A Hudson Valley Perspective:
The Pond Boom and Its Implications for Nature

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Introduction

In our part of the Hudson Valley, ponds are, by and large, not a natural part of the landscape, although one wouldn't know that by looking at modern aerial images. Prior to colonization, ponded water probably occurred mainly where beaver had dammed small waterways (Figure 1); where late-melting glacial ice boulders left dimples (i.e., "kettle ponds"); and where small, shallow puddles formed temporary or nearly temporary pools (i.e., "vernal pools"). View that same landscape today, and it is dotted with ponds. In a nine-square-mile area around our home farm, we identified 14 ponds (here defined as permanent waterbodies under five acres) in the 1940s but 96 in 2021 (Figure 2). In a survey of nearly 100 ponds around our county we found that only 10-20 percent of them existed as ponds prior to the 1940s.

Indeed, ponds are one of the few types of wetlands that are not declining nationally (see, for example, T.E. Dahl 2011. *Status and trends of wetlands in the conterminous United States 2004 to 2009*. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C., 108 pp., and his earlier surveys cited therein).

This of course does not mean that your feet would have stayed dry if you visited the sites of our modern ponds a

Figure 1. Beaver ponds like this one were probably the main historical source of ponds in our landscape until sometime in the 15th century, when colonial beaver trapping essentially removed beaver from the landscape. They returned again in the 20th century, but in many cases their activity is heavily curtailed because of the flooding they can cause. Photo: Hawthorne Valley Farmscape Ecology Program

