A plan for lake purity

Ponds and lakes are often mismanaged, lose their aesthetic value and eventually become worthless. Here is the latest on the dynamics which affect water quality to help you put together your program for lake and pond purity.

By HEATHER L. SCHWABE

Organic nutrients containing phosphorous and nitrogen are essential to plant life in lakes and ponds, but you must keep the nutrient level in an ideal balance to avoid severe weed and plant growth.

Aerobic bacteria will metabolize organic nutrients in the water making them unavailable for vegetation. When a pond is in balance, it has sufficient levels of oxygen in the water to allow the bacteria to breathe and digest these nutrients. If the nutrient levels rise, the bacteria cannot consume the nutrient burden and nutrient levels will swell. The result is dramatically increased plant growth, algae blooms and organic sludge build up.

Nutrients come from several sources: bottom sludge, dead organic material and fertilizers. The greatest source of nutrient in a lake is often found in the bottom sediment and dead organic matter. Algae typically has a two-week life cycle; when the algae die it sinks to the lake bottom forming an "aquatic compost pile." Over time, the amount of available nutrient in the water feature grows at increasing rates. Sediment build up also has significant impact on a lake's capability to store water. Research shows that sediment build up will occur at rates of 1 to 5 inches per year in temperate climates and these rates can be almost double in subtropical regions. Using that equation, a lake will lose 80,000 gallons per surface acre of storage capacity per year, and so begins the gradual consumption of the pond by organic sludge.

Fertilizer leaching into your pond or lake also contributes to nutrient loading. Two to four percent of the fertilizer applied near a lake can leach into the water. Fertilizer, which contains phosphorus, has been identified as the greatest single contributor to aquatic weeds and algae growth. Orthophosphorus, or dissolved organic phosphorus, has been identified as the number one limiting factor in aquatic vegetative growth. Levels greater than .05 mg per liter are considered high. When phosphorus levels exceed .1 mg per liter, nuisance populations of algae and aquatic weeds will abound.

Temperature layering (thermal stratification) occurs when the sun warms the surface water of the pond, causing it to become less dense. This density and the varying water temperatures in the pond cause the water to become separated, or stratified into layers. The colder water settles on the pond bottom and the water gets warmer in layers as you near the surface. Certain solids will get suspended in these layers creating poor clarity. Because the surface layer will remain warm, algae growth thrives while the cooler water temperatures below help inhibit aquatic weed and algae growth.

Sunlight also plays a part in the aquatic ecosystem. In more shallow bodies of water, the sunlight penetrates to the water bottom. These shallow areas are typically warmer which can accelerate plant growth. Green plants will only photosynthesize (grow) in the presence of sunlight. Aquatic weeds, algae, sludge build up, odors, and poor clarity are the most common problems and often, these problems are interrelated. There is good news however. If you address one problem, most likely the other

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problems will systematically follow suit.

When considering lake management practices, it is important to keep in mind proactive and reactive or preventive and fixative strategies. Preventive strategies address the causes of problems while fixative strategies deal with the symptoms. Since many of the visible symptoms of poor water quality take a long time to develop, developing a proactive water management program is advisable. Most of the proactive approaches are biological tools which have a positive impact on the environment. Let's look at the proactive, preventive solutions first.

We must address nutrients in two ways:

▶ limiting nutrient run off into the water feature

▶ supporting aerobic digestion which limits the available nutrients in the water itself.

You can implement methods which will help divert the flow of nutrients into a lake. The goal is to keep the nutrients from reaching the water and if it does, keeping it from the open water zone.

One control method is **the introduction of wetlands** at the areas where water or runoff flows into the pond. The wetland area will slow the progress of water into the pond, reducing erosion and flooding problems and the intensive plant growth in a wetland area will act as a nutrient sink for the high nutrient water flowing into the pond. The plants in the wetland will actually absorb nutrients before they can reach the open water zone. This can result in a higher water quality due to lower organic nutrient levels. By creating a "no-fertilizer" zone from 5 to 10 meters (15 to 30 ft.) around the lake's perimeter, you will again help limit nutrient runoff into the water.

Depth and temperature are two key factors which we have reviewed. This makes the shoreline zone the most difficult area in the water feature to control or manage. When sunlight penetrates to the bottom, the water can become very warm, and nutrient levels are usually very high. Typically this is where you will see aquatic weed and algae problems.

