Coastal Natural Communities at Risk and Invasive Plants

Phyllis Higman, Michigan Natural Features Inventory

Great Lakes Conference, March 10, 2015

Agenda

- Michigan Natural Features Inventory
- Natural communities of Michigan
- Current threats
- Anticipated climate change threats
- Climate change intersects invasive species!
- Invasive species pop quiz!

Michigan Natural Features Inventory

Maintains the most comprehensive database
on Michigan's vulnerable elements of biodiversity

GIS based database:

~ 18,000 <u>element occurrences</u> (EO's)

- endangered, threatened, special concern spp.
- high quality natural communities

420 plants

302 animals

77 natural communities

Deliver highest quality information that contributes to conservation biodiversity, focusing on the diversity of ecosystems native to Michigan & vulnerable species.
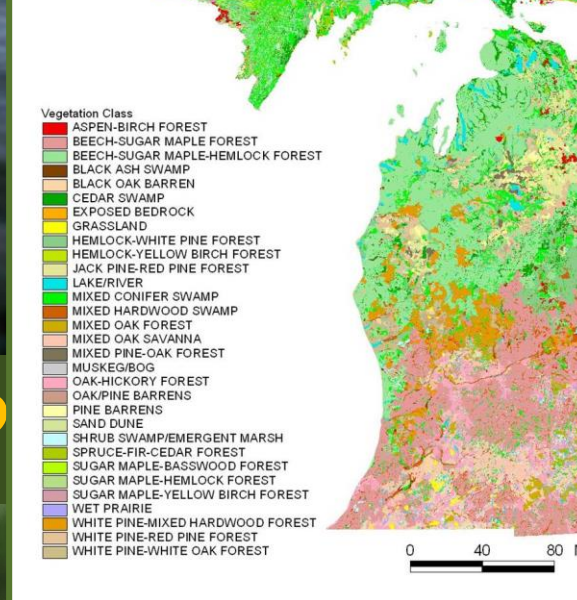
- Ecology
- Botany
- Zoology

- GIS Program
- Conservation Education
- Conservation Planning

Our work is grant funded. We have 17 full time staff and seasonal staff as grants allow.
www.msue.msu.edu/mnfi

Freshwater Mussels of Michigan

What do we do?

Michigan circa 1800

Precambrian bedrock Topography!
Cooler continental climate
northern hardwoods w/hemlock, bedrock lakeshores and cliffs

limestone bedrock; flat, warmer alvar, bedrock lakeshores, fens, muskeg, bogs, swamp forests, rich conifer swamps

rich conifer swamp, fens

Hardwood - conifer forests

pine barrens pine forests

oak-pine barrens pine forests

climatic tension zone

beech maple forests oak hickory forests savannas, prairies wet prairies
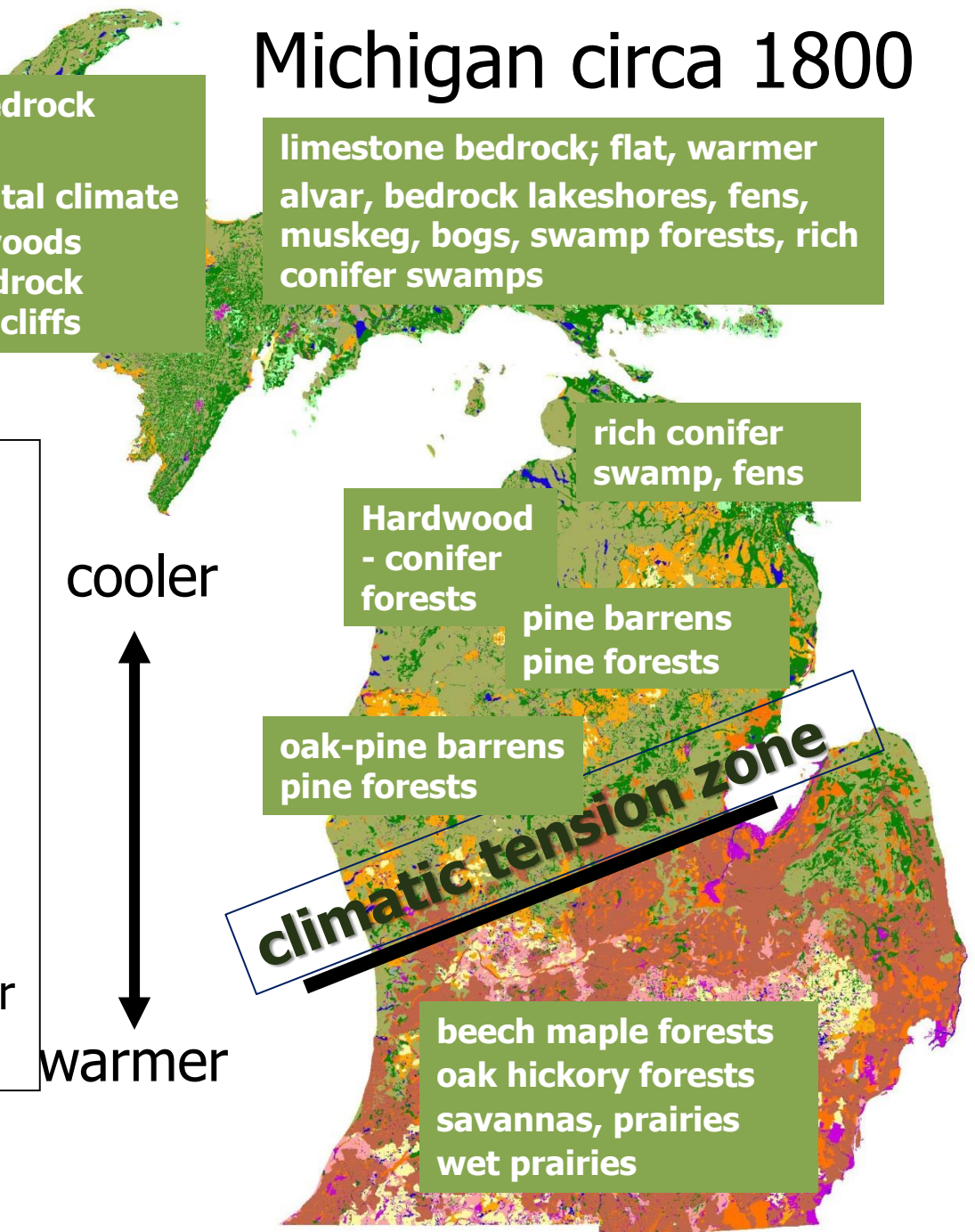
cooler

warmer

Natural Communities:
  Geography
  Physiography
  Hydrology
  Soils
  Natural processes
    (incl. disturbances)
  Vegetation

*Climate is primary driver & changes are brewing…

Natural Communities

Assemblage of interacting plants, animals, and other organisms repeatedly occurring across the landscape under similar environmental conditions; predominantly structured by natural processes.

Natural Communities

Protecting natural communities is a coarse filter approach for capturing a range of biodiversity representative of Michigan's native ecosystems

Joshua G. Cohen, Mike A. Kost, Bradford S. Slaughter, Dennis A. Albert. 2014

Contact Sue Ridge: 517-284-6211

ridges@michigan.gov

Natural Community Classification

- **Palustrine**
  - Marsh (9)
  - Wet prairie (5)
  - Fen (5)
  - Bog (2)
  - Shrub wetland (3)
  - Forested wetland (8)
- **Terrestrial**
  - Prairie (5)
  - Savanna (6)
  - Forest (7)

- **Palustrine/terrestrial**
  - Wooded dune and swale (1)
- **Primary**
  - Dunes (2)
  - Sand/cobble shore (4)
  - Bedrock lakeshore (4)
  - Bedrock grassland (1)
  - Bedrock glade (4)
  - Lakeshore cliff/bluff (5)
  - Inland cliff (4)
- **Subterranean Sink**
  - Karst (2)

77 natural communities

Global & State Ranks:

State Ranks   Global Ranks

- S1: most critically imperiled in state   G1

- S2:

- S3: vulnerable

- S4

- S5: most secure in the state   G5

*We also assign quality ranks to each occurrence.

