Water Column

Spring 2015
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Soil Health = Water Health

~ Melissa Clark

Assessing and maintaining soil health is like taking your blood pressure when at the doctors for a checkup. How does this relate to lakes? Well, if you recall, lakes are a reflection of their watershed; you'll see that healthy soil contributes to healthy waters. Since 2015 is the International Year of Soils, I thought I'd highlight the value of not just healthy watersheds but look closer at the soil and how it connects with healthy lakes. Soil health or quality is "the capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality and promote plant and animal health" (Doran and Parkin 1994). Simply, it regulates the flow of water and partitions what is dissolved. Healthy soil will also filter and buffer materials that flow through it. This helps degrade, immobilize, and detoxify these compounds. This is all accomplished because the soil is healthy and alive, not just dirt.

Soil health is also very important to ponder when you consider the high proportion of stress we subject to our soils throughout Indiana. Over 60% of Indiana soils are either intensely farmed in row crop or grazed (Figure 1). Much of the other acreage is diligently and lovingly maintained around our homes.

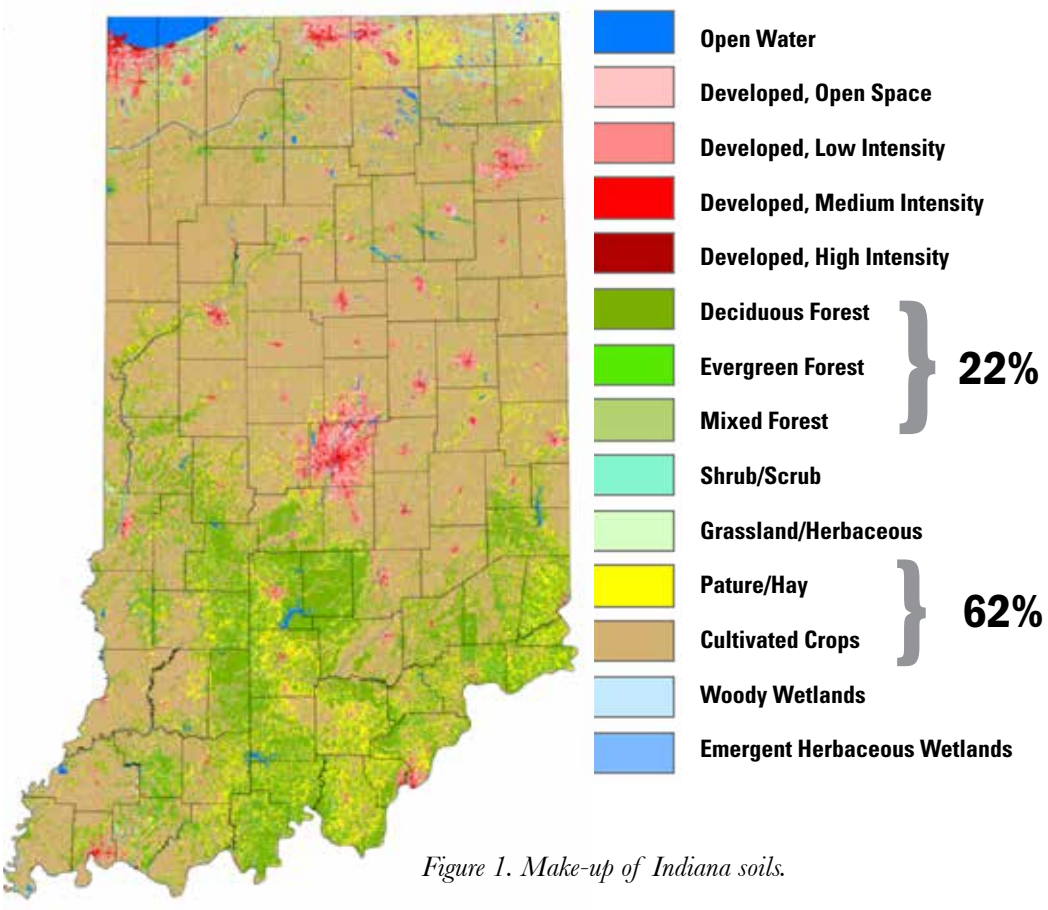

Figure 1. Make-up of Indiana soils.

Unfortunately, while those lawn fertilizers and chemicals create lush green lawns, they don't create healthy soils. Healthy lawns are based on the foundation of healthy soil, which is why we have some great programs to engage all land owners, from farmers to lakeside residents (Figure 2).

Promoting the 2015 International Year of Soils, the Food and Agricultural Organization of the United Nations offers the following information: What is a healthy soil?

Soil health has been defined as the capacity of soil to function as a living system. Healthy soils maintain a diverse community of soil organisms that help to control plant disease, insect and weed pests, form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive effects for soil water and nutrient holding capacity, and ultimately improve crop production (Figure 3). A healthy soil also contributes to mitigating climate change by maintaining or increasing its carbon content.

Figure 2. There are great programs to engage all land owners, from farmers to lakeside residents, including these.

1. *Soils help to combat and adapt to climate change by playing a key role in the carbon cycle*

Healthy soils provide the largest store of terrestrial carbon. When managed sustainably, soils can play an important role in climate change mitigation by storing carbon (carbon sequestration) and decreasing greenhouse gas emissions in the atmosphere. Conversely, if soils are managed poorly or cultivated through unsustainable agricultural practices, soil carbon can be released into the atmosphere in the form of carbon dioxide (CO_2), which can contribute to climate change. The steady conversion of grassland and forestland to cropland and grazing lands over the past several centuries has resulted in historic losses of soil carbon worldwide. However, by restoring degraded soils and adopting soil conservation practices, there is major potential to decrease the emission of greenhouse gases from agriculture, enhance carbon sequestration and build resilience to climate change.

