Waterworks

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What's Phosphorus Got To Do With It?

A Brief Overview of Phosphorus in Lake Management

by M. Elizabeth Conners
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FOLA Scientific Advisory Board

Whether you've been involved in lake management issues for years or only a few weeks, one thing you've heard discussed is phosphorus. What is phosphorus, where does it come from, and why is it so important?

If your lake doesn't have problems with nuisance weed growth or algae blooms, then phosphorus probably isn't part of your lake management problem. Phosphorus is important because it is a plant nutrient, or fertilizer. Aquatic weeds and algae, like land plants, require minerals from the soil to grow. Just like land plants, aquatic plants respond to additions of fertilizer by growing thicker, taller, bushier, and more widespread. When the plant growth in a lake (the symptom) gets to be a problem, one of the most effective responses is to limit growth by reducing the amount of fertilizers (the cause).

Garden fertilizers contain nitrogen, phosphorus, potassium, and sometimes other minerals. For fertilizing land plants, nitrogen is the mineral needed in largest quantities and is generally the largest fraction of the fertilizer. Aquatic plants also need nitrogen and other trace minerals, and additions of nitrogen to lakes can also increase plant growth. The main factor controlling aquatic plant growth in most lakes, however, is phosphorus. This is because phosphorus is usually (though not always) the mineral that is in shortest supply relative to the plant's needs; even if other minerals are available in large quantities, if there is not enough phosphorus, growth will be slowed. Reduction in phosphorus input to a lake is often the target of a lake or watershed management program.

(continued on page 6)

INSIDE THIS ISSUE

Economic Value of A Lake and Its Watershed

by Peter Landre, Director, Keuka Lake Watershed Project and Environmental Consultant

Watershed protection is becoming an appealing method in New York State for solving water quality problems. The process of initiating and establishing a watershed program is complex, to be sure. An important step at the beginning of the process is to develop consensus for action among local citizens and officials. An effective approach for placing watershed issues on the public agenda is to identify the economic values of the lake and watershed and to develop an educational program to share this information with citizens and decision-makers.

The Keuka Lake Watershed Project, sponsored by the Keuka Lake Foundation, Inc., developed economic information and used it as part of a comprehensive program to promote the development of a watershed management program to protect and improve water quality in the lake. Economic information was found to be a very effective tool for engaging citizens and decision-makers in the discussion of the benefits of a watershed management program.

The economic values of a watershed result from the interaction between people and the resource. For example, Keuka Lake and its watershed provides outstanding opportunities for boating, fishing, swimming, picnicking and touring. The lake provides a high quality source of drinking water for nearly 20,000 people, including 10,000 who live along the lake's shoreline. The rural character of the area and tremendous views combine to create an ideal setting for rural residential living. All of these values can be quantified and used to illustrate the relative importance of the lake and watershed.

(continued on page 9)

On The Local Scene...

Findley's Pond: A Source of Power

by Sharon Utegg, Findley Lake Property Owner's Association

Findley Lake is the most western inland lake in New York State, Chautauqua County, Town of Mina. It is an impoundment of 300 acres of water, approximately a mile and a half long and half mile wide.

The impoundment was created by Alexander Findley in 1816 as a source of mill power. Findley was born in Ireland, emigrated to New England and then traveled westward to Greenfield, Pa. He followed the north branch of French Creek into the State of New York. Here he found two small ponds, connected by a sizable stream and each with a small island in it. Alexander bought the land in 1811 from the Holland Land Company, the first purchase in the township, and after serving in the War of 1812, became the first settler. The dam which he built was ten feet high and flooded back the water to form the lake as it is today.

A village was formed near the dam and shared a diversity of commerce. The dam became the base of the highway crossing and eventually a part of Main Street. As the cluster of cabins grew, it was first known as Findley's Pond, sometimes as Findley's Mills and finally Findley Lake.

In 1895 an institution, patterned after the famous one at nearby Chautauqua, was formed and was called the Lakeside Assembly. Lakeside probably did more than anything else to establish Findley Lake as a summer resort and cottages sprang up on both sides of the lake. Even though the Lakeside Assembly financially failed and was discontinued in 1914, it gave the village both a business advantage and a moral and cultural tone few communities possess.

The Findley Lake Property Owners Association (FLPO) was formed in 1949 to better the quality of water and improve the property which forms the dam impounding the 300 acre lake. The primary objectives are to preserve, improve and educate the community relative to lake usage and environmental effects. Funding for the Association comes from membership dues, and the Association has also been the recipient of memorial contributions.

Residential development, as well as that of a neighboring ski resort, Peek N' Peak, has established Findley Lake as a village for all seasons. FLPO grew as did the various concerns of the property owners. There have been numerous problems to address - lake level management, lake overcrowding, boating safety, water quality, wake erosion, flume and boat ramp maintenance, aquatic vegetation control, and other lake related activities.

With the blessings of FLPO, the Town of Mina Board of Supervisors enacted Zoning Laws in 1983. These laws were formulated for the purpose of presenting a comprehensive plan for the continued development of Findley Lake. In 1988 the town passed a Building Law, enacting the New York State Uniform Fire Prevention and Building Code as the laws to be enforced. Permits are required for most construction activities, interior and exterior.

FLPO has established historical records of water quality fluctuations, initially through independent laboratory analysis and, for the past eight years, by participating in the Citizens' Statewide Lake Assessment Program (CSLAP). The computation of this data suggested high nutrient concentrations, and the water quality in Findley Lake was found to be significantly worse in 1991 than in any previous sampling season. In July, 1992, the water quality report from CSLAP was included with the FLPO Annual Report that was provided to the general membership. FLPO decided to initiate efforts to investigate the nutrient sources, beginning with leachate testing of all lakefront property.

