CAYUGA LAKE WATERSHED

Network News

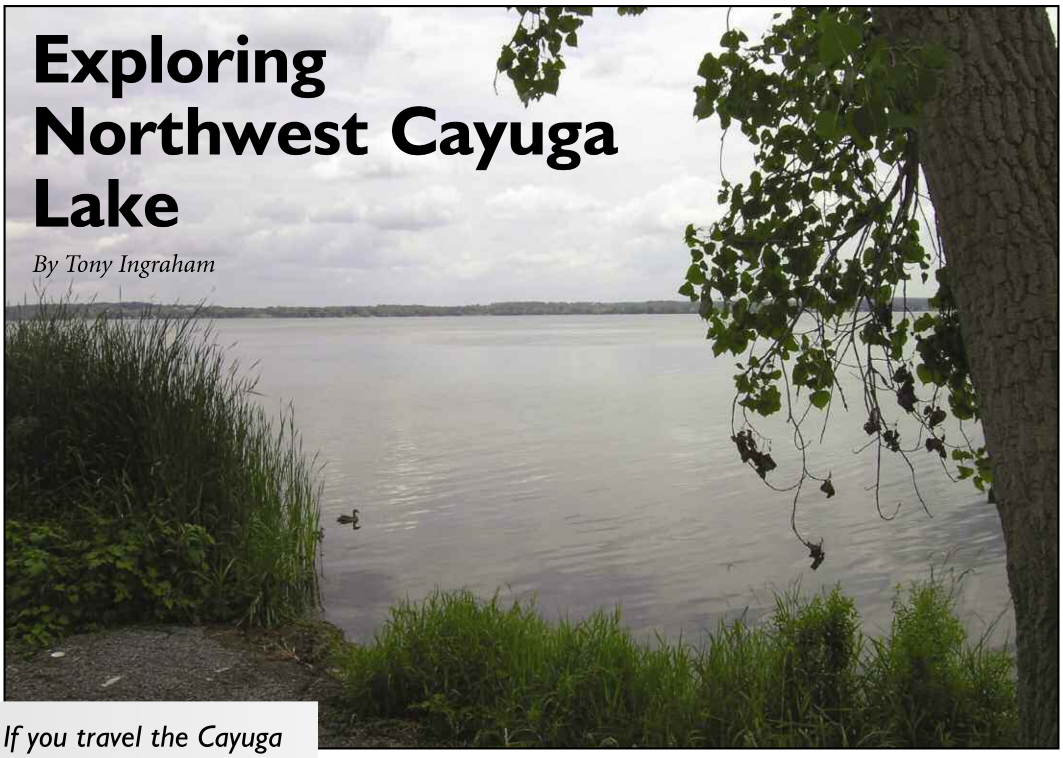
2008 i4

INSIDE...

Cayuga Lake Watershed Network

Exploring Northwest Cayuga Lake

By Tony Ingraham



If you travel the Cayuga Lake Scenic Byway north along Route 89 on the western shore, you will notice that the land thins down. Along the lake in northern Seneca County you no longer encounter the steep hills that are found in the southern part of the watershed.

What is less obvious, however, is that the lake itself thins and becomes quite shallow. South of Sheldrake, the dark, cold bottom of the lake lies below sea level at 435 feet. But much of the northernmost eight miles of Cayuga Lake is less than ten feet deep.

It is as if the northern tip were a different lake from the many miles of deep water to the south. Here the lake warms quickly in the spring and cools rapidly each fall. You fish for bass, perch, pike, and pickerel, and not the trout and salmon found in the depths farther south. In winter, northern Cayuga Lake usually freezes over, and ice fishing is popular.

In summer, sunlight penetrating to the shallow muddy bottom supports the growth of rooted, submersed, aquatic vegetation. Many of these plants are native and beneficial to the ecosystem, but some, including Eurasian milfoil, come from other parts of the world and are considered "invasive." Aquatic plants can block channels, surround docks, and impede boats from launching in or entering shallow areas. Storms can dislodge masses of weeds that float around the lake until they wash

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WATERSHED STEWARD'S MESSAGE

By the time this newsletter reaches you, I will have left the staff of the Cayuga Lake Watershed Network.

