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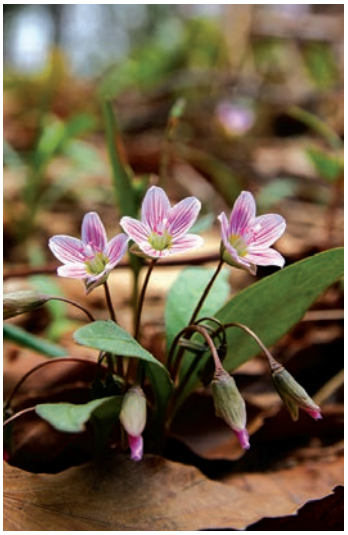
Ben Derr

News from Hudsonia

Volume 34, Number 1 Summer 2020



Cover photo: Carolina spring beauty is an early-flowering spring ephemeral. It is pollinated by a variety of native bees and flies as well as honey bees, and is also visited by butterflies. Photo: Ben Derr

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Volume 34, Number 1 Summer 2020

Dear Friends of Hudsonia,

In the midst of a global pandemic and a nationwide awakening to the effects of environmental injustice on human health, many of us are taking stock of our roles in the perpetuation of these problems and how we can contribute to the solutions. As with many other global problems, widespread local actions can be the beginning of the cure.

Summer is beginning, and Hudsonia is busy with seasonal field work and analysis. Our attention is focused on an electric transmission right-of-way that is proposed for upgrading, a large post-mining landscape that will become a public park, a case study of urban biodiversity, small and large biological surveys and habitat mapping projects, and, as always, education and training for environmental professionals. Pixie lichens, horsetails, bats, birds, turtles, frogs, and clam shrimps are some of the organisms we're working with. There is no shortage of questions in the field of conservation science, only a shortage of resources to acquire the best biological knowledge for informed decision-making.

This is another difficult time for a nonprofit organization as we are caught between pandemic and recession. Meanwhile, federal environmental regulation is being greatly weakened, putting everyone's conservation efforts, and many animals and plants, at risk.

We do know how to resolve many conflicts between biodiversity and human activities. We just need the attention and support that make this possible.

Please consider a generous gift to Hudsonia this season to help us continue our research and outreach, now more important than ever!

Stay well,

Ann Gabler
Interim Chair, Board of Directors

Philippa Dunne MA
Coordinator of Outreach and Development

Erik Kiviat PhD
Executive Director

and the Hudsonia staff

* Nothing is provided in exchange for your donation except the knowledge that you are helping biodiversity survive. Hudsonia only uses funds for the organization's nonprofit purposes. Our most recent nonprofit tax return (Form 990) is available from the Hudsonia office or the NYS Office of Charities Registration.

BIODIVERSITY, PATHOGENS, AND HUMAN HEALTH

By Philippa Dunne*

We are all learning a lot in the midst of the coronavirus pandemic—about modes of pathogen transmission, about how to keep ourselves and others safe, about the value of good science when addressing a global catastrophe, and about the perils of ignoring science in favor of ideology, politics, or short-term economic concerns. Among other things, the current pandemic has focused public attention on ecological research and the connections between biodiversity and human health, including the suppression of pathogens. It has also brought home to many of us the personal value of time spent outside, often alone, in nature.

For decades, scientists have studied how and under what circumstances human activities can increase both the frequency and severity of infectious diseases. In just two cases were we able to eradicate a widespread virus: smallpox and rinderpest (a virus affecting cattle and other ruminants). We have learned that dense urban settings and some of our agricultural practices can lead to evolution of more dangerous pathogens and parasites, and sometimes more resistant animal hosts from which a pathogen can "jump" to humans. Human activities that reduce the genetic diversity of hosts or alter habitat conditions (climate, soils, water, even underwater soundwaves), put further stress on species, that may lead to population declines, and less resistance to disease.[10,12,22,24]

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* Philippa Dunne is a Hudsonia board member, and Coordinator of Outreach and Development.

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For a backyard example of how changes we make to ecosystems can affect the spread of diseases, in the 1990s an avian bacterium, *Mycoplasma gallisepticum*, made the leap from poultry to house finches, *Haemorhous mexicanus,* in eastern North America, and then spread throughout the country largely via backyard feeders. Eastern finches have since developed resistance and tolerance to the bacterium, considered a "costly trait" as it may come at the expense of something else, such as longevity.[19,22] The original transmission and spread appears to have stemmed from human alterations of the environment at multiple junctures: First was a failed business venture in which house finches, native to the western states and Mexico, were smuggled into New York City pet shops for sale as caged birds under a new name, Hollywood finches. A knowledgeable shopper recognized that under the Migratory Bird Treaty Act, at that time among Canada, Mexico and the United States, capture of the finches was illegal, and called on the Audubon Society. A sting operation followed, and when pet-shop owners understood the fines involved, they made the easy choice, opened the cages and sent the finches flying, first to Long Island, and then on to Maine and Georgia.[5] Next came creating the agricultural setting in which the bacterium originally circulated within the poultry population; and finally establishing the backyard bird feeders that enabled the bacterium to make the interspecific leap, helped to support large populations of the finches, and brought large numbers of house finches into close proximity of each other and thus facilitating the spread.[1]

