Woodland Guidelines for the Control and Management of American Beech

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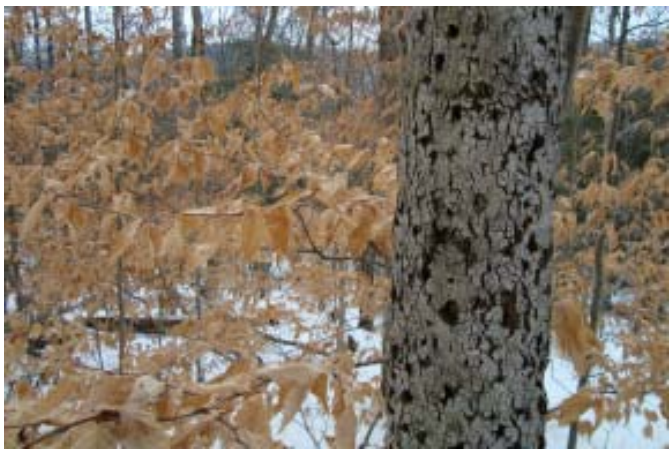
www.ForestConnect.info

Forest Connect Fact Sheet Series

Overview

American beech (*Fagus grandifolia* Ehrh.) is a native hardwood species common to many forest types throughout the Northeast and Central States. Beech becomes less abundant as a component of forests in areas of the Lake States where drier soils may limit its distribution[1]. American beech is tolerant of shade and able to sprout from its roots (called root suckers). Suckering is often enhanced by wounds to shallow roots after ground disturbance, or occurs following decline or death of a beech tree.

A disease syndrome caused by a non-native beech scale insect and exotic beech bark fungi has spread throughout the Northeast and much of the geographic range of beech[2]. This beech bark disease kills most infected trees at least 8-10 inches in diameter, affecting the supply of beech sawtimber. Beech bark disease also reduces beechnut production on infected trees, limiting the contributions of beech as a wildlife food source. In many woodlands, although beech remains abundant, the disease syndrome has limited its contributions for timber and wildlife food source.



Beech bark disease is the result of two independent organisms, a scale insect followed by a fungus, that results in tree death and often stimulates root sucker development. Photo by Peter Smallidge.

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With or without beech bark disease, disturbances that open the canopy will increase light on the forest floor and promote understory beech development where present. The resulting understory beech thicket creates dense shade which inhibits regeneration of other desirable hardwoods and reduces wildlife habitat values. The dense beech thickets also restrict access through the woodland. Harvesting practices in woodlands that include beech can also increase the abundance of beech through stump sprouts as well as root suckers[3].

Because beech can reproduce vegetatively via stump sprouts and root suckers, overstory harvesting has proven ineffective for controlling the amount of beech in the forest. Depending on the size structure of the beech and the amount of canopy openness, both mechanical and chemical[i] controls potentially are effective for reducing understory beech thickets (Table 1). Selecting the optimal treatment depends on owner objectives and attitudes, the extent of an area needing treatment, the size class structure of beech, and the abundance of desirable species in seedling and seed-bearing size classes[4]. Proper application of these management options will increase their effectiveness (Table 2). Where owner objectives include establishing advance seedlings of other hardwood species, the management may require a synchronized effort involving use of an appropriate silvicultural practice, controlling the impacts of deer, and reducing the presence of understory beech and other interfering plant species[5].

Occasionally in woodlands effected by beech bark disease, an isolated mature tree will not have any symptoms. These trees may have some resistance or tolerance to the insect or fungi. Resistant and tolerant trees can be conserved to maintain tree species diversity and the potential for beech nut production to benefit local wildlife.

[i] The use of chemical trade names is not intended as an endorsement, nor is the omission of a product an indication of poor performance. Pesticide users should follow label restrictions and seek assistance from qualified professionals to ensure compliance with state and federal laws that protect applicators, the public and the environment. For educational assistance with pesticides, contact: Cornell University Cooperative Extension or you local office of Cooperative Extension.

