Understanding the impacts of Emerald Ash Borer and Forest Structure on Understory Plant Invasion.

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Overview: The goal of this project is to examine the collective impacts of time since invasion by emerald ash borer, canopy structure and ash tree mortality on understory plant invasion in Indiana. Specifically, we will test the response of the presence of invasive plants in the understory against maximum canopy height, structural heterogeneity, gap fraction and time. This study could provide a test of whether or not invasion by EAB affects the understory composition in a way that could be used in a detection protocol using remote sensing technology.

Background: Emerald ash borer (*Agrilus planipennis*) can cause almost complete mortality in ash stands, an important component of Indiana hardwood forests. Loss of ash (*Fraxinus spp.*) leads to the increased formation of gaps, changing understory light levels and having secondary effects on other components of the larger ecosystem. LiDAR is an important new tool in invasion ecology, allowing one to visualize the three-dimensional structure of forests at a large spatial scale.

Hypothesis and Predictions:

- **Hypothesis:** ***Emerald ash borer invasion facilitates the invasion of plants into forests.***
- There will be more plant invasion in forest plots that have had a longer time since EAB invasion.
- In a longer time since EAB invasion, there will be more loss of ash trees, higher gap fraction, lower tree height and lower heterogeneity.
- In plots with higher ash mortality, there will be more invasion.
- In plots that have shorter canopy height, less heterogeneity and higher gap fraction, there will be higher invasion.

Methods: Using a total of 537 plots from the Continuous Forest Inventory that contained ash trees, we obtained ash changes and understory plant invasion data from two time points. We obtained canopy structural diversity metrics from the 2011-2013 Indiana state LiDAR data and paired this by coordinates with the CFI plots. Structural metrics were estimated in the R programming platform.

FOR FURTHER READING:

- Richardson, J. J., and L. M. Moskal. 2011. Strengths and limitations of assessing forest density and spatial configuration with aerial LiDAR. Remote Sensing of Environment 115:2640–2651.

Preliminary Results:

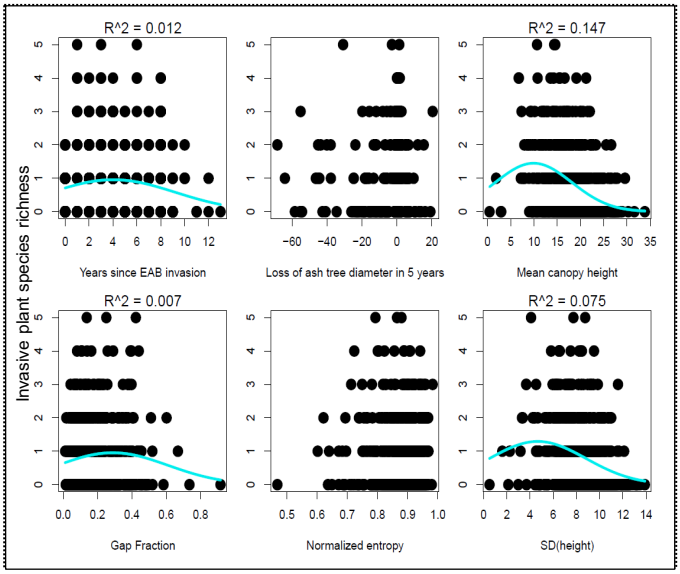

Figure 1. Potential drivers of EAB Invasion and canopy structural diversity on forest plant invasion. We tested for quadratic relationships with Poisson regressions (significant relationship shown by trend line).

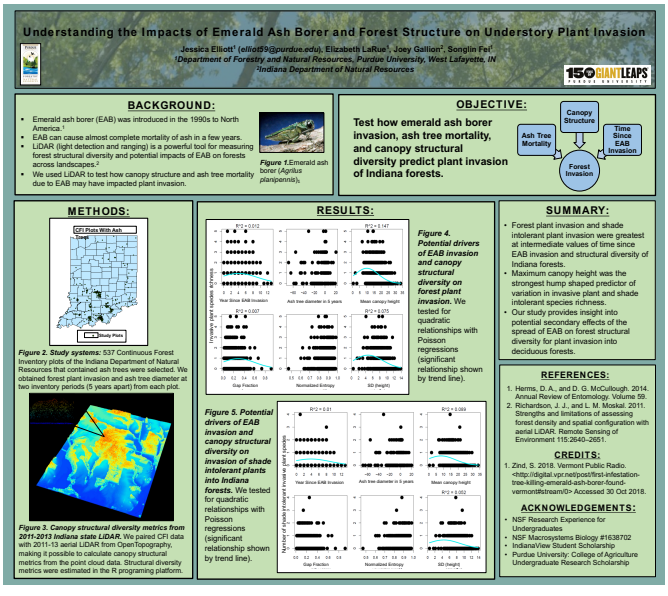

Figure 2. The results of this study were presented at the International Association for Landscape Ecologists conference in April 2019, as well as the Purdue University Department of Forestry and Natural Resources poster competition.