NatureServe - National database

Natural Community Occurrences

Coastal Zone:

- surveys well funded
- 59 natural community types occur here
- 29 occur primarily in coastal zone
- >25% percent of EO's occur here
- 81 species of greatest conservation need identified in WAP
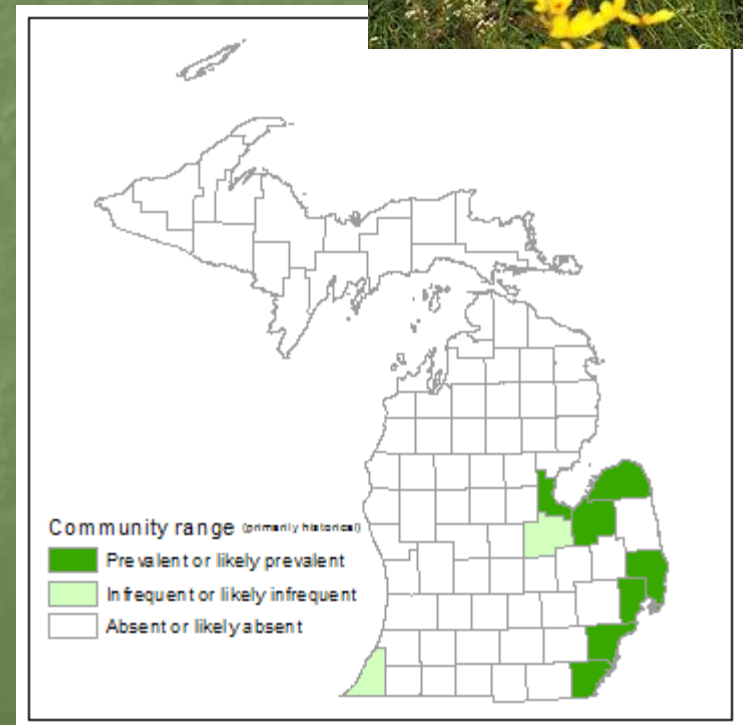
Palustrine – Open Wetlands

- Marsh
  - Submergent marsh – S4, GU
  - Emergent marsh - S4, GU
  - Great Lakes marsh – S3, G2
  - Inland salt marsh – S1, G1
  - Coastal Plain marsh – S2, S2
  - Intermittent wetland – S3, S3
  - Northern wet meadow – S4, G4G5
  - Southern wet meadow – S3, G4?
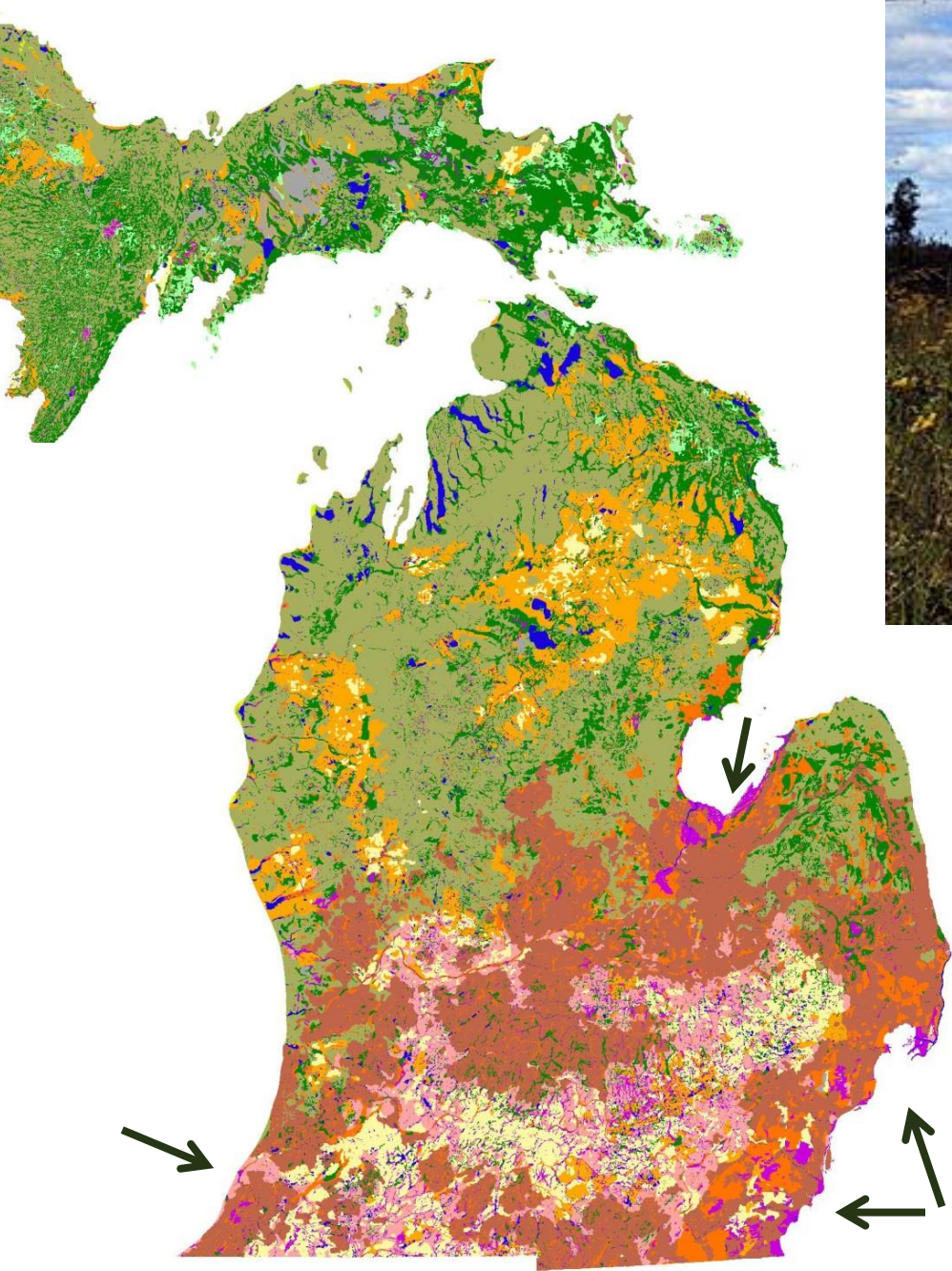 - Interdunal wetland – S2, G2?

Palustrine Open Wetlands

- Wet Prairie
  - Wet prairie – S2, G3
  - Wet-mesic prairie – S2, G2
  - Wet-mesic sand prairie – S2, G2G3
  - Lakeplain wet prairie – S2, G2
  - Lakeplain wet-mesic prairie – S2, G1
- Fen
  - Poor fen – S3, G3
  - Patterned fen – S2, GU
  - Northern fen – S3, G3
  - Prairie fen – S3, S3
  - Coastal fen – S2, G1G2

Lakeplain Prairies S1, G1, G2

- Species-rich prairie grassland on seasonally wet ground of glacial lakeplains
- Sands, sandy loams, silty clays often over a clay layer
- Seasonal flooding, cyclic changes in Great Lakes water levels, beaver flooding, and fire

Community range (primarily historical)

- Prevalent or likely prevalent
- Infrequent or likely infrequent
- Absent or likely absent

