QUARTERLY
THREE LAKES ASSOCIATION SERVING LAKE BELLAIRE, CLAM LAKE AND TORCH LAKE IN NORTHWEST MICHIGAN FEBRUARY 2022

Summer Interns Present to School Boards

By Jeanie Williams & Dean Branson

TLA's Summer Internship program culminates in presentations to the students' school boards. The high school students first make a joint presentation about their study and results to the Three Lakes Association Board of Directors, but when they present to their school boards, they are on their own. In the fall all five of our student interns made these presentations, and they were first-rate.

Vivien Felker and **Lily Brown**: Elk Rapids School Board, September 13, 2021

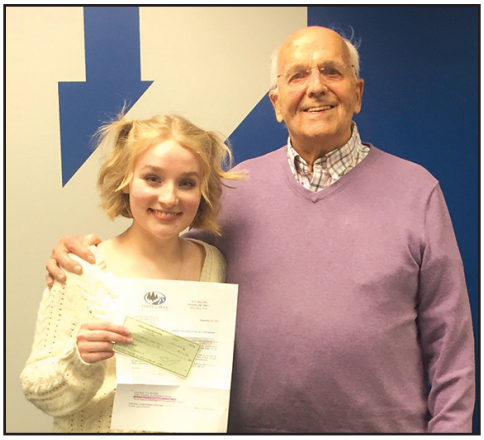
Anna Anger: Mancelona School Board, October 12, 2021

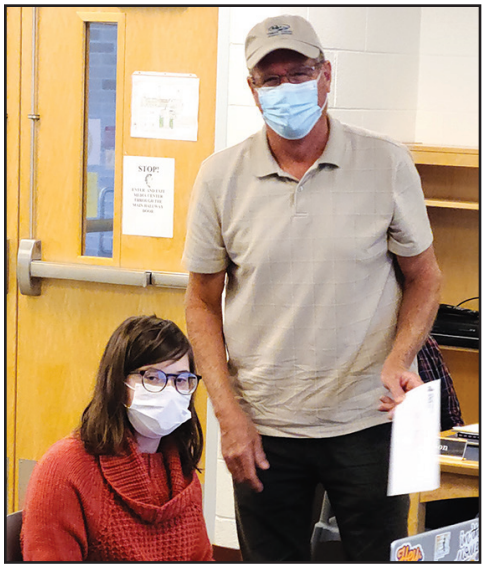
Grace Robinson: Bellaire School Board, October 18,2021

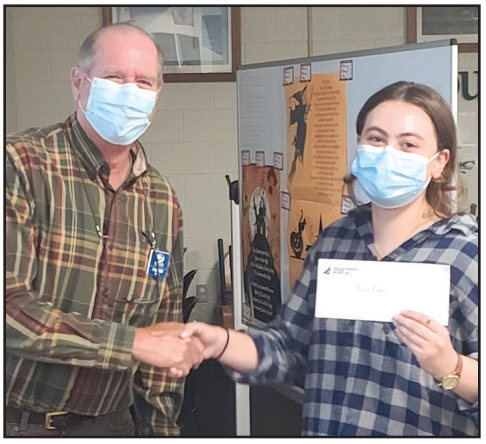
Rebekah Campbell: Kalkaska School Board, November 15, 2021

These presentations are important for several reasons. Most foundationally, presenting what was learned develops communication skills and deepens knowledge. The process of organizing and delivering information results in the students having a full understanding of the research study and the results. Plus, it never hurts to practice public speaking!

Second, since the schools provide support by awarding students who satisfy TLA's internship requirements ½-credit hour of independent study in environmental science, these presentations serve as important feedback about the impact and value of the work the students participated in. Every school board had substantive and diverse questions for the student after her presentation, which indicated school board engagement and the intern's ability to think on her feet







Finally, these presentations serve to strengthen school-community partnerships. Community partners like TLA, make learning vastly more tangible, relevant, and impactful because students are interacting directly with the people in the community most engaged with the topic at hand. The more schools can see the impact that programs like this have on students, the more students will benefit from hands-on, real-world opportunities like the TLA internship program.

