NOAA Teacher at Sea Program
Lesson Plan
Angela Greene
Northern Right Whale Survey

Activity Title: "Tecumseh Middle School Pond Day- Adding Clarity to a Turbid Myth"

Subject (Focus/Topic): This lesson was designed for a general science class, and could also be used in an ecology class.

Grade Level: This lesson was designed for middle school aged students, specifically grade eight, but could also be adapted for lower grades. In Ohio, the state assessment is given in grade eight. The standards for this lesson can be found in the grade band sixth through eighth grade.

Average Learning Time: This lesson will encompass five class periods. Day one and two will be used to form teams, and to train students to use equipment and become familiar with the current perception of the pond and data collection procedures. Day three will be spent completing the fieldwork. Day four will be used to compile the data and debrief the findings. Day five students will write a news article for school alumni reporting the health of the pond as it compares to similar data from a Great Lake or Ocean. I hesitate to call this a lesson when it is more of a lesson event. Teachers have the flexibility to adjust the time scale and the teams to meet the needs of their own learning situations and opportunities.

Lesson Summary (Overview/Purpose): The students will collect limnological and ecological data in a pond ecosystem to determine the overall health of the pond, and add their data to larger sets of data, allowing them to compare a pond to a Great Lake or an ocean.

Overall Concept (Big Idea/Essential Question): The main question the students will explore- "Is the pond on our school campus as toxic as school legend would lead us to believe?" The students will collect limnological and ecological data to try to debunk the myth that our campus pond is a toxic, dead body of water.

Specific Concepts (Key Concepts):

* data collection
* field limnology, ecology, and biology
* using "cues" to collect data that does not directly present itself (a must for any marine mammal biologist)
* stewardship and an awareness of our responsibility to water

Focus Questions (Specific Questions):

* "The Limnologic Team"- What data can be acquired from our rowboat while using the EPA's HydroLab on loan for two weeks from the LimnoLoan program?
* "The Shoreline Sampling Team"- What data can be acquired from the shoreline using pH papers, thermometers, and D-nets; and how does this data compare with the data collected from the HydroLab?
* "The Litter Survey Team"- What specific types of beach litter can be found on the shores of the pond and how does this data compare to the data released from the International Coastal Clean Up compiled by the Ocean Conservancy?
* "The Micro-Habitat Team"- What soil types, ground cover, topography, weather conditions, and biodiversity exist in the area around the pond and how do these factors affect the health of the pond?
* "The Leaf Snap Team"- Which species of trees surround our pond ecosystem, and does a particular species seem to dominate others?

* "The Wildlife Survey Team"- What wildlife can be noted around the pond ecosystem using cues as well as visual sightings?

Objectives/Learning Goals:

* The students will use a HydroLab probe to collect limnological data from the school pond performing one or two successful probe deployments per class period as evidenced by the collection of *reasonable* data recorded from the handheld computer. (Students are learning to correctly deploy a probe.)

* The students will use various pieces of equipment to collect ecological data from the area around the school pond as evidenced by the collection of *reasonable* data recorded on data pages provided for each team.

* The students will add their limnological data to a larger data set housed by the EPA making comparisons between pond data, Great Lake data, and ocean data as evidenced by participation in a data analysis discussion. (Completion of this goal is dependent on the EPA's data site.)

* The students will use data collected in and around a pond to develop a level of understanding of water quality data parameters, and use this understanding to interpret the health of the pond ecosystem. This goal will be measure by a "Statement of Health" based on data.

Background Information: This lesson or "lesson event" was created as a result of my time as a NOAA Teacher at Sea aboard the *Gordon Gunter*. My mission was to survey the Northern Right Whale population in the North Atlantic Ocean. I was fascinated by the "cues" presented by the ocean and the whales themselves that scientist look for in order to locate any marine mammal. The idea of using cues served as my inspiration as did the opportunity to borrow the HydroLab from the EPA through its "Limno-Loan" program.

In this financially difficult time in education it is important to figure out a way to use what we have. In my school district, field trips have been eliminated due to budget cuts, but my school is situated on a naturally beautiful campus complete with a pond and a forested land lab. I developed "Pond Day" to take advantage of these natural resources. This lesson could easily be duplicated in a variety of school campus settings simply by adjusting the six tasks to match any given ecosystem.

If a school is fortunate enough to have a pond, lake or even a creek on campus, it would be beneficial for the teacher to contact the Environmental Protection Agency and ask to be part of the "Limno Loan" program. This is an education and outreach opportunity provided by the EPA that allows classroom teachers to borrow a Hydrolab data sonde for a two-week period of time. The Hydrolab is a large piece of equipment that houses several probes used for aquatic data collection. The Hydrolab is very easy to deploy in any body of water, and the students can easily record data from a small hand-held computer. The Hydrolab container also provides the teacher with a Secchi disk to assess water clarity. The EPA ships the Hydrolab free of charge to the school and provides a free shipping label when it is ready to be returned. This program is an excellent opportunity for classroom teachers and their students. My district has an old rowboat used by the maintenance department that we were able to borrow and use for Hydrolab deployment.