2. *Soils are the foundation for vegetation that is cultivated or managed for feed, fiber, fuel, and medicinal products*

Healthy soils are crucial for ensuring the continued growth of natural and managed vegetation, providing feed, fiber, fuel, medicinal products, and other ecosystem services such as climate regulation and oxygen production. Soils and vegetation have a reciprocal relationship. Fertile soil encourages plant growth by providing plants with nutrients, acting as a water holding tank, and serving as the substrate to which plants anchor their roots. In return, vegetation, tree cover, and forests prevent soil degradation and desertification by stabilizing the soil, maintaining water and nutrient cycling, and reducing water and wind

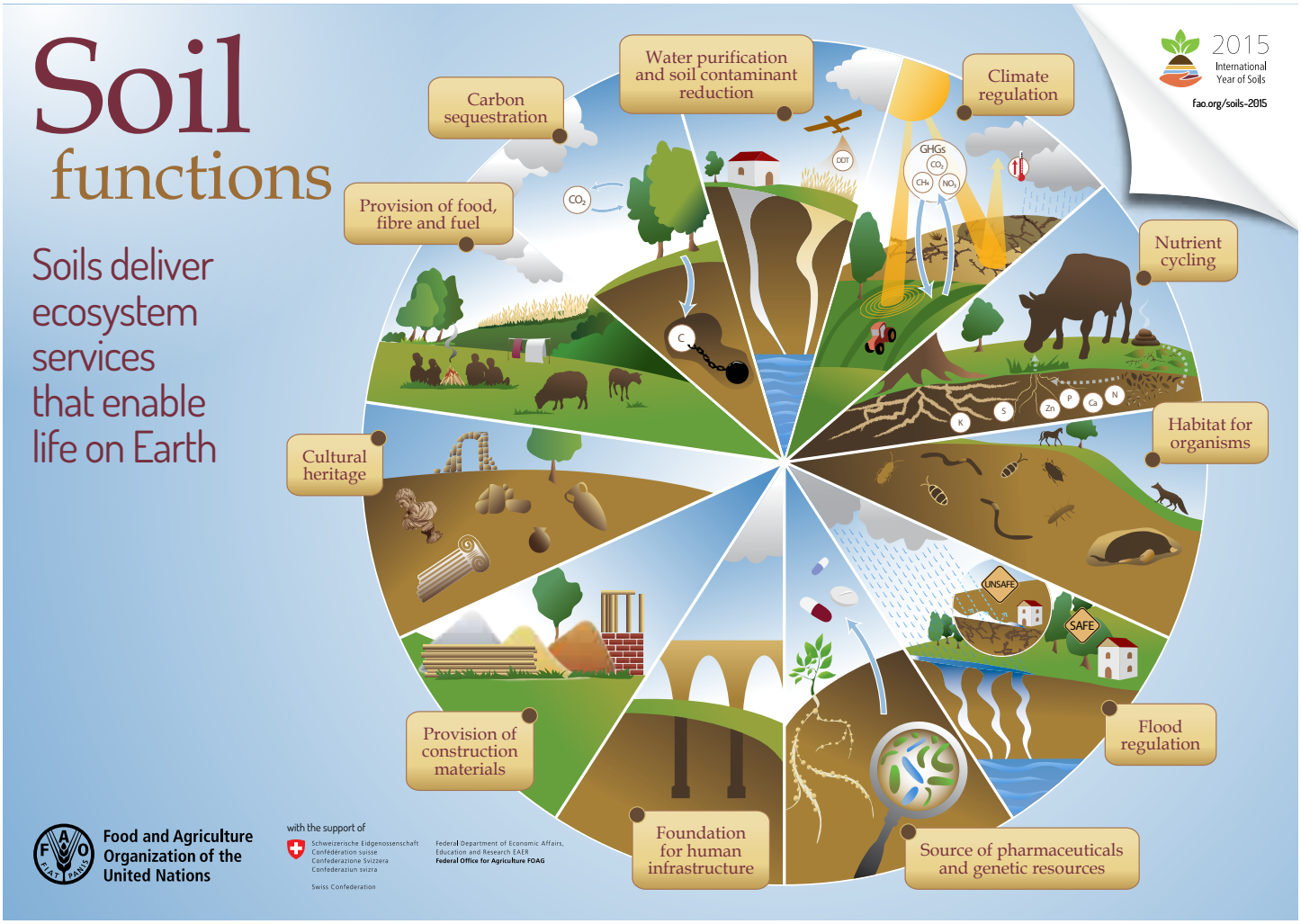

Figure 3. Healthy soil provides countless benefits.

erosion. As global economic growth and demographic shifts increase the demand for vegetation, animal feed and vegetation by products such as wood, soils are put under tremendous pressure and their risk of degradation increases greatly. Managing vegetation sustainably—whether in forests, pastures or grasslands—will boost its benefits, including timber, fodder and food, in a way meets society's needs while conserving and maintaining the soil for the benefit of present and future generations. The sustainable use of goods and services from vegetation and the development of agroforestry systems and crop-livestock systems also have the potential to contribute to poverty reduction, making the rural poor less vulnerable to the impacts of land degradation and desertification.

3. *Soils host a quarter of our planet's biodiversity*

Biological diversity or "biodiversity" is described as "the variability among living organisms from all sources, whether terrestrial, aquatic or marine." It includes the diversity within species (genetic diversity), between species (organism diversity), and of ecosystems (ecological diversity). Soil is one of nature's most complex ecosystems and one of the most diverse habitats on earth: It contains a myriad of different organisms, which interact and contribute to the global cycles that make all life possible (Figure 4). Nowhere in nature are species so densely packed as in soil communities; however, this biodiversity is little known as it is underground and largely invisible to the human eye.

4. *Healthy soils are the basis for healthy food production*

The most widely recognized function of soil is its support for food production. It is the foundation for agriculture and the medium in which nearly all food-producing plants grow. In fact, it is estimated that 95% of our food is directly or indirectly produced on our soils. Healthy soils supply the essential nutrients, water, oxygen, and root support that our food-producing plants need to grow and flourish. Soils also serve as a buffer to protect delicate plant roots from drastic fluctuations in temperature.