This year one of TLA's 2021 interns, Anna Anger from Mancelona High School, was also invited to speak at the 2021 Freshwater Summit, which is a local conference for environmental managers and water professionals. The title of her talk was, ***An Assessment of Torch Lake Snails Grazing on Golden Brown Algae***, and it gave a synopsis of the work of all five interns. If you were there, you can attest to the professionalism and knowledge Anna exhibited. To see her slides, follow this link on the Watershed Center of Grand Traverse Bay website: https://www.gtbay.org/wp-content/uploads/2021/10/Anna-Anger-TLA-presentation.pdf

We are currently preparing for our 2022 internship program and look forward to meeting another set of remarkable young people like the ones we met in 2021. For all the details, visit 3lakes.com, then select Summer Internship Program under the Education Program menu.

Sneak peek

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Hands-On Volunteer Opportunity

✓ **Do you like working with high school students?**
✓ **Are you looking for a way to learn more about our lakes?**
✓ **Do you have a scientific mind or the skills of a coordinator?**

We are seeking some fresh faces to help us with our 2022 high school internship study. The volunteer commitment would be 1-2 days a week through the summer. If you'd like to learn more, or know someone who would be a great fit, please email Jeanie at jwilliams.threelakes@gmail.com, or call Lois at 231-412-7551.

New Members and Donations

A Big TLA WELCOME to these new 2022 members!
We are so happy to have you join us.

Frederick & Kathryn Bechtold
Kathleen Brodhag
John & Jill Carmichael
Richard & Kristin Claar
Leslie Cooper
Mark Cowles
DeCapite Family
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We are always honored to receive memorial contributions
Terrance Malone

A special thank you to everyone who contributed $200 or more to TLA during our membership recruitment for 2022

Anonymous
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The Chain of Lakes Watershed Management Plan

By Lauren Dey
Tip of the Mitt Watershed Council
Watershed Management Coordinator

A Three Lakes Association greenbelt workshop at Lake Bellaire. Photo courtesy of Tip of the Mitt Watershed Council

The Elk River Chain of Lakes is an important natural resource in Northern Michigan that warrants the utmost protection due to its ecological, recreational, and economic value. Despite efforts to protect the lakes, emerging issues, such as invasive species and general development pressures, threaten to impair these waters and degrade their ecological treasures.

What can be done about this? A watershed management plan is a tool used to protect our waters from nonpoint source pollution and other threats. It encourages sound science, communication, and partnerships; focuses on environmental results; and provides a means for cost effective management. An approved watershed management plan is required for watershed groups to be eligible to apply for Clean Water Act Section 319 (CWA 319) grants through the Department of Environment, Great Lakes, and Energy (EGLE), which support nonpoint source pollution mitigation.

In 2017, Tip of the Mitt Watershed Council began creating a watershed management plan for the Elk River Chain of Lakes watershed, which is now in final review with EGLE.

It's important to cover what a watershed is and why it needs a management plan. A watershed is an area of land that drains towards a receiving body of water. The receiving water body for the Chain of Lakes Watershed is every lake and stream in the entire Chain of Lakes, from Intermediate River to Elk River, including the Cedar River and Rapid River.

Activities that happen within watershed boundaries can result in point source and nonpoint source pollution. Point source pollution has a discrete source, typically a pipe from regulated industrial activity or from municipal wastewater treatment plants.

Nonpoint source pollution comes from a diffuse source and is mobilized by rain or snowmelt that runs over the land. Examples include pollutants from erosion, agricultural practices, leaky septic systems, pet waste, and automobile fluids. Nonpoint source pollution is not regulated. A watershed management plan is a tool used to protect and restore a water body from the effects of nonpoint source pollution.

The Chain of Lakes plan summarizes information about the water resources, land use, and water quality within the watershed. It also includes results of resource inventories that were conducted on road stream crossings, streambank erosion sites, shorelines, and forested and agricultural lands. This information was used to identify the types of threats and their sources, which helped us determine the critical areas for protection and priority areas for remediation.

Once this background information was collected and synthesized, implementation steps were developed in collaboration with the Watershed Center of Grand Traverse Bay and our other non-profit, lake association and municipal partners, such as Three Lakes Association (TLA).

