


Mapping and Monitoring Vernal Pools in Michigan 2017 Training Workshop

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Michigan Natural Features Inventory
Michigan State University Extension

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Acknowledgements

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- NE & MW MI GLSI
- MI Sea Grant
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- U.S. Fish & Wildlife Service

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Workshop Agenda

- Classroom Presentation
 - Overview of vernal pools and mapping and monitoring program
- Q&A & Sign up for VP
- Field Training
 - Explore vernal pools
 - Practice animal and plant ID
 - Review monitoring protocol and data form



Workshop Objectives

Overall: Learn how to map, monitor, and protect vernal pools

You will learn:

- What a vernal pool is & how to identify in the field
- What plants and animals occur in vernal pools, and their ecological roles and functions
- How vernal pools are unique, diverse, and variable
- Why vernal pools are important
- Their status, distribution, threats, and conservation in MI
- Michigan Vernal Pool Mapping and Monitoring Program





Emergent Marsh – GU/S4



Northern Wet Meadow – G4G5/S4 (Michael A. Kost)



Inundated Shrub Swamp– G4/S3 (Michael A. Kost)



Floodplain Forest– G3?/S3

Wetland Status

- Wetlands cover 5.5% of the U.S., lost over 50%
- MI - ~11 million ac historically, now <3 million ac (>73% loss)
- Drained/converted due to agriculture & development
- Federal and state protection – but does not cover vernal pools



Why are wetlands important?

- Provide habitat
 - MI - >50% plants, >40% animals
- Water storage
- Groundwater recharge
- Flood control
- Improve water quality
- Store carbon
 - 35% global terrestrial carbon
- Water source
- Recreational value
- Economic value – agriculture, forestry, tourism, recreation
- Cultural value



What is a vernal pool?



- Seasonally flooded wetland
- Naturally occurring
- Forested landscapes
- Lack fish
- Unique species, unique ecosystem

U.S. EPA



Maine

Vernal Pools

Naturally occurring, temporary to semi-permanent pools occurring in shallow depressions in *forested landscapes*. Vernal pools provide the primary breeding habitat for **wood frogs**, **bluespotted** and **spotted salamanders**, and **fairy shrimp** and provide habitat for other wildlife including several endangered and threatened species.

Key Characteristics

➤ Hydrology - Seasonally flooded

May 2, 2013



Yu Man Lee

- Wet in spring
- Dry by late summer / fall
 - Except semi-permanent pools

June 23, 2013



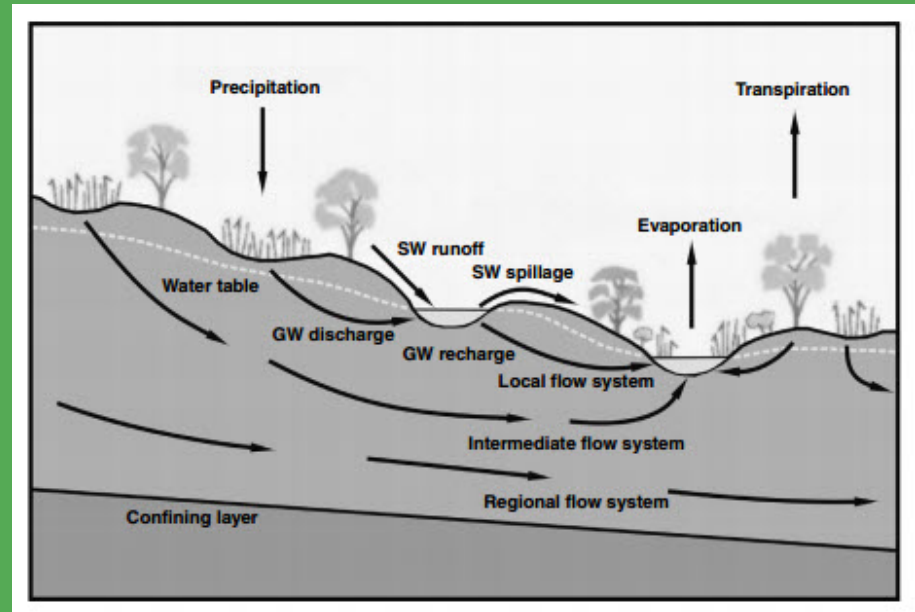
Yu Man Lee

- In MI, hold water for at least 2 months in spring

Key Characteristics

➤ Hydrology – Water Sources

- Precipitation
- Groundwater
- Surface runoff
- Overbank flooding – e.g., rivers
- Intermittent streams



From: Leibowitz, S.G. and R.T. Brooks' chapter in Calhoun, A.J.K. and P.G. deMaynadier. 2008. Science and Conservation of Vernal Pools in Northeastern North America, p.34. Adapted from Sando, S.K. (1996). South Dakota wetland resources. In Fretwell, J.D., Williams, J.S., and Redman, P.J. [compilers] National Water Summary on Wetland Resources. U.S. Geological Survey, Reston, VA. Water-Supply Paper 2425, pp. 351–356.)

Key Characteristics

➤ Size – Small and shallow

- Generally < 2.5 acres
- Vast majority < 0.25 acre
- Most < 1 m deep



Key Characteristics

- Isolated / no persistent surface water connection to permanent water



- Can be connected to other wetlands / permanent water temporarily
- Can have temporary inlets / outlets

Key Characteristics

- Plants and animals specialized for life in a vernal pool – “indicator species” OR “obligate species”



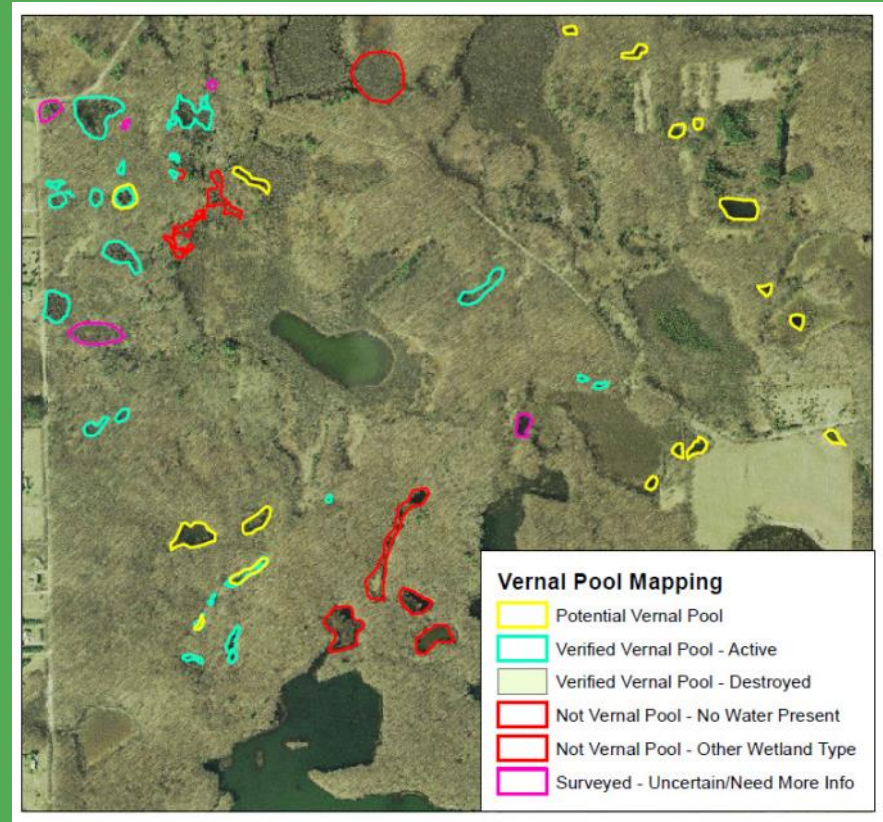
Vernal Pool – Dry Phase



- Shallow depression, often no
- Black, water-stained leaves, mos

Where can we find vernal pools?

- Throughout Michigan, Great Lakes region and worldwide
- But don't occur everywhere
- Need "right" set of conditions to form



Vernal Pool Types - Vegetation

Open Pool



Shrubby Pool



Forested Pool



Marshy Pool



Vernal Pool Types - Hydroperiod

Proposed Hydrologic Class	Average Duration of Flooding (months)	Additional Information
Short-cycle, spring-filling pools	3 – 4	Dry by late Jun/early July
Long-cycle, spring filling pools	5 – 8	Dry mid-late summer/early fall
Short-cycle, fall-filling pools	7 – 9	50% full in fall/winter; dry in late Jun/early Jul
Long-cycle, fall-filling pools	9 - 11	50% full in fall/winter; wet thru mid-summer
Semi-permanent pools	36 - 120	Dry completely every 5-10 years

*From Colburn 2004 – Vernal Pools Natural History and Conservation



Pool A



Pool B



Pool A



Pool B



Water Level Fluctuations



Relatively stable: Vernal pools tied to groundwater levels show slow, steady increases in water levels

Dramatic fluctuations: Vernal pools fed primarily by river flooding will fill rapidly during a single flood event



**MNFI1-1589 -
July 30, 2013**



**MNFI1-1589 -
July 12, 2014**



Is this a vernal pool? How do you know?



How can vernal pools differ, and what factors leads to these differences?