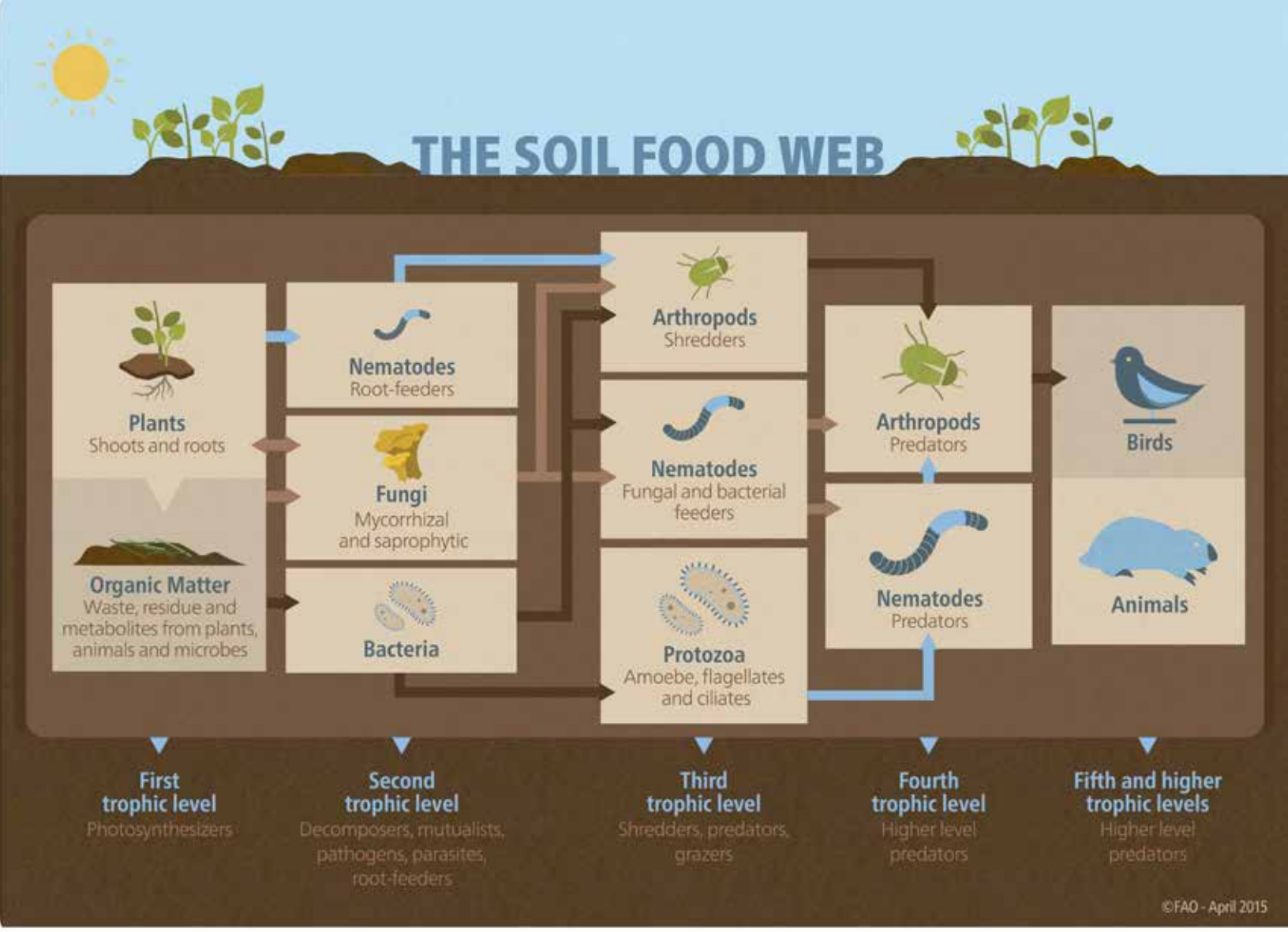

Figure 4. Soil is one of nature's most complex ecosystems and one of the most diverse habitats on earth.

5. Soil is a non-renewable resource. Its preservation is essential for food security and our sustainable future

Soil is a finite resource, meaning its loss and degradation is not recoverable within a human lifespan. As a core component of land resources, agricultural development and ecological sustainability, it is the basis for food, feed, fuel, and fiber production and for many critical ecosystem services. It is therefore a highly valuable natural resource, yet it is often overlooked. The natural area of productive soils is limited – it is under increasing pressure of intensification and competing uses for cropping, forestry, pasture/rangeland and urbanization, and to satisfy demands of the growing population for food and energy production and raw materials extraction. Soils need to be recognized and valued for their productive capacities as well as their contribution to food security and the maintenance of key ecosystem services.

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COVER CROPS

Cover crops are one of the fastest-growing agricultural Best Management Practices (BMPs), where Indiana is a leading state. Cover crops have the potential to provide multiple benefits in a cropping system (Figure 5). They prevent erosion, improve soil's physical and biological properties, supply nutrients, suppress weeds, improve the availability of soil water, and break pest cycles, along with various other benefits. The species of cover crop selected, along with its management determine the benefits and returns. As you can see from the cross-section, the continued plant growth maintains the soil health (Figure 6).

Figure 5. Cover crop services.

Figure 6. Cross-section of cover crop and soil You can choose colorful cover crops, such as bachelor's buttons and crimson clover.

Snapshot reminder of last summer's algal blooms in Lake Erie

Toledo's Water Crisis Starts with the Soil

~ Mark Smallwood (Rodale Institute)

Lake Erie was poisoned by chemical agriculture (see Figure 7). Naturally, the headlines are making people nervous about water supplies – and rightly so. However, what is not making the headlines is that this problem with our water actually starts with the soil.

