The Natural Farmer
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Special Supplement on Biodiversity

Tomatoes in the Wilderness & Spiders in the Broccoli

by Conrad Vispo

About this Article

My colleagues and I run a small research and outreach program in eastern NY. One of our central objectives is to help both farmers and non-farmers find tools for connecting with the ecology of the landscape within which they live and work. This article summarizes some of the experiences and thoughts deriving from nearly a decade of this work. After sketching our general philosophy, I outline the history of such efforts to both pay respects and provide context, I then pass to a few basic definitions and wrap up with the consideration of two core questions: how do farms influence semi-wild habitats and, vice-versa, how do such habitats affect farming?

The Cohabitation of Nature & Farming

Nature is a part of farming and, at least in some cases, apart from farming. While natural processes (such as water and nutrient cycles, and innate physiologies) are widely recognized as central to the growth of crops or livestock, the interaction of farms with untamed natural habitats and the wild organisms that live therein has been less explored, although approaches such as permaculture and agroecology certainly do consider it. This article shares some of our experiences as on-farm researchers studying the interaction of natural habitat and farming in eastern NY.

A core of our philosophy is that both farming and wild nature are valuable in their own rights. That is, nature has inherent value regardless of any good role it may play in agriculture or any other human pursuit; and farming has intrinsic value independent of any benefits it might provide for nature conservation. Taking these as coexisting values, we will look for synergies rather than trying to justify one based on the other: agriculture and wild nature have a home on this Earth, how can they live together as family? The hope with this article is to help spur the ongoing cycle of application and observation that will be central to working with this collaboration.

photo courtesy Conrad Vispo

The Bobolink is a raucous bird slightly smaller than a Robin; the back of its head is capped with yellow. Originally found on the Prairies and other wet and dry grasslands, it has readily adopted mature hayfields, despite the fact that most such fields are dominated by European plant species. Evidently, these birds are looking for the proper structure for nesting rather than being discerning botanists. If the hay is cut before the young leave the nest, then the fields are ecological traps rather than nurseries. In the Northeast, this is generally considered a beneficial species that catches insects to feed its young. Farther south it has been known as the Rice Bird because migratory flocks sup on growing rice.

In thinking about the farms and natural habitats, we have simplistically categorized the interactions into two groups: those in which the farm affects native organisms and those in which native, or at least wild, organisms affect the farm. Each of these interactions can, in turn, be classified as positive or negative. We have, for example, the terms "pest" and "beneficial" exemplifying different roles for wild species that influence the Farm. Likewise, the farm can create or destroy habitat for species in its surroundings. These dichotomies are simplistic – what is 'conserved nature' from one perspective can, simultaneously be farm pest or beneficial from another; further, numerous organisms can be beneficial for the farm at one time or place and detrimental at another, and many species are neither.

As some of my friends are quick to point out, farming is nature, and so speaking of a dichotomy between farming and aspects of nature seems wrong. If nature is defined as the 'living world', then no doubt we and our action of agriculture are part of that. And yet, just as we contrast between human will and the fate that

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Why Biodiversity?

by Jack Kittredge

Looked at from a spiritual point of view, mankind's most heinous acts may not be the enslavement, murders and wars we inflict on our brethren, but rather the destruction we are wreaking on other species by our relentless pursuit of our own ends. Scientists estimate that some 30% of the different organisms present on this planet in 1970 are now extinct.

One of the most destructive of our practices is modern agriculture. Deforestation for farming is relentlessly reducing natural habitats in the most diverse parts of the world. Monocropping edges out wild species of plants. Synthetic pesticides and herbicides destroy all life forms we do not want for our purposes. Traps, fences and dogs have killed or domesticated animals for livestock. Factory fishing is rapidly depleting the world's stock of seafood.

One of the less-heralded strengths of organic certification is that it holds farmers to the principle of finding ways to work with nature to improve biodiversity. The ways farms that maintain high levels of biological diversity can reap practical benefits are many: pollination, predator control, soil friability, moisture retention, and weed control, among others.

In Europe, many countries even provide direct financial payments to farmers who increase biodiversity. In America the National Organic Program is beginning to encourage certifiers to require stronger biodiversity efforts on the part of organic farmers.

This issue focuses on the ways organic farms can do more to promote biodiversity, and why they will benefit if they do. We hope this will bring about an increase in learning about and practicing farming methods that bring more nature back into the fields and pastures.

befalls us, so too can we recognize that there is the nature we participate in with our own hands and the nature that lives on largely independent of us. It is this latter component of nature which I herein call 'untamed nature'. Despite the fact that boundaries blur, there is clearly a boundary of agency between us and 'untamed nature': we have responsibility for the work of our own hand. Beyond that, we must recognize the existence of other impulses; impulses that some embody as gods or spirits. Recently, it has been suggested that we have entered a new ecological era characterized by humanity's pervading impact and that, rather than critiquing that impact, we should feel empowered to reshape the World given our dominant role in it. Humanity's influence has been huge, but I feel this realization should urge humility rather than bravado. It is in this context that it seems useful to recognize the practical dichotomy between us and wild nature and then ask: how can our farming, indeed any of our actions, serve us and, at the same time, honor nature's untamed spirits?

Historical Background

Plus ça change, plus c'est la même chose. As backdrop for our discussion, it's useful to envision the multi-generational history of our concepts. While some ideas may feel new to us personally, few are new to our common pool of thoughts. Reviewing history can reveal teachers or colleagues we never knew we had, can position our own efforts against a broader panorama, and can highlight on-going efforts to tackle core ideas.