Annual water pattern of (most) vernal pools



Drying & the
dry phase



Newly flooded

Aquatic fungi &
bacteria, algae &
diatoms,
protozoa



www.vernalpool.org



Early spring



www.michigan.gov

Mid - spring



Wikimedia Commons

Late spring to
summer



Gail Hampshire,
Wikimedia Commons



Vernal Pool Plants and Animals

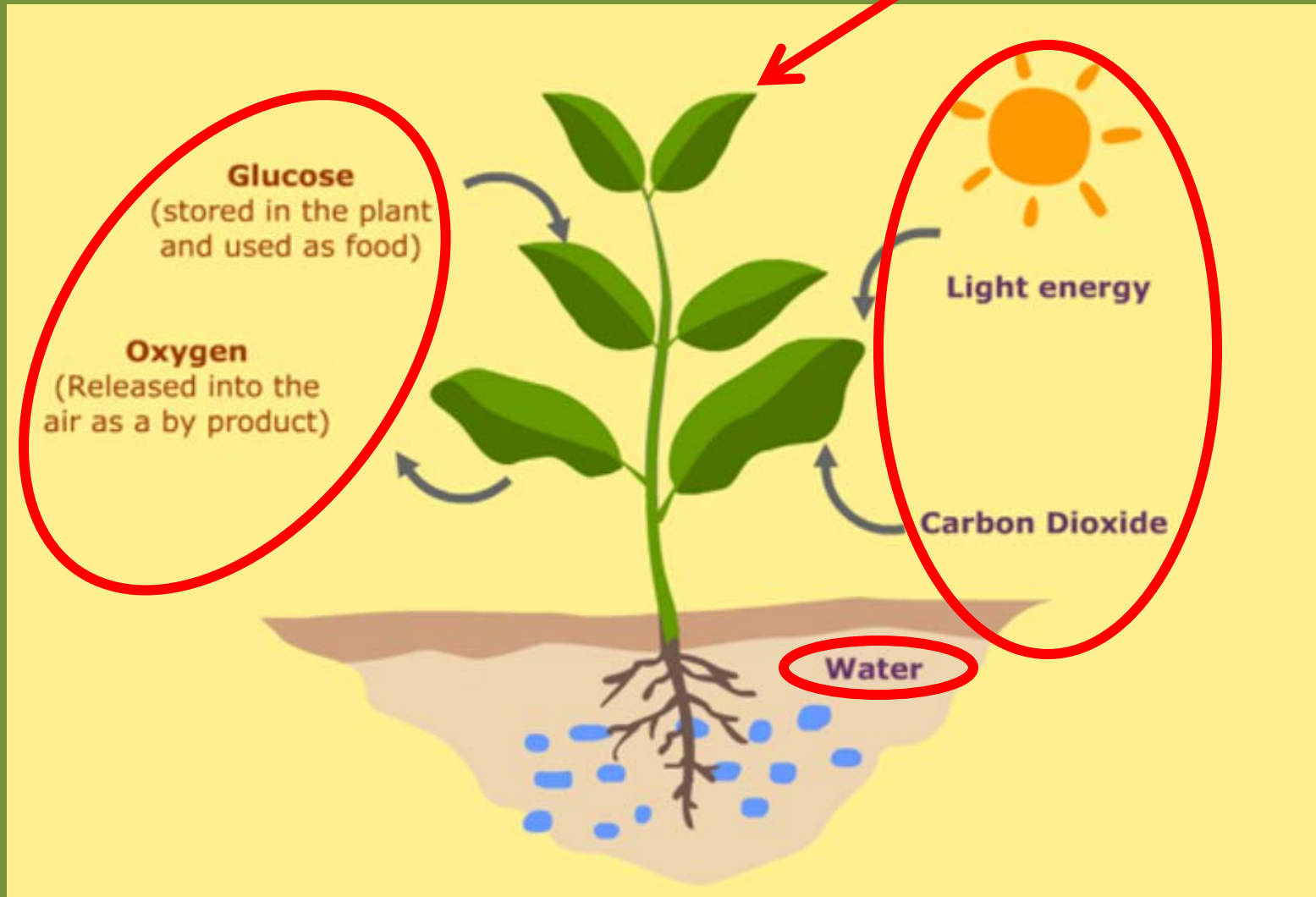
“Coral Reefs of Northeastern Forests”



Plants are not optional



Photosynthesis! Occurs in chloroplasts.



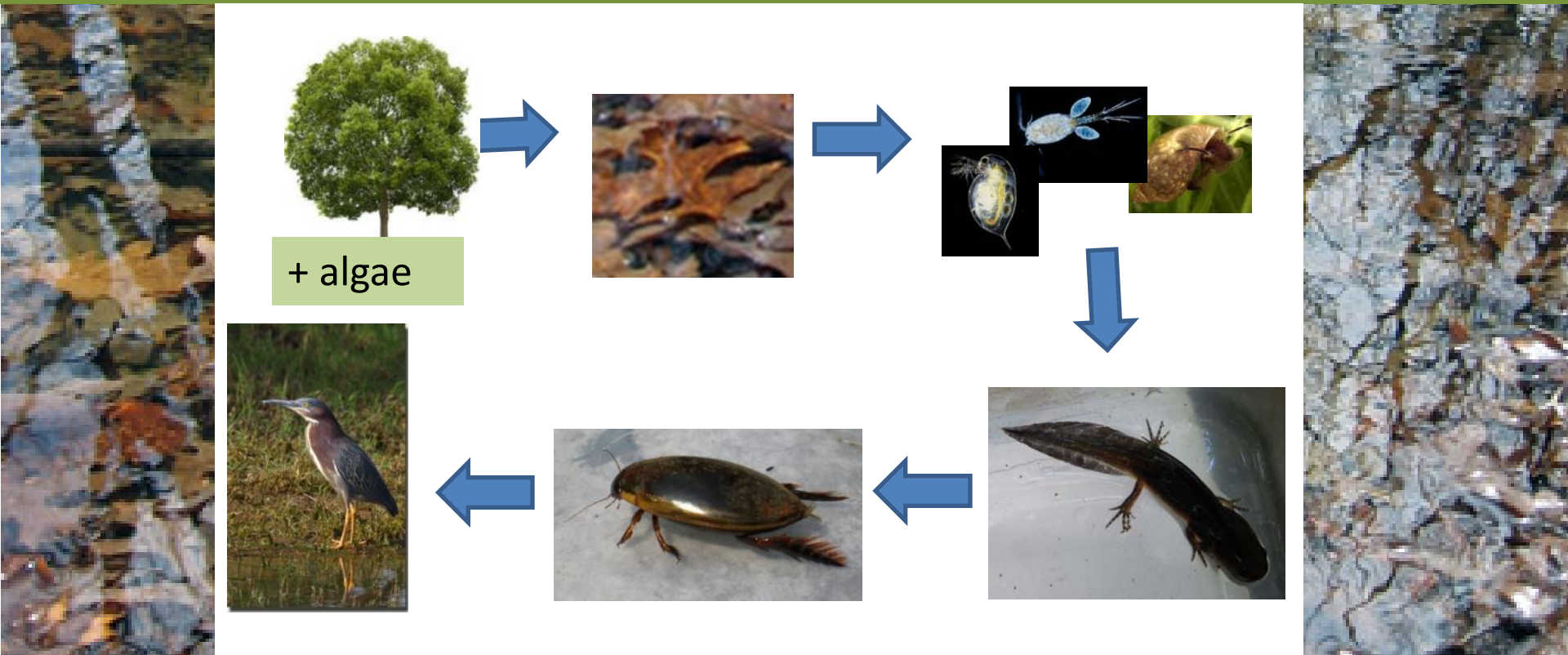
Plants take energy from sun & make food and oxygen.

Plants provide 60% of pool nutrients

Dead animals and leaves in the pool decompose

Fungi and bacteria  NUTRIENTS

These NUTRIENTS form the base of most VP food webs



Plants provide food & energy to other organisms.

What else do plants do?

Shape Habitat:

All the things that an animal
needs to survive and
reproduce

Plants and animals are not distributed randomly or evenly over the landscape. Each organism lives in an environment which best provides the **food**, **water**, **air**, **temperature**, places to **breed**, places to **raise young** and other needs of that organism.



Habitat structure; most VP species require water for breeding.



Marchand



Caddis fly larva
A plant house!

Open



Shrubby



Each is unique & changes over the season. May have lots or few species.
Plants grow in zones based on water tolerance.

Forested



Marshy



What things determine which plants will be there?

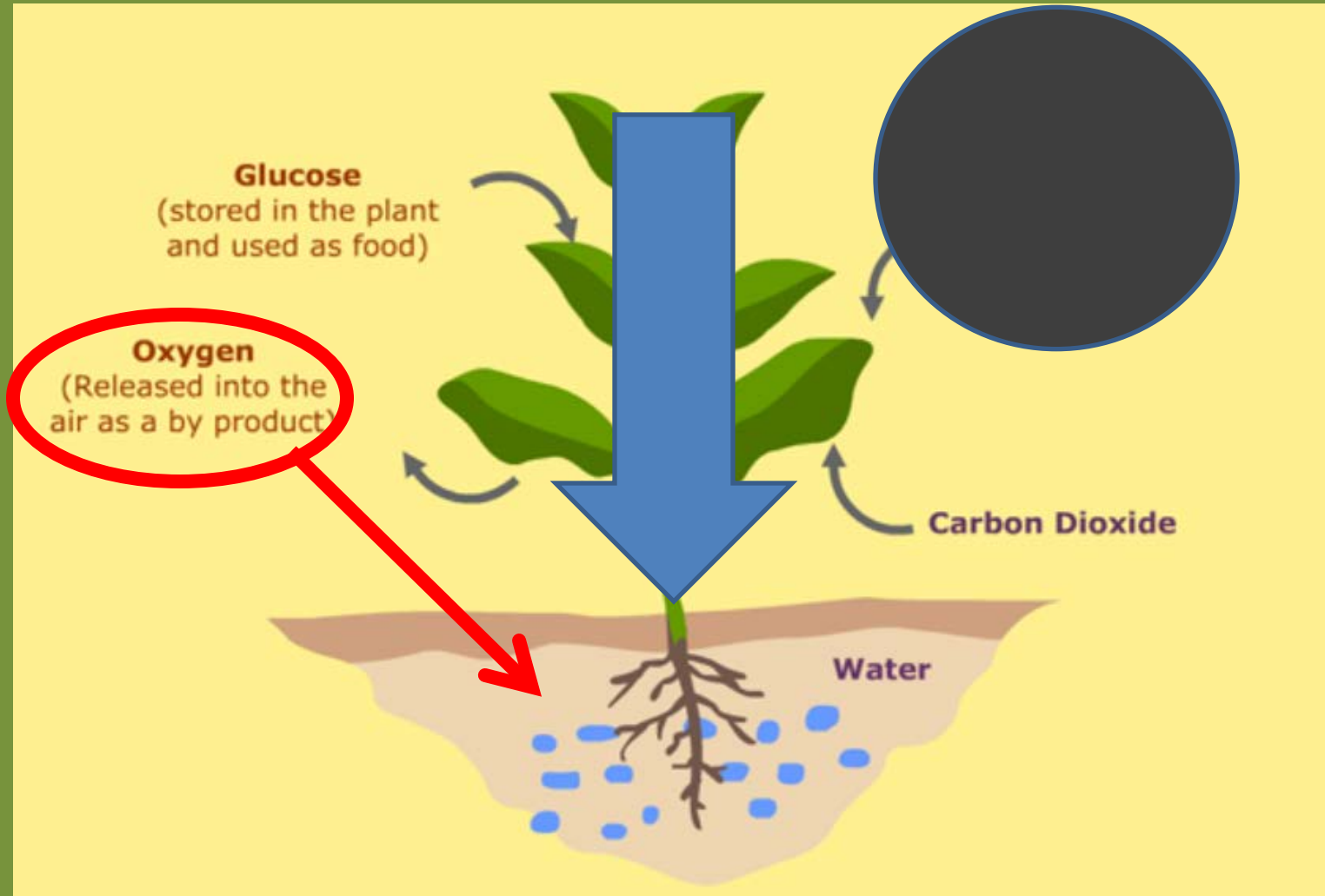
- Size of the pool
- How deep the water is
- How long the water is in the pool
- Soils (substrate)
- Time of year
- Surrounding landscape

Most vernal pool plants have to be able to survive in water for some part of their life cycle.