Looking back I am proud of our publications such as *Smart Steps for Clean Water* and the many informative issues of the newsletter. I appreciate the municipal officials I have worked with that explored their role in protecting drinking water and shorelines, the many dedicated agencies I got to partner with and the hundreds of volunteers who planted thousands of trees and removed tons of trash. I am pleased looking forward at where the Watershed Network is heading as well as where it has been. Graduate students are working with us on a new way of reporting on the health of Cayuga Lake so that it is interesting and meaningful. For those that like data, soon water monitoring data and reports will be more readily available via the Internet. The Watershed Network has begun gathering information to add to a web-based data repository as part of Cornell's eCommons. Thank you to the hundreds of members who are the core of the organization and made all the work possible, both looking back and looking forward.

What Do We Learn from Computer Models?

by Sharon Anderson, Watershed Steward

In a lake as big as Cayuga, it is not practical to measure all the things we would like to. When scientists, agency staff, volunteers, and even automatic sampling equipment, collect water samples for testing the costs add up quickly. Researchers have developed computer models that simulate the movement off the land and into the water, of contaminants like phosphorus and sediment, in order to get an idea of how much is entering the lake. Models also offer the advantage of predicting the consequences of things that could happen but have not happened.

Use of one such model, commonly referred to as GWLF (Generalized Watershed Loading Functions), is widespread in the northeast and mid-Atlantic states. Pennsylvania uses GWLF extensively in regulating water quality. Dr. Douglas Haith, one of the creators of the model and a member of the Watershed Network's Board of Directors, has been helping apply the model to this watershed.

Salmon Creek looks like chocolate milk after a storm. Some of this is natural, as evidenced by the Myers and Salt Point at the mouth of the creek. Models can help us understand how human activities exacerbate the erosion.

Information on soil, streams, weather, wastewater management and activities that take place on the land are fed into the model. The computer model uses mathematical formulas and what is known about the amount of phosphorus and sediment that comes off land that is developed, farmed or forested. Given that set of circumstances, the model estimates how much sediment and phosphorus moves from the land to the lake. The model also predicts the movement of nitrogen, but that is of less concern in Cayuga Lake.

Dr. Todd Walter has adapted the GWLF model by greater considering the movement of water dependent on soil wetness. When soil is saturated, any additional water will run off. Areas in the landscape with a tendency to become quickly saturated are more likely to contribute phosphorus and sediment to the streams and lake. Walter is using the results from

Cayuga Lake Watershed Network

170 Main St., PO Box 348
Aurora, NY 13026
www.cayugalake.org

PHONE NUMBERS:
Office 315-364-2992
Fax 315-364-2991

OFFICE HOURS:
Wednesday - Friday, 9am - 3 pm
Other Hours by Appointment

STAFF
Sharon Anderson, *Watershed Steward*
steward@cayugalake.org
Daniel Carrión, *Program Assistant*
manager@cayugalake.org

The Finger Lakes Land Trust Receives the 2008 David Morehouse award

By Rachel Singley, Wells College student and Watershed Network Intern

The Finger Lakes Land Trust was presented with the Morehouse award on August 23rd at this year's Lakefest celebration, held at Goosewatch winery in Romulus, NY.

Since 1989 the Finger Lakes Land Trust has protected land that is crucial to the character, health, and natural beauty of the Finger Lakes region. In addition to being awarded the Morehouse, the Land Trust is also celebrating its 20th anniversary this year.

Over these years the Land Trust has conserved nearly 3,500 acres located within the Cayuga Lake Watershed. The Finger Lakes Land Trust's work is crucial to the health of our watershed because the hundreds of tributaries that run through their protected lands flow unfiltered into Cayuga Lake. Through the Land Trust's years of work, these delicate hydrological systems are protected from disruption.

"We are honored to be presented with this award" says Land Trust Executive Director, Andrew Zepp "our work wouldn't be possible or successful without working in collaboration with groups like the Watershed Network. We look forward to working with them to continue to protect and care for Cayuga Lake and its surrounding watershed."

Exploring Northwest Cayuga Lake *continued from cover*

ashore and rot. Invasive aquatic weeds can destroy fish habitat. [See "Cutting Helps Control Water Weeds" in this summer's issue of *Network News.*]

Down North

Water that enters Cayuga Lake may go on many adventures before it finds its way to the Seneca River at the northern end of the lake. Winds and currents may circulate the water for as long as ten years. There is an inexorable movement of water northward, though, which is down slope in the watershed. The more than 2.5 trillion gallons of water in Cayuga Lake make their way ever so slowly toward the lake's northern end, where they finally pour through the state's lake-level control gates at Mud Lock into the Seneca River. From there, Cayuga's waters escape through the Seneca and Oswego Rivers to Lake Ontario.

