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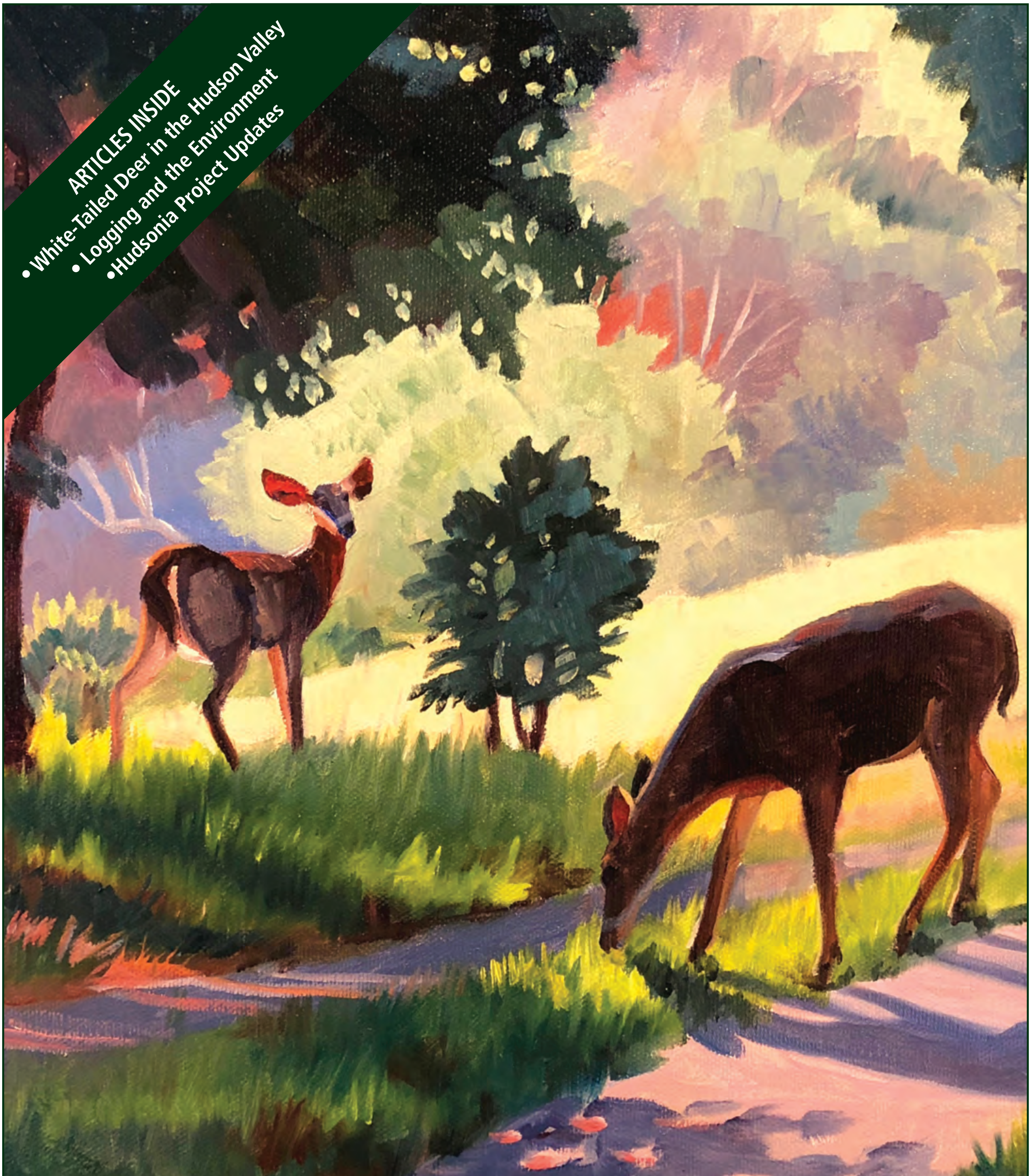

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Environmental Research and Education · Science for Conservation

News from Hudsonia

Volume 32, Number 2 Fall 2018

Dear Friends of Hudsonia,

When public resources are diverted away from environmental protection, more of the burden falls to the private sector.

We are grateful for your contributions in support of Hudsonia's decades of research that provide the essential data and analysis for sound conservation.

Here in the Hudson Valley we are happy to see the arctic visitors return—the snow buntings flickering along the roads, horned larks ringing in the snowy fields, and northern shrikes watchful on their hunting perches.

Local grasslands are crucial to the survival of these and other species, and are also prime sites for land development, including large-scale renewable energy projects. That's one of the reasons we are glad to contribute to the research on a proposed solar energy facility in Greene County. The site in question is one of special biological richness—with meadows, marshes, and forests occupied by numerous rare plants and rare birds.

