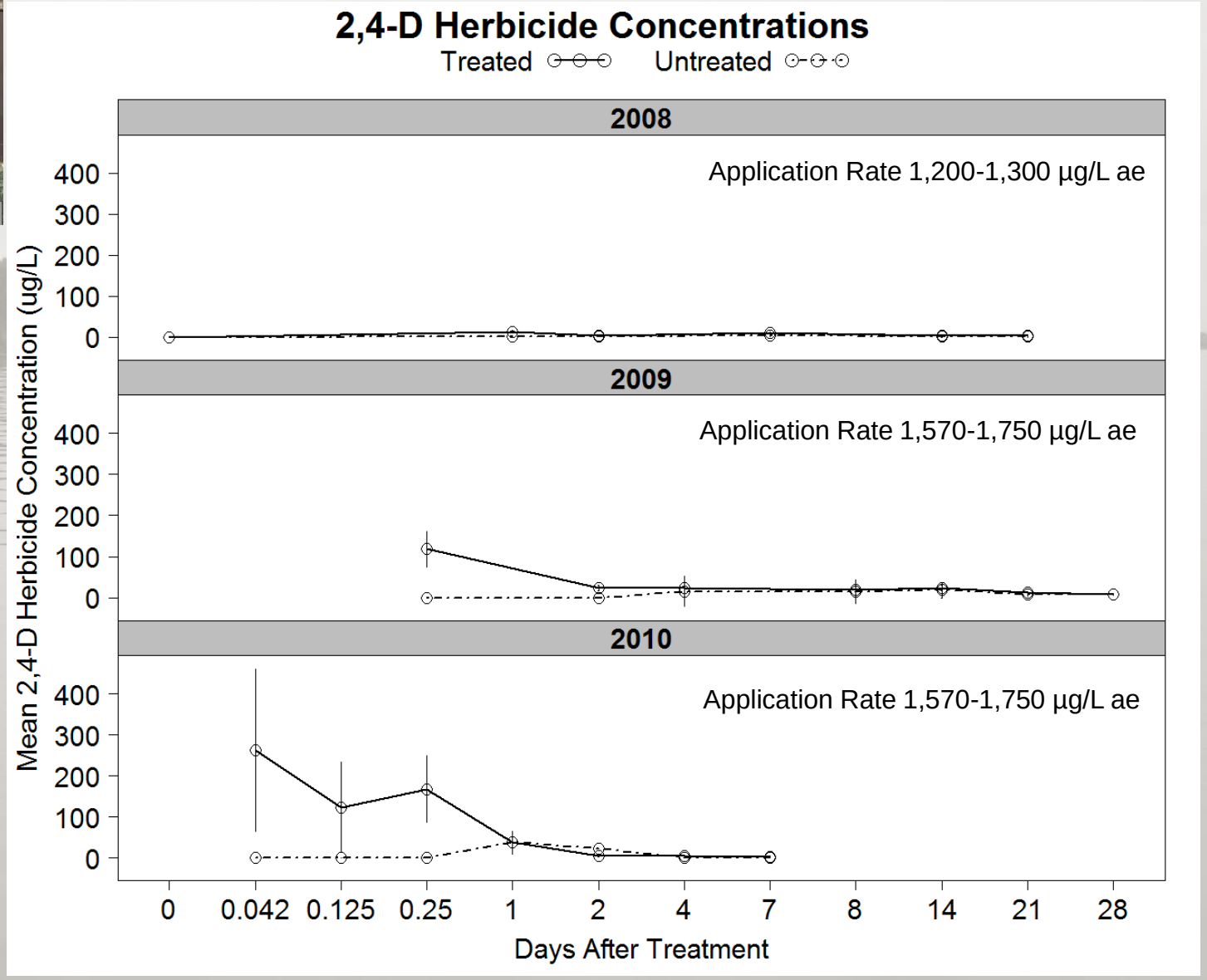
Assessing Plant Response

- 12 Surveys : June & August, 2007-2012
- ~40 points per 5 acre plot

- **Plant presence/absence**
  - Generalized Linear Mixed-Effect Models
  - Presence/absence (binomial distribution)
  - Assess significance of plant response to treatments

Results





- 2,4-D Dissipated quickly
- Very low concentrations detected in untreated areas

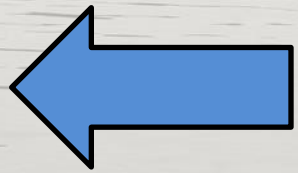
Predict:

Given:

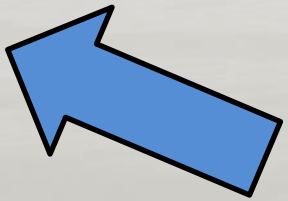
TREATMENT

Reference
Herbicide
Harvest

Species
Presence
Absence



Random plot differences



Random year differences

Generalized Linear Mixed Model

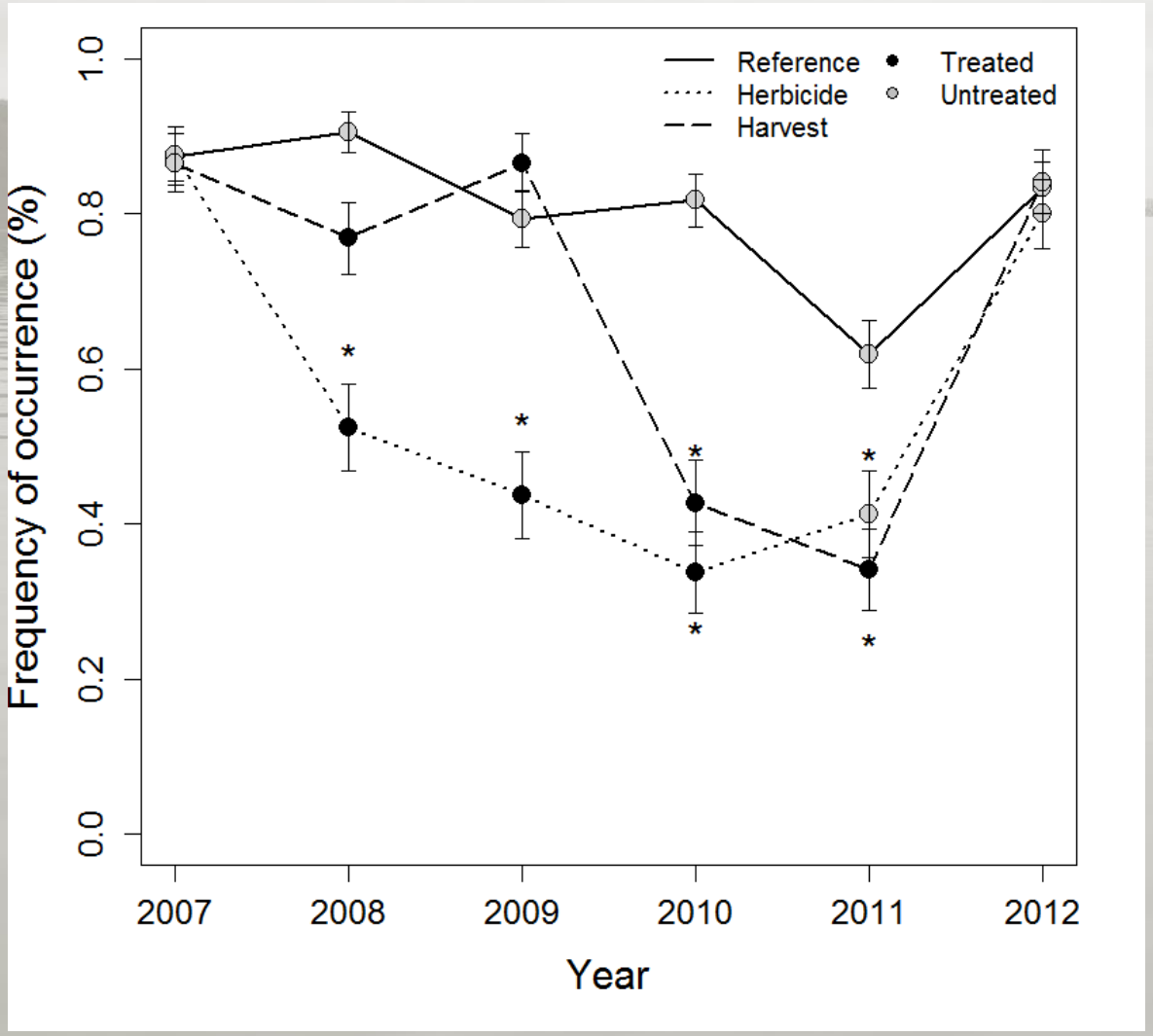
SPECIES ~ TREATMENT + (1 | PLOT) + (YEAR | PLOT)