At 381 feet above sea level, Cayuga Lake is the lowest of the eleven Finger Lakes. Consequently, northern Cayuga Lake grades into an extensive area of lowland marshes and swamps known as the Montezuma Wetlands. These are best characterized by the Montezuma National Wildlife Refuge where pools and shore areas are managed for the needs of hundreds of thousands of migratory waterfowl, wading birds, and shore birds. The Cayuga Lake State Wildlife Management area is directly south of the Refuge at the northern end of the lake.

A scientist once called the area around the north end of Cayuga Lake a "hydrological traffic jam." To make its way to the Seneca River, Cayuga Lake's water must compete with the outflows of both Keuka Lake and Seneca Lake, which enter the northwest corner of Cayuga via the Seneca and Cayuga Canal section of the Seneca River. The canal and river flow east from Geneva and descend through two locks in the villages of Waterloo and Seneca Falls. The area north of Cayuga Lake is further watered by the Clyde River, which runs eastward to the Seneca River, and the Erie Canal from Canandaigua Lake.

Watershed Made History

The water resources of the northwest corner of Cayuga Lake have had a profound effect on our culture and history. The Seneca River, in the section that connects Seneca and Cayuga lakes, provided water power for mills and factories in the 19th century. By 1821, the Seneca and Cayuga Canal connecting the lakes was complete, and Cayuga Lake, in turn, was connected to the Erie Canal in 1828.

With greatly improved transportation and communication, the riverside villages of Waterloo and Seneca Falls became quite prosperous. Religious and social reform movements thrived in the area and culminated in the Women's Rights Convention in Seneca Falls in 1848. This marked the beginning of the movement for equality for women in the United States and was perhaps the proudest moment in our Cayuga Lake watershed history.

Getting into the Lake

There are three public areas where you can get access to the northwest area of the lake. The largest and most popular is Cayuga Lake State Park, just east of Seneca Falls along Route 89. The park has a boat launch, picnic areas, shelter pavilions, and a campground across the highway. A few miles farther south lies Dean's Cove State Marine Park with its boat launch and basin. Finally, there is a boat launch at Mud Lock off Route 90 at the very northern end of the lake.

Puzzling Problems with Phosphorus

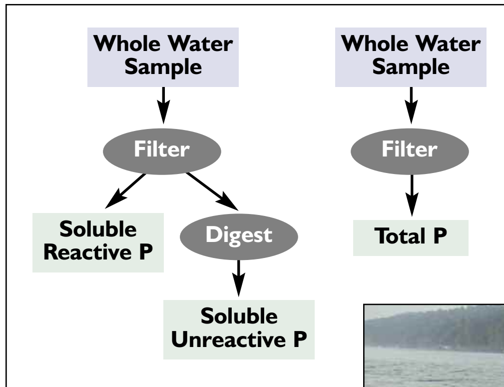
By Sharon Anderson, Watershed Steward

Excess phosphorus has been viewed as a villain in Cayuga Lake. Phosphorus more than any other chemical element is thought to regulate the growth of algae in most moderately to highly productive freshwaters of the US. Several studies over the last half-century have shown phosphorus to be the so-called "limiting nutrient" in Cayuga Lake. The lake has enough nutrients to support the growth of algae except phosphorus; additional phosphorus would mean more algae.

When phosphorus enters the lake, algal growth and water turbidity increase during summer in the upper levels of the lake. This is of great concern, especially at the southern end of the lake where lack of water clarity is a factor in preventing public swimming beaches. In the language of regulatory agencies, the south basin is "impaired." The NYS Department of Environmental Conservation and the US Environmental Protection Agency may limit the amount of phosphorus allowed to enter the lake. Too much phosphorus leads to eutrophication (excess production), and a host of related problems, including reduced biodiversity, degradation of habitat quality in the lake, and potential reduced concentrations of dissolved oxygen.

