The New York Forest Owner

A Publication of The New York Forest Owners Association

For people caring about New York's trees and forests

November/December 2020

Desperate Measures: Slash Wall Deer Exclosure

Volume 58 Number 6

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In This Issue . . .

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Volume 58, Number 6

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The New York Forest Owner is a bi-monthly publication of The New York Forest Owners Association, PO Box 541, Lima, NY 14485. Materials submitted for publication should be sent to: ***Mary Beth Malmsheimer****, Editor, The New York Forest Owner, 134 Lincklaen Street, Cazenovia, New York 13035; Materials may also be e-mailed to mmalmshe@syr.edu; direct all questions and/or comments to jefffjosephwoodworker@gmail.com. Articles, artwork and photos are invited and if requested, are returned after use.* ***The deadline for submission for the January/February issue is December 1, 2020.***

Please address all membership fees and change of address requests to PO Box 541, Lima, NY 14485. 1-800-836-3566. Cost of family membership/subscription is $45.

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Cover: Front cover: Aerial view of 74 acre slash wall completed in summer of 2017. Abundant oak, maple, and cherry saplings can be found throughout after four growing seasons.

From The President

This issue's "From the President" column is somewhat different than past columns. As I was preparing to write the article, I wanted to highlight many topics about our organization that often times are not adequately recognized. I also wanted to acknowledge and introduce the new Dean of the College of Agriculture and Life Sciences (CALS) at Cornell University. With that in mind, I want to share with our readers NYFOA's recent correspondence welcoming Dr. Houlton to New York:

On behalf of the New York Forest Owners Association, welcome to New York state and congratulations on your appointment as Dean of Cornell University College of Agriculture and Life Sciences. I hope you find New York State as rewarding and friendly as Wisconsin and your recent tenure in California.

The New York Forest Owners Association (NYFOA) has a long, excellent relationship with Cornell. Many faculty members in the Natural Resources department, other units, and in Cooperative Extension have given their time and talents to helping us succeed. NYFOA was founded in 1963 to encourage well informed management of privately owned woodlands in New York State and to promote, protect, represent, and serve the interests of woodland owners. Currently there are about 1,500 members, most of whom own family forests in New York. We hold various events throughout the state at our local chapters and statewide. All forest owners in New York are invited to attend.

New York is 65% covered with forests that extend from the extensive spruce-hardwood forests of the Adirondacks to the scattered pine barrens of Long Island and across the farm-forest landscape of central and western New York with many different tree species. Three-quarters of the forest are privately owned; corporations hold 16% and family forest owners including farmers hold 59%. These private family forests range in size from 1 to 500 acres, and in concert with our thriving wood products industry, sustain our forest economy and much of the environment of the state. Along with Cornell, NYFOA partners with many other organizations such as the Empire State Forest Products Association, New York Audubon, Tree Farm, New York State Department of Environmental Conservation, and the SUNY College of Environmental Science and Forestry to educate landowners and the public about the importance of the woods and forests of New York, and how landowners can improve the management of their land.

The current coronavirus pandemic has greatly restricted many activities but when things open up I would like to invite you to our annual statewide meeting, usually held in the spring at the College of Environmental Science and Forestry in Syracuse. Your experiences in other parts of the United States and visions for the College of Agriculture and Life Sciences will be of great interest to our organization. Meanwhile, please feel free to contact me or other members of our board for any assistance or information you may desire. Under separate cover I will send you a copy of the newly published booklet, "Just the Facts: The Past, Present, and Future of New York's Forest and Forest Products."

Again, welcome to New York. NYFOA looks forward to a continuation of relationships we have with Cornell University and the other natural resource organizations across this great Empire State.

NYFOA wishes Dr. Houlton much success and we look forward to working with our partners to ensure NYS forests continue to flourish.

Wishing all a Happy Thanksgiving and a joyful holiday season.

–Art Wagner
NYFOA President

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.

Join!

NYFOA is a not-for-profit group promoting stewardship of private forests for the benefit of current and future generations. Through local chapters and statewide activities, NYFOA helps woodland owners to become responsible stewards and helps the interested public to appreciate the importance of New York's forests.

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Slash Wall Deer Exclosure:

A Reality Check on the Challenge of Forest Regeneration in New York (and Beyond)

Jeff Joseph

One of the defining characteristics of our woodlands is their ability to reproduce themselves abundantly. Any open patch of ground in the proximity of wooded areas here in the northeast is showered each year with seeds from nearby trees, with many thousands per acre taking root and carpeting the ground with seedlings. This is how our forests reclaimed the land after it was scoured clean by mile-high glaciers, reverting to dense forest in just a blink of geological time. In our region, a forest's ability to proliferate is a powerful, awe-inspiring, and almost inevitable force of nature.

Yet our woodlots are not regenerating. Despite massive crops of seed annually, and countless seedlings filling most any available gap, the understory of our forestlands is increasingly bare of our most desired timber species. To the uneducated eye, these forests may look as green and full as ever; to one with even a little knowledge of the history and potential productivity of our woodlands, this absence is staggering. While there have been complex and intertwining forces at work creating this state of affairs over the past century, the overwhelming root cause of regeneration failure in our region today is the unchecked population explosion of deer.

Carpet of oak seedlings in a slash wall protected shelterwood at the Arnot Forest.

It is estimated that there are currently about one million deer in New York. Here is some simple math to illustrate the scope of the problem:

Consider that your average adult deer will eat in the range of seven pounds of browse per day; factor in that some of the most preferred foods of deer are the seedlings of our highest value timber

continued on next page

species—oak, maple, cherry, ash, birch, pine, etc.; take note that it takes about 600 or so tree seedling tips to make one pound of browse; and add it up: even if only one-half of a deer's diet came from browsing tree seedlings, each deer is eating down the growth tips of around 2,000 seedlings per day, for much of each year. Multiply that out by a conservative 500,000 adult deer (equaling one *billion* seedlings devoured daily), and you can see that the forest floors of our woodlands are being basically "vacuumed" clean of the next generation, save for the seedlings of those tree species which deer do not prefer, such as beech, which in many areas throughout New York is one of the *only* species currently regenerating successfully (sadly into unproductive, diseased thickets for the most part, but that's another story).

So despite the rain of mast, and a continued proliferation of seedlings, the prospects for natural forest regeneration in our woodlots are marginal at best today—recent studies in New York estimate that at least 70% of our forestlands are not regenerating adequately. And now the worst case scenario now begins to occur: without a new generation of trees to rise into the canopy and become mast producers themselves, it won't be long—due to natural tree death or harvest—before there simply will no longer be parent trees of desired species around to procreate, leaving our forests stripped of much of their diversity, resilience, economic value, variety of wildlife habitats, and ultimately much of their simple beauty and majesty. This stark potential future was the motivating force behind the NYFOA's development of the Restore New York Woodlands (RNYW) initiative in 2012, to educate the public about these issues, to advocate for changes in public policy regarding deer management, and to collaborate with kindred organizations toward finding lasting solutions (see *www.nyfoa.org/initiatives/restore-new-york-woodlands* for more info).

As things stand today, short of a mass, statewide reduction in deer numbers (not likely in the short-term given the political and economic issues involved), most efforts to ensure successful regeneration focus instead on the following steps: 1) creating the conditions for optimal mast production of desired species in advance of timber harvest; 2) controlling residual

With a slash wall surrounding this stand, the stage is well set to ensure its successful regeneration.

density to ensure that ample sunlight penetrates through our overcrowded forest canopies to the developing seedlings; 3) controlling invasive and/or interfering plants; and critically 4) finding ways to keep deer OUT of these areas long enough for the young trees to grow adequately tall that their growth tips can avoid being repeatedly browsed to death.

