The New York Forest Owner

A Publication of The New York Forest Owners Association

For people caring about New York's trees and forests July/August 2023

The Ascendance of Black Birch

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In This Issue . . .

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Jeff Joseph, Managing Editor
Mary Beth Malmsheimer, Editor

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Please address all membership fees and change of address requests to PO Box 541, Lima, NY 14485 or lgooding@nyfoa.org. 1-800-836-3566. Cost of family membership/subscription is $55.

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Cover: As our woodlands evolve in response to ecological and human-induced change, black birch is poised to assume a much more prominent role in woodlots throughout New York State over the next century. See story on page 4. Photo courtesy of Jeff Joseph.

From The Executive Director

It's hard to believe that I am well into my third year as your Executive Director. The time has flown, but it has been an honor and a joy to serve all of you (hopefully, I have been at least moderately tolerable to have around too). In this short period of time, I have come to see, and would like to assure you, that NYFOA has been in good hands — but I don't mean mine, I mean the hands of your board, and most especially your President, Stacey Kazacos. Stacey has shown himself to be a dedicated member, effectively leading the organization through a lot of good changes; to see him serve in this role, it is easy to forget that he is just a volunteer. Likewise, the members of your board love their woods as much as you and passionately serve NYFOA, representing you and NY's forests well.

It has been an exciting time and we have been making progress to move the organization forward in fulfilling its mission to promote sustainable forest management and stewardship. In the last two and a half years, we have restructured our committees giving them renewed purpose and direction; we are implementing a strategy to develop membership; we are trying to form strategic long-term partnerships with industry and other kindred organizations; we continue to expand our relationships with state agencies; we have made NYFOA known to, and a resource for, policy makers, making your voice heard on forest policy issues; we are giving more focus on programs (see page 11 in this issue for information about regional conferences coming your way this fall); we have given more support to your chapters, and facilitated coordination between them; we continually assess organizational function to better serve you. All this effort has been made from a commitment to you, to make your membership more valuable, and ultimately to fortify NYFOA as the leading organization to educate and advocate for NY forest and woodlot owners, for you.

However, no one person made any of this happen — it was a team effort consisting of your officers, your board members, your committees, and your chapter leaders. It has been made possible by committed members graciously volunteering their time to NYFOA — to make it valuable for you. Without these devoted volunteers, NYFOA wouldn't be much more than a magazine publisher. I would encourage you to thank these volunteers when you see them.

But, in the spirit of Uncle Sam famously proclaiming, "I want you," **your NYFOA needs you**. I'm sure you've heard the phrase "the world is run by those that show up." While we cannot thank our volunteers enough for showing up, their energy and passion is not infinite; they cannot serve forever. You've also probably heard of the 80/20 rule, where 80% of the work is done by 20% of the people, but for NYFOA it is closer to 90/10, and the truth is that we need more volunteers

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The mission of the New York Forest Owners Association (NYFOA) is to promote sustainable forestry practices and improved stewardship on privately owned woodlands in New York State. NYFOA is a not-for-profit group of people who care about NYS's trees and forests and are interested in the thoughtful management of private forests for the benefit of current and future generations.

The Ascendance of Black Birch

By Jeff Joseph

New York's woodlands are constantly evolving, both in response to human activity and to broader, longer-term patterns of ecological change. A major upshot of this evolution is that tree species rise and fall in abundance, sometimes quite dramatically and abruptly, such as when eastern hemlock (most likely due to insect predation) nearly disappeared from the fossil pollen record between 4-5,000 years ago, before rebounding to its current ubiquity across our landscape, only to begin to decline once again in recent years after falling prey to the hemlock wooly adelgid (HWA). The decimation of elm and chestnut populations are two of the most severe examples from the 20th century, and of course ash is the latest victim of non-native insect infestation, leaving us to watch helplessly as the emerald ash borer (EAB) onslaught moves all too quickly through our woodlots.

A rapidly warming climate is playing an ever-increasing role in shifting the species mix of our forestlands, increasing stress on the most susceptible trees, if not killing them outright. While tree ranges surely can and will move in response to fluctuations in climate—consider that approximately 20,000 years ago much of New York State was covered with ice about a *half-mile* thick before trees roared back onto the scene once the Laurentide ice sheet receded at the end of the last glaciation—they simply cannot move at anything close to a pace that matches the rising temperatures recorded over the past few decades.

Data from a recently discovered archive of growing season records from the late 19th century in northwest Ohio (close enough in distance, climate, and flora to be relevant for us) shows that current hardwood growing seasons have extended by 20 to 26 days annually since that time, yet with no net change in the amount of rainfall. While the effects of this shift are complex, it is undeniable that with such a rapid and extreme lengthening of the growing period, forest trees will be more susceptible to late spring frosts (such as the historic one we just experienced in much of New York in mid-May of this year), that pollination may be disrupted for many species, that there will be increases in insect and disease infestations, and that soils will be drier, with more likely occurrences of drought stress compounding the effects of the other stressors.

Figure 1. *Betula lenta* foliage.

Factoring this climate data with the number of other insect and/or disease vectors immanent, right now it feels like there is a lot of bad news coming from (or for) our woodlots, and it is all too easy to feel like we are just waiting for the next shoe to drop. Which may be true. But life goes on.

As one species declines, a new ecological niche is created, and as someone once wisely observed, nature abhors a vacuum, so vacant spaces in the soil and canopy are quickly claimed by those trees most capable of taking advantage. With the current changes in progress, one of the species best poised and most likely to fill this void across much of New York State is *Betula lenta*, or black birch, which to date has been considered a relatively minor player—both

Figure 2. Young black birch stem with characteristic lenticels.

Figure 3. Pole-sized black birch stem: smooth grey bark with raised, elongated lenticels.

in the marketplace and in the ecology of New York's forests. With this in mind, a closer look at the biology, ecology, and utilitarian values of this species seems warranted.

Black birch is a fairly common tree throughout most of New York, excepting the Adirondack region, where yellow and paper birches predominate. It approaches the northern terminus of its range here and across southern New England, extending down the Appalachians as far south as northern Alabama and Georgia. Also known as sweet or cherry birch, it is in the Betulaceae or birch family, which in addition to the birches includes the alders, hazels, and hornbeams.

Like the other trees in its family, black birch leaves are simple, alternate, and ovate in shape, around 2-4" in length, with distinctive double-toothed serrations around the leaf margins (see Figure 1). "Black" birch is actually a bit of a misnomer in my opinion, as the bark is really more of a pale grey to light charcoal in color, but the trees *can* look "black-ish" at a distance. Like all the birches, black birches display very prominent lenticels (pores for gas exchange), both on the bark surface, where they look like raised white dashes that run around the trunk's circumference, and on the twigs and younger branches, where they look more like elongated white dots (see Figure 2).

Behind the lenticels, the bark of young trees is smooth, whereas the bark of older trunks breaks into large flaky plates that curl away from the stem, leaving a more coarsely textured surface (without the prominent lenticels) behind the curling, lenticel-laden plates (see Figures 3 and 4). This is quite distinct, so once you've seen it, you'll know it thereafter. Twigs and young stems are a reddish-brown color. Both the twigs and the inner bark are aromatic, with the strong scent of wintergreen.

Black birch is monecious (with each tree carrying both male and female flowers), and is wind-pollinated. Both male and female flowers are catkins, with the males starting out upright at the ends of shoots, later to elongate and hang downward when releasing pollen. The upright seed catkins form on short shoots, and turn into small cone-like structures known as strobiles that are comprised of scales holding the minute, winged seed. Once mature, the strobiles slowly break apart in the late fall, with each tree releasing massive amounts of seed that can be blown long distances by the wind, and can often be seen dotting or skating across the snow in winter.

While black birch is present in 12 different forest cover types through its range, it is not dominant in any, and although it will seed in prolifically after a disturbance such as a clearcut, it rarely grows in pure stands, as the vast majority of stems will die due to competition in the first 20 years or so. Like all birches, bare mineral soil is best for seed germination, though it will also readily sprout on rotting logs and stumps, creating distinctive stilt-roots as the substrate decays (see Figure 5). It prefers soils that are fertile, well-drained, and acidic, thriving best on moist north- or east-facing slopes. While often present on drier and poorer soils, it will be readily outcompeted by oaks and/or pines there.

Black birch is classified as low in shade tolerance, so is an early-successional species, but does require some light shading in its early years in order for its small seed with minimal reserves to germinate, as well as for its seedlings to successfully take root. Over time, it will decline if overtopped by competing trees. Regeneration can also occur by stump sprouting, but primarily only while the trees are young. Growth rates begin to decline after a century or so, when trees are +/-16" DBH, but diameters of 24"+ are not uncommon, with heights ranging up to 80 feet.