The implementation priorities and tasks span 14 categories including road stream crossings, water quality, and shoreline protection. Each category lists individual projects that can be implemented, estimated costs, timelines, and partners.

Here's an example implementation step from the draft plan, listed as high priority: *Implement best management practices (BMPs) on moderate and severe shoreline erosion sites on large inland lakes in conjunction with property owner outreach.* Moderate and severe erosion sites are identified in the plan, and can be used to determine where these BMPs should be installed for maximum water quality benefits. This is a project that could be funded by EGLE's 319 program.

Once the Elk River Chain of Lakes Watershed Management Plan is approved any partners listed in the plan (including TLA) can apply for CWA 319 funds.

There are plenty of projects listed in the plan that would not be eligible for 319 funds because they do not relate to nonpoint source pollution (e.g. swimmers itch, invasive species). However, our watershed management plan is an excellent tool for seeking other funds for any of the projects listed because it demonstrates to funders that we have solid plans, reliable partnerships, and well-developed projects.

The final plan will be available on the Watershed Council's website: https://www.watershedcouncil.org/ If you have any questions please contact Lauren Dey, Watershed Management Coordinator, at lauren@watershedcouncil.org or (231) 347-1181 x 1109.

Lookout for stormwater!

By Fred Sittel
TLA President

Arial photo of sediment in Clam River entering Torch Lake at the Dockside Restaurant taken approximately forty-eight hours after the extreme rainfall event last August

Every year surface runoff and stormwater deliver significant amounts of sediment and nutrients into our lakes, rivers and streams which damages aquatic habitats and accelerates growth of algae and aquatic vegetation. In addition to conveying excess nutrients, sediment accumulation smothers insect larvae which impacts the food chain, kills fish eggs and reduces the locations where fish can spawn.

In densely populated areas, storm sewer systems often discharged untreated water directly into lakes and rivers. Impervious surfaces such as roads and rooftops increase the volume and rate of stormwater runoff, which is why maintaining a buffer strip of deep-rooted natural vegetation along developed lakeshores is critical to protecting water quality.

Around our lakes where development has reduced natural areas available for soil absorption, road side ditches channel stormwater to culverts that move water to the lakeside of the road. As a result, turbid stormwater containing sediment, nutrients and often harmful chemicals from lawn maintenance and vehicles runs unabated into the lake. Lakefront property owners are advised to avoid channelizing waterflow and to provide landscaping features which slow water down and increase soil absorption. Road side ditches should never be used to dispose of leaves or garden waste because these materials smother the natural vegetation and the roots which hold the underlying soil in place.

The small stream or normally dry ditch in your lakeside neighborhood which swells with rainwater during a storm may ultimately be delivering nutrients and sediment into the lake. The entry points can often be identified by plumes of turbid water emanating from the lakeshore.

A culvert conveying Finch Creek under Alden Highway failed catastrophically during an extreme weather event in August of last year

An increasing frequency of extreme rainfall events may become an even more significant contributor to reduced water quality if recent weather trends continue. In some cases, rainstorms have become so concentrated that longstanding infrastructure such as retention basins, dams, bridges and culverts at road stream crossings have failed resulting in catastrophic releases of sediment into waterways.

An extreme rainfall event occurred last summer during the night of August 10-11, 2021. A rain gage at the East end of Clam Lake, maintained by Antrim County's Lake Level Committee, recorded five and three quarters inches of rain between the hours of 10 pm and 2 am, which followed one and three quarters inches of rain that had fallen the previous day. This extreme rainfall event was highly concentrated over the Cedar River watershed, Lake Bellaire, Clam Lake, Grass River and its tributaries and the extreme southern portion of Torch Lake. Between noon on August 9 and midnight August 11, the surface level of Lake Bellaire rose 14 inches with half the rise occurring during an eight-hour period. During that same eight-hour period Clam Lake rose 9 inches, which is just half an inch less than the lake's total range of level change the entire previous season.