The sources of phosphorus to Cayuga Lake remain poorly understood (see related article on modeling page 2). Some comes from wastewater treatment plants, although this input has recently decreased greatly due to improved sewage treatment, and it will decrease further as scheduled upgrades take place at other wastewater treatment facilities. Other sources include fertilizer, animal wastes and phosphorus bound to sediment carried to the lake by the tributaries. The major source of phosphorus is probably the eroded soils in the watershed, but it is unknown how much of this becomes biologically available within the lake. Much of this phosphorus is absorbed (chemically bound) to the surfaces of soil particles where it is inaccessible to plants. Some is probably released (de-sorbed) and helps fuel the production of algae in the lake. Some of it falls to the bottom of the lake where it will remain buried in the lake sediments. Wind and wave action can re-suspend the bottom sediment in shallow areas, fueling eutrophication in the lake.

Lake scientists typically divide the phosphorus in surface water into three parts—soluble reactive phosphorus (SRP), soluble unreactive phosphorus (SUP) and particulate phosphorus—based largely on the laboratory techniques used to detect and measure them. According to Robert Carlson of Kent State" the sum of SRP and SUP is called soluble phosphorus (SP), and the sum of all phosphorus components is termed total phosphorus (TP). Soluble and particulate phosphorus are differentiated by whether or not they pass through a 0.45 micron membrane filter." Total phosphorus includes that which is extracted from the algae in the water and absorbed in suspended sediment particles. Total phosphorus therefore includes both SP and particulate forms (see figure 1).



Soluble reactive phosphorus and total phosphorus are the most common methods of analysis.

Adapted from Carlson, R.E. and J. Simpson. 1996. *A Coordinator's Guide to Volunteer Lake Monitoring Methods.* North American Lake Management Society. 96 pp.

Watershed Network volunteers with the Citizen State-wide Lake Assessment Program (CSLAP) collect water samples from mid-lake.

Soluble reactive phosphorus is "free phosphorus" in the water column that is readily taken up by algae. The soluble reactive phosphorus concentrations in Cayuga Lake are quite low compared to total phosphorus concentrations. SRP is relatively easy to measure, but since this form is readily taken up by algae, it cycles rapidly. Typical turnover time for SRP is minutes to hours. At one time SRP was referred to as "dissolved inorganic phosphorus." The nomenclature was changed because the analysis measures the portion of phosphorus soluble by certain regents during the course of testing. The fraction is not necessarily dissolved or inorganic.

Soluble unreactive phosphorus (SUP) is the fraction of the filtrate that does not react with the reagents used in the lab analysis procedures. The total amount of SUP is fairly stable seasonally in lakes with long residence times, such as Cayuga Lake, which has an estimated 10-12 year residence time.

SRP and SUP together form soluble phosphorus (SP). The amount of phosphorus in this filterable portion varies with the filter used. The larger the effective pore size of the filter, the more particulate material that will pass through the filter, be digested during the lab procedures into orthophosphorus, and be considered "soluble."

Particulate phosphorus is the "fraction of phosphorus containing all material, inorganic and organic, particulate and colloidal, that was captured on the filter. Typically, particulate forms will contain bacteria, algae, detritus, and inorganic particulates such as clays, smaller zooplankton, and occasionally, larger zooplankton, sediments, or large plant material," state Carlson and Simpson.

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Investments to Upgrade Wastewater Systems Worthwhile

By Sharon Anderson, Watershed Steward

Across the country, many of our nation's wastewater systems — the systems responsible for cleaning our used water before it is recycled back into our streams and lake— are near the breaking point. Aging pipes and wastewater treatment plants are or will soon be in need of repair, upgrades or replacement. Leaking sewer pipes can allow untreated wastes to seep into ground water or contaminate a leaking drinking water pipe. Growing populations are overburdening systems originally designed to serve much smaller communities. New pollutants and increased understanding of risks necessitate costly compliance with additional environmental regulations. Together these trends mean the investment of millions of dollars in capital infrastructure improvements.

This is a vitally important issue because water affects every aspect of the quality of life. First and foremost, the availability of clean water is crucial to public health. The Centers for Disease Control and Prevention credit treatment of drinking water in the U.S. since 1900 for the virtual elimination of waterborne diseases such as typhoid, cholera and hepatitis A and for helping to increase life expectancy by 30 years. Clean water is also essential for a healthy economy. Water is used in manufacturing, food processing, and agriculture. Clean water supports recreation and tourism.