From a utilitarian standpoint, black birch has many positive attributes. While birch lumber in general is hard and dense, black birch is the hardest and densest of all our native birch species. Weighing in at 46

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Ask A Professional

Peter Smallidge

Peter Smallidge

Landowner questions are addressed by foresters and other natural resources professionals. Landowners should be careful when interpreting answers and applying this general advice to their property because landowner objectives and property conditions will influence specific management options. When in doubt, check with your regional DEC office or other service providers. Landowners are also encouraged to be active participants in Cornell Cooperative Extension and NYFOA programs to gain additional, often site-specific, answers to questions. To submit a question, email to Peter Smallidge at pjs23@cornell.edu with an explicit mention of "Ask a Professional." Additional reading on various topics is available at www.forestconnect.info

Managing for oak: ecological and social values

Editor's Note: *Due to the length of this article, it will be presented in two parts, with the second part appearing in the September/October issue of* The New York Forest Owner.

Question: I don't have much oak in my woods, but I've heard that oak in general is in trouble. Is this another pest issue, or what's going on with oak? (Jen, CNY)

Answer: The oak genus is amazing in its breadth of values, geographic availability, uses, and the awe it tends to inspire in woodland owners. There are no eminent pests or pathogens currently known as common and widespread threats to oak, such as exist with white ash and eastern hemlock, but the solutions to oaks' forecasted future scarcity may be just as challenging to resolve.

Oak is in the genus *Quercus*, which includes about 450 species worldwide. Oak is in the family Fagaceae that also includes American beech and American chestnut. The US Forest Service silvics manual lists 25 oak species, which would represent most of the commercially important oaks in North America (search the internet for "silvics manual"). The geographic range of the oaks contributes to their popularity and familiarity as seen by the wide geographic distribution of white oak (Figure 1) and northern red oak (Figure 2) from the USFS Silvics Manual.

While oak remains present in the canopy of many NY and eastern forests, the concern is with the tendency for oak species to be absent from the understory. The replacement potential of oak is in question, and thus concerns about future scarcity. This issue has gained sufficient attention in some states that the White Oak Initiative was formed with private, industrial, state, academic, and federal partners from a multi-state region in the Ohio River valley and mid-Atlantic states. Their goal is to ensure that oak, especially white oak, remains abundant and healthy (*www.whiteoakinitiative.org*). In NY the DEC's 2015 Forest

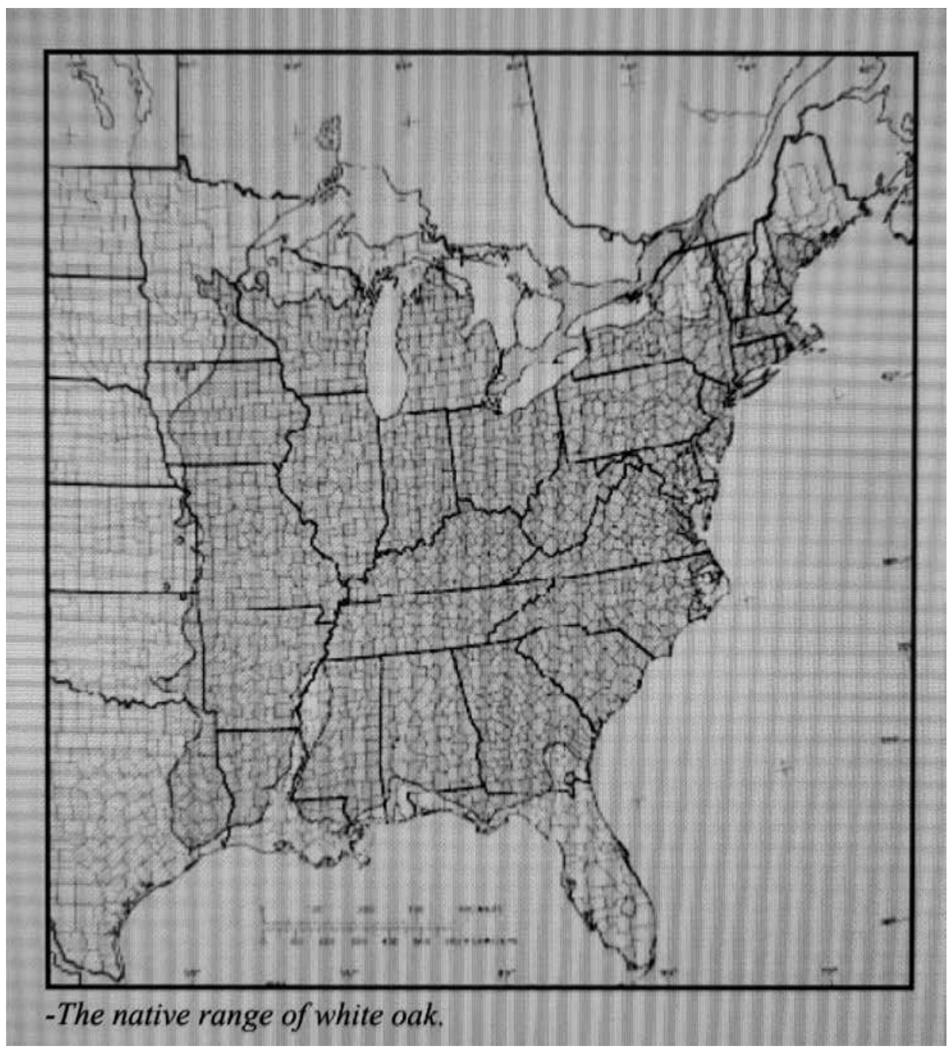

Figure 1. The geographic distribution of white oak includes most of the eastern United States. (photo adapted from the USFS Silvics Manual at https://www.srs.fs.usda.gov/pubs/misc/ag_654/table_of_contents.htm

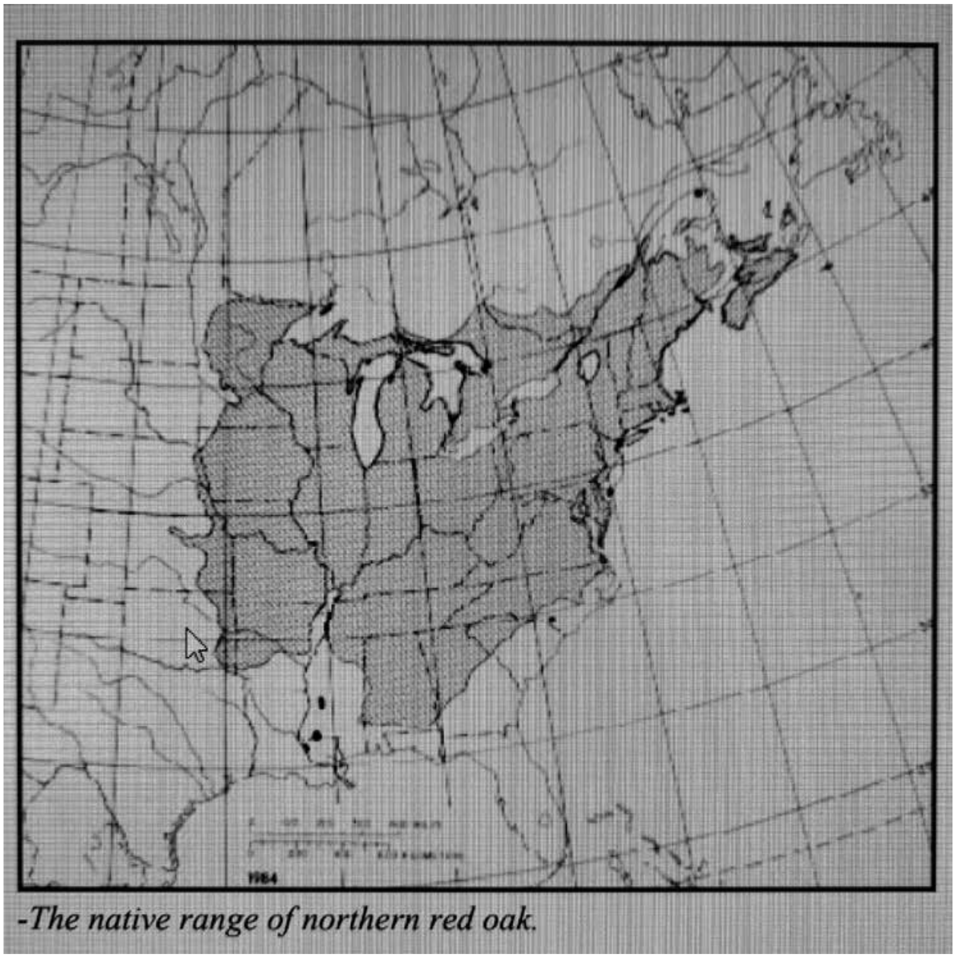

Figure 2. The geographic distribution of northern red oak extends slightly further north and not as far south as that of white oak. (photo source, same as Figure 1)

Resource Assessment shows a decline in the abundance of northern red oak saplings (1 – 5” diameter) and growing stock (larger than 5” diameter) although the abundance of many other common species is stable or increasing (page 42, NYS DEC Forest Resource Assessment and Strategy, 2015). The volume of existing mature northern red oak has increased, but it doesn’t appear to be replacing itself.