The biological resources, cultural and engineering issues, and scenic landscape all contribute to complex conundrums for project sponsors, local residents, conservation organizations, and public agencies. Enter science, as always providing an anchor.

One of the great challenges for all of us in the face of global warming is to establish and scale-up alternative energy sources that minimize the habitat loss, air and water pollution, and carbon emissions otherwise associated with coal mines, oil wells, fracking installations for natural gas, and oil and gas pipelines.

We are confident that our work will enrich the general understanding of renewable energy projects, improve the mitigation for potential harms, and advance our own knowledge in this important emerging field of inquiry and application.

We're looking forward to an exciting year of conservation science, and ask that you please support our work as generously as you can. (Your gifts are still tax deductible.)

All of us at Hudsonia wish all of you a very happy winter solstice.

Erik Kiviat PhD
Executive Director

Philippa Dunne MA
Chair, Board of Directors

* 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.

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We are grateful to Qualprint for printing *News From Hudsonia* each year.

ISSN 1072-8244

Environmental Research and Education
Science for Conservation

News from Hudsonia

A journal of natural history and environmental issues

Telephone: (845) 758-7053
Facsimile: (845) 758-7033
Website: www.hudsonia.org

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Annandale, NY 12504-5000

Volume 32, Number 2 Fall 2018

WHITE-TAILED DEER IN THE HUDSON VALLEY:
History, ecology, and impacts of a keystone species

By Kristen Bell Travis* and Gretchen Stevens*

White-tailed deer (*Odocoileus virginianus*) occupy a unique place in the ecology and history of the Hudson Valley. A staple of the human diet for millennia, they were an important subsistence resource and a profitable commodity during colonial times, then a protected and managed rare species by the early 20th century. Their populations have exploded in and near our settled landscapes in recent decades, creating nuisances for property owners and gardeners, economic losses for farmers, ecological problems in forests, and safety hazards for motorists, and contributing to public health hazards due to their role in the life cycle of the black-legged tick.

The archaeological record indicates that white-tailed deer was the single most important prey species of indigenous societies in eastern North America, with no apparent overexploitation (e.g., changes in age composition of harvested deer) over a period of almost 10,000 years.[13] In fact, indigenous land use practices likely enlarged the deer population in certain places and times. Humans cleared overstory trees for settlement sites, fuel, and building materials, creating open areas with more forage for deer. They also used intentional, periodic burning of forested areas near villages to enhance habitat for deer and other species of edge habitats.[13]

With the arrival of Europeans, hunting pressure by both Native Americans and Europeans increased due to the economic incentive of the deer-skin trade.[13] Colonial settlement at first improved habitat for deer, and their major non-human predators—wolves and mountain lions—were hunted to local extinction. Nevertheless, hunting and forest clearing combined to make deer rarities near towns by the beginning of the 19th century.[11] By 1880, practically all non-mountainous land was cleared (75% of land statewide), and deer were nearly extirpated from the state except in the Adirondacks and Sullivan and Orange counties.

After 1880, the rising trend of farmland abandonment led to more suitable habitat, and between 1900 and 1910, the Hudson Valley saw the return of a few deer from remaining populations in the Berkshires and from other parts of New York. Hunting was mostly banned between 1900 and 1920 to allow the population to recover.[11] After that, enforced bag limits, hunting seasons, and habitat management were used to increase the population, with extraordinary success. Problems caused by overabundant deer began to be widely noticed in the 1980s.[15]

Landscapes with a mosaic of different successional stages, including forested and open land, provide the best habitat for deer. Summer ranges often focus on agricultural lands with abundant forage, while winter ranges tend to be smaller and primarily in forest.[6] Home range areas vary according to population density and

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*Kristen Travis is a Hudsonia Research Associate; Gretchen Stevens is director of Hudsonia's Biodiversity Resource Center.