Two members of the FLPO Board of Directors volunteered to conduct the leachate testing, assisted by volunteers from the community. They traveled to Moscow, Pennsylvania, where Ecoscience technicians taught them how to use the equipment. They returned to Findley Lake with the rented equipment and conducted the tests within three days. The results from this study, conducted in October 1992, showed high levels of nutrients at all stream locations entering Findley Lake.

After the New York Federation of Lake Associations' Annual Conference in June 1993, FLPO purchased a tributary sampling kit. Sampling and testing will be conducted biweekly for a twelve month period to ascertain when nutrient loading is the greatest and which streams contribute the highest levels. To understand these conditions, grab samples will also be taken during periods of extreme run-off, such as heavy storms and spring thaws. FLPO plans on formulating a watershed committee consisting of concerned citizens, politicians, soil and water conservation employees, and FLPO Directors to educate and assist any contributors on the non-point pollution to Findley Lake.

Portions of Alexander Findley's mill foundation and dam can still be evidenced as are his industrious dreams, although channeled in more environmental pursuits. May those that follow find the present efforts of FLPO appropriate to Findley Lake's preservation and continued source of power.

Federation News

At the Federation's June meeting, Robert Canfield finished up a two year term as president. Bob was presented with a set of wooden loon bookends by the Board of Directors in greatful appreciation for his term of hard work and leadership.

During the same meeting, Elaine Horstmyer was voted in as the new President of FOLA. Elaine grew up in a small New Hampshire town, learned to swim and sail on a nearby lake, and has always had an appreciation for the ocean, lakes, rivers and streams. She holds an associate degree in Chemistry, a BS degree in Public Communications, and recently took a limnology course from Randy Fuller (a FOLA Board member) at Colgate. According to Elaine, this course was "a lot of work when your prerequisites are as old as mine, but Randy is a wonderful teacher and I learned a lot."

Elaine served as president of the Cazenovia Lake Association for four years and has been vice president of the Madison County Federation of Lake Associations for six years. During her presidency, Cazenovia Lake began CSLAP monitoring, purchased a weed harvester, instituted a local ordinance for lakeside septic testing, and initiated a lake and watershed management diagnostic / feasibility study. Her lake management philosophy comes from Will Roger's saying, "Even if you're on the right track, you'll get run over if you just sit there."

Anne Saltman, who has been working as FOLA's Executive Consultant since 1988, has accepted a position as the Federation's Executive Director. She will continue on with her responsibilities as Waterworks Editor, supervisor of FOLA's Information Management Service and CSLAP Coordinator.

We are pleased to introduce the following additions to the Board of Directors:

Ralph DeFelice: Ralph, or Buzz, as he is known, lives on Seneca Lake, in the town of Geneva. In 1990, Buzz and a group of concerned citizens formed the Seneca Lake Pure Waters Association (SLPWA). In addition to his professional position as a dentist in Geneva, he now spends much of his time serving as president of the SLPWA Board of Directors and as the Chairman of the Water Quality Committee. Leisure time is filled with fishing and hunting.

Craig Doran: Craig lives near Canandaigua Lake where he practices law. His area of expertise is litigation and real estate and he has had experience with legislative practice. Craig is currently the Ontario County Republican Chairman.

Marty Shubert: Marty is Vice President of the Lake Placid Shore Owners Association and lives with his family on the lake year round. In addition to his professional position as a school councilor, he spearheaded Lake Placid's involvement in CSLAP and also initiated septic dye testing around the lake. Marty has also been very involved with an Essex County committee to research non-point source pollution.

John Whitton: John lives in Ballston Lake, NY where he serves as Vice President of the Ballston Lake Improvement Association. John has a professional background with the General Electric Company and in the area of environmental consulting. His lake interests have focused on CSLAP monitoring, programs to reduce flooding and shoreline erosion, zebra mussel mitigation, beaver population control, personal water craft controls, wetlands, and septic system inspections.

FOLA's Environmental Achievement Award

The Federation's Board of Directors was pleased to present **Martin Culik**, a Cooperative Extension Agent in Batavia, NY, with the 1993 Environmental Achievement Award. Since 1989, Martin's efforts have been focused on the Canandaigua Lake Watershed Task Force, which is a coalition of public agencies, municipalities, private organizations, and individuals concerned about protecting the lake and its watershed. Martin was the founder and principal strategist of the Task Force from its inception. He has recently centered on educational programming and fund raising and has been successful in generating community action for the protection of Canandaigua Lake and its watershed.

1993 Newsletter Contest Winners

The Federation's Newsletter Committee was pleased to present the 1993 Newsletter Award to the **Boquet River Association.** Runners up were the **Honeoye Valley Association** and the **Brantingham Lake Community Association.** Twenty excellent entries were submitted this year.

Message from the President: **SWIM OR SINK?** *by Elaine Horstmyer*

The beginning of a new decade is a logical place to take a look at past accomplishments and from those, assess the goals and needs for the decade to come. The Board of Directors has just begun an assessment of the Federation and discovered that just beginning the next decade is going to challenge every one of us.

At the Annual Conference, the membership voted unanimously to become a Chapter of the North American Lake Management Society (NALMS). By becoming a NALMS Chapter, the Federation will be part of a larger network and have a broader base of timely information. NALMS will vote on our petition to become a Chapter at their November meeting.

As a result of the active participation at the Statewide Lake Management Plan session at the conference, a needs/assessment committee will be formed to study this concept. Please read Lyle Raymond's article on page four of this newsletter issue.

These are only two of the exciting possibilities for the coming decade. On the downside, the Federation's financial status is perilous. To keep the Federation afloat into the coming decade we will have to find ways to increase our income to match our expenses. This Federation belongs to its members. Because you, the members, are so important to us, we want to know how you feel about the Federation. Just as the Board is assessing the past and future decades, we would like you to do the same. Please write and let us know what you think.

