Photo contributed

Ponds like this one in Clermont have relatively short lives, though they often sustain rich and diverse habitats. The muck that accumulates in all but the most manicured ponds provides the nutrients for the plants that eventually fill them.

The LIFE *of a* POND

PONDS COME AND GO, BOTH NATURALLY—THINK BEAVERS—AND FROM HUMAN ACTIVITY

*This is the first of three articles based on "Ponds of Columbia County: Patterns in Their Biodiversity, Thoughts on their Biodiversity"**

By Conrad Vispo

SUPPOSE THAT YOU wrenched your bathtub off the floor, hauled it outside, embedded it in the earth and filled it with water. Aside from getting a sore back and garnering a few stares, what would happen? At first, you'd have a nice clean bathtub in which you could sit, eye to eye with the dandelions. But how do you suppose it would look after a week? A month? Or six months? Unless your house happened to be perched on a cleared mountaintop, stuff (leaves, insects, branches, e.g.) would fall into your bathtub over time. Furthermore, invisible chemicals would rain down from the sky, and perhaps the rain itself would even fill your bathtub to overflowing, letting dirt and flotsam trickle into your tub and settle.

If you accept that your tub would slowly accumulate debris, what next? Do you suppose that, after one year, you'd be able to reach into your tub and pull out leaves as intact as when they first fell off the tree? Branches as sturdy as when they first tumbled into the water? Probably not. Surely they would have begun to rot; surely the hand that dove in would pull out a fistful of a dark, somewhat amorphous mass—muck to be precise.

The goal here is not to warn of the consequences of not cleaning your bathtub; rather, these two processes—the accumulation of debris and its subsequent disintegration—are fundamental to the life of a pond, although they are sometimes hidden from us and, when visible, their results are often deemed undesirable, even unnatural.

As a continuation of our bathtub analogy would readily illustrate, due to filling-in and concurrent rot, ponds are mortal. Indeed, they even age at a rate perceptible to us during our brief, individual sparks in the vastness of geological time.

Let's think a bit more about rot. Suppose a windstorm rips a leaf off of a tree and deposits it in our water body. Bacteria, fungi and other organisms begin to decompose that leaf and release the nutrients of which the leaf was composed. And through no accident at all, those are the very same nutrients that another plant would need to assemble itself. As a result, speaking in general terms, the rot fertilizes the water with the nutrients that will support more life. True, you may not see another sugar maple growing up in the pond into which the leaf fell, but you'll probably get algae, pond weeds and zooplankton (microscopic animals).

There are a few biochemical details that might alter this scenario

somewhat, and there are reasons why large, deep lakes behave differently; but in considering ponds, this general logic holds. So, as a pond ages, it not only fills in but also gathers nutrients, which, in turn, stimulate organisms to grow in it.

So this is the first point about ponds: they age, and that aging process involves their growing shallower and more verdant. Human actions can alter the speed of that aging. For example, management of pond banks can influence how much debris falls in the pond, and additional nutrient input from, say, a leaking septic system or an inflow of fertilizers can unnaturally speed up and intensify the greening. Yet these core aging processes exist in almost all cases. Travel to a secluded, shallow, wooded hilltop pool in our area during spring, and you'll likely see strands of green algae floating about amid the frog and salamander eggs (which may well be growing their own algae).

All this means that most ponds are naturally temporary, ephemeral. Left to its own devices, a pond will usually, sooner or later, disappear. That brings us to our second point: if ponds really are winking out constantly, why are there any ponds at all left in our landscape? Why, if they so quickly turn into fuzzy heads and go bald, do yellow dandelion flowers ever cover our lawns (and surround our bathtubs)? Clearly enough, the answer must be that new ponds (or dandelion flowers) are being created at least as quickly as they are disappearing. And, in fact, we are living during a great blossoming of ponds.

Most ponds are naturally temporary, ephemeral. Left to its own devices, a pond will usually, sooner or later, disappear.