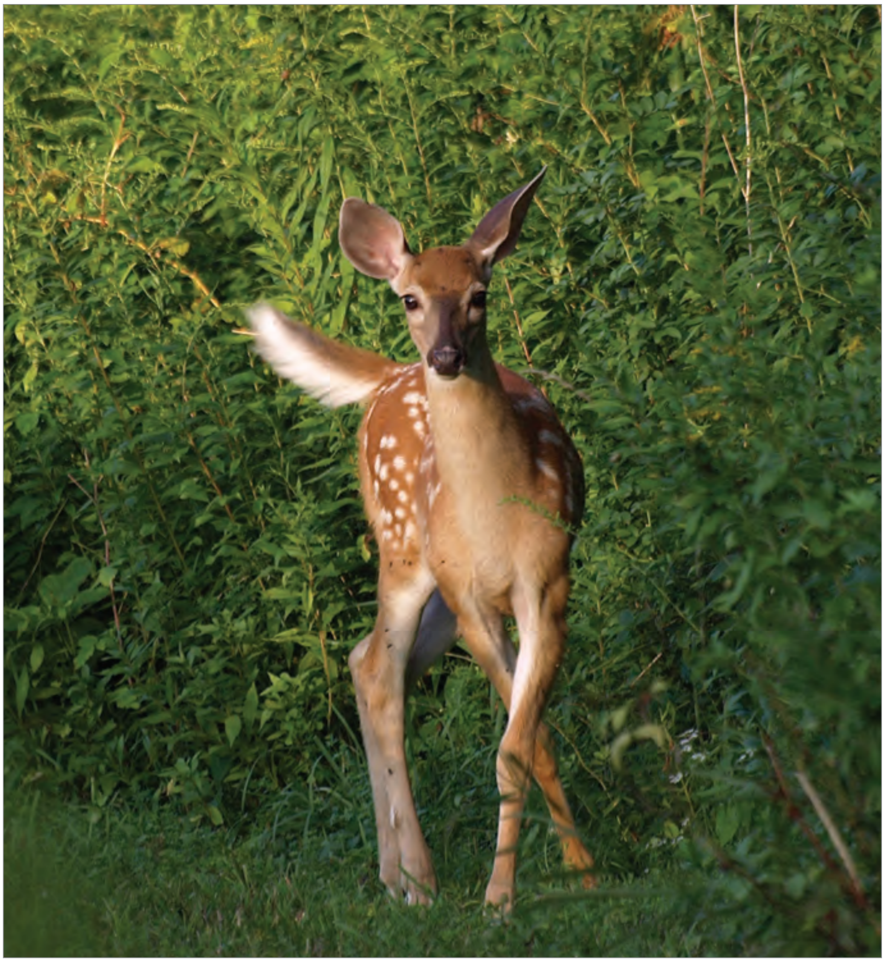
White-Tailed Deer continued from page 1

available resources, but range from approximately 25-75 acres (for does in southern Connecticut with very high population densities [101-176/mi^2][1]) to over 550 acres in the Adirondacks.[6]

Deer are quite mobile year-round, and have little trouble dispersing through poor habitat. They are important agents of long-distance seed dispersal for a wide variety of plants. They also transport significant amounts of nitrogen, for instance from cropland where they feed to forest where they bed down. Agricultural areas can serve as refuges from predation for fawns, which are preyed upon by coyotes, bobcats, and black bears.[6] High mobility, a relatively high reproductive rate, and the ability to hide in a complex forest habitat enable white-tailed deer to tolerate high levels of predation and quickly repopulate hunted-out areas.[6,13]

Although it is difficult to estimate the prehistoric deer population, densities may have been between 1.8 and 10.3/mi^2 before European settlement.[5,14] Today, population densities in the Hudson Valley are generally 15-30/mi^2 with much higher densities in some areas (130-207/mi^2).[10,14] Overabundant deer cause agricultural losses ($59 million in New York in 2002), collisions with vehicles (over 70,000 in New York in 2011), damage to home gardens and landscaping,[8] and a cascade of serious ecological and public health problems.

White-tailed deer are recognized as "keystone" herbivores[15] that profoundly affect forest structure and succession; when overabundant, they tend to reduce the numbers of species and individuals of native forest plants and increase the proportion of non-native plants.[2,15] Where deer abundance exceeds 15/mi^2, tree seedling abundance is reduced in many forest types in the northern US.[10] In general, tree seedling and sapling density ranges from low in the southern part of the Hudson Valley to much higher in the northernmost part; their species composition also differs markedly from the composition of canopy trees.[12] It is probable that deer play a major role in both of these forest-altering shifts.[10] Deer at even the modest density of 12/mi^2 can cause the decline and disappearance of native understory herbs.[15] Deer herbivory on native understory herbs and shrubs (and perhaps non-browsing effects such as litter disturbance, soil compaction, and changes in soil chemistry) also promotes the invasion and spread of some non-native plants such as garlic-mustard (*Alliaria petiolata*) and Japanese barberry (*Berberis thunbergii*), although palatable non-natives such as multiflora rose (*Rosa multiflora*) may be kept in check by deer.[2,4]



White-tailed deer fawn, Town of Hillsdale. John Piwowarski © 2018

Overabundant deer also affect breeding bird communities, invertebrates that depend on understory plants, squirrel populations (which in turn affect bird nesting success), and tick abundance and the prevalence of tick-borne diseases.[15] For example, where deer are more abundant, songbirds that use understory foliage (such as white-eyed vireos and hooded warblers) are less abundant.[7] Five tick-borne diseases (including Lyme) and a syndrome were identified between 1969 and 1999, all transmitted to humans via black-legged or lone star ticks. These diseases were likely identified in recent decades because of their rapid expansion in range and prevalence, facilitated by overabundant deer which are hosts for the ticks and reservoirs for several of the diseases.[9]