Eastern tailed-blue is a butterfly of open areas. Adults nectar on a variety of wildflowers and the larvae feed on native and non-native legumes, such as bush-clovers, alfalfa, and vetches. Photo: Ben Derr

Silver-spotted skipper on wild bergamot (*Monarda fistulosa*), a native relative of the horticultural beebalm. Photo: Ben Derr

Red efts, the juvenile stage of the eastern newt, are important components of northeastern forests where they consume invertebrates in the leaf litter and are preyed on by snakes, raccoon, and other predators that tolerate the salamander's toxic skin secretions. Photo: Ben Derr

Research is underway to document the role of forest loss and fragmentation in West African outbreaks of the (suspected to be) bat-borne zoonosis, the Ebola virus. Although once believed to be transferred to humans by the handling and consumption of bats and other forest animals, just as Europeans consume, say, wild rabbits and deer, recent work suggests that agriculture and forest fragmentation has simply altered the ways that four fruit-eating bat species use the landscape, putting them in closer contact with people and increasing the opportunities for pathogen transfer.[20] This kind of research helps to illustrate some of the unforeseen consequences of our treatment of the land.

A research team from the Universities of Michigan and Colorado cites growing evidence that, in some situations, reductions in biodiversity caused by our activities tend to increase the spread of diseases.[22] One mechanism is this: Changes in the land wrought by human activities (such as deforestation or forest fragmentation) alters the ecological balance in ways that favor a host species for a pathogen. Then, high populations of the host species and relatively low populations of other species leads to a higher incidence of the pathogen.[23] Although still a matter of debate, this synthesis of environmental and health studies has been a research focus for biologists, public health experts, and statisticians for some time.

Bard College biology professor (and Hudsonia advisory board member) Felicia Keesing has documented the relationship of biodiversity to plant, animal, and human health for a quarter-century. In a recent interview she stressed that when we introduce new species into ecosystems, or when we alter habitats to favor certain species over others, we are creating uncontrolled experiments, where "*this* virus can jump to *that* species,"[3] as apparently happened in the case of SARS-CoV-2, the novel coronavirus of the current pandemic.[2]

Bringing conservation science and health sciences together could improve environmental policies related to the health of humans and other animals and plants. Felicia has stressed that the questions her colleagues are now framing require "urgent exploration and explication."[3] Some consequences of the tremendous damage we have done to our environment are understood, some are making themselves known, and others are waiting in the wings. Nothing creates a sense of urgency like a global pandemic, but the urgency has been there all along.

Felicia underscores the need for concrete examples, currently hard to come by, that show how ecologists, anticipating changes in habitats and biodiversity, can help formulate ecological interventions to improve health outcomes. Her work extends from local backyards, where her team studies the effects of neighborhood mitigation efforts on the incidence of tick-borne infections,[8,9] to the African savannas, where she studies how habitats function when large mammals like elephants and zebras are no longer present.[11,17]

With Rick Ostfeld of the Cary Institute of Ecosystem Studies, Felicia has found a "dilution effect," replicated by others, where more diverse species assemblages, especially including those that are poor reservoir hosts for pathogens, "dilute" the reservoir capacities of those hosts.[4,14,21,25]

The research is more down to earth and certainly more complex than the headlines. An experiment on the effect of brush-legged wolf spiders, *Schizocosa ocreata*, on tick populations, conducted by a team that included Felicia, offers a biodiversity anecdote that illustrates some of the complexity

Gaywings (*Polygala paucifolia*) is a spring-blooming wildflower of deciduous forests. The seed of gaywings has an appendage that is rich in lipids, protein, and starch and is a prized food of ants that are prominent dispersers of this plant. Photo: Gretchen Stevens

and subtlety of the ecological interactions that may influence the spread of pathogens. The team found evidence of both a consumptive effect, spiders preying on engorged tick nymphs, and a nonconsumptive effect, ticks being less likely to quest, e.g., crawl up a blade of grass searching for a host, in the presence of active spiders. Although that response doesn't decrease the tick populations directly, it reduces the ticks' interactions with other animals and may lower our chances of infection.[7] Protecting the intact forest floors that are home to wolf spiders and the many other invertebrate and vertebrate predators on ticks is probably important to controlling tick populations.