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Table 1. *Summary of beech management control options to significantly reduce the relative abundance of beech and beech root sucker development associated with harvests or beech bark disease. See associated text and citations[4] for details of control.*

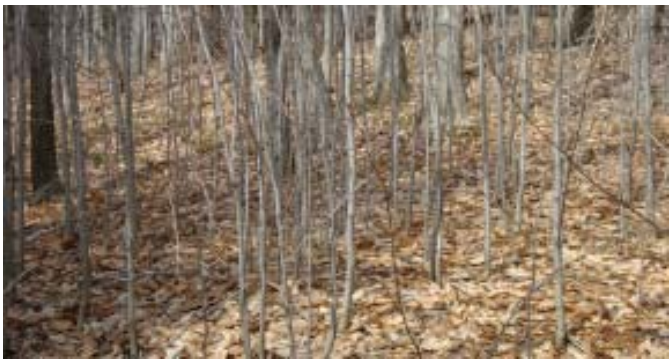
	Beech Size Class		
Method	*predominately less than 2″ dbh*	*predominately between 2″ & 8″ dbh*	*predominately greater than 8″ dbh*
Mechanical	• If canopy is closed, brush saw all understory stems • Effectiveness of treatments decline with increasing canopy openings.	• Girdle stems using handsaw, ax, or flame torch • Goats girdle beech and striped maple. Small stems resprout.	• No options are effective
Chemical	• Foliar spray applications of glyphosate	• Basal bark treatment to all stems less (than 6") with triclopyr. • Cut-stump treatment of largest stems using glyphosate. Repeat as necessary.	• Cut stump treatment with glyphosate

Table 2*. Summary of treatment application techniques. The details to efficiently and safely apply these management options are beyond the scope of this fact sheet. Owners and managers should network with forest owner associations, Cooperative Extension trained volunteers, and state agency service foresters to observe the application of these techniques.*

Management Control Options	Application Techniques
Brush saw of small diameter stems	• Use all appropriate safety equipment and ensure brush saw is working properly. • Some sprouting and suckering will occur if canopy opening allows sunlight to reach forest floor.
Stem girdling	• Must completely encircle stem if done without herbicide. • Usually use a double girdle, separated by an inch or more. • Girdle must be of sufficient width to prevent "bridging".
Flame weeding of stems	• Use safety equipment and have water available to manage unanticipated ignitions.
Cut-stump treatments	• Glyphosate products have the highest level of transmission in the root system. Other chemical active ingredients have not always given desirable results. • Apply to freshly cut stumps or wood tissue. Best translocation and movement is between early July and middle October. • Apply to the outer 2 inches of the stump surface to fully wet the surface, but not to the point of run off. • Not effective on frozen wood.
Stem injection or hack and squirt	• Glyphosate will minimally translocate into the beech root system. • Most of the chemical will move up the stem into the treated plant.
Basal bark treatments	• Apply to full circumference of stems from ground level to approximately 18" in height. • Does not flash to interconnected stems
Goat browsing and girdling	• Provides temporary control, but requires considerable and sustained effort for herd management. • Browsing will impact all vegetation, except ferns, below 5′ height. Monitoring of the herd and timely movement will prevent damage to crop trees.

Woodlands where beech are predominately less than 2" in diameter

Woodlands and forests characterized by few if any large diameter beech and a preponderance of small diameter beech often have a history of harvesting or mortality of canopy beech due to beech bark disease. Some evidence suggests that root suckers develop around infected trees, and the degree of suckering increases as the disease progresses in a tree[6]. In some situations, the sprouts and suckers may exceed 10,000 stems per acre and represent more than 95% of stems less than 2" diameter at breast height (dbh). High stem densities of beech will inhibit the regeneration of other



Small diameter beech whips develop within a few years following the death of mature beech or often in areas having harvesting activity. Photo by Peter Smallidge.

hardwoods. Also, these small understory beech stems may grow rapidly within openings in the canopy caused by cutting or natural disturbances. They will develop into larger size trees that eventually succumb to beech bark disease, initiating new root suckering.

Mechanical treatment of small diameter beech may succeed in some situations. In a closed canopy woodland of mature trees, brush saw clearing of all understory beech resulted in limited stump sprouting and suckering, and the development of desirable advance hardwood seedlings beneath the overstory[7]. Brush saw treatments will likely be most feasible for limited size areas because of labor costs. However, the effectiveness should be independent of the extent of area treated. In open canopy forests, brush saw clearing of understory beech may result in resprouting of the beech stumps, and some root sucker development from roots of nearby overstory trees. Brush saw treatments provide an organic control option.

Brush saw cutting provides a mechanical and organic control method in situations where the overstory canopy is closed, beech are approximately 1" to 4" in diameter, and beech stem density is less than 500 per acre. Photo by Ralph Nyland.