Conflicts of interest around deer management abound: in general, hunters favor higher densities, while landowners, farmers, and ecologists favor lower densities.[3] Recreational hunting, regulated by the NYS Department of Environmental Conservation, is the primary management method for deer in New York. But hunting alone (even with relaxed restrictions and organized hunts) was unable to reduce deer density below 27/mi^2 at several suburban sites.[16] Both the number of hunters and access to land on which to hunt continue to decline in New York,[8] and deer damage to forests, especially in southeastern New York, continues to be severe.[10,12] A regulated commercial deer harvest, in which hunters could profit by selling venison, might be the most effective control, but would contradict long-standing state and federal laws against buying and selling wildlife.[14]

Any effort to reduce the deer population will only be successful if implemented region-wide. Even if control efforts are temporarily successful at reducing the herd in a single town or park, deer mobility and the permeable landscape ensure that deer will quickly repopulate the area should those efforts cease.

Today the population of white-tailed deer is at a pestilential level in most of the Hudson Valley, due largely to human land uses and behavior, our manipulations of the landscape, and our long-ago removal of top predators. Reducing the population to a reasonable level has been an intractable problem but, should successful control measures eventually be discovered, a prudent goal would be to maintain a modest, self-sustaining population, and thus restore white-tailed deer to their rightful place in the Hudson Valley ecosystem. ■

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White-tailed deer adult, New Jersey Meadowlands. Erik Kiviat © 2018

LOGGING AND THE ENVIRONMENT Part I

By Erik Kiviat*

Conservationists often rightfully decry the ecological and climate devastation wrought by logging in tropical forests or in the temperate rainforests of the Pacific Northwest, but less attention is paid to the environmental impacts of logging in the Northeast when it occurs out of sight or earshot. Beyond concerns about noise and logging trucks on the roads, here is a discussion of the ecological impacts of logging in the forests of our region. This is an impressively complex topic that I can hardly do justice to in a short article, and research findings often vary geographically, by species, and by logging method.

KINDS OF LOGGING AND FOREST PRODUCTS

Most northeastern logging is for timber (lumber), or pulpwood for paper making. Veneer logs, bark and wood chips for landscaping, and fuelwood are also harvested. In some areas of the Northeast, whole-tree harvest is practiced, rather than just harvesting stems, because the branches and leaves can be sold for a biomass energy feedstock.

Clearcutting—that is, cutting most or all trees—may be practiced to clear land in preparation for development projects or to harvest forest products *per se*. However, selective cutting is more common—trees of certain species, sizes, and conditions are harvested and other trees are left in place. Even in a clearcutting operation, a few trees may be intentionally left to provide seeds for future forest regeneration. In some cases, trees or patches of forest are left for habitat for certain animals or to reduce potential for soil erosion. Salvage logging involves harvesting trees that have been killed or damaged by storm, fire, insect pests, or pathogens, or is sometimes done in anticipation of such events.

In the 1700s and 1800s, large areas of forest were cleared for agriculture and charcoal production. With the decline of northeastern agriculture before and during the 1900s, there was a trend of increasing forest cover and maturation in the Hudson Valley and neighboring regions. Data indicate that land clearing for residential, commercial, and industrial development may have reversed this trend in the last few decades. For example, in the entire continental U.S. from 2001 through 2011, forest of all types decreased by 66,000 km^2 (25,500 mi^2), while developed land increased by 17,000 km^2 (6560 mi^2) and shrubland increased by 31,000 km^2 (11,970 mi^2).[9] The trend of forest decrease pertains to New England[4] and presumably New York.

A FEW DEFINITIONS

forest basal area Aggregate cross-sectional area of tree stems per unit area of ground, expressed as square meters per hectare or square feet per acre.

coarse woody debris Fallen trunks and branches.

cull tree Live tree unsuitable for lumber due to crookedness, injury, or rot.

downed log Fallen trunk or branch.

slash Discarded branches and tops of harvested trees.

snag Standing dead tree.

top Upper portion of a tree that is discarded in a logging operation.

