Columbia County Ponds:
Novelties & Relicts, Deserts & Menageries.

A summary of research by Hawthorne Valley's Farmscape Ecology Program.

Before we tell you what we found in Columbia County ponds, there's something you should know about most ponds—they're relatively short-lived. Unlike our larger lakes and swifter rivers, most ponds are notably temporary. Think of an old field that slowly evolves into a forest, and you have an analogous ecological process. It's not difficult to understand why.

Picture stepping into any pond that you know and what do you usually encounter? Pond muck. Pond muck is the gracefully rotted remnants of all the debris that has entered the pond. Most ponds are relatively shallow, meaning that rooted aquatic plants can reach precious sunlight; and most ponds have long banks *relative to* their volume, meaning that the nutrient contributions from shore-line plants and animals (not to mention fertilizers) can be fairly large. This all adds up to lots of life in a pond and the accumulation of lots of nutrients, which in turn leads to more life, more nutrients, more life, etc., etc.. As pond muck and life accumulate, the pond gets shallower, and its demise accelerates. Eventually, a pond fills in, reverting to a wet meadow or wooded wetland and, finally, even evolving into something approaching dry land.

If this is true, you might ask, then how come we have any ponds at all in the County? Why haven't they all disappeared? The answer is clearly that they have originated as quickly (or actually, in our case, more quickly) than they have disappeared and that brings us to our first little research result. We studied 97

ponds around the County, and tried to estimate when each of those ponds originated. Only 13 of our 97 ponds were even around in 1940. In other words, more than 85% of our ponds had been constructed in the last 60 or so years. And even those 13 ponds may not have been naturally formed—think of all the mill ponds dug in the 18th and 19th centuries. The latest national Wetland Status and Trends report proudly declares that wetland area has actually increased for the first time in our country's history. However, as the author subsequently clarifies, this increase only occurred because so many ponds were being built.

Does this mean that there were no ponds at all prior to European colonization? No, for we are not this land's only creators of ponds. By their damming, beaver also create ponds, and they surely played a huge role in generating an extensive and dynamic wetland landscape prior to being temporarily extirpated in the 19th century. In fact, some believe that the rich bottomland soils of our stream valleys are largely the remnants of old beaver meadows.

So what? We tell you this because we hope it starts to change how you view ponds and their management. While it is true that human activity has frequently greatly accelerated the rate at which ponds accumulate nutrients and hence has contributed to their aging, it is also true that a static, crystal-clear pond is usually unnatural. Through a variety of interventions, we can try to keep a pond deep and clear, but we need to realize that, in doing so, we're fighting against Nature. That said, too much nutrients is also unnatural and, importantly, overall nutrient loss should be controlled so as not to contaminate our streams, rivers and, eventually, oceans.

As we proceed to tell you about the plants and creatures we found in ponds around the County, we want you to start thinking hard about what constitutes a 'natural' pond. What sort of a pond do you think most of our pond creatures evolved to live in? How might evaluation of pond quality from a biological perspective differ from an evaluation based on human aesthetics?

For plants and animals, water is a mixed blessing. All plants and animals

need it, but many species can get too much of this good thing. Thus, the community of plants and animals that one finds around ponds is usually a specific group of organisms that have evolved to tolerate wet feet if not wet heads. We surveyed plants, butterflies, dragonflies, and amphibians (i.e., frogs, toads and salamanders) in more than 90 ponds scattered around the County. Because of our programmatic interests in farmland and in our changing landscape, we only looked at open ponds, that is farm or lawn ponds.


Turtlehead.

One of the first group of organisms that people think of when ponds are mentioned is fish. However, other than noting their presence or absence, we have not yet sampled the fish of our ponds. In part, this is because the ponds of our area probably harbor few if any fish species of conservation interest. Our native fish seem to be adapted to lakes, rivers or streams. Thus the fish of ponds tend to be either hearty native lake fish, or exotic fish that have been introduced for sport, as spilt bait or to control pond vegetation.

We did study plants in more detail, and amongst the plants, one can distinguish at least two ecological groupings—the wetland plants and the aquatic ones. “Wetland plants” are those who may have their roots in saturated soils, but whose leaves are above water. Cattails are a typical wetland plant, but there are many others. During our study, we found 140 species of native wetland plants, and another 18 species that humans have, intentionally or not, introduced. Some wetland plants are inconspicuous sedges while others are as gaudy and extravagant as Cardinal Flower, Blue Flag Iris, or Turtlehead. One of the most widespread and conspicuous wetland flower is not native. Purple Loosestrife is beautiful but invasive. Originally found in Europe and Asia, this plant was introduced to North America for its ornamental value, but now has escaped into wild wetlands where it tends to crowd out some of the native plant species. Recently, managers seem to have had success controlling it with a weevil from its original homeland. Many of the wetland plants that we registered weren’t in the ponds themselves.