Majority converted to agriculture following European settlement

< 1% remaining today

Eastern fox snake
State threatened
S2, G3

Eastern prairie fringed orchid
State and federal endangered
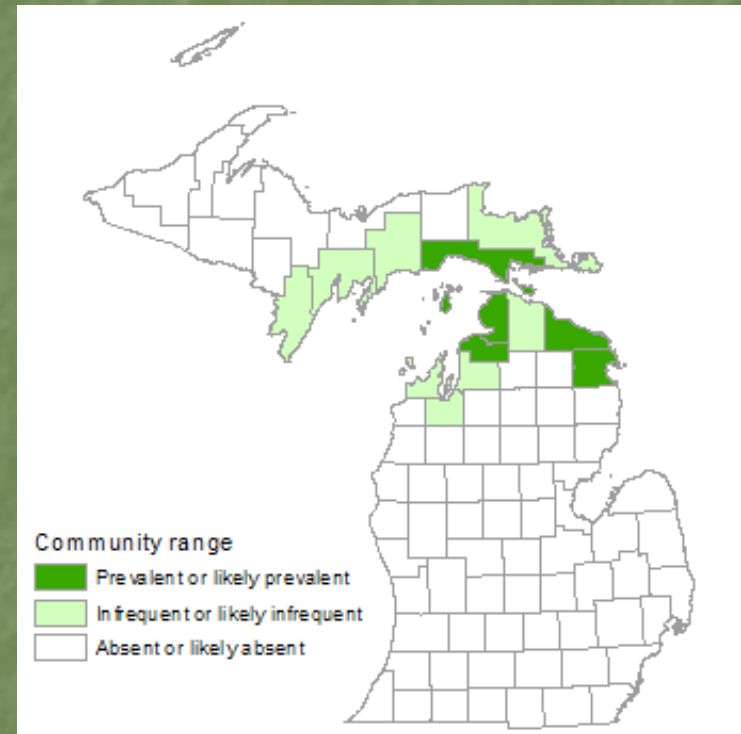S1, G2

Sullivant's milkweed
State threatened
S2, G5

Coastal Fen

- Sedge and rush-dominated

- Alkaline organic soils & marl in protected areas (calcium carbonate)

- Grade to moderately alkaline glacial tills and lacustrine sediments lakeward

- Frequently where groundwater seepage percolates from either calcareous uplands or joints in the underlying limestone bedrock.

Community range
Prevalent or likely prevalent
Infrequent or likely infrequent
Absent or likely absent
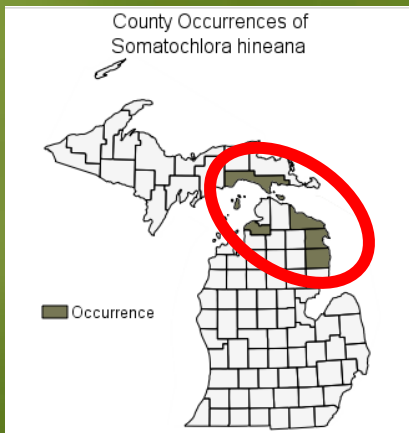
English sundew
State threatened
S3, G5

Butterwort
State special concern
S3, G5

E. massasauga
State threatened
S3S4, G3G4T3Q

Hine's Emerald Dragonfly
(*Somatachlora hineana*)

- Endangered (state & federal)
- S1, G1
- 48 occurrences in world
- Only 16 in Michigan

County Occurrences of
Somatochlora hineana

☐ Occurrence

Illinois (9), Wisconsin
(20), Missouri (3)
Alabama - extirpated
Ohio - extirpated
Illinois - extirpated

Great Lakes Marsh

- Herbaceous wetland on GL shores and major connecting rivers
    - deep marsh-submerged plants
    - emergent marsh
    - sedge-dominated wet meadow inundated by storms
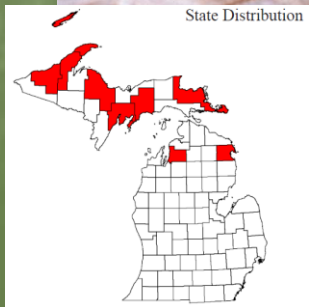- Strongly influenced by water level fluctuations

Community range
- Prevalent or likely prevalent
- Infrequent or likely infrequent
- Absent or likely absent
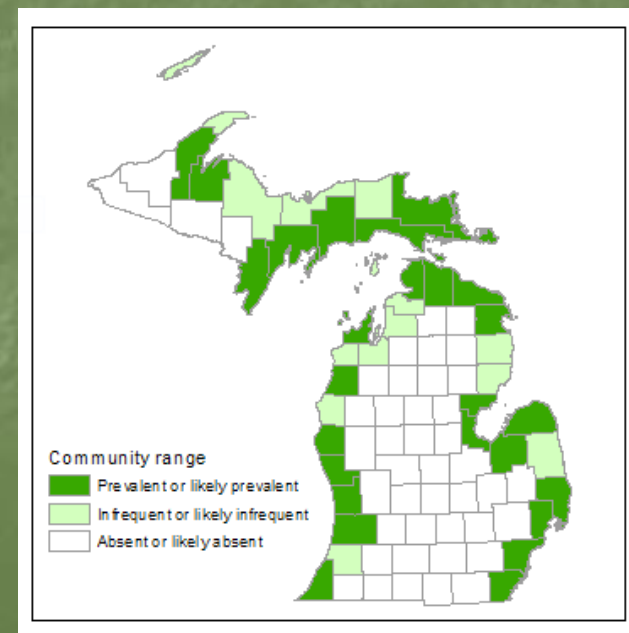
American lotus *(Nelumbo lutea)*

Merlin (*Falco columbarius*)

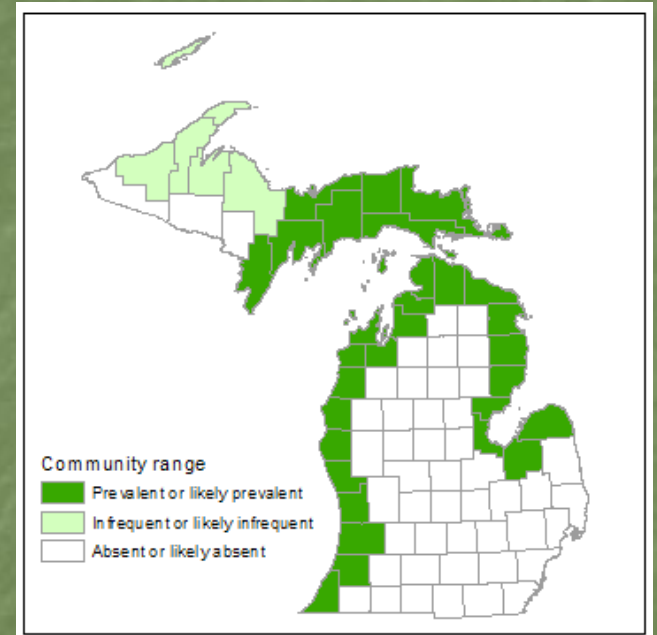# Least Bittern (*Ixobrychus exilis*)