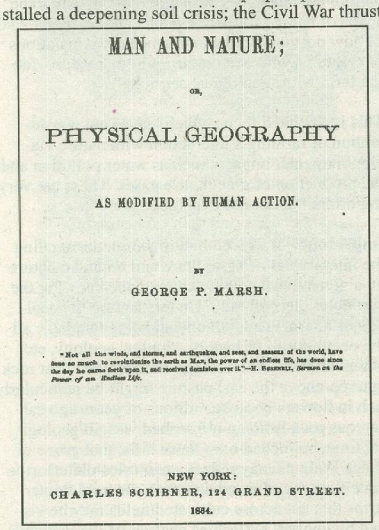
Pre-20th Century. Looking over the past 200 years of northeastern agricultural history, one sees that interest in nature and agriculture has gone through cycles of waxing and waning. The beginning of the 19th century was met, at least in the Hudson Valley, with profound concern over the future of farming. Although the degree of soil depletion experienced in the Northeast during the late 18th and early 19th centuries may have been somewhat overstated as observers compared the yields from extensive, labor-dear, land-cheap American farming with those of intensive, labor-cheap, land-dear European farming, various locations were experiencing declining yields. Commentators, often linked to the agricultural 'improvement' movement, were quick to bemoan the lack of proper management, including disregard of such accepted practices as manuring, crop rotations, and cover-cropping. These concerns were probably amplified as politicians watched population (and hence relative political clout) flow west towards richer Midwestern soils. Much of the attention during this earlier period was directed towards agronomics, however a respect for nature was voiced, at least around the edges of the movement. For example, in a widely read 1818 address which also tackled some of the afore-mentioned soil management issues, former president James Madison stated:

> "But although no determinate limit presents itself to the increase of food, and to a population commensurate with it, other than the limited productiveness of the earth itself, we can scarcely be warranted in supposing that all the productive powers of its surface can be made subservient to the use of man, in exclusion of all the plants and animals not entering into his stock of subsistence; that all the elements and combinations of elements in the earth, the atmosphere, and the water, which now support such various and such numerous descriptions of created beings, animate and inanimate, could be withdrawn from that general destination, and appropriated to the exclusive support and increase of the human part of the creation; so that the whole habitable earth should be as full of people, as the spots most crowded now are or might be made, and as destitute as those spots, of the plants and animals not used by man."

Such words lead into a period of natural history exploration (typified by the state-wide surveys conducted during the 1830s and 1840s in New York, Massachusetts and Vermont) coupled with the budding transcendentalist and romantic movements.

At the same time, new emphasis was placed upon natural history as an applied agricultural tool. Asa

Fitch in New York and Thaddeus Harris in Massachusetts extended and summarized existing work in economic (later called applied) entomology in order that the life histories of farm-relevant invertebrates might be better understood and managed. Slightly later, but deriving from these insect-based roots, economic ornithology worked to understand avian natural history for the purposes of managing the good and bad effects of native avifauna.
While some of its recommendations may have been followed, the farm improvement movement faded in the second half of the 19th century for a variety of additional reasons: the subsequent, more extensive use of fertilizers such as superphosphate, forestalled a deepening soil crisis; the Civil War thrust



MAN AND NATURE;

OR,

PHYSICAL GEOGRAPHY

AS MODIFIED BY HUMAN ACTION.

BY

GEORGE P. MARSH.

"Not all the winds, and storms, and earthquakes, and seas, and seasons of the world, have done so much to revolutionize the earth as Man, the power of an endless life, has done since the day he came forth upon it, and received dominion over it."—H. Bushnell, *Sermon on the Power of an Endless Life.*

NEW YORK:
CHARLES SCRIBNER, 124 GRAND STREET.
1864.

Written in 1864, this work by world-travelling Vermonter George Perkins Marsh was one of the first North American books to try to rigorously catalogue human impacts on 'untamed nature'. While not very well known today, it was influential for many early conservationists.

other, albeit partially agricultural, issues to the fore; and the 'breaking of the Prairie' brought vast new stores of virgin agricultural soil into cultivation.

However, while nature and agriculture may have drifted apart, the likes of George Perkins Marsh, building on commentaries on humanity's local interactions with nature by Thoreau and others, began to warn of the profound impact humanity was having on nature. Works like *Man and Nature* (1864), which scientifically surveyed human impacts on a global scale, helped set the tone for future critiques.

Early Twentieth Century. A second period of profound introspection occurred during the first half of the 20th century. Voices of agronomists, conservationists and social reformers joined together. Spurred on by the combined ecological, agricultural and economic crisis of the Dust Bowl and the Depression, they proposed radical rethinking of the entire agricultural system. The breakdown of certain existing social structures seemed to open space for government to flirt with dramatic restructuring of agriculture and society. A key concept during this period, supported by a sizable group both inside and outside of government, was the idea of permanent agriculture. 'Permanent' was, in many ways, an earlier name for sustainable, and connoted a recognition that human endeavor was embedded within, rather than set apart from, the ecology of the Earth and all of its inhabitants. According to the history book *A Green and Permanent Land*, 'permanent agriculture' "called for a society based on permanence as opposed to the past conditions that inculcated a short-term exploitative, and unplanned land management system"; a key tenant was 'planned ecological harmony'. As exemplified in the works of supporters, such as Aldo Leopold and Paul Sears, proponents were explicit in linking their agricultural approach to a worldview that was respectful of nature at large.

