Influences on the Presence of Invasive Plant Species within Old Growth of Lilley Cornett Woods

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NSF-Research Experiences for Undergraduates, Disturbance Ecology in Central Appalachia 2017

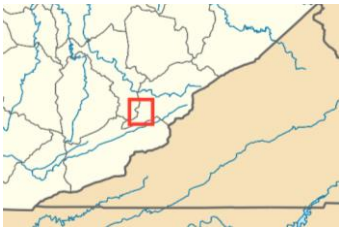
Introduction

An invasive plant is one that is not native to a particular region that is also capable of causing economic or environmental harm [1]. Many of these plants were introduced for ornamental purposes, while some were introduced for purposes such as erosion control [2][3]. They have since escaped into the wild due to the presence of certain characteristics such as the ability to grow rapidly, produce large amounts of seeds, and spread seeds over large distances [3].

Old growth forests may appear more resilient and/or resistant to invasion, but they are by no means immune. There may be several factors that increase or decrease the likelihood of invasion. Those examined in this study include slope, elevation, distance from disturbance such as roads or trails, and light gaps. This study focused on the presence of four key invasives: *Microstegium vimineum* (Japanese stilt grass), *Rosa multiflora* (Multiflora rose), *Ailanthus altissima* (Tree of heaven), and *Paulownia tomentosa* (Princess tree).

Methods

84 long-term-monitoring-plots within Lilley Cornett Woods' old growth forest were surveyed for the presence or absence of invasive species, Invasive species were identified and the coverage was quantified by measuring the diameter at breast height (dbh) for tree species and length/width for estimating coverage of herbaceous species.



Data were taken on the amount of light penetrating the canopy using hemispherical canopy photography. The photos were taken from the center of each plot and were analyzed using ImageJ to determine the percentage of open canopy over that plot.

ArcMap was used to acquire geographical and topographical data: proximity of plots to roads and trails, as well as the slope, aspect, and elevation.

Data were analyzed using general linear models (binary logistic regression). Multi-model inference (model averaging) was used to average the predictions across models. The effect size (beta) of covariates were determined across all models.

Results

Of the 84 plots that were surveyed, 17 were documented as being occupied by an invasive plant while 67 were free of invasives.

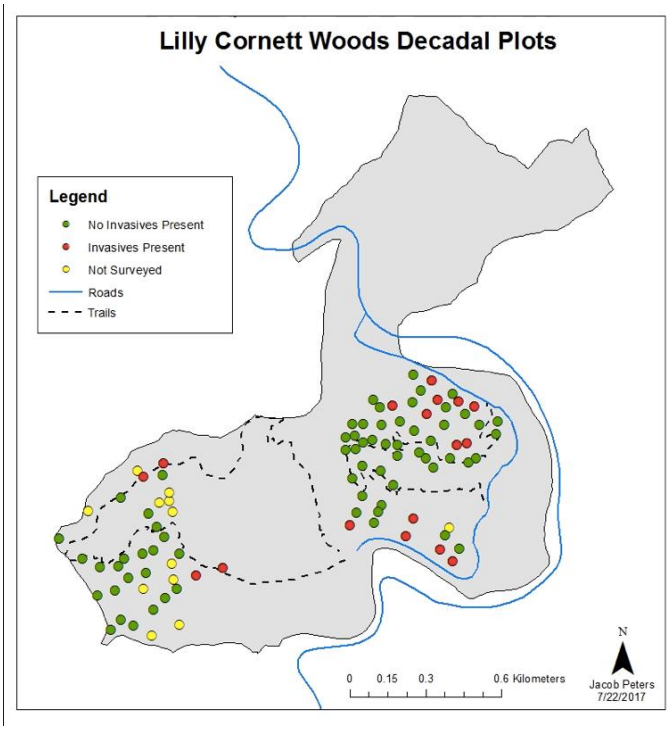


Figure 1. *Presence and absence of invasive plants in Lilley Cornett Woods.*

Canopy openness was shown to have the largest effect on invasive plant occupancy in an old growth forest, with elevation, aspect, and distance to roads still being important but somewhat less significant.

Parameter	beta (effect size)	95% CI	
		lower	upper
distance to trail	0	0	0.01
distance to road	-0.01	-0.02	0
elevation	-0.02	-0.04	-0.01
aspect	0.01	0	0.01
canopy openness	8.42	-7.28	24.13
slope	0	-0.1	0.11

Figure 2. *Results from multi-model inference demonstrating effect sizes of covariates on the presence of invasive plants.*

Discussion

One limitation of this study is the lack of invasive plants within the plots. *M. vimineum* was the most common, being found on 11 plots. By contrast, *P. tomentosa* and *A. altissima* were found on one plot. The lack of data obtained for those two species made it impractical to attempt an analysis solely with them. Consequently, analyses were run using data on all species, as well as *M. vimineum* and *R. multiflora*, specifically.

Areas along the roads and trails were noted as having large patches of *Microstegium vimineum*, but this species as well as other invasives were less common within study plots. While anecdotal, it indicates that areas more removed from roads in old growth forests are more resistant to invasion. Invasive plants seem to have difficulty with becoming established within the forest without the help of another factor such as a large light gap.

Furthermore, if a plot marker was shaded by a few small trees, the data interpreted this as a very shaded plot. However, an invasive plant could be residing in light gaps near the boundary of that plot. This could potentially misconstrue the data, as the plants were not found in the shade, but rather in a light gap that was not captured by the photography.

As data on small ephemeral streams were lacking, it is likely that another parameter such as elevation is serving as a proxy for that effect. Anecdotally, streambeds appeared to harbor more *R. multiflora* and *M. vimineum* than other areas; therefore, a main priority of this study going forward is to acquire that data.

Conclusions

This study may serve as a tool to land managers and future studies—allowing land managers to better understand the factors that make invasion by non-native plants easier so they can take preventative measures or be prepared to act in certain areas where invasion is more likely. Future studies at Lilley Cornett Woods may also use this study to monitor the spread of invasive plants.

To reiterate, canopy openness was shown to be the main factor that influences the arrival of invasive species, acting as a stepping stone for them to appear and begin to spread elsewhere within the forest. Shading out native plants, filling in canopy gaps, and providing little to no food or shelter for native animals and insects are a few major reasons why invasive plants are so dangerous to an ecosystem. It is paramount that land managers, scientists, and civilians understand the importance of controlling invasive plants and preventing their introduction elsewhere.

References

1. USDA. Executive Order 13751-- Safeguarding the Nation from the Impacts of Invasive Species (Dec 5, 2016)
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The study was conducted as part of the NSF Research Experience for Undergraduates and Research Experience for Teachers program: Disturbance Ecology in Central Appalachia — a ten-week summer research program hosted by Eastern Kentucky University.

Funded by the National Science Foundation, DIB 1559980.