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- Two Urban Gems under Threat
- Natural Resource Inventories



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# News from Hudsonia

Volume 30, Number 1

Spring 2016



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Cover photo: Great spangled fritillaries on a common reed stem in a gas pipeline corridor. Erik Kiviat © 2016

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# News from Hudsonia

A journal of natural history and environmental issues

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*Dear Friends of Hudsonia,*

*As we prepare this issue of News from Hudsonia, the region is experiencing an unusual spring after an oddly warm winter. Around the county, political campaigns are advancing greatly divergent views on issues, and the world is shaken by frightening and heart-wrenching geopolitical events; all have ecological impacts that we may feel powerless to control or mitigate. Yet we all can inform ourselves about environmental problems and seek solutions on the local level – if not beyond.*

*Through the economic tumult of the last few years, Hudsonia has steadfastly pursued a mission of research and education. We have continued to study rare native organisms and their habitats; overabundant nonnative species and their management; urban, rural, and wildland places and the regulations and policies that bear on the protection of nature and ecosystem services. We have educated, trained, and assisted hundreds of people like you who are concerned about the future of the communities where they live, work, play, and raise the next generations.*

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*All our best wishes for the spring,*

Philippa Dunne  
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## LONG DISTANCE IMPACTS OF CHEAP GAS

By Erik Kiviat\*

Garrett Hardin<sup>6</sup> wrote about the unforeseen, and mostly long distance, ecological and human impacts of the Aswan High Dam on the River Nile in Egypt. Among those impacts, according to Hardin, were the silt- and nutrient-starvation of the floodplain cultivation areas, the proliferation of schistosomiasis (a serious parasite) in the human population due to hydrological changes, and the failure of the anchovy fishery in the eastern Mediterranean Sea from nutrient starvation.

This article is about the long distance, and mostly unforeseen, environmental impacts of hydraulic fracturing for natural gas in the Marcellus-Utica shale gas region of the Appalachian Basin in the northeastern U.S. High volume horizontal hydraulic fracturing (HVHFF or “fracking”) is a widely used method of extracting natural gas or oil from deep subterranean shales by means of the injection of a mixture of water, sand, and synthetic chemicals at high pressure. Fracking has many adverse environmental impacts over large areas of the U.S. and the world.<sup>12,14</sup> This article refers principally to mining of natural gas, but many of the points here apply to fracking for oil which is also widely practiced in the U.S.

### DISTANT SAND

Let’s begin with the longest distance and most surprising impact of northeastern HVHFF. Fracking (for gas or oil) requires sand particles, the “propant,” of a particular size, shape, and hardness, that prop open the fractures created in the shale. Although some “frac sand” used in the Marcellus-Utica region is synthetic, most of the frac sand is mined from

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\* Erik Kiviat is Hudsonia’s executive director.



Wild lupine. Kathleen A. Schmidt © 2001

central Wisconsin.<sup>17</sup> In 2013 there were about 27 “large scale” operations up to 70 hectares (173 acres) each, and more than 50 additional proposed mines.<sup>7</sup> This mining region coincides with the landscape that supports the federally- and state-listed endangered Karner blue butterfly and other state-listed rare species,<sup>1</sup> and the regulatory agencies are concerned about the impacts of mining on the sandy habitat of the butterfly and its larval food plant wild lupine. The Blanding’s turtle (state Special Concern) is another listed species that occurs in the sand mining region. Transporting sand 1600 kilometers (1000 miles) by rail or truck presumably also consumes a large amount of energy.

### POLLUTION, CONSUMPTION, AND COMPETITION

Transmission pipelines crisscross the country, and thousands of miles more are being expanded, built, or proposed in New York and other northeastern states.<sup>13</sup> Pipeline companies often use horizontal directional drilling (HDD) to install a pipeline in a shallow tunnel beneath a wetland, stream, or building that regulators desire to leave undisturbed by an open trench. Despite the obvious advantages of HDD, such projects may involve spills of the bentonite-water mixture used to lubricate the drill.<sup>19</sup> Ben-

tonite is a finely divided clay that can coat vegetation, clog soil pores, and smother aquatic animals, thereby causing poorly-understood damage to habitats and organisms.<sup>2</sup>

Flooding of large rivers in Colorado and North Dakota in 2013 caused spills of fracking wastewater and oil from damaged storage tanks and open waste ponds at gas and oil well sites on the floodplains, as well as mobilization of fertilizers and pesticides from farm fields.<sup>15,18</sup> In a different interaction, because of the large consumption of water and the risks of water contamination, fracking is expected to compete with agriculture for water and thereby to affect the distribution and prices of agricultural products at distance.<sup>16</sup> Another form of resource competition involves forest products. Hardwood logs are commonly used in Pennsylvania to create temporary “corduroy roads” on soft or wet soils for moving equipment for construction of pipelines and access roads. So much hardwood was consumed in 2015 that importation of hardwood logs for this purpose reportedly caused a fuelwood shortage in New Hampshire.<sup>3</sup>