Scientists have long known that certain species are more likely to harbor pathogens capable of making the switch to humans, and that many of these carriers are in conditions, as in the "wet markets," that facilitate such jumps. Another concept is that the "weedy" species that put more energy into reproduction and growth and, perhaps, less into disease resistance tend to do better in disturbed landscapes, such as a polluted ditch, an isolated fragment of forest, and your lawn. Many of those most likely to carry infections to us are among the "weedy" and opportunistic species that are especially adaptable to human-altered landscapes, like the white-footed mouse that carries the Lyme disease bacterium. In the case of Lyme disease transmission, larger hosts, like opossums, although they can be weedy in themselves, in urban areas they are less likely to be present in low-diversity communities.[6] With their tick-laden diets, opossums are estimated to consume about 97% of the ticks attempting to feed on them, while ticks on mice, the hosts most likely to transmit the bacterium, have estimated success rates of 50%. In this community, both the presence of mice and the absence of opossums increase the risk of infection.[15]

Responding to the concern raised by the world science community and underscored by the pandemic, that knowledge often comes too late to be useful, Felicia will use a recent grant from the National Science Foundation to synthesize the many ideas about how this all works, in ways that are understandable to non-scientists. To prevent the time lags that delay effective responses to health crises, Felicia suggests that as new infections emerge we need to identify the probable source more quickly, and identify which wildlife species may protect us from infections and how to best support those species. She is committed to using this knowledge to "actually make a difference in people's lives," and is working closely with local communities in the Hudson Valley and in Kenya.[3]

Of course, the benefits of biodiversity for human well-being extend far beyond the suppression of pathogens. We depend on biodiversity for keeping the world habitable, with such basic services as oxygen production, soil formation, nutrient transformation, water and air purification, climate moderation, carbon sequestration, pollination, and food production, as well as secondary services such as provision of wood, fiber, and medicines, and the scenic beauty of our landscapes. Many pharmaceuticals, such as taxol, aspirin, scopo-

The wood turtle (NYS Special Concern) uses perennial streams and a complex of nearby habitats for foraging, resting, and nesting. Like other turtles, it is highly vulnerable to mortality from vehicles and farm equipment as it moves between habitats. Photo: Ben Derr

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ECOLOGICAL RESEARCH ON THE IMPACTS OF LARGE-SCALE SOLAR FACILITIES

INTRODUCTION

Erik Kiviat (Executive Director, Hudsonia Ltd.)

Below are five abstracts that were originally prepared for papers to be presented at the April 2020 Northeast Natural History Conference, but the conference was cancelled due to the coronavirus pandemic. The studies they describe provide a taste of the early stages of wide-ranging research on effects of solar photovoltaic (PV) arrays. Many solar facilities, ranging in size from about 1 ha (2.5 acres) to 1,000 ha or more (a few thousand acres), are being proposed, built, or operated in New York, New England, New Jersey, and other northeastern states. These community- or utility-scale facilities have little precedent in the northeastern environments, thus we know little about how they affect the physical environment and its biota. (The photos of plants illustrating this article were all taken at the site of a proposed utility-scale solar facility in Greene County, NY.)

I am a staunch friend of solar PV energy and of renewable energy in general. That said, all energy generation has effects, negative or positive, on biota and habitats. Solar PV, because it requires large land areas, affects microclimate, vegetation, and fauna. Like any land use or habitat change, solar facilities can be beneficial to some organisms and detrimental to others. The point is often made that solar PV does less ecological harm than other common, intensive, land uses, such as residential subdivisions, commercial or industrial facilities, and mining. Moreover, solar PV replaces or augments fossil-fueled electric generation, which does great damage to the oil, gas, and coal fields, air quality, and greenhouse gas balance. Nonetheless, because solar energy development is burgeoning in the Northeast, we need a much better understanding of its impacts and how to reduce and mitigate those that are negative to biodiversity.

I hope these abstracts, and the article about solar energy in spring 2019 *News from Hudsonia* by Elise Heffernan and Gretchen Stevens, help you think about site selection and design to optimize energy capture and minimize adverse effects on forests, streams, rare plants, raptors, other birds, bats, and insects. Hudsonia looks forward to further involvement in research and technical assistance related to solar PV in New York and neighboring states, working with environmental groups, state and local agencies, land trusts, and landowners.

Bush's sedge (*Carex bushii*) (NYS Rare) is a plant of wet clay meadows and other wet meadow habitats. Photo: David Werier

Sand hedge-nettle (*Stachys arenicola*), ranked S1 or "critically imperiled" in New York, is mainly pollinated by native bees, but is also visited for nectar by butterflies and moths. Photo: David Werier

WHERE AND WHO WILL BE IMPACTED BY SOLAR DEVELOPMENTS: A CASE STUDY IN THE HUDSON VALLEY

Nava Tabak (Director of Science, Climate, and Stewardship) and Alex Wolf (Conservation Scientist) (Scenic Hudson, Poughkeepsie, NY)

New York State seeks to rapidly develop renewable energy sources, with statewide goals of 70% renewable energy by 2030 and cutting greenhouse gas emissions 85% by 2050. To help meet these goals, the Hudson Valley's contribution must include medium and large-scale photovoltaic solar energy installations. Located at an ecoregional crossroads, the region supports unusually high biodiversity, and the natural landscapes provide key pathways for adaptation to climate change in North America.