State threatened
S1S2; G5

State Threatened
S2; G5

Photo by Michael Sanders
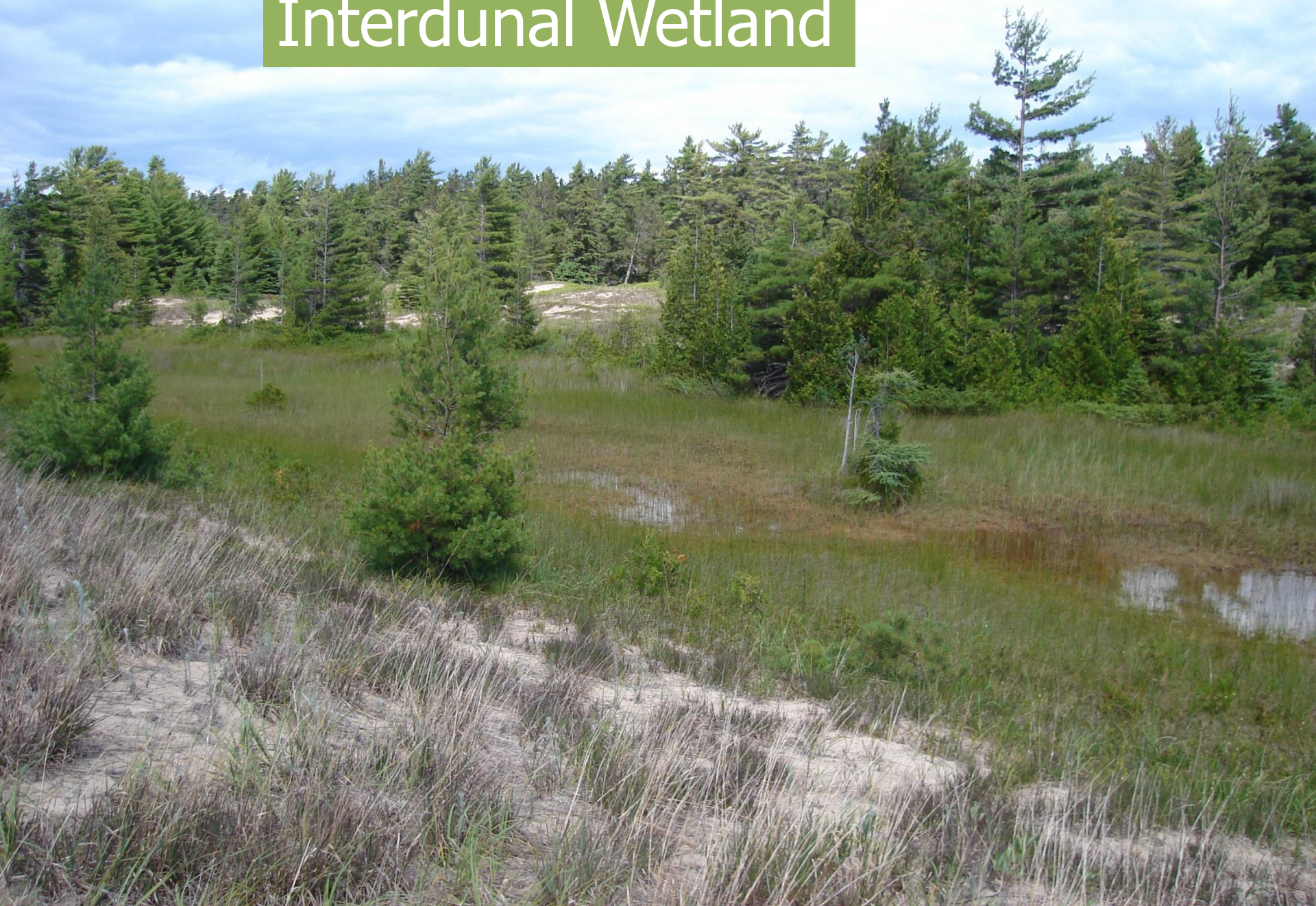
Interdunal Wetland

- Rush, sedge, and shrub-dominated
- Depressions within open dunes or between beach ridges along the Great Lakes
- Saturated sands; sometime thin muck on top
- Marl can form and over time wetland may become a fen
- Fluctuating water table seasonally and yearly in synchrony with lake level changes

Community range
- Prevalent or likely prevalent
- Infrequent or likely infrequent
- Absent or likely absent

Interdunal Wetland

Piping plover
State, federal
endangered
S1, G3

- Atlantic coast, GL shorelines
- rivers ,and wetlands, northern Great Plains

Houghton's goldenrod
State and federal
threatened
S3, G3
Great Lakes endemic

Spotted turtle
State threatened
S2, G5

Natural Community Vulnerability Assessment

Lee, Yu Man, M.A. Kost, J.G. Cohen, E. H. Schools. 2012. Climate Change Vulnerability Assessment and Adaptation Strategies for Natural Communities in Michigan, Focusing on the Coastal Zone.

First attempt to look at natural community vulnerability in Michigan.

Assessing current threats

Existing Stressors

- Fragmentation
  - % natural land cover
  - Road density
- Anthropogenic barriers for terrestrial species
  - Road density
- Anthropogenic barriers for aquatic species
  - Dams
  - Stream-road intersections

- Water withdrawal
  - Non-ag groundwater withdrawal
  - Percent ag land cover
- Point source pollution
- Non-point source pollution
  - % impervious surface
  - Percent natural land cover
  - Percent natural riparian land cover

All of these facilitate the establishment and spread of invasive species

Invasive species change the rules of existence for species that occurred prior to invasion.

Propagule pressure is a strong factor in the spread of invasive species.

Downscaled CC Model Predictions for Michigan

- Increases in annual precipitation, particularly in spring
- Expansion of growing season, with a shorter freeze season
- Fewer days with extreme cold and much more frequent extreme hot days
- More frequent days with extreme precipitation, yet fewer wet days
- Decreases in snowfall, snow depth, and winter severity index

All of these will likely facilitate the establishment and spread of invasive species

Intersection of Climate Change and Invasive Species

- Flooding will carry seeds and other propagules
- Longer growing periods will benefit many invasive species, giving them an edge over the long term
- Disturbances, such as drought created by extreme events will create conditions for establishment of invasive species
- New exposed soils as wetlands contract and expand with changing water levels – conditions for establishment
- Warmer temperatures, and few cold days will favor the movement of invasive species from the south.

Climate Smart Principles

- Act with intentionality
- Manage for change NOT persistence
- Reconsider goals not just strategies
- Integrate adaptation into existing work (in a meaningful way)

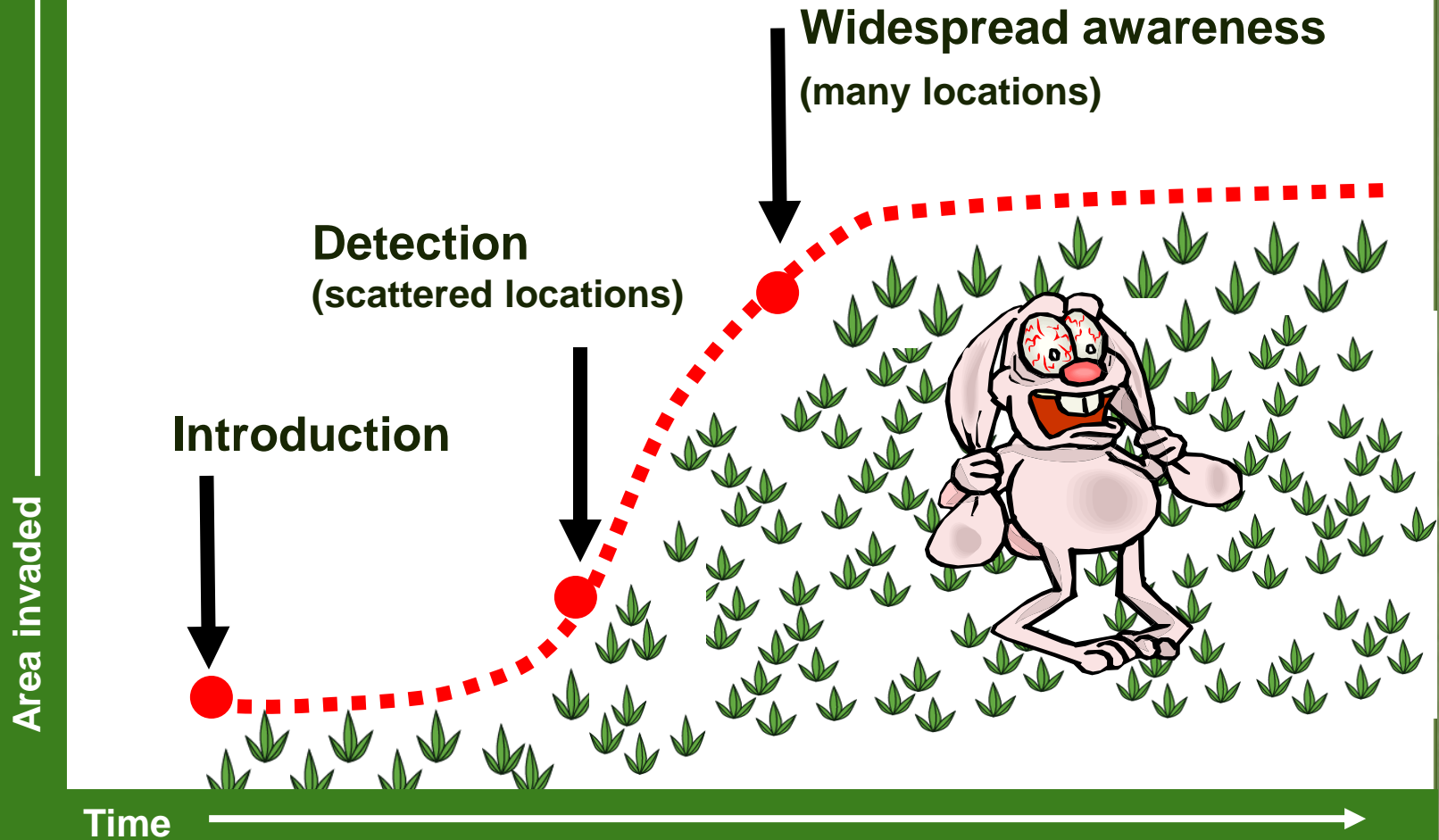Bruce Stein, Patty click, Naomi Edelson, Amanda Staudt