A STATEWIDE LAKE MANAGEMENT PROGRAM

Compiled by Lyle Raymond, Chairman of the FOLA Public Issues Committee.
Other Committee Members: Richard Burton, Martin Culik, and Margaret Schaefer

The Long Range Plan of Operations for the Federation includes a provision to "establish a committee of the membership to address the need for a Statewide Lake Management Program." Federation members have expressed interest in developing a strategy for such a Program. The 1993 annual conference featured a one-half day session, organized by the Public Issues Committee, to stimulate thinking about possible goals and objectives of a potential statewide lake management program.

Conference participants engaged in five small group discussions on topics relating to statewide lake management programs during this session. The topics were: 1) Growth Management; 2) Who Manages?; 3) Conserving Lakes as an Economic Resource; 4) Pollution Control; and 5) Education and Information.

A list of significant issues emerged from these small group sessions for possible inclusion in a statewide lake management program. The following is a general summary of the issues that were identified.

GROWTH MANAGEMENT focuses on the concept of sustaining lakes for the long range future on an ecologically sound basis. The history of the state's lakes provides little indication that growth will stop in lake watersheds. Achieving successful growth management requires collaboration and sharing of responsibility by everyone concerned with a lake and its watershed.

Immediate problems for growth management identified by the discussion group include waste discharges from septic systems, second tier development adjacent to lake shores, and conversions of seasonal cottages to year-round habitations.

Authority to manage growth must be available for growth management to work. The group focused on the authority that towns have to wield such controls. Whether the towns can be persuaded to use their authority is another issue. Furthermore, when ordinances are enacted, "grandfathering" often exempts many violators from having to comply.

Two ***regulatory issues*** in growth management were identified. One issue is what basis can be used for growth management scheme that will hold up in court. The group suggested the possibility of using measurements of the nutrient balance in lakes and streams for this purpose. The second pervasive issue is determining when "enough is enough" -- in other words how much development of what type and form can be accommodated and still protect the integrity of a lake?

The group concluded that education and the relationships with town governments are critical keys to concepts of growth management for lakes and their watersheds.

WHO MANAGES focuses on the fact that no single unit of government has sole authority to manage a lake and its watershed. Furthermore, lake watersheds do not respect town and county boundaries. This means that effective lake management requires a collaborative effort among the local governments involved and with higher levels of state and federal government. Often this leads to the creation of special districts. Who will take the lead in developing new management entities and/or programs often becomes a vexing question in such coalitions.

Public consensus, educational programs, and the availability of resources were identified by this group as critical factors in determining who will undertake leadership in lake management. They noted that lake districts are a method of tapping public funds, while associations depend upon private sources of funding.

Public or private management is related to the fact that public agencies are usually not willing to become involved in the absence of public access to a lake. Other problems identified by the group in deciding who manages include fears of being "taken over" by some higher level of government or new entity that has been created, and the ever present competition among lake users with differing perceptions of what the goals of a lake management scheme should be.

A lead agency must have authority to back up its actions, the group agreed, but the state should definitely not be the fallback for lack of local action. Towns and villages have this authority if they can be persuaded to use it, the group pointed out.

Lake associations have a critical role to play in deciding who manages. Accepting such a role is not easy for many lake associations, who must contend with limited resources and time commitments between social and issue-oriented activity calendars. Nonetheless, the group concluded that lake associations must work with the local towns. To do so successfully, they said, means that association members must do their homework on lake and watershed problems, including identification of acceptable means of paying for protection actions.

CONSERVING LAKES AS AN ECONOMIC RESOURCE relates to local recognition that lakes are generators of tax revenues, business and jobs. However, it should not stop here but should also include recognition that at least a portion of the revenues generated by a lake should be re-invested in protecting it to sustain it as a continuing source of economic benefits for the future. Anything short of this represents exploitation of a lake as a "free" resource to be "mined" for maximum extraction of revenues until it is gone -- or "used up."

Lakes are economic resources for local communities through personal property value; lake frontage; recreation; tourism; local businesses sustained by fishermen; boaters; people who come to public beaches; and lakes as reservoirs for water supply and feeder canals. Economic values include tax revenues and value enhancement through aesthetics and community image.

Exploitation of lakes as a "free" resource occurs in many forms. Among these the group identified were a) local zoning that fails to protect the lake; b) conversion of seasonal cottages to permanent habitations in areas unable to adequately sustain such intensification of use; c) lack of lakefront protection; d) siphoning local tax revenues from the lake into general town funds without dedicating a portion to future protection of the lake as an economic resource; and e) allowing free use of lakes without requiring users to contribute something for maintenance of the resource. The group also mentioned that privately-owned non-tourist lakes are also tax revenue generators and should not be "written off" by local towns as the sole responsibility of the lakeshore owners.

POLLUTION CONTROL is, of course, at the heart of lake management policy-making. How decisions are made to control pollution, who pays, who regulates land and water uses to achieve pollution control, and what priorities should be set relative to the costs involved are often difficult questions to resolve.

Local health regulations may be inadequate and/or outdated for resolution of lake pollution problems. Furthermore, local residents are not taxed in relation to their share of responsibility for pollution of a lake to clean it up or protect it. This group was also quick to point out that state regulations don't always work at the local level either; they must be adapted to local situations to be fully effective.

Lake associations are seen as the current driving force behind water quality protection efforts for lakes. Their needs in accomplishing this include a) ways to influence local budgets; b) new concepts for working with towns; c) curriculum development for educational programs to develop an ethic of lake protection; and d) working with localities to deal with septic system violations.

Enforcement involves a variety of problems. These include a) poor funding and staffing; b) effective monitoring that is mutually beneficial; c) cost sharing; and d) guidance on what to monitor for.