We conducted a regional spatial analysis to identify where high conservation priorities will most likely intersect with solar development, and found that the most desirable locations for solar projects rarely coincided with documented occurrences of rare species or important natural areas. One notable exception is the open habitat used by overwintering raptors and grassland breeding birds; in eastern New York these species—which include some state-listed rare species—rely on relatively few large assemblages of active and recently-abandoned agricultural lands. Research on the response of these birds to large-scale ground-mounted solar arrays is virtually non-existent.

In one large meadow area in Greene County, New York, two adjacent industrial-scale solar development proposals threaten this important avian habitat. We are using the overwintering northern harrier and short-eared owl as focal species to assess the potential impacts on the site's area-sensitive grassland birds. Based on the raptors' known behavior and need for large, contiguous patches of open habitat, we expect that complete on-site habitat mitigation to be virtually impossible. We are working to evaluate and promote other mitigation actions combining on- and off-site habitat conservation and management.

Our work highlights the need for research focused specifically on the impacts of solar development on grassland birds and other rare species. To minimize future conflicts between large-scale solar developments and high-

Environmental impacts of solar photovoltaic facilities should be recognized and mitigated, even though they seem minor compared to those of fossil fuel-based energy sources. Photo: Lea Stickle

priority ecological and agricultural resources, we are developing an interactive online teaching and decision-support tool for siting solar developments. This web map aims to illustrate for municipal land-use planners how solar differs from other types of development and land uses, and to assist them in identifying opportunities to facilitate solar projects with minimal impacts to species and habitats. This tool can directly inform municipal planning and zoning for solar developments as well as the review of specific development proposals. The web map is expected to go online later in 2020; contact Nava Tabak (ntabak@scenichudson.org) for more information.

TREES OR PANELS—THE CARBON TRADE-OFF: ASSESSING THE EFFECT OF COMMUNITY SOLAR ON RHODE ISLAND COMMUNITIES

Gaytha Langlois (Professor of Environmental Policy, Bryant University)

A strong commitment for expanding renewable energy options is occurring throughout the Northeast, including the development of community solar projects that match planned production facilities with potential electrical grid customers. Grant funding is available to encourage these projects in New England and New York. However, some projects are not clearly matched with existing forest protection programs, and accurate data regarding the greenhouse gas (GHG) reductions associated with community solar programs is not always available. An initial survey of Rhode Island communities and NGOs documents an uneven pattern of zoning guidelines, a lack of integration of GHG reduction goals and community solar projects, and resulting conflicts and confusion about the best ways to navigate this complex territory. Best planning practices might call for public/private collaboration in moving forward, but at present the pathways are not aligned among communities, or between state energy programs and community planning. Using the concept of collaborative public-private approaches, our study identifies key issues and suggests possible solutions. In this arena of public policy, there are many disconnects between energy policy and land use policy, as well as mismatches of funding, regulatory structures and permitting processes by federal, state and local government agencies. Public perception of the confusing array of seemingly random decisions further complicates the development of integrated and more rational approaches, often resulting in increased conflicts among parties with different value propositions and varied community visions. We propose a more modulated decision-making approach using GIS mapping, scenario development techniques, and community survey tools easily launched with today's technology, along with the creation of public-private partnerships for assembling and assessing data, and the inclusion of NGOs already in place for protection of farmland, woodlands, and open space. This type of collaboration can result in higher satisfaction and greater trust exhibited by the general public with policy and implementation decisions, retention of community character, and better use of public monies for renewable energy development and natural resource protection.

THE RELATIONSHIP BETWEEN UTILITY-SCALE SOLAR DEVELOPMENT AND FAUNA IN NEW ENGLAND

Flynn Hibbs (Hampshire College)

Utility-scale photovoltaic (PV) arrays are increasingly being installed throughout the United States and world as we shift away from the use of fossil fuels and towards renewable energy sources. Utility-scale PV arrays present a large land-use change; yet, there is limited research on their ecological impacts. In particular, PV arrays fragment the landscape, potentially affecting the movement of wildlife, connectivity of populations, and availability of habitat and prey. We wanted to understand how wildlife interacts and is affected by utility-scale PV arrays. We surveyed mammals and birds using camera traps within and outside of utility-scale PV arrays at Hampshire

Stiff flat-topped goldenrod (*Solidago rigida* var. *rigida*) (NYS Threatened) is a plant of calcareous meadows. Photo: David Werier

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HUDSONIA PROJECT UPDATES, SUMMER 2020

Wetlands and At-Risk Wildlife

We have resumed radio-tracking **wood turtles** (NYS Special Concern) in two Hudson Valley farm environments to analyze exposure of the turtles to machinery hazards and learn how to mitigate those risks (collaboration with Jason Tesauro; funded by the Hudson Valley Farm Hub). Analyses continue of long-term data on **Blanding's turtle** (NYS Threatened) and habitat response to a wetland mitigation and creation project, and **painted turtle** ecology in a freshwater tidal marsh.