Bioinvasions in a Changing World: A Resource on Invasive Species-Climate Change Interactions for Conservation and Natural Resource Management

December 2014

Prepared for the Aquatic Nuisance Species Task Force and the National Invasive Species Council

Ad Hoc Working Group on Invasive Species Climate Change

"Typical" invasion/colonization

Widespread awareness
(many locations)

Detection
(scattered locations)

Introduction

Area invaded

Time

| Prevention Cheapest | Early detection-rapid response; easier to treat | Prioritizing winnable battles. Expensive and harder. |

Prevention:

- Identify novel pathways
  - energy exploration
- Consider changing conditions when conducting risk assessments
- Manage risk of escape if invasive species are being utilized for climate mitigation
  - e.g., bioenergy, filtering toxins

EDRR:

- Target future predictions now
- There are many risk assessments in the works
- DEQ, DNR, MNFI, U of WI study
  - 40-50 species that are invasive elsewhere that are not in the Great Lakes Region yet
  - Gather data on physiological tolerances
  - Run them through climate change scenarios using downscaled climate data models

Long-term Control

- How will native species behave in new places?
- Prioritize based on functionality/resilience to climate change-related vulnerabilities
  - high quality sites in large complexes
- Forward-looking restorations that consider changing conditions
  - fish spawning habitat at different levels

Pop Quiz!