HVHF produces wastewater contaminated with salt, radionuclides, and heavy metals from the shale as well as the synthetic chemicals injected with the fracking fluids.<sup>12</sup> Some of the fracking wastewater from Pennsylvania, Oklahoma, and other states is injected into deep wells for disposal. Many small earthquakes have been caused by wastewater injection in certain locations, and there is risk of larger, more damaging, quakes.<sup>4,8</sup>

### INVASIVE SPECIES

Disturbance to existing soil and vegetation is one of the most important impacts facilitating colonization and spread of nonnative pest plants such as tree-of-heaven, Japanese knotweed, and common reed. Because a pipeline right-of-way (ROW) is a long linear feature, it may act as a dispersal pathway for invasive plants, much as do highway verges. Seeds or fragments of weeds that colonize physically disturbed, sunny soil may be spread along pipeline ROWs by construction equipment, wind, or other agency. Weeds may then move into less-disturbed wetlands, forests, or other habitats off the ROW, especially if pipeline construction or operation causes siltation. In Austria, the

non-native chufa (*Cyperus esculentus*, a sedge) was first detected at a gas pipeline ROW and then infested 80 hectares (198 acres) of agricultural land.<sup>20</sup> Soil handling associated with pipeline construction and other energy development in the western US facilitated invasion by downy brome (*Bromus tectorum*), a highly pestiferous grass.<sup>10</sup>

Soils and vegetation store large amounts of carbon, retarding its movement into the atmosphere in the form of carbon dioxide or other greenhouse gases (GHGs). When vegetation, especially forest, is cleared, or soils are physically disturbed, carbon in organic matter is released to the air more rapidly than normal. The proposed ROW widening, and replacement of the existing pipe in the Algonquin Pipeline in northern Westchester County<sup>13,14</sup> would result in a substantial release of GHGs.

### HABITAT FRAGMENTATION

The very long, linear character of ROWs particularly contributes to habitat fragmentation. Herb and shrub-dominated ROWs in forested regions break extensive forest into smaller blocks. Although pipeline ROWs may be only 15 meters (50 feet) wide, they may inhibit dispersal of West Virginia white butterfly, juvenile amphibians, and ground beetles, or disrupt breeding habitat use by certain forest birds, such as the ovenbird, and plants, such as orchids.<sup>12,22</sup> Not only are some species poorly able to cross ROWs, but other forest species are affected by drying and warming of air and soil near the



Hay-scented fern and common milkweed in a New York pipeline corridor. Erik Kiviat © 2016



Pipeline corridor fragmenting the Tiadaghton State Forest, Pennsylvania. Erik Kiviat © 2016

newly-created edges along the ROWs.<sup>12</sup> Improved routing and more sensitive construction methods can reduce damage to important habitats but will not eliminate fragmentation.

### HABITAT DEGRADATION

Industrialization of extensive landscapes for gas mining can potentially cause declines or even extinctions of wild species with geographic ranges that broadly overlap regions rich in shale gas.<sup>5</sup> Several woodland salamander (Plethodontidae) species with distributions closely tied to the Appalachian Basin are among vulnerable species,<sup>5</sup> particularly because salamanders are sensitive to soil moisture levels and chemical pollution. Two other examples of species threatened by fracking are the short-headed garter snake (*Thamnophis brachystoma*) and the mountain earth snake (*Virginia valeriae pulchra*).<sup>9,10,11</sup> These two poorly-known snakes occur in small areas of Pennsylvania and adjacent New York, most of which are underlain by exploited shale gas reserves. Effects of HVHFF operations on species that occur solely or mostly in the Marcellus-Utica shale region are virtually unstudied. I expect snakes in general to experience increased road mortality due to the large number of heavy truck trips associated with fracking. Snakes are also likely to be affected by habitat loss and fragmentation, hydrological alterations of wetlands, and leaks and spills of toxic contaminants.

Fragmentation of forest or grassland habitat from the establishment of wellpads, access roads, and pipelines is an effect of landscape scale gas mining that is probably unavoidable.<sup>12</sup> When habitat is broken into smaller patches by construction, some “area sensitive” animals and plants no longer have the extent of habitat they require. Other species may experience barriers to movement or additional mortality from mining-associated hazards. Although grasslands, shrublands, and forests all support organisms of conservation concern, it is necessary to preserve large blocks of each habitat type to maintain viable populations of many northeastern species. This conservation requires large scale, long term planning to avoid piecemeal conversion of habitats. Furthermore, the Appalachian Basin is subject to not only HVHHR activities, but also coal mining, logging, agriculture, road building, and residential and commercial development. All of these activities combined have effects that accumulate across space and time, and the cumulative impacts on biota may be nearly impossible to assess.

