



Project Impacts

NSRC-FUNDED RESEARCH FINAL REPORT

Multiple Stressors Play Role in Beech Bark Disease

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An Alternative Model of Beech Bark Disease

PRINCIPAL INVESTIGATORS:

John Castello

SUNY College of Environmental Science & Forestry
jdcastello@esf.edu

Jonathan Cale, Graduate Student

SUNY College of Environmental Science & Forestry

Mariann Johnston

SUNY College of Environmental Science & Forestry



Healthy beech stem on left, beech stem with wax masses of beech scale insect on top right, and fruiting bodies of *Neonectria* fungus on lower right.

Beech bark disease (BBD) has a long and destructive history affecting American beech trees in the northern hardwood forest. Historically, scientists believed that infestation by the beech scale insect (*Cryptococcus fagisuga*) was the only necessary predisposing factor to infection by the causal fungi, *Neonectria ditissima* and *N. faginata*. Recent work in long-affected (aftermath) forests, however, suggests that other factors also drive disease development.

In New York state, NSRC researchers examined how bark nutrients, defensive chemicals, amino acids, and *Xylococcus betulae*, a native scale insect commonly found on beech, affect infection by these fungi. They also examined the potential role of these factors as drivers of beech scale populations. *N. ditissima* infection followed high *X. betulae* densities and low bark isorhamnetin concentration, while *N. faginata* infection followed high beech scale densities and low bark catechin concentration. Low bark phosphorus predisposed trees to both pathogens. Beech scale populations are driven by their density during the previous year but are associated with the phenolic 4-hydroxybenzoic acid, amino acids isoleucine and leucine, and bark boron.

Beech bark disease management in these forests should not focus solely on beech scale control and should instead focus on managing abiotic as well as biotic predisposing factors. The importance of low phosphorus to BBD development suggests increased prevalence of the disease in northeastern forests experiencing phosphorus-limitation following high nitrogen deposition from air pollution and acid rain.