

Management of Beech Bark Disease in Wisconsin

December 2014

Beech bark disease (BBD) is a serious disease of American beech (*Fagus grandifolia*). It is caused by a scale insect (beech scale, *Cryptococcus fagisuga*) and two fungi in the genus *Neonectria*. Wisconsin's first detections of the scale and disease occurred in Door County in 2009. Since then, beech scale has been found across most of the range of American beech in Wisconsin, whereas beech bark disease has not been found in any other counties so far. BBD has caused heavy mortality of beech in Michigan and northeastern states, and we expect the same will occur in Wisconsin as scale populations build.

There is cause for hope for the eventual recovery of beech in our forests. About 0.1-5% of beech are resistant to the beech scale, and with the help of woodlot owners and forest managers, we can identify these resistant trees and enter them into on-going breeding programs to develop disease-resistant stock.

Beech Resource in Wisconsin

In Wisconsin, beech is only found in eastern counties close to Lake Michigan. There are an estimated 18 million beech (sapling-sized and larger), and beech volume is estimated at 37 million cubic feet (FIA data). Beech typically occurs as a component of the maple-beech-birch forest type, of which there is 3.9 million acres in Wisconsin. Beech is an economically significant timber species, and its nuts are highly valued by wildlife. In northern hardwood stands, beech is sometimes the only nut producer.

The BBD complex: beech scale and *Neonectria* fungi

Beech scale

Beech scales are tiny, soft-bodied insects (0.5 to 1 mm) (Fig. 1) that contribute to BBD by creating small feeding wounds that *Neonectria* fungi use to enter the tree. Heavy scale infestations may also weaken the tree by their feeding on sap, leading to moisture stress.



Figure 1. Beech scale crawler. USDA Forest Service Archive, St. Paul, MN, Bugwood.org

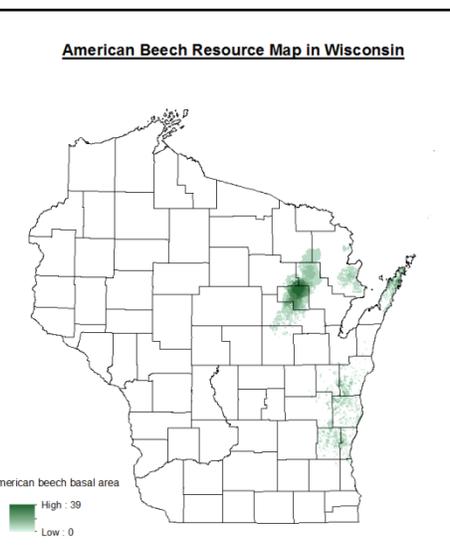


Figure 2. Beech tree heavily infested with beech scale. Photo by Bill Ruff, WI DNR.

The scale is only capable of movement during the immature stage, called a crawler, which is present between July and November. Crawlers can be spread by the wind, birds, and infested firewood or logs. Adult scales are immobile and covered with a white woolly material. This is the noticeable stage seen on beech trees (Fig. 2).

Neonectria fungi



Figure 3. *Neonectria* fruiting bodies on beech bark. Photo by Kyoko Scanlon, WI DNR

Two species of *Neonectria* fungi are able to enter the tree through the scale insect's feeding wounds and then kill areas of woody tissue, sometimes creating cankers (dead spots) on the main stem and large branches. *Neonectria* infections are not visible, except when they produce fruiting bodies called perithecia (Fig. 3). These tiny, red spheres occur in clusters on the surface of the bark of infected beech. Spores of *Neonectria* are spread by the wind.

If beech scale populations are high, *Neonectria* is able to enter the tree in numerous spots, and can cause the entire tree to decline and die. Other beech trees may linger with *Neonectria* cankers for several years, eventually succumbing to *Neonectria* or other pathogens.

Signs and Symptoms of BBD

- White “wool” (Fig. 4). Trees newly infested with scale will have tiny spots or patches of “white wool” tucked into rough areas of the bark. This wool covers and protects the scale insect. As the scale population builds, the entire trunk and large branches of the tree can become covered with white wool.
- Tarry spots (Fig. 5) are often an early symptom of *Neonectria* infection. Tarry spots occur when a brownish fluid oozes from a dead spot on the trunk. Tiny red dots (fungal fruiting bodies) sometimes form around the tarry spots. Other injuries, however, can also cause tarry spots to form.
- Trees declining from beech bark disease usually have small leaves and crowns that appear thin and pale (Fig. 6). These small leaves remain on the trees but become yellowish later in the summer, but prior to normal fall color development.
- Beech snap (Fig. 7). Fungal infection physically weakens the tree trunk, and diseased



Figure 4. A small white wool on a crack. Photo by Kyoko Scanlon, WI DNR



Figure 5. Tarry spot caused by *Neonectria* infection. Photo by Linda Williams, WI DNR.

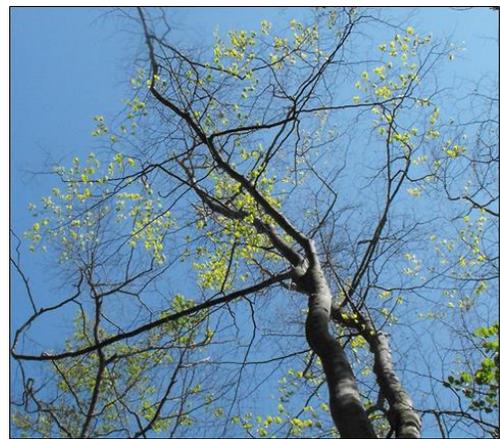


Figure 6. Crown dieback caused by beech bark disease. Photo by Kyoko Scanlon, WI DNR.