These examples of distant, offsite impacts of HVHFF for gas and oil should remind us of the need to analyze offsite impacts of all kinds of energy development. Although solar, wind, and biomass energy generation are in many respects less harmful than fossil fuel mining and

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# TWO URBAN GEMS UNDER THREAT

By Erik Kiviat\*

This is a tale of two city greenspaces, one high and one low, one a park and one privately owned, both supporting concentrations of rare habitats and species, and both being destroyed by unnecessary actions. The two sites are Laurel Hill (Snake Hill), and an unnamed freshwater marsh. Both are in the New Jersey Meadowlands, although similar sites exist in many urban areas.

## LAUREL HILL

Laurel Hill is a rocky eminence that was once surrounded by marshes, half of which have been filled. The hill originated as a volcanic plug when molten rock cooled and hardened within the neck of a dying volcano. Contact of the magma with surrounding sedimentary rocks resulted in a great variety of minerals and diverse habitats at this location. The extensive natural wetland moat isolated Laurel Hill and made it a good place for the things people didn't want in their neighborhoods: a prison, a poorhouse, a general hospital, a mental hospital, a tuberculosis sanitarium, a cemetery, and asphalt plants. The hill was quarried for several decades ending in the 1950s and, except for the quarry scars, most traces of historic use have been removed. Laurel Hill is now a county recreation park with athletic fields, a playground, and a boat landing occupying the former quarry floor. The remains of the hill (actually an east-west ridge) cover about 3 hectares (8 acres) on the map and reach an elevation of 57 meters (187 feet) with 30 meter (100 foot) cliffs—the former quarry faces—on the north side.

Railroads and the New Jersey Turnpike border the south side of the ridge.

Like many urban greenspaces, Laurel Hill supports a seemingly chaotic mixture of native and nonnative plants. Small patches of native woodland dominated by chestnut oak or sugar maple cover areas that apparently were not quarried. Several rare mosses and a rare lichen occur on the ridge, and there is a historic record of rock spikemoss (*Selaginella rupestris*) which could still persist undiscovered in an inaccessible niche. Vascular plants of native species rare in the Meadowlands are present, including wafer-ash. A small rock pool at the foot of the ridge is one of only two known Meadowlands habitats for stonewort algae (*Chara*). A population of red-backed salamanders is associated with old quarry debris that conserves moisture at the soil surface. A pair of common ravens has nested on the cliffs for several years, essentially out of reach of human disturbance although overlooking busy recreation facilities.

A portion of the ridge on the south side was cut back several years ago to protect the Turnpike from falling rocks. Athletic facilities have been expanded on the north side. Shrub thickets on an inactive dump just north of the park, where American woodcocks were nesting a decade ago, are now parking lots and condos. The rock pool was partly filled incidental to expansion of athletic fields, an impact that could have been avoided. Thickets and a weedy herb layer, including much of a population of wild-coffee (*Triosteum perfoliatum*) unique in the Meadowlands, were cleared for no apparent reason. Fortunately, though, most of the ridge itself has not been disturbed recently.



Forest remnant at Laurel Hill. Erik Kiviat © 2016

## FRESHWATER MARSH

The other site that I will describe—the freshwater marsh—shall remain unnamed and its location not described for the sake of this article. The site is privately owned and it is unclear what needs to be done to preserve it and prevent new legal or illegal ecological damage. The marsh covers about 40 hectares (100 acres) and is surrounded by a railroad, major highways, and industrial buildings.

There is a breeding population of the Atlantic Coast leopard frog (*Rana [Lithobates] kauffeldi*, "new" to science in 2014), various ducks, and two uncommon marsh birds—Virginia rail and least bittern. A rare plant, floating marsh pennywort (*Hydrocotyle ranunculoides*),

\* Erik Kiviat is Hudsonia's executive director.



Talus at Laurel Hill. Erik Kiviat © 2016



Athletic fields built on the quarry floor, viewed from Laurel Hill. Erik Kiviat © 2016

occurs in parts of the marsh. This species is known to occur at only two other sites in the Meadowlands and is ranked S1 by the New Jersey Natural Heritage Program, indicating that it is known from six or fewer sites in the whole state. Least expected, and only discovered last year, is an area of several acres where the dominant common reed (*Phragmites australis*) is short and sparse, and is mixed with diverse native herbs and abundant peat moss (*Sphagnum* spp.). Outside of this marsh I have seen less than a quarter square meter of peat moss in the Meadowlands, and that was apparently destroyed several years ago during installation of a wetland mitigation bank. Peat mosses are sensitive to the impacts of human activities, and finding them in abundance in the middle of the city is remarkable. The peat moss area seems to be a relict from the edge of a former Atlantic white cedar swamp (now a rare community in the Northeast); other parts of the marsh have old canals and stumps from cedar logging. *Phragmites* is able to “filter” nutrients, heavy metals, and suspended sediment from surface waters, thus the extensive reedbeds here may protect the peat moss area from water pollution. Who knows

what kinds of unusual plants or animals may occur in association with the peat moss? The area has yet to be studied in detail.