I created six teams to collect limnological and ecological data. After detailing the jobs of each team, I allowed students to choose the team or task that best suited their interests. This worked well for me, but teachers could choose to assign students to specific teams. I created a specific task sheet for each team so that students clearly understood their task during their time spent in the field collecting data.

The six data collection teams and their specific tasks are outlined in the "Focus Questions" section of this lesson plan. In the Lesson Procedure section is a suggested timeline for this event. The teacher may adjust the timetable depending on how much time is needed to train students to use the various pieces of equipment. I encourage teachers to customize each team to fit individual situations and add various data collection parameters based on the equipment available. The idea is to have students collecting data, adding it to larger data sets where possible, and starting an historical data collection on their own campus.

Common Misconceptions/Preconceptions: Day two of this event budgets time for students to hypothesize through journaling about things they may discover while doing their field work. My students did not believe they would find beach litter on a school campus pond. They failed to realize that the pond is in close proximity to the football stadium where many concession stand food items are sold. The beach litter topic alone generated so much "after discussion" and eventually led to the incorporation of a beach litter activity to be published by Ohio Sea Grant in the near future. (Contact me directly if this is a resource needed.)

Materials: The materials needed for each team are listed on the individual lab sheets in the upper right hand corner so that students know what needs to be taken to the field site. (Included in Additional Resources) The following table is a complete listing of materials for each team. I recommend having students prepare buckets for equipment to be transported to the site. Teachers are encouraged to amend the materials list to fit their ecosystem needs.

Limnologic Water shoes recommended	**Shoreline Sampling Team** Water shoes recommended	**Litter Survey Team**	**Micro Habitat Team**	**Leaf Snap Team**	**Wildlife Survey Team**
* Hydrolab Data Sonde or any available probes to collect water quality data * hand held surveryor computer * Secchi disk * row boat or floatation device for Hydrolab deployment * clipboards with lab sheets * pencils	* pH paper and scale chart * pH ranges tolerable for aquatic life * thermometer * plankton net * D nets * marker * tape * sampling jars * scoop cup * macro invertebrate i.d. sheets (Additional Resources)	* clip board with lab sheet * pencil * rubber gloves * trash bags for last period of the day (removes beach litter)	* wire hanger stretch into a circle to define the survey area * thermometer * metal spoon for soil survey or soil sampling device * collection jar for soil sample * clip board with lab sheet * pencil	* tape measure * scissors * colored pencils * Leaf Resource Page (Additional Resources) * iPad with Leafsnap app * white background board for Leafsnap app (white printer paper works fine) *clip board with lab sheet * pencil	* hand held lenses * binoculars * clip board with lab sheet * pencils

Technical Requirements: In the Background Information section of this lesson plan, I strongly suggest participation in the EPA's "Limno Loan" program. (Contact information available in Additional Resources) If this is not possible, access to any number of Vernier Probes would enable students to collect some limnological data. IPad technology will add value to the work being done by the Leafsnap and the Wildlife Survey teams. Once again, I strongly encourage teachers to customize this lesson event to fit the available ecosystem and equipment in their own teaching situation.

Teacher Preparation: Teachers need to be familiar with the Hydrolab probe by scanning the teacher friendly directions included in the kit. Teachers need to be familiar with the "Leafsnap app" which very simply allows tree identification from a photograph of a leaf sample. I would also like to take this opportunity to encourage teachers to intentionally seek out opportunities that allow study on large bodies of water to increase teacher skills on water quality, measurement and management. The NOAA Teacher at Sea Program is an excellent opportunity for teachers to witness firsthand the work being done by scientists on world oceans. If a teacher is employed in the Great Lakes basin, I would also strongly recommend applying for an opportunity to spend a week on the EPA's *RV Lake Guardian*. In this program the vessel conducts research on one Great Lake per summer. The EPA hosts a one-week workshop

bringing teachers on board to work alongside scientists as they conduct various studies on the Great Lakes. Completion of this workshop will give teachers an invitation to be a part of the "Limno-loan" program. A blog link for this opportunity is listed in Additional Resources.

Keywords: biologic diversity, limnology, biologic cues, bioindicators, biotic and abiotic factors

Lesson Procedure:

Day One (Anticipatory Set): The Hydrolab arrives from the EPA and serves as the engaging hook that captures students' attention. Spend time unpacking the Hydrolab and figuring out its capabilities with students. The pond on my campus also has an historical reputation of being a very dirty and dead body of water. I was able to hook students by asking them to challenge the myth and discover the truth about the pond. The teacher reveals the titles of the six data collection teams giving the students the opportunity to think about which team sounds most interesting to them.