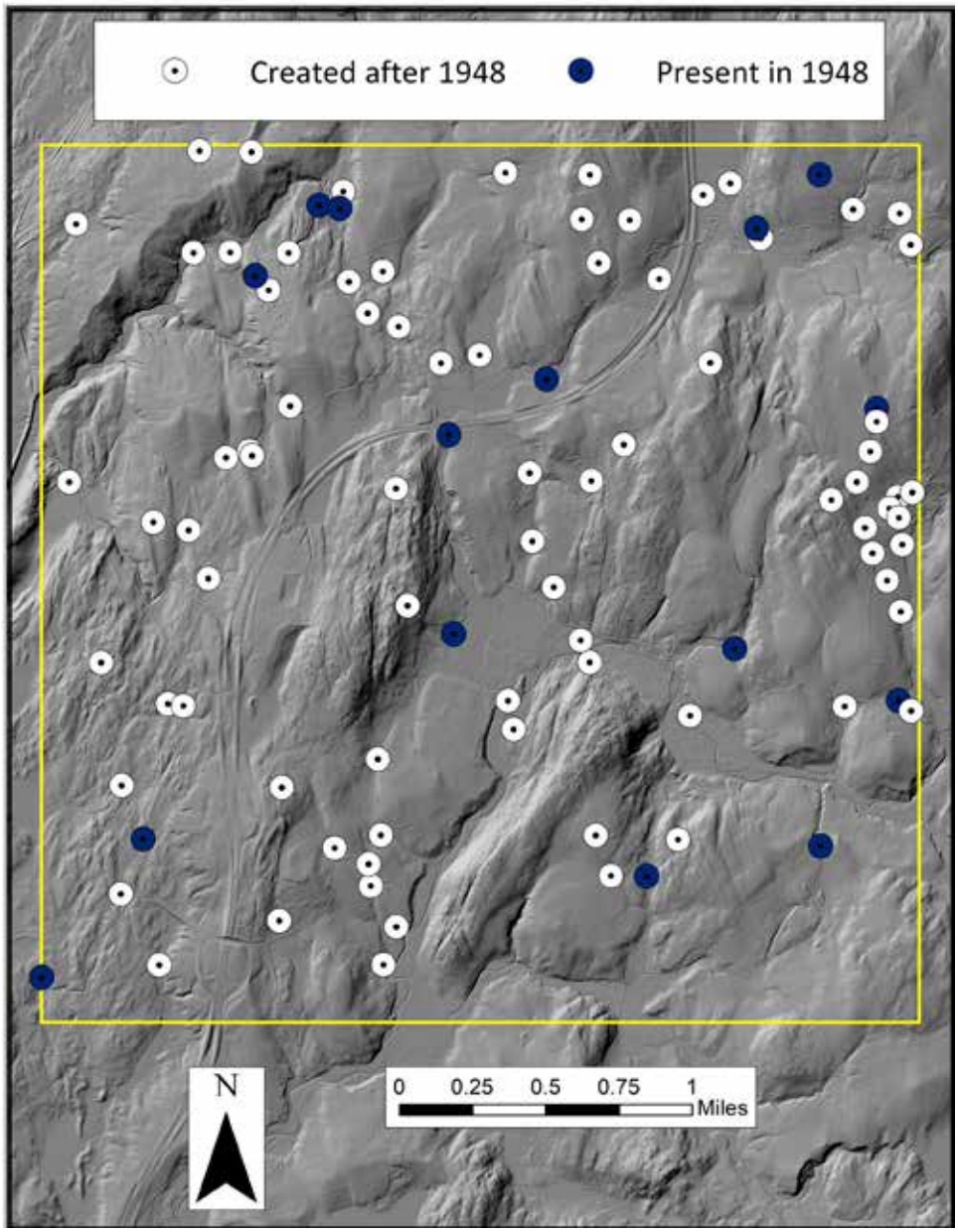

Figure 2. A map of the ponds in a nine-mile-square section of central Columbia County, NY. Blue dots indicate ponds that were apparently present in 1948; white dots indicate ponds constructed after that date. Pond presence in 1948 was determined using the aerial photographs for that year (these are the earliest images we have found for this area) and topographic maps from more or less the same era; modern pond distribution is based primarily on 2021 aerial imagery. Many of the ponds present in 1948 were also human-made, having been created as mill ponds or for agricultural purposes. Vernal pools are not mapped. While it is possible that a few early ponds were overlooked because of poorer image quality, the general pattern seems clear: There has been a huge pond building boom since the mid-20th century. Photo: Hawthorne Valley Farmscape Ecology Program

century ago. Many of our modern ponds were built into existing wetlands, from wet meadows to small streams to full-fledged swamps. Of the 76 ponds whose pre-construction habitats we could surmise, 57 percent were built into some type of pre-existing wet area. The more that natural wetlands are converted to man-made ponds, the larger the negative impact on native biodiversity.

Motivation for pond construction in our area has evolved. Prior to the advent of industrial steam engines, many mill ponds were created by damming waterways; and ice ponds were sometimes built when a regular need could be foreseen (e.g., near a milk plant). Many of these early ponds have disappeared as dams have decayed or been intentionally removed. Agricultural uses – watering holes, irrigation sources, and components of erosion control – probably predominated in the first half of the 1900s but then, due to changing demographics and perhaps fueled in part by the bucolic associations of those early ponds, recreational and ornamental motives have come to predominate. Modern landowners are looking for swimming or fishing opportunities, or simply want a pond to grace their landscape. Visit a realtor, and one can find ponds figuring prominently in house shots. Fire insurance rates also have played a part in impelling pond construction; in our largely rural county, many buildings are distant from municipal water systems, and ponds provide a recognized, reliable water source.

The ecological challenge

What does this relatively recent burst of pond building mean for regional conservation and, by implication, what might it suggest for ecological pond management?

One can suppose that native plants and animals will populate habitats that, even if not restorations of their original natural habitats (some of which are destroyed by the pond building itself), at least provide workable ecological analogies. In other words, the closer that a constructed pond replicates features of a natural pond or wetland, then the more likely it is to be occupied by native organisms. To delve into this, it is useful to consider why many modern ponds might *not* provide those parallels. I take this approach as a way of helping pond watchers understand what they're seeing when looking at many of the modern ponds in our landscape.

One relatively common modern pond is what we sometimes refer to as a lawn pond. Generally speaking, these are fairly deep (e.g., reaching ten feet or more) dug ponds that have relatively steep banks, are mowed to their edges on all sides, and, not infrequently, have been stocked with fish such as non-native largemouth bass and grass carp. They are sometimes chemically and/or physically managed to

control green growth and seek water clarity. A pond like this seems to more or less correspond to the dreams of many pond owners, but what, ecologically speaking, is wrong with this picture? It turns out there are several interacting problems.

Problem #1: The reduction of native aquatic vegetation through "architectural," biological, and physical means.

While it is sometimes conflated with algae control (see below), pond owners often attempt to control aquatic plants. The motivations for plant control seem to be various including purely aesthetic impulses, a desire for clear swimming and/or fishing areas, and a wish to avoid the shrinking of the pond through vegetation growth. Several techniques are used to control aquatic vegetation. During pond-building, steep sides and a relatively deep bottom can discourage the growth of rooted aquatic plants along the shores. Additionally, aquatic plants are sometimes removed physically by uprooting shoreline plants and raking or pulling deeper plants from a boat. Finally, grass carp are often introduced. Grass carp do seem to remove most rooted aquatic plants, although they avoid some plants (e.g., coontail), can make those nutrients available for subsequent algal growth, and may remove rare species. Once palatable plants are gone, they feed on detritus and, in our soils, often leave the pond water in an almost permanent state of muddiness. In New York State, stocking permits and the use of sterile (triploid) grass carp are now required by law. Nonetheless, grass carp that do manage to escape from permitted ponds can, sterile or not, heavily impact natural aquatic habitats.

