



# A FORESTRY CHALLENGE: MANAGING BEECH BARK DISEASE

By John Evans — Coverts Cooperator Class of 2002 spring

The American beech is an important food resource for Vermont wildlife, and especially bear populations dependent on the high protein and fat content of beech mast (beechnuts.) A forest management challenge is how to maintain a healthy population of beech trees when the species is threatened by the long-term effects of beech bark disease (BBD.)

Walking through Vermont woodlands often provides extensive evidence of disease symptoms. They range from evidence of white, woolly beech scale to dead limbs, yellowing leaves in summer, crown die back, beech snap placing stems on the ground and other evidence of tree mortality

A question for landowners is what to do when signs of beech bark disease are noted in your woods. The answers require a better understanding of what BBD is, the visual indicators of trees showing resistance to the disease, and strategies to improve tree vigor and mast production.

In this special supplement to the Vermont Coverts: Woodlands for Wildlife newsletter, information is provided to help make these decisions. The forestry management information is based on a recent publication by the Vermont Agency of Natural Resources (ANR), *Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas.*

As with most prescriptions for forest management, doing the right thing to maintain or improve wildlife habitat also is consistent with best management practices to improve timber quality for all tree species. There may be a few compromises to balance landowner interests in maintaining and preserving wildlife habitat, but generally doing something in the presence of BBD is a better option than standing back and letting nature make all the decisions.



In other words, whether or not the beech trees in your woods show the easy-to-recognize bear scratches and dot-like claw marks indicating bears are climbing beech in search of food, the more you know about BBD the better prepared you will be to make decisions on responsible forest stewardship.

In the case of beech, there is another exceptionally important component to stewardship — to find and protect those trees showing resistance to beech bark disease so they can create a healthy gene pool for the future.

## Disease History

In Vermont, by the 1960s an epidemic of beech bark disease had spread throughout the state. The first trees to become infected were the largest overstory beech. These same trees were the most prolific producers of mast; the impact was to significantly reduce beechnut production. While the loss of mast anywhere is important, it is more critical in northern areas of the state and especially the Northeast Kingdom where beech is the only source of hard mast.

This first wave of BBD, known as the advancing front, was soon followed by a killing front. Mortality was reported as 30% and higher. Today, much of the state is classified as an aftermath forest, characterized by some residual big trees and many stands of smaller trees created by seedlings and extensive root sprouting. The aftermath forest includes many defective beech as a lack of resistance to BBD is passed on from parent to progeny.

As David R. Houston, a retired plant pathologist with the U.S. Forest Service, described in a keynote address at a 2004 symposium on BBD: “Here (in the aftermath forest) severely affected trees, often in patches, lose vigor, slow in growth, and eventually succumb, survived by beech that are either less severely diseased or resistant, and by other species.”



Photo: Forrest Hammond, VT Fish & Wildlife  
David R. Houston, of Danville, Vt., a leading expert on BBD, with an example of a healthy beech.

In a nutshell, this is the problem defined by Houston: “Managing the long-affected, high defective beech-dense aftermath stands has, in the interim, become ever more difficult as trees have become increasingly defective and slow-growing.” Over time in the forest there is an ecological accommodation to the disease. Trees can live and produce mast for many years as a result of a very few trees proving fully resistant to disease, usually around one percent, and others demonstrating a tolerance to BBD or some degree of partial resistance.

In tolerant trees, the disease is present, but the tree responds by maintaining sufficient diameter growth, crown size and health to continue to produce mast. An example of partial resistance is where the tree is diseased, but the disease never significantly expands beyond a base level of infection.

As beech, along with sugar maple and yellow birch, are the most common species in a predominant forest type known as Northern Hardwoods in Vermont, landowner and forester decisions on how to manage aftermath forests assume great importance.

### *Invasion by insects and fungi*

Beech bark disease initially involves infestation by a tiny, non-native beech scale insect. Insect feeding creates conditions where the *Nectria* bark-killing fungus invades the tree, often leading to mortality. The disease equation is beech + beech scale + *Nectria* = Beech bark disease.

Fungi can infect large areas on some trees, partially or completely girdling them. Other insects and wood-rooting fungi quickly invade the wood beneath bark killed by BBD, further weakening the tree: Visual indicators of disease progression are quite easy to see and are defined later in this article.