Eurasian watermilfoil (*Myriophyllum spicatum*)

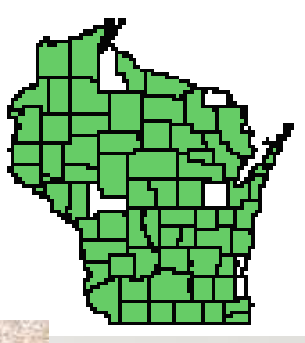
Eurasian watermilfoil (*Myriophyllum spicatum*)

- **EXOTIC**
- Groups of four featherlike leaves whorled around a long stem
- Each leaf has 12-20 pairs of threadlike leaflets
- Leaves often limp when pulled out of water
- In some lakes, forms dense monocultures that displace native species and diminishes recreational and aesthetic value

Eurasian watermilfoil



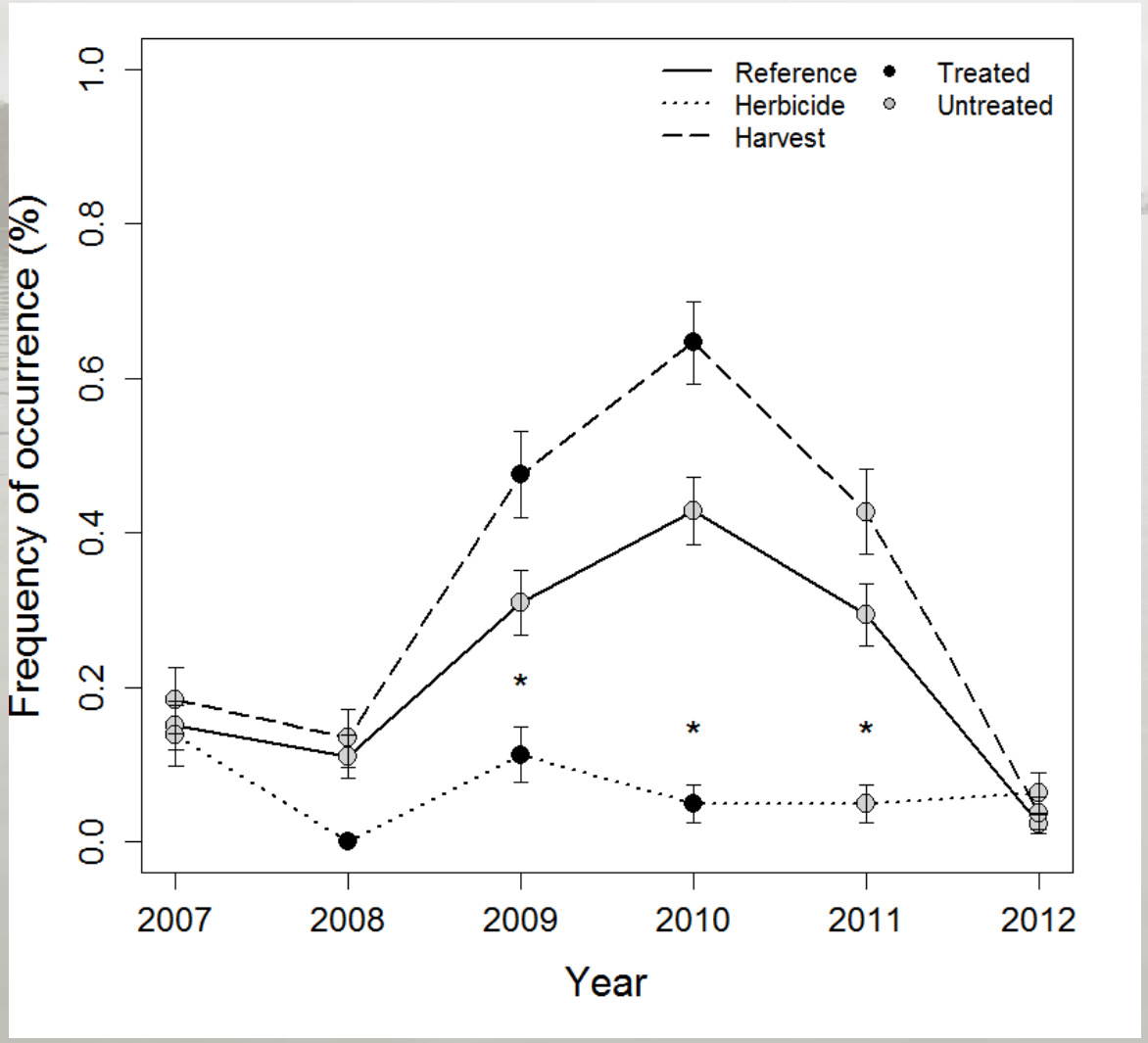
Curly-leaf pondweed (*Potamogeton crispus*)



Curly-leaf pondweed (*Potamogeton crispus*)

- **EXOTIC**
- Wavy “lasagna noodle” leaves are serrate along the margin
- Forms hard “pine cone” like overwintering turions
- Emerges very early in the season, often beginning its growth under the ice
- Dies back by mid-summer as water temperatures rise
- Rapid die-off releases nutrients into the water, which can trigger algal blooms