Hunting has traditionally provided some measure of deer control, but on its own has proven inadequate in most areas of the state to keep deer populations at an estimated sustainable level of no more than 5-15 per square mile. This has left fencing as perhaps the only truly effective means of protecting regenerating stands, yet this option is for most of us prohibitively difficult and expensive to install, aesthetically far less than ideal, and particularly difficult to monitor and maintain over time.

A more recently developed option that holds much promise to achieve the same goals, but more cheaply, efficiently, and effectively is the use of slash walls to encircle and protect areas to be regenerated. To find out more about this technique, I contacted Peter Smallidge, NYS Extension Forester, and Brett Chedzoy, Senior Resource Educator in Ag and Natural Resources, to ask some

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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	Name	Chapter
Danny Barry	WFL	Judie Phillips	LHC
Bob Bleier	WFL	David Shickle	SOT
Michael Cooley	CDC	Jim Shuler	SFL
Cydney Cornell	CDC	Oliver Stockhammer	CDC
Brian Draiss	LHC	Katie Stout	CNY
Samuel Gildiner	NAC	Derrick Towne	NAC
Christianne McMillan White	SFL	Donald Whitbeck	SAC
Christopher Paige	LHC	Alexander Zagoreos	SAC
Robert Penski	NAC		

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

Double-serrate margins, and these trees all look alike as seedlings and saplings

Question: I'm trying to learn how to identify some of the common members of the birch family, but several of them look similar. This is especially challenging in a cut-over area where most stems are less than a few feet tall. What features are important to separate black birch, paper birch, eastern hophornbeam and American hornbeam? (Mike A., SFL Chapter)

Answer: The genera and species of the birch family (*Betulaceae*) can look quite similar for many of their features. Fortunately there are several features that can help in the differentiation of genera and species. When the key features are present, they are readily distinguishable. A great resource for identification of trees of the Northeast is *Trees of New York State, Native and Naturalized* by Dr. Donald J. Leopold of SUNY ESF, published by Syracuse University Press.

The birch family includes four genera that are found within New York. These include *Betula* (birches), *Carpinus caroliniana* (American hornbeam, blue beech, musclewood), *Corylus* (hazelnut), and *Ostrya virginiana* (eastern hophornbeam, ironwood). All the birches can attain tree-size and occupy a canopy position, although gray birch (*B. populifolia*) is of generally small-stature, less common, and found largely in areas with disturbed and low fertility soils. Hazelnut is a shrub that includes two species: *C. americana* (American hazelnut) and *C. cornuta* ssp. *cornuta* (beaked hazelnut). The focus here will be on the common tree species.

The birch family has some common features that differentiate it from other trees. The most notable feature across all genera is the presence of a doubly serrate leaf margin (Figure 1). Another feature is the small hard seed (i.e., nutlet) that is wind-borne by a leafy bract whose shape and size depends on the genus (Figure 2).

Betula spp.

The birch genus, *Betula*, has three common species in NY, all tree form. These include paper or white birch (*B. papyrifera*), black or sweet birch (*B. lenta*), and yellow or bronze birch (*B. alleghaniensis*, A/K/A *B. lutea*). Paper birch, of the three, lacks an aroma of wintergreen that is present for both yellow and black birch. Paper birch has the classic "papery" bark (Figure 3) that starts as a smooth brownish bark typical of all juvenile stems of *Betula*, *Ostrya* and *Carpinus*.

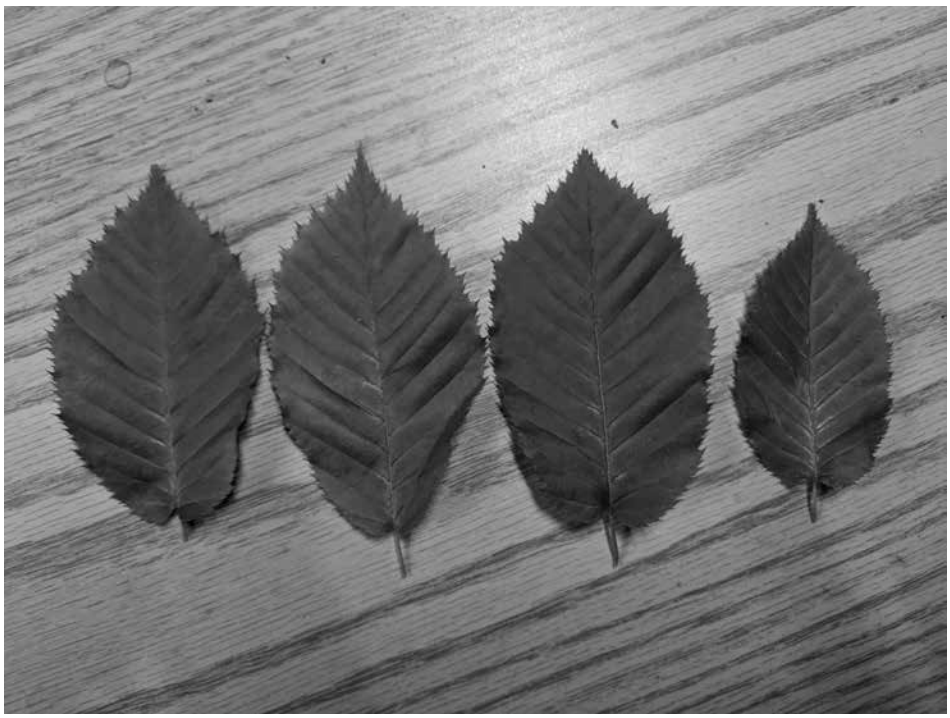

Figure 1.Any leaf with doubly serrate leaf margins, thus patterns of intermixed large and small teeth, is in the birch family among one of four genera.

Figure 2. Immature (paired) nutlet with bract of American hornbeam. Other species of the family typically not paired.

Another feature common to the birch genus is the formation of spur or short shoots (Figure 4). Some buds that might otherwise elongate into a twig are stunted to about a 1/16th inch yet produce two leaves. Because the leaves are compressed onto a nonelongated twig they appear paired. This pair of leaves are differentiated from opposite foliage (such as occurs for ash or maple) because there is only a single bud associated with two leaves.

The fruit of the birches is a strobilus, which is shaped as a cylinder with tapered ends that looks something like a small and not-so-woody pine cone. The strobili of yellow and black birch are upright, known as erect, and lacking a stalk, known as sessile (Figure 5). The strobili of paper birch are pendant and with a stalk, thus pedunculate. The seeds of all birch are quite small, winged, and disperse widely in the wind and on the surface of the snow. The ease and success of seed dispersal creates a reputation for the genus that is comically proclaimed that one tree per county can provide adequate seed for reforestation.

Birch bark is a classic visualization associated with paper birch, but the exfoliation occurs to some extent on all species (Figure 3). The common names of white, yellow and black reflect the color of the bark. Black birch bark (Figure 6) is less exfoliating, dissects into plates, and is thicker than paper or yellow birch.

Paper birch leaves are broader at the base than yellow or black birch, which taper from the widest point. Paper birch leaves also have fewer than 9 lateral veins (Figure 7a). Yellow and black birch leaves are similar (Figures 7b, 7c), including hairy petioles, and bases that are rounded, heart-shaped, and sometimes asymmetrical. However, yellow birch leaves have hairs on the veins of the lower surface and may be somewhat, though indistinguishably, narrower than the leaves of black birch.

The buds of birch twigs pull away from the twig, thus are divergent.

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Figure 3. The term "birch bark" is almost synonymous with the visual image of paper birch. As the stem matures the bark whitens and begins to exfoliate, or peel.

Figure 4. Spur shoots form when lateral buds fail, for whatever reason, to fully elongate. The leaves that would have developed on that twig are compressed to a pair.

