A subject that comes up anytime we talk about Proper Pond Management (PPM) to our clients is a pond’s ecosystem. As soon as those words are spoken a glaze appears in their eyes and we have already lost them in the understanding of what it takes to properly maintain and care for a water garden. The principles of PPM are really quite easy to grasp but in order to explain it I will be using a concept of what I call A Pond’s Patina (APP).

The ease of understanding of what patina is all about is very exciting. APP, simply stated, is the layer of life in an aquatic ecosystem. Some aquatic ecologists may term it a pond’s biofilm. In time, this layer will grow on everything that water comes in contact with but it must also have enough oxygen. It exists on the rocks, liner, plants, plant pots, tubing and, to a lesser extent, even in the water. Of course, there are many factors that affect the growth of this layer of life. This is the main focus of PPM. Part One of this article is to describe what APP is. Part Two will be to explain how PPM affects APP. I know, acronyms can be disturbing but bear with me. Part Two will be in the next issue of PONDKEEPER.

APP is the pond’s natural biological filter. All established water gardens have a patina. There are some that have very little Patina for a variety of reasons and will be addressed later in Part Two. These need extra biological filtration added to insure a balance in the ecosystem. Then there are ponds that have a fully mature patina layer but the organic load, which includes fish, is huge.
and APP cannot keep up with the excess nutrients. When this happens then the ecosystem is out of balance. We must have the right balance of APP and organic load. Usually the first sign that the pond’s ecosystem is out of balance is a proliferation of planktonic algae or what some ponderers call pea-green soup water. If left unchecked the pond can become low on oxygen. Of course, this starts to become toxic to almost all forms of life. If the problem continues, then the pond becomes anoxic (without any oxygen) and all life dies.

I am certain that all ponderers know that the patina layer exists. It is real obvious to observe it when a plant pot is brought out of the water and you can feel and see it. Another area that it becomes real obvious is when a pond cleanout is done and a heavy layer of sediment or muck is removed from the bottom. Where the muck existed there is not any patina but immediately above where it was, APP grows. APP has to have oxygen and a muck layer of greater than a few millimeters will suffocate it. It is apparent that the bottom of a water garden will not have the patina layer if there is much of a sediment buildup. This includes both liner-exposed bottoms as well as rocked bottoms.

What does the patina consist of? Most water garden articles, books and retailers, that try to explain an ecosystem, talk of just bacteria. Yes, bacteria is a major component of APP but there are so many more critters and “plants” that are essential to the overall makeup of the patina. Some of the critters are so small that it is difficult to see them with the naked eye. For these you would need a dissecting microscope. However, it is not important to neither see them nor necessarily identify them. It is important to know that they are there and what it takes to enhance APP. All of these critters are invertebrates. They are animals without a backbone. Good examples are protozoans (one celled animals – ex. Amoebas), annelids (worms), rotifers and insects. There are many other categories of invertebrates but you get the idea. It would be difficult to explain to ponderers what these critters are but they do need to know a whole ecosystem exists in APP. I will explain a bit further for you.

Invertebrates rule the world. Without them, higher forms of life (vertebrates like fish and people) would not be able to exist. They along with bacteria and plants form the base in the web of life. Higher forms of life depend on invertebrates on which to feed. Bacteria, protozoans and simple plants form the basic link in the food chain. They also eat what we would call waste material. In some cases this waste material becomes toxic to some forms of life if the concentration becomes high. Good examples would be ammonia and nitrite. They also convert waste material to a form that other types of critters and plants can utilize to propagate themselves. This process is very complicated to the average ponderer but the important aspect here is that they don’t need to know these cycles in order to have a successful balanced pond ecosystem. All they have to know is that APP exists and that they need to do everything in their power to insure the survival of it.

Are there any critters in APP that would be considered “bad”? I don’t have all the answers to this, yet. I know that some ponderers see a small critter and they immediately want to know how to get rid of it. In almost every case that I have investigated, the invertebrate was a valuable component to the make-up of APP. There is one that I can honestly say is bad in a client’s situation. It is the larvae of the black fly. They have become so numerous that they have plugged up inlets and outlets to water pumps, thereby restricting the flows. However, they are a very valuable component to the ecosystem. Fish love to eat them and they also are huge filter feeders, eating up excess nutrients. We just need to be resigned to cleaning the pumps every month or figure out how to inhibit their growth on the pumps and their tubing.

Plants are also a major component of APP. I am not necessarily talking about water lilies or cattails. There is another group of plants that is often overlooked. These are several thousand species of algae. Yes, there are good forms of algae that adhere to a substrate. It forms a very friendly environment for the critters and bacteria. Guess what happens when some types of algae killers are added to a water garden? Yep – part of APP is killed off along with the string algae or planktonic algae that was the original target of the algae killer. A mature patina layer could not exist without algae because it gives the critters more of a “substrate” to grab onto and, in some cases, even graze on.