Day Two: The teacher maps the six teams out on the board listing specific data collection tasks and briefs students on the use of any equipment associated with the tasks. This day can be extended depending upon student knowledge of equipment. Students join teams and have brief team meetings to discuss specific jobs that will need to be done in the field. Students can journal thoughts and ideas about what they believe will be discovered. For example, the Litter Survey Team should hypothesize types of litter they may find. (This was an eye opener for my students.)

Day Three: "Pond Day"

Limnologic Team Water shoes recommended	**Shoreline Sampling Team** Water shoes recommended	**Litter Survey Team**	**Micro Habitat Team**	**Leaf Snap Team**	**Wildlife Survey Team**
* launch row boat from north end of pond to site one * record data that is sent to shore from the HydroLab probe (deployed by an adult) * record Secchi depth data * help manuver row boat to collection site two * record data that is sent to shore from the HydroLab probe (deployed by an adult) * record Secchi depth data * dock row boat to north end of pond	* aquire water samples from south, north, east and west sides of pond * use pH paper to test the pH of each water sample * use thermometer to determine water temperature of each sample * toss plankton net horizontally across surface of pond to acquire a plankton sample to survey for microorganisms in lab. * use D nets to acquire macro invertebrate samples from benthos layer.	* starting at north end of the pond, survey beach litter by recording litter by location on map provided. * organize litter into a chart by type and quantity. * create a histogram of beach litter survey *add comparison data to histogram using the Ocean Conservancy's International Coastal Clean Up data for the current year.	* select land plot for survey * describe land plot location * survey *biotic factors* starting with macro invertebrates, followed by plant life, and fungi * survey *abiotic factors* in land plot including light exposure, moisture condition, weather, drainage, topography, soil temperature. * using soil sampling tool, acquire a soil sample to bring back to the lab for analysis and comparison.	* select one tree species per team member * photograph tree with iPad *aquire leaf sample from tree (not from ground cover) * use white background board for photo of leaf * use Leafsnap app on iPad to identify tree * complete data collection requirements from lab sheet on this specific tree. ***NOTE The idea here is to informally determine the presence of the invasive*	* gather evidence that supports the assumption that our pond ecosystem has a rich *biological diversity* * walk the perimeter of the pond three times noting wildlife sightings, or *biologic cues* provided by wildlife * photograph sightings and cues when possible with the your iPad * offer an identification hypothesis for each sighting and cue provided by the ecosystem

	(used as *bioindicators*) * identify macro invertebrates on site			*honeysuckle in this ecosystem.*	

Day Four: Each team will need a class period to meet to organize data and discuss findings. Each team will prepare a "Statement of Health" based on their specific findings. These statements will be combined to create a report for the community and alumni newsletter prepared by the district. Teams should focus on finding answers to the following focus questions. Internet access is assumed.

* "The Limnologic Team"- What data can be acquired from our rowboat while using the EPA's HydroLab on loan for two weeks from the LimnoLoan program? How does this data compare to data from Lake Erie. (Select closest large body of water.) (Additional Resources contains examples of published data sets.) It is recommended to select pieces of data to compare based on the ability level of students. It is perfectly acceptable to simply compare water pH, average temperature, depth, clarity, and dissolved oxygen levels. It is my personal intention to add data parameters each year as I become familiar with collection methods and interpretations.

* "The Shoreline Sampling Team"- What data can be acquired from the shoreline using pH papers, thermometers, and D-nets; and how does this data compare with the data collected from the HydroLab?

* "The Litter Survey Team"- What specific types of beach litter can be found on the shores of the pond and how does this data compare to the data released from the International Coastal Clean Up compiled by the Ocean Conservancy? (2013 International Coastal Cleanup available in Additional Resources.)

* "The Micro-Habitat Team"- What soil types, ground cover, topography, weather conditions, and biodiversity exist in the area around the pond and how do these factors affect the health of the pond?

* "The Leaf Snap Team"- Which species of trees surround our pond ecosystem, and does a particular species seem to dominate others?

* "The Wildlife Survey Team"- What wildlife can be noted around the pond ecosystem using cues as well as visual sightings?

Day Five (Assessment and Evaluation): Using a "jigsaw" procedure, organize students into writing groups. (A writing group contains one member from each of the original data collection teams.) Writing groups can assemble the six "Statements of Health" into one document that reports the health of the campus pond ecosystem and simply makes comparisons to a larger body of water. This assessment is an opportunity to work cooperatively with the Language Arts department to save time in the science classroom. Teachers need to consider the lesson objectives when reflecting on assessment.

* The students will use a HydroLab probe to collect limnological data from the school pond performing one or two successful probe deployments per class period as evidenced by the collection of *reasonable* data recorded from the handheld computer. (Students are learning to correctly deploy a probe.) (Remember that this only applies to the group of students that directly worked with the probe.)

* The students will use various pieces of equipment to collect ecological data from the area around the school pond as evidenced by the collection of *reasonable* data recorded on data pages provided for each team.