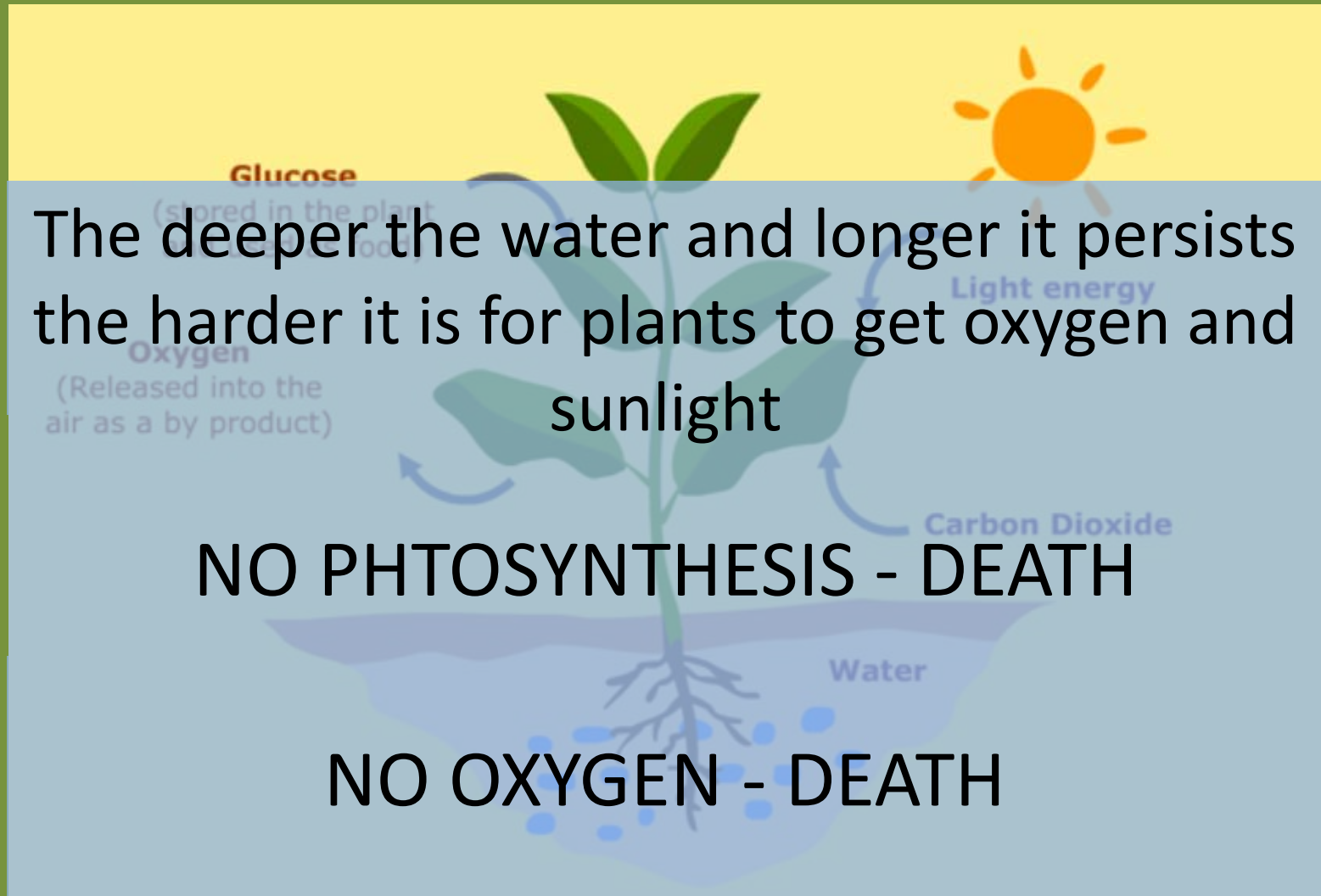
Plants need food and oxygen too!

Respiration occurs in all plant cells.



Plants use their own sugars and oxygen for energy.

It's tricky to live in water!



Adaptation

Anything about an animal that helps it live or survive in its environment.

Vernal pool plants have adaptations that allow them to survive in water.

Floating plants

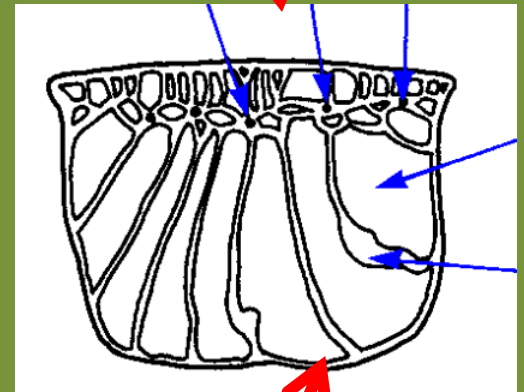
Greater duckweed



Common duckweed



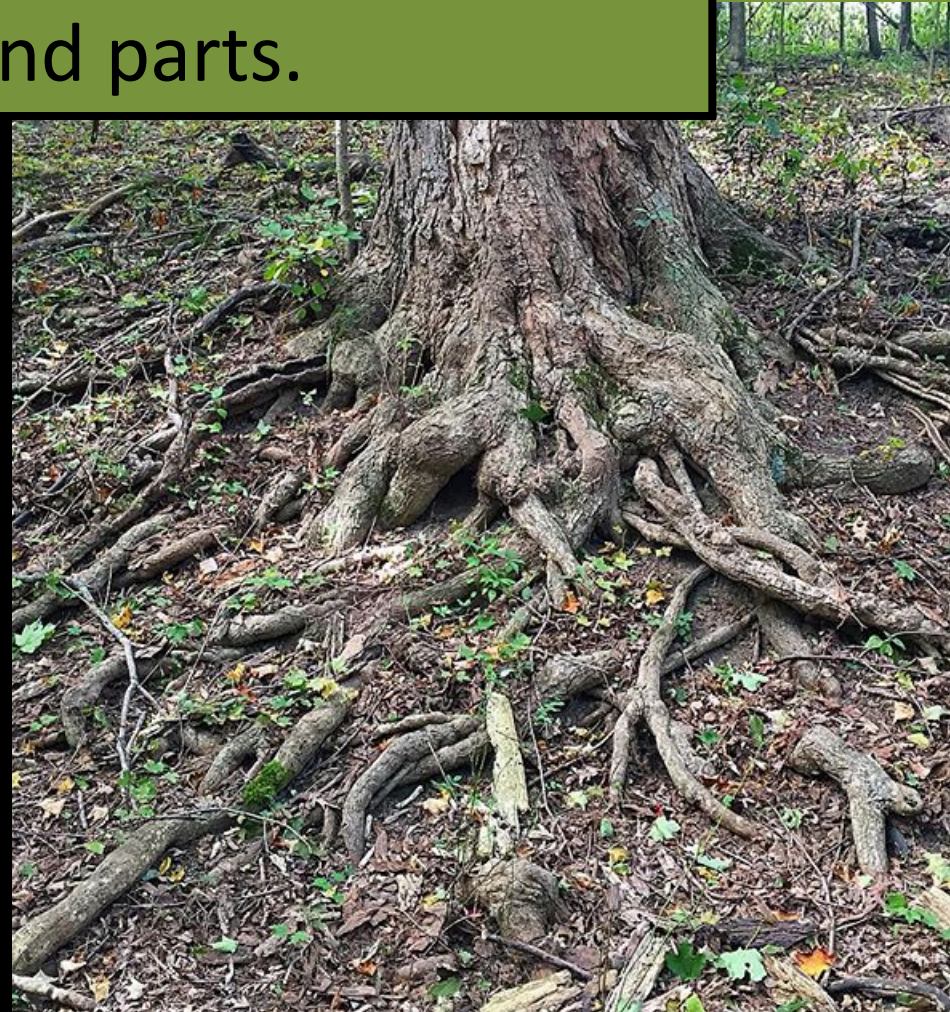
Chloroplasts on top



Big air cells on bottom help it float and carry oxygen.

Adaptations - Trees and Shrubs

Shallow, spreading roots so they can get more oxygen and pump it down to the underground parts.





Big lenticels!
Openings for gas exchange.