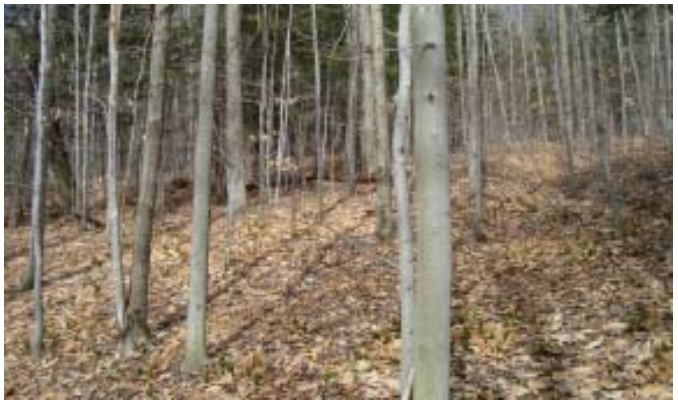
For large acreages or beneath canopy openings, owners will need to use a herbicide to control small diameter beech. The crowns of beech less than 1" dbh, and often less than 2"+ dbh, are normally within reach using a ground-based foliar herbicide treatment, and particularly by mist blowing. Glyphosate concentrate diluted in water to label specifications effectively controls small diameter beech[8]. Foliar treatments are most effective in late summer and early fall. Woodland owners should follow requirements on the label for the herbicide, and insist on application by qualified and appropriately trained personnel. Worker safety and environmental protection are paramount.

For areas larger than a few acres, a backpack or skidder mounted mist blower will increase efficiency. In smaller areas, a backpack low pressure spray tank will suffice, assuming that the spray reaches the tops of the target trees. Additional chemicals, such as Oust® (sulfometuron methyl) can be tank-mixed with the glyphosate to control fern rhizomes. Caution is warranted for foliar applications, and especially mist blower treatments. With a broadcast chemical treatment, all plants less than approximately 15 to 20' tall may be killed, including advance seedlings of desirable species. After the herbicide treatment, replacement seedlings will need to come from seed dispersed from on-site trees, seed blown or carried into the stand, or by replanting.

Untreated areas dominated by small-diameter beech will likely increase in understory beech abundance as the beech trees get larger, become infested with beech bark disease, die, and resprout from the roots. Areas with small-diameter beech that are allowed to develop into larger diameter classes must be treated with methods other than foliar sprays (see below). For some ownership objectives, delaying treatments until beech stems reach larger diameter classes may be acceptable, but that will require using one of those alternate treatments.

Woodlands where beech are predominately between 2" and 8" diameter

Areas of intermediate sized beech may have a history of previous harvests and the subsequent development of beech sapling thickets. Many of these trees will have an interconnected root system, but the degree of interconnectivity will not be known. The extent of interconnectivity will influence the efficacy of some treatments, and the choice of a method to use. Another important consideration in selecting a treatment is the density of beech to treat. Areas with more than 400 to 500 stems per acre[9] should be considered for broadcast foliar applications. Brush saw cutting and other individual stem treatments usually are most cost-efficient in areas with a lower density of understory beech.



Sapling-sized beech can dominate the mid canopy and create dense shade on the understory. Stems may be of low density and permit selective treatments such as girdling or basal bark spray. Photo by Peter Smallidge

Girdling of a stem severs and completely disrupts the cambial layer located immediately inside the bark, and kills the treated tree. The treatment can be done with small hand saws for trees <4-5 inches dbh, or using a chainsaw for larger trees. Some evidence indicates that girdling will not significantly stimulate root sucker development, particularly if the overstory canopy is closed. Crowns of some girdled trees may redevelop foliage for as many as three growing seasons following treatment, only to eventually die. Girdling sapling-sized beech has resulted in only limited sprouting on the stem[10]. Similarly, flame girdling of beech in this size class also resulted in stem mortality, although some crowns of larger diameter beech trees retain live foliage for up to 3 years[11]. Other work with flame treatment of beech noted the absence of root sucker development[12].

Goats can be used in woodlands to provide temporary control of beech[13]. Goats girdled beech 2" to 5" dbh and did not affect the stems of mature hardwoods or sapling sized sugar maple and red oak. Goats also girdled striped maple. Goats function as a broadcast treatment impacting most vegetation below 5 feet of height. Smaller beech stems resprouted within a year or two of removing the goats. Because goats browse preferentially, the best control occurred with goat stocking rates of 40 to 80 per acre and frequent movement to fresh paddocks.

One chemical method to control sapling-sized beech is to use a basal bark treatment of triclopyr (e.g., Garlon® 3A or 4) in water or basal oil, as per label specifications. Basal bark treatments can be applied throughout the year, but typically not before, during or immediately after a rain event. Water based treatments should not be applied in winter because the water freezes and won't penetrate frozen wood. Triclopyr does not translocate into the root system and thus will not flashback through roots of interconnected beech stems. It also will not prevent root suckering.