Disease transmission is generally by wind with currents of air carrying the insect and eggs aloft, often far above the canopy for long distances. Mammals and birds also transport the wingless larvae,

called crawlers, and the pale yellow eggs that are deposited on the bark in midsummer.

In some cases, firewood is assumed to be the probable cause of new infestations in campgrounds far from any known BBD source. Human transmission is another possibility as long range expansion of the disease has been linked to areas frequented by naturalists and vacationers.

As Houston noted in a recent conversation, all it takes to start an infestation in a new area is for the beech scale insect or eggs to become attached to a coat when someone is leaning against a large beech tree to admire the surroundings. When this coat travels, so does the risk of new infestations.

### IMPORTANCE OF BEECH AS A MAST PRODUCER



Among nature's creatures, beechnuts are on the preferred menu for not only black bear, but white-tailed deer, American marten, fisher, wild turkey, ruffed grouse, and many small mammals and bird species.

A number of studies have demonstrated the special importance of beechnuts for black bear reproduction as females need high protein content in the fall diet. This can be critical if other food sources are scarce. The high protein nuts have five times the fat content of corn, twice the fat of white oak acorns and about the same fat content as red oak acorns.

Bear studies indicate these animals show no strong preference to climb only healthy trees in search of mast. In other words, even if a beech tree shows evidence of BBD disease, as long as it is healthy enough to produce mast bears and other wildlife, will use this tree as a food source.

Bears will seek out trees producing larger quantities of mast and climb them to feed on beech nuts, leaving signs of claw marks or beech “nests” in upper limbs.

### IMPORTANCE OF BEECH AS TIMBER AND FIREWOOD

The BBD problem is compounded by a strong tendency by foresters and landowners to discriminate against cutting beech because of its low relative economic value when compared to sugar maple and other hardwood species. When beech is not harvested, this prolific species will continue to expand its population in a woodlot.

There is another side to the problem. If beech is harvested as timber, saw logs will be selected on the basis of smooth barked and disease-free trees. These are the very same trees that in many cases should be protected and preserved, as their resistance to disease can be transmitted to future generations.

Looking far in the future, with the hope that better beech management will result in sustained mast production and healthier beech stands, and research finds way to encourage disease resistant regeneration, it is not unreasonable to assume that the low economic value of beech as a hardwood for furniture and other uses may change for the better. Mark Twery, a project leader at the George D. Aiken Forestry Sciences Lab in Burlington, notes that improvements in kiln drying techniques in the 1980's largely solved the problem of instability of beech. The result is a fine, tight grain with conspicuous wood rays, which takes stain well and is rather similar in appearance to maple and birch.

A common use for beech is firewood as the wood, being hard, burns slowly and puts out heat comparable to sugar maple, the oaks and yellow birch. So, when you get around to improving beech growing conditions using the management guidelines which follow, you can be assured of stacking the woodshed with firewood of the highest quality.

## MANAGEMENT GUIDELINES AND STRATEGIES

Agency of Natural Resources guidelines are designed to manage larger beech stands within the home range of a viable population of black bears. The same management guidelines can be used in the absence of a bear population, and in smaller stands, to maintain tree health and nut production for other wildlife species, and to encourage reproduction of beech trees resistant to BBD.

A first step is to walk the land to identify beech populations and look for visual evidence of BBD. The most obvious evidence is associated with later stages in tree disease. This includes telltale bark injuries, dead limbs, die back and yellow leaves in the crown, abundant woodpecker holes, and wind snap (where trees break as a result of weakening by invading insects and fungi.)

### Recognizing early symptoms

Early symptoms will indicate the presence of the beech scale insect, the first stage in BBD, and later invasion by the Nectria fungus. These trees may not have developed the bark defects or crown damage indicating reduced tree vigor and potential mortality.

Beech bark is thin and this makes beech a target for infestation by the sap-feeding beech scale insect. An obvious sign of scale infestation is a white, woolly substance secreted by the nymphs as a protection. Insects will appear as pinhead-sized, white dots. Dots will initially be found clustered in bark fissures, callous tissue near old wounds, areas under branches and patches of bark covered by mosses and lichens.