IMPACTS ON HABITAT, BIODIVERSITY, SOILS, AND WATER

Obvious impacts of logging include direct loss or alteration of forested habitat, alteration of light and moisture regimes within the forest, and soil compaction, rutting, and erosion. The impacts can extend far beyond the harvest area itself—for example, sedimentation of nearby streams, ponds, and wetlands, and habitat fragmentation. A logging road can be a significantly negative feature in an otherwise unbroken tract of habitat. In a Southern Appalachians study, logging roads degraded habitat for woodland (plethodontid) salamanders,[20] although logging roads do not necessarily increase depredation of ground-nesting birds.[12,23] Increased soil erosion and surface runoff after tree removal at the harvest site can damage offsite streams, lakes, ponds, and wetlands. Noise pollution from chainsaws, harvesters, skidders, and trucks can disrupt the courting and nesting of birds, and can affect behavior of other wildlife. Not surprisingly, different groups of organisms respond differently to logging.

Retaining snags, trees with cavities, downed logs, stumps, bark slabs, and slash piles as animal habitat components can improve the biodiversity values of a logged area. Among the users of large live trees, snags, and large downed logs are many cavity-using and bark-void-using animals (e.g., several bats, eastern screech-owl, American kestrel, wood duck, great crested flycatcher, brown creeper, several other songbirds, southern flying squirrel). These resources are also critically important for many mosses, liverworts, lichens, fungi, and invertebrates. For these reasons the cull trees that are often removed as part of forest management for timber should really be left because of their valuable habitat functions for other organisms.

Foresters and public agencies sometimes portray logging as only positive for the environment. For example, a NYS Department of Environmental Conservation (NYSDEC) webpage on timber harvesting states "In addition to providing income, tree harvesting enhances forest health and appearance, improves productivity, wildlife habitat and recreational access, and increases property values and preserves water quality" (NYSDEC 2018). Components of that statement may be correct in some instances

* Erik Kiviat is Hudsonia's executive director.

Clearcut in Arctic China State Forest, Delaware County. Erik Kiviat © 2018

and not in others, given the great variation in sites, vegetation, logging method, biodiversity, management goals, and need for ecosystem services. Certain kinds of forest management and timber harvest can improve the economic gain from production forests (i.e., forests managed for products), but those practices do not necessarily benefit—and are often harmful to—native biodiversity, carbon storage, and water resources.

PROMOTING WEED COLONIZATION AND SPREAD

Reduction of forest canopy cover and soil disturbance associated with logging open the forest stand to colonization by, or consolidation of, weedy non-native plants such as multiflora rose (*Rosa multiflora*), Bell's honeysuckle (*Lonicera* x *bella*), barberry (*Berberis thunbergii*), tree-of-heaven (*Ailanthus altissima*), and oriental bittersweet (*Celastrus orbiculatus*).[3,21] Logging equipment may also introduce seeds of these and other weeds, and excessive cover of such weeds can inhibit tree regeneration, alter other aspects of the forest plant community, and change habitat functions. (It should be noted that some plants adversely affecting regeneration are native, e.g., hay-scented fern [*Dennstaedtia punctilobula*], and that non-native plants are sometimes favorable for certain wildlife species.) Clearcuts and log landings, where harvested logs are temporarily stored and then transferred to trucks, are evidently more susceptible than certain other types of disturbance to weed colonization, probably because of the intense soil disturbance.[13]

EFFECTS ON SOILS

Soil disturbance is an often-overlooked but a lasting effect of logging operations. Substantial soil compaction from logging equipment on skid trails persisted from 6 to 55 years in various studies in the western U.S. and one in northern Québec,[2,22] and most damage occurred after just a single skidder pass. Skid trails may cover as much as 25-35% of a timber harvest site.[2,6] Compaction of soil along trails can create a barrier to many small burrowing animals such as salamanders and small mammals, and also affects plant growth, invasive species colonization, and forest regeneration. Skidding can also cause rutting and soil erosion, and sometimes create temporary pools that may be favorable to some organisms, such as breeding American toad and mosquitoes, and act as ecological traps for others, such as breeding salamanders. In one New England study, whole-tree clearcutting resulted in removals of large amounts of nutrient elements; nitrogen was then replenished to the soils from atmospheric deposition but calcium was depleted.[10] Logging disturbance can also cause the loss of carbon from forest floors and deeper soils.[18]

STREAMS AND WETLANDS

Most wetlands and streams have no legal protection from damage during logging operations. New York State permits are required for crossing only the larger (state-classified) streams and for logging in the very large (>5 ha [>12.4 acres]) wetlands and the few small wetlands under state jurisdiction, but activities in all the other streams and wetlands are unmonitored and unregulated by the state, despite their great importance to the water quality and biodiversity of ecosystems.[14,15] Skid trails can damage streams directly, and runoff from logged areas and skid trails often carry large sediment loads into streams and wetlands.