During 2006 we studied nearly 100 farm and house ponds around Columbia County, looking at their biodiversity and other aspects, which we shall detail in a subsequent article. However, of the 97 ponds we investigated, only 13 or so appeared to exist in 1948, when some of our earliest aerial photographs were taken. Likewise, in a square mile around our Hawthorne Valley Farm home base, there were two ponds in 1942, and 24 ponds in 2004. This same trend is occurring at a national level; the latest federal report on wetlands (authored by Dahl and available on-line at wetlandsfws.er.usgs.gov/status_trends/ index.html) shows major increases in pond area. The author estimates that, nationally, pond area has almost tripled since the 1950s, increasing by nearly 4 million acres. The accumulated surface area of our nation's ponds is now roughly the same as that of Lake Erie.

Not all local pond building occurred during the last 50 years. An 1830s aerial photograph of the county would, no doubt, show it dotted with mill ponds. As hydropower receded in importance, agricultural motives spurred new construction. More recently, while farming has ebbed somewhat, landscaping fashion has arisen as a new motive for pond making. And what about prior to colonization? Was this a pond-less land? Certainly not. Some biologists believe that the rich soils of most of our valleys are the legacy of the beaver's pond building ways, and, in any case, beaver activity spiced by hydro-geological events helped create a dynamic population of ponds.

A later article in this series will return to a consideration of the origins of ponds and how this may relate to wetland ecology, but two points should already be already clear:

- It is natural for most ponds to grow green and slowly disappear over time; if you want to keep a "nice, clean" pond, you're going to need to work against this natural trend (this *doesn't* mean that you should dump your sewage or fertilizer in a pond—

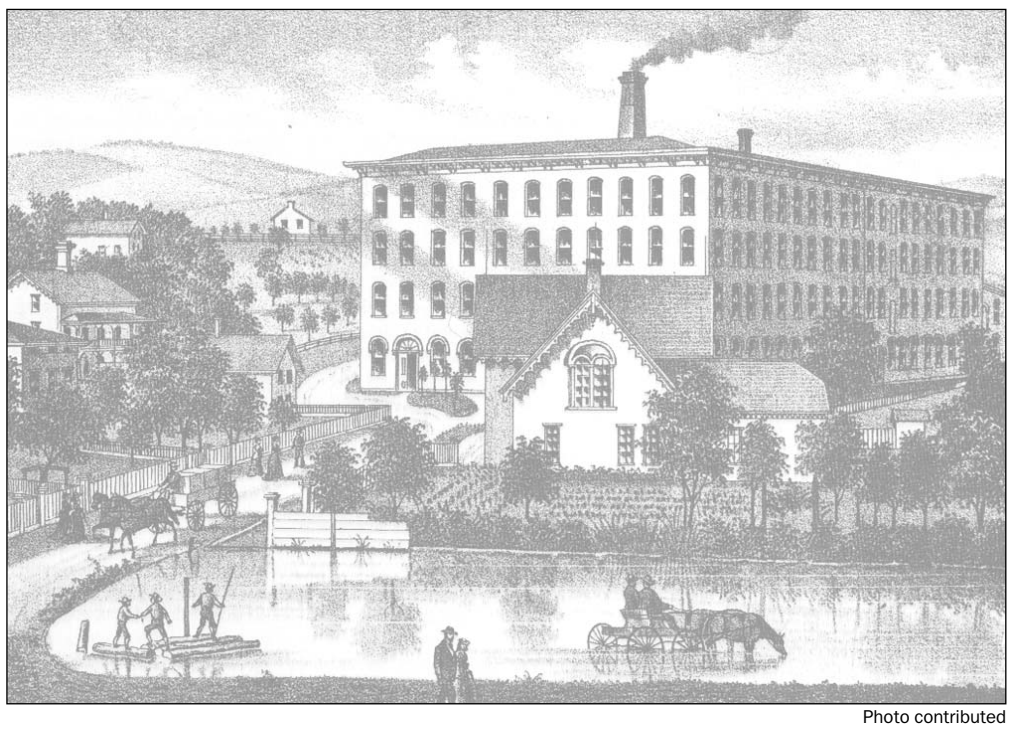

Photo contributed

Not all ponds occur naturally. In the 19th century ponds like the one above near a mill in Philmont were manmade, created to turn the water wheels that powered nearby factories.