In NY, the USFS Forest Inventory and Analysis estimates there are more than 45 million white oak (white, swamp white, chestnut and bur oaks) stems larger than 5” in diameter at breast height (dbh). The top ten counties for numbers of stems are Ulster, Sullivan, Orange, Steuben, Dutchess, Suffolk, Jefferson, Greene, Columbia, and Rensselaer. The top ten counties contain about 65% of the white oak stems larger than 5” dbh in NY. In terms of board-foot volume, these “white oaks” (see below) are estimated to total more than 3 billion board feet among most of the same counties though with the inclusion of Washington, Cattaraugus, and Otsego. The top ten counties contain about 65% of the board-foot volume of white oaks in NY.

Why the interest in oak?

Oak has benefits that align with the interests of almost everyone. Most people, even those without a woodland connection, know that acorns are the seeds of oaks and that wildlife “like” acorns. As many as 100 vertebrate wildlife species eat acorns, and acorns can constitute as much as 75% of the white-tailed deer’s fall and winter diet. Wood frogs grow better in vernal pools layered with oak leaves. Professor Tallamy of the University of Delaware reports that more than 500 species of moth and butterfly, Lepidopteran, larvae use oaks. These Lepidopteran and other insects that use oak are the foundation of complex food webs and ecological dynamics in these eastern forests.

Oaks supply unique and valuable lumber. White oak containers (usually barrels but other shapes are allowable) are required for use in the production

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Figure 3. White oak lumber is prized for its mellow color, grain pattern, strength, and durability.

Figure 4. White oak can attain massive size. While slow growing, their longevity allows for impressive stature. This white oak, in NY's Lake Champlain valley, is approximately 5 ft in diameter.

of bourbon, the official native spirit of America. Oak lumber is the quintessential material of the American Arts and Crafts – Mission Style – of furniture (*https://www.museumaacm.org/furniture.html*), and oak lumber is popular among furniture makers and hobbyists for a variety of uses (Figure 3).

Aside from the tangible benefits of oak to wildlife vertebrates, humans, and insects, oaks provoke images of resilience and awe (Figure 4). The often robust, massive-crowned habit of oaks creates a sense of power and majesty. Perhaps related to the sense of awe inspired by oak was the important role it often played occupying the ecological void created by the death of American chestnut. Additional information about the values of oak are available at the White Oak Initiative website.

The identification and ecology of oak

The oak genus is divided into two subgenera known as the red oak and white oak groups. Some common NY species in the red oak group include northern red oak (*Quercus rubra*), black oak (*Q. velutina*), pin oak (*Q. palustris*), and scarlet oak (*Q. coccinea*). The white oak group includes white oak (*Q. alba*), chestnut oak (*Q. montana*, formerly *Q. prinus*), swamp white oak (*Q. bicolor*), and bur oak (*Q. macrocarpa*).

One distinguishing feature of oak is the presence of a cluster of buds at the terminal end of each twig (Figure 5). The vascular tissue that supports the bud cluster results in a star-shaped pith when the twig is cleanly sliced in cross-section. The shape of oak foliage is usually that of lobes and sinuses, with the red oak group possessing a bristle tip on each lobe. The lobes of the white oaks are rounded. However, shingle oak has an entire (meaning smooth) margin and the classic oak-leaf lobing on chestnut oak is subdued to coarsely rounded but large teeth known as a crenate rather than a lobed leaf margin. Red and white oaks are further described in this magazine, 2016 no. 5 (available at https://nyfoa.org/resources/archives-new-york-forest-owner/2016). A full taxonomic description of NY oaks, with outstanding photography, is available in "*Trees of New York State Native and Naturalized*" by Donald Leopold.

It is not surprising that a genus as diverse as *Quercus* has considerable variability in its ecological presence and pattern. On dry sites you are more likely to find white, scarlet, chestnut, and black oak. Moist sites will have northern red oak, and on wet sites pin and swamp white oaks. Bur oak can be found on either moist or dry sites, often associated with limestone soils. On the drier sites oak tends to be competitive, reproducing more easily and growing successfully. On the moist and fertile sites, oak seedlings struggle to compete with other hardwoods.

Acorn production and distribution is sporadic, although acorn formation is more regular. Most of the variation in annual acorn production is due to survival and viability of the female flowers, with weather being a key determinant. White oak acorns do not store in the leaf litter and red oaks store for up to 6 months. White oak has good acorn production in 1 of 4 years, and red oak in 1 of 3 years (average normal acorn production is approximately 1,000 to 10,000 acorns per acre). A bumper or "mast" crop year might occur 1 in 7 years and yield 200,000 acorns per acre. Tree size, not

Figure 5. All of the oaks, such as the northern red oak pictured, have a cluster of buds on the terminal end of the twig; this feature is defining for the genus.

Figure 6. This northern red oak root was dug from a stand 3 growing seasons after an initial regeneration harvest. The root, though broken from digging, is about 0.75 inches in diameter and likely reflects many years of top dieback and resprouting that took advantage of the now increased sunlight.

age, is the best predictor of which trees produce acorns; 96% of canopy dominants and 75% of codominants produce acorns, yet only 38% of oaks with an intermediate crown position produce acorns.

Oak seedlings differ from other hardwood seedlings in their tendency to prioritize root growth over stem growth in their early years. Acorns of the white oak group mature in one growing season, drop in the fall, and immediately push out the first root known as a radicle. Within a few days a large portion of the energy stored in the acorn is redistributed from the embryo to the radicle. Stem growth begins in the spring. In the red oak group, acorns mature over two growing seasons, also dropping in the fall, but not germinating until the spring. The two growing seasons allow managers to anticipate the size of the red oak acorn crop. Oak seedlings may have multiple growth phases or pulses each year, with each pulse allowing some of the energy to be stored in the stem and roots.

Another feature of oak seedlings through small sawtimber, is the tendency to accumulate dormant buds on the root collar below the ground line as compared to those buds forming above ground on other hardwoods. The location of the buds and the stored energy reserves allow oaks to sprout if the stem is damaged, cut, or top-killed. In fact, oak seedling stems often die back due to environmental stressors and subsequently resprout. In the absence of established seedlings, sprouting of saplings and small sawtimber trees might be the only way to bring oak into the next forest. The potential for oak to prioritize root growth (Figure 6) and the presence of below ground dormant buds able to sprout following stem dieback favor the oak in situations of low-intensity chronic (e.g., livestock grazing) or more intense episodic disturbances (e.g., fire).

Peter Smallidge, NYS Extension Forester and Director, Arnot Teaching and Research Forest, Department of Natural Resources, Cornell University Cooperative Extension, Ithaca, NY 14853. Contact Peter at pjs23@cornell.edu, or (607) 592 – 3640. Visit his website www.ForestConnect.info, and webinar archives at www.youtube.com/ForestConnect. *Support for ForestConnect is provided by the Cornell University College of Agriculture and Life Sciences and USDA NIFA through McIntire-Stennis, Smith-Lever and the Renewable Resources Extension Act.*

Wild Things in Your Woodlands

By Devon Davis and Kristi Sullivan

Big Brown Bat (*Eptesicus fuscus*)

The big brown bat (Eptesicus fuscus) is the largest cave bat species in New York State. Despite their name, they only have a 13–14-inch wingspan. Besides their comparatively larger size, they can be identified by their long, brown, oily fur, dark, rounded ears, and black wings and tail. Females tend to be slightly larger than males. Mating occurs during fall and winter, but females store sperm until the spring. During the spring, males roost individually or in small groups, while pregnant and nursing females form large maternity roosts. Females give birth to one or two pups, born blind and naked, in late May to early June. Though maternity roosts can contain hundreds of individuals, mothers can identify their own young. They are nursed for up to five weeks. The young learn how to fly at around three to five weeks old, and how to forage after approximately five to seven weeks. They then become independent of their mothers. Big brown bats can live up to 18-20 years in the wild. However, many young fail to store enough fat to survive their first winter.