Individual beech stems may also be treated using stem injection by the hack-n-squirt method. Herbicides with active ingredients such as glyphosate at 50% active ingredient or triclopyr at approximately 15% (as Garlon® 4) are squirted into the frill of a girdle or directly via a "Hypo-Hatchet®" or similar device. Other devices, such as EZJect®, can forcibly inject a capsule of herbicide into the stem. Glyphosate will move from the treated trees to other beech via an interconnected root system. Even so, these types of treatments are most effective where the majority of beech stems are injected, rather than relying on appreciable translocation through the roots as flashback[14]. Stem injection also can be used in beech stands having larger diameter beech. Some evidence indicates that after large trees injected with glyphosate die, the herbicide moves into attached root suckers and kills those small trees as well[15].

An alternative strategy for stands having beech with diameters of predominately 4" to 8" is to cut these trees and apply a concentrated solution of glyphosate to the freshly cut stumps, known as a "cut-stump treatment". Cut-stump treatments applied to all beech 5" dbh and larger using glyphosate as approximately 50% active ingredient to wet the outer 2" of stump surface resulted in 50% control of nearby beech stems greater than 1" dbh, and 65% control of those less than 1" dbh[16]. Results were similar for cut-stump treatments to all beech greater than 3" dbh, thus the greater work to cut the added smaller diameter stems doesn't seem warranted. The greatest mortality was associated with plots having the highest basal area of treated beech. The time required for cutting small beech trees (>5 inches dbh) and applying the stump treatment is greater than for basal bark applications to trees of equivalent sizes, although chemical costs may be greater for basal bark treatments and basal treatment chemicals do not provide control of root suckers through flashback. Where glyphosate was applied to stumps after brush saw cutting of all understory beech <5 inches, no stumps sprouted and some adjacent beech trees of larger diameters also died due to flashback via the interconnected root systems[7].

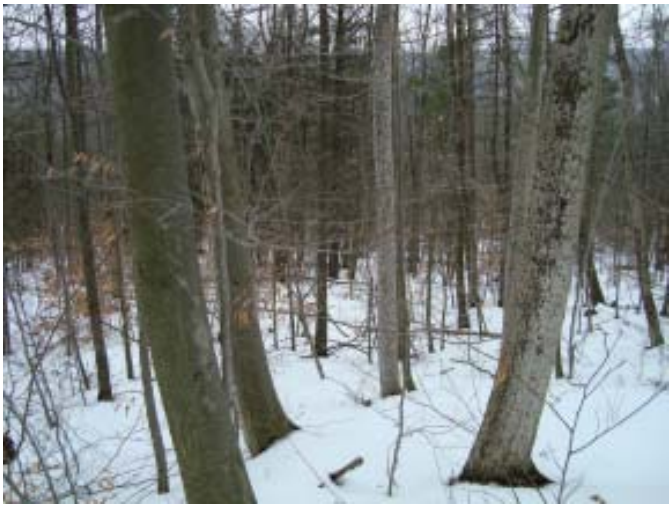
There is no evidence that glyphosate causes mortality to other species when correctly applied as a cut-stump treatment, or when injected into a standing tree. Glyphosate first kills the target tree. Then it moves through the tree's root system, causing mortality of attached beech stems. Most effects are apparent within 4 weeks of the treatment.

As beech trees increase in size, cut stump treatments of concentrated glyphosate can be applied during firewood cutting. Picture illustrates cutting and recent glyphosate treatment, before effects are apparent. Photo by Laurel Gailor.

Woodlands where beech include stems greater than 8" diameter

A variety of management histories may result in stands having large diameter beech with or without small diameter beech. Because of the larger diameters