* The students will add their limnological data to a larger data set housed by the EPA making comparisons between pond data, Great Lake data, and ocean data as evidenced by participation in a data analysis discussion. (Completion of this goal is dependent on the EPA's data site. At the time of this writing the data warehouse was not yet available.)

* The students will use data collected in and around a pond to develop a level of understanding of water quality data parameters, and use this understanding to interpret the health of the pond ecosystem. This goal will be measure by a "Statement of Health" based on data.

Future Plans for the Lesson Event: I created this lesson event as a result of my time as a NOAA Teacher at Sea. I piloted the event on my school campus in late October 2013. Conducting this event has been a learning experience for me, and I have many future plans for improving the event. Through my "beginning of the school year" pre assessments, I learned that my students did not have an understanding of the water quality standards that were necessary for success on the state assessment at the end of the year. I began the year studying a GEMS activity call "Environmental Detectives" (Additional Resources) I believe in doing so, my students were ready to handle the challenges of assessing the health of an ecosystem. I intended to modify the GEMS unit to make it more applicable to my local area, but found it to be very valuable.

I am also waiting on the EPA to publish a site that houses data from around the country of other classes that borrow the Hydrolab. I intend to use this data prior to the arrival of the Hydrolab as an anticipatory set, and to help students actively choose the data parameters for our study. This could also facilitate a partnership with a school in another area. Connecting with those students to discuss water-monitoring events could easily be achieved via Skype or Facetime.

I also intend to save data from our pond year after year to build an historical record for future students to use.

My students would like to replicate "Pond Day" in the spring, and invite one of our elementary school classrooms. My eight graders want to teach the younger students about ecosystem health.

I can't stress enough how I wish for this lesson to serve as model to other schools. The ecosystem, the teams, the equipment and the method of assessment may not be exactly the same, but the model of "bio-blitzing" an area translates.

In December of 2013 I secured grant funds to purchase additional equipment for "Pond Day".

Alignment:

Next Generation Science Standards:

Life Science Middle School (6-8)

Interdependent Relationships in Ecosystem

Disciplinary Core Idea: Ecosystem Dynamics, Functioning, and Resilience: Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

Ocean Literacy Principles: (version 2 March 2013)

Principle Five- The ocean supports a great diversity of life and ecosystems.

C. Most of the major groups that exist on Earth are found exclusively in the ocean and the diversity of major groups of organisms is much greater in the ocean than on land.

F. Ocean ecosystems are defined by environmental factors and the community of organisms living there. Ocean life is not evenly distributed through time and space due to differences in abiotic factors such as oxygen, salinity, temperature, pH, light, nutrients, pressure, substrate and circulation. A few regions of the ocean support the most abundant life on Earth, while most of the ocean does not support much life.

Principle Six- The ocean and humans are inextricably interconnected.

E. Changes in ocean temperature and pH due to human activities can affect the survival of some organisms and impact the biological diversity.

G. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Ohio Revised Science Standards and Model Curriculum:

Grade 6

Earth and Space Science

Topic: Rocks, Minerals, and Soil

Content Statement: Soil is unconsolidated material that contains nutrient matter and weathered rock.

Science Inquiry and Application

- Use appropriate mathematics, tools and techniques to gather data and information
- Analyze and interpret data
- Think critically and logically to connect evidence and explanations
- Communicate scientific procedures and explanations

Grade 7

Life Science

Topic : Cycles of Matter and Flow of Energy

Content Statement: In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.

Science Inquiry and Application

- Use appropriate mathematics, tools and techniques to gather data and information
- Analyze and interpret data
- Think critically and logically to connect evidence and explanations
- Communicate scientific procedures and explanations

Grade 8

Science Inquiry and Application

- Use appropriate mathematics, tools and techniques to gather data and information
- Analyze and interpret data
- Think critically and logically to connect evidence and explanations;
- Communicate scientific procedures and explanations.

Great Lakes Literacy Principles:

Principle Four- Water makes Earth habitable; fresh water sustains life on land.

A. Fresh water has unique properties. Its density and electrical conductivity (a measure of salinity) are lower than that of salt water.

Principle Five- The Great Lakes supports a broad diversity of life and ecosystems.

C. The Great Lakes watershed supports organisms from every kingdom on Earth.

E. The Great Lakes ecosystem provides habitat for terrestrial and aquatic species. The Great Lakes are three-dimensional, offering vast living space and diverse habitats from the shoreline and surface down through the water column to the lake floor.

F. Great Lakes habitats are defined by environmental factors. As a result of interactions involving abiotic factors, such as temperature, clarity, depth, oxygen, pH, light, nutrients, pressure, substrate type, and circulation, life in the Great Lakes is not evenly distributed temporally or spatially. Abiotic factors within the Great Lakes can change daily, seasonally, or annually because of natural and human influences.

I. Life cycles, behaviors, habitats, and the abundance of organisms in the Great Lakes have been altered by intentional and unintentional introduction of non-native plant and animal species.

Principle Seven- Much remains to be learned about the Great Lakes.