Water testing: Who does it? What are the goals or needs? Priorities in relation to testing options and costs are questions that need better answers. Testing is often done without much synchronization by private groups and individuals, colleges, Citizens' Statewide Lake Assessment Program, and state or county agencies. Agricultural inputs to lake pollution are another issue. The group stressed implementation of best management practices for pollution control. It was felt that dye testing of septic systems, roadway inputs, and stressed stream analysis (where 80% of the contaminants may come from one stream) should be an integral part of a testing program. Property transfers should require septic system tests that must be met.

Approaches to water pollution problems include a) showing that remediation works by verifying corrective actions; b) identifying corrective options rather than yelling first; c) public recognition for those who have complied with pollution control measures; d) establishing a hotline to provide expert advice; and e) to remember that the "tortoise wins the race!"

EDUCATION AND INFORMATION is critical to lake management. The quality of lakes can be improved through education of those whose actions affect lakes. The critical question is who will carry out education programs, how they relate to other management actions, and who will pay for it.

Appropriate clientele that should receive priority for education programs were identified by this group. Local officials, schools, and youth groups were at the top of the list, followed by volunteers hwo are willing to help with educational programs, and of course, the general public.

Educational techniques include ways to solve problems locally; identification of resources that are available; identification of common problems; knowledge of technical issues relating to lake management; identifying incentives to learn and act; getting news media attention; interacting with legislators and their staff people; attendance at public meetings and letter writing.

What an educational program should say includes the general dictum that lakes are valuable; the need for coordination among agencies and granting of regulatory permits; information from other states; understanding how land use decisions are made; and encouragement to participate in planning boards and other local bodies.

Educational needs include leadership training, learning land use laws, identifying resource sources, and imparting a sense that "you are part of the problem."

The ***educational mission*** should include education for lake management, encouraging coordination of group efforts, and developing clearinghouses for information (such as the Federation). ●

A Call to Action!

Milfoil Management in Northeastern Lakes

September 20 and 21, 1993
Roaring Brook Conference Center
Lake George, New York

An Interactive Conference for All Lake People in the Northeast Region

Sponsored by COLAM - Coalition of Lakes Against Milfoil

Cost: $63.00 per person, plus lodging
Register by September 10, 1993
For more information, call COLAM at (518) 668-3558

PHOSPHORUS *(continued from page 1)*

Sources of Phosphorus

There are two principal pathways that supply phosphorus to lakes. The first is from **external sources**, including runoff from the watershed, point sources such as sewage treatment plants, and atmospheric input. Controlling the external nutrient sources is the main reason why lake management programs include and emphasize proper management of the lake's watershed. Runoff from fertilized fields or lawns, livestock areas, urban and paved areas, and areas of soil erosion all carry phosphorus into the tributaries and eventually into the lake. Additional phosphorus is added from septic tanks, as well as municipal or industrial discharges. Some phosphorus is also carried from distant sources in rain and snow, and enters the lake directly through precipitation.

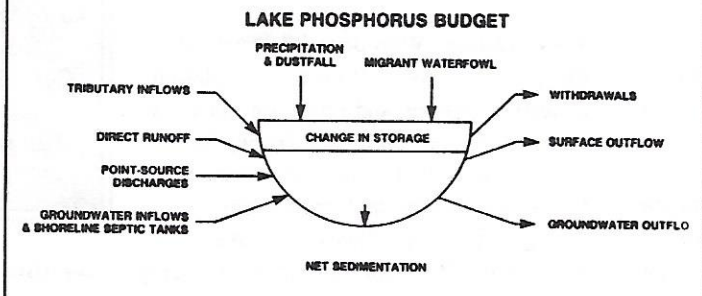


Figure 1. Phosphorus Budget Schematic *(from The Lake and Reservoir Restoration Guidance Manual, NALMS, 1988)*

The internal supply of phosphorus to the plants in a lake is much harder to measure and control the phosphorus from external sources. Nearly all lakes have at least part of the bottom covered by soft mud or silt, which is usually very rich in phosphorus. In shallow water, these sediments encourage the growth of rooted plants such as milfoil or pond lilies. In deep water, phosphorus-rich sediments are at risk of becoming anoxic (lacking oxygen) and setting up a cycle of internal loading or internal cycling that can result in extreme algae blooms and water-quality problems.

Phosphorus compounds are part of a special chemical cycle in lake bottoms that is mediated by dissolved oxygen. Under most circumstances, phosphorus compounds are strongly associated (adsorbed) with soil or other particles. As long as dissolved oxygen is available, chemical attractions (primarily to iron oxides) bind most of the phosphorus to the sediment. If the lake begins to lose oxygen near the bottom sediments, however, a chemical shift occurs that releases the bound phosphorus back into the water and makes it available for plant growth. (For a discussion of how and why lakes lose their dissolved oxygen, see "Anoxia, the Invisible Problem" in Waterworks Volume 8, No 2.). Once a cycle of anoxia and internal phosphorus loading from the sediments is underway, this internal supply can quickly become the controlling factor in the lake's rooted plant and algae growth.

It is important to note that there are several different chemical forms of phosphorus, not all of which are available to plants. Most phosphorus carried in watershed runoff and present in lake sediments is tied up with soil particles (particulate phosphorus) and cannot be used by plants. Several different forms of phosphorus are dissolved in lake water (soluble, dissolved, or ortho-phosphorus); these forms are available for plant uptake in varying degrees. All of the various forms of phosphorus interreact, however, and particulate phosphorus can become dissolved phosphorus and vice versa, depending on the surrounding chemistry. The simplest approach is simply to measure and discuss **total phosphorus**, which includes all forms, but it is often useful to test for some of the **dissolved phosphorus** forms as well. Be certain that when you start to discuss phosphorus testing with a laboratory technician or professional, you know which forms and measurements you are talking about!