Wild Things in Your Woodlands

Maggie Lin

FISHER (*Pekania [Martes] pennanti*)

The fisher is a medium-sized mammal with short legs, small ears, and a furry tail that is about 1/3 of its body length. Their fur color can range from dark brown to almost black, and they can have white irregularly shaped 'blazes' on their belly. Fishers range from 30-47 inches in length and can weigh 3-13 pounds! They live exclusively in North America with a fairly wide coast-to-coast range in Canada and can be found on the east coast of the US as far south as Virginia.

As furbearers, fishers have long been a highly valued resource by trappers for their pelts. Because they are easily trapped, they can be susceptible to overharvest, which has had a lasting impact on their geographic range. Fishers were extirpated from large portions of New York, except the Adirondacks in the northern part of the state. This area remained the core of the species' New York range until the NYS Department of Environmental Conservation began a restoration program in the mid-1970's. Since then, fishers have continued to expand their populations across central and western NY, with additional help from a reintroduced fisher population in northern Pennsylvania.

Fishers use deciduous, coniferous, and mixed forests, and prefer dense canopy cover and large-diameter trees. Even though they are tolerant of landscapes with an open-habitat component, a minimum threshold of forested cover (about 40%) is needed to sustain a fisher population, and predominantly forested landscapes host populations that are more stable. Fishers' habitat selection appears to be largely driven by prey availability, uninterrupted overhead forest cover, and the availability of suitable denning sites. These include natural cavities in old trees, hollow logs, cavities in rocky outcrops, brush piles, and underground burrows. Dens used for birthing young are usually found high above the ground in hollow sections of trees.

Fishers are dietary generalists—they eat a wide variety of small to medium sized mammals and birds, including hares, rabbits, squirrels, mice, and shrews. They are also one of the few animals that eat porcupines and have developed a unique technique—they flip the porcupine on its back to avoid its quills. They will also eat carrion of large mammals like white-tailed deer and rely heavily on both that and hares in the winter. They have to compete for prey with many other carnivores, such as martens, bobcat, coyote, foxes, and some raptors. Luckily, as omnivores, fishers can also get their food from a variety of sources of hard and soft mast such as beechnuts, apples, and berries.

With large, wide, five-toed feet and semi-retractable claws, fishers are well adapted for walking on snow, climbing trees, and grasping and killing prey. They can rotate their hind feet nearly 180 degrees, which allows them to descend headfirst from trees. They also have large anal scent glands which are used to mark their territories and attract potential mates. Fishers operate in a 'home range' territory—female fishers have an average range of 8 square miles, while males' average about 14 square miles. Males' territories seldom overlap. Variations in fishers' home range size may result from a variety of influences, including population density, prey availability, habitat quality, and landscape composition. All fishers are

solitary except for during brief periods of their breeding season and are active at any time during the day or night.

Fishers display sexual dimorphism, or difference in appearance between the sexes. Female and juvenile fishers have a more uniform color, while males can have a blonde or grizzled appearance due to sporting multi-colored guard hairs around their neck, upper back, and shoulders. Males also weigh more than females (7-13 lbs compared to 3-7 lbs) and tend to be bigger as well (35-47 in. compared to 30-37 in.). Fishers reach sexual maturity in the first year of their life, but most females do not breed until age two. In fact, implantation of the fertilized egg is delayed until the following season, so most females actually give birth at age three. Reproduction peaks in early March, although breeding can occur as late as May. Fishers usually have litters of 2-3 young, which are born helpless —partially furred with closed eyes and ears. Within 8-10 weeks the kits are weaned, and the young fishers strike out on their own by their fifth month after birth. By the time autumn begins, any fishers still in family groups begin to display interfamilial aggression until they move on to solitary lives again.

As forest-dependent carnivores with a high trophic position, fishers can reflect the health of forested ecosystems and lower trophic levels, or prey populations. Under the NYS Environmental Conservation Law (ECL), fishers are defined as a protected small game species. Because they have a relatively low reproductive capacity in comparison to more common furbearers, fishers occur at naturally low densities. In the past decade, fisher populations have declined in the Adirondack region, but their range and populations in the southern portion of the state have been expanding. Because fishers have few natural predators, and are rarely affected by disease, the population decline is presumed to be a result of trapping by humans. Fishers have been harvested by trappers operating under an annual season framework since 1949, and laws and regulations define trapping season timing, length, and methods of take.

Although fishers have few natural threats, habitat and community-level changes that may result from climate change can alter fisher distributions by changing forest composition and structure, prey abundance, fire frequency, drought, water stress, insect and disease occurrence, snowpack, and competitive interactions with other carnivores. Dense forests on protected lands are an important resource for fisher habitat. Leaving brush piles and standing dead wood in your forest can also increase the number of available denning sites for fishers. Your stewardship helps these amazing fishers to thrive and continue being wild things in your woodlands!

Maggie Lin 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 at https://blogs.cornell.edu/nymasternaturalist/

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American Chestnut Restoration Project in USDA Public Commentary Period

By Eric Jenks

The American Chestnut. A tree that was once so plentiful that it led to the creation of songs, lined the main streets of cities and towns, was a mainstay tree for colonial furniture, and filled the woodlands throughout the country. All of that changed in the early 1900's when a blight was introduced through the import of ornamental Asian chestnuts. Recently, American Chestnut Research and Restoration Center (ACRRC) has worked on a transgenic American chestnut that is resistant to the blight. Their research has currently reached a public commentary phase with the USDA.

"In the late 1800's when the import of ornamental chestnuts began, there wasn't a lot of information on preventing the spread of plant pathogens" said Dakota F. Matthews, the molecular lab manager for Director William Powell at ACRRC. "People planted them whenever and wherever they wanted."

According to Matthews, the death knell for the American chestnut (*Castanea denata*) was first sounded when the chestnut blight struck in 1904 at the Bronx Zoo. "The blight is a fungal pathogen from Asia," said Matthews. "It co-evolved with Chinese chestnut, where it will infect the tree but doesn't kill it. After pathogen was found at the Bronx Zoo, it was continued to be monitored as the disease spread. In the first half of the 1900's, this blight spread through the entire range of the American tree, killing any that weren't severely isolated."

The blight changed the American landscape in ways that continue to this day. "The only chestnuts that survived are from root sprouts," said Matthews. "You'll see a monster root system even for a small tree, which will typically die after eight to ten years."

Interestingly enough, even the lack of chestnuts in an area doesn't prevent the blight from living on to infect future trees. "You would think if you cut down all the chestnuts in an area, let it sit for 20 years and replant, you'd be fine," said Matthews. "However it can survive on Oak and other alternative hosts."

ACRRC has spent years working to find a way to combat the blight at a genetic level. "Dr. Powell's initial research was working on infecting the fungal tissue with a hypo-virus to make it less competitive, so it wouldn't kill a tree completely," said Matthews. "Then a NYS chapter member, Mr. Herb Darling, approached Dr. Powell and Dr. Charles Maynard about taking a transgenic (biotechnological approach) to modifying the chestnut itself. He [Darling] had a couple of massive chestnut trees that he had managed and protected. He built scaffolding around the entire tree to pollinate it, providing us with a huge source of NYS grown chestnuts for years. He did amazing work and this project wouldn't be possible without him."

Using immature embryos as a base, the team at ACRRC started the laborious process of finding what might work to save the chestnut. According to Matthews, the winning combination proved to be the agrobacterium that creates burls on trees, along with a gene from wheat that breaks down the oxalic acid produced by the blight. "After thousands of transformations and attempts, we developed a blight resistant chestnut," said Matthews. "We then started doing a widespread breeding program with transgenic pollen and trying to crossbreed with natural trees. We sent pollen to collaborators in Indiana, Maine, Pennsylvania, etc. Using a grant from the Templeton Foundation, we have selectively harvested demonstration forests so that we can look at the long term ecological effects of reintroducing the tree to its range. We're getting about 1-2,000 crossed chestnuts each year, and fifty percent of them will inherit the transgenic gene."

