

3-28-2014

Dendrochronological Assessment of Ash Growth Rates Relative to Emerald Ash Borer Infestation

Kayla N. Boyes

Indiana University - Purdue University Fort Wayne

Follow this and additional works at: http://opus.ipfw.edu/stu_symp2014



Part of the [Biology Commons](#)

Recommended Citation

Boyes, Kayla N., "Dendrochronological Assessment of Ash Growth Rates Relative to Emerald Ash Borer Infestation" (2014). *2014 IPFW Student Research and Creative Endeavor Symposium*. Book 68.
http://opus.ipfw.edu/stu_symp2014/68

This Poster is brought to you for free and open access by the IPFW Student Research and Creative Endeavor Symposium at Opus: Research & Creativity at IPFW. It has been accepted for inclusion in 2014 IPFW Student Research and Creative Endeavor Symposium by an authorized administrator of Opus: Research & Creativity at IPFW. For more information, please contact admin@lib.ipfw.edu.

Dendrochronological Assessment of Ash Growth Rates Relative to Emerald Ash Borer Infestation



Kayla N. Boyes

Department of Biology, Indiana University-Purdue University Fort Wayne

INTRODUCTION

Overview

- Emerald ash borer (*Agrilus planipennis* [EAB]) is an invasive species introduced from Asia in the 1990s that cause mortality in certain species of ash tree [1].
- Tens of millions of ash trees could be impacted causing an estimated \$10.7 billion in damage by 2019 [2].
- However, even within a few miles of Westland-Garden City area of metro-Detroit, the *de facto* epicenter, there are large, mature trees that are healthy, with minimal signs of EAB attack [1].
- The significant loss of ash trees has been linked to increased mortality in people due to cardiovascular and lower-respiratory distress [3].

Objectives

- To investigate growth patterns among infested ash trees.
- To identify any existing relationship between EAB attack/ash growth.

METHODS

- Ash trees (N = 80) were selected from a gradient of apparent host tolerance to EAB attack [4] in Kensington, Oakwoods, Lower Huron, and Willow Metroparks, MI (Figure 1).
- Visual health indicators including vigor (overall health), percent dieback (canopy health), and signs of attack (i.e. bark splits, exit holes, wood pecker activity) were used to determine susceptibility.
- Two tree cores were collected from each tree at breast height using an increment borer during July 2013.
- Measured tree core rings to determine growth rate of each tree relative to EAB introduction.
- Non-metric multidimensional scaling ordination (NMDS) was used to visualize relationships between parks and tolerance groups relative to growth rates, and cluster analysis was used to group individual trees and years.

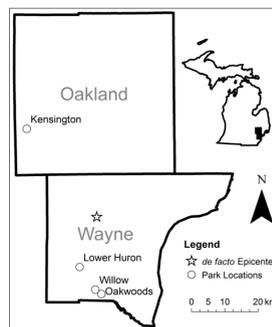


Figure 1. Metropark locations in southeastern Michigan.

RESULTS

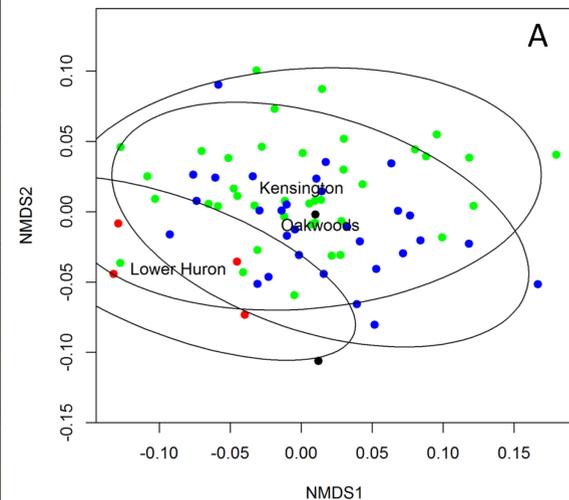


Figure 2. Non-metric multidimensional scaling (NMDS) ordination for growth rates between Metroparks (A) and host tolerance groups (B) with 95% confidence ellipses.

- Significant overlap between parks (Figure 2A) and tolerance groups (Figure 2B) indicated tree growth rates were relatively similar.
- NMDS ordination included trees with rings from 2002-2012.
- Final NMDS stress (0.124) suggests it provided a reasonable assessment of relationships (Figure 3).