As one of the most common bat species in North America, big brown bats can be found anywhere throughout the continental United States. They are found in all parts of New York State. Being nocturnal creatures, their presence often goes unnoticed, and their calls are too high-pitched for the human ear to detect.

Big brown bats can be found in nearly all habitats in New York State. They are an extremely hardy bat species and can tolerate colder and drier conditions than many others. They frequent deciduous forests and clearings adjacent to human development to find prey, as they tend to roost in human-made structures such as mines, barns, bat houses, buildings, and bridges. They roost less commonly in caves, tree cavities, and loose bark. During the cold winter months, they will hibernate in these spaces to stay warm and hide from predators.

Big brown bats are an especially important species. As insectivores, they primarily feed on beetles, moths, flies, wasps, and several other flying insects. Big brown bats can control populations of crop and forest pests, such as cucumber beetles, ground beetles, scarab beetles, snout beetles, moths, and stink bugs. Using echolocation, they can detect prey and avoid obstacles, allowing them to consume insects efficiently and in mass amounts. A single bat can eat its weight in insects (thousands) in just one night!

Unfortunately, several other bat species, such as the little brown bat, have faced severe declines due to white-nose syndrome (WNS), an invasive fungal infection that infects hibernating bats and slowly starves them to death. Luckily, the big brown bat has fared much better than most, possibly due to their larger size and fat reserves. However, big brown bats are still susceptible to WNS, and the impacts should continue to be monitored. Predation is the most prominent threat to big brown bats. Their natural predators include large birds of prey, snakes, and raccoons, which typically target young bats or bats leaving the roost to hunt. Feral cats or cats left to roam freely outside also predate on big brown bats.

Though big brown bats are currently listed as "least concern," and their populations are relatively stable, their protection is still important. As development increases, big brown bats will continue to make their way into human-made structures, including homes. The best way to lure a bat out of a house is to provide an alternative bat house, which can come in many shapes and sizes. Bat houses can be easily constructed and provide mutual benefits for bats and homeowners alike (*https://www.batcon.org/article/bat-houses-the-secrets-of-success/*). Bats can continue to control insect populations without impacting the homes and other structures of landowners. Keeping cats indoors, especially if bats are known to be roosting near the property, is an important way to protect roosting bats, and especially young.

In our forests, protection and management of mature stands of forest is important for conserving bats. Thinning can encourage big brown bats to forage and roost. Linear corridors are important for foraging bats, so maintaining forest habitat adjacent to roadways, skid trails, and riparian buffers can benefit bats. Landowners can also help bats by reducing or eliminating burdock (*Arctium minus*), an exotic weed that produces seeds that trap bats and cause death from exposure. Maintaining or creating snags or cavity trees, especially those near known roost locations, can provide roosting habitat for bats in the summer. Woodland seasonal pools may be important foraging and water

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sources for the big brown bat and others because they provide areas for feeding and drinking in an otherwise closed-canopy forest.

By being aware of the needs bats have, and taking steps to provide roost sites either in the forest or near human habitation, landowners can witness the peculiar and unique behavior and appearance of these important animals, all while allowing them to fulfill their significant ecosystem duties.

Devon Davis is a Program Assistant for the New York State Master Naturalist Program, directed by Kristi Sullivan at Cornell University's Department of Natural Resources.

More information on managing habitat for wildlife, and the NY Master Naturalist Volunteer Program, can be found a https://blogs.cornell.edu/nymasternaturalist/ Photo credit: Erin Adventure on Flickr

From the Executive Director (continued)

— we need your help. We currently have one vacancy on the board, with more terms expiring next year. We need those willing to eventually serve as officers; our committees would welcome more help; your chapters need help on their steering committees; there are voids throughout where members had to step away from leadership abruptly after many years of service; we need everyone to be an ambassador recruiting new members. I know that everyone has busy committed lives, but I am sure that you've also heard that old saying that "many hands make light work." Well, it still holds true and if you are willing to be one of the many sets of hands, even in the smallest of ways for NYFOA, it will make light work for all, it will help NYFOA continue to be all that it is and more. I hope you will consider serving. **If not you....then who?**

If you would like more information on how you can help, please feel free to contact me directly: *cvollmer@nyfoa.org* or 716-237-0880.

Until next time...go to the woods — take it all in and love it until you can't.

–Craig Vollmer
NYFOA Executive Director

SAVE THE DATE!

NYFOA 2023 REGIONAL CONFERENCES

NYFOA is excited to bring to you four regional conferences to be held across the state this fall that will be accessible to all members (and non-members). If you prefer to stay close to home, one will be held nearby, or you may live where you can choose from more than one; but if you're looking for a reason to get away or can't make the one nearest you, you can choose from any of the other conferences to attend instead.

Hudson Valley Region – September 9th
Adirondack Region – September 30th
Central New York Region – October 14th
Western New York Region – November 4th

The agenda will be similar for each conference and cover a wide variety of topics that may include presentations on bears (or possibly moose in the Adirondacks), estate planning for the forest owner, timber markets, planting trees for waterways and wildlife, federal cost share programs, invasive plants and insects, timber management, slash walls for deer exclusion, maple sap production, bird habitat management, a field demonstration in the use of the forest resiliency score card, and updates on the 480a regulations and the Regenerate NY cost sharing.

The final agenda, location details, and registration information will be available by mid-August.

Watch the NYFOA website at ***https://www.nyfoa.org/events/statewide-events*** to register on-line, or to request this information be emailed to you please contact the NYFOA office by email at ***info@nyfoa.org*** or call 1-800-836-3566. We will put out reminders and notifications by email and in the next issue of the Forest Owner.

We hope to see you there.

Woodland Soil Science: An Overview

By Russell Briggs

Soil is an amazing resource, beautiful in its complexity, and essential to our wellbeing and continued prosperity. Soil can be viewed as a system, consisting of four components: The first two, mineral particles and organic materials, comprise the matrix. The second two, air filled pores and water filled pores, consist of space. The ideal distribution of these four components allows for delivery of both oxygen and water to root systems while providing physical support (Figure 1). This configuration allows trees to 'be all that they can be' with respect to growth and development (i.e., highly productive).

As stewards of forest land in NY, you are familiar with the vast array of goods and services that forests provide beyond merely rapid growth of high-quality wood and other forest products. Motivated by the need to make everyone, not just forest landowners, more aware of this multitude of benefits, the concept of ecosystem services was developed. Ecosystem services, which refer to the goods and services provided by an ecosystem, are categorized in four groups: provisioning (production of food and fiber), regulating (climate, water quality, pollination), supporting (nutrient cycling), and cultural (aesthetics, cultural heritage, recreation). Viewing the forest through the lens of ecosystem services shines a light on the central role of soil.

As landowners, you recognize soil's role in provisioning ecosystems services via production of food and fiber. We take advantage of that production to help defray the costs or owning forest land. You may be less familiar with soil's wider role as a biogeochemical membrane, regulating the transfer of energy, water, and gas among the three earth systems: the atmosphere, the lithosphere (upper portion of the earth's crust), and the hydrosphere (the interconnected system of surface waters and groundwater). This perspective places soil at the center where these global systems intersect. Let's bring this global look down to a local point in the forest.

How does this exchange play out when we stand under the forest canopy on a rainy day? As precipitation drips off tree foliage, water infiltrates into the soil system. A wide array of organic and inorganic materials are filtered out as water continues its journey through the soil. Some of that water will make its way to the hydrosphere; some will be temporarily stored and later returned to the atmosphere via transpiration. As the large pores empty, water is replaced by air; oxygen makes its way through the air-filled pores to tree roots while carbon dioxide produced from root respiration makes its way out. Water movement is directly related to soil aeration. Tree roots, along with the organisms responsible for nutrient cycling depend on both water and aeration.