Phosphorus Budgets

Because there are many different possible sources of phosphorus within a lake and its watershed, it is important to determine *which* sources are actually supplying most of the phosphorus in a particular situation. This is one of the reasons why lakes are so different from each other, and why a lake management plan has to be tailored to the individual lake. While one lake may be controlled mainly by external phosphorus sources through soil erosion and agricultural runoff, another lake nearby may be driven almost entirely by internal loading. When the goal is to reduce plant growth by reducing phosphorus supply, it is critical to make sure that management efforts are focused on the major sources that give the best chance for phosphorus control. If a lake has a steady supply of phosphorus from internal cycling, for example, intensive measures to control external nutrient sources are likely to have little effect.

On a volunteer level, tributary sampling can be used to give some indications of which parts of the watershed contain the largest external phosphorus sources. To get an accurate overall picture of phosphorus dynamics within a lake, however, more detailed study is required. The professional tool most widely used in managing phosphorus is called a nutrient budget.

In order to construct a nutrient budget, all of the possible sources are evaluated and their relative contribution is determined. In order to "balance the budget", the amount of phosphorus lost through the lake's outflow and deposited into bottom sediments is also measured or estimated. The concentration, or amount of phosphorus present in a given place at a given time, is measured by collecting a water sample for careful laboratory analysis. In order to construct a nutrient budget and determine the long-term rate of supply of phosphorus from different sources, concentration measurements must be collected from several locations (tributary inflows, lake outflow, surface water, deep water) over time. Mathematical models based on measurements of nutrient levels in many lakes are also often used in rating the overall rate of phosphorus loading and identifying major sources. Constructing the nutrient budget for a lake is the central part of a lake diagnostic study, and should always be part of the planning process prior to launching a major management or restoration effort.

Phosphorus Concentration (mg/l)	Trophic State	Lake Use
<0.010	Oligotrophic	Suitable for water-based recreation and propagation of cold water fisheries, such as trout. Very high clarity and aesthetically pleasing.
0.010–0.020	Mesotrophic	Suitable for water-based recreation but often not for cold water fisheries. Clarity less than oligotrophic lake.
0.020–0.050	Eutrophic	Reduction in aesthetic properties diminishes enjoyment from body contact recreation. Generally very productive for warm water fisheries.
>0.050	Hypereutrophic	A typical "old-aged" lake in advanced succession. Some fisheries, but high levels of sedimentation and algae or macrophyte growth may be diminishing open water surface area.

Table 1. Proposed Relationships Among Phosphorus Concentration, Trophic State, and Lake Use for North Temperate Lakes *(from Engineering Approaches to Lake Management, Volume 1, by K.H. Reckhow and S.C. Chapra 1980)*

How Do We Tell if We Have a Phosphorus Problem?

Phosphorus by itself is not a problem, but if you have algae blooms, low transparency (secchi disk), or heavy weed growth in your lake, then phosphorus supplies may be excessive. Spring and summer algae blooms that follow periods of heavy rainfall and runoff often indicate high external phosphorus sources. Algae blooms that occur after wind storms in late summer or in the fall at lake turnover, in particular, are an indication of internal phosphorus loading. Point-sources of phosphorus, such as septic tanks, can often be spotted by a localized patch of filamentous algae growth.

Laboratory analysis of water samples can be used to determine the amount and types of phosphorus present in lake water. The Citizens Statewide Lake Assesment Program includes measurements of phosphorus from surface water samples and may include monitoring of phosphorus in the tributaries. Analysis of one or two water samples, however, is not a complete answer, because it is the overall rate of supply of phosphorus to the lake that controls plant growth.

If you have problems with plant growth and want to check on phosphorus loading in your lake, the first step is to contact a reputable laboratory that is capable of performing *low-level* phosphorus testing, and have one or two samples of the surface water from your lake tested. These tests will let you know about your overall level of lake productivity (refer to Table 1). In my experience, surface water concentrations above about 0.030 mg/l as P (same as 30 ppb P) are generally associated with problem algae blooms and low transparencies. If possible, test a sample from near the bottom at the deepest part of the lake in late summer, to see if internal phosphorus loading is a problem in your lake. As discussed in several recent articles in Waterworks and at the FOLA 1993 meeting, sampling of tributaries, especially during storm runoff, can be very useful in identifying watershed areas contributing large external phosphorus loads. If problems with weeds and algae blooms are severe, particularly in larger lakes, it may be time to look into constructing a full phosphorus budget, usually with the assistance of a professional planner or lake management consultant.

How Do We Control Phosphorus in Our Lake?

For external phosphorus sources, watershed management is the key to phosphorus control. Measures to reduce runoff and soil erosion, reduce or contain fertilizers, and route storm drains away from lakes and streams all pay off in reduced phosphorus loading. Control of internal phosphorus loading is more difficult and is usually based on controlling dissolved oxygen levels. Methods for controlling phosphorus loading are an almost continual topic of publications and discussions on lake management, and many resources are available that address both small-scale and lakewide efforts at phosphorus control.

If you've been confused about phosphorus, it's for good reason. Phosphorus is one of the many invisible links in the complex web of lake and watershed dynamics that result in the visible problem (excess weeds and algae). While it is far from the only factor, phosphorus' important role in nourishing plant growth makes it a key player in the overall balance, or imbalance, in the lake. ●

HISTORIC PHYTOGEOGRAPHY OF AQUATIC MACROPHYTES IN CENTRAL AND WESTERN NEW YORK

by Lauren Elaine Giebel and Bruce Gilman

Management of freshwater bodies could be improved by a more thorough understanding of the aquatic macrophyte communities. Macrophytes are the large, vascular plants typically associated with water, such as milfoil, water lilies and cattails. Comparison of historic macrophyte records to modern inventories could help to document recent trends in lake ecology. Information on modern plant composition could provide direction to resource managers. For example, the presence of some plants may indicate siltation problems, suggesting the need for upland watershed treatment. Dense-growing plants may be a signal of nutrient loading, helping to identify instances of shoreline pollution. Macrophytes, because they must tolerate all conditions of the habitat where they grow, may provide still other clues on the delicate ecology of freshwater lakes and streams.