As a result of this extreme rain event the culvert which channels Finch Creek under Alden Highway failed catastrophically. Finch Creek is one of three major tributaries to Grass River entering in two main channels close to where the river enters the East end of Clam Lake. This culvert failure undoubtedly contributed to the large amount of sediment and nutrients washed into Clam Lake during the storm. Sediment which settled to the creek bottom in downstream pools caused Finch Creek to become locally wider and undoubtedly will increase tree fall along the banks further aggravating sediment transport into the Elk River Chain during seasons to come.

Local pilot and TLA board member Art Hoadley captured a picture of the sediment plume flowing from Clam Lake into Torch Lake approximately forty-eight hours after the August storm last year. According to Art, the turbidity in Torch was evident along the East shoreline all the way South to Alden and extended almost to mid-lake at some points.

It would be difficult to estimate the tons of sediment that entered Torch Lake from this single extreme rainfall event or the quantity of algae and aquatic weed stimulating nutrients that came along with it. As detrimental as a single extreme rainfall event can be, it is more likely that typically heavy rains we experience frequently in our region throughout the spring and summer are responsible for most of the sediment and nutrient transport into local waterways.

That's why it's important to not only be on the lookout for potentially undersized culverts, aging dam structures and undercut river banks with recent treefall, but also small ditches and streams that swell rapidly after it rains particularly when they directly enter local waterways and create turbidity plumes.

Directing the flow into a retention basin or natural soil absorption area helps sediment settle out before it enters waterways. Natural vegetation on shorelines and river banks absorbs nutrients, stabilizes shorelines, and slows water on its path into a water body. These features will prove to be even more important in the years to come!

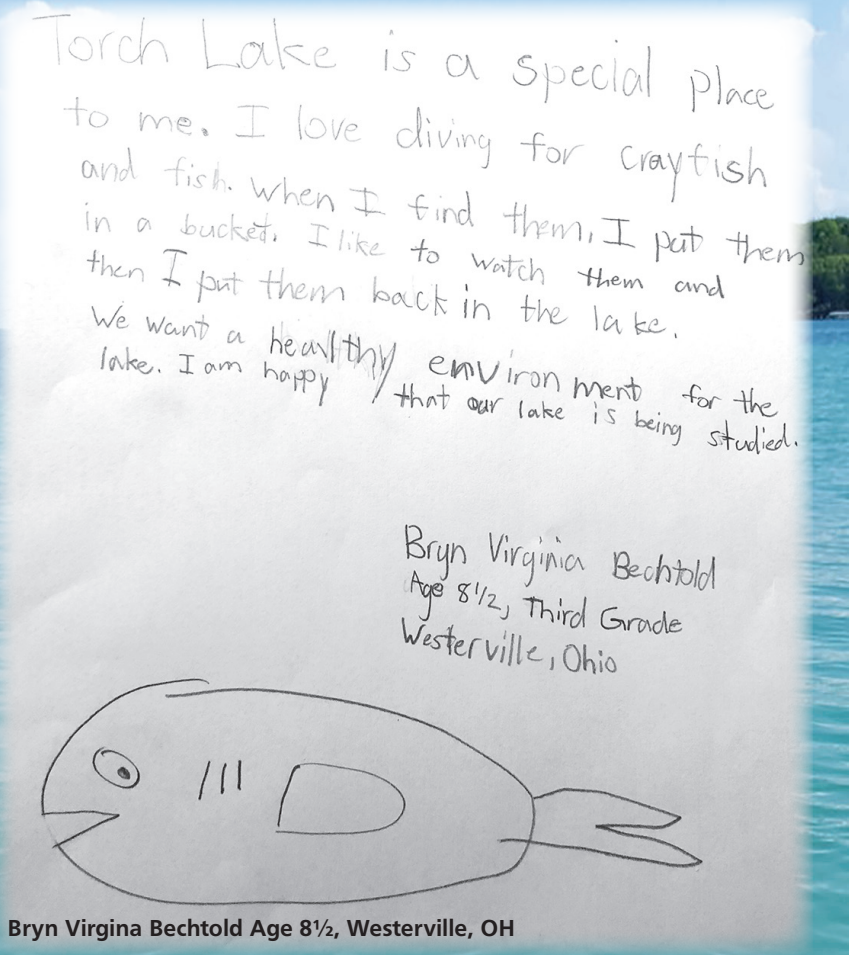
Young People Love Torch Lake

How many of you have been coming to Torch Lake since you were young? We know this is true for many of you. Your parents brought you up here as a kid and the lake simply became part of who you are. Do you remember what you loved most about lake life in your youth? What fascinated you and kept your attention for hours? What lake-based traditions do you remember fondly, and maybe still follow today?