A. Exploration and understanding of Great Lakes interaction and links among diverse ecosystems and people are ongoing. Such exploration offers great opportunities for inquiry and investigation.

B. Understanding the Great Lakes is more than a matter of curiosity. Exploration, inquiry, and monitoring promote better understanding and protection of Great Lake ecosystems, resources and processes.

D. New technologies and methods of observation are expanding our ability to explore the Great Lakes. Fresh water scientists rely on such tools to monitor conditions in the Great Lakes and provide information to policy makers and leaders in coastal communities.

Lake Erie Literacy Principles:

Principle Four- Water makes Earth habitable; fresh water sustains life on land.

A. Fresh water has unique properties. Its density and electrical conductivity (a measure of salinity) are lower than that of salt water.

Principle Five- Lake Erie supports a broad diversity of life and ecosystems.

C. Lake Erie's watershed supports organisms from all taxonomic kingdoms.

E. The Lake Erie ecosystem provides habitat for terrestrial and aquatic species. Lake Erie is multidimensional, offering vast living space and diverse habitats from the atmosphere to the shore, to the water surface and down through the water column into the lake bottom.

F. Lake Erie habitats are defined by environmental factors. As a result of interactions involving abiotic factors, such as temperature, clarity, depth, oxygen, pH, light, nutrients, pressure, substrate type, and circulation, life in the lake is not evenly distributed temporally or spatially. Abiotic factors within Lake Erie can change daily, seasonally, or annually because of natural and human influences.

I. Life cycles, behaviors, habitats, and the abundance of organisms in Lake Erie ang its watershed have been altered by intentional and unintentional introduction of non-native organisms. Non-native species may have positive or negative impacts on the lake and its watershed.

Principle Seven- Much remains to be learned about Lake Erie.

A. Exploration and study of Lake Erie and its watershed are ongoing. Such exploration increases understanding of the role people play within the ecosystem.

B. Understanding Lake Erie is more than a matter of curiosity. Exploration, inquiry, and monitoring promote better understanding and protection of Lake Erie ecosystems, resources and processes.

D. New technologies and methods of observation are expanding our ability to explore Lake Erie. Fresh water scientists rely on such tools to monitor conditions in the Great Lakes and provide information to policy makers and leaders in coastal communities.

Additional Resources:

Attachment Page 1- Limnologic Team Data Sheet

Attachment Page 2- Shoreline Sampling Team Data Sheet

Attachment Page 3- Litter Survey Team Data Sheet
Attachment Page 4- Micro Habitat Team Data Sheet
Attachment Page 5- Leafsnap Team Data Sheet
Attachment Page 6- Leafsnap Team Resource Page
Attachment Page 7- Wildlife Survey Team Data Sheet
"Limno-loan" Program Contact Information: Kristin TePas- Illinois Indiana Sea Grant http://www.iisgcp.org/staff/tepas.html
Macro Invertebrate Identification Resource (Roaring Fork Conservancy) http://www.roaringfork.org/images/other/aquaticinvertebratesheet.pdf
Environmental Detectives GEMS- http://www.lhsgems.org/GEMSenvdet.html
EPA's RV Lake Guardian opportunity- http://coseegreatlakes.net/news/20100706
Example of Water Quality Data Site organized by Ohio Counties (USGS)- http://waterdata.usgs.gov/oh/nwis/current/?type=quality&group_key=county_cd
The Ocean Conservancy's International Coastal Cleanup 2013 Report- http://www.oceanconservancy.org/our-work/international-coastal-cleanup/

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Creation Date: August 2013- October 2013

Photo Collage from My "Pond Day" Event (see below)


Pond Day at TMS

Team: Limnologic Team
Location: Launch from north end of Pond
Date:

Pond Survey

Name:
Period:
Equipment: Lab sheet, clipboard, pencil, Hydrolab data sond, Surveyor computer, boat

Water Quality Testing

Testing Date: **Water Depth at Test Site**

Test Site	Tecumseh Pond	Tecumseh Pond
Location		
Water Flow		
Weather		
pH		
Lat/Long		
Temperature		
Depth Reading/Bottom		
Pressure		
Conductivity		
Chlorophyll		
Turbidity %		
Turbidity NTU		
LDO%		
DO mg/L		
Clarity (Secchi) m		

Weather Last 7 Days

Dates:

Acquire a summary from each team for EPA Reporting

Shoreline Summary:

Wildlife Summary:

Beach Litter Summary:

Leaf Snap Summary:

Microhabitat Summary:

Team: Shoreline Sampling Team
Location: NSEW of Pond
Date:

Pond Survey

Name:
Period:
Equipment: Lab sheet, clipboard, pencil, pH paper & scale, plankton nets, dip net, thermometer, marker, tape, sampling jars, scoop cup, macro invertebrate id sheet.

Note: Members of this team need to work cooperatively so the equipment can be shared.