Flowers hidden in center of plant

On boat launch near Belle Isle

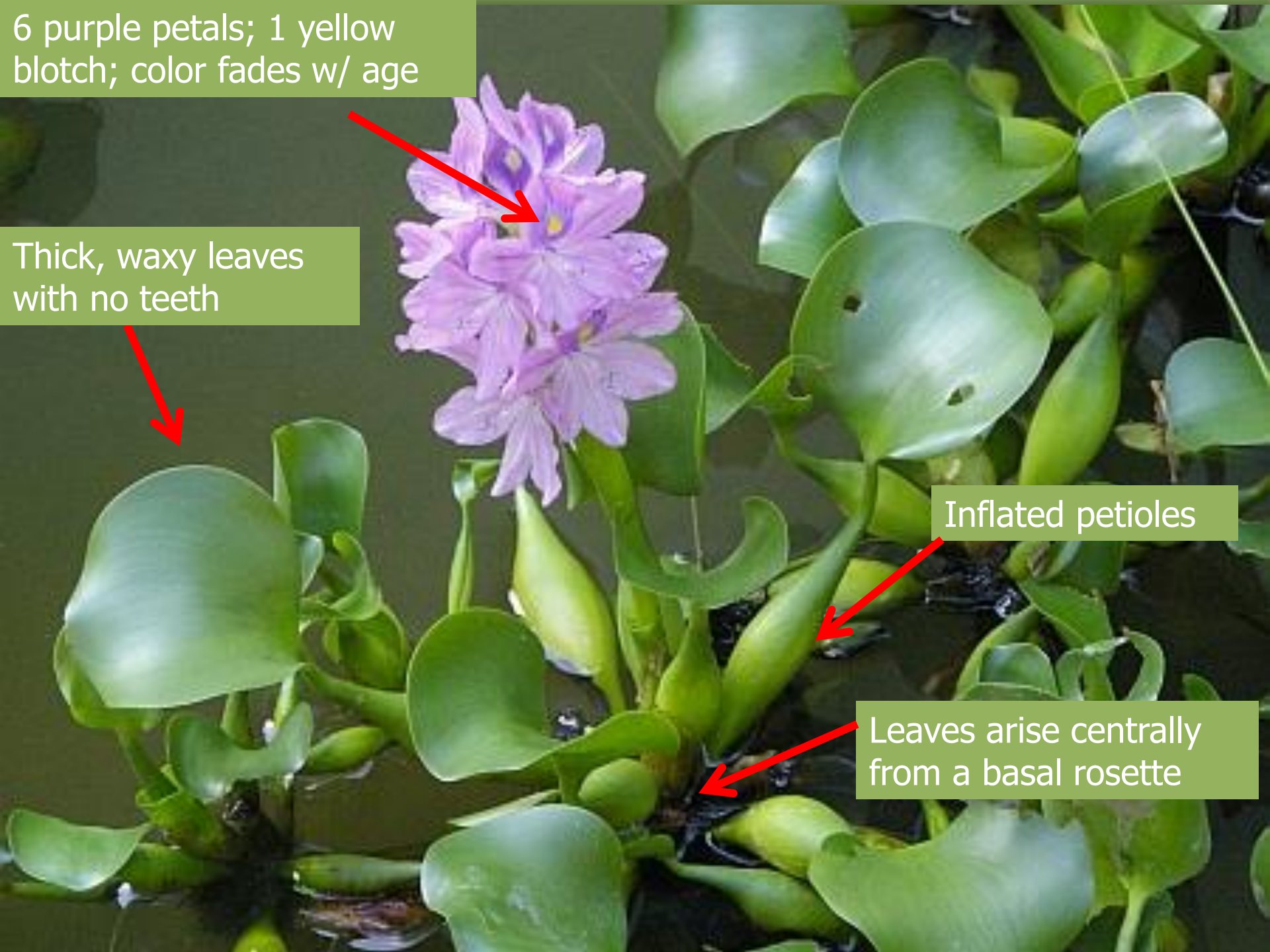New rosettes break off and

Floating in Detroit River

Water lettuce (*Pistia stratiotes*)
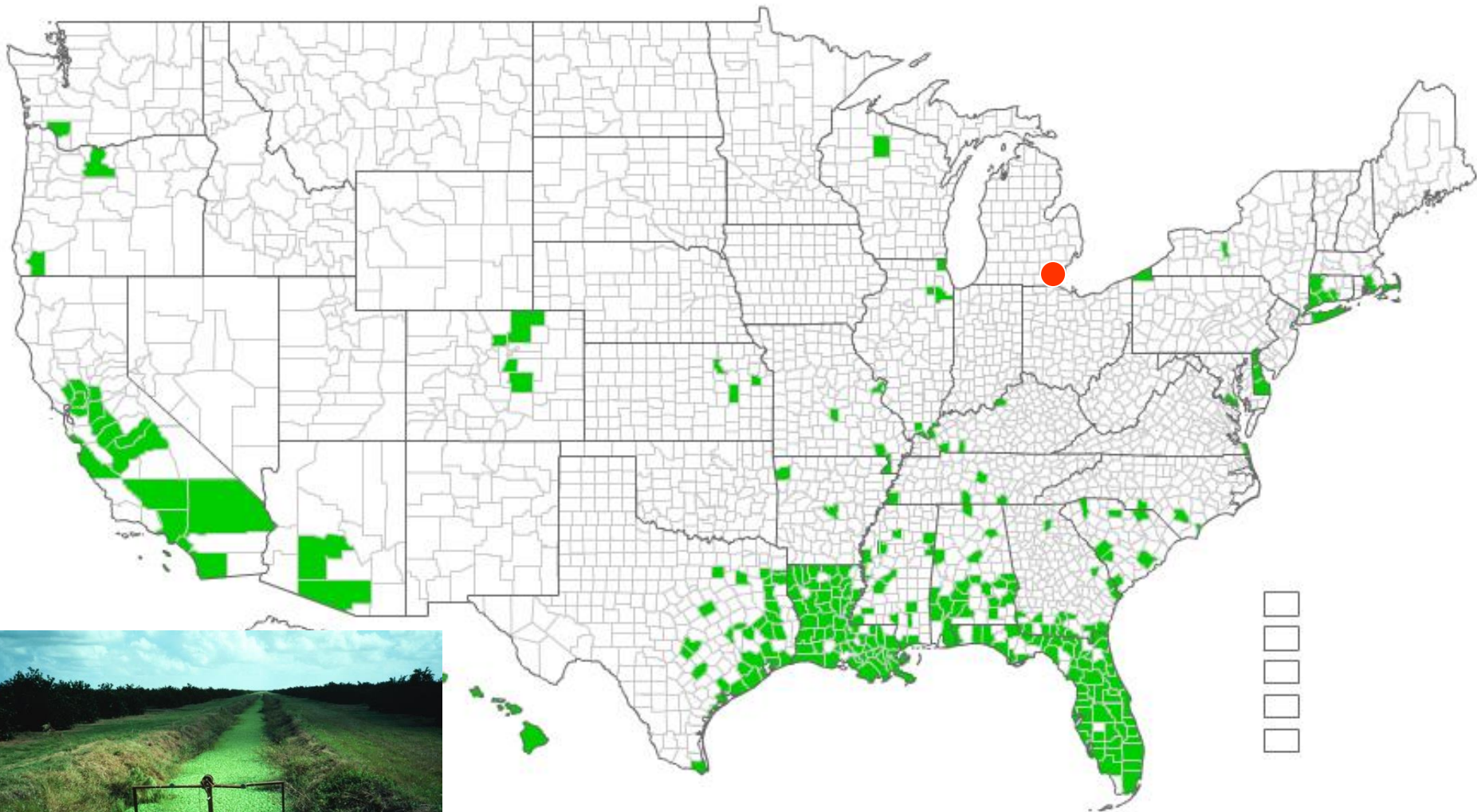
6 purple petals; 1 yellow blotch; color fades w/ age

Thick, waxy leaves with no teeth

Inflated petioles

Leaves arise centrally from a basal rosette

Water hyacinth *(Echhornia crassipes)*
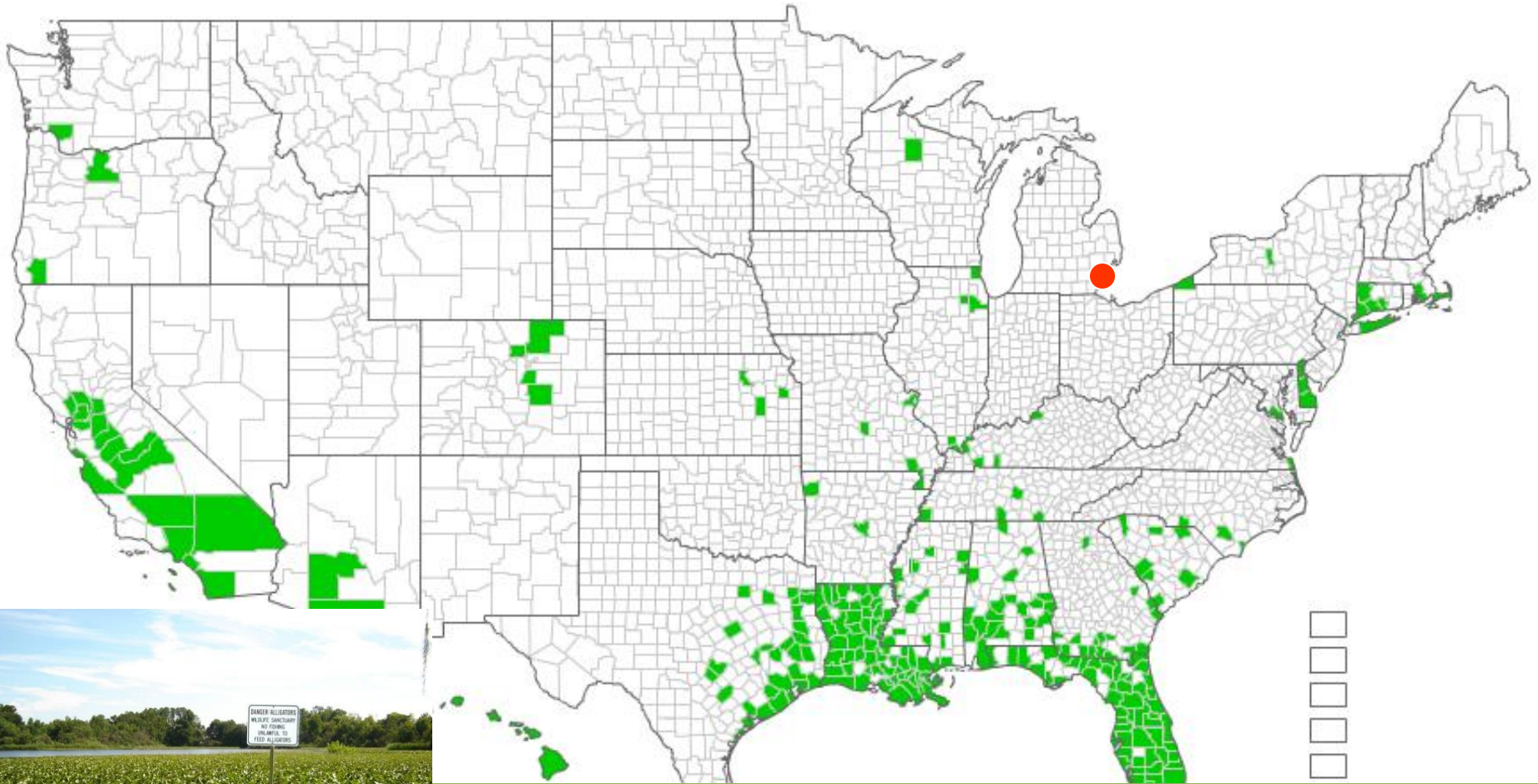
Reproduces vegetatively by stolons (horizontal stems) and produces seed that is dispersed.

flashmaps

Not confirmed overwintering in Great Lakes yet.