American Chestnut. Joseph OBrien, USDA Forest Service, Bugwood.org

Continued on next page

ACRRC has reached a pivotal point in their research, where they are now at a public commentary period with the USDA on their work. "Here is where we can use all the help we can get," said Matthews. "People can write a brief comment on why they want to see our chestnut project continue to the USDA website. After that. the USDA will either say you're good to go, or you have to do more research, We're pretty close to the end of that process from our communications with the USDA, and we will then head on to the EPA for their approval.

For more information on the USDA public commentary period which ended on October 16th, visit: *https://www.esf.edu/chestnut/open-comment.htm*. For more information on ACRRC and the work that they're doing, visit: *https://www.esf.edu/chestnut/*, or find them on facebook: *https://www.facebook.com/americanchestnutgroup*

Eric Jenks is a freelance writer with Morning Ag Clips, LLC. Morning Ag Clips is now managing the Tree Farm column.

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When Should You Cut That Tree?

By Hugh Canham

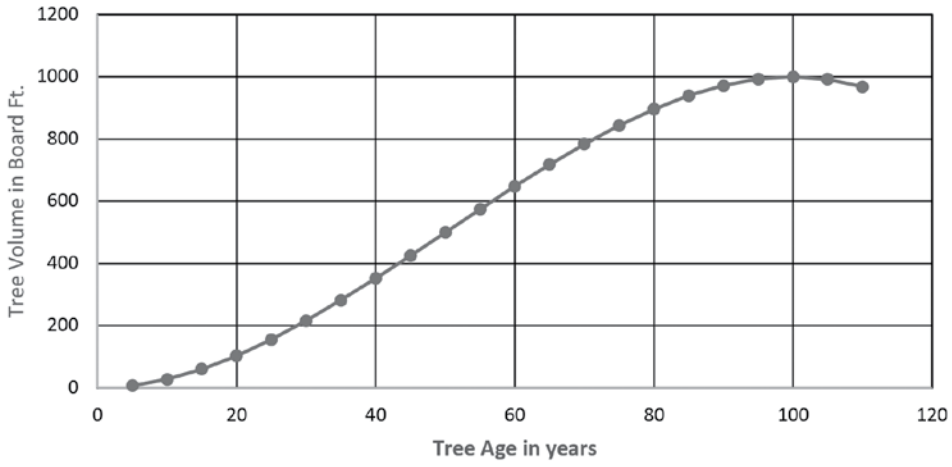
The optimal harvest age, size, and time to harvest is one of the long-standing debates in forest management. Silviculturists, forest economists, finance specialists, wildlife biologists, and others, often have differing concepts. The short answer for those who do not want to read this article is, "it depends." For a longer explanation we will present different concepts and considerations that your consulting forester employs when advising you. To guide the discussion let's talk for now about larger trees; those that might be considered "mature" and ready for harvest. This will help to put some scope on the discussion. Thinning or improvement cuttings brings in other considerations which can be addressed later.

Trees generally grow in what mathematicians call a sigmoidal growth curve (See Figure 1).

Simply put, tree volume increases as the tree grows usually at an increasing rate for young vigorous trees, then slowing down in growth but still increasing in volume until reaching the greatest volume the tree will have, after which the tree starts to lose volume due to old age, etc. In this way the tree resembles all other living organisms (including humans, but we don't like to admit it). One way to decide a tree is ready for harvesting is to cut it when it reaches that point of maximum volume; what can be called **biological maturity.** Other things being equal (we will address this condition later), this will result in getting the highest amount of money for that tree. However, waiting for the tree to reach its biological maturity entails forgoing income that could be gained.

A second concept is to harvest when the tree reaches its point of the greatest average annual growth; what can be called the **culmination of mean annual increment**. This is the point when the increase in volume, and value (again, other things being equal) begins to slow down. The tree is still putting on net growth but at a decreasing rate from early years.

Figure 1. Hypothetical Relationship Between Tree Age and Volume



A third concept is to harvest the tree when the rate at which the tree's increase in value falls below the rate of return that the owner uses in making financial decisions. That is, the tree has reached what can be called its **Financial Maturity**. This puts the tree in a somewhat similar position to a financial stock that one might hold. That is, if the stock is not returning the rate of return you want, or what could be earned on other investments, sell it, and invest in other stocks. The culmination of mean annual increment and financial maturity are related but will only result in the same age, size, etc., in certain circumstances.

For those who do not want to delve into the math behind this, skip to the next paragraph. For the rest, mathematically, average annual increment is calculated by dividing tree volume by tree age, or:

Avg. Annual Inc. = Volume/Age.

Increase in tree volume and value is a compound interest function. Financial maturity depends on the **internal annual rate of return** at which the tree is growing. This can be determined from the formula, Value at the end of a number of years = Value now times 1 plus the interest rate raised to the number of years, or:

$$V_n = V_0(1+i)^n$$

A hand-held calculator with financial functions can be used to calculate the annual rate of return given the expected future value at a specified number of years, the present value, and the number of years in the planning interval. Another way is to develop a simple spreadsheet in Excel or other program, enter in a set of growth and value data and use the built-in financial functions to automatically develop a set of annual rates of return. (The author has developed a simple Excel spreadsheet using a hypothetical tree volume and value function which one can use to see the effects of changing time intervals

tree ages etc. on value and annual return on investment; email me for a copy at *hughforest@outlook.com*).

Even though you may not be guided by a narrow financial return when managing your woods, knowing the financial rate of return you might be getting on your trees gives you a benchmark to judge alternative actions you might want to take, such as harvesting some high interest rate trees to create a wildlife opening, or conversely, leaving some high return trees to maintain a particular viewshed or aesthetic appeal.

All these concepts depend on knowledge of the tree growth in volume and value. For certain species and sites the growth function is reasonably known to be able to predict future growth and foresters with experience can judge what the tree might be expected to do over the next 10 to 20 years (barring any unforeseen incidents). What you, the landowner, need to communicate to your forester are the objectives and needs you might have from your woodlot. Let's look at the effect of some of those objectives on when to harvest the tree.

Suppose you have funds in a conventional certificate of deposit or savings bank account and some expenses arise (take a vacation trip to Aruba or pay for your children's college tuition). Currently CDs are returning at best 2 percent. If you have timber that is increasing at 4 or 5 percent interest rate it would be better to cash in the CDs and leave the trees to increase in value. Conversely, suppose you are someone out of work, exhausted your savings (and not wanting to borrow from your rich uncle) and suddenly you need a new heating system in your house. You could put this on your credit cards but that will cost you about 18% or more per year. You might think about having a timber harvest now since you are only getting 5% on the trees. However, before running out with the chain saw remember that your fortunes might improve, and you could pay off that credit card. Once you cut those trees it will be many years before the replacements earn a good rate of return.

But one does not normally harvest just one tree. Typically, there would be a timber sale across part, or all, of the woodlot. The typical mixed deciduous and conifer forest found in many areas of New York State is like a "biological mutual fund." Each tree, or possibly group of trees, is somewhat like an individual stock in that fund. Just as one can manipulate the fund holdings to improve financial performance, so too you can cut some trees and retain others to improve overall growth and financial return. However, your forest is much more than a financial fund. In a typical financial portfolio, removing one stock will not affect the performance of the rest. In your woods the action you take on one tree can (and usually does) have an impact on surrounding trees. In addition, other resources, suach as water, wildlife, and recreation opportunities, can all be affected.

Another complicating factor is that as trees grow in size and age, often the type of wood products that can be made from that tree will change. Smaller trees might be suitable for fuelwood, pulpwood, or short, small boards. Larger trees may yield more knot-free, clear, wider boards or have veneer quality wood. These changes in products are not linear but may come at specific changes in log diameter. Thus, a tree might slow down in interest rate earned but if you can hold it over a certain diameter it will increase in value growth again. Finally, insect and disease problems can arise. For example, the current scare over emerald ash borer has prompted some landowners to harvest trees yielding high rates of return now in fear that the value might plummet with onset of the insect damage. This again is similar to one's belief in what might happen to a particular stock in the future. One might decide to cash it in even though it is a very good producer now.