The freshwater marsh receives stormwater and sewage from the surrounding urban landscape, although the peat moss area seems unaffected. One end of the marsh has very poor water quality. The other end of the marsh has a large area of recent fill, and the agencies and NGOs queried did not know who placed the fill and whether it was permitted. Recreational All Terrain Vehicle (ATV) use is inhibiting natural development of vegetation on the fill, and causing vegetation loss in the marsh including the peat moss area. Several years ago massive broadcast antennas were installed in the middle of the marsh.

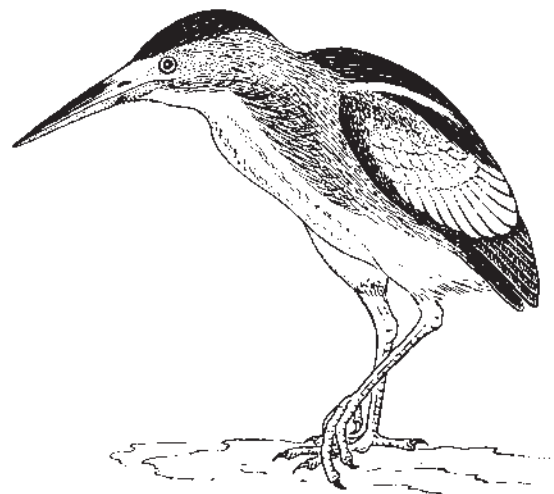
### WHY SHOULD WE PROTECT?

Why should we bother to protect an abandoned quarry and a polluted marsh in an urban area? This is more than an academic question for researchers and naturalists. Urban greenspaces provide important ecosystem services such as maintaining water and air quality, moderating local air temperatures, absorbing stormwater, providing stepping stones for animals and plants dispersing or migrating across urban landscapes, and protecting people and structures from flooding. Urban greenspaces are the principal places where an increasingly large segment of our own population gets to see, study, and enjoy nature. Perhaps most importantly, our physical and mental health is improved by the proximity of green vegetation and other elements of nature.

Urban dwellers affect the environment and its ability to support biodiversity in many ways—by their consumption habits, by their management of yards and gardens, and even by voting; elected officials at the local, county, and state levels can strongly influence land uses, stormwater management, and the extent to which important areas are protected or harmed.

Urban parks and preserves, and even “vacant” lots and wetland fill, sometimes support rare plants and animals. But without expert surveys,

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Least bittern. Kathleen A. Schmidt © 2001

# NATURAL RESOURCE INVENTORIES FOR MUNICIPALITIES

By Gretchen Stevens\*

Where are the areas in your town that are most likely to flood in the next big storm? Where are the most important groundwater aquifers, and where are they most vulnerable to contamination? Where are the remaining streams that are still clear and cool enough to support wild brook trout? Where are the largest forests? Where are the calcareous ledges? The intermittent woodland pools, kettles, and fens? (Are there any in your town?) Where are the large contiguous habitat areas that might allow wildlife to move safely between breeding and foraging areas, or between nursery and overwintering areas?

If you do not know, you could consult your town's Natural Resource Inventory.

WHAT?! Your town doesn't have one??

Although many towns in the region DO have Natural Resource Inventories and have put them to good use, many others do not, and landowners, developers, and town agencies continue to make land use decisions with very little knowledge of the important resources that might be affected by those decisions.

## WHAT IS AN NRI?

A Natural Resource Inventory (NRI) is a document prepared for a municipality, county, or other entity that describes the character and distribution of important natural resources, and explains their significance for the human community and the natural world. What kinds of resources? For example, bedrock, soils, land cover, streams, floodplains, lakes, ponds, groundwater, farmland soils, special habitats, scenic areas, recreation areas . . . and lots more.

A typical NRI includes a series of maps showing the locations and extent of important natural and cultural features throughout the area of interest (e.g., a town or a county), and a descriptive narrative.

The NRI is often used to inform the development of (or revisions to) a municipal comprehensive plan, open space plan, or zoning ordinance,

and regulatory reviews related to land uses and the environment. But it is also used by landowners interested in understanding their property in the context of the larger landscape, by land trusts weighing the conservation value of lands for acquisition or helping a landowner design a conservation easement, and by others seeking further knowledge of the landscape.

Because a townwide NRI addresses a large area, it enables users to plan for the protection of whole watersheds or sub-basins, or long stream corridors, or extensive areas of forest, shrubland, grassland, rocky crests, and other habitats that so many wild animal and plant populations need to thrive.