The wastewater transports suspended materials, dissolved organic matter, microbiological pathogens such as bacteria, and nutrients such as phosphorus and nitrogen. The actual content of the wastewater depends on the source of the water. Industrial wastes can contribute a diverse and more toxic combination of contaminants including trace metals and organic compounds. Wastewater treatment plants are designed to remove the bulk of these contaminants to protect downstream aquatic systems and to human health. The completeness of removal is dependent in large part on the type of wastewater treatment system that is used and the permit requirements that must be met. Each treatment facility has a SPDES permit (a topic explored in the next Network News) issued by NYS Dept. of Environmental Conservation that is tailored to that facility and that sets limits on discharge concentrations.

Remember, there is no new water, just water that is endlessly recycled and reused.. Wastewater discharged at the southern end of Cayuga Lake moves downstream past the intake pipes of private and public water supplies. Current technologies are capable of transforming wastewater to drinking water quality. There are numerous municipalities around the world that turn sewage into public drinking water, especially where water is in limited supply

The following overview of wastewater treatment was condensed from The Expanded Diet for a Small Lake, soon to be published by the NYS Federation of Lake Associations.

Once the collection system conveys the wastewater to a treatment facility, screens remove large objects that can plug the pumps and remove sand and stones that can fill up tanks. This pre-treatment is followed by primary treatment. Solids that are heavier than water settle out and floating materials such as plastics, grease, and other materials that are lighter than water are removed. All these are transferred to the facility's solids handling unit where they may go through digestion or dewatering. The liquid product that flows out of the primary treatment system is moved along for secondary treatment.

Aerial view of a wastewater treatment plant

Jim Cunningham

There are a great number of processes that can be used to achieve secondary treatment. They all have the same goal of removing solids that did not settle out and converting soluble materials into a form that can be separated from the liquid. The majority of secondary processes use microorganisms that consume the soluble organics in the wastewater. Dissolved organics are consumed by biological microorganisms that have a specific gravity greater than water and will settle to the bottom of a secondary clarifier (large low velocity tank). At some point these microorganisms are removed from the secondary system and processed in the same solids-handling facilities where the primary solids are processed. Some of the microorganisms specifically remove nitrogen and phosphorus.

The Ithaca area wastewater facility added tertiary treatment in 2006 to remove more phosphorous. The Cayuga Heights plant will soon follow suit. The tertiary treatment selected by the Ithaca facility consists of chemical precipitation of phosphorus. It has reduced the amount of phosphorus entering the lake from 33 pounds per day to 10 pounds per day (see *Network News* fall 2007).

Post treatment takes place prior to discharging the final wastewater, from either secondary or tertiary treatment, into a stream or lake. Almost all municipal systems are required to disinfect their treated water prior to discharge to remove any possible pathogenic microorganisms that might make it through the process. Some permits require that the treated water to be conditioned to make it more suitable for aquatic life in the receiving water.

To meet the current and future needs of our communities, we must invest in innovative solutions with new technologies to rebuild and expand outdated wastewater systems. These investments are long-term and expensive. Citizens can help by supporting local and state government to make sure that the health and safety of water is a priority. This will not be an easy or swift process, so it is essential that we pay attention and begin asking tough questions now.

Lake Friendly Farm Recipients of 2008

CONGRATULATIONS go to the following two farms and two wineries that were selected to receive the Lake Friendly Farm Award.

Keith and Mo Tidball
Canoga Creek Farm
Seneca County

John and Joyce Switzer
Tompkins County

Cameron Hosmer
Hosmer Wine
(Patrician Verona Inc.)
Seneca County

Gary and Rosemary Barletta
Long Point Winery
Cayuga County

Our four new recipients will receive a Lake Friendly Farm sign. They will join a total of 20 Lake Friendly Farm recipients selected since the program began in 2006. The Cayuga Lake Watershed Network, on behalf of all those who benefit from clean water and fresh agricultural products, thank them for their efforts.

Puzzling Problems with Phosphorus

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Five speakers at a February 2008 public meeting on phosphorus at the south end of the lake agreed that the lake is generally in good shape, with some areas of improvement possible, notably at the southern end. The total phosphorous data are similar in the deep lake to values from 40-50 years ago.

The New York State Department of Environmental Conservation (NYSDEC) has developed a guidance value for phosphorus. The guidance value is used to identify lakes and reservoirs where levels of this element are high enough to support nuisance growth of plants and algae. NYSDEC uses a guidance value of 20 ug/l (a unit of measure equivalent to a part per billion). The guidance value is measured at a mid-lake station at a water depth of one meter, and the average concentration of total phosphorus over the summer period is calculated. A review of total phosphorus data collected through the Citizen Statewide Lake Assessment Program over five years showed an average of 10 ug/l, a low value of 4 ug/l and a maximum of 22 ug/l.