Water lilies and other higher forms of plants also add to APP by providing more surface area for the critters to adhere to. This surface area also has a different texture than rocks and liner that will allow different kinds of critters to flourish.

The addition of bacteria certainly speeds up the process of APP development but what about all the rest of the critters and plants that will eventually inhabit a mature patina? Time is a critical part of this equation. They will show up – in time. A pond owner can speed up this process by adding a bucket of “muck” from a known healthy pond. This muck must smell good. Sure – what muck smells good? Good smells are of the earth – like soil. Bad smells are of the sewer – like rotten eggs. This is really a tough one to teach but any seasoned pond owner will know what I am talking about. Pull the muck out of an area that has a real light layer of it. I would also steal a few rocks out of the healthy pond. Keep them moist and the bucket of muck aerated while transporting to the new pond. It does not take very long to inadvertently kill off the critters in a bucket of muck on a hot day. Without aeration the bucket of muck will lose all of its oxygen, fast.

This may speed up the colonization process of APP but it still takes time for it to mature. I know for some ponds this may take 2 years or more in the Midwest. In more Southern climates it would take less time depending on the zone.

You can view this colonization process as a succession. Succession takes place in all ecosystems. You are probably familiar with how succession occurs in terrestrial situations. If the ground is tilled and fresh soil is exposed then the first plants that will show up are annual weeds. Then after a few months herbaceous perennials start growing and crowd out some of the weeds. After a few years trees colonize and the succession continues. It becomes a more balanced ecosystem. Even after the trees mature there is change in the ecosystem but at a much slower rate so that it is difficult to detect change.
Succession also takes place in water. New water, liner and rocks are like the fresh tilled soil. The first plants that show up are the annual weeds. These are the planktonic algae and then, in time, the more perennial weed, string algae, will arrive. These algae compete for nutrients that the planktonic algae need to survive. Less pea-green soup type of water and more string algae will be the case. As APP matures, string algae have a more difficult time finding a foothold to adhere to. Of course, this is if succession is allowed to take place naturally.

The same is true for the invertebrates and the rest of the entire make-up of APP. Higher forms of plants and critters arrive with human help but you could count on them arriving on their own in due time. The species of fish and plants that arrive by natural ways of dispersion may not be what a water gardener wants. So, we add what we want before this occurs.

How fast APP is colonized naturally is different for every pond but the overriding factor in almost all cases is how close the water garden is to naturally occurring water. If a creek, river or another pond is within a few hundred yards, then colonization can be very fast. Larger animals, like frogs and muskrats, can inadvertently bring in all kinds of invertebrates and bacteria.

When a water garden becomes fully mature we can consider this to be the climax community of APP. Each geographic region’s water gardens will have a different community of invertebrates and algae. There are a lot of factors that determine the make-up of the community. Weather conditions are the biggest influence but there are others. Water gardeners in more temperate zones that experience heavy icing certainly have a different type of APP than those in more tropical environments. Each water garden is different, even within a geographical region, but it becomes even more obvious when you compare regions.

Like I have already mentioned, the process can be jump started by adding bacteria and “muck” from another healthy ecosystem. Almost all ponderers add fish and higher forms of plants. Why stop at this? Go ahead and add the muck and bacteria as well.

When APP reaches the maturity stage it is in a climax condition. It now has the full potential of keeping wastes of fish and decomposing organic matter from becoming toxic to the fish as well as to the rest of the ecosystem. It will also keep planktonic algae where it is not noticeable and you should have clear water. APP is the pond’s natural biological filter. Part 2 of A Pond’s Patina will focus on keeping the patina in a healthy condition or simply PPM.
About the Author

The very popular subject of adding water features to a garden is one that Jamie Beyer brings a lot of knowledge and enthusiasm to. Jamie is a Lifetime Master Gardener and is founder and immediate Past President of the Central Iowa Water Garden Association. Water gardening has been a passion of Jamie’s for over 45 years and, currently, he has three 10,000 gallon ponds and one 27,000 pond which contains many kinds of water plants and fish. He combines this experience with his Master’s Degree in Fish and Wildlife Biology to become uniquely qualified to be one of the Midwest’s foremost experts on the subject. His broad background of fisheries, dynamics of water, wildlife ecology, and horticulture gives him impressive credentials. Jamie frequently speaks and writes on all aspects of water features and water gardening to gardeners in the Midwest. In addition, he also has a consulting/installation business, called Midwest Waterscapes, which he works as a water garden, fountain and pond consultant/installer to people that want extra help. Jamie has considerable experience installing ponds, diagnosing water garden problems, teaching classes and helping do-it-yourselfers, do it right. Since the late 80's, he has been involved with the design and installation of over 500 water gardens and features.

Jamie and co-author Veronica Fowler, wrote the Ortho Book “All About Garden Pools and Fountains”. Over a half million copies of the book has been sold in the six years since it’s publication.

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