CHAPTER 11 – BEECH BARK DISEASE

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Beech bark disease is an example of a disease in a non-human species being caused by an invading pathogen. Its effects on our forests can be profound both ecologically and economically, and Westwind Forest Stewardship Inc., the not-for-profit with responsibility for managing crown land in the French-Severn forest, has undertaken substantial work to understand and to ameliorate the impacts of this disease. Westwind has provided the following information for this Report Card.

OVERVIEW

American beech is a common tolerant hardwood tree that is found in many tolerant hardwood stands in the Great Lakes-St. Lawrence Region. It is commonly found in stands dominated by Sugar maple and other tolerant hardwood species and is easily identified by its smooth gray bark. Beech is highly valued for its contribution to wildlife habitat, in particular providing mast (hard fruit i.e., beechnuts) as an important fall food for many species. Beechnuts have more nutritional content for wildlife than even red oak acorns. Black bears leave claw marks in the thin smooth bark of the tree when they climb into the crowns to forage for beechnuts on the branches. Beech directly and indirectly contributes to biodiversity. Beech is not considered a particularly high valued tree for wood products, although it makes excellent firewood.

Beech bark disease (BBD) has been present for a century in eastern Canada although entry into Ontario has been much more recent. It was first confirmed in the Muskoka area in 2010. Two different organisms form the BBD, which only affects American beech; a beech scale insect and a neonectria pathogen *(Neonecria faginata).* The scale insect feeds by inserting feeding tubes into the outer bark cells allowing the pathogen to enter and become established. The infection can go as deep as the cambium layer. The pathogen causes death to the cells and as more cells are killed, branches and finally whole sections of the tree weaken and die. The lag time between

scale infestation and appearance of fungal infection varies from 2 to 5 years, however, local observations suggest the shorter time periods are more common.

Individual scale insects are difficult to see. However, they cover themselves with a white waxy coating which is easily spotted, especially when populations increase. It is not uncommon to see large sections of Beech tree trunks covered in white.

The scale spreads when the tiny crawler stage of the beech scale insects moves on wind currents or attached to wildlife. Spread can be assisted by the movement of firewood, especially during the crawler stage, in mid-summer to late fall.

In fall, the pathogen produces small, bright red fruiting bodies called perithecia, which erupt through the bark. Initially these occur in lemon-shaped clusters but as the infection progresses, they coalesce into large, sunken areas on main branches and the bole of the tree. BBD can kill Beech trees, however, as the trees are weakened, secondary pathogens may also be able to successfully attack and cause mortality.

The Ontario Forest Research Institute (OFRI) (2012) advises that scattered large beech trees are not attacked by the beech scale. These trees are disease resistant, as the canker fungus only infects scale-infested trees. There is also some evidence that a very small portion of beech trees might be resistant to the scale insect (1-4%), and therefore not affected by the canker fungus. It is also possible that some trees may be susceptible to the scale insect but resistant to the fungal pathogen. The extent of this is unknown but OFRI (2012) reports any resistance or tolerance is minimal.

IMPACTS OF BEECH BARK DISEASE

- Beech bark disease kills a majority of American beech trees across the forest landscape where it is present and is therefore a threat to local forest biodiversity. The loss of a major component of the tree canopy has forest management and wood supply impacts in managed forests. The loss of beechnut production, which has a high caloric content, will have an impact on wildlife. Mature beech trees often provide high quality cavities for bird nesting and animal denning. Dead and dying beech provide poorer quality and less desirable cavity nest opportunities.
- Beech-snap is a term that describes how large branches or whole mature beech trees break off at the stem, even before it is obvious that they are dying. Beech trees in the forest often

grow in clusters, mass mortality due to BBD results in a large hole in the canopy, affecting cover for wildlife and increasing light levels below.

- BBD is unique in that the disease that kills its host also contributes to the successful germination and proliferation of a second generation of the host. i.e., as mature trees are killed. Beech regeneration tends to proliferate in a vigorous manner, sometimes called Beech jungles or beech thickets. These young beech seedlings and saplings are often beech root sprouts. The host root provides resources to the beech saplings to take advantage of the additional light from the parent beech trees dying.
- Because these beech saplings have the same genetic makeup as the parent trees from which they sprout, they will not have genetic resistance or tolerance to beech scale or the fungal pathogen. They tend to dominate the understory and eventually midstory of tolerant hardwood stands where BBD has caused damage to the beech overstory. They outcompete most other species including sugar maple, yellow birch and other wood species that should be forming a large part of the future forest canopy. The expectation is then that the young beech trees will not allow other species to mature but will be killed themselves by BBD before they contribute to the mature forest canopy cover that is typical of the Great Lakes-St. Lawrence forest regions tolerant hardwood forests. It is expected that there will be a short period of time in which the second generation of beech trees become sexually mature and produce beechnuts before succumbing to the BBD themselves. In addition to outcompeting other tree species, they also shade out other forest plants. In upper state New York, studies showed a 50% reduction in species richness, including fern species, that are found in these stand conditions.