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Burning slash in clearcut, Dutchess County. Erik Kiviat © 2018

Logging continued from page 5

DISPOSAL OF RESIDUE

Tops and slash resulting from logging are commonly left in place, chipped, piled, or burned. Brushpiles create a valuable habitat component for many animals,[7] and brushpile creation has been encouraged for at least several decades by NYSDEC and others. The fate of logging residues is important because they contain large amounts of carbon, phosphorus and nitrogen; much of the carbon returns to the atmosphere, and the phosphorus and in some cases nitrogen over-enrich streams[17] causing ecological shifts that may favor common and adaptable organisms over rare and sensitive ones. Residues can also be used as a biomass energy feedstock which may be carbon-neutral in the long term (removes as much carbon from the atmosphere as it emits, but only in time frames greater than a century[19]). However, burning forest residues for bioenergy increases near-term carbon emissions and other air pollution away from the logging site.[1] The urgency of rapidly reducing carbon emissions over the next few years to reduce global warming mandates immediate shifts to climate-positive energy sources.

GREENHOUSE GAS BALANCE AND AIR QUALITY

Woody vegetation and forest soils sequester large amounts of carbon from the atmosphere. Some carbon remains stored in lumber, wood furniture, and other long-lived forest products, but timber harvest typically results in a net contribution of carbon to the atmosphere. If the forest is used for paper production, the paper generally has a short lifetime before being burned or decomposed to release carbon dioxide. Replacement of old forests with young forests is adverse to carbon storage.[8] Logging also creates material (slash, sawdust, etc.) that decomposes more rapidly than does the natural accumulation of woody debris in a forest, releasing carbon more rapidly back into the atmosphere. Chipping slash hastens decomposition and carbon release. Burning slash and stumps, of course, creates local air pollution and returns carbon to the atmosphere most rapidly and is therefore undesirable with regard to mitigating climate change.

SOME BENEFITS

Of course, certain organisms benefit from the effects of logging. Many native and non-native plants are quick to repopulate a clearcut site and, if left unmanaged, the site will commonly develop into meadow, shrubland, and eventually forest again, although maturation of that forest may take 75 or more years. Recently, much has been made of the importance of shrublands and sapling woods for certain mammals, birds, and snakes in New York and other northeastern states, and the states and the federal government in the Young Forest Initiative are purposefully trying to establish shrublands and small-tree forests to support some of the animals of conservation concern. Many organisms, however, that are adapted to life in shade, forest interiors, on or among large trees, in extensive mature forests, or in relatively stable forest habitats, are harmed by logging. These species include many native shrubs, forest floor herbs, songbirds, birds of prey (e.g., barred owl, red-shouldered hawk), mosses, liverworts, fungi, invertebrates, and others.

Cull tree (open-grown white pine) at edge of clearcut. Erik Kiviat © 2018

Although logging roads adversely affect many aspects of the forest ecology, one study in a southern Appalachian forest found that greater light availability within 100 meters (330 feet) of logging roads apparently increased floral resources and helped bee assemblages.[11] In northeastern Pennsylvania forests, amphibian and small mammal diversity was positively correlated with tree basal area of the forest, whereas reptile and bird diversity was negatively correlated with basal area.[5] Logging reduces forest basal area and it is the basal area of the larger trees that many organisms seem to respond to. Furthermore, diversity measures do not reveal the status of individual species of animals, and the effects on rare and uncommon species might tell a different story.

A conservationist's approach to logging would begin with an assessment of soil and water sensitivities as well as potential habitat for plants and wildlife of conservation concern, so that the logging operation could be designed and carried out in ways that minimize harm to those resources. For biodiversity goals at certain sites, and for some non-habitat ecosystem services such as carbon storage and water quality maintenance, a decision not to log or to clear the forest for other purposes might be advisable. ■

Part 2 of this article, to be published in the spring 2019 issue of News from Hudsonia *(33[1]) will discuss regulation of logging, reducing the need for and effects of logging, and the relevance of climate change.*

(Gary Lovett commented on a draft of this article; E. Kiviat takes responsibility for any errors.)

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HUDSONIA PROJECT UPDATES, 2018

Biological Assessments

Flint Mine Solar. Hudsonia has collaborated with Patricia Serrentino, David Werier, Jason Tesauro, and several summer interns to perform biological surveys, habitat mapping, and biodiversity analyses on a ca. 1500-acre proposed solar photovoltaic energy site in eastern **Greene County**. The proglacial Lake Albany clay meadows and rocky, wooded knolls of this site proved to be extraordinarily rich in plant species considered rare statewide. The site also overlaps a NYSDEC-designated Winter Raptor Concentration Area. These biological resources, in combination with cultural, visual, and engineering concerns, make for a complex and interesting design challenge with little precedent. Given the process of shifting from fossil fuel based energy to renewable energy, the ability to develop utility-scale solar energy facilities and understand their interactions with biodiversity is very important. (Funded by Flint Mine Solar.)