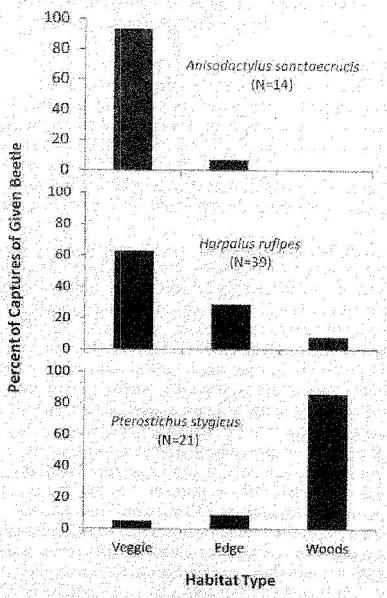
This same period also saw the initial incarnations of philosophies that later went on to become the organic and biodynamic movements. Albert Howard, F. H. King, J. I. Rodale, Masanobu Fukuoka and Rudolf Steiner, among others, began to formulate explicit sets of practices that were alternatives to so-called conventional methods with their burgeoning use of synthetic fertilizers, herbicides and pesticides. These practices were justified in a variety of ways – spiritual, ecological, nutritional and agronomic. Rudolf Steiner, for example, based his approach upon a well-developed view of the interlinked spiritual and physical worlds, but, within that, spoke of the importance of good food in creating a healthy society, provided specific agronomic recommendations including the use of preparations and certain soil nutrients, and commented, on various occasions, on the interconnectedness of all life. Fukuoka's natural farming was premised both on certain practices and a certain philosophy which he summed up as "serve nature and all is well". The visions of Howard, King and Rodale, while highly influential, were perhaps more circumscribed in that care of the soil and human health seemed to be their primary foci, with less emphasis placed upon spiritual beliefs or compatibility with the ecology of non-production organisms. These and similar thoughts were shared widely with the public through the effective communication by their originators and through the likes of Ralph Borsodi, Edward Faulkner and Louis Bromfield.

Post WWII. The post WWII role of US agriculture in world-wide food systems, linked to both famine relief and global power struggles, together with the rising power of agribusinesses and the growing public acceptance of consumerism, seemed to eclipse 'permanent agriculture' as a movement and its popularity receded. Simultaneously, technological advances and structural changes converted the agricultural landscape from one of many small farms to that of a few big ones.

The clout of the 'farm vote' declined dramatically in the late 20th and early 21st centuries. In our home county (Columbia County, NY), for example, almost 2/3rds of the workforce was in farming during the 19th century era of the improvers, it was down around 1/3rd who were so employed during the time of "permanent" agriculture, down around 8% by 1970, and roughly only 3% today. That drop in the farming population helped shape alternative agriculture, accentuating the relative strength of forces exerted from outside of the farming community.

In 1962, Rachel Carson published *Silent Spring* and crystallized a critique of conventional agriculture that has lived into the present. By pointing out the threats that agrochemicals presented to both nature and human health, she helped create a ground swell amongst consumers which, in turn, provided impetus and markets for organic products. The counter culture of the 1960s and 70s, accompanied by a new wave of 'back to the land' grounded in part in the Nearing's 1954 *Living the Good Life*, helped establish the vision of small, organic (speaking generically) farms in the landscape. More recently, Michael Pollan's *Omnivore's Dilemma*, accompanied by the growing commercialization and industrialization of organic methods, helped create the 'food movement' with its core focus on the consumers' relationships with the farmer. "Local" supplanted "organic" as a key term, and novel (or at least reborn), relationship-rich marketing forms such as farmers' markets, CSAs and pick-your-own operations gained strength. Personal health, as affected by the production methods of the food, has remained a strong undercurrent. Agriculture and environment are perhaps most commonly discussed together with respect to climate change, although water quality (for example, the Mississippi delta 'dead zone') is also a regular topic. Certain GAPS measures which pit consumer health against on-farm habitat may dilute support for the latter, and increased urbanization has reduced intimate knowledge of both farming and wild nature.

In contrast, our topic here, the landscape-scale ecological effect of agriculture upon untamed nature and vice-versa, is not core to current public desires for agriculture. It is, perhaps, closer to the concerns of the some earlier generations. This is not to say that the theme is completely ignored today. Permaculture, while often more aimed at recreating natural processes or copying natural models, also hopes to create more ecologically interesting habitat. The "Wild Farming" movement has had some influence, especially in the West. Departments of Agroecology or related fields are arising at various universities (for example, UNH). Organic farming retains a constituency who value on-farm biodiversity, and various individual farmers show deep dedication and commitment to incorporating the fate of native plants and animals into their management considerations. Given the hearty modern birding community, the impact of haying on grassland birds is perhaps the most publically discussed regional example of farm/habitat interactions. We advocate the sincere and practical bridging of agronomic and conservation sciences; this article is meant to contribute a little drop to a rich history of laying out such a vision.



This figure shows the distribution of three different species of Ground Beetles based on studies conducted with the help of intern Page Taliaferro on 19 different farms in our county. Notice how one species (Anisodactylus sanctaecrucis) was more or less confined to the vegetable fields themselves; another, the introduced Harpalus rufipes, seeped out into the surrounding edge habitat; and, finally, a third (Pterostichus stygicus) was largely confined to the woods. One way to view these graphs is as diagrams showing the degree to which the ecology of one habitat influences that of another. "N" refers to the total number of a given beetle species captured.

Questions and Definitions

Herein I consider two questions regarding farming and nature: 1) how does current or recent agriculture influence the availability, at the landscape scale, of habitat for native plants and animals? And 2) how do such habitats influence the populations of creatures who benefit farming (that is, provide the farm with "ecological services")?

This is a limited focus which leaves out consideration of farming's interaction with nature via environmental impacts such as water pollution and the production of greenhouse gases. These are very important but not our expertise.