Cardinal Flower.

Rather, they were found in adjacent soggy lowlands that were often fed by the ponds. As a result, native wetland plant diversity increased as the amount of adjacent wetland increased, but declined as adjacent developed area rose.

Aquatic plants are usually not as showy as wetland species, nor are they as diverse (we found 41 aquatic species). However, they do include one record-holder—our smallest flowering plant is Water Meal, a tiny floating island resembling Duckweed. It is often mistaken for an algal scum. While aquatic plant study can seem a bit esoteric, some rare lacey Pond Weeds do grow in the area, and exotic invasives are also affecting this realm. Water Chestnut is one pernicious invasive making its way into our region. Its edible seed is housed in what appears to be nature's version of a medaeval mace, albeit only an inch or so across. The diversity of aquatic plants was greatest in our older ponds. This may be because older ponds simply accumulated more species, or because the ecological conditions of older, shallower ponds were simply more conducive.

Grass-of-Parnassus.

One of the main factors determining the distribution of plants in our area is the presence or absence of limestone (or its geological relatives like marble and dolostone). Just as farmers lime their fields, areas with natural limestone in the soil tend to be more fertile and botanically diverse. Columbia County is woven through with limestone, and one occasionally comes across rock faces with embarrassing botanical riches such as Canada Violet, Ginger, Squirrel Corn, and Miterwort. Wetlands are apparently not exempt from this pattern, and ponds on limestone soils tended to be more diverse, if only because they were home to more introduced species. Invasive wetland and invasive aquatic plant diversity increased as water pH increased (i.e., as it became less acidic). A limestone-influenced wetland can also hold such native beauties as Grass-of-Parnassus, Shrubby Cinqfoil, and Marsh Bellflower.

A study of plants leads, not illogically, to butterflies. We studied butterflies not because they are aquatic, but rather because the caterpillars of some species do rely on wetland plants for food. We found a total of 39 butterfly species around the ponds we studied; we classified 6 of these as wetland-dependent.. Wetland butterflies are a study in contrasts, ranging from the dramatically marked and fairly large Baltimore Checkerspot (decked, as the name implies, in Lord Baltimore's colors), through the only slightly smaller but much less dramatic Eyed Brown, to the medium-sized yet strikingly-colored Bronze Cop-

Baltimore Checkerspot.

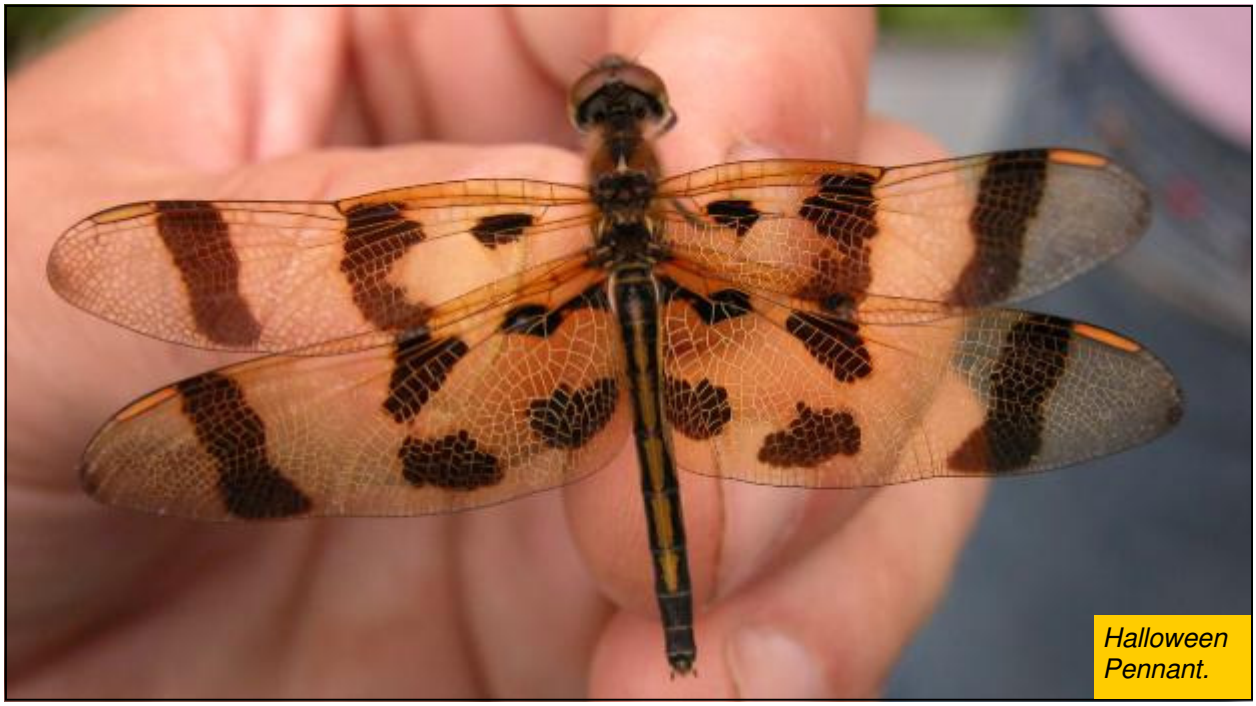
per, and then the much less conspicuous Black Dash and Mulberry Wing. The last, in keeping with our medaeval theme, bears a wing pattern reminiscent of the shield of the Knights Templar.

