The Impact of Beech Bark Disease on the Northern Hardwood Forests of the Adirondacks

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The disease complex known as beech bark disease has significantly impacted the American beech (*Fagus grandifolia*) component of the northern hardwood forests of the Adirondack region. The effects of this disease were first observed in the central Adirondack region in the early 1960s. Beech bark disease has caused widespread mortality of beech trees throughout southeastern Canada and the northeastern United States, and is currently being reported as far south as Pennsylvania and West Virginia (Miller et al. 1989). Few places have been affected more severely than the hardwood forests of the Adirondacks.

Beech bark disease is caused by sequential infection of beech trees, first by the beech scale insect *Cryptococcus fagisuga* followed by the fungus, *Nectria coccinea*. Infestation of the bark by the introduced scale insect predisposes the tree to invasion by wind-carried spores of the Nectria fungus. Although the beech scale insect is smaller than the head of a pin, its presence can be detected by a white, "waxy" secretion evident on the surface of the bark of infected trees. Heavy infestation by the insect results in conspicuous white "patches" along the lower bole of the tree (often most evident on the north face). The feeding activity of the insect alone does not harm the tree, but provides entry points for the spores of the Nectria fungus. Following infection of the cambium by the fungus, the foliage becomes yellow and dwarfed, and portions of the crown begin to die. Eventually as the fungus "girdles" the main stem, the tree dies. Most trees die within a few years of initial infection by the fungus, however some remain alive in a weakened condition for many years. Frequently, infected trees break off several feet above the ground even while they are still alive, a characteristic known as "beech snap" (Houston 1975, Houston et al. 1979, Shigo 1972).

Typically, the larger beech trees (stems >16 in. dbh) are infected first and suffer heavy mortality. Data from continuous forest inventory plots at SUNY ESF's Huntington Forest, and other sampling done in the central Adirondacks indicate that between 1965 and 1980 nearly 80% of the beech over 16 in. dbh succumbed to this disease. Since 1980, most of the remaining large trees have died or are in severe decline. Mortality rates have increased dramatically in the 10-15 in. dbh classes. Current surveys indicate nearly 90% of the beech > 6 in. dbh show some signs of the disease (scale and/or fungus). Limited mortality has been observed among trees < 10 in. dbh, however crown dieback or yellowing, often in association with heavy scarring on the stem, is common on nearly 40% of

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these trees (Miller-Weeks 1983, Mize and Lea 1979, Houston and Valentine 1988, Costello 1992).

The impact of beech bark disease has been especially severe in the hardwood forests of the central Adirondacks. Favorable site conditions, past land use history, and the long-term influences of herbivory all contributed to an abundance of beech in many of these stands. Selective logging practices removed the high value sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghantensis*) from many stands in the 40's and 50's leaving behind the less valuable beech. Selective browsing by increased white-tailed deer (*Odocoileus virginianus*) populations, resulting from the elimination of predators and the favorable habitat conditions created by widespread fires in the early 1900's also favored beech development. These factors together with the aggressive root-suckering capacity of beech and its extreme shade tolerance allowed beech to prosper in the understory of our hardwood stands and gradually dominate at the expense of other tree species (Jones and Raynal 1988). As a result, vast acreages of Adirondack hardwood forest contained large numbers of beech. These stands constituted a perfect host for this pathogen.