a pond that is perpetually pea soup is just as unnatural as one that is forever crystal clear)

- We are rapidly dotting our landscape with ponds; a trend that no doubt has relevance for the ecology of wetland plants and animals. If we care about our landscape as a whole, and about the organisms that inhabit it, then we need to try to understand the ecological consequences of our pond building and of our quest for the ponds' equivalent to the fountain of youth.

Based on the "Ponds of Columbia County: Patterns in Their Biodiversity, Thoughts on their Biodiversity" by Conrad Vispo and Claudia Knab-Vispo for the Farmscape Ecology Program, Hawthorne Valley Association, May 2007.

Photo contributed

Beavers are great pond engineers, a result of the industrious animals building their lodges across running water. But when the lodge yields to the forces of nature, the pond can drain as quickly as it appeared.

The wood frog, right, and the spotted salamander, below, are examples of vernal pool amphibians found in or around ponds or seasonal puddles in this region. These bodies can support many different species, though not surprisingly human activity often limits what lives where.

For some things, a POND *is* HOME

FARM AND RESIDENTIAL PONDS CAN SUPPORT A VARIETY OF HABITATS, BUT DO THEY?

*This is the second of three articles based on "Ponds of Columbia County: Patterns in Their Biodiversity, Thoughts on their Biodiversity"**

By Conrad Vispo

WHEN NED LAND, Conseil and Professor Arronax board the *Nautilus* in Jules Verne's *20,000 Leagues under the Sea*, Captain Nemo astounds them by offering them a delicious, landlubber's meal, only to reveal that all of it comes from the sea. The steak is not beef but fillet of sea turtle, the ragout of pork is dolphin liver, and the tasty fruit compôte is actually preserve of anemone. Captain Nemo has served his guest foods that are comparable or, one might say, analogous, to familiar fare. In some cases they may serve just as well as the food they are replacing although, if, like me, you are allergic to shrimp, then the shrimp-based version of Spam would fail the test.

Last week's article described the aging of ponds and their increasing abundance in our landscape. Our interest now is in how well our new ponds serve to support native creatures. Over thousands of years, native species adapted to lakes, beaver ponds and the vernal pools that perched on rocky depressions. The ponds that we create sometimes provide analogous habitat; just like Captain Nemo's dolphin liver ragout, they are substitutes that might or might not work. To some species, for example, a shallow, grazed pool surrounded by ample wet meadow is ecologically similar to an aging beaver pond. If we want to understand how our activities interact with the biology of native species, we need to think about how well the habitats we create serve not only our own needs but also those of plants and animals adapted to a somewhat different landscape.

Our study looked at 90 Columbia County farm and house ponds, and here assesses how well such ponds support native species. In other words, to the native species that come to visit, were our ponds 'crème de la crème' or "unstomachable" fare?

Most of us know the adults of dragonflies, some of which nearly reach the length of hummingbirds and are often seen in their hover-dart-hover flights over ponds. Less well-known perhaps are the closely related but slimmer and slighter damselflies. If you watch these insects, then sooner or later you will see a dragonfly kissing the water with the tip of her abdomen or a damselfly climbing down a sedge stalk to immerse herself in the water. These are females

The dot-tailed whiteface dragonfly, left, and the bronze copper butterfly, below, are two insects often found above or around local ponds.

The characteristic most strongly influencing the occurrence of amphibians at our ponds was the intensity of adjacent, non-agricultural development.

The amber-winged spreadwing dragonfly, left, and the mulberry wing butterfly, below, make their homes in marshes and ponds.