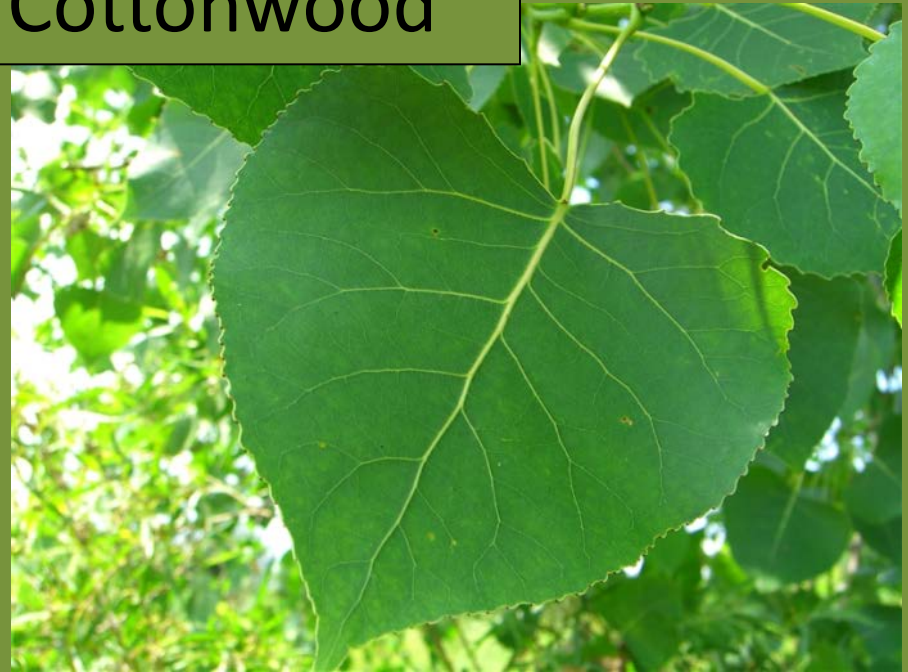
American elm



asymmetrical
leaf base

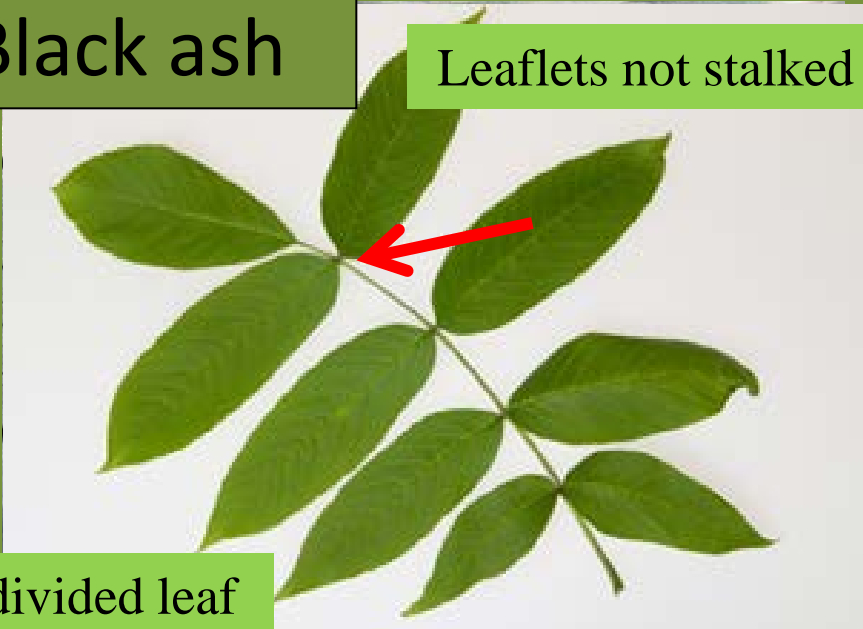
Arthur Haines. New England Wild Flower

Cottonwood



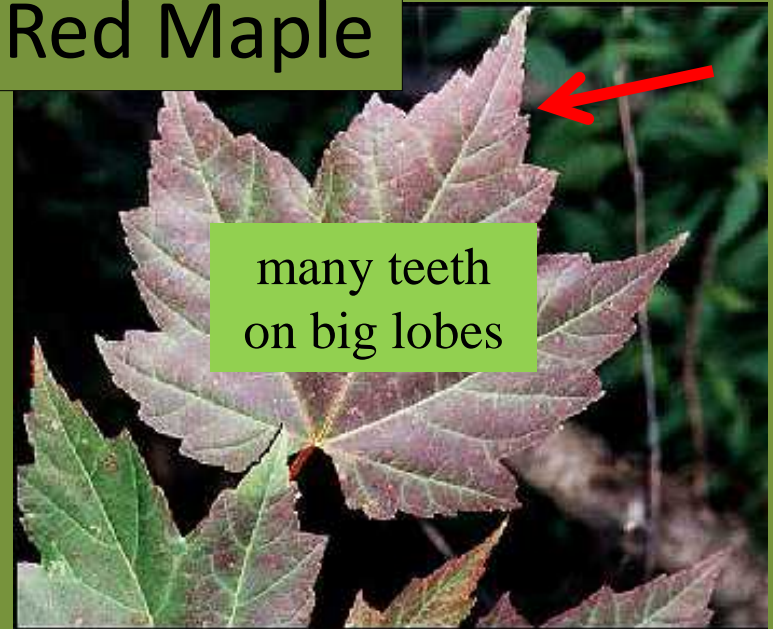
Black ash

Leaflets not stalked



divided leaf

Red Maple



many teeth
on big lobes

Michigan holly; Winterberry



SB Johnny, Creative Commons

Red-osier dogwood



Phyllis Higman, MNFI



D.L. Nickrent

Speckled alder



Phyllis Higman, MNFI

R. W. Smith

Willow



A.A.Reznicek



Buttonbush

Adaptations

Herbaceous plants



Jewelweed
(*Impatiens capensis*)

Touch-me-not



Shooting, waterproof seeds!

- Flexible stems
- Hollow stems carry oxygen

If you know your plants
they can tell you a story!





A.A. Reznicek



Duckweed

Which plant is not a vernal pool plant?



Paul Drobot

Jewelweed/touch-me-not



American elm

Threats:

Direct destruction

ORV or other use damage

Tree harvesting

Pollutants from run-off

Invasive species

Japanese knotweed



Garlic mustard



Non-native; economic, ecological or human harm.
Big impacts to things we value.




Japanese barberry



Reed canary grass



- 
- Provide buffers around pool
 - Limit disturbance
 - Don't let seeds/toxins hitch-hike on you
 - Early detection and response: report invasive species to the MISIN
 - Teach others about their importance

QUIZ!

- All vernal pools have a diverse flora. True or False?
- Name two important things that plants do for vernal pools?
photosynthesis, 1st link in the food chains, habitat structure
- All vernal pool plants can tolerate being in water for long periods. True or False?
- Name one adaptation of wetland plants.
Air cells, shallow roots, big lenticels, flexible, narrow leaves, floating seeds, dormant seeds, floating leaves
- How can plants provide clues about vernal pools?
They have different tolerances for water which helps you whether a pool of water was there.

Invertebrates of Vernal Pools: Mollusks, Crustaceans, and Insects

Mollusks

- In pool year round (Wet and Dry phase)
- Filter feeders and detritivores
- Burrow in mud and go dormant when pool is dry (operculum)



Common snails of vernal pools



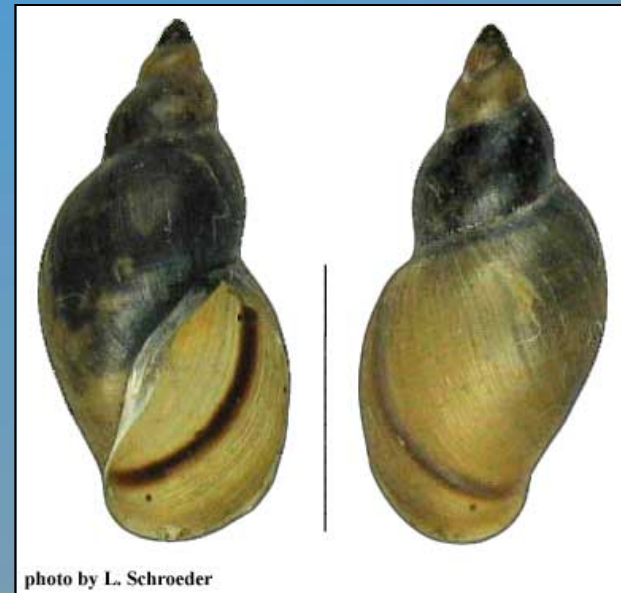
Gyro (Gyraulus)



Ram's horn (Helisoma)



Physa



Pondsail (Stagnicola)

Crustaceans

Burrow in ground when pool is dry



Crayfish

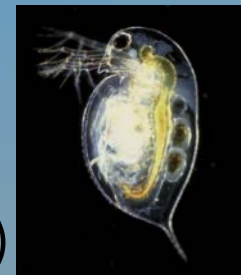


Pill bugs

Eggs survive drying and freezing (Adults seen only when vernal pool is wet)



Clam shrimp



Daphnia (water flea)



Fairy Shrimp



- Only found in vernal pools (waters with no fish)
- Eggs hatch when pool fills with water
- Eggs survive drying and freezing
- Adults live only a few weeks, done by mid-late May.



Fairy Shrimp

- 3 species documented in Michigan
 - *Eubbranchipus bundyi* (knob-lipped fairy shrimp) G5
 - Found throughout Canada and in W, N, and NE U.S.
 - In N. US and S. Canada – most common fairy shrimp
 - S1 in IN, S2 in WI and not ranked in all other states and provinces
 - *Eubbranchipus neglectus* (neglected fairy shrimp) G5
 - *Eubbranchipus vernalis* (springtime fairy shrimp) G4



Insects

WET: Aquatic larvae (gills)

DRY: Terrestrial adults (wings)



Midges/mosquitoes



Damselflies



Insects

WET: Aquatic larvae



Mayfly

DRY: Terrestrial adults with wings



Caddisfly



Insects

WET: Aquatic larvae



DRY: Adults can swim and fly



Water tiger beetle

Strategies of invertebrates in vernal pools

1. Persist year round

- Are mobile within minutes of flooding
- Active by end of May
- Adults go dormant during dry period
- Water temperature range of 32-80°F



Photo by Chris Lukhaup

Mosquito larvae



Water flea/Daphnia



Copepod



2. Hatch-on-flooding

- Early spring
- Active within a few days of the pool filling up
- 4-6 week life cycle, grow fast
- Adults leave, immature larvae diapause, eggs & cysts
- Water temperature range of 32-62°F

3. Late spring

- Appear 2-5 weeks after the pool fills up
- A life cycle of about 5 weeks
- Includes predators like beetles (Dytiscidae) and dragonflies larvae
- Temperature range 50-70°F



Damselfly larvae

Water tiger (beetle larva)

Damselfly larvae



4. Drying phase

- Late summer - early fall
- These appear 2-3 weeks before the pool dries.
- Very fast growth
- Damselflies, mayflies, midges
- Water temperature range 60-80°F



Rat-tailed maggot



Mayfly

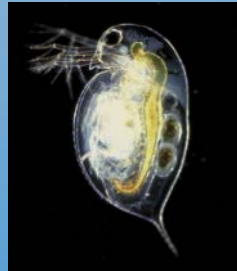
Dry phase – Fall (Winter)

- Only terrestrial species are active
- Millipedes, slugs, beetles, dragonflies...



Invertebrate activity comes in waves

- Filter feeders first
(wet phase - early spring)
Crustaceans, mosquitoes...



- Predators second
(late spring/summer)
Dragonfly and beetle larvae, amphibians, ducks...