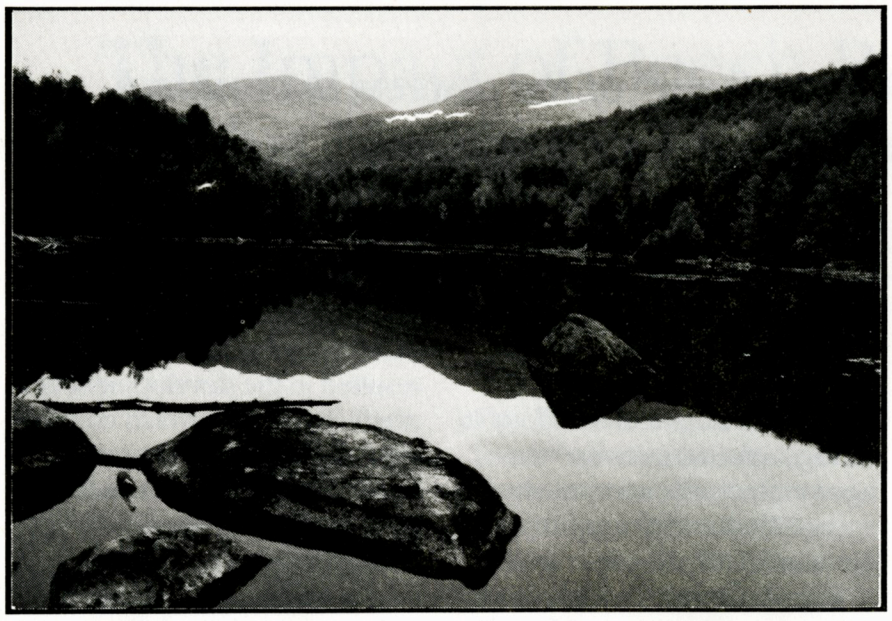
The "killing front" of the disease decimated most of the mature beech beginning in the mid 1960's through the early 80's. Economic impacts on private forest lands in the Adirondacks ranged from $60 - $120/acre in many hardwood stands due to lost sawtimber and pulpwood stumpage values alone. Efforts to salvage infected trees on managed timberlands were only partly successful due to the rapid progression of the disease.

On Forest Preserve land, this "natural thinning" of the forest was viewed by some as an opportunity for revitalization of aging stands. Research has shown however, that the holes in the canopy created by the loss of the large beech were quickly filled by young beech already present in the understory. These smaller beech are for the most part vegetative offspring of a dead or dying parent tree. As a result they are genetically identical to their parent and will exhibit little or no resistance to beech bark disease in the future (Houston et al. 1979). Current evidence suggests that as these stems reach 8-12 inches in diameter, they too are subject to high rates of mortality, or at least very heavy scarring on the trunk and reduced vigor.

In addition to the losses of wood fiber and the aesthetic qualities we have long associated with the large, smooth, gray-barked beech trees in our forests, beech is the primary "hard mast" producing species in the central Adirondack region. A wide range of mammal species and numerous avian species utilize beechnuts as an important, often "critical," fall food resource (Martin et al. 1951).

Intensive sampling of beechnut production by trees of varying size and condition (healthy to heavily infected), resulted in the development of a predictive model which could be used to estimate the impact of beech bark disease on beechnut production. The application of this model to several hardwood stands on the Huntington Forest indicates that their ability to produce beechnuts has declined by 37% since infection with beech bark disease. The mortality of the larger trees, and the reduced vigor of the remaining smaller trees, are primarily responsible for this dramatic decline (Costello 1992). A decline of this magnitude in an important wildlife food resource on such a large scale constitutes a significant change in the long-term productivity of Adirondack wildlife habitat for a variety of animal species. Research in the Northeast has clearly shown that increased fall weights of deer, improved reproductive rates of black bears, higher over-winter survival of chipmunks and other small mammals are associated with years of abundant beechnuts (McLaughlin et al. 1993, Rogers 1976).

The future of beech in the hardwood forests of the Adirondacks remains uncertain. Less than 1% of the larger beech have shown "resistance" to this disease. In a heavy seeded species such as beech, these widely scattered individuals are not likely to re-populate extensive areas very fast. The abundant sapling and pole-sized



Twin Pond, Dix Wilderness. Photo by Gary Randorf.

beech stems found in our stands today are of "root-sucker" origin. Their fate is likely very similar to their parent. In forests of southeastern Canada where the disease has been active for > 50 years, beech has been reduced to a small, heavily scarred tree, seldom reaching the size and quality we associate with the beech trees of the past (Burns and Houston 1987, Twery and Patterson 1984).

Although it appears unlikely that beech bark disease will eliminate beech from our forests to the same extent the chestnut blight and the Dutch elm disease affected the American chestnut and American elm, this pathogen has produced major changes in the Adirondack ecosystem. The effects of this disease on wood fiber production, wildlife populations and habitat, biodiversity and aesthetics, will continue to be felt by all users of the Adirondack forest well into the future. In light of the attention being directed towards other "perceived" impacts on the Adirondack Park, I find it hard to believe that a "real" impact of this magnitude has received so little recognition outside the scientific community.

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