Widespread use of synthetic fertilizers caused the chemical run-off into Lake Erie, cutting off the supply of drinking water to over 400,000 residents. The ban on drinking public water has been lifted – for now.

Toledo's problem could soon become an issue for the vast majority of Americans whose lives depend on public drinking water, however, if agriculture in the U.S continues to use synthetic chemicals. Clean drinking water will become scarce if chemical farming practices continue to leach excess nitrogen and phosphorous into the water.

Rodale Institute is one of the only organizations in the U.S. that conducts independent research on agricultural practices. As early as the 1940s, Rodale Institute founder J.I. Rodale noted that "Healthy Soil = Healthy Food = Healthy People." Current circumstances might have inspired him to also acknowledge that "Healthy Soil = Healthy Water = Healthy People."

Rodale Institute's Farming Systems Trial has over 30 years of research, comparing organic and conventional agriculture – including impact on water systems. The results clearly demonstrate the destructive impact that agricultural chemicals have on soil health and water.

Through growing organic and conventional, side by side, our trials showed that water volumes in soil were 15 to 20% higher in the organic systems than the conventional. In organic farming systems, healthy soil absorbs rain, recharging the groundwater supply and leaving the soil in the field – where it belongs. On farms where the soil microbiology has been poisoned with synthetic chemicals, the soil cannot hold the rainwater and so the result is chemical run-off and soil erosion, sending the agricultural pollutants running off the surface – into Lake Erie, for example – taking the contaminated soil with it.

Algae blooms like those in Lake Erie reveal nature's balancing act. For anyone in Toledo who dared to drink the water during the ban, they could expect vomiting and illness. Lake Erie is essentially responding in the same way to the agricultural run-off.

Chemicals on most farms are most easily moved throughout our ecosystem by water, and when the water picks these toxins up, they

Figure 7. Toxic algal bloom on Lake Erie during summer 2014.

spread easily. The algal blooms in Lake Erie are just one recent example of how this can happen. We'll need to work faster to help farmers transition to regenerative organic farming practices to preserve the purity of our water – for we will not last long without it.

We must focus on the health of the soil, as it is inseparable from the health of our water supply. Quite simply, everything is connected; water, soil, air, animal life, human health, and, of course, our food. We can correct many of the problems by transitioning global agricultural activity to regenerative organic practices, ensuring that clean water, and all our other life-giving resources, will remain healthy and accessible to all.

The Indiana Department of Environmental Management Begins Fifth Year of Blue-green Algae Surveillance

2015 marks the fifth year that the Indiana Department of Environmental Management (IDEM) has been sampling select Department of Natural Resources (DNR) swimming areas for cyanobacteria (blue-green algae) and the toxins they produce (Figure 8).

When the program began in 2010, IDEM staff collected samples at 10 lakes and analyzed the water for the microcystin toxin. Today, samples are collected from 16 swimming sites at 14 DNR lakes and checked for microcystin and two additional toxins: anatoxin (a) and cylindrospermopsin.

IDEM collects and analyzes samples from 14 sites. DNR collects samples at two sites for IDEM analysis. The swimming sites sampled are:

- Monroe Lake – Fairfax and Paynetown State Recreation Areas
- Starve-Hollow State Recreation Area
- Deam Lake State Recreation Area
- Hardy Lake State Recreation Area
- Cecil M. Harden Lake (Raccoon Lake) – Raccoon State Recreation Area
- Whitewater Lake at Whitewater Memorial State Park
- Brookville Lake – Mounds and Quakertown State Recreation Areas

Figure 8. IDEM field crew sampling lake water at the baech.

- Mississinewa Lake – Miami State Recreation Area
- Potato Creek State Park – Worster Lake
- Ferdinand State Forest – Ferdinand Lake (sampled by DNR)
- Lincoln State Park – Lake Lincoln (sampled by DNR)
- Pokagon State Park – Lake James
- Chain O'Lakes State Park – Sand Lake
- Salamonie Lake – Lost Bridge West State Recreation Area

IDEM scientists identify and count the cyanobacteria cells, and perform the toxin analysis using an Enzyme-Linked Immunosorbent Assay (ELISA) process at its field office in Indianapolis. The sampling season coincides with DNR's swimming beach season, from Memorial Day through Labor Day. Water samples are collected on Mondays and Tuesdays, analysis is done on Tuesdays through Thursdays, and results are posted on Indiana's Blue-green Algae website (**www.Algae.IN.gov**) on Friday mornings.

DNR staff will post signs at the swimming beaches and provide various alerts depending on whether cell counts and/or toxin levels are of concern (Figure 9). To date, three lakes have had high cell count recreation alerts: Brookville Lake – Mounds State Recreation Area, Cecil M. Harden Lake (Raccoon Lake) – Raccoon State Recreation Area, and Potato Creek State Park – Worster Lake. High cell count alerts