Keeping your financial portfolio and insurance policies current is important. So also is keeping your "forest portfolio" healthy and productive. In the end it depends on what you and your family want to do with your woods, what the current conditions are, future expectations, and needs. Do not be rushed into a timber sale by an overeager logger who might tell you that the timber market is going to crash so you better sell now. Conversely, if you see your fortunes changing in a few years you might want to have a harvest now. Call your forester and have a discussion. If you do not have a consulting forester contact the local NYS DEC office, Cooperative Extension office, or call our NYFOA office to get some suggestions.

Hugh Canham is a a member of the NYFOA board of directors and SUNY ESF Professor Emeritus.

Woodland Health

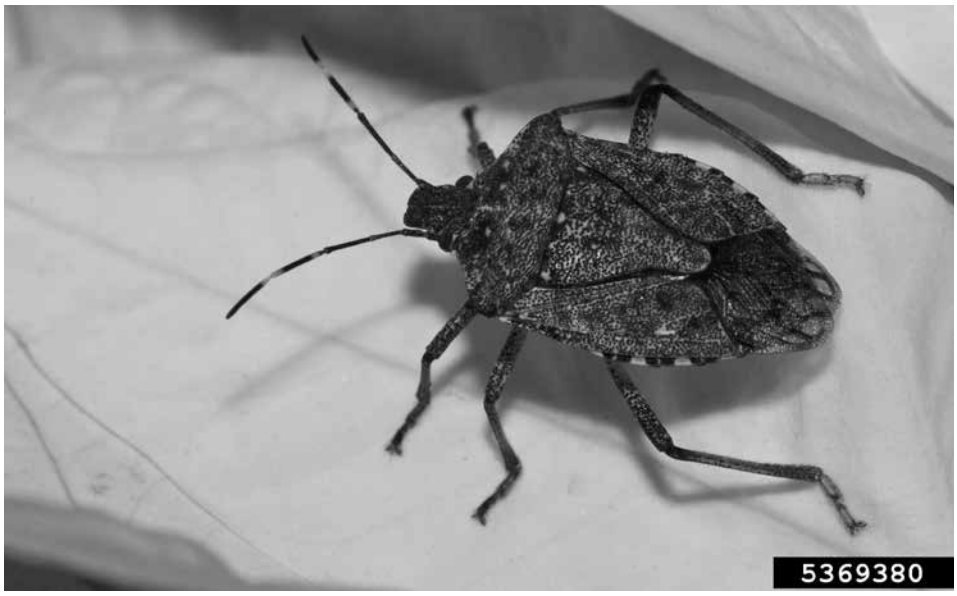
A column focusing on topics that might limit the health, vigor and productivity of our private or public woodlands

Coordinated by Mark Whitmore

Snug as a Bug in a Rug

By Mark Whitmore

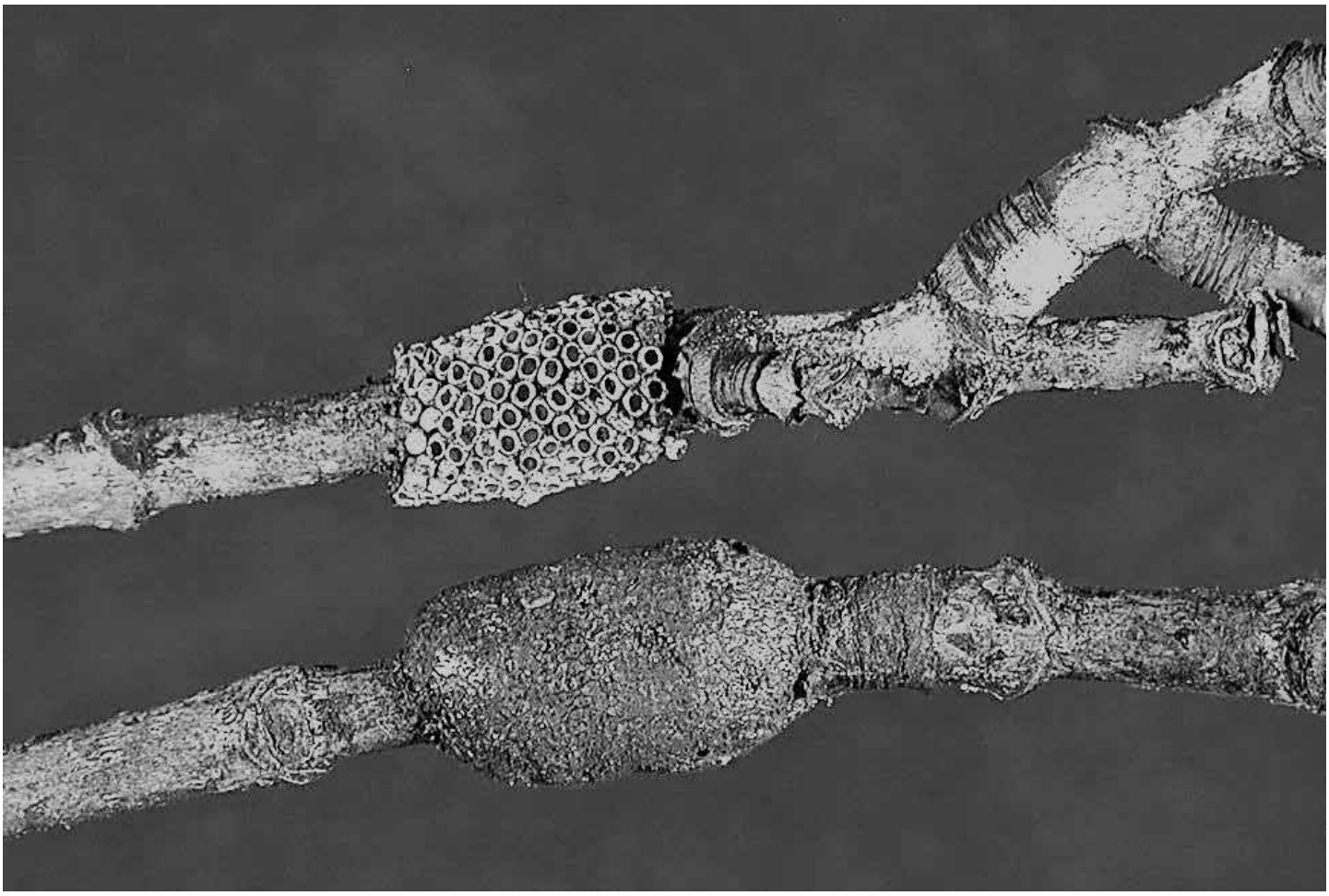
As I was growing up I always found the phrase "snug as a bug in a rug" comforting when my mom would tuck me into bed on a cold winter eve. It wasn't until later when I had a nice wool rug that it took on new meaning as carpet beetles gradually devoured it. However, now, at this time of year, as I wander through the woods I marvel at the myriad tactics bugs have found to survive the harsh realities of winter. The woolly bears have finished their last perilous trek across the rural roads, winter moths (actually Bruce spanworms in NY) have mated and laid their eggs, the snow covered stillness of the woods in winter has arrived and next year's crop of bugs are awaiting their cues to begin the growing season anew. So how do they survive? Tiny little down coats and insulated rubber booties? A billion bonfires dotting the landscape? ...and you thought they were stars!