BEECH BARK DISEASE TREATMENT OPTIONS

PREVENTION

- Do not transport beech firewood or logs from infested stands to uninfested areas between mid-summer and late-fall to prevent beech scale infestations from becoming established in new areas.
- Use harvest systems that minimize injuries to beech root systems. Root injury can cause extensive root sprouting, especially if roots are injured in spring.

TREATMENT

- At the forest level there are no effective treatments against the scale insect nor the *Neonectria* pathogen although individual horticultural and urban trees can be treated with insecticides and fungicides.
- Forest management efforts focus on targeting most beech trees for removal. Salvage of BBD impacted trees can retain some value of the tree before the trees become hazard trees. However, due to the quick decline of the trees, there is little time from onset of disease before the wood has no economic value.
- In addition to removal of diseased trees, it is important to use beech regeneration control techniques to deal with the secondary impact of the disease, the generation of an abundant and vigorous beech understory. If beech trees are left, they will produce root shoots (and beechnuts for seed) before they die.
- Available beech regeneration control techniques include;

  Brush saw and/or chainsaw: To manage young beech tree regeneration, the use of a motorized brush saws with a circular blade, chain saws, or other cutting devices cut the plant off above the ground is the most effective approach. Brush saws are effective for smaller beech up to 8 cm while a chainsaw is required for larger beech trees.

  Brush saw treatment with a herbicide applied to the cut stump: The same stem felling is carried out as with the saw only, except that a specific herbicide (glyphosate or triclopyr) is applied to the cut stump to control resprouting.

  Stem specific herbicide treatments including; basal bark treatment with triclopyr, "Hack N' Squirt", and cut stump treatment: Each of these methods is labor-intensive and involves careful application of triclopyr (garlon) or glyphosphate herbicide to individual stems or small trees to kill the tree and to limit or eliminate the root's capacity to produce new sprouts. Workers must be licensed pesticide applicators.

  Broadcast spraying of herbicide: The herbicide, usually glyphosphate, is sprayed from ground level onto the foliage of small trees and saplings, killing the trees and their roots. Non-target trees and other plants will also be affected so cautious application is required.

REGENERATING TO NON-BEECH TREES/SUPPLEMENTAL PLANTING

In managing BBD, the overall objective of regeneration or supplemental planting is to reduce the amount of beech in the understory and midstory so that other species of trees may be in a more competitive position to grow and form part of the mature forest canopy.

Depending on circumstances there may already be healthy young non-beech trees growing among the Beech, or there may be few healthy non-beech trees present. Having other species already established is the optimal condition. In this case, removal of the diseased beech acts as a forest tending action. It releases the established desired species of tree from competition by beech, increasing the chance of success and decreasing the time for these non-beech trees to dominate the stand.

In cases where there are few healthy non-beech trees present, the beech removal acts as a site preparation action but a new crop of young trees must be established. While these new trees are being established, new beech seedlings may also be becoming established, especially when there are larger beech trees remaining in the stand.

Tolerant hardwood forests are very well suited to natural regeneration. The number of tree species that can be found is relatively large compared to other forest types in Canada. In addition to beech, sugar maple, yellow birch, red oak, black cherry, basswood, red maple, and white ash are hardwood trees typically found in tolerant hardwood stands. Some conifer trees may be found in these stands with eastern hemlock being the most common, however, white spruce, white pine, and red spruce are often associated species. While these species all share many attributes with respect to requirements for light and soil type, they each have specific growing conditions for which they are best suited.

All trees can be either planted or naturally regenerated depending on the suitability of the site and availability of seed trees. In Canada, most regeneration of tolerant hardwoods uses natural regeneration while artificial regeneration is commonly used for conifers. Not all species are reliably found at tree nurseries so seedling availability can be a limiting factor. Hardwood species often cost more to produce and have lower probability of survival as seedlings due to various factors including browsing by animals such as deer. Hardwood species successfully germinate naturally to produce thousands of trees per hectare significantly increasing the probability of enough trees surviving to maturity. Conifer tree planting is often less expensive, and a single conifer seedling has a higher probability of surviving into maturity then a single hardwood seedling.

In the context of managing BBD, artificial regeneration has several benefits over natural regeneration. If timed correctly, planted trees may have a competitive advantage over new Beech seedlings becoming established, the sensitivity to specific soil exposure conditions of some species is reduced, and there is greater predictability in timing of seed crops.

Tree planting also can be done to augment natural regeneration. However, natural regeneration may aggressively out-compete planted trees. For example, naturally regenerated sugar maple may shade out a planted oak tree.

MONITORING

Tending of the planted, or to some extent, naturally regenerated trees may be required. This may involve control of future beech, control of less desirable trees over planted trees, or control of non-woody vegetation including grasses, raspberries, and other herbaceous plants. As with any forestry-related activities, professional foresters and other forestry consultants are good resources to assist in deciding how to proceed.