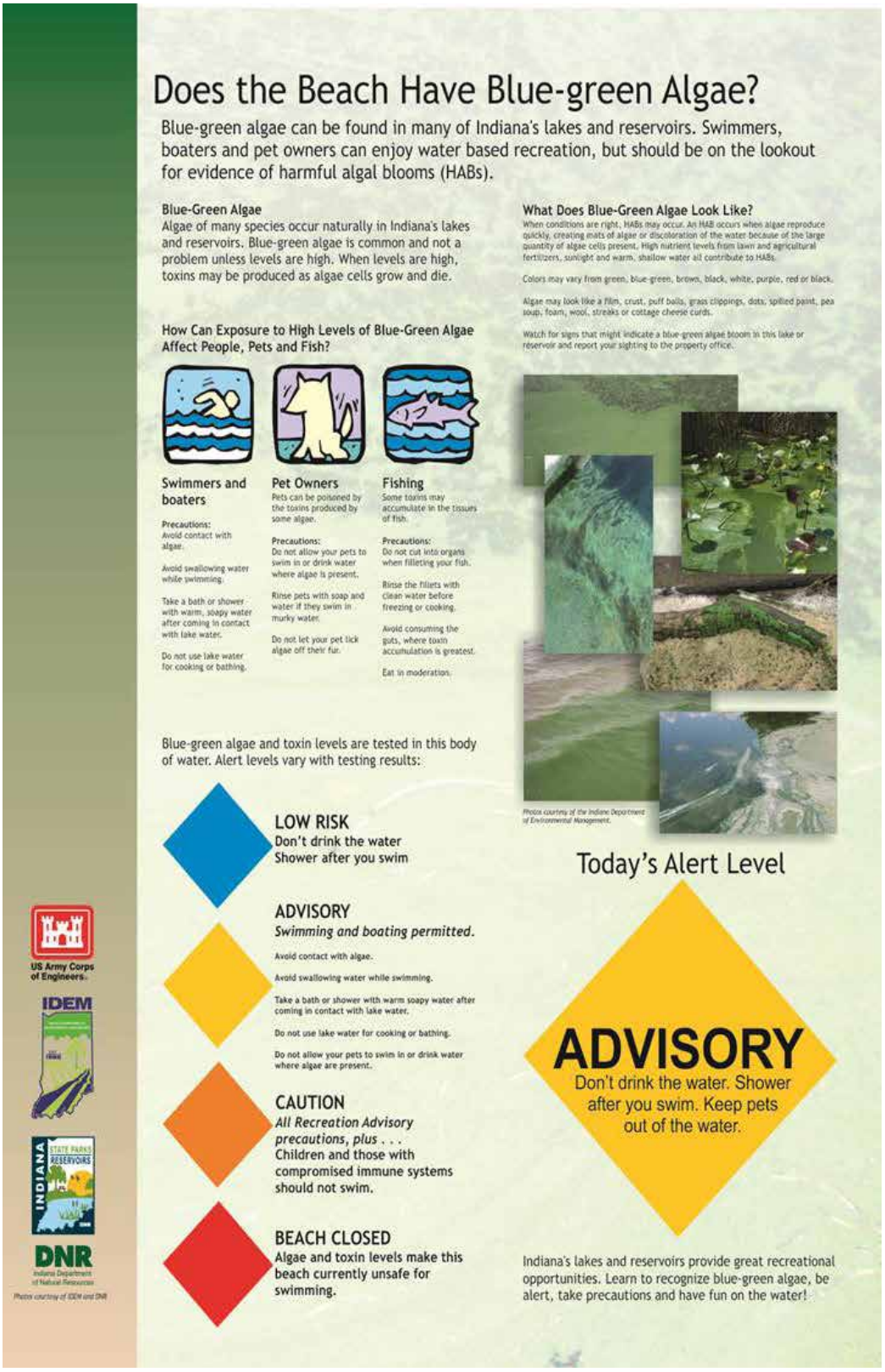

Figure 9. DNR blue-green algae signage.

means the algal densities exceeded 100,000 blue-green algae cells/mL. Citizens who wish to test other local public or private lakes can find a list of consultants and laboratories that provide services at **www.in.gov/idem/algae/files/bluegreen_sampling_services.pdf**.

The Beach is Closed Again?

~ Lauren Swierk

It's a well-known fact that some lakes are, well…unclean. Although beaches can close for a variety of reasons such as high winds and hazardous conditions, the most common reason for day-to-day beach closings is high *E. coli* counts. *Escherichia coli* is a bacterium found in feces from urban, residential, and agricultural areas (Figure 10). Throughout a watershed, *E. coli* will enter surrounding lakes and streams, especially during rain events. Clearly, this does not have a positive effect on any of its inhabitants, including the frequent beach-goers. It's not uncommon to have a certain amount of *E. coli* in swimming waters, but there's a line where it becomes unsafe. In Indiana, waters are not swimmable if the geometric mean of five samples taken throughout a 30-day period is higher than 235 CFU (colony forming units) per 100 mL. *E. coli* isn't by itself a dangerous bacterium, but it is an indicator that more potentially harmful bacteria are likely in the water as well.

Similar to finding out a food is poisonous only after eating it; conventional *E. coli* samples provide delayed benefit. Why? Using the filtration and incubation technique for *E. coli* samples usually take 24 hours to analyze (Figure 11). YIKES! Although this is an effective method, it delays results that are used to close beaches. People may be swimming in water with high amounts of *E. coli* without knowing until the day after. Waiting 24 hours for the laboratory results to be processed shows a need for higher development testing in this sector of science.

Seeing this fault, a new method, called nowcasting, has recently been developed. Nowcasting has the capability of assessing estimated *E. coli* levels in less than two hours. Now that is incredible! Various