Photos from Ponds of Columbia County

depositing their eggs in the pond. Scoop through such waters and you're apt to find the young—stocky and prehistoric-looking in the case of dragonflies, more delicate and culminating in a trio of plume-like gills in the case of damselflies.

Because of their aquatic eggs and young, dragonflies and damselflies are useful for looking at how native species respond to the aquatic habitats we create. When doing so, it is important to distinguish the specialists from the generalists. Some organisms seem nearly ubiquitous, while others are few and far between. Try to find a field without a song sparrow nearby or a lawn without a dandelion, or, conversely, a field with a vesper sparrow or a grassland with an orchid, and you will understand the distinction. Much of this difference is due to how picky these organisms are when choosing habitat; some accept a wide range of conditions while others are more particular. Using published information, we can, a priori, group the dragonflies and damselflies we found into generalists and specialists. The latter group includes species that may be searching for habitat more ecologically similar to the aging beaver ponds that were abundant in our pre-colonial landscape. To assess how well we are doing at supporting such species, we compared the abundance of specialist dragonflies with certain characteristics of our ponds. (It's not that we don't care about generalists, it's just that they seem less needy.)

Not surprisingly, specialist dragonflies (e.g., dot-tailed whiteface, calico pennant, or amber-winged spreadwing) were rarer; the average specialist occurred at only 6% of our ponds. In contrast, the average generalist (e.g., fragile forktail, eastern pondhawk, or common green darner) occurred at about 20% of our ponds.

Picture an aging beaver pond and perhaps it will not be difficult to understand why, in our sample, the specialists tended to favor fish-less ponds with grazed margins. A beaver pond that is filling in will get shallow to the point where summer oxygen depletion or winter freezing kills the fish. A grazed pond margin (we looked only at farm and house ponds, no woodland pools) is probably better than a mowed one because it presents a diversity of structure—spikes and clumps of plants that support adults defending a territory, females trying to deposit eggs, or young clambering up into the airy world to metamorphose and fly away. Thus, the distribution of these specialists helps us understand the ecological resemblance between our doings and the habitats these creatures evolved with.

Amphibians are specialists of a sort, hence the widely heralded worldwide decline in frogs. So it is worth looking at patterns in the occurrence of this group as a whole. The characteristic most strongly influencing the occurrence of amphibians at our ponds was the intensity of adjacent, non-agricultural development; areas with numerous buildings, lots of roads and extensive lawns or parking areas supported fewer amphibians. Evidently, these creatures sense the difference between such residentially surrounded ponds and their original haunts.

Our description of an aging beaver pond resembles that of a vernal pool, those seasonal puddles that hold a collection of specially adapted organisms, including so-called vernal pool amphibians (spotted salamander and wood frog, for example). Despite the fact that all the ponds we studied were permanent, we found salamander eggs in about 40% and wood frog eggs in more than one quarter. These amphibians favor seasonal pools because drying eliminates certain predators (i.e., fish, bullfrogs and newts). Indeed, among our permanent ponds, they tended to occur in the fish-less ones.

Their favored ponds were also relatively close to woods. The latter correlate derives from the life history of these organisms: mating adults congregate in ponds; however the rest of the year they live in the woods. The closer the home forest is to the breeding pond, the easier it is for adults to arrive without being attacked by predators or killed by cars.

One additional analysis of amphibian distribution illustrates the complexity of ecology and the multiple consequences of our actions. We looked at the relationship between amphibian abundance and shoreline vegetation—think cattails—in ponds with and without fish. In the absence of fish, such vegetation appeared to have no effect on amphibian abundance. In the presence of fish, however, ponds with little or no vegetation had substantially fewer frogs and salamanders. Apparently, such plants help shelter amphibians from predators. Stock a pond with predatory bass and plant-eating grass carp and you have dealt amphibians a one-two punch.

Just as Captain Nemo's offerings might serve some of us better than others, so too do the ponds we create serve some species better than others.