Brown marmorated stink bug (Halyomorpha halys). Susan Ellis, Bugwood.org

Monarch butterfly (Danaus plexippus). Steven Katovich, Bugwood.org

Well, it's a lot more entertaining than that, especially if you're an entomologist. Basically there are two strategies to survive the winter cold: avoidance and tolerance. Avoidance is simply a behavior that allows the insect to avoid exposure to the cold, and migration would be the most common. One of my favorites, and the most amazing, is the annual migration of Monarch butterflies from the north all the way to the mountains of Mexico. I marvel at the fact that the adults that return to the small patch of woods in Mexico are the grandchildren of the monarchs that were there the year previously. How they manage to pull that off is a miracle of nature that I encourage you to read up on if you are unfamiliar with it. Another avoidance behavior is one that can be annoying, like when the seemingly endless number of ladybugs or brown marmorated stinkbugs decide to find a nice warm place in your house to take up residence in winter. The annoying part is when they emerge from their winter slumber and drive you nuts with their windowpane antics trying to get back outside as it warms up in spring.



Forest tent caterpillar egg masses.

Tolerance of cold is a much more complicated subject, and is the way of life for most insects in a northeastern forest. Basically, bugs physiologically increase the concentration of cryoprotectant (or freezing protectant) chemicals in their blood so that low temperatures will not initiate ice crystal formation in their bodies. If ice crystals were to form they would pierce the walls of cells in their body, causing death. However, the champion of freezing tolerance is not a bug but the wood frog. Wood frogs increase the level of cryoprotectants in their blood to the point that they can tolerate ice crystal formation and they can go through multiple freeze/thaw cycles throughout a winter.

Accumulation of cryoprotectant chemicals in a bug's blood is a gradual process. Triggered by some environmental cue in fall, the concentration of cryoprotectants increases to the height of their freezing tolerance in deep winter, which is then gradually lost in spring as the levels of cryoprotectant in their blood diminish and body growth begins anew. One of the problems with this approach is that in fall or spring the insects are vulnerable to a surprise frost. Our work with hemlock woolly adelgid has shown temperatures just below freezing in April can cause as much mortality as below zero temperatures in February. This brings up one of the nagging questions in my mind is if these rogue freezing events will occur more frequently with climate change. If so, how will the different native and invasive forest insects respond? Will climate change actually offer greater freezing damage to insect populations even though the mid-winter low temperatures are warmer?

There are a number of strategies bugs have devised for successful overwintering. Some of our most common defoliating insects spend the cold months as eggs, a very resilient life stage. Forest tent caterpillars have conspicuous egg clusters on twigs in the canopy. Gypsy moths have their furry egg masses in more protected areas on tree bark. Bruce spanworm eggs are laid adjacent to leaf buds, exposed to winter cold in the tops of trees as they await the buds bursting so they can be the first to feed on the tender young spring leaves.

Insects also overwinter as larvae. This is a tender life stage so most all overwintering larvae are in sheltered conditions. Most folks are now, or will shortly be aware of the Emerald ash borer. This invasive beetle overwinters beneath the bark of its host tree, protected not only by the outer bark,

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Mourning cloak butterfly adult. Photo by Jerry Payne, USDA. Bugwood.org

but also by the thermal mass of the tree trunk that is warmed whenever it is exposed to the sun. This is not to say the larvae don't succumb to cold mortality. High levels of mortality were recorded during recent hard winters, yet populations have recovered. There are always refuges in winter, a forested environment is never all the same. For instance, snow offers good insulation from extreme cold events and often covers the base of trees and their roots (where I've found EAB frequently) as well as fallen tree trunks.

Overwintering adults are not as common as larvae and eggs, but do occur and often in the context of there being many different life stages present as winter comes along, and it's just a game of roulette if the winter will be mild enough for them to survive. Mountain pine beetles in the west are a perfect example, where if the winter is severe only the larvae will survive, but if it's mild there will be a ton of adults ready to emerge in spring. Unfortunately milder winters and increased winter survival of these beetles has been implicated as the cause for widespread outbreaks. Another example is the balsam woolly adelgid that will continually develop throughout the summer and all life stages will be present on the bark at winter's onset, but only the 2nd instars have been shown to be tolerant of the coldest temperatures. Every spring I'm reminded of one of my favorite overwintering adults, the mourning cloak butterfly. The caterpillar of this gorgeous butterfly feed on a variety of trees then metamorphose into adults that can live up to 10 months, spending the winter in protected tree cavities, under shagbark hickory bark, or other convenient locations. As spring first hits a 60F day they will emerge from their hiding places to brighten the landscape and remind me of the splendor that is about to burst forth.

One of the more interesting stories that I've come across does not involve bugs or northeastern forests. While working on the west coast a few years back there was a mysterious dieback of yellow cedar in southeast Alaska. Dieback and tree mortality was primarily located at lower elevations in areas of saturated soils. Researchers looked for just about any living thing that could be causing the dieback: insects, fungi, nematodes; but came up empty handed. Then in the early 2000's they noted that fine roots in saturated soils were found primarily near the soil surface. These fine roots become active early in spring to get a jump on nutrient uptake. The problem is that when these roots are stimulated to begin uptake earlier in the season with an unseasonable warm spell, they become particularly vulnerable to freezing damage. Consensus among researchers now is that the absence of snowpack earlier in the season, as a result of climate change, exposes the roots which become active early and succumb to early spring freezing events.

The take away from this discussion is that winter is never a simple thing for an organism to deal with. Biologies are diverse and many strategies have been adapted to avoid or tolerate the complexities of winter survival. Some species have more or less robust strategies to deal with winter, but others are more fragile. As we begin to see the increased impacts of climate change, winter will likely become more important to a species' survival be, they pest or one of our beautiful native butterflies.

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

Are you interested in a particular topic and would like to see an article about it?

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

Figure 5. Pictured is a strobilus of yellow birch. The strobili of yellow and black birch are upright, known as erect. In contrast, paper birch strobili are pendant.

As with the foliage, twigs of yellow and black birch have a smell of wintergreen. The buds of all three may occur on short or spur shoots, though these short shoots may elongate after multiple years of compressed growth.

Figure 6. Black birch bark on pole-sized stems appears to exfoliate, but as the tree matures the bark develops plates.

Ostrya virginiana* and *Carpinus caroliniana

Ostrya has only one species in the Northeast and is known commonly as eastern hophornbeam or ironwood. The former name is attributable to the fruit that looks like a hop, and the latter is to the density of the wood that was used in the textile industry as spools or turned on a lathe for mallets. This species is most likely to be confused with American hornbeam. Here, reference to each will be by genus.

Ostrya and *Carpinus* do not form spur shoots. On lateral branches there is often a variety of leaf sizes (Figure 8). The leaves of *Ostrya* are finely hairy on the upper surface, but their petiole (the stalk of the leaf) is reported as without hairs, thus glabrous. *Carpinus* has similarly sized and shaped leaves as *Ostrya*, but the petiole is hairy and the upper surface of the leaf is glabrous to the point of feeling like wax paper (Figure 9). The leaves of both species are thin and delicate. The veins of *Ostrya* foliage may often be branches, though this is unlikely on the veins of *Carpinus* foliage.

The twigs of *Ostrya* are fine, though stouter than *Carpinus*. The buds of *Ostrya* are ¼ inch compared to the 1/8 inch buds of *Carpinus*. The buds of *Ostrya* are also more substantively divergent versus the minimally divergent or appressed buds of *Carpinus*. If you use a hand lens, you may see vertical striations on the bud scales of *Ostrya*, but not on the bud scales of *Carpinus*.

The mature bark of each is readily distinguishable. The bark of *Ostrya* is finely shredded and peeling (Figure 8). The bark of *Carpinus* is smooth, bluish, tight, and fluted to look like the separations of a well-formed muscle, thus the common names “blue beech” and “musclewood” (Figure 10).

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Figure 7a. Paper birch leaves are broader at the base, more coarsely toothed, and have 9 or fewer lateral veins.

Figure 7b. Black birch leaves on spur shoots

Figure 7c. Yellow birch leaves which are similar to black birch leaves.

The fruit of *Carpinus* is a paired nutlet with lobed bracts (Figure 2). The fruit of *Ostrya* is a single nutlet encased in an oval wing.