As we age, we develop an appreciation for our history as we seek to understand how we came to be. Soil plays an important role, preserving cultural legacies over time scales ranging from hundreds to thousands of years. Relict stone walls and foundations of long abandoned houses and barns throughout NY and New England reveal a recent past of colonial settlement and abandonment of lands poorly suited to crop production. European settlers cut down mature forests and introduced the plow, converting forests to crop and pasture lands. At its agricultural peak in the 1830s, 65% of New England was in fields, pastures, and orchards. The indelible footprint of the plow remains visible some 200 years later in the soils beneath present day secondary forests that developed on those abandoned lands. Going back in time even further, the presence of Indigenous Peoples' artifacts reveals a history prior to the arrival of Europeans. Changes in land use, along with processes responsible for soil development, are permanently etched into the land surface and soil profile morphology. Our journey to understand forest soils begins with a soil pit, which provides a window into soil processes as well as past land use within the soil profile (vertical face of a soil pit) itself.

Distinguishing Features of Forest Soils

Although obvious in hindsight, it is worth noting that forest soils develop under the influence of a tree canopy, leading to three features that are unique relative to other land uses. The first, the forest floor,

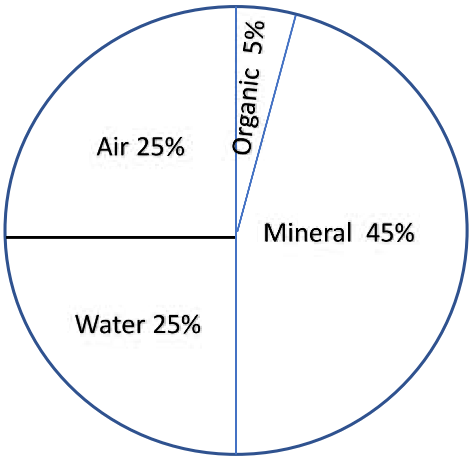

Figure 1. The ideal distribution of components of the soil system to support maximum biological productivity.

results from accumulation of annual inputs of foliage, along with irregular inputs of twigs, branches, and tree boles over time. The second unique feature is the presence of root systems that persist for time periods ranging from decades to centuries and even millennia. Large channels and pores remain behind as root systems decay, adding to those created by burrowing animals. Those large pores and channels have been dubbed biotic megapores. One study conducted by the US Forest Service documented that 30% of the volume of surface soils in an oak stand in Ohio was comprised of those large pores. Those channels and pores serve as a conduit for water, which drains via gravity. The capacity to transmit a large volume of water combined with the surface protection afforded by the forest floor explains why forest systems are the benchmark for natural erosion rates.

A diverse array of organisms, ranging in size from macro to micro, is the third feature. These organisms, which comprise large, intricate food webs, utilize aboveground plant litter and belowground products of root systems for both energy and habitat. Plant litter is transformed from foliage, branches, and other plant parts into a highly decomposed and resynthesized material known as humus, which remains in the soil for hundreds to thousands of years. Consequently, the forest floor exists in a continuum of decomposition beginning with raw plant litter at the surface, transitioning to humus below. We deal with this continuum by defining three discrete layers or horizons: Oi (fibric), material which can be identified as to original plant part; Oe (hemic), material that is masticated and partially decomposed; and Oa (sapric), highly decomposed and resynthesized by bacterial and fungi into a material commonly referred to as humus.

Both above and below ground organic inputs play an important role in carbon sequestration. Multiple cohorts of fine roots produced each year continually add organic carbon via root exudates and tissue sloughing. Fine roots are relatively short lived; their mortality contributes to soil organic carbon. The amount of organic carbon added belowground is often as great or exceeds that added aboveground. Whereas we are reminded of the latter every fall, we often fail to appreciate the former, in accordance with the adage '*Out of sight, out of mind*'.

Morphology of the Mineral Soil Horizons

Below the forest floor lies the mineral soil, defined as material containing less than 20% organic carbon. The mineral master horizons, A, E, B, and C are defined based on their morphology, which reflects the chemical processes acting upon the parent material. Horizon terminology provides a useful means to convey field observations consistently. It is important to note that every profile may not contain all four master mineral horizons.

The A horizon, a surface horizon often referred to as topsoil, is an intricate mixture of mineral particles and highly decomposed organic matter, which imparts dark color and high nutrient and water supplying capacities. Typically, in terms of water holding capacity and source of plant nutrients, the A horizon is the richest part of the soil profile. When European settlers cleared the forests and plowed the fields, organic and upper mineral horizons were thoroughly mixed, creating a mineral A horizon with a smooth, abrupt lower boundary at the depth of plowing. Several years of plowing imprinted this morphologically distinct Ap horizon (lower case p indicating it was plowed) permanently into the landscape. This agricultural legacy persists in the soil profile today under forests that developed in abandoned farm fields and pastures.

The E horizon, underlying a forest floor or an A horizon, is characterized by its light gray, bleached color which reflects how it was formed. Decomposition of organic matter generates organic acids, which are

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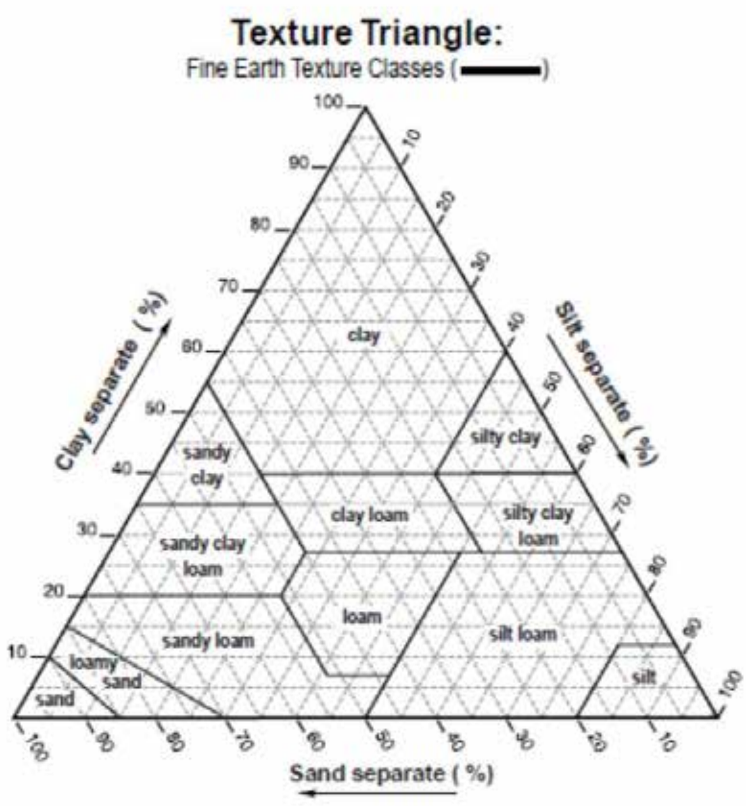

Figure 2. Soil texture classes are defined by percentages of sand, silt, and clay.

Characteristic	Soil Textural Class			
	Sand	Loam	Silt loam	Clay
Internal drainage	Excessive	Good	Fair	Fair to poor
Plant available water	Low	Medium	Very high	High
Tillability	Easy	Easy	Moderately difficult	Difficult
Runoff potential	Low	Low-medium	High	Medium-high
Water detachability	High	Medium	Medium	Low
Water transportability	Low	Medium	High	High
Wind erodibility	High	Medium	Low	Low

Table 1. Soil texture impacts on key soil characteristics.

carried downward in percolating water. These acids remove organic matter and sesquioxide (oxides of iron and aluminum) coatings from the mineral particles, leaving a distinct light gray ('bleached') color of quartz and feldspar grains. This acidic leaching process is referred to as podzolization, a term dating back to the mid-1800s Russian soil scientist Dokuchaev. Currently, we refer to these soils as Spodosols.

The B horizon, a subsurface horizon, is defined as currently undergoing pedogenesis (chemical change). Depending on parent material and climate, the nature of the change can vary. For example, in coarse textured soils in the northeast, organic matter, sesquioxides, and clay particles can be leached from overlying A and E horizons via percolating water and deposited into the B horizon, a process referred to as illuviation. Morphologically, this generates a striking change in color compared to the overlying horizon. The B horizon may be darker (more organic matter) and/or brighter red and yellow (iron sesquioxides) compared to the overlying A or E horizon. In carbonate-rich parent materials in areas with less rainfall, carbonates may be dissolved and removed from the B horizon. The horizon below such a B horizon displays lighter color due to increased calcium carbonate. In both cases, the chemical changes in the B horizon are reflected in the contrast in color and structure relative to the overlying horizon.

The C horizon is characterized by much slower, almost imperceptible rates of change relative to the overlying B horizon. The lighter color (relative to the horizons above) indicates low organic matter content, a low rate of biological activity, and minimal movement of materials into or out of the C horizon. Roots are few and far between. Fluxes of energy, water and gas are minimal relative to horizons above; the term quiescent comes to mind. Bedrock, when present in the profile, is designated with the letter R.