Curly-leaf pondweed



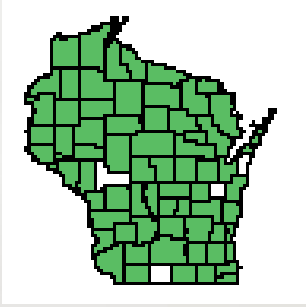
Native Species

13 Native Plant Species found

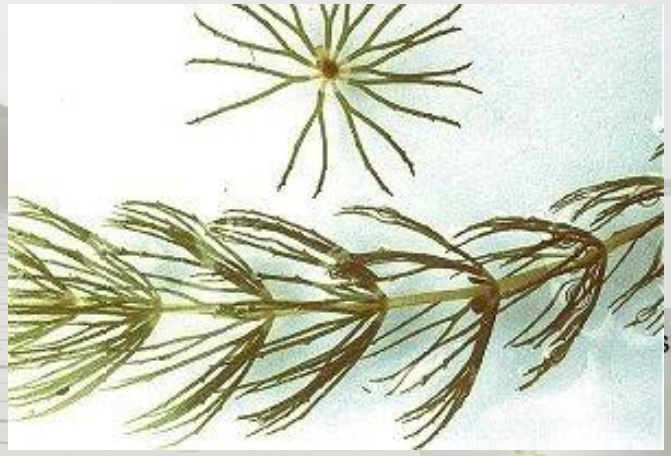
7 occurred > 5% frequency of occurrence

	Common Name	Scientific Name
1	Coontail	*Ceratophyllum demersum*
2	Sago pondweed	*Stuckenia pectinata*
3	Clasping-leaf pondweed	*Potamogeton richardsonii*
4	Wild celery	*Valisneria americana*
5	Common waterweed	*Elodea canadensis*
6	Water star-grass	*Heteranthera dubia*
7	Leafy pondweed	*Potamogeton foliosus*
8	Muskgrass	*Chara* sp.
9	Small duckweed	*Lemna minor*
10	Slender naiad	*Najas flexilis*
11	Flat-stem pondweed	*Potamogeton zosteriformis*
12	White water crowfoot	*Ranunculus aquatilus*
13	Horned pondweed	*Zannichelia palustris*

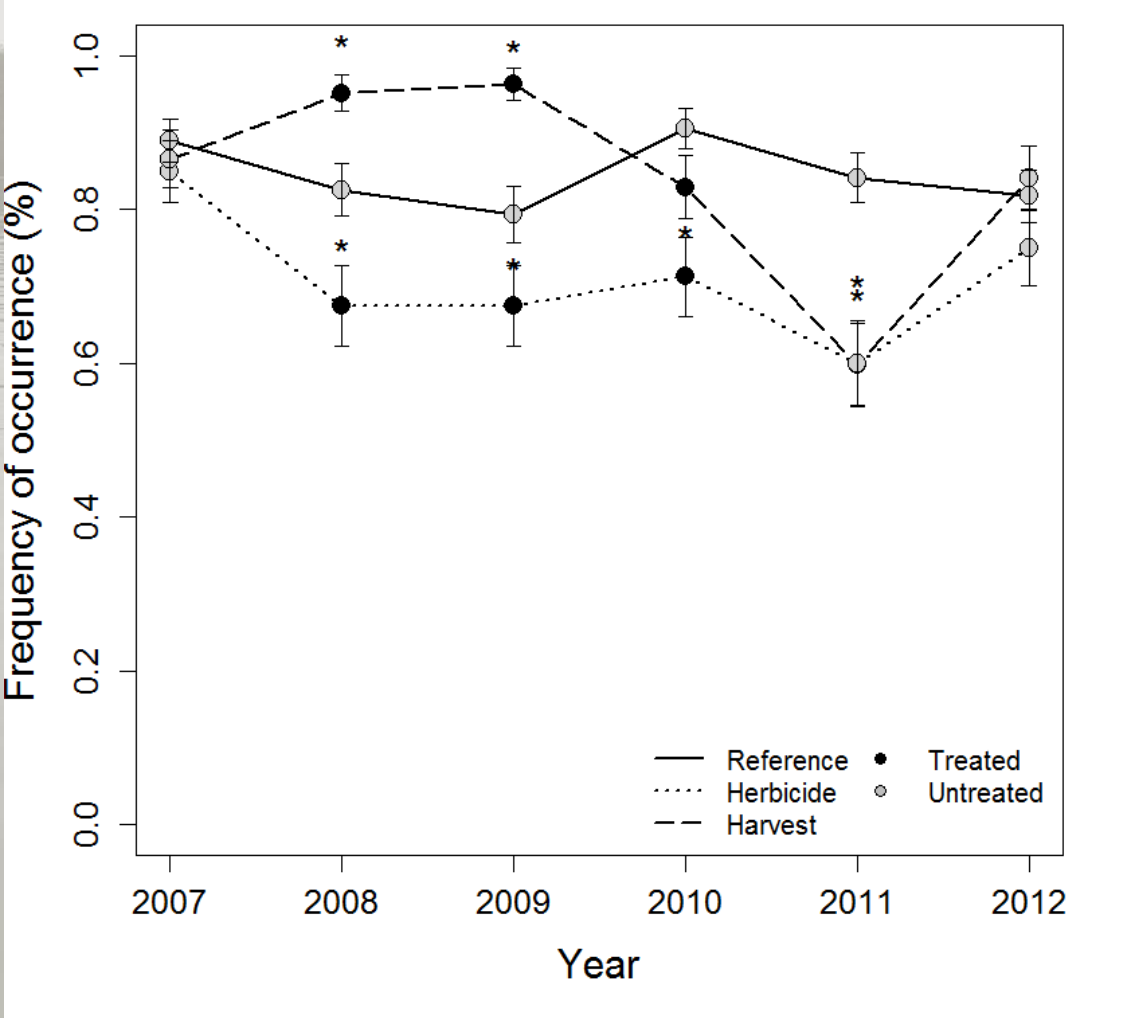
Coontail (*Ceratophyllum demersum*)



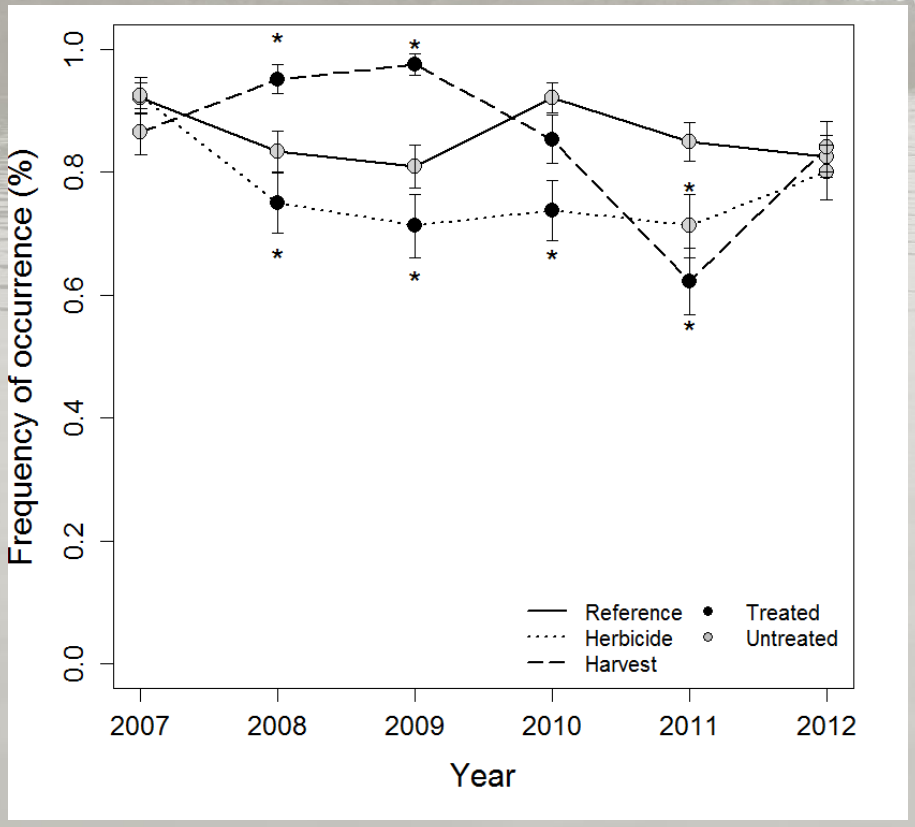
- **NATIVE**
- Leaves in whorls of 5-12 along the stem
- Each leaf is forked 1-2x, with small “teeth” along the margins
- No true roots, often loosely anchored to sediment
- Provides habitat for fish and invertebrates and food for waterfowl