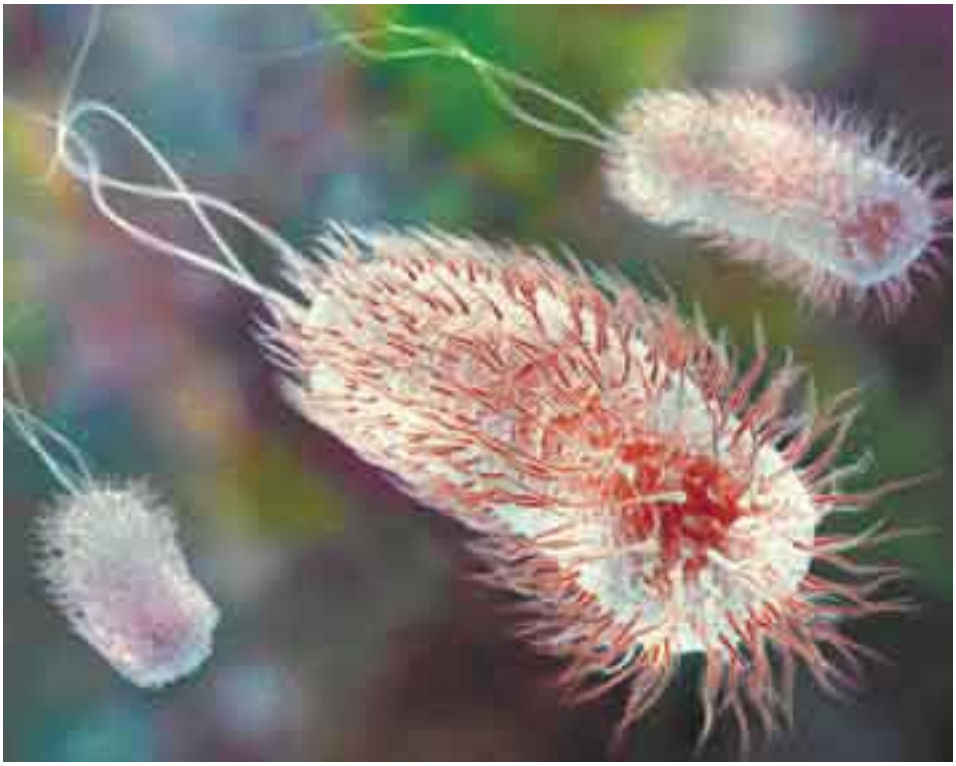

Figure 10. E. coli *bacteria*

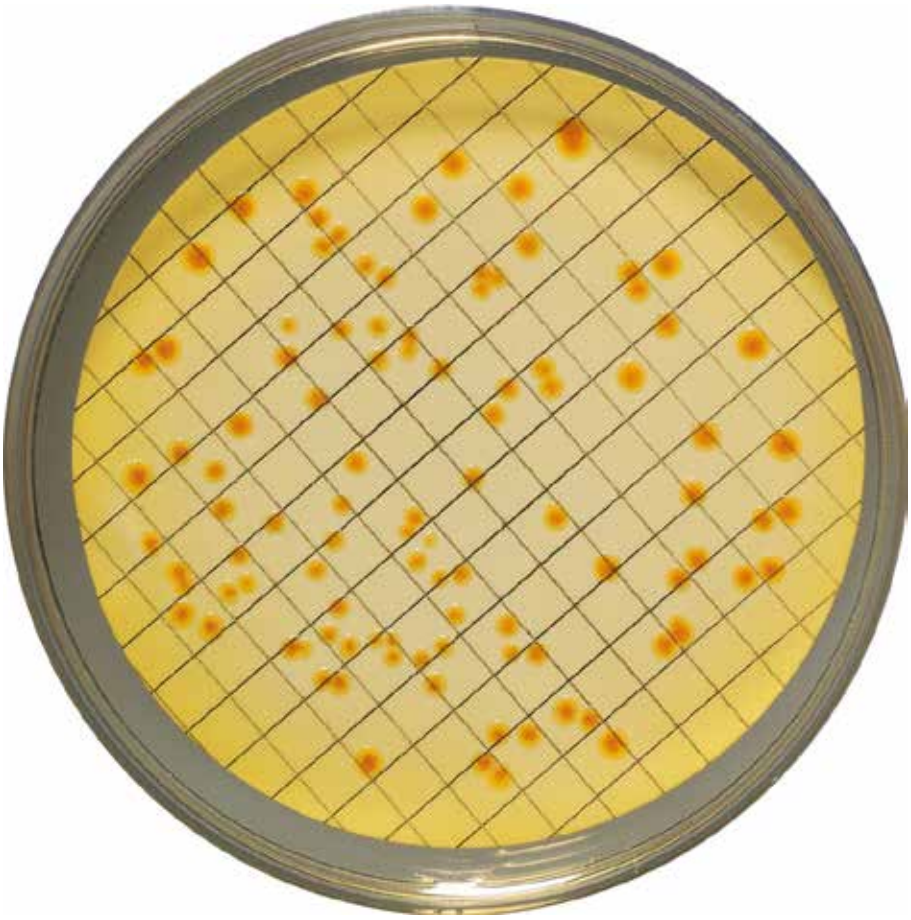

Figure 11. E. coli *colonies grown after filtration and incubation. Each dot on the gridded filter is one bacteria colony.*

areas in Illinois and Ohio are adopting predictive water quality methods allowing for up to date water conditions. How does this new method work? A mathematical formula was created to predict *E. coli* levels based on parameters, such as turbidity and precipitation, which can be more quickly analyzed in the laboratory. Nowcasting models change with each beach and also account for current weather and environmental conditions. Because of this advancement, these areas only have to collect easily obtainable parameters and enter data into the formula to determine *E. coli* levels each morning.

Either way, with the current filtration method or if the nowcasting gets adopted throughout Indiana, check out the beach updates and enjoy the summer! You can use the state beach app as well: **http://www.in.gov/beachesalert/home-geo.html**! The following beaches are routinely monitored:

- Cedar Lake: Cedar Lake Beach
- Center Lake: Center Lake Beach
- Fish Lake:
  - Lower Fish Lake Beach
  - Upper Fish Lake Beach
- Hermits Lake: Hermits Lake Beach
- Hidden Lake: Hidden Lake Beach
- Hudson Lake: Hudson Lake Beach
- Lake Dalecarlia: Lake Dalecarlia Beach
- Lake Michigan:
  - Broadway Beach
  - Buffington Harbor Beach
  - Central Beach
  - Drexwood Beach
  - Dunbar Beach
  - Duneland Beach
  - Hammond Marina Beach
  - Indiana Dunes State Park Beach
  - Jeorse Park Beach
  - Kemil Beach
  - Lake Street Beach
  - Lake View Beach
  - Long Beach
  - Marquette Park Beach
  - Michiana Shores Beach
  - Mount Baldy Beach
  - Ogden Dunes Beach
  - Porter Beach
  - Sheridan Beach
  - Shore Avenue Beach
  - Shoreland Hills Beach
  - Washington Park Beach
  - Wells Street Beach
  - West Beach
  - Whihala Beach
- Lakes of the Four Seasons:
  - Clubhouse Beach
  - Sandy Beach
- Pike Lake: Pike Lake Beach
- Pine Lake:
  - Assembly Beach
  - Kiwanis Park Beach
  - Waverly Road Beach
- Stone Lake
  - New Stone Lake Beach
  - Old Stone Lake Beach
  - Stone Lake Launch Beach
- Syracuse Lake:
  - Hoy's Beach
  - Syracuse Lake Beach:
- Wabee Lake: Wabee Lake Beach
- Webster Lake: North Webster Beach
- Winona Lake: Winona Beach
- Wolf Lake: Wolf Lake Beach