Phosphorus, even in excess, does not tell the whole story. A recent synthesis of lake phosphorus data by the Upstate Freshwater Institute raises questions about the degree to which phosphorus is a limiting nutrient and the culprit responsible for the murky waters in Cayuga. The next issue of Network News will continue exploring the role of phosphorus and the extent to which excess phosphorus is a villain.

Amphibians Pt. 3: The conservation response

continued from back cover

we can nurture and grow together. Our activities include:

- building international partnerships between organizations with abundant resources and those with numerous local threatened species
- building capacity internationally through husbandry and expertise workshops
- developing guidelines for managed breeding programs, biosecurity, and research
- leading a global awareness campaign ***2008: The Year of the Frog*** to help our partners raise the funds they need to expand their work (see *www.2008YearoftheFrog.org*).

Our portion of the $400 million ACAP budget is ~$50 million. That still sounds like a lot, but it is only $100,000 for each amphibian species rescued from extinction.

> *It seems to me that if you wait until the frogs and toads have croaked their last to take some action, you've missed the point.*
> —Kermit the Frog

How can you help?

Most of the threatened species are found in the tropics, so it is difficult for us to help other than to send money. You can support your local zoos and partners during their Year of the Frog events, and join our signature petition online *(www.amphibianark.org/online-petition.php)*. We have had some very creative supporters, including many kids who organize bake sales and can drives, even ask guests at their birthday parties to donate to AArk in lieu of bringing gifts.

And there are things you can do to help our local amphibians, which might not be threatened, but are becoming less common. Organize a group to clean up an existing amphibian habitat (stream, pond, etc.). Create a new amphibian habitat in your own backyard *(http://www.nwf.org/backyard, www.treewalkers.org/projects/OFP)*. If you build it, they will come. If you are surrounded by development and they don't come, rescue eggs and tads from local swimming pools and use them to seed new populations in your habitat. (Do not use animals that have been in captivity or come from far away, as they might carry new diseases or alter local genetics.) Quit using chemicals around your property, including fertilizers, weedkillers, and insecticides. Dispose of household hazardous waste safely according to your local municipality's guidelines. Encourage local schools to use amphibian-related curricula *(http://www.helpafrog.com/toolkit.htm)*. And most important, strive to live a *small footprint* lifestyle, for the benefit of amphibians and all other living things.

For more information on amphibians, the extinction crisis, and the conservation response, please visit *www.AmphibianArk.org.*

Departure of Watershed Steward

By John Mawdsley, Chair of the CLWN Board of Directors

It is with regret that we inform you that Sharon Anderson, our Watershed Steward of almost 8 years, is leaving this post at the end of September 2008. She has been a very effective organizer of the Watershed Network's activities, spokesperson for us, and has had a crucial role in the development of the Network in its first decade: most of the successes of the organization in this period, of which there are many, have been dependent on her input. But as a result of this success the Watershed Network is in a strong position to recruit an accomplished replacement Watershed Steward, which we hope to do in the next few months. She is moving to a leadership role in Cooperative Extension for NY State – our loss is their gain and we wish her every success in her new position.

What Do We Learn from Computer Models? *continued from page 3*

Haith's efforts to run a series of "what if" questions for the Salmon Creek sub-watershed. The hypothetical scenarios largely center on agriculture since approximately seventy percent of the land in that sub-watershed is farmed. Here are some examples: What if manure was stored and only applied during the growing season? What if manure was only applied during dry weather to the areas that become quickly saturated? What if a corridor of land along the stream was left forested? Does that corridor need to be 20 feet or 100 feet wide? How much will the increased use of methane digesters change the contribution of phosphorus? Read future issues of *Network News* for more details on what is being learned from asking these questions.

Information is fed into the model as if those conditions existed and then the model provides information on the consequent changes in the amount of phosphorus and sediment. The model may show that some changes do not make much of a difference and therefore are not worth the financial investment they would cost to change the situation. In the Catskills, modeling showed that changes in barnyard practices were insignificant in reducing phosphorus reaching a stream. Therefore, it was better to learn that from a model rather than encourage farmers to make expensive changes and only find negligible improvement.