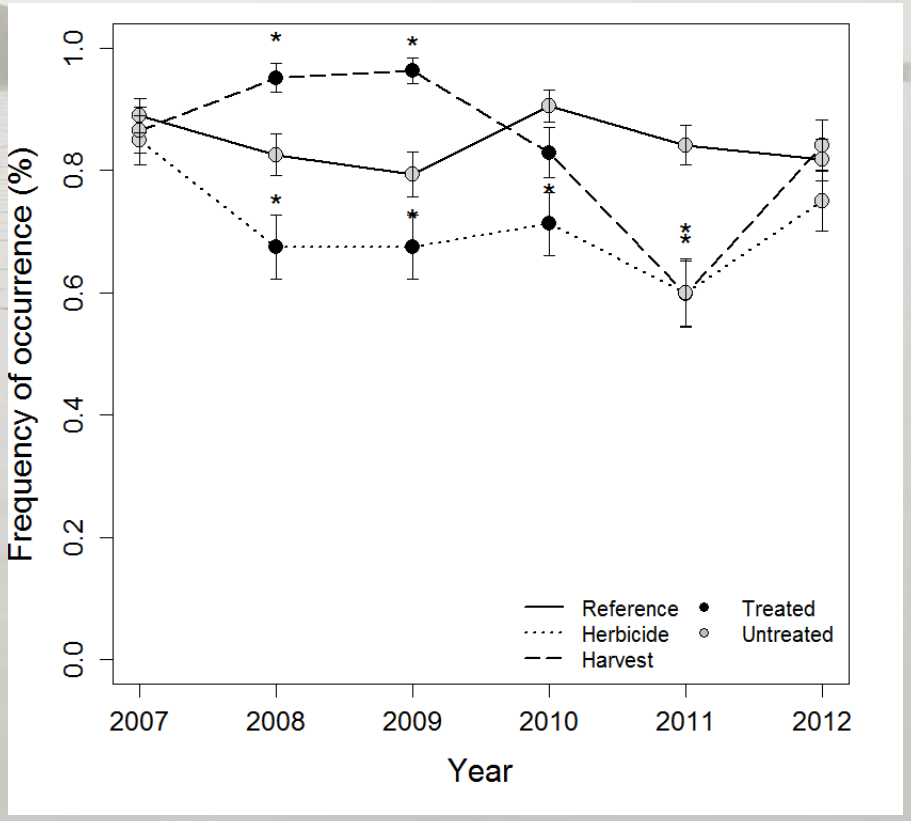
Coontail
(*Ceratophyllum demersum*)



All Natives



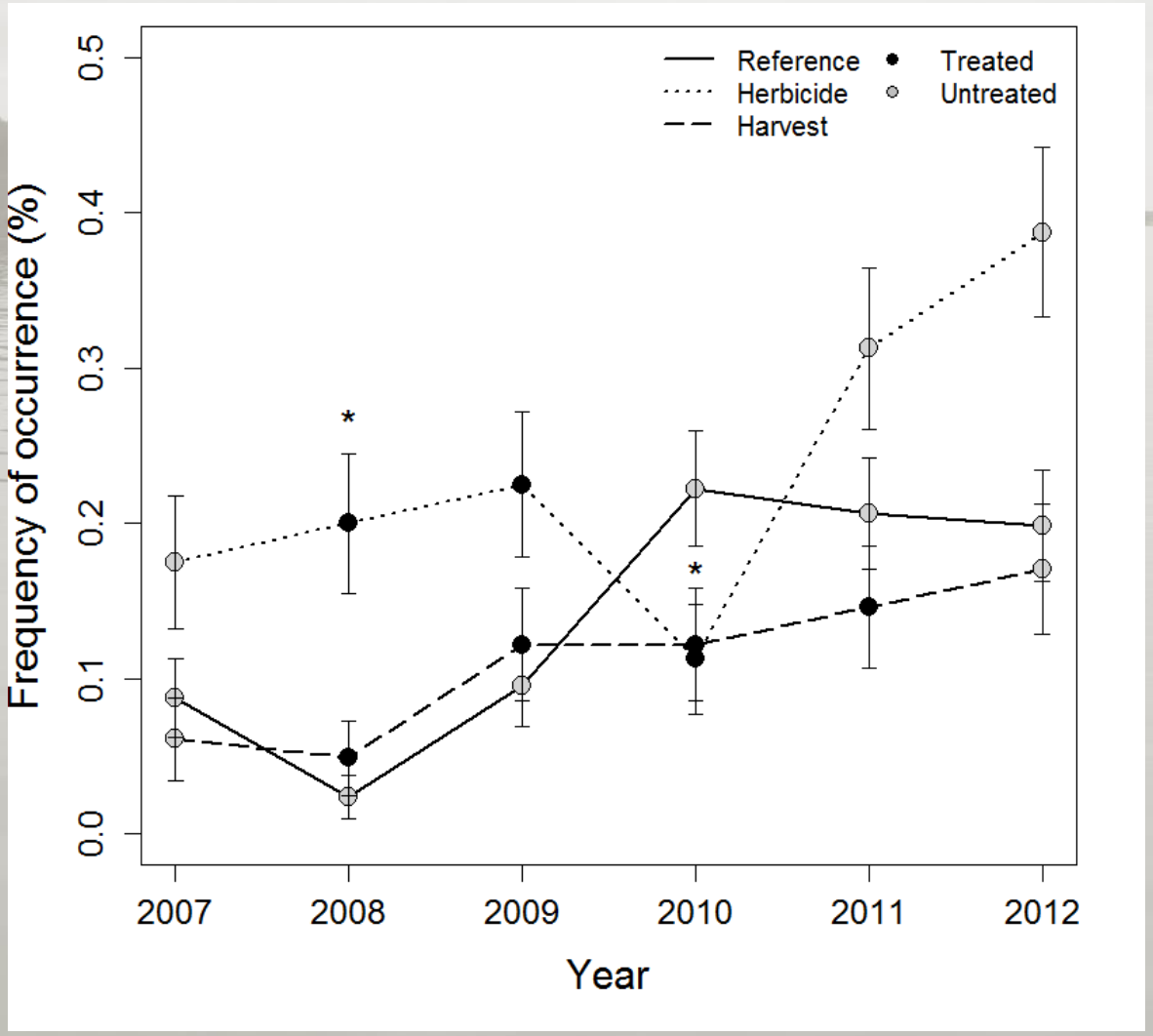
Coontail



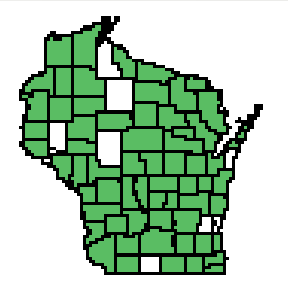
Sago (*Stuckenia pectinata*)