The Show Your Lakes Appreciation Challenge

In the month of July, the North American Lake Management Society (NALMS) issues the "Show Your Lakes Appreciation Challenge."

The goal of the challenge is to promote and encourage support for Lakes Appreciation Month.

Here's how you can join in:

1. Take a picture of yourself or someone you know enjoying or working on a lake or reservoir during the month of July.
2. Log on to Facebook or Twitter and upload your picture.
3. Add an information, funny, or witty caption along with the name of the lake.
4. Be sure to type #LakesAppreciation in your post so we can find your entry.

Why should you join in?

- You can win **PRIZES**
  - First Place: a NALMS polo shirt
  - Second Place: a NALMS baseball hat
  - Third Place: a copy of the Lake Pocket Book
- You get **RECOGNITION**
  - With your permission, NALMS may include your photo on our Lakes Appreciation Month webpages or other media.
  - With your permission, NALMS will consider your photo for the Photo of the Month in NALMS Notes.
- Because you're **AWESOME**
  - And you are! Thank you for joining the Challenge and for appreciating your lakes!

FACTSHEET:
E. coli in the Environment

Indiana Department of Environmental Management

Description:

- *Escherichia coli*, or *E. coli*, is a common example of coliform bacteria. Coliform bacteria are organisms that are present in the environment and in the waste of warm-blooded animals and humans.
- Public water systems monitor for coliform, as the presence of coliform bacteria in drinking water indicates an increased likelihood that other organisms may be present.
- Many types of coliform bacteria are not harmful. A few strains of coliform such as *E. coli* are pathogenic and can cause illness if ingested. Ingesting *E. coli* may cause severe diarrhea and abdominal cramps.
- During rainfalls, snow melts, or other types of precipitation, untreated sewage containing *E. coli* may wash into creeks, rivers, streams, or lakes.

Sources of *E. coli* in the environment:

- There are many pathways through which *E. coli* can enter and contaminate water:
  - Combined sewer overflows (CSOs) – When it rains, those systems can become overburdened and release excess storm water and untreated sewage. Communities must post warning sign near where outfalls are located.
  - Sanitary sewer overflow bypasses – Separate sanitary sewer and wastewater treatment plants occasionally experience unauthorized discharges of untreated or partially treated wastewater.
  - Septic systems – When septic systems fall into disrepair or reach capacity, the sewage can leak into nearby waterways. Because of this, the absorption field, or area over which the discharged sewage is dispersed into the ground, should be located away from waterways and wells.
  - Straight pipes – Some individual homes or subdivisions have pipes that transfer untreated waste directly from septic tanks to a river or lake. This illegal practice should be corrected and is punishable by fines if continued.
  - Wildlife – Waste from ducks, geese, deer, raccoons, and other fauna living on or near water can contaminate waterways with *E. coli*.
  - Urban and agricultural run-off – Waste from pets and farm animals is a source of *E. coli*.

IDEM's Role:

- The Indiana Department of Environmental Management (IDEM) is responsible for protecting human health and the environment while providing for safe industrial, agricultural, commercial, and governmental operations vital to a prosperous economy.
- IDEM sets and enforces water quality standards for safe bacteria levels.
- IDEM requires municipal wastewater systems to test for *E. coli*.

- IDEM's Office of Water Quality periodically tests *E. coli* levels in waters throughout Indiana to assess bacteria levels in rivers and streams. IDEM uses this assessment to help local entities develop pollution reduction plans to address *E. coli* contamination originating from non-point sources.
- IDEM requires public drinking water systems to conduct tests to regularly monitor bacterial levels in drinking waters provided to customers.
- IDEM maintains a searchable database of drinking water quality reports submitted by each community water system in Indiana.
- IDEM does not monitor or regulate food products for compliance with *E. coli* regulations. That falls under the responsibility of the U.S. Department of Agriculture and its agents.

Citizen's Role:

- There are a number of actions every citizen can take to reduce *E. coli* contamination in the environment:
- Regularly inspect private, residential wells to ensure that there are not pathways for surface water to enter the well, such as a cracked casing or missing cap.
- Properly dispose of pet waste, which can contain bacteria, viruses, and parasites; and contaminate the environment.
- Have septic tanks regularly checked and emptied to prevent overflows or leaks.
- There are actions citizens can take to reduce their exposure to *E. coli* at the beach or during recreational activities:
- Find out which beaches are regularly monitored and have posted advisories.
- In areas not monitored regularly, choose swimming sites with good water circulation.
- When canoeing, kayaking, fishing, or boating, avoid accidental ingestion of surface water.
- Wash your hands before eating, and shower after coming in contact with surface water.