Methods:
Over 70 freshwater bodies are currently managed within an 18 county area of central and western New York. The occurrence of 78 macrophyte species was investigated within each site. Preliminary data was obtained from the Atlas of New York State Flora which provides county distribution maps for macrophytes but lacks the site-specific information needed by watershed management organizations. To obtain site-specific data, four regional herbaria were visited: the New York State Museum in Albany, the herbarium at Finger Lakes Community College in Canandaigua, the Bailey Hortorium and Wiegand Collection at Cornell University in Ithaca, and the herbarium at Hobart and William Smith Colleges in Geneva. Over 12,000 specimen sheets were reviewed, revealing nearly 2,000 collected from the managed water bodies. Label information on water body, specific location, county, collector, date, year, and accession number were manually recorded and later transferred to a computer filing system. New Information, as it becomes available, can be readily added to the file to enhance future analyses.

Results:
Historical information on macrophyte distribution is sporadic, with episodes of aggressive collection in some decades, only to be followed by significant chronological gaps. Earlier inventories tend to be inclusive of all aquatic habitats while more recent research often focuses on one habitat (i.e., submersed macrophytes) or one species group (i.e., pondweeds). Herbarium labels are generally complete, but some confusion exists about name changes of specific locations and taxonomic problems of certain plant groups. Common macrophytes appear to be under-collected; perhaps their abundance makes them less interesting.

If you are interested in using historical changes in aquatic macrophyte communities as an indicator of trends in water quality, the complete report, including a lengthy appendix of individual water body records, is available from the second author at Finger Lakes Community College, 4355 Lakeshore Drive, Canandaigua, NY 14424-8395.

Recommendations:
Standardized methods and seasonal timing of collection would provide a wealth of information valuable to watershed managers. Monitoring of aquatic weedbed composition should be a part of all holistic management programs. Proper volunteer training could be provided through existing vehicles like the CSLAP initiative. Exclusive use of scientific names would alleviate confusion caused by multiple common names. Those responsible for macrophyte identification should be experienced in botanical taxonomy. Lake associations should ask assistance from regional academic institutions and members of the Scientific Advisory Board of FOLA. To insure greatest access to, and exchange of information on aquatic macrophyte distributions, storage of records on a standard computerized database is recommended.

Acknowledgement:
Funding and professional support was provided by the Environmental Protection Agency, the Federation of Lake Associations, and the Water Resources Board of the Finger Lakes Association. Cooperation from the herbaria curators is gratefully recognized. A special thank you is extended to Finger Lakes Community College students who assisted in data collection and analysis. ●

ECONOMICS *(continued from page 1)*

Economic information was developed in four areas to help illustrate the importance of the watershed to local officials and residents. The four areas are: 1) property values; 2) tourism and recreation; 3) water filtration costs; and 4) potential development. Good information was developed on the first two categories while anecdotal information and common sense was applied for the latter two groups.

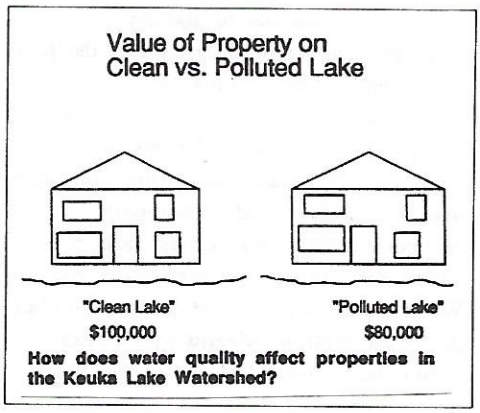
Property values in a lake watershed are closely tied to the quality of the lake. The value of shoreline property on Keuka Lake, for example, is staggering. The assessed value in 1991 was over $600 million and the market value was estimated at $1 billion. This fact has been repeated numerous times by Town Supervisors when discussing the importance of protecting Keuka Lake.

This fact alone, however, does not tell the entire story. It is important for local officials and residents to understand the connection between human activities and the tax base. Activities on the land impact water quality and ultimately the value of property and the distribution of taxes.

Several studies have documented that similar shoreline properties located on "clean" and "polluted" lakes vary in value by as much as 20%. On Keuka Lake, a local realtor who has tracked property sales over the last decade confirms that water quality factors, such as aquatic weeds, do indeed reduce property values on Keuka Lake.

We further analyzed lake property tax contributions and the potential impact that poor water quality might have on taxes. In the towns surrounding the lake, a major proportion of the taxes are contributed by lakeshore property owners. In the Town of Jerusalem, for example, nearly 70% of the taxes come from lakeshore properties. For lakeshore towns, the major "business" is lakeshore properties.

To take this one step further, we assumed that the lake water quality declined, resulting in a lowering of lakeshore properties by 20%. We then analyzed the tax impact in terms of tax dollars lost (assuming services were maintained) and how much taxes would be raised across the board to make up for this loss. We found that a significant increase in taxes would be required to offset a reduction in lakeshore property values.



The tax information described above was obtained from the county Real Property Tax Office. A local realtor with an excellent database helped us sort out the information by town and lakeshore property.

A second major area of economic importance in a watershed is tourism and recreation. For Keuka Lake, we obtained information from the Finger Lakes Association for Yates and Steuben Counties, such as the number of industries, employees, and their payrolls. The 1987 Overall Economic Impact from tourism and recreation was $52.7 million for Steuben County and $5.7 million for Yates County. The actual value of the tourism industry to the community is estimated to be 4 to 7 times these values due to reinvestment of the money in the local economy.

The impact of fishing on Keuka Lake is very significant. The Department of Environmental Conservation recently published the results of an angler survey for lakes in New York State. In the report, the DEC estimated that anglers spend over $5 million annually while visiting and fishing on Keuka Lake.