- **NATIVE**
- Pondweed with very thin thread-like leaves
- Appears “bushy” or “fan-like”
- Important food for waterfowl; food and shelter for young fish

Sago (*Stuckenia pectinata*)



Leafy pondweed (*Potamogeton foliosus*)



- **NATIVE**
- Pondweed with narrow submersed leaves
- Leaves have 3-5 veins
- Important food for waterfowl; food and shelter for young fish

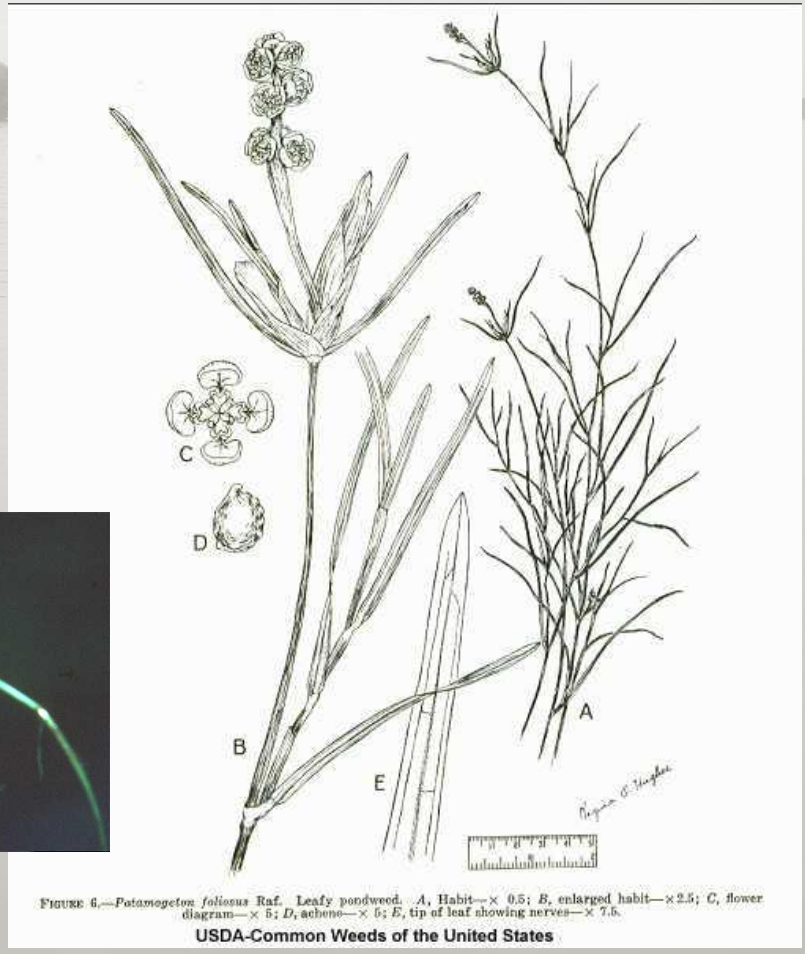
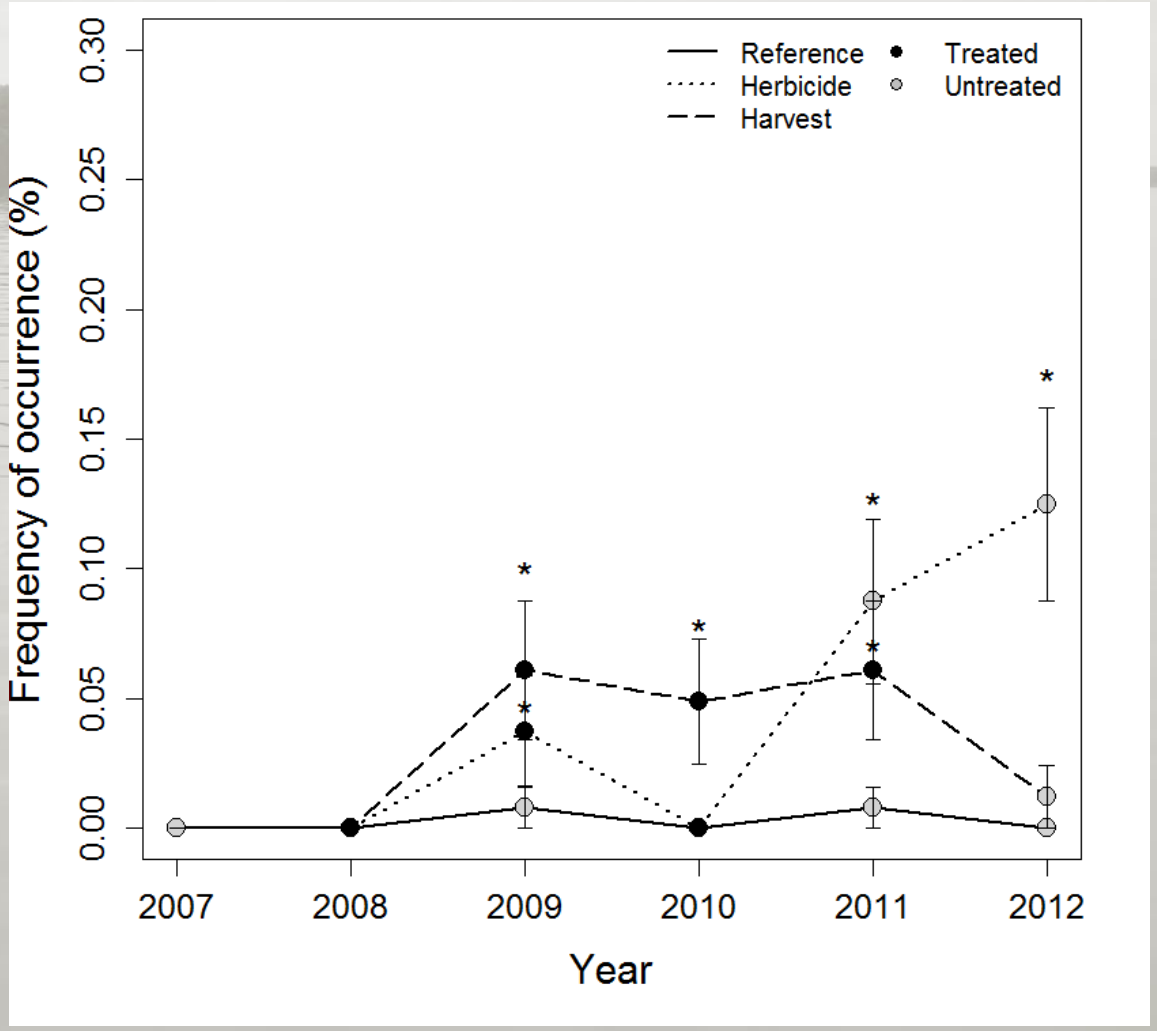


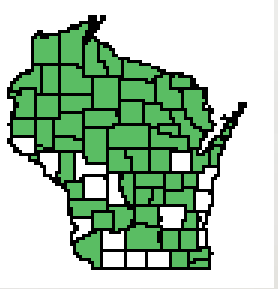
FIGURE 6.—*Potamogeton foliosus* Raf. Leafy pondweed. *A*, Habit—× 0.5; *B*, enlarged habit—×2.5; *C*, flower diagram—× 5; *D*, achene—× 5; *E*, tip of leaf showing nerves—× 7.5.