- Detritivores third
(dry phase – late Summer/fall)



Review





- “Nature’s Nursery”
- Rely on vernal pools for breeding – no fish
- Early and “explosive” breeders
- High egg/larvae mortality
- Rapid development – emerge by July-Aug
- Use same pools year after year

Wood Frog



- Each female can lay from 200 up to 1,000 eggs!!
- Eggs hatch within 3 weeks.
- Emerge from pool by early July
- High breeding site fidelity – 80-85% return



Wood Frog Tadpoles



- Feed on algae, detritus, and dead and living animals (incl. salamander eggs and frog/toad eggs/tadpoles)



Spotted Salamander



- Migrate to breeding ponds at night w/in 24 hrs of spring rains / snowmelt – air temp $>40-50^{\circ}\text{F}$
- Breeding season – 2 wks to ~1 month (late Feb-early Apr)
- Males first, then females

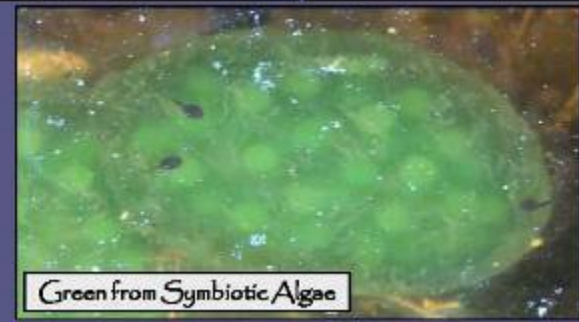
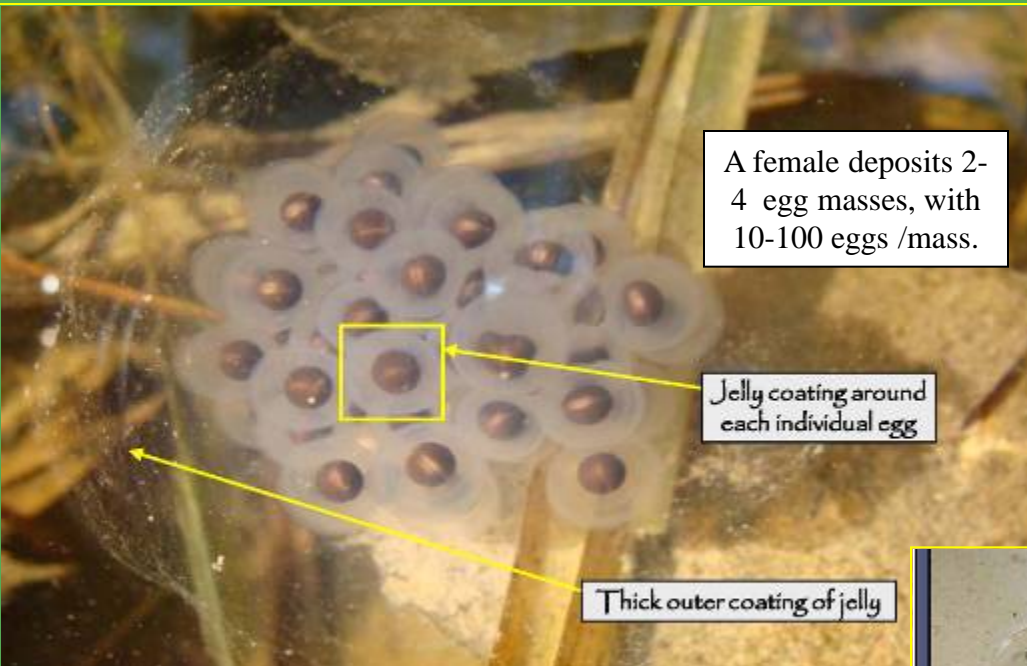


M. Marchand



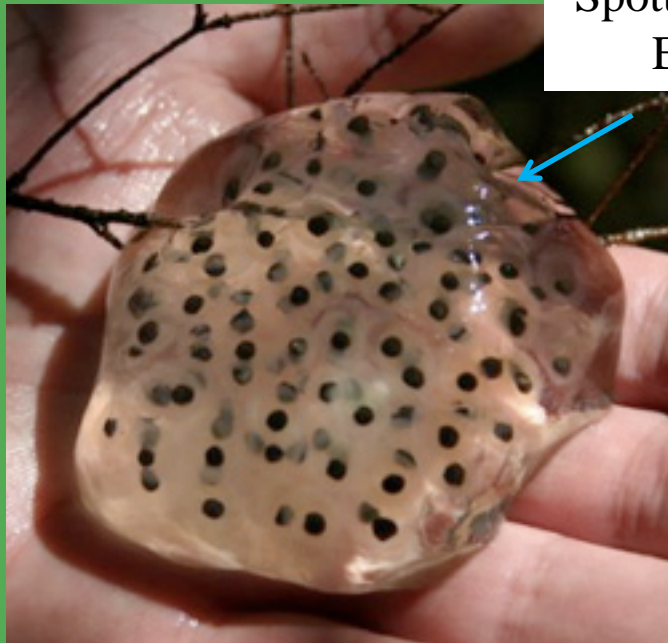
M. Marchand

Spotted Salamander Egg Mass & Larva





Wood Frog Egg Mass



Spotted Salamander
Egg Masses

“Globby Egg Masses” ID

Blue-Spotted Salamander Complex



- Hybrid complex - unisexuals, mostly females
- Breed mid-late Mar - April
- “Explosive” breeder – 2-3 days to 2-3 wks

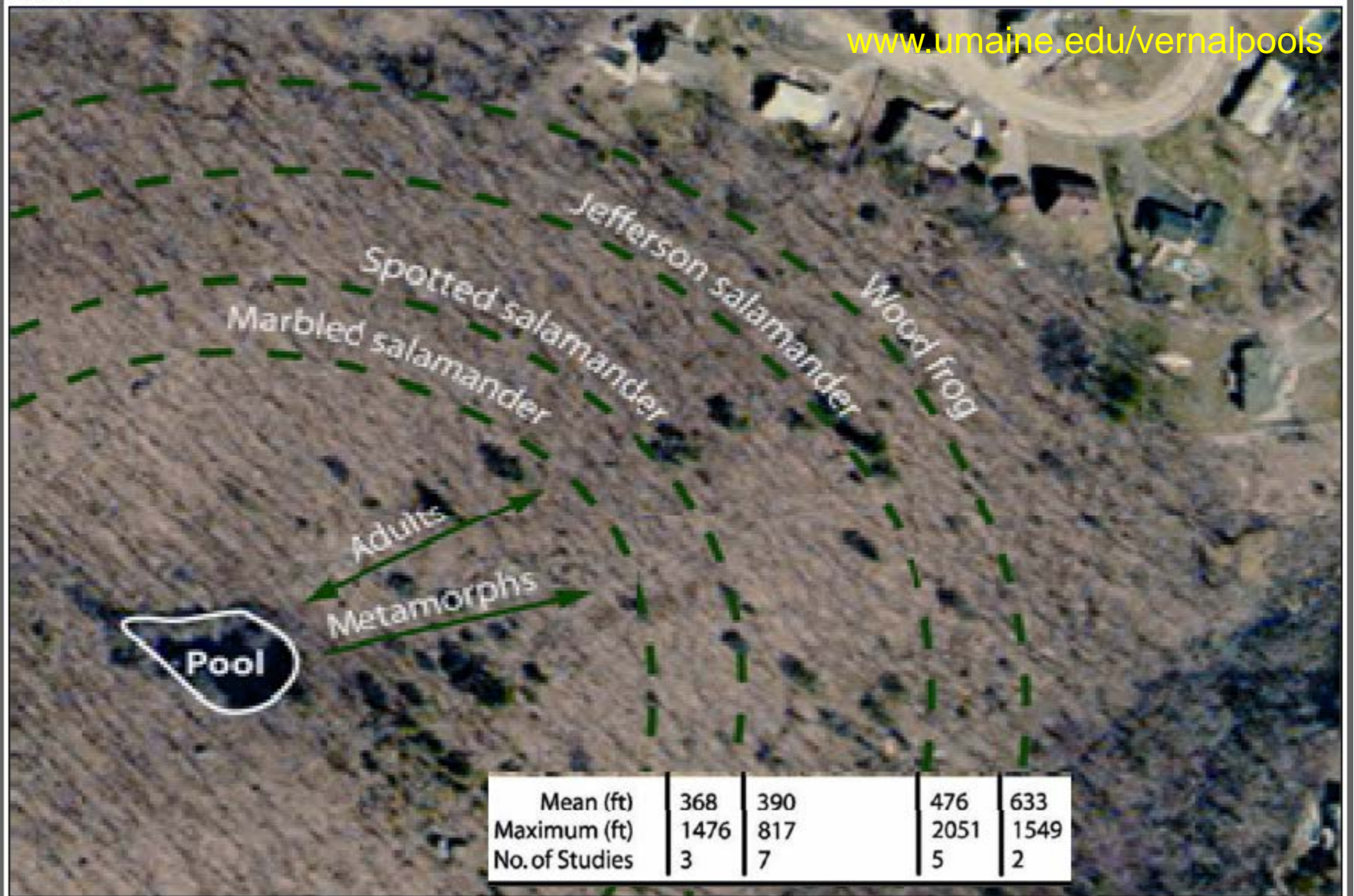


Blue-Spotted Salamander / Complex



- Eggs laid individually, in small loose clusters, or as strands along sticks and bottom of ponds.
- Hybrids – high % infertile eggs (white)
- Hatch in 3-5 weeks
- Larvae transform by late June/Jul - Aug





Semlitsch and Bodie 2003 – core terrestrial habitat for amphibians = 159 - 290 m, core terrestrial habitat for reptiles = 127 to 289 m; forest extent & canopy cover

Other Amphibians in VPs



Reptiles in VPs



Whose eggs are these?



Vernal Pools Salamander Videos

- Vernal Pools Spring to Life -
https://youtu.be/fzI_yaY_j-Q
- Michigan Amphibians -
<https://youtu.be/qBXA31NShXk>
- The Great Salamander and Frog Migration -
<https://youtu.be/m8iFqkZenBA>



Why are vernal pools important?

- Critical habitat for wildlife
 - Invertebrates and amphibians
 - Other wildlife species – 550-700 spp. in NE US



Why are vernal pools important?