Soil horizons develop over time, depending on parent material, landscape position, climate, and organism activity. This development is a fascinating story that is described in the State Model of Soil Formation, attribute to Hans Jenny (more about these details in a future installment).

Fundamental Soil Physical Properties Influencing Soil Management

Two soil physical properties that have a tremendous influence on natural resource management are soil texture and soil structure. Soil texture is the relative proportion of the primary particles: sand (2-0.05 mm), silt (0.05 – 0.002 mm) and clay (<0.002 mm), defined by their effective diameter (in parentheses). Sand size particles, relatively large, do not attract water to their surfaces and have large spaces or pores between them. The smaller clay particles attract and hold water; pore sizes are small so that water is held against the force of gravity. Silt size particles are in the middle. The differential capacity to attract and hold water means that soil texture has a tremendous impact on fluxes of energy, water and gasses (e.g., O_2 and CO_2) through the soil system, directly impacting ecosystem services. Soil texture gives us a great deal of information regarding the capacity of soil for a variety of uses, ranging from tree productivity to constructing skid trails. For example, sandy soils have low plant available water, which increases with increasing clay (Table 1 above); they are more 'forgiving' of harvesting equipment travel.

Sandy soils are dominated (> 85%) by sand sized particles while clay soils are dominated (>35%) by clay sized particles. Silty soils are dominated (80%) by silt sized particles. When no single particle size dominates, the textural class is loam. The loam textural classes are further modified or fine-tuned depending on the amount of sand, silt, and clay (Figure 2).

Soil structure refers to the aggregation (i.e., clumping) of the primary particles into secondary units referred to as aggregates or peds. Clay and humified organic matter combine and serve as the glue that holds mineral particles together in water stable aggregates. Soil structure modifies the effects of soil texture. Spaces between soil aggregates allow water to move under the force of gravity so that water drains readily from the soil. Pore spaces within aggregates are small and hold water against the force of gravity. Thus, aggregation provides the best of both worlds- soil moisture retention and soil aeration.

Skidding and harvesting equipment can negatively impact soil structure, especially if used in wet conditions. Destruction of structure reduces the large pores that allow water to move through the soil thereby reducing aeration. Care must be taken to minimize soil compaction and disturbance when machinery is operated on forest soils and skid trails. Thinking back to the discussion of the need for both water and aeration, maintaining soil's capacity to transmit energy, water, and gas is key to soil management. Soil management boils down to maintaining, that is not reducing, fluxes of energy, water, and gas. The use of forestry Best Management Practices (BMPs) to protect both water quality and site productivity is essential to support sustainability of ecosystem services that are provided by these amazing forest systems.

Russell Briggs, Distinguished Teaching Professor at SUNY ESF, has been teaching soils and directing the Forest Soils Analytical Lab since 1995.

Would you like to see an article about a particular topic we haven't covered?

Please send your suggestions to:
Mary Beth Malmsheimer, editor at mmalmshe@syr.edu
or
Jeff Joseph, managing editor at jeffjosephwoodworker@gmail.com

THANK YOU LIANA!

Please join us in thanking NYFOA's Office Administrator **Liana Gooding** for her dedicated service, outstanding performance, and for keeping us all in line for the last 18 years.

Liana has been a real asset and caring friend to the leaders and members of NYFOA, and she will be sorely missed.

Congratulations on your retirement in September. You've earned it.

Welcome New Members

We welcome the following new members (who joined since the publishing of the last issue) to NYFOA and thank them for their interest in, and support of, the organization:

Name	Chapter
Eli Arnow	CDC
Richard Auer-Weisbach	NAC
Brooke Finley	WFL
Joseph Galante	WFL
Kerry Koen	CNY
Ken Langlieb	SOT
John & Martha Lemondes	CNY
Ian Loy	WFL
Jeffrey & Annie Martin	WFL
Craig Myers	AFC
James Rees	CDC
Brian Rolfe	CNY
Michael Spath	LHC
Liz Young	SOT

Woodland Health

A column focusing on topics that might limit the health, vigor and productivity of our private or public woodlands

COORDINATED BY MARK WHITMORE

REPLANTING AFTER FOREST PESTS

BY CAROLINE MARSCHNER

On my drives through the southern Finger Lakes in the last few weeks, the spring vistas have been a bit depressing. Emerald Ash Borer (EAB) mortality is abundant along roadsides, while many of the hemlock stands I've been in are thin and grey due to hemlock woolly adelgid (HWA). Spongy moth pressure is thankfully much lower this year than last, but beech leaf disease (BLD) is rampant through the woods of our favorite nearby hike, while beech bark disease (BBD) is taking out my yard trees and turning our tiny woodlot into a thicket of beech scrub. On top of all that, it looks like several species of trees in my neighborhood need a second flush of leaves after the late frost a few weeks ago.

While at least the frost-damaged trees should bounce back, there are definitely places where abundant forest pests are leaving holes in our forests. With intense deer pressure, invasive earthworms, and invasive shrubs reducing forest regeneration rates in New York, active management will be critical to ensure healthy, resilient regeneration in these gaps. But what to plant? Diversity is key, given the many stressors our forests face and the probability of more forest pests arriving in our state. Then there's the changing weather to consider: where I live, we've gone from growing zone 5b to 6a in the last thirty years, and are likely to keep going into 6b or even 7a by the end of the century (or even 8a — that's like Atlanta, Georgia!) . Many northern forest trees I plant now are likely to struggle by the end of the century.

Maple + black ash swamp. Photo by Stephen M. Young

Replanting After Black Ash Loss

In northern Minnesota forests there are 500,000 hectares (1,235,000 acres) of black ash wetlands, where black ash is the dominant or co-dominant overstory tree. New York has these wetlands as well, mainly silver maple and ash swamp. The loss of black ash may shift these forested wetlands to open wet meadows with mainly shrubs and few trees (Youngquist et al 2017 review). Black ash is also culturally and economically important to the Haudenosaunee people, as its wood structure allows splitting into thin strips for basket making. While planting other species in wetland areas can help maintain some ecosystem services provided by black ash, such as hydraulic function and forest cover for wildlife, they do not fulfill all the ecosystem services or the cultural values of black ash. The Great Lakes Basin Forest Health Collaborative is a network of organizations looking for black ash trees (and other species as well) that are resistant to EAB and developing EAB-resistant strains of ash for replanting. In the interim, maintaining the hydraulic function of these forested wetlands will require planting novel tree species, and which species will thrive in such a challenging, flooded environment in the changing climate is an open question.

Two studies in northern Minnesota looked at this problem, one in the field (Palik et

Hemlocks dead and alive by Charlotte Malmborg. Bugwood.org

al 2021) and one in a flooding experiment (Keller et al 2023). In 2012, researchers cut round plots in black ash wetlands and replanted with a range of species that were already present or present not far south of their sites. Eight years later, disease-resistant ash, swamp white oak, hackberry, and balsam poplar all survived and grew fairly well. They also found that patch cuts provided better establishment and growth of new seedlings than either clearcutting or letting the black ash die (they girdled this treatment, to mimic of EAB mortality). The second study was a one-year assessment of seedling survival of various species with flooding. They put tree seedlings in tubs and flooded them in treatments from zero to 15 weeks. The species that did best under extreme flooding were American elm, bald cypress, and river birch. Sycamore and silver maple did well in all but the 15-week flooding treatment. Northern white cedar, red maple, and swamp white oak thrived in marginally flooded areas (3-6 weeks annually). A lot of these species would make sense in New York wetlands, although bald cypress would only thrive in the Lower Hudson region and northern white cedar only in the Adirondacks at present.

Replanting after Hemlock Woolly Adelgid?

HWA has already caused widespread mortality in the Lower Hudson, southern Catskills, and southern Finger Lakes. If your hemlocks have HWA, treatment is critical to keep those trees alive until a biological control solution can be developed—and working on that solution is what we eat, sleep, and breathe at the NYS Hemlock Initiative. Unfortunately, in some places hemlocks are already dead; given how hemlock often grows in dense stands, this can leave significant gaps in our forests. Without intervention, what has regrown in these gaps varies widely across hemlock's range. In the southern Appalachians we expected to see nearby hardwoods fill these gaps, but in many cases what actually happened was that dense shrubs choked out tree seedlings and ex-hemlock gaps transitioned to shrubland (Dharmadi et al 2019). Usually, the shrub causing this was rhododendron. In gaps without a high rhododendron cover, yellow birch, black birch, and red maple increased in post-hemlock gaps in the Great Smoky National Park (Mulroy et al 2019). In southern New England, black birch (*Betula lenta*) often thrives as hemlocks decline (Kizlinski et al 2002), while in northern New York and northern New England, red maple is projected to dominate after hemlock loss (Krebs et al 2017).