USDA-Common Weeds of the United States

Leafy pondweed (*Potamogeton foliosus*)

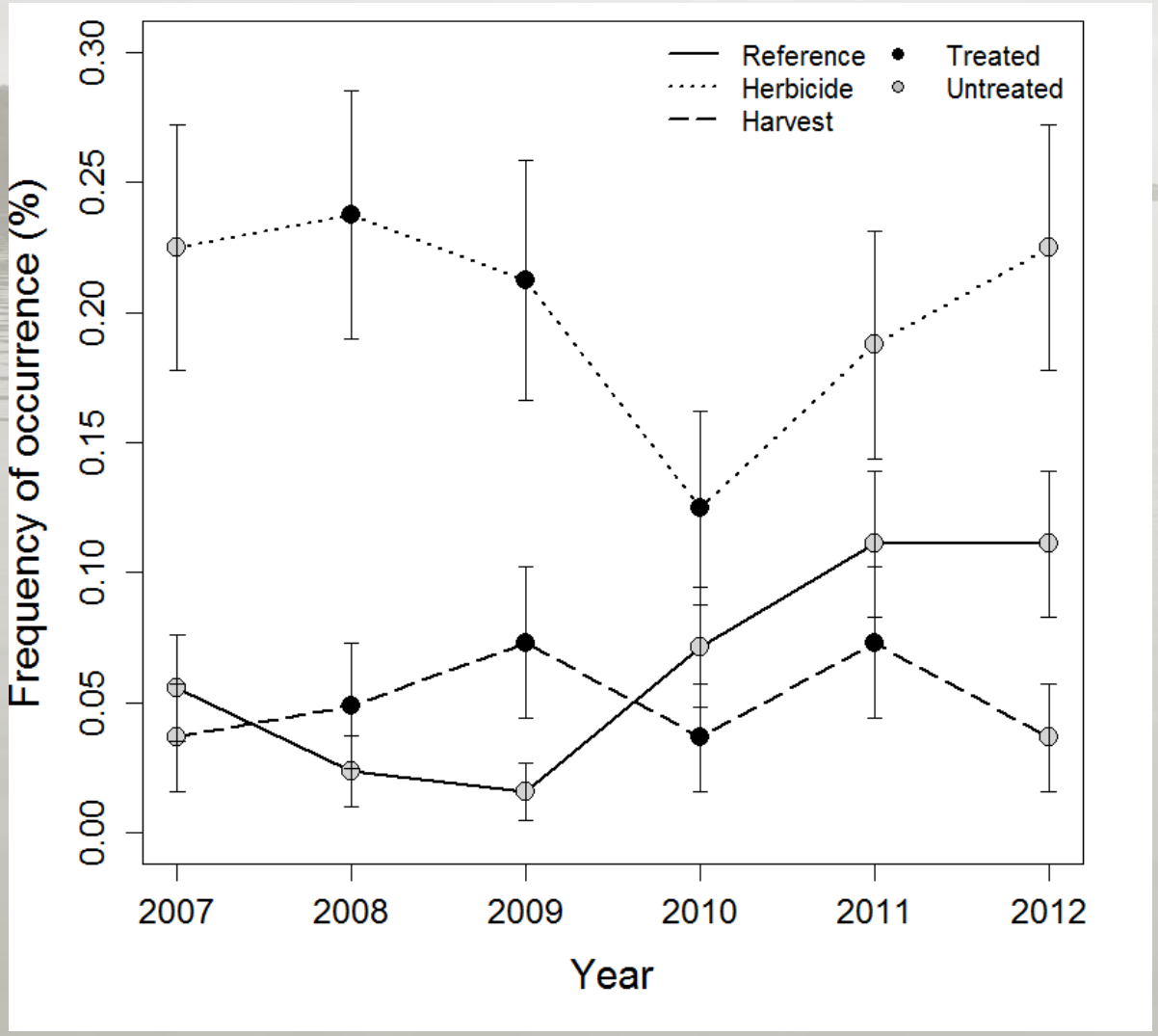


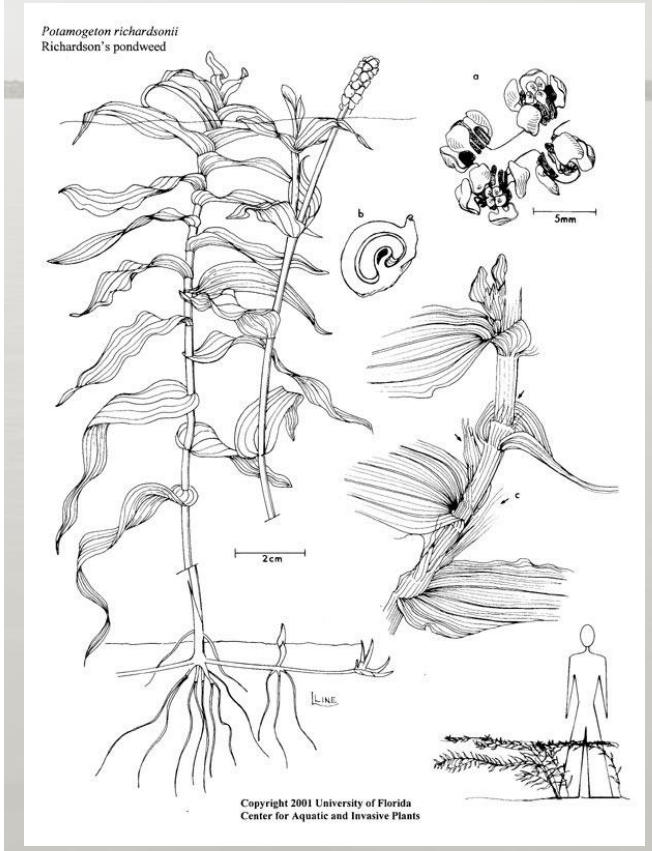
Clasping-leaf pondweed (*Potamogeton richardsonii*)



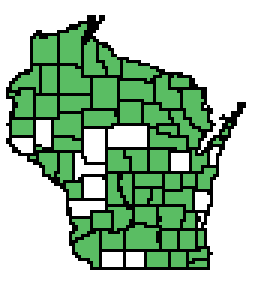
- **NATIVE**
- Bright green leaves with prominent central vein
- Leaves clasp ½-¾ around the stem
- Leaf margins smooth
- Provides habitat and food for waterfowl, mammals, invertebrates, and fish

Clasping-leaf pondweed (*Potamogeton richardsonii*)