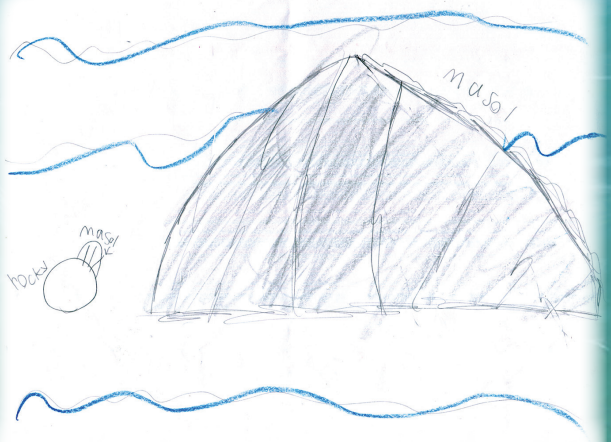
There are still young people who come up from cities and far-away states for weeks or months every summer. They are swimming and snorkeling all day, running between neighboring yards, watching the stars, fishing, and enjoying barbeques by the water, just like you did.

And they might keep coming up here their whole lives, just as you have; the clean water and dark sky calling them back year after year.

If these young people are any indication, the next generation will grow to be just as committed and attentive to the water as you are. Please share with us stories and drawings that show how the young people in your life enjoy and see our Three Lakes. We'd love to publish a few more articles from our young water stewards. Send them to jwilliams.threelakes@gmail.com.



Bryn Virgina Bechtold Age 8½, Westerville, OH



The First thing I want to talk about is Zebra musols. The boats carry them in. At the bottom they don't even know when they hang onto it! rocks. they have a Block big thing that sticks on the rocks in torch lake.

Grayson Marion Athon, Age 7, Washington D.C.

One of the traditions in board member Rick Doornbos' family is taking a "polar plunge" on Memorial Day weekend. At the end of May in 2021 water temperatures were around 48 deg F and all five of his grandchildren took the plunge! From left to right: Andrew, Myles, Hannah (4th grade), Zeke (2nd grade), Nolan (1st grade). All live in Midland, MI.

An Organized Approach for Solving Problems like GBA

By Jan Stevenson, MSU Professor
Lead TLA advisor on GBA

The arrival of GBA in Torch Lake called for a tried and true approach for solving environmental problems. The approach I like best involves four major steps, with minor steps within those four. The four steps are: designing the assessment, characterizing condition, diagnosing stressors, and finally selecting and implementing management options (see Table on this page).

Designing the Assessment

In the case of GBA, the first step was defining a management goal, which was to **reduce GBA to historic levels or levels low enough to protect the aesthetic, recreational, and biodiversity functions that stakeholders want for the lake.**

Next, we needed a conceptual model for how human or natural factors could have changed to cause GBA. This conceptual model can be used to formulate questions and hypotheses for testing.

Conceptual models should address 5 major elements:

1. Human well being (aesthetics)
2. Valued ecological attributes (VEAs, e.g. clean sand)
3. Pollutants and habitat alterations affecting VEAs (e.g. phosphorus and water temperature)
4. Human activities causing pollutants or habitat alterations (e.g. septic systems, fossil fuel emissions)
5. Environmental policies that could effectively change human activities to reduce pollutants (e.g. sewers around the lake).

These five elements of the model are each important because they clarify our goals, what pollutant we need to reduce, and how we can go about reducing that pollutant.

Our goals are ultimately to manage ecosystems largely for human well being (swimming, fishing, boating, views, etc.). We also want to be able use the ecosystem as much as possible without affecting valued ecological attributes, which are also called ecosystem services. Therefore, we target reductions in the pollutants and habitat alterations that humans cause until human well being is satisfactory (or better) because VEAs have been restored to a sufficiently high level (see Figure on next page).