*Beech scale in heavy infestations can cover the trunk. Recently infested trees may not have other bark symptoms.*  
Photo: R. Kelley VTANR

Beech scale tends to first colonize trees with the roughest bark, the largest trees in a stand.

### Nectria infestation

The next stage of disease is infection by the Nectria fungus. The drying and cracking of bark near cells killed by beech scale allows penetration and invasion by fungi. After infection, small, red fruiting structures are distributed on the bark face and may be visible in the fall. As infection expands, large sections of the trunk will appear to be reddened by nectria.

### Bark and tree injury



*Nectria fungi in heavy infestations are large, reddened areas. Trees may be tolerant or susceptible to BBD.*  
USFS Photo

Eventually, usually after a period of years, BBD will kill a high percentage of infected trees of larger diameter and result in beech stands characterized by many defective and slow-growing trees. Fortunately, long-term studies have shown that beech which are reasonably healthy will respond to crown release and put on diameter and crown growth and produce greater quantities of mast.

The ANR management guidelines are designed to identify those trees with resistance or tolerance to scale and BBD, and as a result are expected to respond well to crop tree selection and crown release.

Visual indicators are used to classify trees into priority categories for selection as crop trees or trees to be harvested.

These decisions are largely based on evaluation of four types of bark injury, as defined in a 1987 study coauthored by Barbara Burns, Forest Health Coordinator at the Department of Forest Parks and Recreation, and David Houston.

### Bark injury types

The four basic bark injuries are raised lesions, sunken lesions, blocky (rough) bark, and dead bark. Raised lesions and blocky bark are signs the tree has successfully walled off Nectria fungus

infection. As a result of this resistance to disease, these trees are considered “tolerant” of BBD.

Trees with sunken lesions and dead bark are considered “susceptible” to BBD. If damage is extensive, there is a high probability of continuing decline, decay, mortality or wind snap.

Damage severity is evaluated as percentage of circumference affected. When 20 percent of the circumference is affected by sunken lesions or dead bark within a three-foot vertical band, wounds to the cambium are likely to impact tree health.

Raised lesions indicate bark injury is

#### Raised Lesion



#### Sunken Lesion



Photos: R. Kelly VTANR

walled off without destroying cambial tissue needed to transport water and nutrients. Sunken lesions appears as holes in the cambium.

Mast production begins at about 10



*Dead Bark is an obvious sign of BBD.*  
Photo: USFS

inches dbh (diameter at breast height.) Forest management decisions aimed at maintaining or increasing mast production will focus on larger beech, as well as beech in the 6”– 10” dbh range, because of their potential for production or resistance or tolerance to BBD.

For this reason, an important factor is to evaluate crown condition, an excellent indicator of tree vigor and capacity to

produce beechnuts. Production will be greatest in dominant or co-dominant trees in a stand.



*A sparse beech crown, especially if leaves are bright yellow in midsummer, is a sign of poor health and mast production.*  
USFS photo

When over 50 percent of the crown is affected, the risk of mortality exceeds 50 percent. There is an elevated risk of mortality when >10 percent of the crown is dead or the leaves turn bright yellow by midsummer.

### Selecting Crop Trees to Save

Four criteria are established in the ANR guidelines.

**1. R-GM. Resistant to BBD, good mast producer:** Large crown  $\geq 10$ " dbh; smooth bark without any evidence of beech bark disease defects, scale or Nectria; <ten percent of branches are yellow or recently dead. Bear claw scarring indicates the great value of these "super beech" as mast producers.

**2. T-GM. Tolerant to scale/BBD, good mast producer:** Dbh  $\geq 10$ ", some smooth bark, raised lesions and/or blocky bark show evidence of repeatedly walling off and coping with BBD. There may be signs of beech scale. Less than 20 percent of circumference is affected by injuries affecting cambium; <10 percent of branches yellow or recently dead. Evidence of bear clawing indicates importance of these trees as mast producers.

**3. R-PM. Resistant to scale, poor mast producer:** Dbh  $\geq 10$ " with smooth bark not showing evidence of BBD, scale or Nectria, <10 percent of branches yellow or recently dead. These ultra smooth barked trees, about two to five percent of the beech population, are desirable to maintain for their contribution to resistance in the population via sexual reproduction.