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Lining the pond's bottom can be an effective tool in many situations; to help eliminate bottom rooted weeds, to improve clarity when the soil is easily mixed into suspension, and in sandy soils when the earth will not hold water. There are many different types and grades of liners depending upon the use. The most common is a PVC liner. Use of a UV resistant liner is suggested when water levels may drop or when sunlight may be able to penetrate the bottom.

Aeration, fountains, and waterfalls are all common tools for lake management. All add oxygen and mixing in varying degrees. By adding oxygen the process of aerobic digestion is supported, lowering the nutrients available for algae and weed growth while helping to retard the growth of or even reduce the sludge bed. The water in a lake should be turned over 4 to 7 times a day. While waterfalls and certain types of fountains are helpful, they do not have sufficient mixing and aeration capabilities to be used as stand alone tools. Supplemental aeration and/or chemicals must be used.

Aeration is the most effective, long term pond and lake management tool. There are three types of aeration systems; surface spray, horizontal aspirators, and bottom diffusers. Each has a set of strengths and weaknesses which need to be considered. Surface spray aerators are the best choice when the pond is less than 12 ft. in depth and irregularly shaped. The better units add over 2 lbs. of oxygen per HP per hour to the water and add 2 mg\l of oxygen at depths over 10 ft. The circulation rate produced by aeration breaks through the thermal stratification and distributes oxygen to all parts of your pond. By pulling cooler water to the surface of the pond, algae growth is slowed and the water's pH level is lowered. This process helps reduce odors. Remember to check

for oxygen transfer rates and pumping rates when selecting a system.

Horizontal aspirators have a directional flow. They are the best choice for long narrow bodies of water or canals.

Bottom diffused aeration is extremely effective in water 12 ft. deep or deeper. As the bubbles rise to the surface they transfer into the water column and circulate. Since the bubbles rise at roughly 1 ft. per second, pond depth is critical. These types of systems require 12 ft. in depth to operate at peak efficiencies. Studies indicate that for every three foot decrease in depth, the systems relative efficiencies drop 50 percent. Contrary to popular belief they are relatively ineffective in less than 8 ft. in depth and should not be used in less than 5 ft.

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Ozone is a relatively new approach to lake water quality management. They are especially good when clarity and foul odors are an issue. Corona discharge systems have 10 times the output of UV systems and have much lower operational costs. Regardless of the type of ozone system you choose, insure that the system is supplied with an oxygen generator, a certificate of output (in either grams per hour or pounds per day) and effective mixing system such as a diffuser system. Please note that aeration tubing will be ineffective in more than 6 feet of depth.

Another option available to you are lake dyes. Available in powder or liquid form, lake dyes prevent the sun's ultraviolet light from penetrating the water. Aquatic plants can't photosynthesize without ultraviolet light. Dyes are a good tool to use when you have bottom rooted weed or benthic algae problems. Most dyes last six to eight weeks and should not stain signage, turfgrass or waterfowl. It's important to use products which have EPA or government approval. Lake dyes can only be used in lakes that have no discharge.

Chemical control is a common method of pond and lake management. Herbicides are applied to the pond to kill the algae and plants. This method is quick and effective but may require the assistance of an aeration system to support its efficiency. A correct pond and lake management solution counters each problem in an effort to maintain the natural ecosystem of the pond. Because some plant life is essential to a naturally balanced ecosystem it is not advised to take a 'chemical only' approach. As we mentioned previously, many pond and lake management approaches will incorporate a few different methods of management. Many people believe that because it is not a natural treatment it should be avoided. However, chemicals are essential in some circumstances. Because chemical application requires permits to apply, you should discuss this option with an aeration systems or pond and lake management specialist before you begin.

Bioaugmentation is a relatively new advance in the management of ponds and lakes. Aerobic bacteria are added to the lake which compete with the algae for nutrients. The bacteria make the nutrients unavailable for algae by locking them up in their own cell mass. In addition, they reduce suspended solids and improve water clarity.

Bioaugmentation should only be considered in ponds with a neutral pH. A pH higher than 9 will kill the bacteria. Temperature is also an important factor. In cooler waters, the metabolic rate of the bacteria slows, making it an ineffective alternative. The pond or lake must also have adequate levels of dissolved oxygen to support the increased demand for oxygen the bacteria will create.

Each pond is individual and will require its own special mix of water quality management efforts. What works for one pond might not be suitable for another. A proactive approach to water quality management is ideal, before a problem occurs. Once your pond or lake experiences water quality issues, it can quickly become a foul smelling, algae ridden eyesore. By remembering the factors which impact water quality you can make use of the proper management techniques to manage lakes and ponds, making them beautiful and functional for many years to come. □

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