1. Design Assessment
a. Define Objectives
b. Develop Conceptual Model of the System – The Hypotheses to Test
i. Relate human well being to valued ecosystem attributes ii. Relate pollutants to valued ecological attributes iii. Relate human activities to pollutants iv. Relate potential policies to likely changes in human activities (that would reduce pollutants enough to increase valued ecological attributes and provide for high levels of human well being)
c. Design the Study Plan
i. Select variables to measure ii. Determine where, when, and how to measure variables
2. Characterize Condition
a. Measure existing condition b. Compare existing and desired condition
3. Diagnose Stressors
a. Explore relationships among variables b. Employ stressor diagnosis and causal analysis protocols
4. Select and Implement a Management Option
a. Benefits and costs analysis for all management options b. Include social impacts in that analysis c. Evaluate risk of unintended consequences

A table illustrating the steps in an ecological assessment and management framework. *Although the steps are illustrated in a linear way, 1 through 4, at any place in the assessment, it may be necessary to return to a previous step to integrate what has been learned.*

We can use the conceptual model approach to rank the relative likelihood that hypotheses are plausible and cause GBA. For example, one hypothesis for the cause of GBA was that runoff or stream inputs were adding phosphorus and causing GBA. Runoff adds phosphorus to the water column where it stimulates growth of phytoplankton (tiny algal cells in the water column) more directly than growth of algae on the bottom of the lake. Since increased phytoplankton was not evident, testing that hypothesis was not a high priority.

After establishing priorities for hypotheses to test, and keeping in mind how much each would cost, we designed study plans.

Characterizing Condition

The study plan is designed to gather information to characterize condition and later diagnose stressors (pollutants and habitat alterations) for the potential causes of GBA. In the case of GBA, the hypothesis we prioritized was that **groundwater phosphorus (P) from septic system contamination was reaching the lake and causing higher benthic algal growth.**

Over the last 5 years we have gathered data to determine if we have evidence to support or refute this hypothesis. We will share those results in the next issue that comes out in April.

Diagnosing Stressors

After we characterized the conditions and tested hypotheses statistically, we then checked to make sure the relationships were biologically plausible. If the relationship was plausible then we performed additional tests to confirm that the factor in question was indeed the cause of the effect, and not simply correlated with the effect. This is called a "causal analysis."

Selecting and Implementing Management Options

Diagnosing the causal relationships in an ecosystem is critically important for the next step, selecting and implement management

SOLVING PROBLEMS continued on page 7

Solving Problems *Continued from page 6*

options.

We do not want to implement a management option that addresses the wrong pollutant or habitat alteration, or the wrong human activity causing them. However, we also don't want to wait too long to implement a management action. Every year we wait can compound the condition, so we have to weigh the pros and cons of acting before we know everything.

When selecting management options, costs, benefits, and likelihood of success should all be considered. Among the costs that should be considered are factors associated with human well being, equity of social benefits among all groups, and unintended consequences of a management option.

A new hypothesis that I am evaluating is that GBA is caused by a decrease in P in the surface water of lakes. So why not just implement the management option of adding more phosphorus to the surface water of lakes? Because the unintended consequences of adding P are very likely to be increased algae in the water column and reduced water clarity. Perhaps GBA would disappear, but alternatively, it could grow thicker and more extensive.

I hope this article helps you understand how I prioritized study plans and data analyses to solve the GBA puzzle. GBA seems to be a novel problem and as with many environmental problems, our first hypotheses for causes may not be correct or a complete explanation. Only with an organized approach can we identify what changed to cause GBA, and determine what can be done about it. In close, I want to acknowledge the great contributions of information and effort made by many TLA volunteers.