Finally, *Ostrya* is more likely to be found growing on drier soils, and *Carpinus* is more likely to grow in moist soils or near streams. Both are tolerant of shade, but will prolifically stump sprout if cut. The name "water beech" reflects the common streamside and moist soil habitat for *Carpinus* though it is not typically found in standing water.

Summary of key features:

• **Paper birch** (*Betula papyrifera*) – white papery exfoliating bark, spur shoots possible, non-aromatic twigs, 9 or fewer veins on foliage that is broadest at the base and coarsely doubly serrate margin. Leaf base may be rounded or symmetrically flat on either side of the petiole. Buds are divergent.

• **Black birch** (*Betula lenta*) – black bark with plates, spur shoots possible, wintergreen aroma of twigs and foliage, typically more than 9 veins on foliage, doubly serrate with small serrations. Leaf tapers from mid-point of leaf towards base, which may be asymmetrical and cordate (heart shaped). Petioles are hairy. Veins on lower leaf surface without hairs. Buds are divergent.

• **Yellow birch** (*Betula alleghaniensis*) – yellow or bronze papery and exfoliating bark though large diameter mature trees develop plates. Foliage may occur on spur shoots and with twigs have aroma of wintergreen. Leaf tapers from mid-point of leaf towards base, which may be asymmetrical and cordate. More than 9 veins on foliage, doubly serrate with small serrations. Petioles are hairy. Hairs on veins of lower leaf surface. Less common on dry sites, more common in cool habitats and soils with adequate moisture.

• **Eastern hophornbeam** (*Ostrya virginiana*) – finely shredded bark, fine double serrations on delicate leaves sometimes with branched veins, asymmetrical leaf base,

Figure 8. The foliage and bark of eastern hophornbeam, also known as ironwood. Veins of foliage may be branched (evident in this picture), and the leaf surface is delicately pubescent to the touch.

leaves of various sizes, fine hairs on upper surface of leaf apparent to the touch, unlobed wing encasing single nutlet fruit, vertically striated scales on ¼ inch green-brown divergent bud.

• **American hornbeam** (*Carpinus caroliniana*) – smooth bluish fluted bark, fine double serrations on delicate leaves that lack branched veins, asymmetrical leaf base, leaves of various sizes, glabrous upper surface of leaf, lobed wing encasing double nutlet fruit, smooth scales on 1/8 inch brown slightly appressed bud.

The column is coordinated by 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.*

Figure 9. The foliage of American hornbeam is visually similar to eastern hophornbeam, though lacks branched veins and in this figure suggests a glabrous leaf surface. Smaller buds, more appressed to the stem.

Figure 10. The ridges of the stem of American hornbeam are described as fluted and lend to the other common name of musclewood.

Harvest Name	Map Label	Year Completed	Harvest Area (acres)	Harvest Area Perimeter (ft)	Slash Wall Perimeter (ft)	Area Under Wall (acres)	Percentage of Harvest Area Under Wall (%)	Harvest Perimeter per Acre (ft/acre)	Cost per acre of wall at $1.50/ft
Red Pine (RP)	A	2017	13	3122	3122	1.6	10.8	240	360
Gas Line (GL)	B	2017	74	7452	7452	3.8	4.8	101	151
North Gate	C	2019	135	11025	8588	4.3	3.1	82	123
Station Rd. 5-14 (Wedge)	D	2017	11	2653	2653	1.3	10.9	241	362
Station Rd. 5-13 (Boot)	E	2017	16	3775	3775	1.9	10.6	236	354
Recknagel North	F	2020	6.4	2198	2198	1.1	14.8	343	515
Recknagel South	G	2020	31	5486	5486	2.8	8.2	177	265
Patch 1 (experimental)	H	2019	1	740	740	0.4	27.2	740	1110
Patch 2 (experimental)	I	2019	1	740	740	0.4	27.2	740	1110
Patch 3 (experimental)	J	2019	1	740	740	0.4	27.2	740	1110
Camp Ridge	K	2019*	128	9619	9619	4.9	3.7	75	113
Sugarbush - mesh fence	L	2018	34	4658	4658		0.0	137	
Decker Road	M	2020	25	5092	5092	2.6	9.3	204	306
Slash Wall Total (avg of comm.)			442		50,205	(2.7)	(8.5)	(312)	($283)
All Enclosures Total			476		54,863				

Table 1. Arnot Forest - Perimeter and Area Summary of Slash Walls and Mesh Fence Exclosures. P.J. Smallidge and B.J. Chedzoy, 4/2020.

questions about the innovative experiments that they have been doing to keep deer out of regenerating stands at Cornell's Arnot Teaching and Research Forest in Van Etten, NY. Peter is the Director of the Arnot Forest, and Brett is the Arnot's Forest Manager.

1) What prompted the idea of using slash walls at the Arnot? Can you briefly describe the status of forest regeneration there, and the approximate deer herd density versus what would be considered appropriate to ensure successful regeneration?

Peter: All of our efforts are in the context of a working forest used in support of the mission to educate people who make decisions about how to best manage their lands. We test ideas that might be too risky for others. We had stands of timber that needed to be regenerated based on their age, stand condition, and prior management. Some of the stands also had high density of white ash, and EAB is present at the Arnot. Prior management had thinned the stand, removing lesser value trees, but the residual stand didn't have enough volume to allow for additional intermediate (e.g., thinning) treatments. The next entry needed to start the regeneration process. We attempted to layout the position for a fence, but recognized that we lacked sufficient staffing to regularly inspect and maintain the fence. From that we arrived at the notion of a slash wall as an option to test. The deer herd at the Arnot hasn't been estimated since the late 1990s. The actual size of a deer herd, anywhere, is interesting to know but the impact on the function of the processes of the forest are what we have focused on. We had attempted two regeneration harvests in 2004 and 2005 that failed to successfully regenerate to desired species. Both stands regenerated to low-value species with greater than 99% dominance in beech, striped maple, hophornbeam and pin cherry. Our earn-a-buck program started in 1998; we increased deer harvest but the change wasn't sufficient to reduce deer impact. We felt the weight of the evidence necessitated some deliberate effort to exclude deer from access to the regeneration layer.

Brett: A variety of deliberate "text book forestry" attempts to regenerate mature stands at the Arnot over the past twenty years were unsuccessful, even where problematic understory vegetation was removed. Similar experiences were well-documented across the state. This led Peter and I to shift away from thinking that good forestry + more hunting + "bad plant" removal would ever be enough and at that point we committed to a strategy of temporarily excluding deer. As we started to lay out our first regeneration harvest where the plan was to exclude deer with fencing, we started to realize the challenges to building secure fence on the Arnot's rugged terrain and the ongoing costs of maintaining it. From that concession, we started to consider any and all other options and decided that it was worth trying to build a deer-proof barrier from logging debris (slash). At that point, we started discussing the concept with other foresters and loggers for their opinions and realized that there were no precedents.

2) Where did the idea of using slash walls originate? Is this the first time this method has been used for this purpose?

Peter: We recognized that each harvest produced significant slash, and had heard stories of "windrowing" slash in other areas for the purpose of improved access

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for planting. When we started the project we were unaware of any other use. No one we know of has done slash walls at the scale we have, but we've since learned that a forester in CT that tried a smaller and narrower slash barrier (not really a wall) on an acre. There wasn't enough slash to produce a more significant wall.

3) When did this project start? How many areas, and how much total acreage are currently protected? What do the initial results look like versus the surrounding unprotected areas?

Peter: I've attached a table that summarizes the effort thus far (see Table 1). The table also includes a fence in the sugarbush. The first harvest that included slash walls in the contract was sold in July 2016, but the first harvest to actually start a wall was sold in about March 2017 and that wall was completed in June 2017.

4) Briefly, what machinery was used in the creation of the walls? Have you been able to calculate a per acre price of slash walls versus fencing or other methods of deer control/exclusion?