Importance of Place. In terms of understanding the interactions of agriculture and untamed nature on a given farm, nothing can replace knowing the particular piece of land. Understanding the ecology of a farm is about understanding its place: all the peculiarities of history, climate, geology, etc. which influence the ecology of that land. That rock outcrop above the east pasture might be particularly rich in flowers because millions of years ago calcareous rock from an old seabed was, in geological time, bulldozed onto those hills; that grove of Black Walnuts may reflect a centuries-old effort to have a source of wood and nuts; the wild flower strips that cut across cultivated fields may be visited by unusual butterflies because of the wetlands lurking in the forests nearby; the wild bees that pollinate the crops may relish the sand that marks the farm as glacial-lake beachfront property. Information from elsewhere can provide background in the same way that psychology can help us understand the people around us, but it alone doesn't create an ecologically integrated farm. Local knowledge of place in the landscape and in the historical flow of land use will both inform and engage one in ways

that more remote information cannot. Most farmers I know develop a very detailed agronomic sense of place; here, I'm just trying to illustrate how that might be widened somewhat.

A related word of caution – take what we say with a grain (chunk?) of salt. One of the key reasons that we urge farmers to explore their own farms is because each farm, each landscape, each region has its own ecologies. Having worked with farms and nature in our county for almost a decade, we are regularly surprised by how different the ecologies of certain wild species are in other parts of the Northeast. For example, certain plants that indicate alkaline or basic soils in our region have no such indicator value in other areas. As we share examples or ideas from our own work, you should always view them as open ideas or questions, observations to be corroborated or contradicted in any particular landscape. While I may mention some illustrative examples of certain ideas, our goal herein is to encourage a way of thinking, a route of engagement, rather than to shovel on the information.

Habitat for Whom? Habitat can really only be discussed in detail once you have answered the question, 'habitat for whom?' Our focus is on 'native organisms', that is, species which were not introduced by humans since European colonization. Such a definition accepts as native those species introduced to a given spot by Native Americans before Columbus (for example perhaps some of the nut trees of the Champlain Valley), or which arrived later but apparently of their own accord (in our area, examples include such familiar animals as the Opossum, Coyote, and Cardinal). The primary reason to distinguish between pre- and post-European colonization is that most prior biogeographical shuffling by humans was quite regional and/or happened over such long periods that it is difficult to distinguish from other modes of species range extension. Our reason for a focus on natives is not because we believe that all non-native organisms are ecologically worthless or somehow inherently tainted – many are key to food production. Rather, returning to our initial philosophy, we believe nature has inherent value and hence, the conservation of species is important. If each of us, in our own parts of the World, doesn't care for the conserva-

photo courtesy Conrad Vispo

This relatively large, long-jawed ground beetle (Sphaeroderus stenostomus) reportedly feeds largely on slugs and snails. However, perhaps to the dismay of some growers, we have only found it in mature forests.

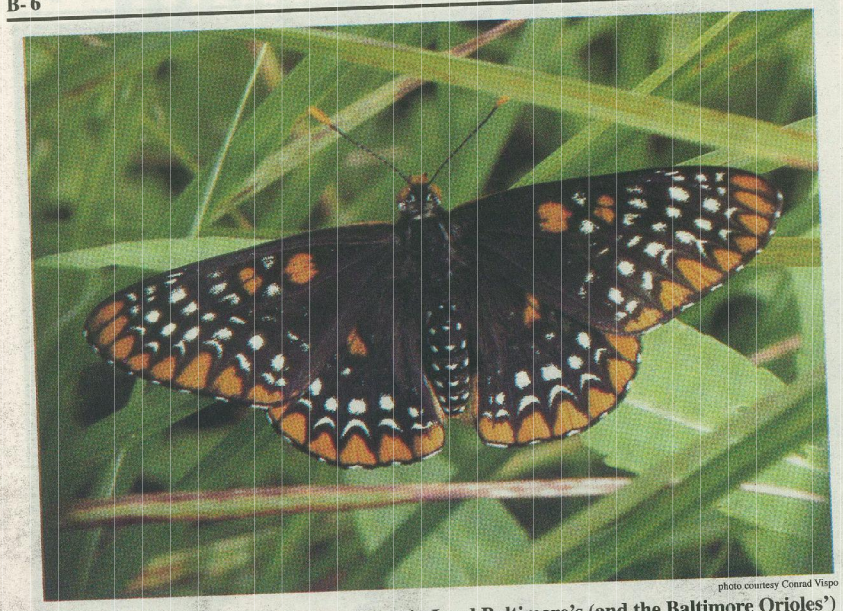


photo courtesy Conrad Vispo

The Baltimore Checkerspot is decked out in Lord Baltimore's (and the Baltimore Orioles') colors of orange, black and white. Like many butterflies, the caterpillars of this species are rather picky in their food choice. Traditionally, they have only favored Turtlehead, a wild flower of open wet areas. We have regularly encountered them on lightly managed wet meadows. More recently, it has been reported that their caterpillars are using Plantain, a European import. As we alter the landscape, some species co-evolve with us.

tion of species native to our areas, then who will? They are, so to speak, our charges on this Ark.

The Importance of Imagining. One cannot wonder about the role of farms in maintaining habitat for native species without thinking broadly in terms of time and geography. For example, it is only if we think diligently about pre-European forests and other early habitats, and about how they have subsequently been shaped by humans that we might begin to subsequently wonder if farm woodlots might sometimes be ancient forests (in the sense of being long forested, but not untouched 'old growth') that make a unique ecological contribution to certain landscapes. Likewise, it's only when we take into account land use history at a continental scale that we can begin to understand the one-two punch that grassland birds have received over the past 200 years as the Prairie was ploughed and grass-based northeastern farming faded. While physical intimacy with the ecology of your farm is key, so too is imagination that leads you to wonder what the land looked like years, decades or centuries ago and what it might look like in the future; the imagination that lets you picture your flora and fauna as localized inflorescences, each bloom, each species, of which is bound by unseen roots to all others of its race, its local future determined by the health of those spreading roots and vice-versa.