Over 20,000 people drink water from Keuka Lake. Water filtration costs for both individuals and municipalities depend on the quality of water entering the treatment system. The Village of Penn Yan at the north end of Keuka Lake is installing a new sand filtration plant to comply with the new Safe Drinking Water Act requirements. The plant will cost $3 to $5 million to install and will require regular maintenance, depending on the turbidity of lake water entering the plant. Lake water turbidity is influenced by the concentration of algae and sediments. To a large extent, both of these factors can be managed using various "best management practices" or other pollution prevention initiatives. Reducing algae and sediment concentrations in the lake may reduce the frequency of sand filter maintenance required by the municipality. Over time, the savings to the taxpayers may be significant.

Finally, we know that development and growth are important to many of the communities around Keuka Lake. Desirable future development depends upon a high quality environment. Quantitative information to support this notion has not been developed, but we felt this point was an important one to raise. The best development is usually located where the quality of the environment is excellent. While there often is a conflict between development and environmental quality, we took the position that good development incorporates sound environmental planning. In terms of water quality, this means that the quantity and quality of water leaving the site is unaltered from natural conditions. This concept is central to the new stormwater principals outlined by the DEC.

In summary, economic facts can be a useful tool for getting water quality issues on the public agenda. Local decision-makers and concerned residents seemed to respond positively to learning about the economic facts and relationships. Economic information has helped decision-makers put the cost of proposed watershed protection efforts into perspective and move the process forward more quickly. ●

Silver Lake News

FARMERS LOOK OVER THEIR SHOULDERS IN SILVER LAKE WATERSHED

A Citizens Group Takes Watershed Farm To Federal Court

by Lorraine Sturm, Secretary, Silver Lake Association

Silver Lake in Western New York is a silt-bottomed lake, three miles long, a half mile wide and 37 feet at its deepest point. At its south end is a wildlife sanctuary vital to the lake's ecology. At the lake's north end, is its most unique feature - the inlet and the outlet. Upland, surrounding the lake is some of the most productive farmland in New York State and a state park. There are 24 farms in the watershed. On the lake are 800 residences, an 18 hole golf course, and 4 marinas.

Agriculture is Wyoming County's biggest industry. This Spring's civil trial, Concerned Area Residents for the Environment (CARE) vs. Southview Farm, was closely followed by farmers and agricultural agencies, environmentalists, and Silver Lake Association (SLA).

Southview Farm, 2.5 miles east of Silver Lake, has nearly 2000 cows and is probably the largest dairy farm in New York State. It is considered state-of-the-art and is toured annually by students and farmers worldwide.

CARE, a group of six Southview neighbors, took Southview to court after exhausting local resources to stop alleged pollution from Southview's manure.

The jury found Southview guilty of violating the Federal Clean Water Act and trespassing private residents' wells with nitrates. The Federal Act was violated because evidence showed the farm's manure reached the Genesee River which flows through Letchworth State Park, through the City of Rochester and into the Great Lakes. Silver Lake's outlet runs into the Genesee.

There has never been a case like CARE vs. Southview Farm. Southview motioned to dismiss the case on the grounds that a citizen's group had no right to litigate a federal law. CARE's total award was $4,101. Southview filed a postverdict motion to dismiss the findings, arguing on July 27 that the jury didn't understand judicial instructions. CARE insists the money was never the point -- pollution was. Nitrate levels in their wells fluctuated in conjunction with manure practices and occasionally exceeded healthy levels. The farm now awaits the court-set fines on the Clean Water Act violations and the post-verdict dismissal motion. Meanwhile, CARE groups have formed elsewhere in New York State.

In Castile, where Silver Lake and Southview Farm are located, good relations between the overall agricultural community and the lake homeowners have prevailed. One of Southview Farm's partners and other area farmers have cottages on the lake where they can see the weeds and silt firsthand. They point out, however, that the golf course and cottagers must also bear some blame for nutrient loading. True, each year tiny white flags dot lakeside lawns where chemical fertilizers and weed killers are applied and SLA newsletters remind cottagers of the impacts.

A lot of the goodwill between lakers and watershed folks is the result of the SLA. Like farming, SLA has changed and expanded to meet the times. It opened its membership to the watershed property owners and recreational lakers. One of the first nonlakers to join the new association was a Castile farmer.

SLA realized years ago that the age-old cottage septic systems were damaging the lake. In 1985, the town of Castile, with SLA support, formed the Silver Lake sewer district and all cottages are now hooked up to the public sanitation system. Already, water clarity is much better.

As SLA increases its local network, our President, Elaine Cook, does the same at the state level through the Federation of Lake Associations. Networking educates and informs, but more importantly, makes hard-to-get state grants for lakes more available when regions work as a unit.

To get data to support the need for the lake management study, SLA volunteers participated in the Citizens' Statewide Lake Assessment Program (CSLAP). SLA members used these results and successfully lobbied our state legislators to get a $100,000 lake management study grant. The initial study cost $50,000, and the remainder is being spent on clean-up work primarily to stop the flow of nutrients into the lake.

The grant is administered by the Silver Lake Watershed Commission, a state-authorized organization comprised of municipal representatives of towns who depend on Silver Lake for drinking water. They each contribute $1,500 annually to the Commission's operating budget.

SLA used to vote on non-financial Commission issues until the County Farm Bureau challenged our right to vote. When legal opinion determined that only the Municipalities can vote, SLA was rebuffed but not deterred. The Commission now seeks our input at its meetings and its chairman is a SLA member. All Watershed Commission meetings are now attended by representatives of Wyoming County Farm Bureau, Soil Conservation Service, Agriculture Stabilization Conservation Service, the lake district Zoning Officer and SLA.

The first person helped by the grant was the farmer/SLA member who spent $40,000 to control barnyard runoff. He received $5,000 to offset costs, and his plans to initiate additional improvements is setting an example for colleagues.