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Natural regeneration will often fill post-HWA gaps with whatever is in the seedbank nearby. If you've got a lot of deer pressure and invasive species, though, it's more likely you will get a thicket of low-value invasive species. In this case, what should you plant? Well, the "more species is better" theme probably holds from the ash example to reduce the chance of the next invasive species wiping all your freshly planted trees out, but there's just not as much research on this topic as there is for black ash. Hemlock is such a unique foundation species, a shade tolerant conifer that stabilizes stream flows and provides deep shade in summer and shelter from wind in winter. There probably isn't anything that will fulfill all the ecosystem services that hemlocks provide. Red spruce (*Picea rubens*) is shade tolerant and provides good replacement habitat for red squirrel, but is already restricted to our New York mountainous regions and may not thrive in the near future even there. White spruce (*Picea glauca*) could be an option, but doesn't love waterlogged soils (so a no-go for hemlock swamps) and isn't recommended above growing zone 6. With warming temperatures it's probably not a good choice for today's zone 5b either.

Given the lack of obvious species to select for reforestation after hemlock loss, a targeted project to develop a list of potential species would be helpful. It would be great to know which species to encourage or plant that would help improve your forest's wildlife value, provide some quality timber wood, and keep your streams cool and flowing year-round. Let's hope we find some funding to get started on this, so we can provide you with better answers soon.

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Caroline Marschner is an extension associate, New York State Hemlock Initiative at Cornell University.

Mark Whitmore is a forest entomologist in the Cornell University Department of Natural Resources and the chair of the NY Forest Health Advisory Council.

Figure 4. Mature black birch bark, with prominent lenticels visible on the outer flaking/curling plates only.

lb./cu.ft., its rating on the Janka hardness scale is 1,470 ft.lbs., and its modulus of elasticity (a measure of a wood's stiffness as an indicator of its structural strength) is 2,170,000 ft.lbs./sq.inch. By comparison, sugar maple weighs 44 lb./cu.ft., rates 1,450 ft.lbs. on the Janka scale, and its modulus of elasticity is 1,830,000 ft.lbs./sq.inch—so a little heavier/harder/stronger than hard maple, which is impressive. Its rates of shrinkage are somewhat higher than sugar maple, so it is a little less stable, more prone to distortion (warp/cup/twist/bow/crook etc.) when drying, and more likely to expand and contract in response to fluctuating temperature and humidity levels when in service. In actual use I have found it to be pretty well on par with hard maple in this regard, so used with care to accommodate wood movement, it does not present any significant problems.

Black birch is a diffuse porous species (see Figure 6), meaning its pores are evenly distributed throughout its growth rings, with minimal color gradation between early- and latewood. Its sapwood (the valuable part of this species' lumber) is a fairly uniform light pink/salmon overall, with hints of tan and/or light brown, and with prominent ray flecks visible (see Figure 7) while the heartwood, which can be quite variable in its thickness from tree to tree, is more of a brick-brown color. In use, the color of black birch wood will darken with age, which is one reason why this species was once known as "mahogany" birch. It is close enough to the more common yellow birch in its look and properties to be mixed with it in the lumber trade.

While clear, knot-free boards are commonly found, due to this tree's propensity to slough off all its lower branches while young when in a competitive forest setting, leaving a smooth clean bole, the grain of black birch is often wavy due to the tree's very common habit of growing with a sweep or curve, even when on level ground (see Figures 8 and 9). This leads to the formation of what is known as reaction wood, which consists of abnormal, non-linear grain patterning resulting from the tree trying to support itself structurally when not standing upright. Reaction wood is inherently less stable, and harder to work. It also leads to grain that can rise and fall in a wave-like fashion in a board, making it more difficult to surface boards cleanly without the grain tearing out (see Figure 10). Running such boards through a jointer or planer, or planing them by hand requires very sharp tool edges and shallow passes to avoid such tearout; scraping or sanding instead of planing will help avoid the worst of this type of damage on boards where the grain runs up to the surface. In use, black birch sands easily, glues well, and finishes to a fine polish. Sadly, the wood when dry has no odor, as the refreshing wintergreen smell is limited to the twigs and inner bark. While it can be used for all types of furniture and cabinetry, birch lumber is commonly used in the manufacture of veneer, plywood, flooring, dowels, interior trim and doors. It could certainly also be used for structural timbers provided they are kept dry.

The wood of all the birches has basically no rot resistance, so should only be used in applications where it is

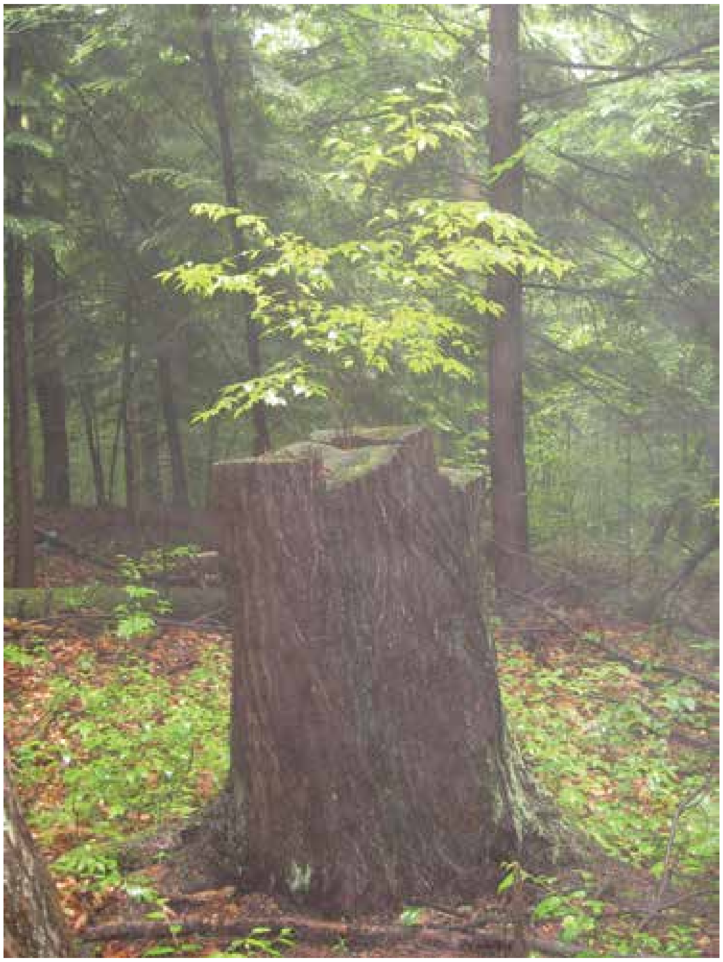

Figure 5. Birches will often sprout on decaying stumps and logs—this black birch sapling is taking advantage of a tall hemlock stump.

protected from the elements—indoor uses only. Despite this drawback, the density of black birch makes it an *excellent* choice for firewood. At 26.8 million BTU/cord, it is comparable to black locust (and offers over 20% more heating value than yellow birch), provided it is processed soon after felling, and is stacked and stored in a protected location with good airflow. I once heard someone complain about how bad black birch performed as a firewood, which I found curious, and it turned out that the individual in question had left the split wood in piles in direct contact with the ground, which he then covered with a tarp—perfect conditions to promote fungal decay, not so much for firewood storage. With this in mind, however, another great use for black birch logs is as bolts for growing shiitake mushrooms (see Figure 11); these logs have proven to be about as productive as beech or maple in my experience. Birch trees can also be tapped for a milder-than-maple syrup, which can be fermented into birch beer.

As far as its value in the marketplace, black birch as previously stated is often just sold as "birch," but in the most recent (Winter 2023) Stumpage Price Report from New York's DEC, black birch is tallied on its own, and the average price range (average price paid for "middle quality" timber over the previous six months) median was $150 in the Western/Central region, $255 in the Adirondack region, $110 in the Hudson/Mohawk region, and $125 in the Delaware/Catskill region (all in dollars per thousand board feet). Not particularly impressive numbers when compared to cherry or hard maple, perhaps, but comparable to yellow birch pricing at least.