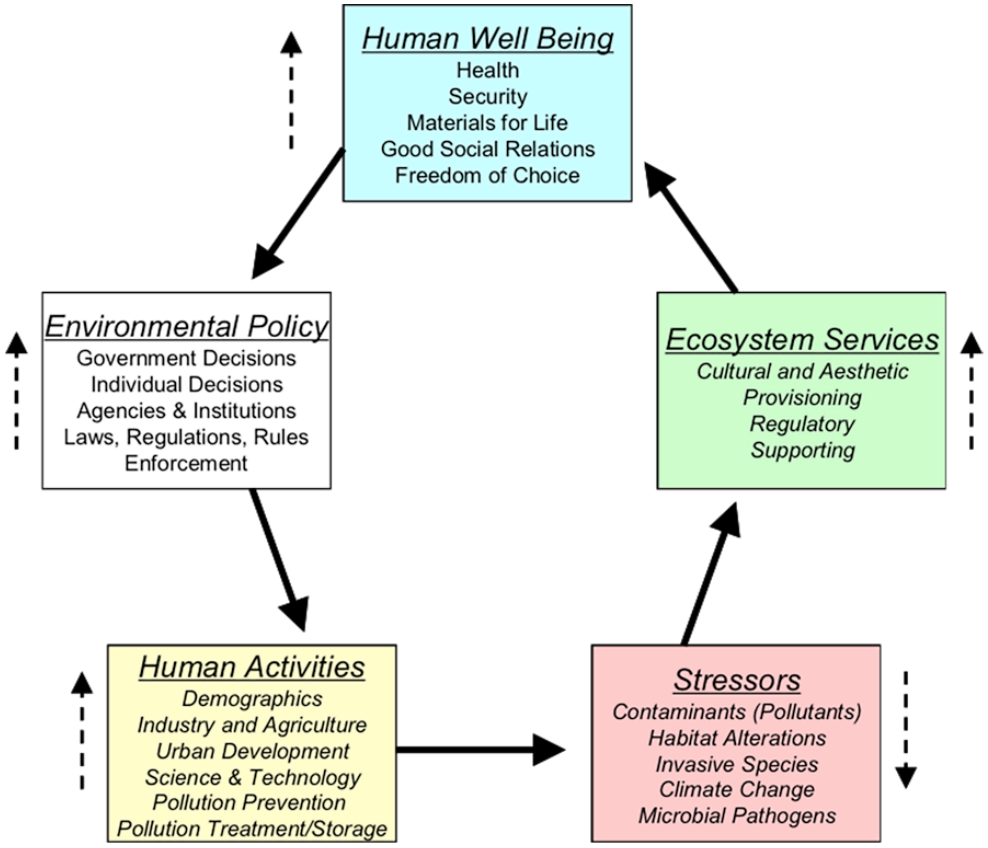


Figure of Generalized Conceptual Model of a Coupled Human-Natural Ecosystem. *The up and down arrows indicate the goals of environmental managers. Ideally the system can be made sustainable by reducing stressors without having to reduce economic activities, many of which require the resources and services provided by ecosystems.*

In future newsletters I will provide more detail about testing and evaluating the hypotheses that increasing groundwater P or decreasing surface water P are causes of GBA.

In a second piece in this newsletter, please take a guided tour of GBA from aerial photographs to microscopic layers that show the lake-wide extent and constituents of GBA.

A Guided Tour of GBA from Aerial Photographs to Microscopic Images

The complex we are naming Golden Brown Algae (GBA) on the bottom of Torch Lake is mostly composed of two types of algae: diatoms and cyanobacteria. Diatoms are algae with glass cell walls and golden brown pigments. Cyanobacteria are much smaller, have very different cell structures and produce golden brown mucilages.

From historic aerial images, we can see what Torch Lake looks like without GBA, whereas recent images reveal fascinating patterns of GBA occurring across the nearshore shoals.

When we collect samples off the lake floor from a depth of about 10 feet, a firm mat of algae can be observed with three distinct layers.

Art Hoadley and Dr. Jan Stevenson developed videos to provide guided tours of GBA from aerial photographs to microscopic images, and scales in-between. We hope these guided tours are as interesting to you as they were to us. Click here or scan QR code to watch! https://www.youtube.com/watch?v=-kVoHpUqWWs

Our new membership portal is up and running. If you have not yet done so, please renew and donate today at 3lakes.com.

You can still renew and donate through the U.S. mail with the form provided on the last page of this newsletter.

The mission of the Association is to provide leadership to preserve, protect, and improve the environmental quality of the Elk River Chain of Lakes Watershed for all generations with emphasis on Lake Bellaire, Clam Lake, Torch Lake and their tributaries.

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