Task One: Checking the pH and Temperature of the Tecumseh Pond

Check the pH and temperature of the pond in four different locations. Use the scoop cup to get water sample. Use pH paper and a scale to determine the pH. Use thermometer to determine temperature. Describe the location of your test site. Parking lot=south, Land lab=north, middle school=west, high school= east.

Site #	Site location description	pH of site (ok for fish, too acidic, too basic)	Temperature of site
1			
2			
3			
4			

Task Two: Acquiring Plankton Samples from the Tecumseh Pond

Your group needs one good plankton sample from one site of the pond. Using the plankton net, carefully toss the net into the pond. Make sure you hold onto the rope so the net is not lost in the pond. Drag the plankton net slowly to the shore horizontal with the water. This is called a plankton tow. Your plankton sample will be collected in the tube. Dump sample into a collection jar. Label the jar with masking tape and a marker.
"Plankton Sample from Period ____"
Make sure your plankton sample is returned to the lab.

Task Three: Surveying Macro-Invertebrates from the Tecumseh Pond

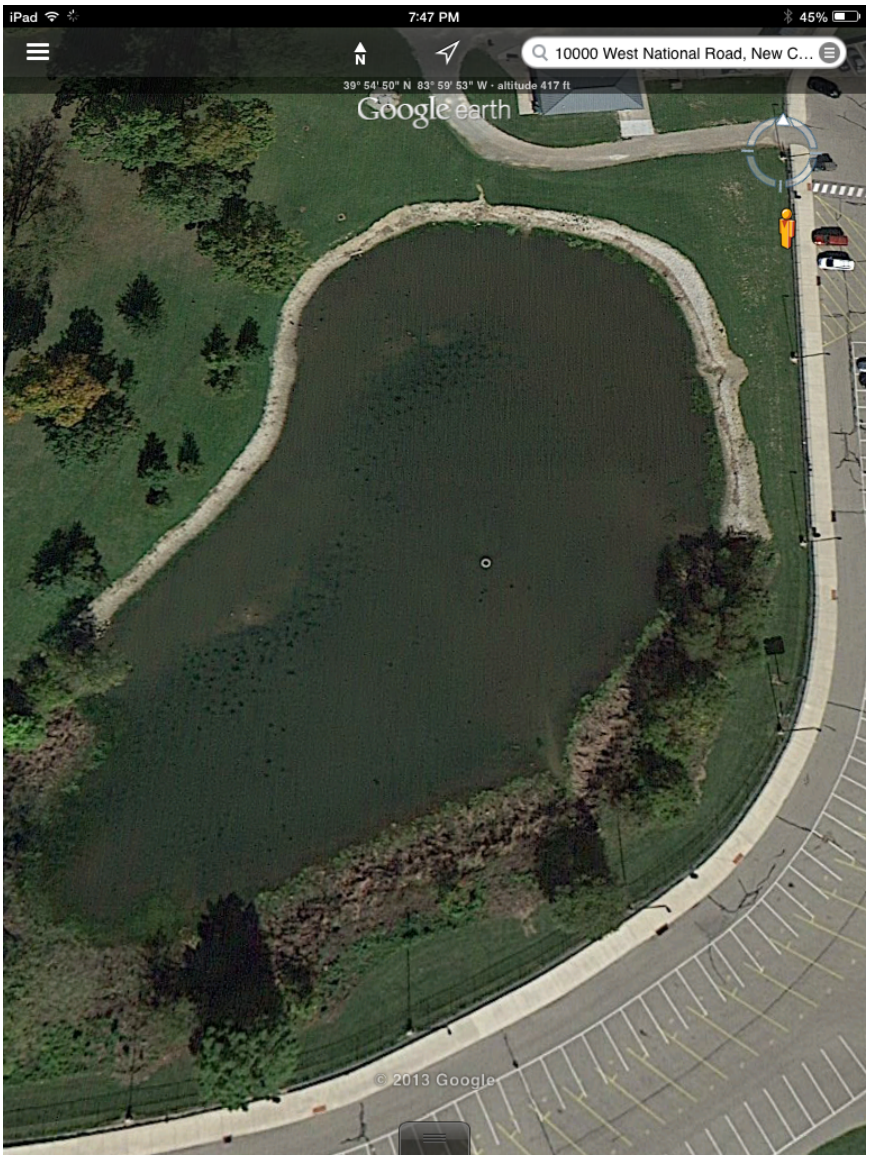
Using the dip net, jiggle the benthos layer of the pond edge to stir up the macro-invertebrates in the pond. Sort any invertebrates into the water-filled sorting pan. Use the macro-invertebrate I. D. sheet to identify any macros you find. List them here.

Team: Beach Litter
Location: NSEW of Pond
Date:

Pond Survey

Name:
Period:
Equipment: Lab sheet, clipboard, pencil, (trash bags for seventh period)

This is an image of the Tecumseh Pond. Begin your journey at the north end of the pond and walk the shoreline. Put a small X on the map to indicate where you see a piece of beach litter. Next to the X, identify the litter. Do not remove the litter. (7th period will be collecting the litter in trash bags.)

