IMPACTS OF BEECH BARK DISEASE ON UNDERSTORY COMPOSITION IN MICHIGAN

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Abstract

Beech bark disease was discovered in Michigan in 2000 and will likely kill at least 50% of mature American beech trees. Our study was designed to determine how understory composition will be affected as beech bark disease spreads and intensifies throughout Michigan. We assessed the potential impact in forest stands with varying beech densities (low, moderate, and high) and abundance
of *Cryptococcus fagisuga* (absent, light, and heavy). Variables were measured in 62 stands throughout the Upper and Lower Peninsulas of Michigan in 2002 and 2003. We found no significant difference in density of beech stems among stands. Significantly fewer sugar maple stems occurred in stands with heavy *C. fagisuga* than in stands with absent or light *C. fagisuga*. No current evidence suggests dense beech thickets will regenerate in stands impacted by beech bark disease in Michigan.

Introduction

Beech bark disease (BBD) was discovered in Michigan in 2000, although evidence suggests it had been established for at least 10 years prior to identification (McCullough et al. 2001). Spreading from its origins in Luce and Mason Counties, BBD is now confirmed in at least eight counties in both the Upper and Lower Peninsulas. The impacts of BBD specific to Michigan's forests are largely unknown but will likely include changes in understory species composition. Michigan State University (MSU) is working in conjunction with the University of Michigan on a long-term research project to investigate the impacts of BBD as it spreads in range and intensifies throughout the state. The objectives of our research at MSU are to *i*) assess differences in understory vegetation in stands with varying levels of beech bark disease and beech densities and *ii*) compare baseline vegetation with long-term data of stands affected by beech bark disease.

Study Area

Research was conducted in 62 permanent plots in the Lower and Upper Peninsulas of Michigan. Stands were selected in a two-factorial design and grouped by beech density and *C. fagisuga* abundance. Beech density was classified by absolute basal area of beech as low (< 9 m^2/ha), moderate (9-18 m^2/ha), or high (>18 m^2/ha). Abundance of *C. fagisuga* in a 100 cm^2 sample area was estimated on 12 beech trees on the north and south sides of the main bole at 1.3 m on upslope side. Trees were considered "heavily infested" if *C. fagisuga* covered greater than 30% of the area on at least one azimuth. Stands were classified according to the number of trees heavily infested with *C. fagisuga* within the plot boundary as absent (zero), light (< 2), or heavy (> 2).

Methods

In each stand, four permanent, fixed radius plots were established at 18 m from the center of the research plot, one in each cardinal direction. We identified number and species of seedlings (< 30.5 cm tall) within a 2.4 m radius, saplings (> 30.5 cm tall and < 2.5 cm dbh) within a 3.5 m radius, and recruits (> 2.5 cm dbh and < 12.5 cm dbh) within a 7.3 m radius.

Results and Discussion

There was no significant difference in mean stems per ha of beech seedlings, saplings, and recruits among stands with absent, light, or heavy *C. fagisuga*, nor among stands with low, moderate, or high beech density. Results suggest that beech bark disease had not yet altered the abundance of seedlings, saplings, or recruits in Michigan forests. Mature beech trees under stressed conditions, such as disease, are known to generate aggressive root-suckers and create dense thickets (Houston 1975). Beech decline was evident in our intensive research stands with heavy *C. fagisuga* abundance, yet no corresponding increase of vegetative regeneration occurred.

Sugar maple seedlings, saplings, and recruits were significantly less in stands with heavy *C. fagisuga* than in stands with absent *C. fagisuga* ($p=0.001$, $p=0.004$, and $p=0.002$ respectively). Interactive effects of *C. fagisuga* abundance and beech density were significant for seedlings, saplings, and recruits ($p=0.008$, $p=0.023$, and $p=0.001$). Sugar maple seedlings and saplings did not differ among stands with low, moderate, or high beech

density. Sugar maple recruits were significantly more abundant in stands with low beech density than in stands with moderate beech density (p=0.024). Interactive effects for recruit regeneration of *C. fagisuga* abundance and beech density were significant (p=0.001).

Other hardwood species included striped maple (*Acer pensylvanicum*), black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), American basswood (*Tilia americana*), ironwood (*Carpinus caroliniana*), serviceberry (*Amelanchier arborea*), common witch-hazel (*Hamamelis virginiana*), sassafras (*Sassafras albidum*) birch sp. (*Betula* sp.), and aspen sp. (*Populus* sp.). Regenerating conifers included eastern hemlock *(Tsuga canadensis),* balsam fir (*Abies balsamea*), and white pine (*Pinus strobus*) but collectively comprised less than 3.9% of total seedling, sapling, and recruit regeneration.

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