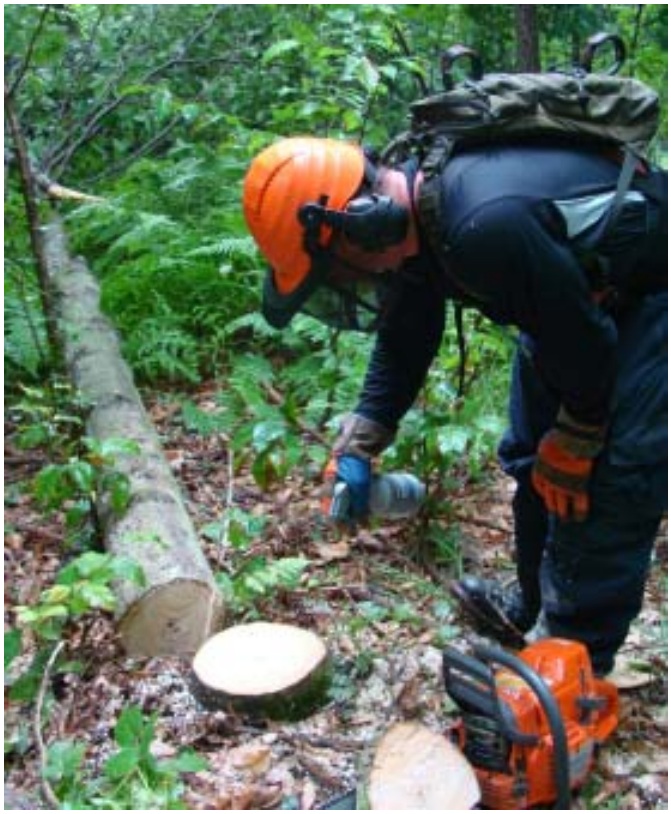
and ages of overstory beech, understory root suckers in these stands will likely have the greatest interconnectivity to the root systems of the larger trees. That interconnectivity provides an opportunity to control beech root suckers by stem injection or herbicidal treatment on stumps after cutting the overstory trees, thereby killing the tree's root system. For stands of this kind, simply cutting the large trees will not reduce the abundance of understory beech or control the development of root suckers.



Woodlands with large diameter beech provide opportunities for cut stump herbicide applications as part of a low-grade commercial harvest. Photo by Peter Smallidge

Cut-stump treatments and stem injection methods are particularly useful in stands with larger diameter beech that are less responsive to basal bark treatments and which offer an opportunity for utilization of cut stems. In stands where the small diameter trees are absent, simply cutting the larger diameter beech for firewood or other forest products, or for other purposes, often results in the development of root suckers near the harvested beech trees. Yet owners can control that potential post-harvest root suckering by linking cutting of the large diameter beech with cut-stump treatments applied at the time of harvest. When glyphosate is applied as 50% active ingredient to all cut beech greater than 6" dbh, the treatment resulted in greater than 90% sucker mortality in areas lacking beech bark disease[17], and 75% sucker mortality in areas affected by beech bark disease for several years[16]. Cut-stump treatments using glyphosate dilutions in water with 25% to 35% active ingredient resulted in sucker mortality of approximately 55%[16].

Injecting large diameter beech with glyphosate without cutting the tree has also resulted in mortality of understory suckers attached to the same root system[15], but the extent of mortality of root suckers may be less than with cut-stump treatments[14]. The extent of mortality will likely be enhanced with late



Concentrated glyphosate is applied to wet the surface on the outer two inches of the freshly cut stump. Herbicide applicators need to be certified in most states. Glyphosate needs to be applied at the time or the cutting or to freshly exposed active wood tissue. Photo by Mike Wine

summer injections using active ingredient concentrations of approximately 50% glyphosate.

Beech suckers not connected to a treated root system won't die as a result of either cut stump treatment or stem injection, and a second treatment may be necessary to reduce them as well. At the second entry, evaluate stem diameters and consider the appropriate treatment. Limited evidence suggests that for stumps up to 3 months old, re-surfacing the stump followed by immediate application of glyphosate will result in some control of root suckers. Basal bark treatment and brush saw cutting would also reduce these remaining beech saplings.

In woodlands where beech is abundant in all size classes, harvesting the beech trees with or without cut-stump treatments can result in significant increases of sunlight to the forest floor. That will promote understory development. So before harvesting and treating those trees, plans should be in place to assure that desirable species occupy the openings. Prior understory removal without reducing the overstory density (e.g., by basal bark treatment, brush saw cutting, or foliar spraying) will result in development of advance seedlings in the brightened understory. Once well established, overstory cutting will stimulate these advance seedlings, filling spaces created by the harvest of larger trees.

Pesticides:

Herbicides are a subgroup of pesticides used to control plants. When applied according to label specifications they are effective tools for controlling beech. The two primary chemical active ingredients used to control beech are glyphosate and triclopyr. These active ingredients are available for general and/or restricted use in several different formulations. Formulations differ in the way they are mixed, the use of additional chemicals, and the use of water or types of oil to serve as carriers for the active ingredient. The websites below offer information on different formulations, or seek guidance through Cornell Cooperative Extension in your local county.

Penn State University Forest Herbicide Handbook: http://pubs.cas.psu.edu/freepubs/pdfs/UH174.pdf

Search for a NYS registered pesticide label by active ingredient, EPA #, or trade name: http://magritte.psur.cornell.edu/pims/current/

New York Pesticide Management Education Program: http://pmep.cce.cornell.edu

Emergency Exemptions for pests not on the label: http://pmep.cce.cornell.edu/regulation/nysdec-lib/2ee/menu99.html

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