To begin to understand the ecology of your farm, you need not simultaneously study its entire ecology, that would be an overwhelming task. However, you can start pulling on the strands of the ecological skein. By picking one part of the farm you particularly like, one group of organisms who appeal to you, one aspect of land history that fascinates you, and by delving into that, you can slowly come to form a perspective on the whole.

The Influence of Farms on Natural Habitats. Our first question is 'how does current or recent agriculture influence the availability, at the landscape scale, of habitat for native plants and animals?' In other words, *how can farming contribute to nature conservation*? To illustrate our perspective on this question, we'll take an imagined walk around a hypothetical farm in our region.

A Walk Around. We begin at the top of an adjacent hill, perched above the farm itself. Looking down, your mind can wander back in time. What is now perhaps vegetable ground may well have been part of a dairy farm not so long ago. The flatter ground, or interval(e), probably saw corn. For its course nearest the barn, our little valley creek is strangely well-behaved – cutting a neat, unwavering line. Inspection of an early aerial photograph (say from the 1940s or, even, 1930s) reveals the natural meanderings that were since straight-jacketed by ditching. Downstream a bit, where the valley is particularly low, broad and even, the stream abandons the unity of a single channel, forming a broad wetland that has been kept accessible to scythe, hoof and, occasionally even plough, by centuries of Beaver trapping and some well-placed, but now well-clogged, drains. The livestock still visit regularly enough to keep what is largely sedge and Rice Cutgrass cropped relatively low. A particularly ferocious tangle of Rose and brambles mark where someone tried to keep pigs. What was once a neat-edged pond has, from regular cattle visits and a dose of neglect, become a pond edged by cattails and rushes, draining out through a particularly wet patch where purple Irises bloom in spring and the red of Winterberry dots the snow. On somewhat higher, yet gently sloping terrain, there is still hayfield and pasture, grading into all pasture, but along the forest edge, where the land is steepest and rocks poke through the thin soil, the woods have long-ago enveloped the stone wall and barbed wire that marked an earlier pasture border. In autumn, the auburn mist of Little Bluestem accentuates that edge.

In fact, on the way uphill, we stepped across several stone walls, some of their tops draped with rectangular remnants of sheep fence. On the hillside opposite is an oddly rectangular patch of White Pine. All these clues tell us that at least some of the forests around the Valley are abandoned farmland. Sheep, if not also other livestock, probably grazed parts of these hillsides; a scattering of apple trees in one forest stand hints at a past orchard. Even now, that reversion to forest is underway; where the creek cuts a steep-sided trough, brush is establishing itself on what used to be hillside pasture for the dry stock. Multiflora Rose, some of it now red, bristly and dying due to the Rose Rosette Virus, mixes with Red Cedar and the occasional Common Juniper – evergreens whose prickly young foliage discourages browsing; a clone of Grey Dogwood is marching like a formation of thin grey soldiers from one side while, from the uphill edge, Shagbark Hickory, quite literally, is rolling in.

Although it may be hard to believe right now, looking at the quiltwork of fields below you, 500 years ago this was probably almost all forest. True, those arrowhead scraps sometimes plowed up on the interval hint at an earlier use, but there is little to say that the great majority of this, minus perhaps some rotationally-cut indigenous fields on the flatland, was not forest. It was not, however, one continuous blanket of climax forest. Indeed, many forest ecologists now believe that woods are regularly set back by disturbance – fire, ice storm, wind throw, Beaver cutting, flooding – so that some stable end point representing the ultimate outcome of undaunted vegetative succession may never exist. Estimates vary, but for many forests in northern North America, it is believed that some sort of major natural disturbance strikes a given stand, on average, at least once every 500-1000 years or so. Smaller disturbances (lone tree falls, isolated lightning strikes) are more common so that a study in Maine by Andrew Barton and colleagues found that, on average, around 10% of any stand was disturbed during a given decade. Of course, select portions of the landscape, such as dry, lightning-rod hilltops; storm-buffeted coastal areas; and flood-prone lowlands are especially hammered.

Ecological Analogies and the Unique Value of Farmland. This imaginary walk-around and historical contemplation is valuable because it can help you think about the question: what can be this farm's contribution, so to speak, to the Ark? Who are the native plants and animals for whom this farm might be important habitat? As we look down on this farm, a concept that might help is that of 'ecological analogy'. The idea is that the hay field; the marshy area by the cattle pond; the shrubby, thin-soiled hillside; the old woodlot, and perhaps other spots, all hint at natural habitats once found more abundantly in the past – grasslands (rare inland on the East Coast other than on hilltops and sand plains, once seemingly endless in the Midwest), Beaver meadows, burn-overs, and old growth patches, for examples. For millennia, the region's native plants and animals coexisted, perhaps even co-evolved, with such habitats. In a mere couple of centuries, those creatures had the habitat rug pulled out from under them. In at least a conceptual sense, they are still 'looking for' such habitat in the landscape, and farms can provide partial analogies for those habitats.