Despite its less than uniform distribution across the state, black birch has been on the rise through much of New York in recent decades. In terms of overall net volume (cubic feet of wood on the stump), black birch ranked 12th among all NY tree species as of 2017, which was up from 20th in 2007, and 13th in overall numbers of trees 5+" in diameter in 2017, which amounted to a 13% increase over the preceding decade. A most notable increase occurred in the Catskill/Lower Hudson region, which saw a 27.3% increase in black birch volume from 2007-2017.

While never a dominant species here, black birch has proven itself to be both adaptable and resilient to the changes afoot in our woodlots, and has slowly but steadily expanded its numbers by exploiting the holes left by the blighted American chestnut, the oaks assaulted by spongy moth, hemlocks decimated by the wooly adelgid, ash with EAB, and also cherry (see the November/December 2022 issue of this magazine for more about the potential decline of cherry) as it struggles to maintain its numbers here in New York.

So what is it about black birch that makes it so resilient and adaptable when so many other species are in decline? Some of it could just be circumstance, as while

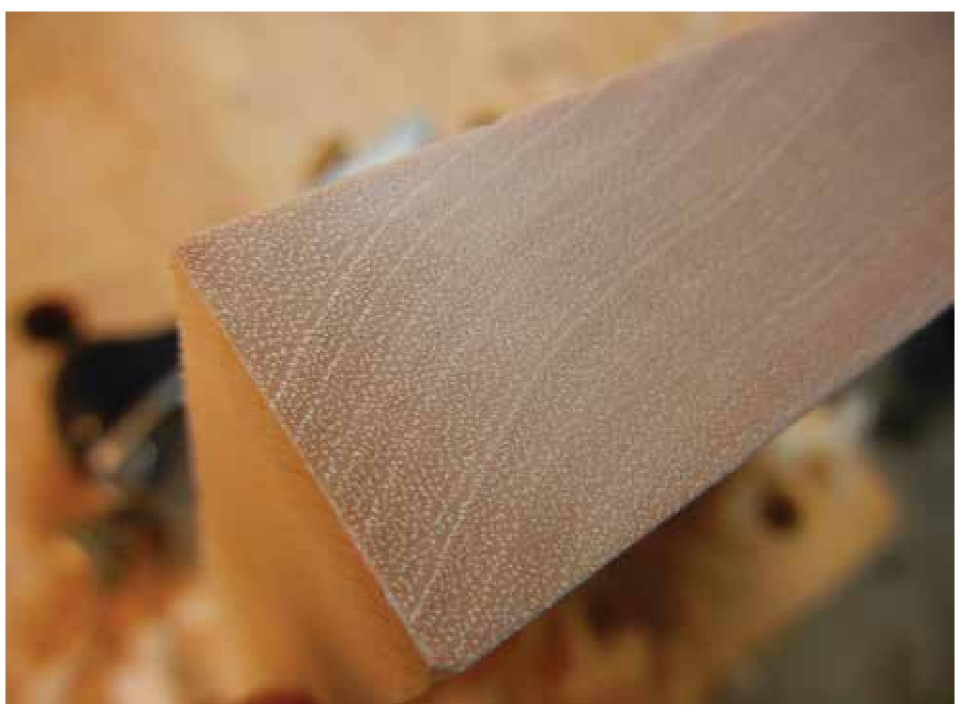

Figure 6. Black birch endgrain. Diffuse-porous.

Figure 7. Black birch flitch-sawn board showing both its pale sapwood and richer colored heartwood.

Figure 8. Curving reaction wood is common in black birch, due to its growth habit. Straight-grained boards are uncommon.

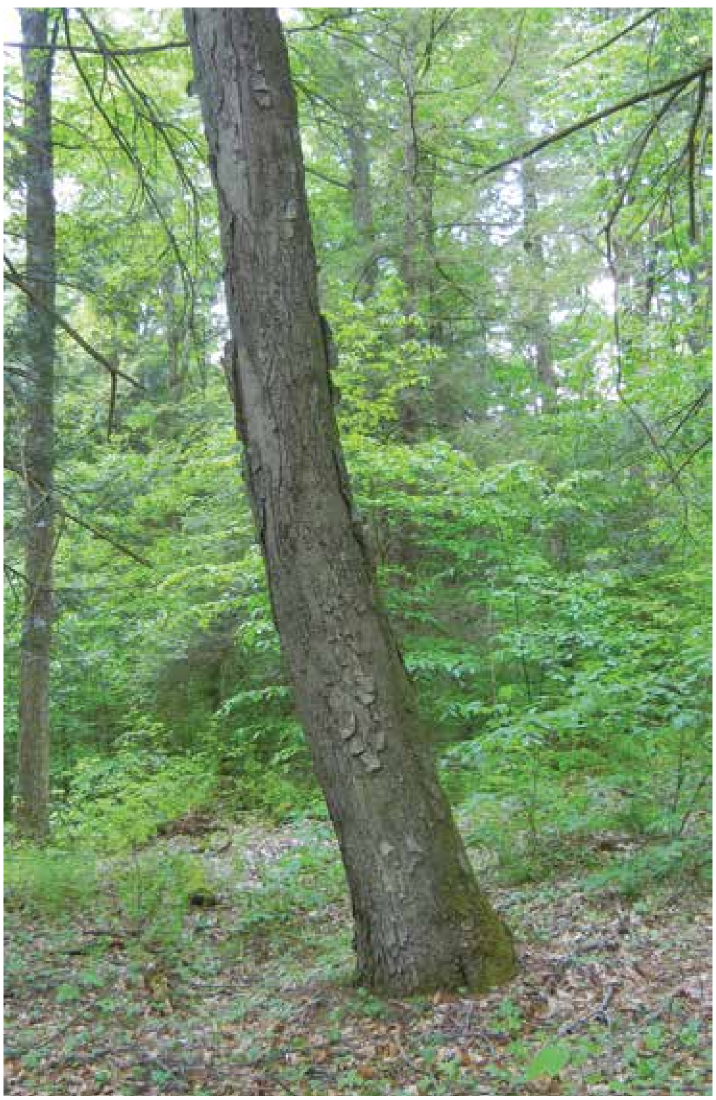

Figure 9. A sawtimber-sized black birch stem with its characteristic lean and trunk sweep, even when growing on level ground.

birch too is beset by a host of insects and diseases, none have arrived here as abruptly as those that have proven so lethal to other native tree species. This will always remain a possibility, as there are over 50 *Betula* species outside of the US that could possibly host a lethal pest that could be inadvertently imported into this country, and for which our native birches would have developed no resistance.

Short of that dire outcome, however (knock on wood), there are a number of factors that give black birch a distinct advantage moving forward:

First, as discussed at the outset is simply that niches long held by more dominant species are being vacated, hence less competition for limited supplies of sunlight, water, and nutrients.

Second is that the high wintergreen content of black birch twigs and young stems may make it less palatable to deer than yellow birch or other more desirable species of browse. I

Figure 10. Wavy grain running up through the face of birch boards makes it difficult to surface boards without grain tearout.

Figure 11. Black birch logs are a great substrate for growing shiitake mushrooms.

have no data to back this up, but it seems possible at least based upon what I've seen in my woodlot.

Third, black birch reaches the northern end of its range here, so as the climate warms, it will likely become even better suited to New York's climate than it has been in the past, providing that it does not become excessively dry for it to thrive. Warmer temperatures should only enhance its already rapid growth rate—it currently grows at about *two times* the rate of sugar maple or beech. I have firsthand experience with this, as my woodlot has a significant percentage of beech, and in the few times I have attempted to create patch openings to regenerate more desired species, only black birch has shown the ability to survive the predation of deer and to outcompete the widespread stump and root sprouting of beech (see Figure 12). I actually had to see it to believe it, as neither regenerating maples or oaks have proven able to survive the dual onslaught of deer and beech in my woodlot, to my great chagrin.

Figure 12. Young, vigorous black birch stems outcompeting beech in a small patch opening.

Fourth, black birch leafs out early enough in spring to begin photosynthesis in time to outcompete and overcome the interference of fern foliage and fern mats, which are another significant barrier to regeneration of many other tree species in our woodlots. The low shade provided by ferns may even provide just the right amount of shade necessary for black birch seedlings to take root and thrive in their early years, turning what is commonly an insurmountable problem to their advantage.

In sum, while perhaps not the most desirable or valuable tree in anyone's woodlot, black birch is undeniably a species to get better acquainted with, and to appreciate for its unique virtues, as we will most likely be seeing much more of it in the coming decades. In the meantime, it will humbly continue the work of filling the voids left as other less fortunate species face adversity and decline.

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