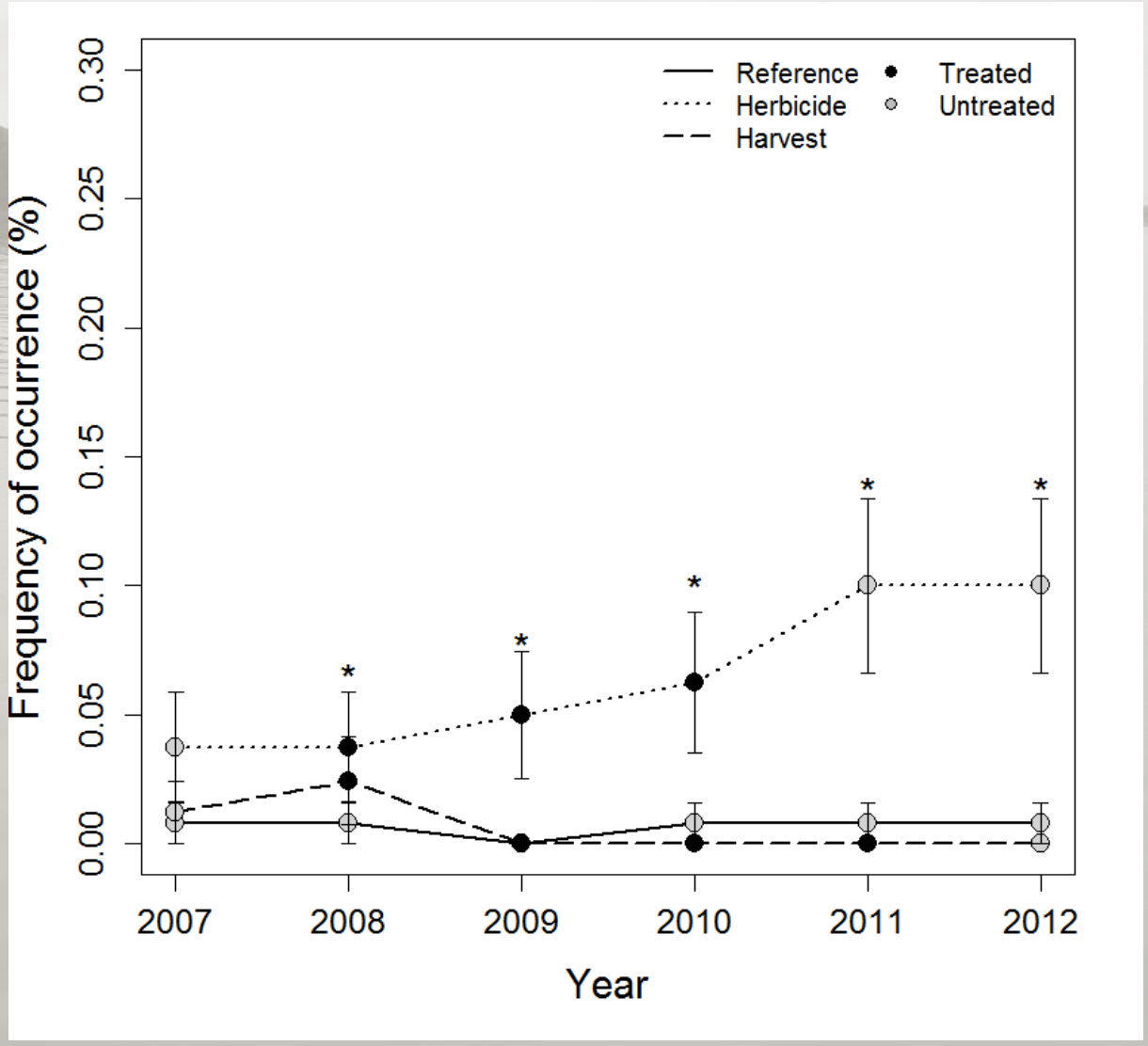


Wild celery (*Vallsneria americana*)

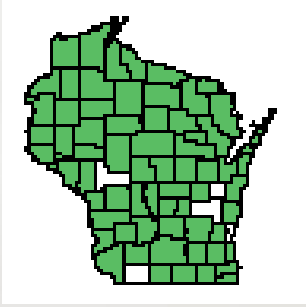


- **NATIVE**
- Long “ribbon-like” leaves with prominent central stripe
- Often produces spiral-coiled flower stalks
- Excellent food source for waterfowl and shore birds; good habitat for fish

Wild celery (*Vallisneria americana*)

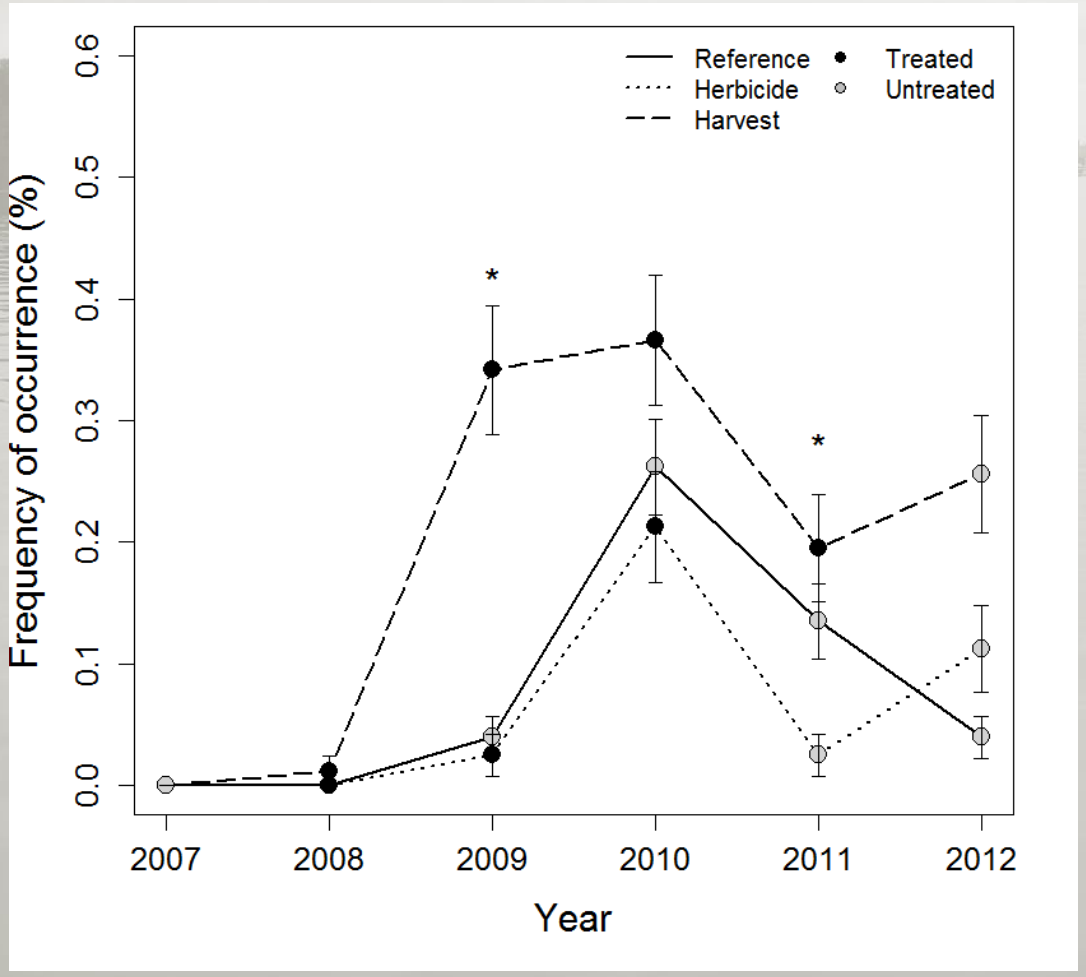


Common waterweed (*Elodea canadensis*)