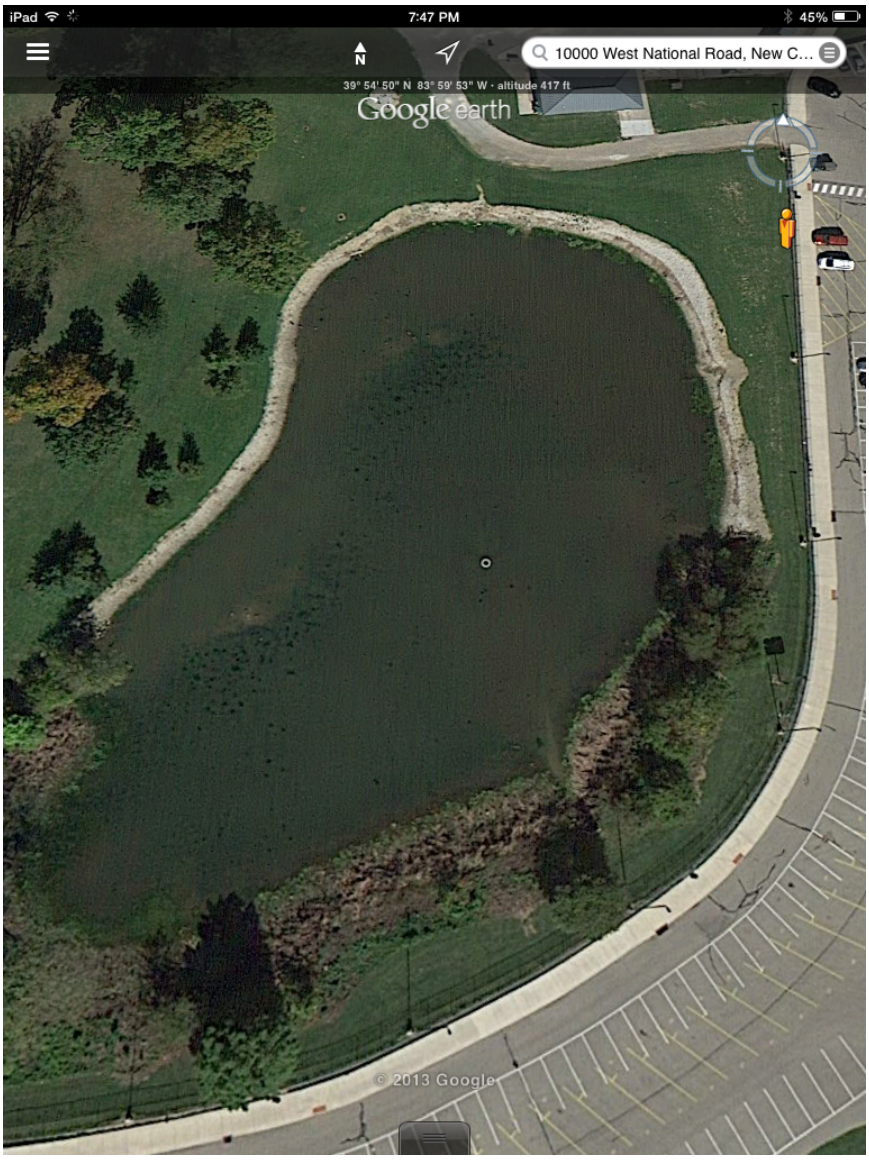


Team: Beach Litter
Location: NSEW of Pond
Date:

Pond Survey

Name:
Period:
Equipment: Lab sheet, clipboard, pencil, (trash bags for seventh period)

This is an image of the Tecumseh Pond. Begin your journey at the north end of the pond and walk the shoreline. Put a small X on the map to indicate where you see a piece of beach litter. Next to the X, identify the litter. Do not remove the litter. (7th period will be collecting the litter in trash bags.)



Team: Leafsnap Team
Location: NSEW of Pond
Date:

Pond Survey

Name:
Period:
Equipment: Lab sheet, pencil, clipboard, tape measure, scissors, colored pencils, measuring tape, Resource Page, iPad with Leaf Snap app

1. Each Leaf snapper must obtain a different leaf by snipping the leaf at the base of its stem.

2. Carefully and accurately sketch your leaf below. Then, label the following parts (if applicable):
   - blade
   - midrib
   - veins
   - petiole

leaf sketch

3. Bag your leaf.

4. Use the Leaf Snappers' Resource Page to record specific information and observations about your leaf.

5. Once inside the classroom, carefully tape your leaf to the back side of this page.

6. Photograph the leaf (using a teacher iPad) via the Leaf Snap app.

7. Record the name and scientific name of the leaf/tree as given by Leaf Snap.

_____

Leaf Snapper Observations

1. Describe your leaf's original location in relation to the school and pond.

_____
_____
_____

2. Describe the tree/shrub from which your leaf came. Include details such as estimated height of the tree, circumference of trunk, color and texture of bark, and appearance of flowers or berries/fruits.