Water lettuce and water hyacinth in SE Michigan. October 2014
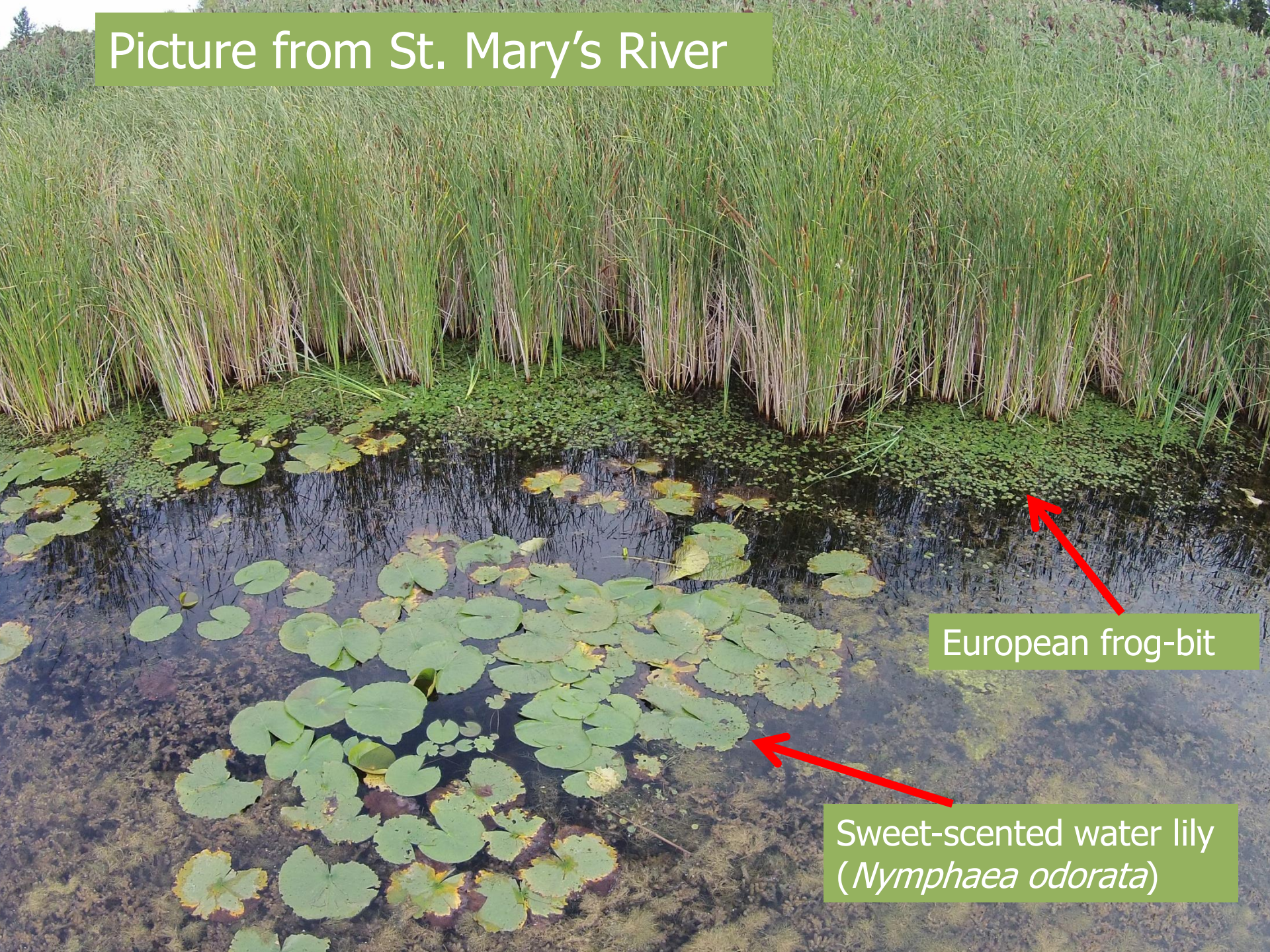
3 petaled white flowers; not always produced

Leaves heart-shaped, petioles originate between lobes

Leaves arise from a basal rosette

miniature; only 1-2 inches wide

Picture from St. Mary's River

European frog-bit

Sweet-scented water lily (*Nymphaea odorata*)

European frog-bit *(Hydrocharis morsus-ranae)*

Reproduce vegetatively by turions primarily. Occasionally produce roundish berries.

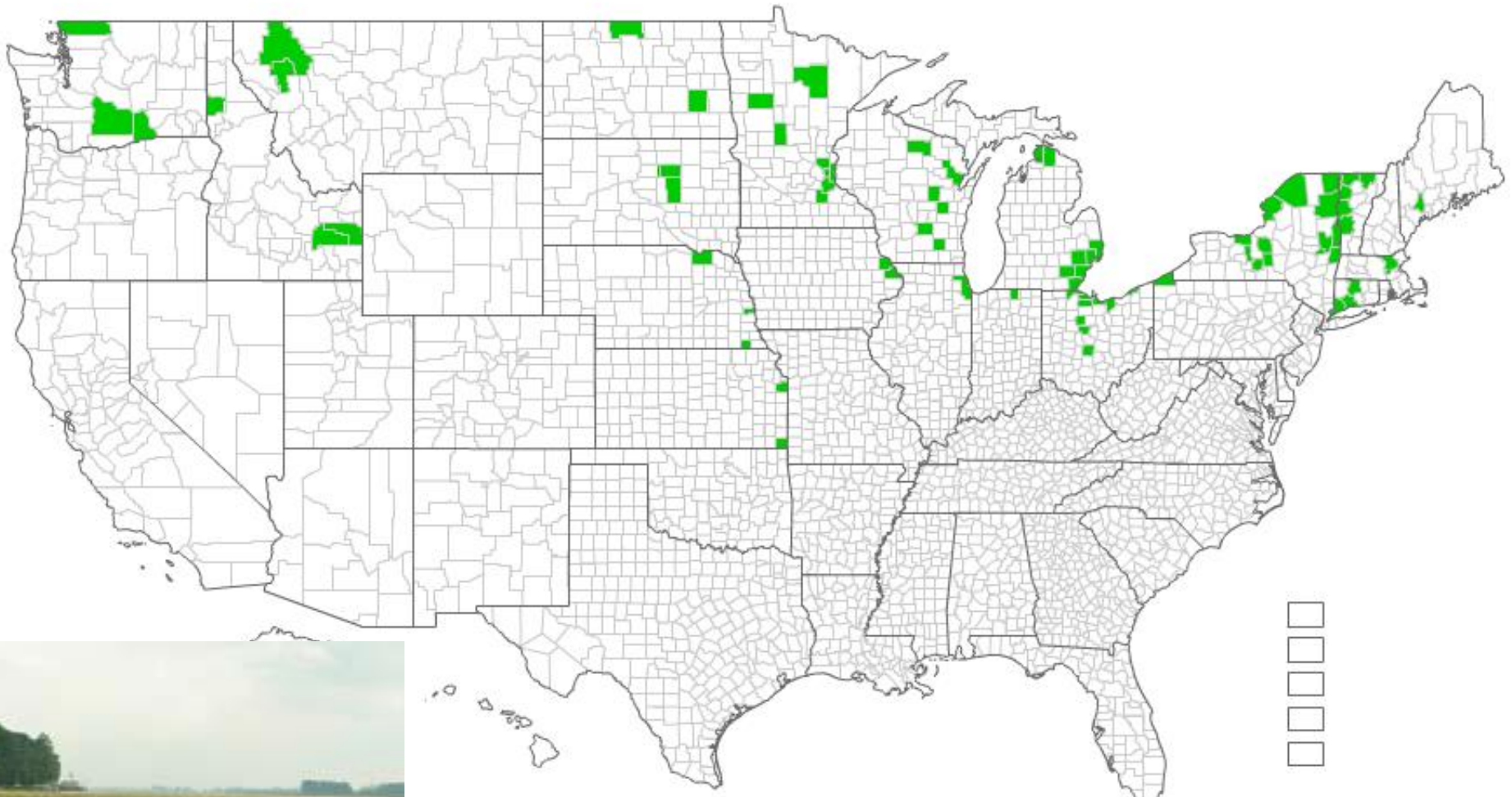Triangular leaves

Round stem

Curly tip

Clumped

Early detection!

Flowering rush *(Butomus umbellata)*

Reproduces by bulbils on roots and base of flowering stalks, rhizomes and rhizome fragments; some varieties produce seed

Rooted with submergent and emergent leaves

flowers in axils of fully developed emergent leaves (like submersed lvs).