Mountain Top Arboretum. We completed the field studies for a Natural Resources Inventory of the MTA property in Tannersville (**Greene County**), along with our collaborators—Bob and Johanna Titus (geology), Michael Kudish (land use history), Larry Federman (breeding birds), Jason Tesauro (reptiles and amphibians), and the Hawthorne Valley Farmscape Ecology Program (butterflies, moths, bees, bats). Findings included sandstones formed in ancient river deltas, glacial etchings on exposed bedrock, farms of two families from the early 1800s into the 1920s and 1930s, some unusual present-day plant communities including that of the oldest known bog in the Catskills and a large fen-like peatland, at least 40 species of sedges and 20 species of ferns, at least five bat species, and many invertebrate species that are more typical of northern latitudes, including a statewide-rare bumble bee. These and other findings will contribute to the MTA's public education programs and planning for land management and public uses of the site. (Funded by the Mountain Top Arboretum.)

Biologist Chris Graham among asters, Mountain Top Arboretum. Marc Wolf © 2018

Newtown Creek. Field work is complete for the habitat map and flora survey of this extensive industrial corridor between **Brooklyn** and **Queens**. We are still identifying plant specimens, and the list of both native and non-native species is growing. Although little can grow in the intertidal zone because of salinity and poor water quality, the flora is diverse above Mean High Water. A butterfly survey component of the project will continue next year. (Conducted in collaboration with the Newtown Creek Alliance, and funded by the Hudson River Foundation Newtown Creek Fund.)

Overmountain Conservation Area. We completed field studies on the southern part of this new Public Conservation Area of the Columbia Land Conservancy (**Columbia County**). In collaboration with the Hawthorne Valley Farmscape Ecology Program, we looked mainly at plants, butterflies, dragonflies, damselflies, moths, reptiles, amphibians, and bats. The southern part of the site has a large, intact, mature deciduous forest, several "wild hay" meadows, intermittent woodland pools, hardwood swamps, patches of spring ephemeral wildflowers, and unusually diverse communities of dragonflies, damselflies, and skippers. These and other findings will help the CLC with planning for land management and public uses of the site. (Funded by the Columbia Land Conservancy.)

Saw Kill Parcels. In collaboration with Jason Tesauro and Larry Federman, we completed habitat mapping, a breeding bird survey, and a reptile and amphibian survey of 335 acres along the Saw Kill in the Town of Red Hook (**Dutchess County**). We found a wood turtle population (NYS Species of Special Concern) and several nesting bird species of conservation concern. Next growing season we will finish a flora survey and make recommendations for trail routing and other aspects of management of this future preserve. (Funded by the Winnakee Land Trust.)

Turtles and Agriculture. As part of a larger project examining relationships of agriculture and ecology, we piloted two wood turtle studies with mark-and-recapture at the Farm Hub in **Ulster County** and Roxbury Farm in **Columbia County**, in collaboration with Jason Tesauro. These studies will continue in 2019 with an added radio-tracking component. We also drafted a broad-based review paper about agriculture-turtle interactions in the Northeast. (Funded by the Farmscape Ecology Program.)

Other Biological Assessments and Surveys. We found four state-listed rare plant species while conducting a plant survey at a fen in **Lakeville, CT,** to help assess potential impacts of removing a causeway. With Marielle Anzelone we began surveys for rare plants and non-native invasive plants at **Joppenbergh Mountain** in Rosendale (**Ulster County**), and will complete the surveys next year. The findings will help the Wallkill Valley Land Trust with planning for land management on the site. We conducted biodiversity assessments of the sites of a proposed warehouse complex in **Putnam County**, a proposed fire training center in **Ulster County**, a proposed development project on municipal forest land in **Rockland County**, and a proposed area for Critical Environmental Area designation in **Dutchess County**. An interesting question arose about the potential manner of disposal of large quantities of invasive plant (smooth buckthorn) biomass from clearing that would take place on the warehouse site. Although this is a Prohibited species under the New York invasive species law, the disposal of cut material from the wild is apparently not regulated. Many weeds readily propagate from fragments of stems or roots, as well as from seeds. (The Lakeville study was funded by the landowner; the Joppenbergh study by the Wallkill Valley Land Trust; and the several biodiversity assessments were supported by citizens' and neighbors' groups.)

Snowberry on stump in peatland at the Mountain Top Arboretum.
Chris Graham © 2018

Habitat Mapping

This year we completed the identification and mapping of significant habitats for the **City of Poughkeepsie**, the **Town of Dover** (both in Dutchess County) and the **Town of Pound Ridge** (Westchester County).