We say 'analogies' because that pond-side wetland is no Beaver meadow. Aside from the Beaver themselves, a variety of other inhabitants of the Beaver pond succession chronology are likely absent, but some are present, and, at least for those few, the analogy works. That woodlot clearly harbors no old-growth trees, but then invertebrates and microbes living in and below the leaf litter of the unplowed ground may sense the analogy to intact forest. Likewise, while you might not find Fireweed in your shrubby pasture, the Dogwoods and Goldenrod seem happy enough, as does the Prairie Warbler (a misnomer); the analogy to post-fire, or perhaps post Beaver, shrub land works well enough for them. The partial nature of such analogies is clearly indicated by a consideration of hayfields: late-cut hayfields are, structurally speaking, good enough prairie analogies so as to provide nesting habitat for certain grassland birds. The plants that provide that structure, however, are primarily European. This means that hayfields are much poorer habitat analogies for our grassland butterflies, species whose caterpillars often have long histories of co-evolution with particular native food plants. Given their incompleteness, an abundance of analogies in the land cannot fully replace loss of original habitat, and the conservation of wild lands is still important. Conscious consideration of analogies, however, can help us find more synergy in worked landscapes.

Importantly, farmland is not just an incidental purveyor of such habitats. Farmland is one of the few remaining sources of creative disturbance. Look beyond the farm fences and, other than on other farms, where else do you see those ecological analogies? Not in the neatly managed young forests where fire is carefully controlled; not on the lawns and "grounds" of houses; not around the tidy landscaped ponds; not on parking lots and shopping malls. Many of those pre-settlement habitats we mentioned are ones that existed in the landscape because of disturbance, the regular resetting of the successional clock by fire, flood or tree fall, events that modern society works hard, if not always successfully, to eliminate. Throughout the more settled Northeast, we are becoming a landscape of rigid lines: upland *or* lowland; forest *or* field (or lawn or development), those glorious intermediates are, with some exceptions, dwindling as we try to tame the land.

There are several native species which we have seen in our county, almost exclusively, on current

or recent farmland: the Bronze Copper (an elegant butterfly decked in black, orange and, on the male at least, a deep iridescent blue), Yellow Stargrass (a low, but sun-bright relative of the daffodils), Ragged Fringed Orchid (a dainty, feathery little native orchid), the Juniper Hairstreak (a deep-green butterfly), Bobolinks (those raucous field birds with their coats on backwards), and others. If you can keep this general image of farmland as potentially unique natural habitat in the back of your head, then you may be more apt to work with the nature/farming synergy, and your farm may be blessed by not only more Prairie Warblers, but also more Mockingbirds, more Field Sparrows, more Common Wood Nymphs and Little Wood Satyrs (both butterflies, alas), more Sedge Sprites (a damselfly), more of those Blue Flag Irises, more Cardinal Flowers, more Fringed Orchids, and increases in other native visitors.

Biodiversity and Production. Enhancing diversity may or may not enhance production. The web of ecology is often so complex that bottom-line answers are hard to come by. That said, on many farms much can be done by stepping back and asking questions such as, does that stream edge really need to be kept so cleanly grazed? Do you really need to go in and regularly mow those grassy edges where the irrigation doesn't reach? What would the real impact be on hay stores if a couple of those Bobolink fields weren't cut until after the fourth of July? These questions might make a farmer nervous because, as in many professions, practice is shaped not only by current knowledge but also by aesthetics and norms. Nonetheless, such questions might reveal unexpected room for letting nature be a bit freer on the farm at little cost to production. In other cases, an immediate detrimental impact on production might seem more evident, although the long-term impact might be less clear.

A few years ago, helped by an apprentice on the farm where we work, we surveyed plant diversity in our various pastures and compared that to milk production for the periods when the rotationally-grazed herd was on each pasture. Not surprisingly, the highest production was on the most intensively managed pastures where regular manuring and re-seeding had produced a lush growth with low native plant diversity. The worst milk production and highest plant diversity was on some of those sloping, thin-soiled, floristically-diverse shrubby fields. But there was a middle ground: fields whose production was average and whose native plant diversity was noticeably higher than the intensively-managed pastures, perhaps not a bad compromise. Maybe herd production could have been enhanced somewhat by 'improving' those steeper pastures, but at what cost in resources and safety? Furthermore, it is possible that, while not apparent in immediate production, those diverse pastures are apothecaries of sorts for the herd, allowing them a chance to self-medicate some of their ailments.

The Influence of Nature on Farming.
Let's now switch our focus from 'what do farms provide in terms of natural habitats?' to 'what can such habitats provide to farms'?

Some Hypothetical Sweep Netting. Down from our high hill, we walk amongst the crops. Swing a sweep net along a row and look inside. You are apt to be surprised by the bundle of life squirming in the bottom of the net: racing ants, humming bees, clumsy Lady Beetles, an abundance of flies, bouncing Jumping Spiders, tank-like aphids, urgent Tarnished Plant Bugs, plodding Cabbage Worms... the crops are evidently habitat too. Indeed, the farmer is a habitat engineer, searching for ways to support a productive community on a given piece of land. Some of the wild creatures in the net, such as the pollinators, the pest predators and parasites, the weed-seed consumers, and the soil turners, can help with that; others will be less collaborative.

Sitting down with our net-full, we can, figuratively at least, question each member of the catch. Where did you come from? How do you make a living? These are questions that can help us understand how to offer suitable encouragement (or discouragement) to these visitors. In many cases, the answers to these queries would lead us back out of the cropfield and into our surroundings, into those semi-wild areas we visited earlier and, perhaps, to more distant lands. Those Stink Bugs sucking the plant stalks, the Flea Beetles perforating the leaves, the bees buzzing the flowers, the spiders stalking prey, and the Ground Beetles hunting root-eating grubs did not arrive *de novo* on the crop field. Like the rest of us, they have lineages, extended family, and neighborhoods. They assist or plague the farm because they have found suitable habitat within commuting distance of their winter residence.

photo courtesy Conrad Vispo

The Northern Leopard Frog is a high-jumping, largely green frog with rounded, irregularly-distributed black splotches on its back; its call sounds like a creaking door opening very slowly. In our area, these are rare meadow frogs, found in grazed wet fields or in the meadow-like vegetation along frequently-flooding creeks.