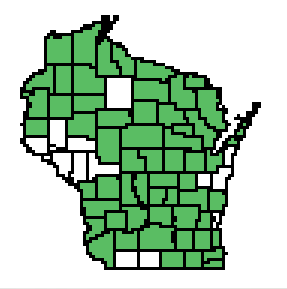


- **NATIVE**
- Leaves in whorls of 3 along slender stems
- May branch several times
- Provides habitat and food source for fish, small mammals, waterfowl, and invertebrates

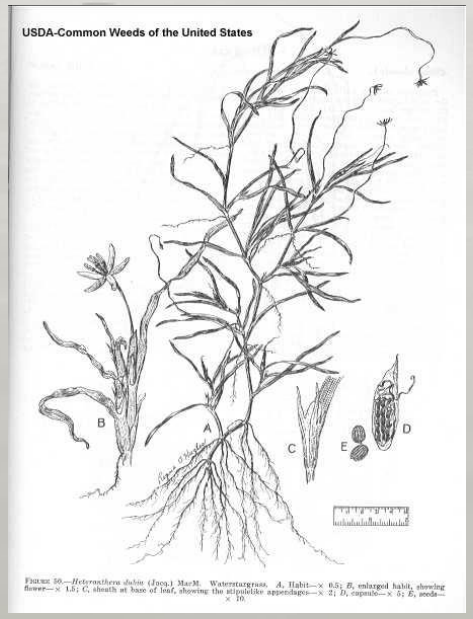
Common waterweed (*Elodea canadensis*)



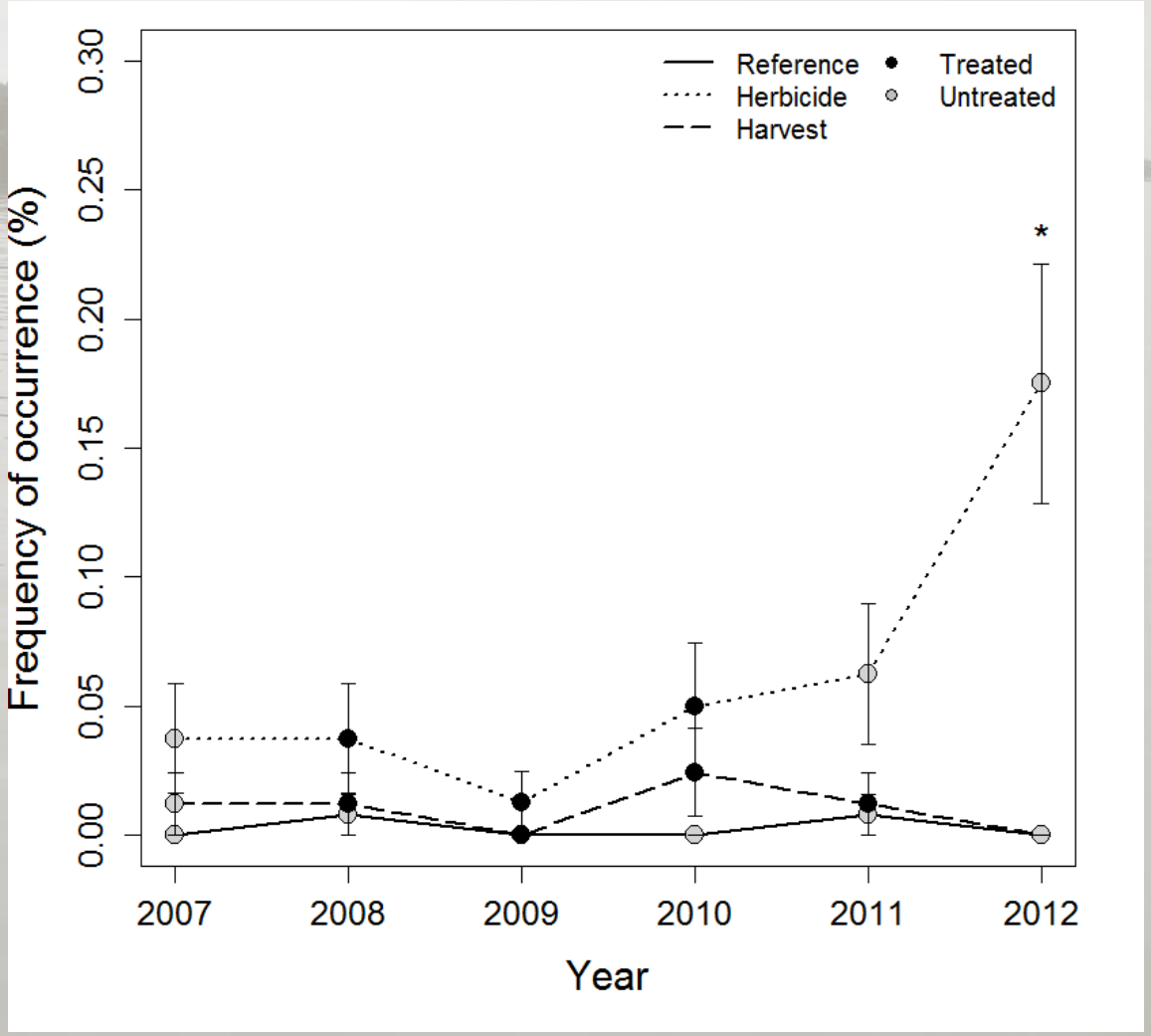
Water star-grass
Heteranthera dubia



- **NATIVE**
- Narrow, alternate leaves that lack midvein
- Yellow, star-shaped flowers
- Often mistaken for pondweeds
- Provides food for waterfowl and provides habitat for fish



Water star-grass (*Heteranthera dubia*)



Summary

Herbicide

- EWM decreased all years of treatment + 1
- Coontail decreased all years of treatment + 1
- 1 other native species decreased
- 4 other native species increased

Harvest

- EWM declined during years 3 and 4 of treatment
- Coontail increased the first 2 years then decreased the last 2 years of treatment
- 2 other native species increased during the study
- May have different results if operational issues resolved

Conclusions

1. The use of early-season 2,4-D treatments on small target areas of EWM may provide selective nuisance control.

2. The use of early-season harvesting may also provide nuisance control of EWM in small areas of larger lake systems. Successive years of treatment, however, may be necessary to begin to achieve good control.

3. The long-term ecosystem impacts of herbicide and harvesting treatments are not well understood and need further study.

4. Deciding which control method to use should be based on the overall management goals and time scale to achieve those goals.

5. Small-scale management activities within large lakes can provide temporary, localized nuisance control of EWM with little impact to natives.

6. Long-term restoration of an aquatic plant community after a successful invader becomes established remains a challenge for managers.

Acknowledgments

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We would like to acknowledge the early organization and planning efforts by the Dane County APM Committee members, county staff, and others: Doug Bach, Thom Belk, Eileen Bruskewitz, Susan Josheff, Howard Teal, Donna Vogel, Dale Suslick, Sal Troia, John Van Dinter, Kurt Welke, Kurt Getsinger, Mike Netherland, Darren Marsh, Joseph Yaeger, David Doll, Bill Ratajcsyk, Donna Sefton, Connie Fedor, Mike Flaherty, Bob Johnson, and Susan Tesarik.

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THANK YOU!

Questions or comments?

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