The final question, which leads us into the final article in this series, is how can we ensure that the habitats we create, the ponds we dig for example, are suitable not only for us but also for at least some native species? We, like all other species on this planet, require a certain habitat to prosper. Beyond that, fashion and taste lead us to create or modify additional habitats. While recognizing the table we want to set for ourselves, can we be conscious of the platter that, as a result, we lay before this land's other creatures?

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This house pond is partially surrounded by forest and with only a narrow mowed strip. It provides a varied habitat even though parts of the land nearby are mowed.

WHAT ARE PONDS FOR?

WHETHER AESTHETIC OR PRACTICAL, PONDS SERVE MANY PURPOSES

*This is the last of three articles based on "Ponds of Columbia County: Patterns in Their Biodiversity, Thoughts on their Biodiversity"**

By Conrad Vispo

IN THE STORY of the blind men touching the elephant, each man touches a different part of the beast. The man who touches the trunk proclaims the elephant to be very much like a snake, he who touches the elephant's sides declares the critter similar to a wall; and he who hugs a leg states that the elephant resembles a tree. None is fully wrong, none is completely right. In the past two installments, we have described those aspects of ponds that we, as ecologists, have touched. Now we want to look at how the aspects that we viewed interact with the perspectives that others may have on ponds.

A farmer sees a pond as a source of water for cattle or irrigation, a fisher views it as a place to go fishing, a young family looks at it as a place to swim. These perspectives occur together with that of the pond as home to native plants and animals, and our goal for this last article is to consider how these uses can coexist.

Let's start with an example. Last week we summarized some of the ecological needs of the dragonflies and amphibians in the 90 ponds we studied around Columbia County. Although we didn't mention it then, we also observed plants and butterflies at each of our study ponds. When we looked at all of these organisms together, it turned out that ponds in agricultural settings tended to support more native plants and animals than ponds in residential settings. Apparently, some farm ponds provided ecological conditions that certain residential ponds lacked. What were these traits and how might they be incorporated into a house pond? It is not that frogs have love affairs with cows or sedges rely upon tractors for pollination, nor that dragonflies are allergic to barbecues or wetland butterflies vaporized by cell phones; rather farm or residential uses tend to affect the structure and conditions in ponds in ways that, respectively, encourage or discourage certain creatures. If we can pinpoint those effects, then we can begin to look for ways of making each of our aims mutually compatible rather than exclusive.

So, why do occasionally grazed farm ponds tend to have relatively high diversity? Think about any such ponds that you might know. These ponds may not be very deep; indeed cattle use may have helped silt them in. Shallowness has at least a couple of important ecological effects: first, shallow ponds are more apt to dry out in the summer and/or freeze solid in the winter, and this means that obligately aquatic predators, such as fish or bull frogs (tadpoles and adults of this species over-winter below the ice), are eliminated; second, shallower waters can mean broader bands of aquatic vegetation around pond margins, something that provides shelter for aquatic organisms.

> *There are ways of landscaping with native species and of incorporating ecological needs that can result in ponds that are appealing and ecologically valuable.*

Think too of the pond margins. Grazed ponds are often scruffy, they are rarely mowed to the edge, and cattle tend to be choosy. As a result, such ponds will tend to have a combination of short and long sedges and grasses, and even some shrubs. These are important perching and emergence sites for dragonflies. Imagine also the inlets and outlets, often these are simple streams or seeps rather than highly channelized routes or drain pipes. Such wet areas tend to be surrounded by sedges and grasses, and often begin to resemble wet meadows. As such, they become home to native wet meadow plants and the butterflies that rely on them.

This is a somewhat idealized picture—we found grazed pastures with few of these traits and house ponds with many of them. But that is just the point. These important ecological characteristics can be incorporated into ponds with a variety of uses. The accompanying table lists some of the ecological characteristics that we found to be most important for encouraging native species. Look at that list and ask yourself which characteristics might be compatible with the uses of a pond that you know. Can at least a portion of the pond banks be mowed only once yearly, preferably in the late autumn? Is this a fishing pond or might fish be left out? Can the inlets and/or outlets be allowed to develop into gentle streams? This is not an all-or-nothing situation; every little bit helps. For example, fishing is a great way of connecting with a pond. If one wants to stock fish, then leaving some vegetation around the banks can help shelter amphibians and their young from hungry bass.