## HOW IS IT CREATED?

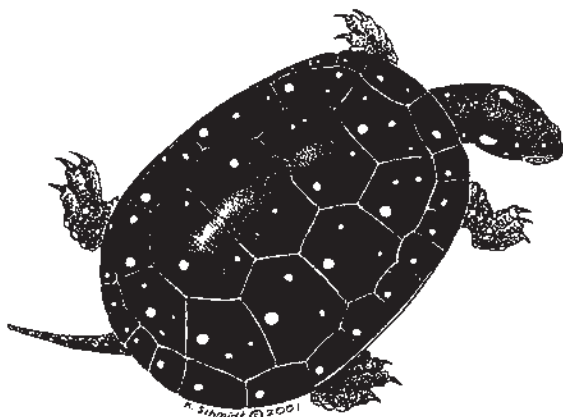
An NRI project is usually spearheaded by a Conservation Advisory Council or other public commission or agency, and is sometimes prepared in-house by capable staff or volunteers. But more often it is prepared by a hired consultant under the direction of a town agency or commission. The information is compiled primarily from existing public sources, but sometimes also includes original data gathered especially for the NRI.

The Hudson River Estuary Program (of the New York State Department of Environmental Conservation [NYSDEC]) recently published *Creating a Natural Resource Inventory*,<sup>1</sup> which provides excellent guidance on what to include in an NRI, sources of information, and examples of approaches taken by several Hudson Valley communities.

## A CONSERVATION PLAN?

Some towns decide to take the inventory a step further and develop a "natural resource conservation plan" which entails 1) identifying the resources of conservation importance—such as prime farmland soils, groundwater aquifers, streams, extensive forests, habitats for rare species, recreation areas, scenic vistas—and the land areas that support those resources, 2) identifying the conservation priorities—that is, the areas deemed most important, most vulnerable to harm, or where protection will yield the greatest return for biodiversity, water resources, or other resources of concern, 3) identifying the various means of securing protection, and 4) developing an action plan.

The most effective plans are developed with the help of ideas and information from public agencies, landowners, residents, businesses and conservation NGOs, and describe a great variety of strategies for accomplishing conservation goals—for example, public education about conservation measures that landowners can employ on their own small or large properties; grant assistance to farmers to help them carry out certain actions; collaboration with public and private entities for land ac-



Spotted turtle. Kathleen A. Schmidt © 2001

\* Gretchen Stevens is director of Hudsonia's Biodiversity Resources Center.



quisition or conservation easements on important lands; or adopting local legislation for protecting a groundwater aquifer.

A good conservation plan will also identify conservation partners—such as neighboring towns, county and state agencies, businesses, and local land trusts and other conservation organizations—that can assist with direct funding or fundraising, volunteer services, or parallel efforts to achieve shared conservation goals.

### CONSERVATION EVERYWHERE

Hudsonia has contributed to several county-wide and municipal NRIs in the past, and in 2015 we completed a Natural Resource Conservation Plan (NRCP)<sup>2</sup> for the Town of Ancram (Columbia County) under the direction of the Ancram Conservation Advisory Council (CAC). Funding for the project was provided by the Hudson River Valley Greenway, the Hudson River Bank and Trust Foundation, and the Town of Ancram. The final document is available on the Ancram town website.

Ancram had the unusual advantage conferred by a detailed habitat map for the northern half of town—prepared over many years by the Ancram CAC and associates. The CAC found and mapped most of the fens, kettle wetlands, woodland pools, wet meadows, shrublands, large forests, streams, and other special habitats in that area, so the NRCP could provide guidance specific to the plants and animals of conservation concern known to use those habitats, such as bog turtle (NYS Endangered), spotted turtle, Jefferson salamander, New England cottontail, and red-shouldered hawk (all NYS Special Concern).

A prominent message in the Ancram NRCP is that conservation needs to happen everywhere if we are to retain intact ecosystems and the incalculable services they provide to the human community. Lands that are set aside for conservation in parks, sanctuaries, state forests, and conservation easement lands, while helpful, will never be enough by themselves to maintain our water, wildlife, and natural communities. To extend protections to other important areas, small measures can be applied to every piece of privately-held land to, for example, buffer streams, wetlands, and other sensitive areas; maintain large contiguous habitat areas and adequate movement corridors for wildlife; and protect streams and groundwater from contamination.

How to do this? One approach is to make sure that landowners—whether they own ½ acre or 500 acres—are well-informed about all the ways that their land management can contribute to this effort—for example, by landscaping with native plant species; avoiding or minimizing use of pesticides on lawns, gardens, and agricultural fields; designing land uses to maintain broad connectivity between habitat areas onsite and on adjacent lands; maintaining intact floodplains and broad buffer zones of undisturbed soils and vegetation along streams, around wetlands, and around other sensitive areas; and managing forests for species diversity and structural complexity.

### 2016

This year Hudsonia is working with the Town of New Lebanon (Columbia County) Conservation Advisory Council to prepare a Natural Resource Conservation Plan for the town (funded by the Hudson River Estuary



Intermittent woodland pool. Andy Reinmann © 2016



Intermittent stream. Laura Heady © 2016

Program). To expand the existing natural resource data available from public sources, biologists with Hudsonia and with the Hawthorne Valley Farmscape Ecology Program are mining their field notes and compiling data from past surveys of New Lebanon sites so that the NRI can include more detailed information about habitats and species of concern.