➤ Rare species

Smallmouth Salamander - E



Spotted Turtle - T



Copperbelly Water Snake – LT, E



Blanding's Turtle - SC



Red-shouldered Hawk – T

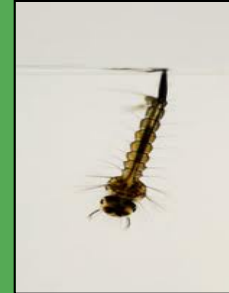


False Hop Sedge - T



Why are vernal pools important?

- Incredible biomass
 - Up to 4,000 frog larvae/m² (Woodward 1982, Petranka 1989)
- Provide food, energy, and nutrients for vernal pool and surrounding ecosystem (higher nutritional value)



Why are vernal pools important?

Ecosystem services

- Water storage & infiltration
- Groundwater / aquifer recharge
- Flood control
- May help improve water quality



Michael Kost

Why are vernal pools important?

➤ Social / Educational Value

- Easy to study / work in
- Capture people's interest
- Inspire people to learn about and help conserve wetlands & forests



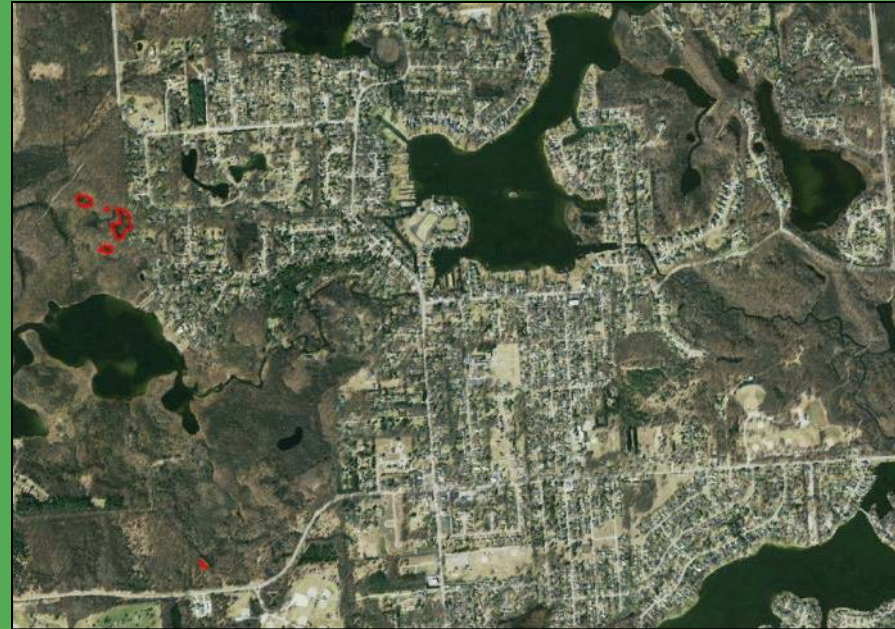
Vernal Pool Status and Threats

- Limited information and awareness in MI
- Hard to identify and map
- Limited protection - voluntary



Vernal Pool Status and Threats

- Loss and degradation
 - Development
 - Conversion to detention ponds & permanent ponds
 - Timber harvesting
 - Pollution & chemical contamination
 - Climate change?



VP Mapping, Monitoring & Conservation

- Growing interest and awareness of vernal pools
- Vernal pool mapping and monitoring – 15+ states
- Legal protection - 11 states
- MI – Wildlife Action Plan, Soil & Water Quality Standards, Forest Certification



- 2011 - 2014
 - MDEQ & U.S. EPA Wetland Program Development Grant
- 2014 – 2017
 - Verso, MFPC, MDNR, USFS Hiawatha NF, GLFT, MSUE, Meridian Twp, and partners

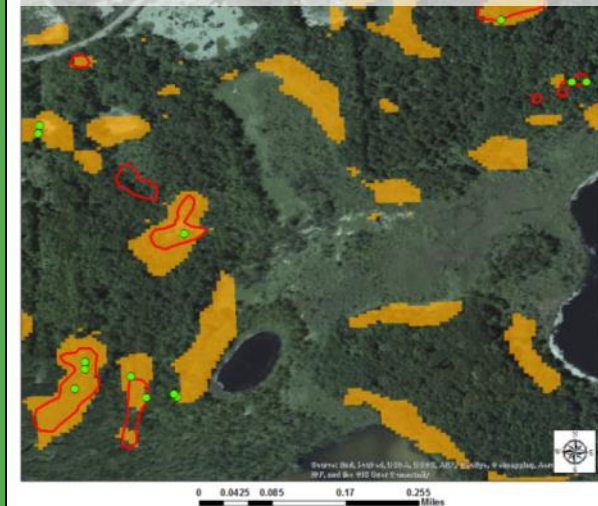


VP Identification & Mapping Remotely

Air Photo Interpretation



Radar / LiDAR with MTRI



Field Verification & Mapping



Vernal Pool



Not Vernal
Pool – Other
Wetland Type

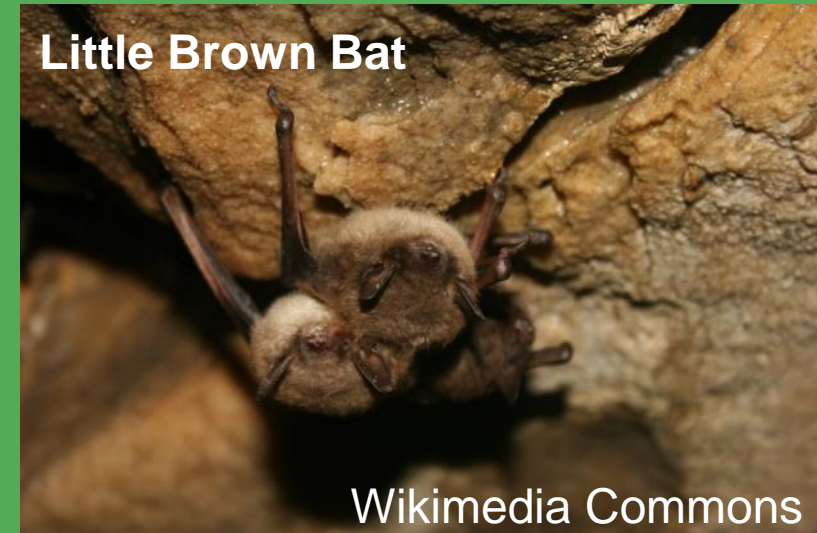


Not Vernal Pool –
No Water/Not
Wetland

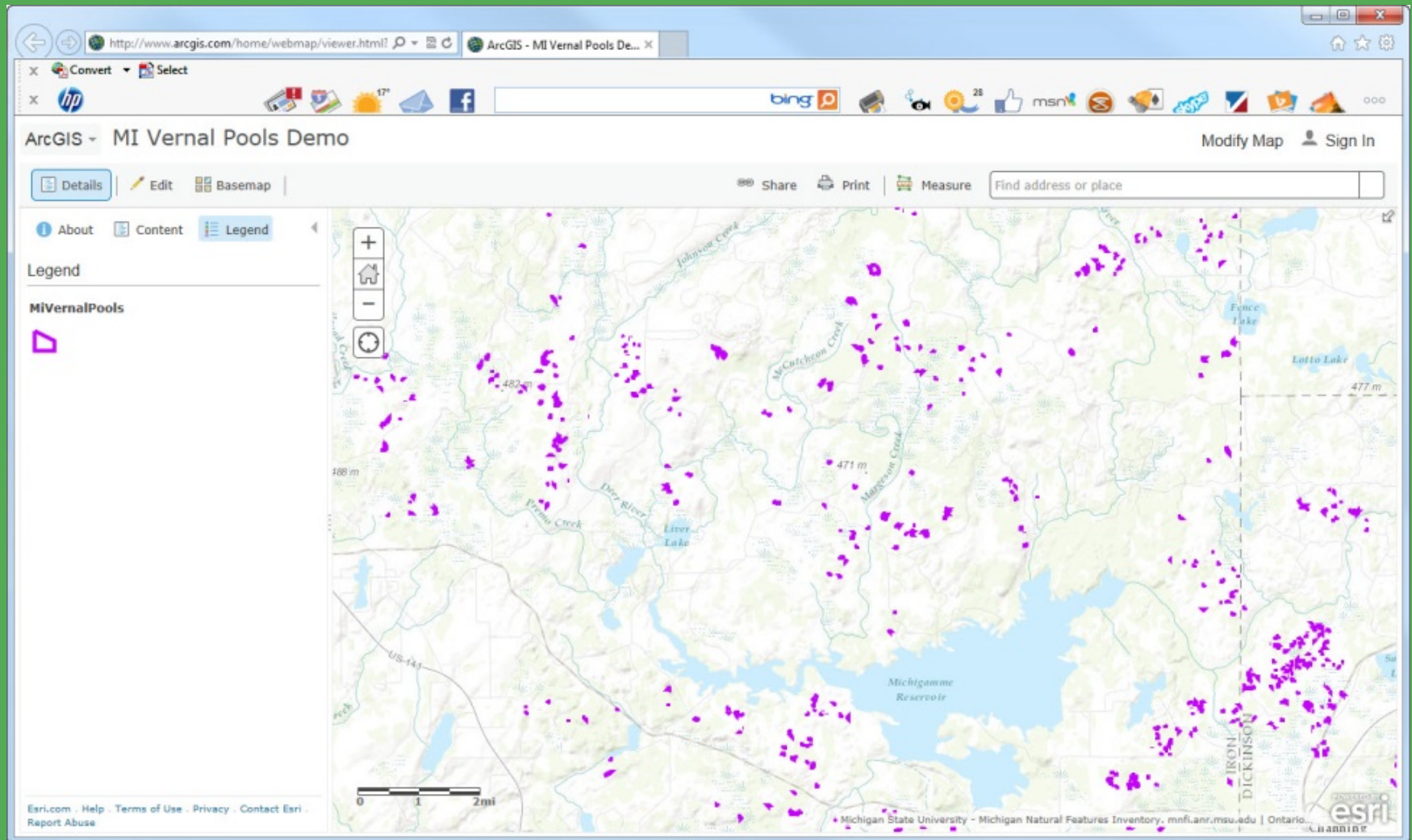


Ecological Data

- Physical, chemical, and biological characteristics
 - Plants – 139+ spp.
 - Animals
 - Indicator species – ~30-59% of pools
 - Inverts – 104 taxa, bats – 6 of 9 spp., and amphibians & reptiles