The reduction of aquatic vegetation can directly reduce native botanical biodiversity. In the Northeast, there are roughly 100-150 native species of aquatic plants and another 400 species or so are considered wetland plants. A lack of botanical diversity translates into a lack of entomological diversity. For example, around ten of our butterfly species have caterpillars that feed on wetland plants (Figure 3).

Problem #2: The reduction of native animals due to abnormally high predation pressure caused by an abundance of native and non-native predators and by a lack of shelter.

Figure 3. The caterpillars of the Mulberry Wing feed on wetland sedges sometimes found around the edges of ponds where such vegetation is allowed to develop. Photo: Hawthorne Valley Farmscape Ecology Program

Relatively deeply dug ponds enable fish and other natural predators to overwinter. Our vernal pool amphibians (Figure 4) usually populate shallow pools where seasonal drying and/or a solid winter freeze mean that native aquatic predators like fish, bullfrogs (whose tadpoles overwinter), and snapping turtles are largely absent. A deep pond can therefore exclude those vernal pool creatures. In addition to these native predators, pond owners sometimes introduce non-native game fish, such as largemouth bass, adding to the threats faced by prey species.

Furthermore, the vegetation removal mentioned above reduces available shelter. Our results suggest that the presence of fish coupled with a lack of aquatic vegetation is associated with reduced amphibian abundance. It's a bit as if you released a fox and mouse on a parking lot. Damselfly and dragonfly species are known to vary in their sensitivity to fish predation, and we have observed some evidence that their communities are altered when fish are abundant and shelter scarce.

Vernal pool amphibians can be long-lived and many appear to return to the same breeding pool year after year. If a vernal pool is made into predator-bearing pond, then it becomes an unfortunate ecological trap.

Problem #3: Inhospitable aquatic conditions due to toxins or eutrophy.

We regularly receive calls from people looking for solutions to green ponds. While duckweed or similar plants

Figure 4. Spotted Salamanders, here shown during an early spring breeding congregation, are regionally our most common vernal pool salamanders. They are mainly found in fish-free seasonal pools. Other aquatic predators, such as bullfrogs and snapping turtles, also tend to be absent in such pools. Photo: Ben Derr

are sometimes the culprit, landowners are often concerned about algae. This concern has been exacerbated by recent reports of toxic algae blooms. Both the "cure" and the condition itself are apt to alter native ecology. While impacts reportedly vary based on context, some researchers have found that at least one "cure," the use of copper-based algaecides, can negatively affect amphibians and certain aquatic insects (e.g., mayflies; see https://dnr.wi.gov/lakes/plants/factsheets/CopperFactsheet.pdf). A decrease in insect life also means less food not only for aquatic predators of insects but also for aerials ones, such as the bats whose calls we regularly record above our ponds or the swallows one often sights.

The condition itself, i.e., excess nutrients and eutrophication, if extreme, can be detrimental to pond life especially if it causes periods of anoxia. Some level of algal growth is to be expected (we know relatively remote, hillside pools that will have algae at some times of year), but ponds dug near current or former farmyards, beside leach fields, or in areas with fertilizer or manure run off, will often show signs of marked eutrophication. Because much of our land is or was agricultural and because many dug ponds are located near houses with septic systems, eutrophy is a common problem.

Treating eutrophy at its source is not easy, and involves both reducing nutrient inflow – by repairing septic systems and avoiding fertilizer and manure run off – and removing nutrients already in the system, by dredging or botanical "mining."

Problem #4: Perils to Pond Life because of the Management of Adjacent Land.

Ponds don't exist in isolation – the management of their banks and of adjacent lands can influence their ecologies in a variety of ways.

We have already mentioned that animal manure or fertilizers on adjacent lands may reach the ponds themselves; this is also true of applied herbicides or pesticides. In our region, the agrochemicals used in landscaping can be substantial. The mowing of pond banks to the water's edge can make such land management even more problematic because of the lack of an intercepting buffer strip. In some cases, lawn or meadow stretching to the pond edge attracts flocks of Canada geese; their droppings then add natural fertilizer to the waters (Figure 5). Geese seem to be

Figure 5. Canada geese can easily access this pond due to the absence of tall shoreline vegetation. Flocks like this can add nutrients to the pond and so hasten eutrophication. A strip of vegetation hindering geese access can reduce their use of a pond. Photo: Hawthorne Valley Farmscape Ecology Program

discouraged by an intervening border of vegetation.