Black rat snake in Pound Ridge. Chris Graham © 2018

The habitat maps and reports from these projects provide information about habitats, plants, and animals of conservation concern, and will help landowners, municipal agencies, and others better understand how to protect biodiversity and water resources. All will be included in the Natural Resources Inventories for those municipalities. (The Poughkeepsie project was funded by the NYS Environmental Protection Fund through a grant from the NYSDEC Hudson River Estuary Program to the Environmental Cooperative at the Vassar Barns. The completion of the Dover project was funded by an anonymous donor through the Dutchess Land Conservancy. Major funding for the Pound Ridge project was from the Westchester Community Foundation and the NYS Environmental Protection Fund through the Hudson River Estuary Program.)

Natural Resource Inventories & Conservation Priorities

We completed a landscape analysis project for the Woodstock Land Conservancy (**Ulster County**) to help them further incorporate climate change into their assessments of conservation priorities for the WLC service area. We also completed a Natural Resources Inventory (NRI) for **Columbia County** which will be published in December, and are well on the way to completing NRIs for **Greene County** and for the **Town of Dover** (**Dutchess County**). These documents illustrate and describe many of the natural resources of those areas (e.g., minerals, water, plants, animals, habitats, farmland, scenic areas, recreational resources), explain their importance to local ecosystems and the human community, and offer ideas for identifying priorities for conservation. The projects were variously conducted in partnership with the Columbia County Environmental Management Council and the Columbia Land Conservancy, the Greene Land Trust and the Cornell Cooperative Extension, and the Dover Climate Smart Task Force, as part of the town's larger Climate Smart Community initiative. (Funding for all three NRIs was from the NYS Environmental Protec-

Continued on page 10

Hardwood swamp in Pound Ridge. Chris Graham © 2018

tion Fund, through the Hudson River Estuary Program [for Columbia and Greene counties], and through the Climate Smart Communities program of NYSDEC [for Dover]).

Conservation Education

In **Columbia, Dutchess,** and **Rensselaer counties** we held outdoor workshops on **Recognizing Habitats** and evaluating their condition, and the implications for land uses; and in **Ulster County** we held a two-day course on **Habitat and Water Resource Assessment for Land Use Planning**. These programs were especially for municipal officials and land trust staff who are regularly involved with matters related to land use and conservation. We also held a one-day **Inventories to Action** workshop in **Putnam County** to help municipal agencies and others with practical next steps after completing a municipal Natural Resource Inventory or an Open Space Inventory. The workshop was sponsored by the Hudson Highlands Land Trust. (All programs were conducted with staff of the Cornell Department of Natural Resources in partnership with the Hudson River Estuary Program, and were funded by the New York State Environmental Protection Fund.)

We completed a project for the **Cragsmoor Conservancy** to provide information on Cragsmoor ecology, and guidance for landowners on land management to protect sensitive habitats, plants, wildlife, and water resources. (Cragsmoor is a hamlet in the Shawangunk Ridge, **Ulster County**.) We identified and mapped habitats at Cragsmoor, and created an educational display that highlights the unusual habitats and fire ecology of the hamlet and the Shawangunk region, and offers ideas for living harmoniously in that exceptional landscape. (Funded by a grant to the Cragsmoor Conservancy from the Land Trust Alliance.)

Scientific Papers

Hudsonia staff have authored, or contributed to, papers in the publication pipeline that discuss the Atlantic Coast leopard frog, painted turtle ecology in a tidal marsh, knotweed-moss interaction, Phragmites-using organisms, bog turtle response to habitat restoration, re-survey of the flora of a bog lake after four decades, geographic distribution of clam shrimps, *Phragmites* biological control, and wetland imagery in American fiction. Let us know if you are interested in one of these topics or another subject of Hudsonia research. ■

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Cover art: "Deer in Orchard," oil on canvas, 11"x14", by Joan Stiles Bell. Joan lives in the mountains of western North Carolina and draws inspiration from local landscapes, nature subjects, and her travels abroad. Her award-winning paintings are on display at her gallery, Originals Only, in West Jefferson, NC, and also at joanbell.com.

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

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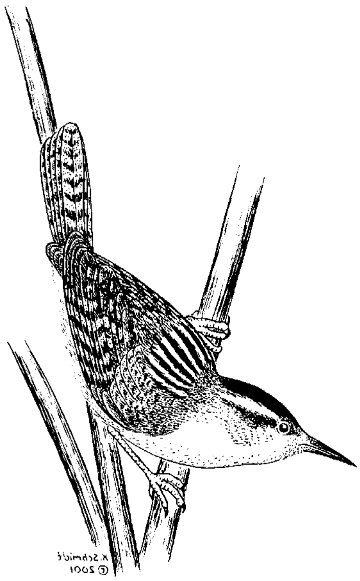

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