Several species of blue-eyed grass (*Sisyrinchium*), a wildflower of meadows, are native to New York. Photo: Lea Stickle

Following several years of opportunistic collections of **clam shrimps** and **fairy shrimps**, we are initiating a survey of temporary pool invertebrates in Ulster County, New York. Temporary pool habitats and their wildlife (other than amphibians) have been studied little in the Northeast, and clam shrimps are a group of global conservation concern. Last year we found a clam shrimp in the New Jersey Meadowlands for which there were no published reports between Virginia and Massachusetts. You can help Hudsonia by steering us to the locations of temporary or vernal pools of all kinds. (Wetland wildlife studies are funded by Will Nixon in memory of his father Justin Nixon, and by the Derald H. Ruttenberg Foundation.)

We are conducting preliminary surveys of **bobolinks** and **other grassland birds** in upland meadows at the two **Schunnemunk Mountain** preserves of the Open Space Institute where we conducted biodiversity assessments last year (funded by OSI). Bird surveys will be continued by volunteers.

Energy Facilities

Hudsonia has been retained by a group of towns, NGOs, and a farm to analyze the proposal to upgrade electric transmission in an existing right-of-way in **Columbia** and **Dutchess counties**. We are also returning to the **Saw Kill** at Bard College (Dutchess County) to collect more data on wildlife, plants, and water quality prior to installation of micro-hydropower turbines at an old estate dam (funded by Bard under a grant from the New York State Energy Research and Development Authority). This year's work addresses American eel, Louisiana waterthrush (both NYS Species of Greatest Conservation Need), wood turtle,and the riparian flora.

Urban and Post-industrial Biodiversity

In collaboration with other scientists, Hudsonia has begun spring-summer surveys of **habitats, flora, water and soil quality, bats, birds, reptiles,** and **amphibians** on a large post-industrial site on the Hudson River (more about this in the fall issue). Last year we surveyed the flora on the **Gansevoort Peninsula**, a former industrial pier and addition to Hudson River Park in Manhattan (funded by Hudson River Park Trust via James Corner Field Operations). Field dodder (*Cuscuta campestris*, NYS Endangered) occurs at Gansevoort and we had found it earlier at Newtown Creek, also in New York City. We identified specimens of the flora at an industrial archaeology study site in the **Binnewater Lakes** region of Ulster County, New York (for Jeff Benjamin, Columbia University). Following peer review, we are revising the first of two book manuscripts about our case study of urban biodiversity in the **New Jersey Meadowlands** region. A paper about outdoor human activities in relation to the Meadowlands environment is undergoing journal review. (Meadowlands projects are currently funded by the Geoffrey C. Hughes Foundation, Will Nixon, and individual donors.)

Rue anemone (*Thalictrum thalictroides*), is a springtime wildflower of rich deciduous forests. Photo: Ben Derr

Invasive Species

Twelve years ago Hudsonia conducted biological surveys of **Denning's Point**, a state park on the Hudson River at Beacon (Dutchess County), New York. We are now re-surveying the invasive flora and rare native flora, and training biologists and educators in plant identification at Clarkson University's Beacon Institute for Rivers and Estuaries (funded by Lower Hudson PRISM via CUBIRE). Our research on the ecological relationships of **knotweed** with songbirds, mosses, and other organisms continues. (Funded by the Derald H. Ruttenberg Foundation.)

Significant Habitats & Ecological Communities

We have embarked on the final phase of habitat mapping for the **Town of Pound Ridge** (Westchester County). In previous years we identified, mapped, and described habitats in all the large, undeveloped land areas in the town, and now we are mapping all the intervening areas, some of which have significant habitats in their own right or constitute important connecting corridors between the larger areas. (Conducted in partnership with the Pound Ridge Conservation Board with funding from Pound Ridge citizens.)

We are collaborating with the Hawthorne Valley Farmscape Ecology Program on a study of the **Fox Hill Public Conservation Area** in Ancram (Columbia County), owned and managed by the Columbia Land Conservancy. The study entails identification and mapping of ecological communities, surveys for spring ephemeral wildflowers, mapping of areas where non-native invasive plants are most concentrated, identification of old charcoal pits, and a summary of past land uses. The purpose of the study is to inform the CLC of areas of ecological or cultural interest which will help them plan for land management and public uses. (Funded by the Columbia Land Conservancy.)