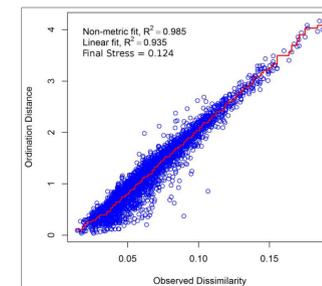
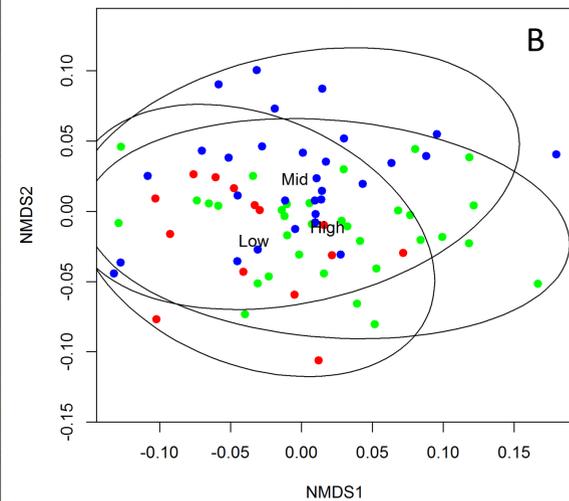


Figure 3. Non-metric multidimensional scaling (NMDS) ordination stress plot.

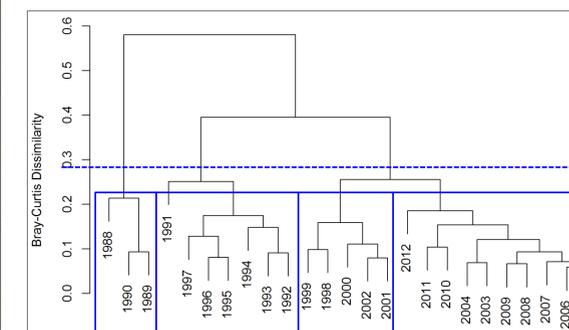


Figure 4. Cluster analysis of growth rates by year with Bray-Curtis dissimilarity. Dash line indicates 25% dissimilarity for branching, blue boxes indicate clustered years.

- Clustered years (blue boxes Figure 4) may align with EAB infestation (pre-introduction, post-introduction, accelerated population growth, exponential population growth).

RESULTS cont.

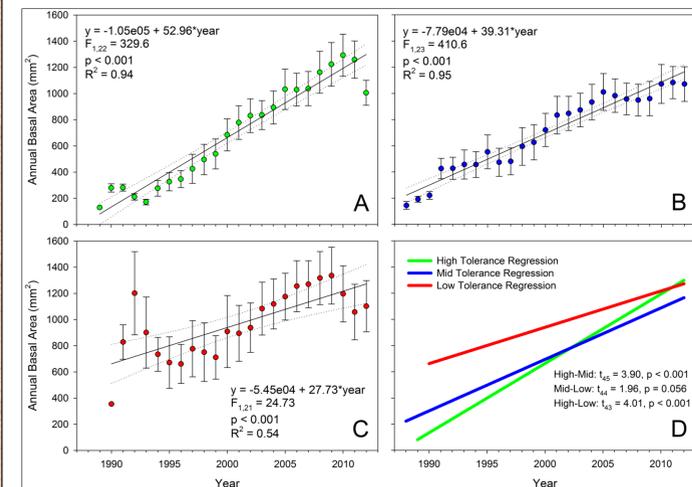


Figure 6. Simple linear regression for mean annual basal area growth per year for tolerance groups with 95% confidence intervals (dotted lines).

- Slope for high tolerance group was significantly different from the low and mid tolerance groups (Figure 6D).

CONCLUSIONS

- Individual trees from different Metroparks or different tolerance groups had substantial overlap in growth rates.
- There appear to be four distinctly different time periods of growth: 1) 1988-1990, 2) 1991-1997, 3) 1998-2002, and 4) 2003-2012. This suggests different phases of EAB infestation may have impacted tree growth rates.
- While linear growth rates appear to be relatively similar between tolerance groups; high tolerance group had the fastest and most consistent area growth rate while the low tolerance group had the slowest and most erratic area growth rate.
- Consistency in growth may be an indicator of tolerance to EAB attack.

Literature Cited

- Marshall et. al. (2013) The American Midland Naturalist 169: 179-193.
- Vannatta et al. (2012) Journal of Economic Entomology 105: 196-206.
- Donovan et al. (2013) American Journal of Preventive Medicine 44: 139-145.
- Hietala (2012) MS Thesis, Michigan Technological University.

Acknowledgements

I would like to thank Dr. Jordan Marshall for his knowledge and guidance as well as Kelley Boyes, Ryan Boyes, Rachel Fuelling, Katie Hietala, and Maja Slijivar for field assistance. Funding partially provided by the IPFW Honors Program.