A dozen businesses also applied to the Commission to help fund their erosion - control projects. Although they won't receive a lot of grant money, it will be enough to show support and further relations.

This summer, funds will go to a variety of watershed projects including an agricultural-chemical manufacturer, a marina, 3 farms, and a county water quality committee with three projects: 1) continue CSLAP lakewater sampling to determine if clean-up projects are working; 2) conduct an inventory of watershed operations where hazardous materials are stored and estimate what route they would flow if spilled; and 3) establish a coordinated haz-mat response team using watershed fire departments. Castile Highway Department will get aid to improve 3 roadside culverts and the Perry Public Works Department will get $1,000 for boom-type, spill-retention equipment.

The grant money will go quickly. It has taken two years since the study ended in December, 1991, and the state wants the money back in March, 1994, if it isn't spent or encumbered.

Once expended, watershed work will continue through the Commission which plans to increase its annual budget to help fund projects that didn't make the first cut. Down the road, cottagers may see a weed harvester, but first things first. There's little point in harvesting weeds if you don't stop what the watershed is feeding them.

SLA members now voluntarily hold offices on municipal boards and subcommittees in Castile and Perry. Two cottagers are town councilmen and another is a member of the Castile-Perry Area Planning Board. A local Town Supervisor said the best laws are those that constituents help write. Currently under review is a proposal to regulate our lake's docks and moorings and you can bet SLA members are right there participating in all discussions.

Actively protecting our little pieces of paradise through education and information networking is increasingly important as state coffers continue to dry up. ●

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The Federation of Lake Associations, Inc.

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Lake associations with less than 50 members.....$30.00/year
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President/Contact Person: _____

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Summer Phone ( ) _____ Winter Phone ( ) _____

Total number of newsletters requested of each issue: _____

NEWS, VIEWS, and OPPORTUNITIES

GREAT LAKE WATER QUALITY GUIDANCE: How Will It Affect You? US EPA has published proposed Great Lakes Water Quality Guidance that establishes consistent water quality goals and control of discharges throughout the Great Lakes Basin. The Guidance was developed in cooperation with the eight Great Lakes states (including NYS), Indian tribes, environmental groups, industries and municipalities in the basin. The public comment period for the Guidance will be open until September 13, 1993. NYSDEC will comment on the details of the Guidance and how they will affect NY's water quality program. DEC also encourages the public to review and comment on the Guidance. Copies of the proposed Guidance may also be reviewed at DEC Regional offices. Copies of EPA fact sheets can be obtained by calling the DEC Division of Water, Public Participation Section at (518)457-0669.

HELP SAVE OUR LAKES - A Storm Drain Painting Project: Storm drains are located throughout NY's towns and cities. When it rains, the water runs along the gutters on your street "disappears" down the storm drains. Anything that is poured into your storm drain goes into the rivers, bays, lakes or groundwater. Your association can help clean up these waters by stenciling the words "Don't Dump" on storm drains in your area to remind members of your community that nothing but rainwater should enter the storm drains. To obtain stencils contact the New York Sea Grant Extension Program, 21 South Grove Street, East Aurora, NY 14052 or call (716)652-7874.

ALL YOU EVER WANTED TO KNOW ABOUT ZONING...by James A. Coon, Esq., and Sheldon W. Damsky, Esq. -- second edition, is available from NY Planning Federation (518)432-4094

NATIONAL DRINKING WATER CLEARINGHOUSE (NDWC) - Several free publications are now available that provide information about various NDWC services. NDWC offers technical information and low-cost educational products that address small community drinking water issues. To request free materials or for more information call the NDWC at: 800-624-8301.

LEAGUE OF WOMAN VOTERS CITIZEN INFORMATION SERVICE Helpful for tracking legislative bills, committee calendars, voting, and more. Call 1-800-836-6975 Monday - Friday 10am - 4pm.

TURN IN POACHERS AND POLLUTERS - Help stop wildlife poachers and environmental polluters! If you see or are aware of someone taking wildlife illegally or illegally dumping waste, discharging chemicals or sewage or otherwise polluting the environment, call the toll-free hotline: 1-800-847-7332.

WILD ABOUT NEW YORK's WILDLIFE? "Wild in New York" is DEC's new fish and wildlife newsletter and is produced quarterly by the DEC's Division of Fish and Wildlife. To subscribe contact: "Wild in New York", NYS DEC, Division of Fish and Wildlife, 50 Wolf Road, Albany, NY 12233-4755.

GEESE A PROBLEM? Non-migrating geese can have severe impacts on pond and lake water. Large populations of geese can increase concentrations of potentially harmful bacteria and can enhance vegetation and algae growth through deposition of fecal waste. For information dealing with problems of geese, sea gulls, and other animal pests, contact the US Department of Agriculture, Animal Damage Control Unit, Laura Henze, (413)253-2403.

FREE PUBLIC EDUCATION INFORMATION PACKAGE - The National Small Flows Clearinghouse (NSFC) offers a free Public Education Information Package that contains brochures on septic tank care, groundwater protection, user fees, wastewater systems, a SCORE poster, and a complete listing of the NSFC's public education videotapes. To order the package, indicate item #POOO497 and allow $2.00 for shipping and handling; contact: NSFC, West Virginia University, P.O. Box 6064, Morgantown, WV, 26506-6064 or call 800-624-8301.

CALL TOLL FREE TO HELP UNCLE SAM IMPROVE NPS & WATER PROGRAMS - The Clinton admonistration wants you to call the following toll-free numbers to report government waste or suggest improvements in how government works. Use the numbers to give your ideas on cleaning up the nation's waters and NPS pollution prevention: Agriculture: 800-424-9121; Education: 800-647-8733; Energy: 800-541-1625; Environmental Protection Agency: 800-424-4000.

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