The accuracy of models is limited by our understanding of the natural world and our ability to represent that understanding mathematically. For example, GWLF assumes that the runoff from a given type of vegetation or crop is uniform. The flow of groundwater and its variability is simplified. In its modeling of sediment, GWLF is limited to looking at what runs off the land. Recent studies suggest that a lot of sediment comes directly from the stream [channels] rather than washing off the land so the model may under predict the loading of sediment from the land to the lake.

The model works best in relatively large areas and over time. Assumptions are made, such as septic systems either function well or not at all. This neglects the fact that some systems may be partially effective. However, the resulting errors become less important when all the septic systems in a watershed are taken together. Similarly, the model may not accurately predict the amount of sediment that moves during one particular storm. The accuracy increases when all the storm events over several years is considered. The information generated through modeling can be improved by comparing its results with actual water quality measurements.

In summary, GWLF is a tool that can aid our understanding of the consequences of storms, land use and management practices. Both versions of the GWLF model, like any computer model[s, provide only estimates of the actual sources and loads of nutrients and phosphorus, and these estimates must be interpreted with care. In an ideal world, we would have perfect measurements of water pollution, but we seldom have the money and time to collect this information. Most of the time, model results are the best we can hope for.

This work is supported, in part, by the Cornell University Agricultural Experiment Station federal formula funds Project No. NYC-123410 received from Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture.

The recognition of the importance of non-point sources of pollution has led to increased efforts over the last two decades to identify and quantify non-point source pollutant loads, especially at the watershed level. Typical techniques for determining the extent and magnitude of non-point source pollution problems include long-term surface water monitoring and computer-based simulation modeling. Due to the time and expense associated with surface water monitoring, however, simulation modeling has been relied upon more frequently to provide needed information for the development and implementation of non-point source control programs. Watershed simulation models, in fact, are commonly considered to be essential tools for evaluating the sources and controls of sediment and nutrient loading to surface waters. Such models provide a framework for integrating the data that describe the processes and land-surface characteristics that determine pollutant loads transported to nearby water bodies.

Penn State, AVGLWF Overview, www.avgwlf.psu.edu

Amphibians Pt. 3: The conservation response

by Kevin Zippel, Program Director, Amphibian Ark

Although a few of our green frogs and tree frogs continue to sound off when the weather so inspires them, by fall most amphibians are quieting down. My backyard is so thick with newly metamorphosed leopard frogs that I literally have to *watch my step*. I can't help but recall sadly the places I knew in Central America that used to be the same way but are now nearly devoid of amphibian life. In the last newsletter, we talked about the global extinction crisis and humankind's responsibility for finding solutions. An Amphibian Conservation Summit was convened in 2005, gathering the world's amphibian authorities: professors from academe, zoologists, government officials, veterinarians, and experts from other related disciplines. An Amphibian Conservation Action Plan (ACAP) resulted, including research, assessment, and conservation action. The overall budget for these initiatives in the first five years is estimated at $400 million. Although this seems like an impossibly large sum, it is less than the cost of two 747 airplanes and just 0.1 percent of the US war budget in the Middle East. It is only about a quarter of what US federal and state agencies currently spend on endangered and threatened species in a year ($1.4 billion), and it's just three times what these agencies spent on their top recipient, the Chinook salmon ($161,309,500), a single sport and commercial fish species that is being deliberately introduced in parts of North America.

Limnodynastes dumerilii, and amphibian stewards in the making.

While the ACAP's greatest conservation priority is in the wild, some threats like chytrid fungus simply cannot be addressed there at this time. Without immediate captive management as a stopgap component of an integrated conservation effort, hundreds of amphibian species will become extinct. Fortunately, a thriving industry already exists that specializes in captive management of animals. Zoos, aquariums, botanic gardens, museums, etc. number over 1200 institutions around the world with more than 100,000 employees and attract about 600 million visitors per year. They have been working with amphibians for decades and can already claim to have rescued a handful of species from extinction. However, these efforts represent a small fraction of what is now needed, with perhaps 500 species requiring rescue. The Amphibian Ark pulls all of those global partners together, giving their vital efforts a single name and a face, a unified response to a global crisis, something

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The Mission

The Cayuga Lake Watershed Network identifies key threats to Cayuga Lake and its watershed, and it advocates for solutions that support a healthy environment and vibrant communities.

Cayuga Lake Watershed Network
PO Box 348
Aurora, NY 13026

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