_____
_____
_____
_____

3. Leaf Type _____

4. If clustered, # per cluster _____

5. If broad, simple or compound? _____

6. If compound, pinnate or palmate? _____

6. If simple, lobed or not lobed? _____

7. Serrated or smooth edges/margins? _____

8. Leaf measurements (cm) _____ height (not petiole)
   _____ width (across widest point)

9. Describe your leaf using the information given above.

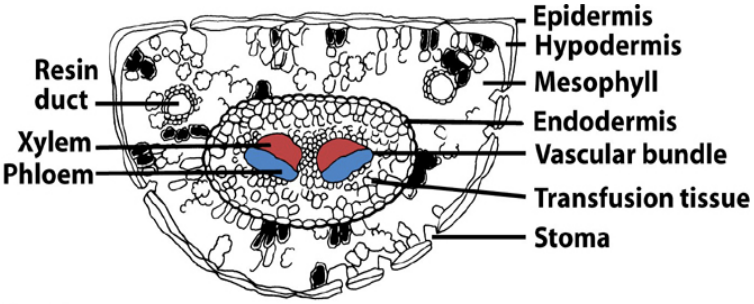
_____
_____
_____

Name _____ Period _____ Score _____

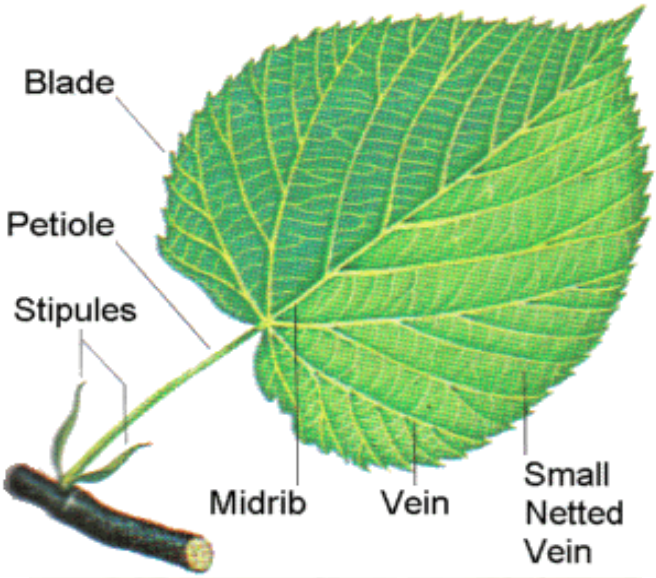
Leaf Snappers Resource Page

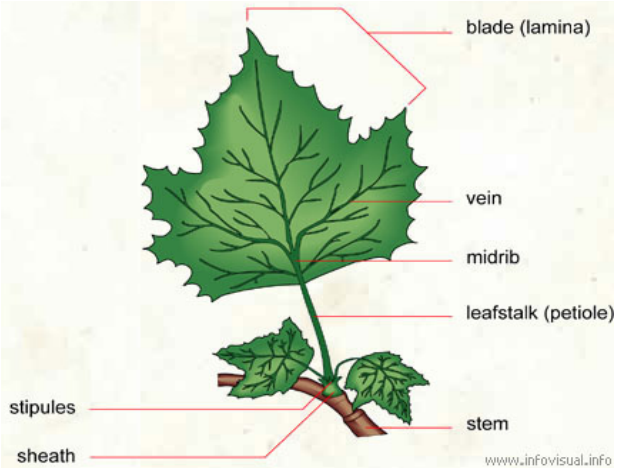
Task: Collect and identify various leaves from the Tecumseh Pond ecosystem

Cross-section of a Pine Needle



Structure of a Leaf





Leaf Types

Needles

clustered/bundled

individual needles

Scales

twig-like scales

spray-like scales

Broad

simple (lobed)

simple (not lobed)

compound (pinnate)

compound (palmate)

Flat

Team: Wildlife Survey Team
Location: NSEW of Pond
Date:

Pond Survey

Name:
Period:
Equipment: Lab sheet, pencil, clipboard, hand lens, binoculars

The Tecumseh Pond ecosystem is home to a diverse population of wildlife.

Task: As a member of the Wildlife Survey Team, your task is to locate and identify evidence that supports this statement. Complete the table and map the evidence by recording its number on the pond map. ** NOTE: Members of this team need to work cooperatively so equipment can be shared. **

Type of Evidence (sighting, sound, shelter, scat, feeding or trail activity)	**Describe/Sketch**	**Identification Hypothesis**
1.		
2.		
3.		
4.		
5.		
6.		

Tecumseh High School

Tecumseh Middle School

Choose one of the animals from your data table. Describe one biotic and one abiotic factor that affects the animals survival. _____

_____