Also, CAC members and students in the Darrow School Hands-to-Work program are developing original data that will add significantly to the knowledge base for the plan. Honoring a Shaker tradition, the Hands-to-Work program engages students in non-academic projects that build practical skills and harness “purposeful work” in service to the school community or the larger community outside the school. Students and the CAC are analyzing aerial photos and other spatial data to identify and map vernal pools, small streams, and old forests—features of special value for biological diversity—and then conducting field work to verify those findings and assess the character and quality of habitats.

Continued on page 10

## HUDSONIA PROJECT UPDATES, 2016

### *aAtlantic Coast Leopard Frog*

Two years ago Hudsonia joined a team of biologists studying the geographic distribution, habitat affinities, and genetics of this **newly described frog** occurring from Rhode Island to Virginia. All the data are being analyzed and a publication prepared under the leadership of the New York Natural Heritage Program. (Funded by the US Fish and Wildlife Service through the Research Foundation SUNY.)

### *Berry's Creek Flora*

We studied the flora and vegetation of 445 hectares (1100 acres) of wetlands and wetland fill in an industrial area of the **New Jersey Meadowlands** as part of a Superfund Remedial Investigation. This is one of the most intensive flora surveys ever conducted in the Meadowlands. (Funded by the ELM Group, Inc.)

### *Biodiversity Education*

We are collaborating with the Rensselaer Plateau Alliance and the NYS-DEC Hudson River Estuary Program on a June workshop for municipal leaders and conservation organizations on **Wildlife, Water Resources, and Landscape Connectivity**. In September we will lead a three-day Short Course on **Habitat and Water Resource Assessment and Conservation**, designed especially for municipal planning boards, environmental commissions, and the staffs of land trusts and other conservation organizations. (See p. 11 for more information about these events.) We continue to provide **technical assistance** to past participants in our biodiversity education programs to help advance their work on identification, assessment, and conservation of biodiversity and water resources. (Much of the biodiversity education work is funded by the NYS Environmental Protection Fund through the NYSDEC Hudson River Estuary Program and the Cornell Department of Natural Resources.)

### *Biological Assessments*

We are continuing our biological surveys (collaborating with the Hawthorne Valley Farmscape Ecology Program) on the **Greenport Public Conservation Area** (Columbia County) for the Columbia Land Conservancy (CLC), and are also surveying plants and animals on a large property in **Ancram** to help the CLC plan for future management and public uses on these sites. We are surveying biota at the **Stone Church** property in Dover (Dutchess County) to assist the Dutchess Land Conservancy and the Town of Dover as they develop plans for land management and public uses on properties recently added to the natural landmark site.

### *Bog Turtle Habitat Management*

In collaboration with Jason Tesaro Consulting, we spent three years managing a bog turtle habitat with light cattle grazing to create a lower-stature fen habitat more favorable for the turtles. In the fourth year (2015), a dense low sedge and grass layer developed where the previous

grazing had inhibited tall, dense cattail growth. Currently we are analyzing data from turtle radio-tracking and vegetation monitoring plots to understand the outcome of these management changes. (Funded by the US Fish and Wildlife Service through the NYS Department of Environmental Conservation.)

### *Bog Turtle Habitat Connectivity*

This project is using Hudsonia's townwide habitat maps to model how bog turtles can disperse from one core habitat to another. We are preparing a final report for publication. (Funded by the Geoffrey C. Hughes Foundation, the Andrew Sabin Family Foundation, and the US Fish and Wildlife Service.)

### *Greene County Conservation Priorities*

We are working with the Greene Land Trust, Cornell Cooperative Extension, and the Greene County Conservation Leaders Alliance to identify, map, and describe important natural resources throughout the county, and identify conservation priorities. In 2015 (funded by a grant from the Land Trust Alliance to the Greene Land Trust) we gathered lots of spatial data, and prepared a series of maps depicting physical, biological, and cultural resources that will help us analyze the landscape and identify the areas that may be most important for maintaining water supplies, biodiversity, scenic and recreational resources, and other important features. In early 2016 we prepared an interactive **Greene County Natural Resources Map**—now available on the websites of the GLT and the CCE—that allows users to view data layers selectively, including such things as Significant Biodiversity Areas, large forests, flood hazard zones, trout spawning streams, prime farmland soils, protected land, tax parcel boundaries, and much more. We are seeking funding for the next phase of the project in which we will analyze the data and prepare a document describing important resources, explaining their significance, and providing recommendations for effective conservation measures.