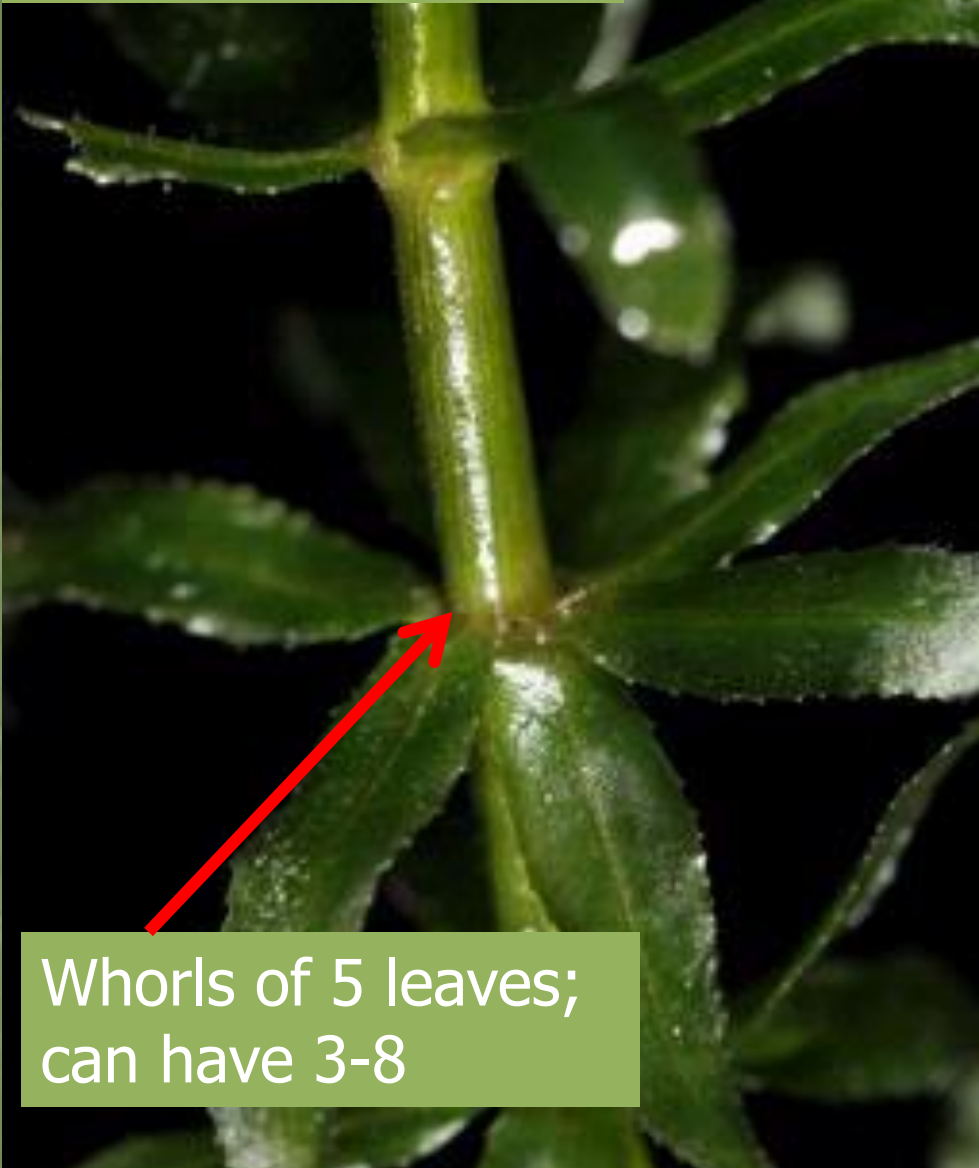www.xidservices.com

Whorls of mostly 5 (6-8) lvs pinnately divided. 2-3 cm

Many, short leaf segments per leaf; smooth margins

Detention pond in SE Michigan

Rooted submergent

Whorls of 5 leaves; can have 3-8

Leaf margins toothed
(Midrib spines on dioecious form only; NE - monoecious)

Enlarged portions of stem form reproductive tubers

Hydrilla tubers
Photo by Alison Fox

hydrilla *(Hydrilla verticillata)*

Not in Michigan yet!
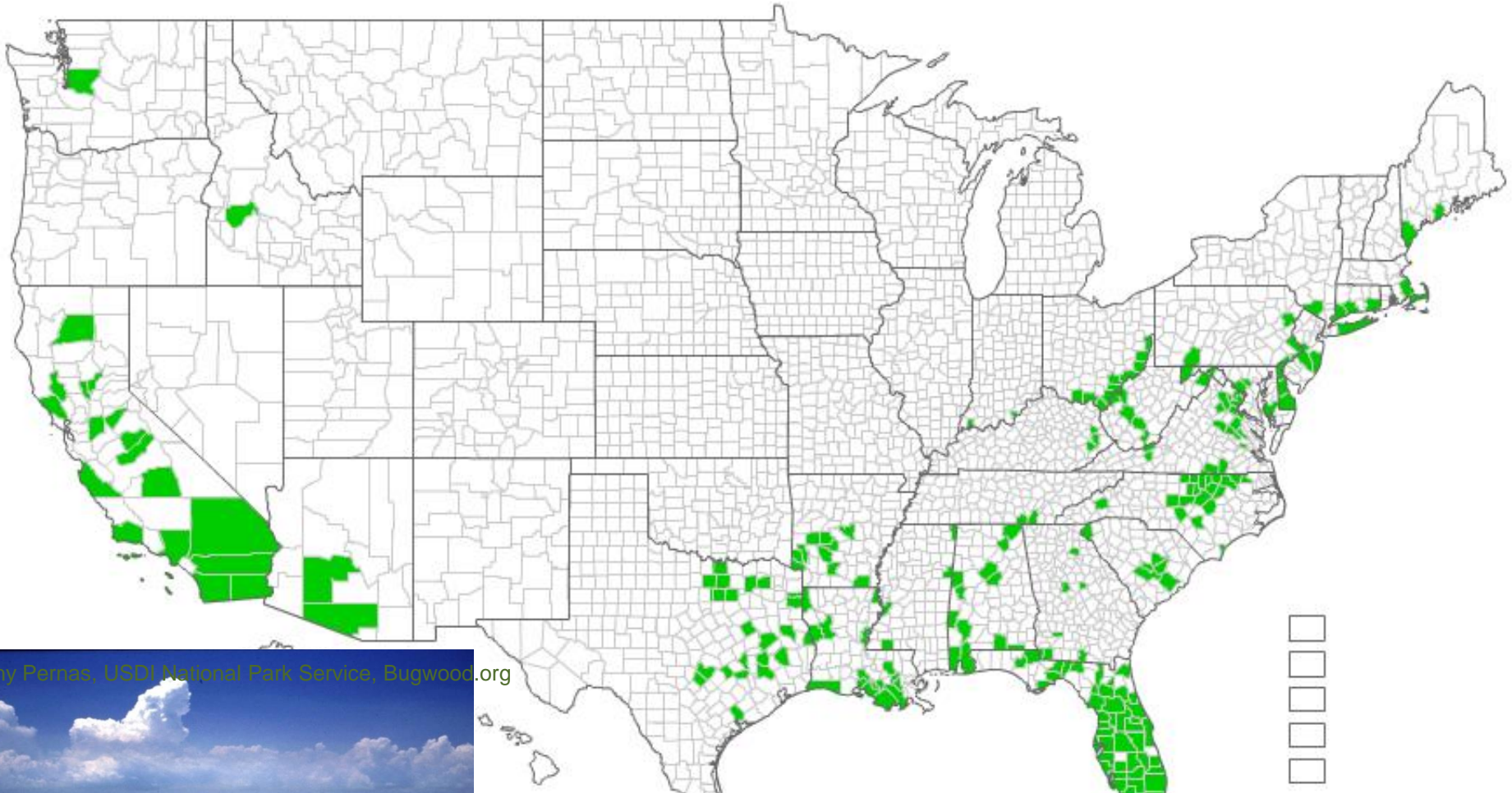
Tony Pernas, USDI National Park Service, Bugwood.org

Reproduction is primarily vegetative by turions (overwintering buds), and tubers

Native phragmites

The sum is greater than it's parts!