Peter: The best equipment thus far is a feller-buncher. Brett may know a better descriptor. The attached table has prices per acre and per foot (see Table 1).

Brett: A feller-buncher is a steel-tracked excavator-like machine that cuts trees and stacks them in piles. This ability to carry trees short distances over rough terrain and stack them in tall, dense windrows makes the feller-buncher ideal for building slash walls. Most feller-bunchers cut trees with a "hot saw" that looks like a giant buzz saw. This gives the machine the added capability of cutting small stems of "interfering vegetation" in the understory in an efficient, cost-effective manner. Both deer exclusion and removal of the competing understory are necessary for successful regeneration. Limited experiences to date suggest that slash walls can also be built using a variety of other logging equipment.

Inpenetrable slash wall barrier protecting oak and maple seed trees at the Arnot Forest.

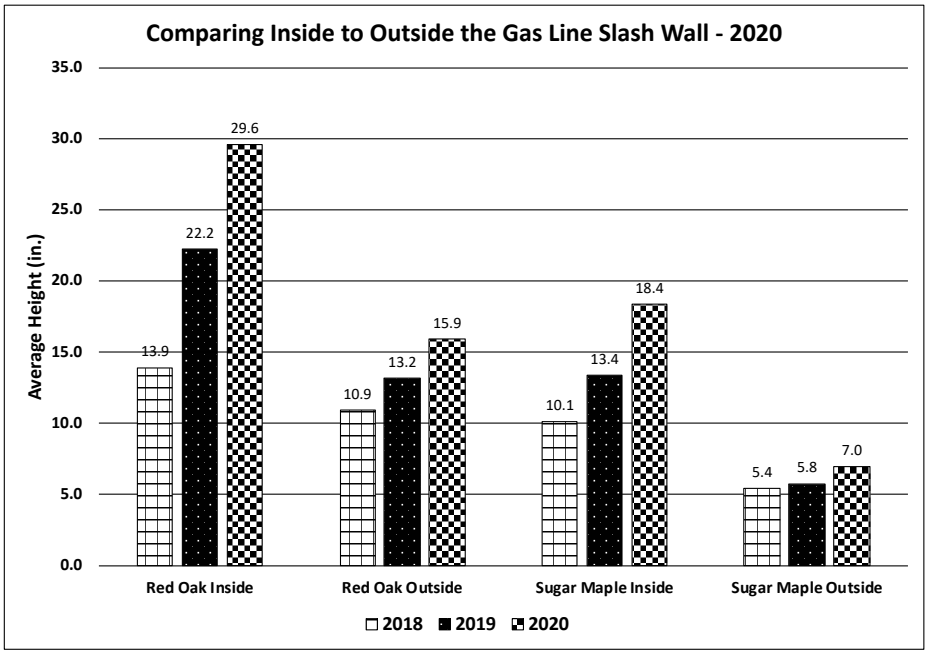

Figure 1. Data from AVID plots in the "gas line" slash wall illustrate that seedling height growth rate inside the slash wall is greater than outside the slash wall. Seedling height growth inside fences inside the slash wall (data not shown) was similar to unfenced seedlings inside the slash wall. (Smallidge, Curtis, Chedzoy, Ashdown, unpublished data 2020)

5) Based upon the results so far, do you anticipate slash walls becoming a viable tool for private woodland owners seeking to ensure successful regeneration in their woodlots?

Peter: Preliminary data using the AVID protocol (basically tagged seedlings measured annually for height growth) illustrates the impact of deer and the effectiveness of the slash walls to date (see Figure 1). After we learned the process of creating a foundation of stems in the wall to prevent deer from crawling through, there have been zero examples of deer getting inside the slash wall. So, the slash walls work. Whether they become a viable tool depends on several factors such as the availability of logging crews with interest and equipment, the scale of the harvest and cost effectiveness, and the availability of cost-share funds. We are starting a project that will assess (1) applications of slash walls on small harvests ($<$ 10 acres) and (2) silvicultural nuances such as timing of the wall relative to the preparatory cut

vs. the seed cut. We would also like to experiment with "enhanced" walls for situations when there is insufficient slash.

We run a field tour each September. The participants seem especially excited about the slash walls. Dr. Jeff Ward of the Connecticut Experiment Station has started research in areas where they will install slash walls. A slash wall was created in Rhode Island last winter (picture attached). Another was created in Tioga County (Spencer) this past summer. We are aware of others in the planning/execution stage in Chemung County, Tompkins County, Madison County, and Allegany County. Efforts by Dr. Aki Koyama at Michigan State University for research funding are ongoing. There is strong interest among early adopters for this technology.

6) Building slash walls to protect regenerating stands is undeniably an *extreme* measure, and clearly highlights the severity of the challenge presented by the overpopulation of deer in NYS—what are your thoughts as to the likely future of our woodlands in the northeast (and beyond) should we not begin to find and carry out measures such as these?

Peter: Hmmm, I guess that depends on how you define "extreme." It is less costly and more organic that metal or plastic perimeter fence and requires less time to inspect and maintain, and has no removal cost. But, it is visually more abrupt and more novel. With limited exception, I have not seen situations of successful regeneration harvests in the last 20 years that will produce another forest of comparable mixture of species diversity, stem density per acre, and stem quality without deliberate exclusion of deer. There are regeneration harvests where some desired species establish, but not in sufficient density. In the higher elevations of the Adirondacks I've seen 24 acre clearcuts that successfully regenerated in the early 2000s. These areas have heavy winter snows and likely increased winter kill of deer. The large cuts (multiple 24 acre blocks) can overwhelm the relatively small herd. Most owners don't have this configuration of land and winter conditions. The prognosis for healthy, diverse, productive and functional forests is quite poor in the absence of deliberate efforts to limit the impacts of deer.

Brett: The bottom line is that regeneration must be free to grow (i.e. free from interference) and protected from herbivory until enough quality stems are above browsing height (> 6') to form the next stand. We know of no exceptions for mixed hardwood stands. Slash walls are the most cost-effective and safest method that we know of—safe, in that their utility and performance are not dependent on rigorous maintenance like fences.

Forest stewardship in practice.

7) What are some additional resources for those wishing to learn more about this project?

Peter: We are locating all resources at www.slashwall.info. *(There you can find all the latest news and information about slash walls, including a gallery of images, some video (aerial/drone) footage of slash walls and a feller-buncher in action, and an archived webinar detailing the potential for slash walls to aid in ensuring that our woodlands have at least a fighting chance).*

Postscript: In preparation for writing this article, I took a quick drive through the Arnot Forest to see what a slash wall looks like up close. Despite their size—and they *are* big (ideally 10' tall x 20' wide!), even when newly built, they blend with the landscape much better, and feel like much less of an imposition on the landscape than the standard deer fencing I drove past on my way up the hill. Peering inside the bounds of the walls themselves, it was great to see such textbook silviculture in practice. The shelterwoods were loosely filled with autumn-vibrant oak and maple seed trees well-spaced throughout the stands to be regenerated, and it was particularly gratifying to know that within the slash walls these areas would be able to repopulate themselves without hindrance, providing a rare view of the diversity and abundance that forest regeneration in NY once was, and could be again, with our help.

Sadly, despite individual efforts such as these (which hopefully will take root and expand as part of our standard regeneration toolkit), when taken as a whole, we are letting an unchecked deer herd determine the course of forest succession throughout New York State, to the great detriment of generations to come, as the ecological and economic damages unfold *just* slowly enough to keep the spotlight off the inevitable decline of diversity and value in our woodlots. It doesn't have to be this way, but some hard, politically fraught choices will need to be made, and soon, one way or the other. What it comes down to is basic population biology—you simply cannot maintain an unnaturally large deer herd and expect to have woodlands full of maple, oak, and cherry in the future.

I vote for the trees.

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