### *Habitat Mapping*

We were delighted to receive funding from an anonymous donor through the Dutchess Land Conservancy (DLC) that will enable us to complete the identification and mapping of significant habitats throughout the **Town of Dover** (Dutchess County). We began this project in 2009 with initial funding from the Millbrook Tribute Garden (through the DLC), the Educational Foundation of America, the Town of Dover, and many individual donors, and have been seeking funds to complete the work ever since. The town is famous for its unusual landscape supporting many habitats, plant species, and wildlife that are uncommon or rare in other parts of the Hudson Valley. A townwide habitat map and report will help landowners and town agencies better understand how to effectively protect biodiversity, water resources, and the natural systems that support the human community in Dover and beyond.

The **Town of Pound Ridge** (Westchester County) has been awarded a grant from the Hudson River Estuary Program to fund our work to identify and map significant habitats on large undeveloped land areas in the northern half of town—within the Hudson River watershed. Although much of Pound Ridge has been developed for residential land uses, the town still retains large areas of undeveloped land, including 2900 acres of the 4300-acre Ward Pound Ridge Reservation that extends into the Town of Lewisboro, and other intact areas on public and privately-held land distributed throughout the town. The habitat mapping project will help to illustrate how all of these undeveloped areas contribute to a landscape of considerable biological diversity and importance to local and regional ecosystems and water resources.

### **Hudson River Tidal Wetlands**

Under a contract with the Lower Hudson Partnership in Regional Invasive Species Management (LH PRISM), we analyzed **relationships between rare native plants and invasive plants** in fourteen tidal marshes. Our goal was to identify those rare species that would benefit most from monitoring or management of potentially competing non-native weeds. Interesting discoveries included previously undocumented stands of the endangered New England bulrush (*Schoenoplectus novae-angliae*), and observations that some but not all stands of rare native plants were separated from invasive plants at different levels of the intertidal zone.

Our 2016 LH PRISM project, conducted jointly with Cornell Cooperative Extension Rockland County, is the compilation of **best management practices for managing selected invasive plants**. We are focusing on small scale, non-chemical methods, and would welcome learning about your experience.

### **New Lebanon Natural Resource Conservation Plan**

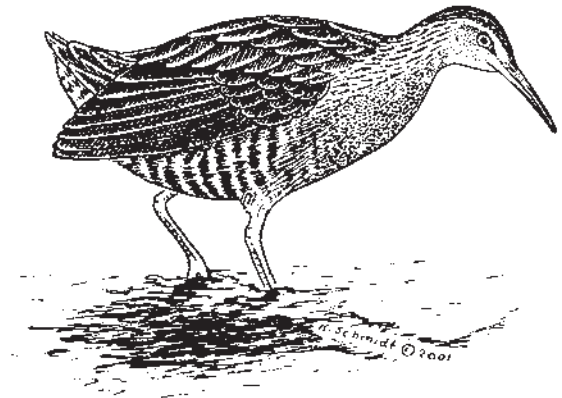
We are working with the Town of New Lebanon Conservation Advisory Council to prepare a Natural Resource Inventory and Conservation Plan for the town. (Funded by a grant to the town from the New York State Environmental Protection Fund through the Hudson River Estuary Program.) See article on p. 6. ■



Darrow School students Marshal Dong and Abe Pritzker are working with the New Lebanon Conservation Advisory Council to find and map old forests, vernal pools, and small streams throughout the town. Peg Munves © 2016

*Urban Gems* continued from page 5

those rarities are not discovered, documented, or preserved, and are often destroyed by our actions on the land before we know what we are losing. In the 21st Century, with our cultural consciousness of the importance of wetlands, parks, and open space, it is hard to believe that urban greenspaces in the Meadowlands, or anywhere, are not treated as sacrosanct, and nurtured for all the ways that they improve our lives and contribute to the natural systems in and around our cities.



Virginia rail. Kathleen A. Schmidt © 2001



Peat moss (*Sphagnum*) and common reed. Erik Kiviat © 2016

In this era of decisions about protecting people and the built environment from rapid sea level rise and increasing severity of coastal storms, understanding the occurrence and quality of unusual habitats and rare species is all the more urgent. Some low-lying coastal areas will be used for the installation of dikes, artificial dunes, seawalls, and other storm defenses, for the relocation of existing infrastructure, or for “mitigation” for the loss of habitats elsewhere. Thorough and accurate biodiversity surveys are needed so that structures can be sited where they will not harm biological resources unnecessarily, and to help planners and conservationists protect key habitats for people and other species. ■

combustion, any widespread industrial conversion of a landscape will have large impacts on biodiversity. The troubling aspect, as Hardin<sup>6</sup> illustrated, is that it is difficult, if not impossible, to predict every environmental impact of a project. It is especially challenging to predict the combined (cumulative) impacts of many large-scale human endeavors acting together on the landscape, some of which are distant in space and time from the activities that generated them. ■

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The New Lebanon NRCP will describe important resources and recommend conservation actions that can be carried out by landowners, conservation organizations, and town government. The plan will also address measures to help the town respond to the higher temperatures, larger and more frequent storms, spread of invasive species, and reduced phenological synchrony (e.g., between pollinators and crops) that are likely to accompany a warming climate.