In our pond study, wetland butterflies were relatively rare with the Baltimore Checkerspot, our most common species, occurring at only 15 sites. A wetland that is home to at least two of these species is a special place. One pond characteristic that did appear to be associated with a greater diversity of wetland butterflies was grazed pond margins. We believe that this is because pasture ponds tended to be more loosely managed than lawn ponds, and hence there was greater tolerance for the sedgy, seepy pond overflows that contained food for these butterflies.

From Knights Templar, we move onto dragons and damsels. Dragonflies, and their smaller, slimmer cousins, the damselflies are widely-recognized pond residents. Their predaceous larvae lurk in pond ooze, waiting not for human swimmers but other aquatic insects. When they're ready, these larvae creep up onto emergent vegetation, where the winged adults escape from a crack in the larval skin. A hollow cast of the larva is left behind, and the clear-winged adult flies off to catch mosquitos, blackflies and other flying insects.

Bronze Copper.

Some dragonflies and damselflies are widespread, occurring around lakes, ponds, marshes and even creeks. Others are confined largely to marshes and shallow pools. We were particularly interested in this latter group because of their more demanding habitat needs. Overall, we found 47 species of dragonflies and damselflies during our surveys, of which we classified 13 as specialized. The flagships of the specialized species were, appropriately enough, the Halloween and Calico Pennants. While the Pennants are not as big as the huge Darners, their coloration is appealing because their body hues (orange and red, respectively) seep into



Halloween Pennant.

their wings. Analysis of our data suggested that the specialized species favored fishless ponds with grazed margins. In this case, grazing may have produced the open but structurally variable pond banks that these species seem to favor. Many fish are predators and, as we shall also note in relation to amphibians, many of our small-pond organisms are not tolerant of fish.

The last group which we studied were the amphibians, that is the frogs, toads and salamanders. Frogs have received widespread attention both because they are reportedly experiencing global population declines, and because they are such vocal pond residents. Even if you're not sure who they are, there are few in the County who have not heard Spring Peepers, American Toads, Green Frogs, and Bullfrogs calling. All of our toads and frogs, and most (but not all) of our salamanders, gather at ponds to breed. They lay their eggs in those waters, the tadpoles and larvae develop therein, and the semi-terrestrial young adults eventually go forth. The Red-spotted Newt is an exception to this pattern: the bright orange, punk-teenager terrestrial stage (aka Red Eft) is followed by an aquatic adult of more subdued coloration.

The ten amphibian species that we found in our ponds can be divided into two groups: vernal-pool amphibians and permanent-pond amphibians. The distinction is whether or not the species is adapted to the fish-full world of permanent ponds and lakes. Species such as Bullfrog and Green Frog actually *overwinter at least once as tadpoles* meaning that they can only occur in water bodies that don't regularly dry out and that, hence, regularly contain fish. Our "vernal-pool amphibians" (mainly Wood Frogs and Spotted Salamanders), on the other hand, take a hurry-up-and-leave approach. Much of their life history

is predicated on getting into ponds early, breeding, and having the next generation leave as miniature adults before the nursery dries up. In an immediate sense, it doesn't really matter to them whether or not the pond actually does dry up. What does matter is whether or not there are hungry fish in the pond, and seasonal drying eliminates the fish problem. Although we didn't look at any temporary pools, not all of our ponds had fish. In our data, the presence of fish was associated with a reduced abundance of vernal pool amphibians, In fact, it's not just fish that may eat them—the permanent-pond amphibians such as Bullfrogs, Green Frogs, and Red-spotted Newts are all potential predators on the eggs and/or larvae of vernal-pool species.