Because our theme here is synergy, we'll center our discussion on the ecology of the creatures that benefit your farm. How might you be most welcoming to them? There may be logical reason to suppose that the beneficials are more affected by the semi-natural habitats that surround your farm than are the pests. Many beneficial are, after all, predators while many pests, at least of vegetable operations, are herbivores, and it is a general pattern that predators are rarer and wider-ranging than the herbivores they feed upon. That, however, is conjecture open for exploration. The best we can say with any certainty is that, for the most part, there is *not* strong evidence that managing for beneficials simultaneously and consistently manages for pests and so we can, with a relatively clear conscience, focus on management for beneficials.

Apparent 'Commuting' Distance. One of the ways that scientists have 'questioned' farm insects about their immediate origins and effective neighborhood is to look for correlations between the abundance of a given insect in a crop field and the amount of 'home habitat' at various distances from that field. Picture, for example, that we swing our net on two dozen different farms. At each farm, we record, say, the number of Lady Beetles. Aided by aerial images and ground truthing, we then characterize the land cover at various distances from the sampled points on each farm. The question then becomes: at what distance do the characteristics of that land cover best predict the abundance of Lady Beetles at our sampling site? Are the Lady Beetles on a given farm derived from a wellspring no bigger than the farm itself? Are they part of a larger population whose overall vitality is determined by the habitats in the farm valley? Are their demographics linked even more widely with habitat composition across the township or even the county? Researchers have assembled such data and run such correlations, and the answer seems to be 'it depends'.

In other words, some creatures seem to be well capable of surviving largely within the limits of your farm. Certain flightless Ground Beetles for example, especially if provided with unplowed beetle banks, can survive for generations in and around our plowed fields. Some earthworms (not native in our area) and ants do likewise. In contrast, the native bees in our catch, or at least their close relatives, may have visited the spring ephemerals that bloom in the floodplain forest further down the valley or the fall flowers in the wetland. Being on the wing for longer than the crops bloom, they need to assemble a working plan that includes nectar and pollen sources throughout their flight season. Similarly, many of them nest in the ground, and their colonies may rely on a stream- or hill-side patch of open, sandy soil a bit removed from the crop field. Finally, those Jumping Spiders in our net are expert balloonists. Although the silken tents in the woodpile and beneath the bark of forest snags are the winter quarters for some of these spiders, populations may be regularly replenished from farther away. Standing on an elevated perch, the baby spiders (and sometimes the adults) loose a long strand of silk into the wind. Eventually, the breeze pulling on that gossamer strand carries the spiderling aloft and takes it on its way. While many such explorers may fall foul of nearby hedgerows (and swallows?), some may sail farther.

Go back for a moment to our visions of the landscape of 500 years ago. The forest was probably scuffed by scattered burnt patches and pockmarked by openings when some of the large mother trees finally tumbled; the ponds, meadows, and wetland thickets of Beaver work probably pulsed on and off along the waterways.

These were localized, passing openings; temporary frolics where sunlight reached the ground and opened up new possibilities for life at the rich soil/sun interface. Creatures poised to take advantage of those literal and figurative openings had to throw their 'seeds' to the wind in much the same way that goldenrod, milkweed or raspberry (with feathered help) might do so. To some organisms, your field is just one more such fleeting bonanza. There is a near-constant flow of colonists, both eaters of plants and eaters of plant eaters, hoping to find and settle upon it,

The Insularity of Neighborhoods. Another more intimate way of approaching this same question is to sweep our net not only in the crops but also in the grass and 'weeds' of the field edges and even in the adjacent forest. How similar are our resulting

photo courtesy Conrad Vispo

Besides jumping, Jumping Spiders are apparently characterized by keen eyesight and often look at you as you look at them. These spiders stalk prey lion-style, gradually creeping up and then pouncing. Spiders such as this may have drifted in from off-farm, attached to the ends of their ballooning silk.

net-fulls? To what degree, for example, do the ant species view crop field, weeds, and forest as one continuous landscape vs. three distinct and 'gated' communities?

Again, the answer seems to be, 'it depends'. We made such comparisons on 19 vegetable farms around our county for Ground Beetles, ants and spiders. Some species of Ground Beetles and of ants appeared to be relatively restricted to cultivated land, while others ranged more widely. The Labor Day Ant (*Lasius neoniger*) for example, was the most common species of ant captured in our study fields and yet of minor importance in adjacent field and forest while, amongst the beetles, *Anisodactylus sanctaecrucis*, a relatively small, weed-seed eating species showed a similar pattern. In contrast, the so-called Cornfield Ant (*Lasius neoniger*) was, ironically, one of the most evenly distributed species, being found regularly in farm field, weedy edge and forest; amongst the Ground Beetles, the tiny, light-spotted *Bembidion quadrimaculatum* was found not only in cultivated ground but also in some adjacent edges and woods. Our work with spiders has only been at the family rather than species level (for example, the distribution of Jumping Spiders, Orb Weavers, and Wolf Spiders). In general, spider families seemed to be spread across habitats rather than be restricted to single areas, although we've yet to determine whether this reflects relatively loose ties to specific habitats or the coarseness of our analyses.