Aesthetically pleasing ponds can also harbor native plants and animals (indeed, from our viewpoint, this makes them even more attractive). Humans appreciate order and this can sometimes result in sterile landscaping. However, there are ways of landscaping with native species and of incorporating ecological needs that can result in ponds that are appealing and ecologically valuable. For images and tips on such 'pondscaping', we recommend

The farm pond lies near a forest, which makes for a very different, and frequently more diverse, habitat compared to many residential ponds.

Photos by Conrad Vispo

From left, this Baltimore checkerspot butterfly is a denizen of ponds in this region. Turtlehead is a wild plant found at the edge of ponds and wetlands. A new dragonfly emerges at a local pond.

Lakescaping for Wildlife and Water Quality by C.L. Henderson and colleagues (Minnesota's Bookstore, 1998). In a short article like this, we cannot enter into deep detail, but another reference which we have found particularly helpful is the web page of G. Winfield Fairchild, a Pennsylvania pond ecologist (http://darwin.wcupa.edu/ponds/management.html). Again, creating a pond that is home to many native species does not mean that the pond cannot also be a fish pond, swim pond or farm pond; however, to realize that potential, ecological needs must be consciously taken into account.

We will end our story at the beginning. One of the first considerations of pond construction, and one that will do much to determine the pond's net ecological effects, is where the pond will be put. Dig a pond in an existing wet meadow and you are likely to replace a fine aquatic habitat with a biologically mediocre one. On the other hand, place it in an upland area near woods and don't stock it with fish, and you're likely to be adding valuable habitat for the vernal pool amphibians we mentioned last week.

This is no small issue: we estimated that fully 1/4 to 1/2 of the ponds we studied had been dug in existing wetlands or along streams, implying that our pond-building ways might be occurring at the expense of habitat for native plants and animals.

Ponds naturally come and go over time. They are dynamic and ephemeral and yet, just as each of us is ephemeral but also a link in our bloodlines, so too is each pond and each wetland a crucial if temporary home to a variety of organisms. If these homes essentially disappear at any point in time, then their residents are gone from that time forth. Considering conservation does not mean that we necessarily abandon fishing in our ponds, swimming in them, irrigating from them or making them aesthetically beautiful. Rather, it means that, in satisfying our mortal and individual ambitions, we simultaneously respect the nearly eternal needs of other species. Their needs aren't the whole elephant, but they are at least one of the legs it stands on.

This work would not have been possible without the kind collaboration of all the landowners whose ponds we studied. We hope that, at the least, they found our stumbling about with dragonfly nets entertaining. Several volunteers and interns provided the hands and eyes that let us tackle so many ponds. Key financial support for this project came from the DEC's Hudson River Estuary Program. Our professional home, the Farmscape Ecology Program, is located at Hawthorne Valley Farm. To learn more about the farm or our program, contact us at fep@taconic.net or 518 672 7500 ext 254; view the farm web site, www.hawthornevalleyfarm.org; or come and visit. A digital copy of the report upon which these articles are based is available upon request.

**Based on the "Ponds of Columbia County: Patterns in Their Biodiversity, Thoughts on their Biodiversity" by Conrad Vispo and Claudia Knab-Vispo for the Farmscape Ecology Program, Hawthorne Valley Association, May 2007.*

Pond management that may encourage a high diversity of plants and animals

- Absence of predatory fish (while some of these fish are native, most are introduced lake fish)
- Pond margins with a diversity of plant types and structures (i.e., not entirely mowed lawn)
- Wetland habitat allowed to develop around inlets and outlets
- At least some 'greenness' allowed (but also freedom from excessive fertilization)
- Woods nearby
- Located away from many roads, buildings and yards