Aside from their taste for temporary waters, vernal-pool amphibians also differ from permanent-pond amphibians in that their adults range farther from ponds. The frogs that most children catch around ponds are Green Frogs or Bullfrogs; Wood Frogs and Spotted Salamanders disappear into the woods once they've finished their reproductive duties. This latter characteristic means that the vernal-pool species not only require nice ponds but also good uplands. A pond surrounded by acres of mowed lawn will rarely host vernal-pool amphibians. Several studies, including our own, have demonstrated the need for nearby forest.

In our study, overall amphibian diversity and abundance decreased as the amount of adjacent commercial/residential (but not agricultural) development increased. Interestingly, the relationship between overall amphibian abundance and fish presence depended upon whether or not pond-margin vegetation was present. With vegetation, fish presence seemed to have little effect; when such vegetation was absent, amphibian abundance dropped off markedly in the presence of fish. Possibly, vegetation served to shelter larvae from predatory fish. Ponds stocked with, for example, Large-mouth Bass and Grass Carp (plant-eaters who eliminate the shelter) might thus deal amphibians a one-two punch.

We hope that you have kept track of our allusions to pond management, and have used them to formulate your vision of what a biodiverse pond looks like. While water quality can no doubt be an issue, our modest efforts to test its importance suggested that, *within the range of ponds we studied*, habitat management, both immediately around the pond and in the adjacent uplands, was one of the most important factors influencing diversity, together

Leopard Frog.

with whether or not the pond was located in limestony soils. Ponds that were surrounded by high levels of commercial or residential development tended to have lower diversity of plants and animals. Likewise, for some groups, the management of the shoreline seemed important. Wetland plants, wetland butterflies, and specialized dragonflies appear to benefit from pond margins that were open, but varied. A pond that was lightly grazed so that it was surrounded by a few bushes and by herbaceous vegetation of various heights tended to have more of these species. Likewise, a sedge-covered, seepy overflow that perhaps spread into a wet meadow also added diversity even if it were periodically grazed.

In light of these thoughts, let's return to our opening remarks about a pond's life cycle. The greatest diversity of native species appeared to occur in those ponds who, as messy and aesthetically unappealing as they might appear, were aging somewhat naturally. Ponds whose aging had been arrested by attempts to keep them clear and clean may have been less diverse. This doesn't mean that any attempt to create a swimmable pond is doomed to create a biological desert. Fortunately, attracting native species is not an all or nothing situation. For example, even if the water body itself is somehow managed to reduce algae, keeping the shoreline and the surroundings in relatively natural habitat can be beneficial. If our ideal is a beaver pond, rather than a golf-course water trap, and if we actively try to manage for that distinction, then we will likely have a pond that harbours numerous native species.

In closing, we want to touch upon one preliminary but important aspect of pond management—where do you dig a pond in the first place? There are engineering factors that help determine where a pond should go, however from an ecological perspective there are additional determinants. As we noted early on, wetlands are apparently increasing in the U.S. solely because more and more ponds are being built. We have already touched upon what might make those resulting ponds most valuable ecologically once they are constructed, however a central consideration must be, is the pond's construction itself degrading existing wetland habitat? We estimated that somewhere around 20-40% of the constructed ponds in our sample were located in former marshy wetlands or vernal pools. In other words, these ponds probably replaced a more biodiverse wetland with a less biodiverse one. While ponds carefully constructed in uplands or possibly even along creeks might enhance overall wetland diversity, it is unlikely that digging out a vernal pool, a marsh, or a swamp will result in something that is, in terms of native species, any better. These are natural habitats being replaced, in most cases, by artificial ones.

Columbia County still has quite a diversity of wetland organisms, however maintaining that diversity will require more than just building more ponds; indeed, it may require less than that. Ponds are appealing places and can provide valuable outdoor recreation possibilities. They can play important agricul-

tural and even safety roles (as fire ponds). Yet we believe that much of what is currently driving pond construction, especially around new or refurbished houses, is fashion. As such, we believe it is important to try to reshape the fashion ideal so that it is more inclusive of native species. We hope that our little work helps inform the redefinition of that ideal.

The work summarized in this article would not have been possible without the collaboration of many Columbia County land owners, nor without the help of our trusty field crew. Major funding came from a DEC Hudson River Estuary Program grant for our continued work on Farmscapes. We thank all who have made this possible.

If you're interested in the gory details of this study. A digital copy of our 64-page report is available from The Farmscape Ecology Program, Hawthorne Valley Farm, 327 Rte. 21C, Ghent, NY 12075; fep@taconic.net. Questions and corrections are also welcome.