\* \* \* \* \*

Having lots of information on streams, drinking water sources, farmland, wildlife habitats, and scenic and recreational areas at your fingertips in a single document can be invaluable to those engaged in land use planning for a single site, environmental reviews of multiple development projects, or comprehensive planning for a whole town. An NRI can alert everyone to places and features of special conservation importance, and enable us to better care for the landscapes that we all depend on. ■

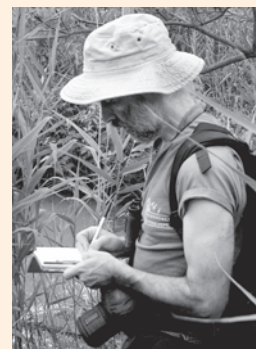
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### *Bard Award in Medicine and Science*

*Hudsonia's executive director Erik Kiviat will receive in May the 2016 John and Samuel Bard Award in Medicine and Science from the Board of Trustees of Bard College and the Board of Governors of the Bard-St. Stephen's*

*Alumni Association. The award is named for the two 18th-century physicians, father and son, whose descendant, John Bard, founded the college, and it honors "scientists whose achievements demonstrate the breadth of concern and depth of commitment that characterized these pioneer physicians." Previous recipients have included Nobel laureates Linus Pauling and Rosalyn Sussman Yalow, as well as medical researcher and social activist Mathilde Krim, physician and essayist Lewis Thomas, physiologist and writer László Z. Bitó, and wildlife biologist and conservationist Stuart Fefer. The Hudsonia board and staff congratulate Erik on this well-deserved honor.*



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**Julianna Zdunich**, for designing our fundraising appeals and managing the Hudsonia website.

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Binoculars (lightweight, good quality)

Natural history and conservation science books, periodicals, maps

Lightweight pruning pole

(For technical equipment, we are interested only in items less than 5 years old and in good working condition. For all items, please inquire first)

## UPCOMING EDUCATIONAL EVENTS

### Wildlife, Water Resources, and Landscape Connectivity Poestenkill Firehouse

**Saturday, 11 June 2016, 9:00 am – 1:00 pm**

In this workshop for landowners, planning boards, and others engaged in land use decisions, we will discuss the status of some of the rare, uncommon, and vulnerable wildlife species in Rensselaer County—from salamanders, turtles, and bats, to hawks, waterfowl, otters, and bobcats; explore the ways that wildlife use our forests, meadows, wetlands, and streams, and discuss the importance of landscape connectivity to maintaining habitat quality, wildlife populations, and the integrity of our ecosystems. Co-instructors for indoor and outdoor sessions are Gretchen Stevens (Hudsonia), and Ingrid Haeckel (Hudson River Estuary Program). The workshop is funded by the NYS Environmental Protection Fund through the NYSDEC Hudson River Estuary Program and Cornell University, and conducted in partnership with the Rensselaer Plateau Alliance. To register, contact Lea Stickle at [lstickle@bard.edu](mailto:lstickle@bard.edu) or 845-758-7053.

### Habitat and Water Resource Assessment and Conservation

**NYSDEC Region 3 Office, New Paltz**

**Thursday–Saturday, 22–24 September 2016**

This three-day short course on recognizing and protecting significant habitats and water resources is especially designed for members of planning boards, town boards, and environmental commissions, and staffs of land trusts and other conservation organizations involved in land use decisions. Topics to be included in indoor and outdoor sessions are 1) finding existing information, 2) using maps and other resources to identify important areas, 3) reviewing site plans, and 4) applying conservation principles to land use planning and policy, environmental reviews, and design of conservation easements. Instructors: Gretchen Stevens (Hudsonia) and Laura Heady (Hudson River Estuary Program). The workshop is funded by the NYS Environmental Protection Fund through the NYSDEC Hudson River Estuary Program and Cornell University. To register, contact Lea Stickle at [lstickle@bard.edu](mailto:lstickle@bard.edu) or 845-758-7053.

To be notified about other Hudsonia educational events in 2016, join the email list at <http://hudsonia.org/maillinglist/> or check back at <http://hudsonia.org/events/>.

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(Listed here are donations received between 1 January 2015 and 5 April 2016.)

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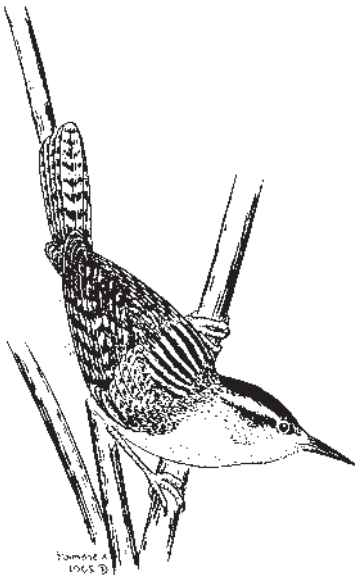


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