Biodiversity Education

Since 2001 Hudsonia has collaborated with the NYSDEC Hudson River Estuary Program and Cornell University Department of Natural Resources to help local land-use decision-makers recognize and protect important natural resources. We have trained more than 790 people in techniques for identifying, assessing, and mapping ecologically significant habitats, and incorporating conservation principles into local policies and practices. Each year we offer some combination of workshops, short courses, and technical assistance to municipal agencies, conservation NGOs, and others who are regularly engaged in planning and decisions related to land use, development, and conservation. Due to the needs for social-distancing in the midst of the coronavirus pandemic, we have moved our in-person 2020 programs to a webinar format. The webinars scheduled so far are on **Best Practices for Environmental Reviews** (June), **Headwater Streams** (August), and **Wetlands** (September).

Field Guide to Columbia County

Work continues apace on the ***Ecological and Cultural Field Guide to the Habitats of Columbia County***, to be published in 2021. Co-authored with the Hawthorne Valley Farmscape Ecology Program, the generously illustrated *Field Guide* describes many of the ecological communities in the county, past and present uses of the land, and aspects of people's interactions with the natural world. (The project has received support from the Sandy River Charitable Foundation, the T. Backer Fund, the NoVo Foundation, the Kalliopeia Foundation, the Hygeia Foundation, the Furthermore Foundation [an initiative of the J.M. Kaplan Fund], the Bank of Greene County, the Columbia Land Conservancy, the Hawthorne Valley Association, and from many private donors and landowners.) ■

Find us on Instagram (@HudsoniaLtd)!

Ragged fringed orchid (*Platanthera lacera*) is a spectacular orchid of wet meadows, marshes, and other wetlands. Photo: Elise Heffernan

Although monarch caterpillars feed only on milkweeds, the adults feed on nectar from a variety of plants, including the grass-leaved goldenrod shown here. Photo: Ben Derr

Northern pearly eye is most often found in the forest understory. Unlike many other butterflies, the adults do not consume nectar but obtain nutrients and water from dung, tree sap, decaying fruit, and carrion. Photo: Ben Derr

Pathogens continued from page 3

lamine, and coumarin are botanically derived, and countless other plants, lichens, and animals are being investigated for medicinal use.

Here at Hudsonia we accept the world we have, and focus our efforts on ameliorating what we can, and identifying important habitats in order to prioritize conservation resources. Our ongoing work with other scientists, land-use planners, and local officials promotes the best outcomes for the environment. As Keesing and researchers here at Hudsonia have found, it is possible for people and their livestock to co-exist with wildlife, on Kenyan savannas with large endangered mammals in her example,[16] and on Hudson Valley farmlands where threatened bog turtles benefit from the effects of light cattle grazing in ours.[26]

Active restoration of damaged habitats may prove to be an important part of restoring the ecological balance that supports native biodiversity, but habitat restoration that actually reproduces all the complexity and particulars of the target original is difficult if not impossible. It's quite easy to manage water levels in a newly created wetland, but deep organic soils take thousands of years to develop, and a shallow layer moved from another wetland, a common practice, may never regain the microbial and invertebrate community, or function fully in carbon and nitrogen transformations. High-profile restoration efforts require heavy resources, and with such high stakes a failure can advance the idea that ecological projects are bound to fail.

Hudsonia's work, which spans pure and applied research as well as public education, also includes technical assistance to those who are restoring or managing land and habitats to protect threatened or endangered species. For example, we have found that certain turtle species select nesting sites by moisture content, while others reject silted sites for thermoregulation and perhaps foraging, even if all else meets their approval. Understanding these kinds of preferences and constraints is essential to the success of habitat restoration efforts for those turtles and for other rare species with very specialized habitat requirements. We are also continuing our field work related to reducing farm-equipment injuries to wood turtles, a Species of Special Concern that must sometimes travel between stream beds and croplands to reach nesting and foraging habitats.

Trout lily (*Erythronium americanum*) is a spring ephemeral wildflower of moist forests. It blooms and produces seeds in spring before the forest canopy leafs out; then the leaves and stem wither and die back, leaving no trace above-ground until the following spring. Photo: Ben Derr

Whether you call them novel, emerging, or no-analog ecosystems,[13] artificial or highly disturbed environments, often near dense human settlement, present opportunities for study and potential environmental benefits. Ecologists study the use of offshore drilling platforms as artificial reefs to determine the habitat benefits of leaving them standing when they are decommissioned. Hudsonia is compiling decades of research documenting the threatened and endangered species of the Hackensack Meadowlands, an area thought by many to be polluted beyond redemption. But over forty rare, threatened, and endangered species have been documented there, a strong indication that the Meadowlands, accessible to the 18 million residents of the New York metro area, may in fact be a hotspot of urban biodiversity of statewide and even national significance.[18]

Humans have long altered our environments in very significant ways, some beneficial. In the last century, myth-busting anthropologists showed that Native Americans have for thousands of years altered North America's pristine landscape, including intentional burnings tailored to cereal, fruit, and nut crops, hunting lands, and woodland paths. The glacial Lake Albany Sand Plains were regularly burned by spontaneous wildfires and by fires set by Native Americans. More recently, when fire containment became the universal practice, the sunlit forest floor that had been home to the endangered Karner blue (butterfly) was thrown into shadow and rendered unsuitable for the butterfly and other pine barrens specialists.