**4. RU-MU. Resistance to scale and mast**

## RESOURCES FOR ADDITIONAL INFORMATION

**VT ANR Management Guidelines for Optimizing Mast Yield in Beech Mast Production Areas.** Paul L. Hamelin, Certified Wildlife Biologist, Vermont Fish and Wildlife Department. March, 2011. Available online at [www.vtfishandwildlife.com/library/Reports\\_and\\_Documents/Fish\\_and\\_Wildlife](http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife) (see VT ANR Beech MPA Guideline 3-22-2011.pdf.)

**Beech Bark Disease: Proceedings of the Beech Bark Disease Symposium, 2004.** Available online at [http://www.fs.fed.us/ne/newtown\\_square/publications/technical\\_reports/pdfs/2005/ne\\_gtr331.pdf](http://www.fs.fed.us/ne/newtown_square/publications/technical_reports/pdfs/2005/ne_gtr331.pdf) (Especially, see Keynote Address, pages 2-13, by David R. Houston.)

**Fifty-Year Impacts of the Beech Bark Disease in the Bartlett Experimental Forest, New Hampshire.** William B. Leak, USDA Forest Service, Northeastern Research Station. Available online at [www.treesearch.fs.fed.us/pubs/15602](http://www.treesearch.fs.fed.us/pubs/15602).

**Woodland Guidelines for the Control and Management of American Beech.** Cornell University, Cooperative Extension. Available online at [www2.dnr.cornell.edu/ext/forestconnect/web/american%20beech%20Fact%20Sheet.pdf](http://www2.dnr.cornell.edu/ext/forestconnect/web/american%20beech%20Fact%20Sheet.pdf). This publication is especially useful as a reference to the problems involved in managing very large, multi-acre areas of beech with thickets of stump sprouts and root suckering. These conditions create dense shade, inhibit regeneration of desirable hardwoods, reduce wildlife habitat and restrict woodland access.

**Beech Bark Disease Management: How to identify the beech scale in the field.** Wisconsin DNR. Available online at <http://dnr.wi.gov/forestry/FH/pdf/IdentifyBeech.pdf>.

**both unknown.** Smooth barked, Dbh 6-10" with broad crown, <10 percent of branches yellow or recently dead. Trees are potentially resistant or tolerant future crop trees, and desirable to retain for contribution to resistance in the population via sexual reproduction.

### Selecting Trees to Remove

The objective is to release the crowns of crop trees from competition by thinning on three sides (W-N-E) and retaining trees of any species to shade and prevent sun scald on beech on the south side.

#### Remove:

Beech trees BBD susceptible (i.e., sunken lesions) or >50 per cent yellow or recently dead crown.

Beech trees BBD tolerant but poor mast producers, with no bear scarring.

Any beech trees  $\geq 6$ " dbh with poor crown development or severe wind snap defect.

Any other tree species  $\geq 6$ " dbh which will release crop trees on W-N-E.

### Harvesting Guidelines

As beech reproduce prolifically from root suckering, harvest operations should be conducted in winter conditions (frozen ground or >12" snow) to minimize injury to beech roots and trunks. Harvest with tracked equipment if possible.

Tree species other than beech can

be girdled and not felled to avoid damage to crop trees or regeneration. However, beech trees are not to be girdled as trees will regenerate by sprouting, creating a dense thicket sometimes described as "beech hell."

ANR published guidelines (see Resources for Additional Information) provide numerous photographs to illustrate BBD susceptibility and the various types and stages of bark injury. Detailed information is presented on how to apply crop tree selection and release methods to mitigate beech bark disease and manage the genetic composition of natural regeneration.

This special insert is funded by the Vermont Fish & Wildlife Department's State Wildlife Grant program. It is available online at [vtcoverts.org](http://vtcoverts.org).

Vermont Coverts, established in 1985, conducts workshops and training programs to educate landowners about sound forest management and wildlife stewardship.

For information contact:  
Lisa Sausville, Executive Director  
[Lisa@vtcoverts.org](mailto:Lisa@vtcoverts.org) 802-388-3880  
PO Box 81, Middlebury, VT 05753