Whereas thoughts of ecological analogies were the imagination's fodder when considering the contribution of farming to nature, perhaps visions of ecological commuters are most helpful when trying to visualize the lives of the beneficials on your farm. Where are they commuting to and from, and why? What is the transit system (wind, wing, or legs) that facilitates that? As a result, where are the 'bedroom communities' and how distinct are the neighborhoods? On snowy evenings, pondering your favorite garden creature, you can nose about in some of those old (and new) entomology books and discover the 'stops' in each creature's life history cycles; studying their form, you can guess at how they connect those stops and hence the distances they can potentially travel; and, lastly, you can imagine what your farm and surroundings might look like in order to encourage their life cycle. With those thoughts stored away, you can begin to pose questions that observation might answer once the snow melts.

In-Field Habitat Diversity. Habitat for beneficials has been more commonly considered at the in-field scale than at the landscape scale. While not our emphasis here, it certainly warrants mention. How can the land 'within the fences' be managed so as to be more hospitable to the wild creatures you wants to invite in as helpers? While details vary depending upon the species, inserting fingers of wilder nature into the fields, via, for example, wildflower strips or beetle banks, is one technique. While their pollination 'services' may have been modest, one of my strongest memories of on-farm nature comes from watching wetland butterflies, such as the Bronze Copper, Mulberry Wing and Dion Skipper, flit along the wildflower strips that one farm, nearly encircled by wetland, laced through its fields. The caterpillars of those butterflies probably fed off-farm in those wet areas, but the adults were more than happy to venture on to the open land where seeding, good sun and adequate water provided ample flowers and nectar. Similarly, studies around beetle banks have shown that both beetles and their influence (such as weed-seed consumption) emanate out with decreasing intensity from the banks.

Some farmers try to include more diversity in the crop beds themselves either through interplanting or by alternating relatively small patches of different plants. Such diversity might not only be more hospitable to the wild creatures you want to include but also more confusing to potential pests. Although hard to document, many of the farmers we've talked with believe such diversity makes their farm more ecologically sturdy. Again, there may be few short cuts to working with your own fields to understand what manipulations work for your particular suite of crops and wildlife – the results of those wild flower strips would, at the least, have been less conspicuous had not that aforementioned farm been edged by wetland. Clearly too, harvesting/managing practicality needs to be considered in the context of each farm's own operations.

A Very Small Aside

Below-ground ecology probably has a large influence on crop productivity. The physical and chemical intimacies of the intertwined swarm of microbes, roots, and invertebrates are only slowly being revealed. New photographic and microscopic techniques, new genetic approaches, and new ways of exploring chemical habitats are all opening windows onto the underground world. It is probably fair to say that, in terms of soil ecology, we are about where ornithology was 200 years ago. That is, we are starting to name the creatures and collect scattered observations; we are beginning to have the tools for finding patterns but much is still clouded. Our own simplistic attempts to link soil conditions, including basic descriptors of soil microbe communities, to crop productivity have not produced clear results; others, more experienced than us, likewise caution against overstating our current understanding. Nonetheless, relationships between crop health and soil ecology surely exist, and the general questions we outlined above hold for the soil world: how can our methods of farming conserve below-ground diversity and, in turn, how can that diversity help our farming? This is an exciting, key frontier. To extend our ornithological analogy: just because we've now got a decent pair of binoculars doesn't mean we automatically know what the birds we see are doing. But oh, how much fun to start watching!

Some Concluding Thoughts

The reason that I have focused more on the landscape-scale vs. farm-scale aspects of managing for beneficials is that, to my mind, one of the central 'morals' of the story derives from the image of green tendrils extending out from the crops themselves - ecological connections populated by those creatures in our sweep net, connections that are cast near and far on the landscape. Importantly, those living strands often make little pause at the farm fence. Likewise, I believe that it is only by thinking your way across the landscape in time and space that you can really understand how a given farm can contribute to regional nature conservation. If a human community wants to work deeply with local agriculture that feeds people and the land, then, in addition to socio-economic considerations, it needs to think about the future of the ecological landscape within which that farming is embedded. The most beautiful farm, surrounded by acres of concrete or, even, of LEED-certified houses, is unlikely to fulfill its potential to contribute to nature conservation or to benefit, productively, from nature.

Untamed nature and farming were long tied together perforce by the balance of power between wild nature and humanity. For many centuries, farmers had little choice but to collaborate with the wild natural world. Even at the 19th century dawn of so-called scientific agriculture, untamed nature was more a force to be worked with than to be overcome. Subsequent developments in agriculture gave us the illusion that we could distance farming from such natural forces. We could supply infertile soil with nutrients we distilled from the air or dug from far off grounds, we could eliminate pests and weeds by the poisons we made. This article was meant to help imagine the middle ground: both untamed nature and farming have intrinsic value, and hence creative coexistence seems appropriate. Such a belief supports the importance not only of 'environmental' solutions – such as nature's so-called services of water and air cleansing and technological innovations that lessen our own impacts upon these shared resources – but also 'ecological solutions' that value life itself not only for those services, but also for the intrinsic beauty it displays in the species around us. As nebulous as that may sound, actually working with that beauty in a synergistic way will require informed compassion taught by observation and experimentation. We need sustainability, we need resilience, but beyond those practical bottom lines, we need love of nature, including of ourselves as part of that.

On our web site (http://hawthornevalleyfarm.org/fep/onfarmbio.html), we provide links to some of our own more detailed work exploring on-farm nature, to the publications pages of a few professors studying related questions, and to a set of regional habitat publications that can help you think about analogies on your own (and we would be happy to hear of your 'discoveries').

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