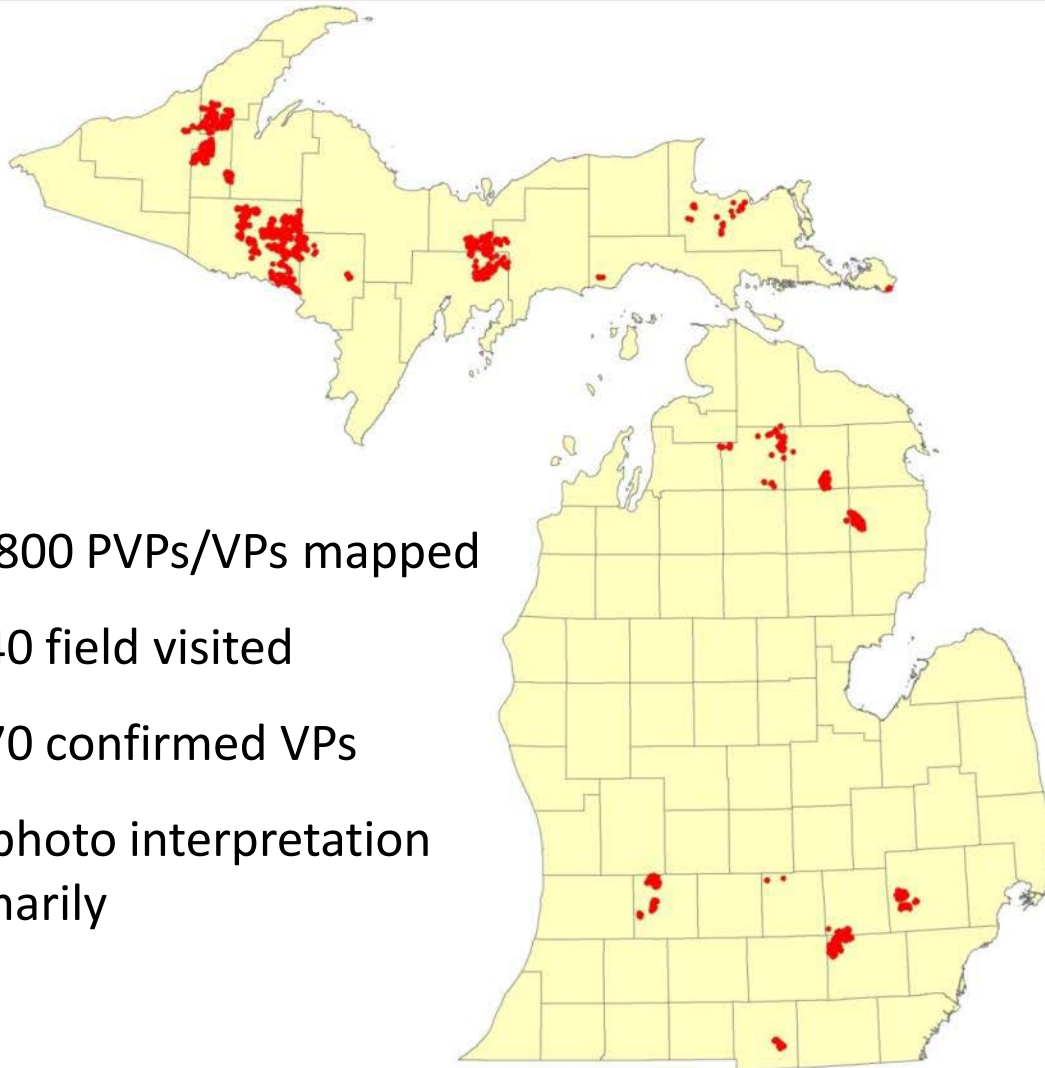


Statewide Vernal Pool Database



VP Mapping & Monitoring 2012 - 2016

- > 4,800 PVPs/VPs mapped
- > 840 field visited
- > 570 confirmed VPs
- Air photo interpretation primarily



Citizen Science-Based Vernal Pool Program

- Pilot in SE LP and NLP – 2012-2014
 - 53 volunteers
 - Over 380 hrs logged
- Network of partners and citizen scientists!

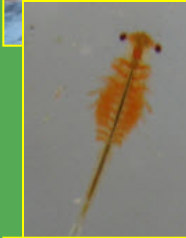
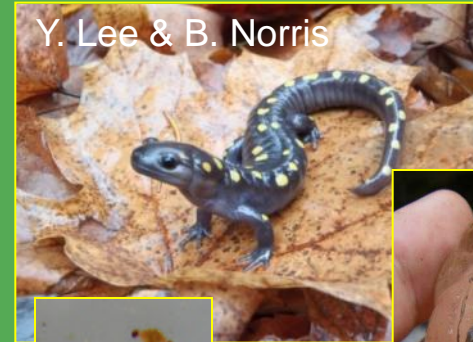


Mid-Michigan
Stewardship Cluster



Citizen Science-Based Vernal Pool Program

- Volunteers help verify, map, and monitor VPs in the field.
- Collect data following a standard protocol
- Statewide vernal pool database
- Information is critical for protecting vernal pools and maintaining healthy forest ecosystems.



Vernal Pool Mapping & Monitoring Program

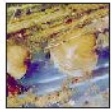


MICHIGAN STATE UNIVERSITY | Extension



Volunteer Training Manual

Michigan Vernal Pool Mapping and Monitoring Project



MICHIGAN
NATURAL
FEATURES
INVENTORY



- Attend training
- Select potential vernal pool(s) to verify & survey
- Obtain landowner permission
- Conduct field surveys
- Fill out data form for each pool each visit
- Photo document
- Compile data forms, maps, and save photos and GPS files, and submit by **Oct. 31**. Return equipment if necessary.

Field Survey / Assessment

- Conduct 3 field visits (at least)
- ✓ Visit 1 - Early spring (late Mar – mid-Apr)
 - Verify if vernal pool
 - Wood frog, also salamanders and fairy shrimp
- ✓ Visit 2 – Late spring (early/mid-Apr – late Apr/early May)
 - Salamanders and other herps/animals
- ✓ Visit 3 – Late summer (late July/Aug – September)
 - Document if pool is dry & vegetation





1a) Observer Information		<input type="checkbox"/> Visit 1	<input type="checkbox"/> Visit 2	<input type="checkbox"/> Visit 3	Time: from <input type="text"/> <input type="checkbox"/> AM <input type="checkbox"/> PM to <input type="text"/> <input type="checkbox"/> AM <input type="checkbox"/> PM
Name(s): <input type="text"/>		Date: <input type="text"/>			
1b) Property Information		<input type="checkbox"/> Ownership?	<input type="checkbox"/> Public	<input type="checkbox"/> Private	Landowner/Manager Name: <input type="text"/>
Site name: <input type="text"/>		Address: <input type="text"/>			
Plot # <input type="text"/>		City: <input type="text"/>		State: <input type="text"/>	Zip: <input type="text"/>
2a) Vernal Pool Location Was pool mapped as a Potential Vernal Pool (PVP)? <input type="checkbox"/> Yes <input type="checkbox"/> No					
Pool ID #: <input type="text"/>		New Pool ID #: <input type="text"/>		Enter coordinates in Decimal Degrees (e.g. Latitude: 44.764322 Longitude: -72.654222)	
Township/Range/Section/1/4 info: <input type="text"/>		Latitude: <input type="text"/>		Longitude: <input type="text"/>	
County: <input type="text"/>		For verification of PVP's location please enter names and coordinates for the nearest crossroads. Record as Decimal Degrees as shown above.			
Method for locating pool?		Latitude: <input type="text"/>		Longitude: <input type="text"/>	
<input type="checkbox"/> GPS <input type="checkbox"/> Topo Map <input type="checkbox"/> Google Earth <input type="checkbox"/> Air Photo		Crossroad names: <input type="text"/>			
2b) Brief Site Directions to Pool **					
<div style="border: 1px solid black; height: 100px; width: 100%;"></div>					
<small>** Written site directions to pool (This should include: (1) description of a logical starting point; (2) the distance from the starting point to pool; (3) the direction of travel; and (4) distinctive landmarks and water bodies.). For example "Enter Robinhood Park on the trailhead at Jordan Road. Follow the trail west approximately 1/2 mi. This is the first pool on your left, just behind a low stone wall."</small>					
3a) Pool Type Is this a Vernal Pool? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Sure Pool Photo Numbers: <input type="text"/>					
<input type="checkbox"/> Open Pool <input type="checkbox"/> Sparsely Vegetated Pool <input type="checkbox"/> Shrubby Pool					
<input type="checkbox"/> Forested Pool <input type="checkbox"/> Marsh Pool <input type="checkbox"/> Other (describe): <input type="text"/>					
3b) Presence of Inlet or Outlet					
Is this pool connected to or part of another water feature? <input type="checkbox"/> culvert <input type="checkbox"/> lake <input type="checkbox"/> open/emergent/shrubby wetland					
<input type="checkbox"/> No, pool is isolated <input type="checkbox"/> Yes, pool is connected to: (check ALL that apply) <input type="checkbox"/> stream <input type="checkbox"/> ditch <input type="checkbox"/> forested wetland <input type="checkbox"/> vernal pool					
If inlet/outlet is present, indicate type: <input type="checkbox"/> permanent <input type="checkbox"/> temporary <input type="checkbox"/> do not know <input type="checkbox"/> none					
3c) Surrounding Habitat (within 100 feet of pool) (check ALL that apply)					
<input type="checkbox"/> Upland Deciduous Forest <input type="checkbox"/> Lowland Deciduous Forest Disturbances: <input type="checkbox"/> Powerline right-of-way <input type="checkbox"/> Other: <input type="text"/>					
<input type="checkbox"/> Upland Coniferous Forest <input type="checkbox"/> Lowland Coniferous Forest <input type="checkbox"/> Agriculture <input type="checkbox"/> Light development (<25%) <input type="checkbox"/> No disturbances					
<input type="checkbox"/> Upland Mixed Forest <input type="checkbox"/> Lowland Mixed Forest <input type="checkbox"/> Road/driveway <input type="checkbox"/> Intensive development (>25%)					
<input type="checkbox"/> Floodplain <input type="checkbox"/> Grassland or open <input type="checkbox"/> paved <input type="checkbox"/> Minor logging (> 70% canopy remaining)					
<input type="checkbox"/> Emergent Wetland (marsh, bog) <input type="checkbox"/> dirt/gravel <input type="checkbox"/> Major logging (< or = 70% canopy remaining)					
4a) Approximate Maximum Pool Depth					
<input type="checkbox"/> Ankle-deep (<6") <input type="checkbox"/> Hip-deep (2-3 ft)					
<input type="checkbox"/> Shin-deep (6-12") <input type="checkbox"/> Chest-deep (3-4 ft)					
<input type="checkbox"/> Knee-deep (12-24") <input type="checkbox"/> Deeper than 4 ft					
4b) Water Level at Time of Survey (check one)					
<input type="checkbox"/> Full/Nearly full 75-100% <input type="checkbox"/> Less than half 25-49%					
<input type="checkbox"/> Partially full 50-74% <input type="checkbox"/> Dry/mostly dry 0-24%					
4c) Water temperature (*F): <input type="text"/>					
4d) Approximate Size of Pool (at maximum capacity - at widest and longest points)					
Width: <input type="text"/> feet					
Length: <input type="text"/> feet					
Size determined by: <input type="checkbox"/> Pacing <input type="checkbox"/> Measuring <input type="checkbox"/> Using GPS					
4e) Substrate (when dry - check ALL that apply)					
<input type="checkbox"/> Leaf litter <input type="checkbox"/> Sand - Gravel <input type="checkbox"/> Unknown					
<input type="checkbox"/> Bedrock <input type="checkbox"/> Muck - Peat <input type="checkbox"/> Other: <input type="text"/>					
<input type="checkbox"/> Loam <input type="checkbox"/> Silt - Clay					