More Information:

- For more information on *E. coli* and IDEM's water quality monitoring programs, please visit IDEM's website at **http://www.IN.gov/idem/4114.htm**.
- For more information on Indiana Lake Michigan beach monitoring, visit IDEM's Indiana Beach Guard Monitoring System website at **http://www.IN.gov/idem/4151.htm**.
- For more information about the quality of your drinking water system, consult the annual water quality report provided by a local water system. Water quality data and reports are available by searching IDEM's Drinking Water Facility Database at **http://www.IN.gov/idem/5095.htm** or the U.S. Environmental Protection Agency's (U.S. EPA's) website at **http://cfpub.epa.gov/safewater/ccr/index.cfm?OpenView**.
- For more information on home water testing, private well disinfection, and annual compliance reports from public water systems, visit IDEM's website at **http://www.IN.gov/idem/4281.htm**.
- For questions and concerns, please call IDEM's Office of Water Quality, Drinking Water Branch at (317) 232-8670.

Volunteer Corner

~Sarah Powers

Since I began working with the Volunteer Lake Monitoring Program in 2009 I have spent a great deal of time working on ways to improve the program and gain new participants. Over the years I have dealt with many challenges in doing so, however overall I feel in many ways we have substantially improved the program.

Areas we have improved

Improvements to the program have included, but are not limited to, the addition of invasive species monitoring, increased participation in expanded monitoring of chlorophyll-*a*, total phosphorus, dissolved oxygen, temperature, and the numerous new volunteers that have been added to the program. These improvements have been great for the program and great for our lakes. However, we still have several areas we need to work on.

Where we want to do better

One of these is our feedback time. Sometime we struggle to be quick with feedback, whether that be data feedback or response time to your questions. Time management can be difficult and sometime things slip by. We are working on this and with our new database and reports we will continue to do better. Feedback from you is also important to help us know what you would like to see more of on the reports. Do you want more details? Explanations? What is most important?

Another major area we still stand to improve is expanding the program to monitor more lakes and more areas of the state. While we love the northern half of the state for the beautiful natural lakes, there are also many lakes in the southern half of the state and in order to have the best picture of Indiana's water quality we also need to capture these lakes.

The other area we need to improve is volunteer retention. We find that while it is sometime easy to get someone to commit to volunteering, we sometimes have difficulty keeping individuals motivated to collect data.

The past two years we have gone through some substantial changes and moves, with new databases and a new lab we have been very busy building on the program framework. Now that this work is complete I think we are ready to begin working on the volunteer program and really building on the foundation that we have had in place for many years.

A plan moving forward

As our commitments have grown and changed over the years we have begun to realize that it is time to add more support to the volunteer team. I will continue to coordinate the program with additional support from a dedicated graduate student working in our lab.

Lori Lovell has joined our team this summer and will continue to work with us this fall. Lori has proved to be a valuable asset to the Indiana Clean Lakes Program, the Volunteer Lake Monitoring Program, and myself! Some of you may have had the chance to talk with her at the Northern Indiana Lakes Festival, on the phone, or received emails from her. She is a tremendous asset to the program and I look forward to having her with us.

With the additional staffing we can really begin to work on ways to build on the foundation that is in place to improve and expand our citizen monitoring efforts. We can't thank our volunteers enough for all the work they do.

This program would not be possible without the individual support of all these individuals.

Indiana CLP 2015 summer sampling crew including: Melissa, Jason, Dan, Amy, Kristen, Kerry, and Lori.

Aquatic Invasive Monitoring Plant Highlight

These will be the 12th AND 13th plant in the plant highlight series. We will be featuring one aquatic plant in each Water Column issue. We will feature both native and invasive plants to improve our plant identification skills. We feature two this issue so you can directly compare two similar plants.

Arrow arum (*Peltandra virginica*) – NATIVE

Arrow arum is an emersed plant that is commonly found in swamps and marshes throughout the state and blooms from winter to spring. This aquatic is especially common in and along shallow waterways, where it may occur in large colonies. It grows in areas of highest light and darkest shade. The common name, arrow arum, of course, derives from the pronounced arrowhead leaf shape. They typically are 10 to 12 inches long and half as wide. The leaf underside is whitish with three prominent veins. Its leaves are clustered on long succulent stalks, which can be three feet long. Arrow arum flowers are small and light yellow, on a fingerlike spike. The flower spike is surrounded by a bract, or spathe, that is usually yellowish green. Blackish berries follow, which attract wood ducks and king rails

You can find more information about our Invasive Plant Monitoring Program and the Flowering Rush on the Clean Lakes Program website **www.indiana.edu/~clp**. We will be updating the Invasive Plant Monitoring page to include links to several resources and tips on identification guides.

Identification tips:

- Emergent plant
- Basal leaves that are strongly arrowhead shaped.
- Flowers form a fingerlike spike.

Arrow arum
Peltandra virginica
Photo by Ann Murray
© 2001 University of Florida

Arrow arum
Peltandra virginica
Photo by Vic Ramey
© 2001 University of Florida

Common arrowhead (*Sagittaria latifolia)* – NATIVE

Many showy Sagittaria species are native to Indiana. They are generally known as the arrowheads. This species, *Sagittaria latifolia*, is known as the common arrowhead. It is one of the largest and most conspicuous of the emersed Sagittarias. Common arrowhead is found in shallow waters throughout Indiana. Common arrowhead gets its name from its moderate-sized, arrowhead-shaped leaves. This is a distinctive shape. Especially note the pointed lobes. Common arrowhead leaves can be 8 inches wide and more than a foot long. They are erect and supported by thick stalks. Common arrowhead flowers are showy and white and very similar to the flowers of other emersed Sagittaria species. They have three petals. Flowers extend on thick stalks that often are taller than the leaves. Common arrowhead is a moderate-sized aquatic plant.

Identification tips:

- Emergent plant
- Basal leaves that are strongly arrowhead shaped.
- Flowers are showy, white, and three-petaled.
- Flowers tower over the leaves, generally

Have you checked out the Indiana Clean Lakes Program Web page lately? Take a look at www.indiana.edu/~clp/ and see what's new and happening with the program and with Indiana lakes!

Perspectives

"Chance is always powerful. Let your hook be always cast; in the pool where you least expect it, there will be a fish."

~ *Ovid*