If there is any value in making predictions, it is to anticipate what's coming and make changes that will lead to the best outcomes. The pandemic experience and attendant research are revealing to a growing number of people that biodiversity is not a luxury but is essential to the health and well-being of human populations. The demographics getting hit the hardest are in many cases those that started with the least, including access to clean resources and safe open spaces. When the pandemic subsides, the economic and social reconstruction will give us an opportunity to rebalance what we value, building on what we have learned and will learn from our scientists about the health services of robust ecological systems, perhaps including suppressing pathogens, and from the pandemic's reminder of the value of natural areas when other aspects of our lives are so disrupted.

Resources will be strained, and expected migrations out of urban areas may trigger a home-building boom in the countryside that will put new pressure on the habitats and biodiversity of rural landscapes. The work Hudsonia has done identifying significant habitats, species of conservation concern, and conservation priorities, sharing our findings with public agencies, conservation NGOs, and landowners, and our thoughtful approach to land management all have changed the conversation around land use and biodiversity conservation in the Hudson Valley. Our work documenting biota in wetlands and woodlands, meadows and farms, and the techniques we have pioneered to insure their persistence can be used in other regions far and wide. Within our region, our research will help guide land use decision-makers in the early stages of anticipated urban-to-rural migrations and ensure that the biodiversity of the region is protected as Hudson Valley communities welcome and accommodate the new arrivals.

BEN DERR 1987–2020

The photo on the cover page of this issue of News from Hudsonia *and several of the photos in this article illustrating aspects of regional biodiversity were taken by Ben Derr, a promising biologist who died, far too young, earlier this year—a great loss to us all. We are grateful to his partner Chelsea Gendreau, who worked by his side, for giving us permission to publish these.*

And for those who continue to live in our cities, increased access to outdoor spaces through enhancement of greenways will provide greater opportunities for renewal, recreation, and study. The Albany Sand Plains mentioned above are just such a place. Now partially restored as the Albany Pine Bush Preserve using techniques initiated by the Mohawk and Mohican peoples over thousands of years, lying within the city limit, they are accessible and free, and their pathways, scattered with refracted blue, draw visitors to habitats that support diverse species—prairie warblers, dusted skippers, and hognose snakes—at safe distances for everyone.

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Solar continued from page 5

College in Amherst, Massachusetts, to examine species presence and absence. We found the fencing surrounding the arrays did not strictly exclude some species from the arrays. Woodchuck burrows and bird nests were common inside the arrays, showing the space was used as a source of habitat. The arrays were also actively used by predators, such as coyotes, bobcats, gray fox, and red fox, as a space to find prey, such as cottontails, woodchucks, other rodents, and opossums. Our results can be used to inform and advise decision-makers on positive ecological strategies to design and maintain utility-scale arrays. Further research is needed on small mammal biodiversity, whether arrays are a population sink, and how different array management strategies affect biodiversity found in other large-scale PV arrays.

POLARIZED LIGHT POLLUTION AS AN EXPLANATION FOR BIRD COLLISIONS WITH SOLAR PANELS

Bruce Robertson (Associate Professor of Biology, Bard College)

Birds are attracted to utility-scale solar facilities where they frequently collide with solar panels and die from their injuries. One explanation for this apparently maladaptive behavior is the so-called "lake-effect" hypothesis that birds mistake the sunlight polarized through reflection with solar panels for a natural water body such as a lake or river. Existing studies demonstrate that songbirds are capable of seeing skylight polarization patterns and using them to calibrate their navigational compass, but it remains unknown if they can use this same polarization sensitivity to locate water bodies. We exposed wild songbirds in New York to bird feeders and bird baths modified to manipulate their visual properties (color, brightness, and degree of polarization) and examined patterns of behavioral responses to them. Two feeder-based studies were designed to examine visitation rates of birds to four surfaces that manipulate surface color, degree of polarization and the wavelength of polarization with the prediction that polarized light should make feeders more visually conspicuous and enhance visitation. We observed birds diverting their approaches to high-polarization treatments in ways that suggested they were attempting to avoid collisions with objects they perceived to be water bodies. Heated bird baths were used to confirm that attraction to polarized light was also used within the context of water-seeking behavior. We provide the first evidence indicating that birds use polarized light to locate natural water bodies. This evidence supports a key assumption of the lake-effect hypotheses related to solar panels, and also has important implications for understanding and mitigating bird-building collisions.

A tiger swallowtail nectaring on common milkweed. The larvae of this species feed on plants in the magnolia and rose families. Photo: Ben Derr

WHAT BIOLOGICAL STUDIES FOR TWO SOLAR PROJECTS TEACH ABOUT IMPACTS ON BIODIVERSITY

Erik Kiviat (Executive Director, Hudsonia Ltd.)