Mowed lawns are generally quite poor in native plant biodiversity, but we have a rich flora of wetland plants that, if permitted, often grow on the banks of ponds. In our landscape, woody species might include silky and red Osier dogwoods, alder, spirea, and willow. Native herbaceous plants can include such showy species as monkey flower, cardinal flower, blue flag iris, turtlehead (Figure 6), boneset, Joe Pye weed, blue vervain, and swamp milkweed (although all these species do not usually all co-occur). Removing pond-edge vegetation also removes animal habitat. Red-winged blackbirds and other birds may nest in herbaceous or low vegetation around ponds. Some dragonflies seek perching, exclosure and/or egg-laying sites (Figure 7). Leaving taller woody vegetation can provide surveillance spots for the likes of green heron and belted kingfisher, and tree cavities might even invite nesting wood ducks.

Additionally, a lack of wilder corridors connecting a pond to forest can discourage the use of the pond by some wildlife. Even if forest amphibians seek to breed in such a pond, crossing a mowed lawn can expose them to predation. While vernal pool amphibians do cross open terrain (witness how many die crossing roads), openness likely makes their movements more perilous.

Conclusions

The four problems described above are perhaps artificially discrete, and they are not the only way that human activity interacts with pond ecologies. A largely unexplored potential interaction between ponds and biodiversity relates to their impacts on adjacent streams. If there are a plethora of constructed ponds within a stream's watershed, one can suppose there might be at least two effects: ponds may warm shallow ground water before it enters nearby streams and increased evapotranspiration may remove water from the system. We have no personal basis for stating that this is happening, but given the large increase in pond numbers in some landscapes, these possibilities might be worth evaluating.

When we are approached by someone wanting pond construction advice, our first question usually is – Do you really need a pond and where are you planning to put it? Ponds can be beautiful to look at, can provide a place for a convenient dip or for a quick fishing trip, and can be useful fire protection. If ponds are installed into an already open upland, they may add to local biodiversity by increasing habitat diversity. Yet, as outlined above, they can also have real impacts if dug in areas that are already supporting some sort of wetland. This is often not an either/or situation, but managing expectations and informing perspectives is important. It is, for example, unlikely in our landscape that one will be able to maintain a showroom lawn pond without rather intensive management and without substantially harming biodiversity. The latter caveat sometimes surprises people who suppose that creating such a conventionally beautiful pond also means that it will be appreciated by most other organisms.

Figure 6. Turtlehead is one of the showy native flowers that can grow around the edges of ponds where native vegetation is encouraged. Turtlehead also happens to be the host plant for a showy butterfly, the Baltimore checkerspot. Photo: Hawthorne Valley Farmscape Ecology Program

Figure 7. As shown here, some odonates seek emergent or shoreline vegetation as exclosure sites. "Exclosure" happens when the aquatic nymph clambers into the above-water world, unzips its skin, and emerges as a winged adult. It leaves behind the so-called exuvia pictured here. Photo: Hawthorne Valley Farmscape Ecology Program

We have seen ponds where subtle beauty, a level of human use, and conservation value do coexist (Figure 8). We have listed "problems" above, but we hope that the solutions are as easily imagined as the converse. Most of our ponds, like lawns, are human-designed habitats, but as is also the case for lawns, when management is released from conventional approaches, these designed habitats can provide valuable resources for native species and can be aesthetically appealing (for example, when some of the showier native wetland flowers mentioned earlier are planted). In our region, there are now several landscaping companies offering to supplant lawns with native wildflower plantings or other more ecological management; perhaps, if public perceptions evolve, then there will also be more room for like-minded pond-scaping firms.

Ponds are hardly a plague on the land, but, if one accepts the importance of nature conservation, then their complex ecological roles should be recognized and efforts made to tailor them not just to our needs but also to the needs of the native organisms that will be drawn to them.

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Figure 8. A partially landscaped pond such as this, if kept free of introduced predatory and vegetation-eating fish, can provide both a place for human enjoyment and, given the close connection being maintained with adjacent forest and the wetland vegetation that is being allowed to develop, a home for native biodiversity. One caveat would be not to create a pond such as this in a natural wetland, which would likely already be amply supporting native species. Photo: Hawthorne Valley Farmscape Ecology Program

Conrad Vispo earned a PhD in wildlife ecology at UW-Madison, spent some time exploring freshwater fish in a tributary of the Orinoco, then returned to his home ground in Columbia County, NY, where he helped create the Hawthorne Valley Farmscape Ecology Program (https://hvfarmscape.org) with his wife Claudia. He is co-editor of the monograph *Plants and Vertebrates of the Caura's Riparian Corridor* (2003), author of *The Nature of the Place: A History of Living with the Land in Columbia County, NY* (2014), and one co-author of the upcoming *From the Hudson to the Taconics: An Ecological and Cultural Field Guide to the Habitats of Columbia County, NY*. He welcomes questions and comments at conrad@hawthornevalleyfarm.org.