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Quantifying the ability of common invasive shrubs to acquire and use water, to tolerate drought, and compete with native plants within Holden Arboretum, Ohio

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Do Times of Drought Give Native Plants the Advantage Over Invasive Plants?

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Introduction

There is very little data on the interaction between native and invasive shrubs in Eastern North America. There are a number of traits that make the establishment and impact of shrubs different than other species. Early emergence of leaves and varying rates of photosynthesis play a significant role. How plants use water, and how plants are influenced by drought have not been studied thoroughly.

Objectives

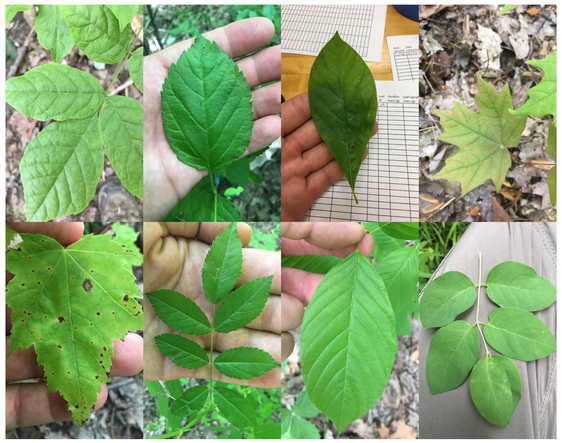
- To better understand how plants will respond to the alteration of precipitation regimes that occur from climate change.

Native Species of Interest

- Arrowwood *(Viburnum dentatum)*
- White Ash *(Flaxinus Americana)*
- Red Maple *(Acer rebrum)*
- Sugar Maple *(Acer saccharum)*
- Spicebush *(Lindera benzoin)*

Invasive Species of Interest

- Glossy Buckthorn *(Frangula alnus)*
- Bush Honeysuckle *(Lonicera morrowii, Lonicera x bella)*
- Multiflora Rose *(Rosa multiflora)*



Acknowledgments

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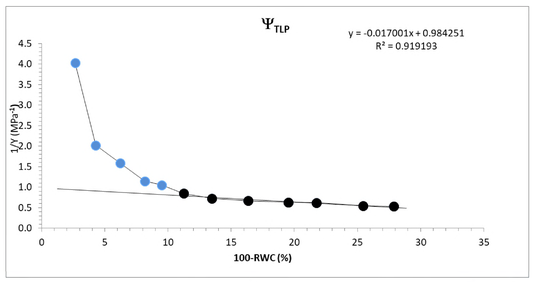
Hypothesis

- Compared to co-occurring native species, the invasive species will have higher rates of water use, lower use efficiency, lower drought-tolerance, and use water from shallower layers of soil.

Methods

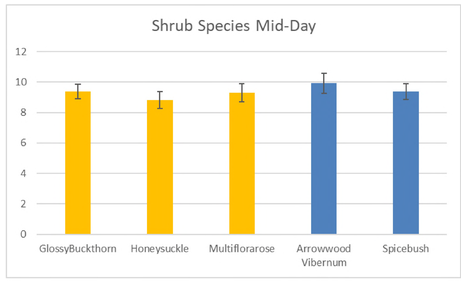
- Measuring rates of photosynthesis and stomatal conductance in leaves (indicators of energy-gain and water-use) and the ratios of stable carbon and oxygen isotopes in leaves (indicators of water use efficiency) by the use of a LI-COR 6800 Photosynthesis machine.
- Measuring leaf water potentials (indicators of depth of water use and water stress) and leaf osmotic potential at full turgor and turgor loss point (indictors of drought tolerance) using a pressure chamber.

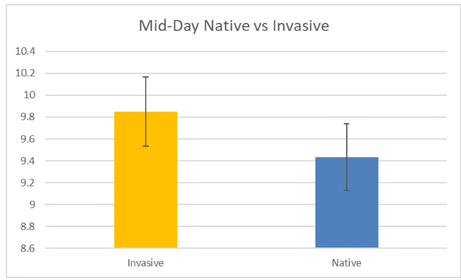
- Left: Pressure chamber used for leaf water potential measurements
- Right: LI-COR 6800 Photosynthesis Machine used for measuring photosynthesis and the stomatal conductance of leaves

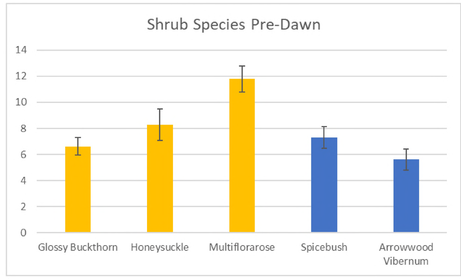


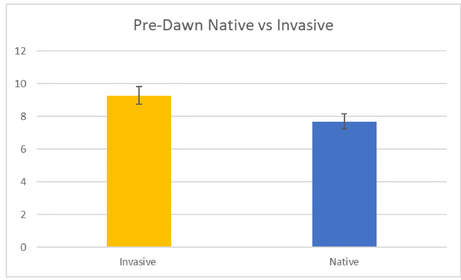
- Turgor Loss Point graph of Honeysuckle compiled of leaf mass and leaf water potential measurements ran through a series of formulas.
- Once a leaf has reached its turgor loss point the hydrostatic pressure in the cell sap is equal to atmospheric air and any additional loss would collapse the cell wall.

Pressure Chamber Data and Results





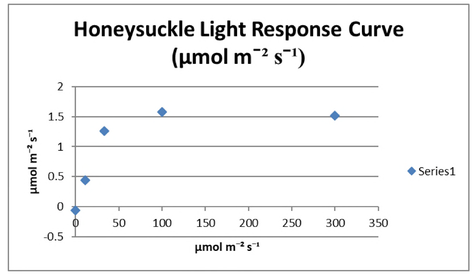


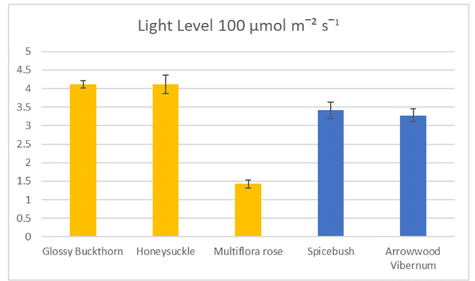


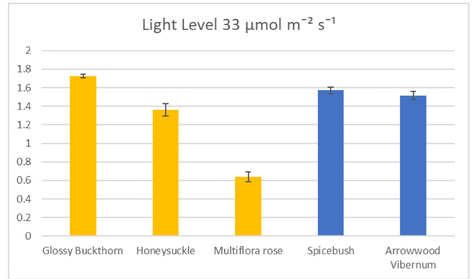
Conclusion

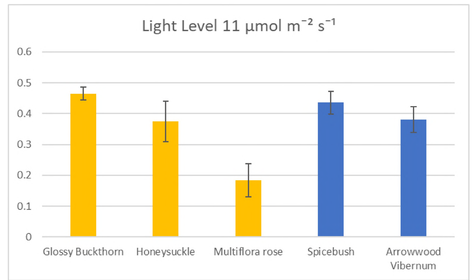
- Our data suggests that the invasive shrubs have a less conservative water use strategy than the native shrub species. This conclusion was drawn because of the low pressure measurements of natives and high measurements of invasives. In terms of photosynthesis measurements, species ranking depended on the light level. →

Light Response Curve Data and Results









- →Some species had higher light curves and some lower, there was no clear difference between native and invasive species. The only note worthy species that was significantly high was Glossy Buckthorn (*Frangula alnus*).