Figure 7. Beech snap caused by beech bark disease. Photo by Kyoko Scanlon, WI DNR.

trees that are declining but not dead yet may snap in high winds.

Disease progression in the forest

Beech bark disease typically develops in three sequential stages known as the Advancing Front, the Killing Front and the Aftermath Forest.

- **Advancing Front** - Found in areas where beech are infested with beech scale but not yet infected by *Neonectria*. Stands in the advancing front can be infested with beech scale for a few years before *Neonectria* infection.
- **Killing Front** - Occurs in areas where beech scale populations are high and *Neonectria* infection is killing beech.
- **Aftermath Forest** - Defined as areas that have experienced the first wave of beech mortality. A large portion of the mature beech has died. Most remaining beech are defective (Fig. 8) and declining. A small percentage of the original beech population may remain in good health. These are the trees that are likely to be resistant to beech scale and are thus resistant to beech bark disease.



Figure 8. Beech tree deformed by *Neonectria* cankers. Photo by Linda Haugen, USDA Forest Service.

Management of forest stands containing beech

Although its population is currently low in many areas, beech scale has been detected across most of the range of American beech in Wisconsin. Wherever beech is found, it is possible that tree mortality due to BBD could occur within the next cutting cycle. Pre-salvage and salvage harvests may be necessary, depending on stand composition and goals.

If beech is less than 20% of basal area in a forest stand, management goals will likely be met even after beech bark disease becomes established and the majority of beech die or are harvested. Keeping a minor beech component will be valuable for wildlife, as beech nuts are a good food source and beech snags provide nesting and denning sites. For the purpose of species diversity, wildlife benefits, and potential resistance to BBD, some beech trees can be left in forest stands long term. Some dead trees can be retained for wildlife purposes.

If beech is more than 20% of a stand's basal area, pre-salvage and salvage harvests should be considered based on the stage of the disease in the forest. Maintain adequate stocking in all stands unless beech density is very high. It may be appropriate to coordinate harvesting activities to manage emerald ash borer and BBD at the same time.

- **Advancing Front** – During the next stand entry, prioritize removal of trees that are heavily infested with beech scale, low vigor beech (trees with decay, large wounds, thin crown, broken tops, etc.), and beech with rough bark. Retain vigorous beech trees with smooth bark. Promote species diversity within the stand by encouraging/releasing non-beech species, but do not encourage the growth of ash regeneration.
- **Killing Front** – Identify and report trees that may be resistant to the beech scale (see the section “Resistant trees” for more information). Salvage or reduce the beech component by removing trees with heavy scale infestations, beech with rough bark, and low vigor beech as soon as practical. Retain vigorous beech trees with smooth bark. Beech snap is a potential hazard during harvesting activities in any areas with moderate scale populations

- Aftermath Forest – Identify and report beech that may be resistant to the beech scale (see the section “Resistant trees” for more information). Harvest all declining trees with thin crowns and yellowish foliage with sunken lesions or large patches of dead wood. Beech snap is a potential hazard during harvesting activities. If there would be at least 40 potential crop trees of non-ash species per acre remaining after harvesting, the stand may continue to be managed according to type-appropriate silvicultural guidelines. If less than 40 potential crop trees per acre would remain, then the stand should be regenerated.

When harvesting, avoid damaging the root systems of the trees. Beech produce abundant sprouts in response to root injury, and the resulting thickets of susceptible beech would delay recovery of the stand to a productive condition. Favor the regeneration of other tree species within canopy gaps, but discourage the regeneration of ash species due to the threat of emerald ash borer mortality. Oak and other mast-producing species may be particularly suitable as substitutes for the loss of beech nuts for wildlife.

Financial considerations and management objectives will affect the suitability of harvest recommendations. Management guidelines may change over time due to new research findings and management options. Consult with a professional forester before starting management.

Management in recreational or residential areas

Diseased trees are a safety hazard because they can snap unpredictably. In campgrounds and other areas where beech snap may be a danger to people and structures, remove the beech trees once they are moderately infested with beech scale even if the tree has a healthy crown.

There are control options to reduce beech scale population on high-value ornamental or yard trees. However, some of the options are labor intensive and require repeated applications.

Control options include:

- scrubbing the tree with a brush
- washing the scales from the tree using a strong stream of water
- using contact insecticides or insecticidal oils when crawlers are present
- using other insecticides that are registered for use on scale insects

The above options are not one-time treatments and will need to be repeated for the life of the tree. Continued protection is necessary to prevent scales from re-infesting trees and creating the wounds that allow invasion of the *Neonectria* fungi.

Resistant trees

Approximately 0.1-5% of American beech are considered resistant to the beech scale.

Identification and protection of resistant trees offers hope for a future healthy beech resource and is therefore part of sustainable forestry. Contact your regional DNR forest health specialist if you see a potential resistant beech in the killing front or aftermath front. Potentially-resistant trees should be all of the following:

- 1) at least 9” inches dbh
- 2) adjacent to trees that are heavily infested by beech scale
- 3) free of scales, or scale populations have remained low for more than one year.

Use white marking paint to place an “R” on two sides of the tree. Protect candidate trees by leaving a buffer of other tree species to protect the tree from sunscald and possible wind throw.

Restoration

Since 2002 the USDA Forest Service has been working to develop disease-resistant varieties of the American beech. None are currently available for reforestation but research is in progress. Work with your local forester to determine the restoration options that are best for your property.

References

FIA (Forest Inventory and Analysis) FIDO (Forest Inventory Data Online) <http://www.fia.fs.fed.us/tools-data/>

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