4f) Vegetation in Pool

Are trees (trees = or > 4" in diameter) present in the basin? (check one)

☐ No ☐ Yes, within pool basin ☐ Yes, but only at the edge# of trees only within the pool basin? live and/or ☐ dead/snags

% Cover within the pool (check one):

Floating vegetation: ☐ 0% ☐ 1 to 9% ☐ 10 to 25% ☐ 26 to 50% ☐ >50%Emergent vegetation: ☐ 0% ☐ 1 to 9% ☐ 10 to 25% ☐ 26 to 50% ☐ >50%Shrubs: ☐ 0% ☐ 1 to 9% ☐ 10 to 25% ☐ 26 to 50% ☐ >50%Tree canopy over pool basin (when leaves are fully out): ☐ 0% ☐ 1 to 9% ☐ 10 to 25% ☐ 26 to 50% ☐ >50%**4g) Pool Disturbance** (in pool, immediately adjacent or along shore of pool - check all that apply)☐ Dumping - Refuse ☐ Filling ☐ Invasive Species Present☐ Ditching - Draining ☐ Sediment ☐ Purple loosestrife ☐ Garlic mustard☐ Agricultural runoff ☐ Vehicle ruts ☐ Reed canary grass ☐ Other: ☐ Cultivation - Livestock ☐ Presence of rock pile or other anthropogenic disturbance ☐ No disturbances**4h) Cover** (Any material in the pool that can provide egg attachment sites and offer concealment to adults and/or larvae; check all that apply):☐ Shrubs☐ Submergent vegetation☐ Branches, twigs☐ Logs or large woody debris☐ Sphagnum moss☐ Emergent vegetation (grasses, cattails)☐ Algae☐ Other: ☐ Leaf litter**5) Indicator Species and Additional Species** (if other species are observed please list below in blank fields under Fingernail Clams)Provide a photograph of each indicator species (adults, juveniles/larvae, or egg masses) observed. **Photos of species observed are required.**

Species Observed	Adults	Tadpoles/Larvae	Egg Masses		Photo? Yes	Notes/Photo ID#
			Number	Estimated	Counted	
Wood Frog	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Spotted Salamander	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Blue-spotted Salamander	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fairy Shrimp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fingernail Clams	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Were any of the following observed? (check **ALL** that apply)☐ Fish: (indicate all lengths observed) ☐ ≤ 3" ☐ > 3"☐ Green frogs: ☐ tadpoles ☐ adults☐ Bullfrogs: ☐ tadpoles ☐ adults☐ Other: **Comments:****Draw diagram of pool** (include landmarks, location of indicated species, north arrow and area surveyed if entire pool was not surveyed):

Photo-documenting



Photodocument:

- Vernal pool – from outside
- Surrounding habitat - in all four directions from outside pool
- Indicator species
- Rare species, if observed

Label Photos:

- Pool ID #
- Study area name
- Date including year
- Visit #
- Your name
- What the picture documents



Labeling Photo Files

- Create and name folder for photos for each vernal pool visited using:
 - Pool ID #, observer's last name, the year, and name of study area/rec area/forest area
 - MNFI1-228_Lee_2014_NLP_Atlanta
- Please label computer images/photos of vernal pool, indicator species, or other species using:
 - Pool ID #, subject of photo, visit #
 - MNFI1-228_Wood Frog egg mass_Visit 1
 - MNFI1-228_looking north toward pool_Visit 2



Sensitive Habitats / Creatures

Empty buckets gently

Water is dense, critters
are delicate



Sensitive Creatures

- Amphibians & insects – good environmental indicators
- “Breathe” through their skin
- Minimize handling / only if necessary
- Be careful about what comes in contact with their skin
– no lotion, insect repellent, etc.
- Disease – Chytridiomycosis – caused by chytrid fungus, *Batrachochytrium dendrobatidis* (Bd)

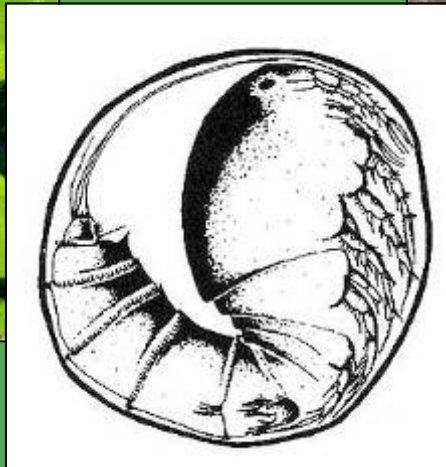
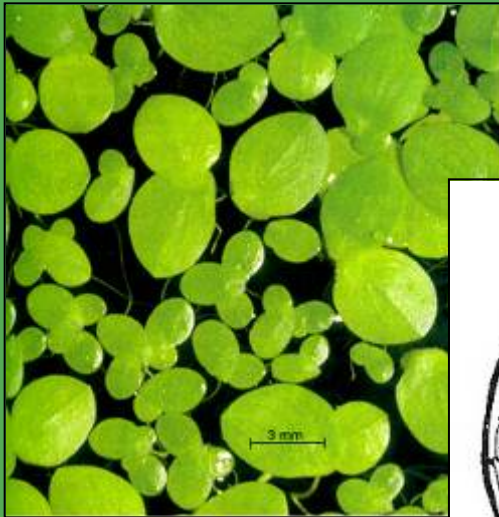


Michigan Natural Features Inv

Disinfect Equipment

Everything that touched the water should be disinfected.

Use 1 cup of bleach to 2 gallons of water to a 3% bleach disinfecting solution



*Eggs & cysts travel
on boot soles and*

← duckweed →



Questions?



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New Vernal Pools

- If you encounter a new vernal pool in the field that was not mapped as a PVP, please map and survey as well, if possible.
- Assign VP ID #
 - Add A, B, C, etc. to closest PVP Pool ID#
 - MNFI1-228 – MNFI1-228A, MNFI1-228B,
- Map location of VP on map/using GPS
- Follow protocol and fill out form

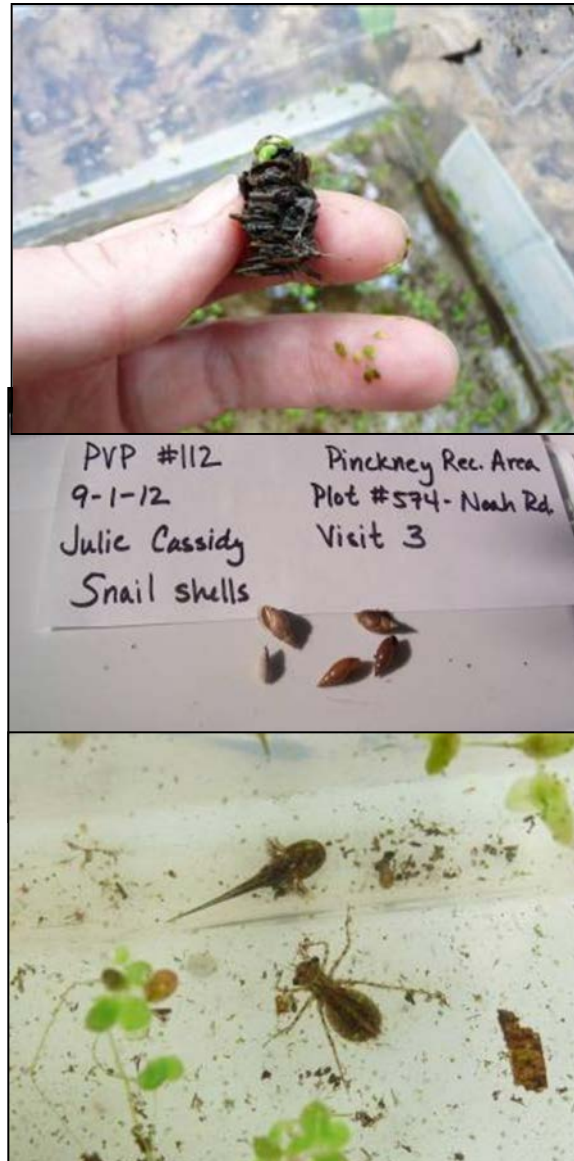
Amphibians & Reptiles Recorded



- Blue spotted salamander
 - Bullfrog
 - Chorus frog
 - Green frog
 - Leopard frog
- Spotted salamander
 - Spring peeper
- Wood frog (MANY!)
 - Blanding's turtle
 - Garter snake
- Northern water snake
 - Ribbon snake

Invertebrates Documented (28 groups)

- Amphipods
- Aquatic worms
- Backswimmer
- Caddisfly case
- Clam shrimp
- Cocapod
- Crayfish
- Damselfly
- Daphnia with eggs
- Dragonfly
- Fairy shrimp
- Fingernail Clams
- Fly larvae
- Freshwater snails
- Isopods



- Leech
- Mayfly
- Midge larvae
- Millipede
- Mosquito larvae
- Ostracod
- Slug
- Springtails
- Water beetles
- Water fleas
- Water mite
- Water striders
- Wolf spider