In 2017-2019 Hudsonia conducted biodiversity assessments, habitat mapping, and biological studies at two proposed solar photovoltaic sites in the Hudson Valley. The first was a 6.5-hectare (16-acre) community solar site slated for 0.8-ha (2-ac) of solar arrays, and the second a ca 600-ha (1500-ac) utility-scale site slated for about 300 ha (700 ac) of arrays. The goals of our studies were to understand which habitats and species of conservation concern occurred at the sites, and how to reduce and mitigate the impacts of solar development on those biodiversity elements.

The community solar site was a shrubby oldfield on glacial till near hardwood forest and wetlands with potential breeding pools for woodland amphibians. This site was fairly straightforward. I determined that Blanding's turtle (NYS Threatened) was a low probability, and I considered that amphibians such as wood frog and spotted salamander were more likely to move from breeding pools into woodland than into the drier oldfield. Assessment of the utility-scale site was more complex due to its large size and extensive fallow field and hayfield habitats, predominantly underlain by glaciolacustrine silty clay soil. We found low reptile and amphibian diversity and no species of conservation concern in those groups. The site supports winter-foraging and -roosting raptors, including northern harrier (NYS Threatened) and short-eared owl (NYS Endangered), as well as grassland-breeding songbirds. We also found a high diversity and some large populations of rare plants. We guessed that meadow plants such as Georgian bulrush, (*Scirpus georgianus*, NYS Endangered) and Bush's sedge (*Carex bushii*, NYS Rare), given their abundance in recently-farmed meadows, will probably tolerate installation of arrays. Mowing regimes can be tested experimentally to find the best schedules and techniques for maintaining rare plant species and retaining flowering forbs for pollinators. Rare woodland herbs (e.g., green rock cress, *Borodinia missouriensis*, NYS Threatened), which are much less abundant on-site, will need protection of the hardwood canopy in more-or-less its current extent. Mitigating impacts on winter raptors is more challenging and partly dependent on land use surrounding as well as within the solar facility. Although landscapes likely to attract solar development (e.g., extensive flat or gently-sloped farmland, brownfields, capped landfills) may be characterized generically, field surveys are still needed to identify important at-risk elements of biodiversity so that solar energy generation may be optimized with biodiversity management. ■

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Headwater Streams: Identifying and Protecting an Essential Resource

Webinar Series, 3-6 August 2020, 3:00pm – 4:30pm each day

Small headwater streams are often unnamed and unmapped, and unprotected by state or federal regulations. Yet these streams support distinctive biological communities, play ecological roles important to the surrounding landscape, and are essential sources of clean water, organic materials, and organisms for the larger downstream systems. We will discuss the ecological and water resource values of headwater streams; how to identify them remotely and in the field in the context of environmental reviews; threats to stream habitats and water quality; current regulatory status at the state and federal levels; and how to extend local protections to these important resources. Certificates for six hours of municipal training credit will be available to attendees..

Wetlands: Values, Threats, and Protection

Webinar Series, 21-24 September 2020,
3:00pm – 4:30pm each day

Wetlands provide numerous benefits, from critical habitat to clean water and flood control. Despite some protections at the state and federal level, wetlands are still being lost and degraded. This webinar series will introduce the diversity of wetlands in the Hudson River estuary watershed and discuss their ecological and water resource roles, their significance in a changing climate, common threats facing wetlands, recognizing and assessing wetlands in the field in the context of environmental reviews, and local measures that can be adopted to enhance wetland protection. Certificates for six hours of municipal training credit will be available to attendees.

These programs are free-of-charge, and are especially designed for municipal officials, conservation NGOs, and others who are regularly engaged in policy-making, environmental reviews, and issues related to land development and conservation.

The webinars are conducted in partnership with Cornell University and the NYSDEC Hudson River Estuary Program, and funded by the NYS Environmental Protection Fund. For further information contact Lea or Gretchen at Hudsonia: 845-758-7053. To register, go to https://hudsonia.org/events/.

Join the email list at http://hudsonia.org/mailinglist/ or check back at http://hudsonia.org/events/ to learn more about additional 2020 programs as soon as they are scheduled.

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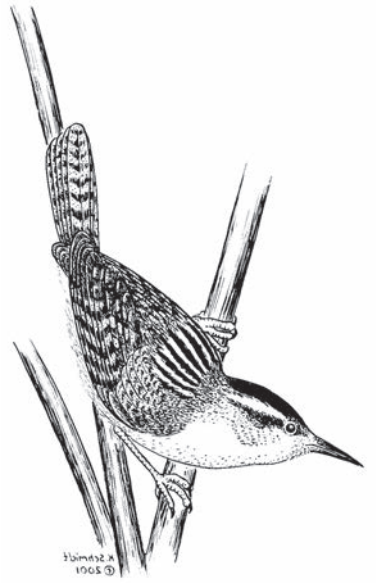

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