Influence of white-tailed deer and an invasive shrub on ant communities: a long-term experimental study

Michael B. Mahon[1], Kaitlin U. Campbell[2] & Thomas O. Crist[1]

[1]Department of Biology, Miami University, OH; [2]Department of Biology, University of North Carolina at Pembroke, NC

Introduction

- White-tailed deer and invasive Amur honeysuckle broadly influence plants in eastern US forests[1,2]
- Deer and honeysuckle alter leaf litter decomposition rates[3,4]
- Through changes to leaf litter and vegetation structure, forest floor invertebrates may suffer
- Ants (Formicidae) play key functional roles in forest ecosystems, and can be used to monitor changes in invertebrates and the environment
- We used abundance, richness, functional diversity, and species composition of the leaf litter ant community to measure direct and cascading effects of deer and honeysuckle on ecosystem function

Hypotheses and Predictions

How do litter dwelling ants respond to experimental deer exclusion and honeysuckle removal?

	Ant Rich & Abun	Ant Comm.	Reason
Deer Exclosure	↑	SHIFT	↑ Litter
Honeysuckle Removal	↓	SHIFT	↓ Veg.

Materials and Methods

- Five sites in Miami University's Natural Areas in SW Ohio, US
- 20x20-m deer exclosure paired with control plot, each with split-plot removal of honeysuckle (Fig. 1)
- Collected leaf litter (June 2011-2017) from 0.25m^2 quadrats (Fig. 1) and ants were extracted using Winkler extraction
- Developed functional groups based on natural history and morphometrics
- Measured ant abundance, richness, Shannon diversity, and functional richness
- We used AICc selection of GLMMs to test effects of
  - Leaf Litter Biomass
  - Deer exclosure
  - Honeysuckle removal
- Used PERMANOVA, PERMDISP, and NMDS to test effects of experimental treatments on ant composition

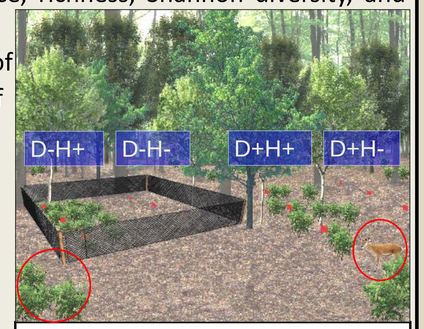


Figure 1. Paired plots with split plot design. Flags indicate sampling locations of leaf litter from 0.25m^2 quadrats.

Results

- 4,665 workers were collected from 2011-2017, representing 30 species
- Common species included *Aphaenogaster rudis, Temnothorax curvispinosus, Ponera pennsylvanica, and Myrmica punctiventris*

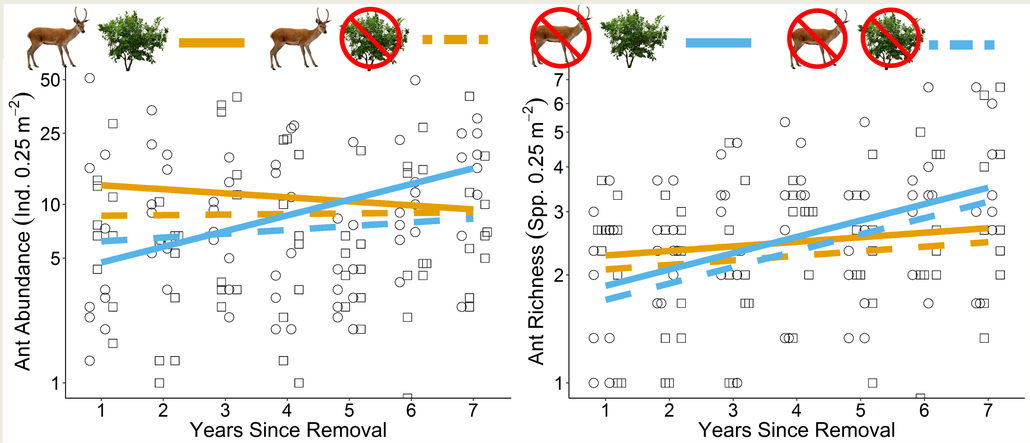


Figure 2. Change in ant abundance (left) and richness (right) through time in response to experimental treatments.

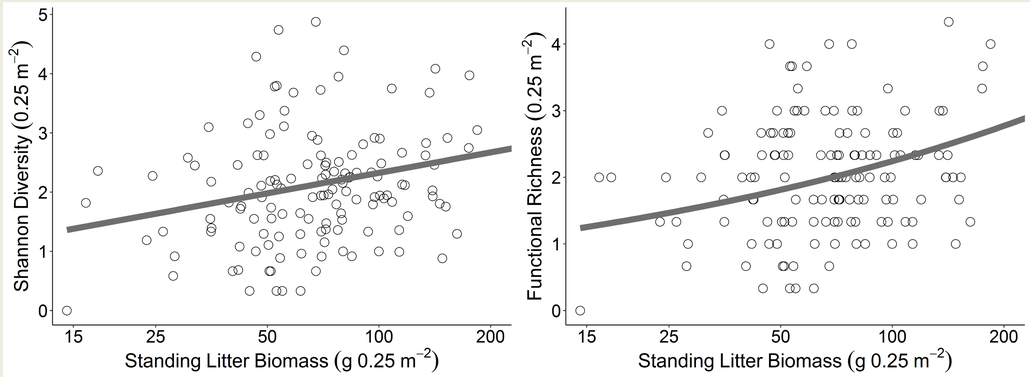


Figure 3. Significant relationship between both Shannon diversity (left) and functional group richness (right) and standing litter biomass.

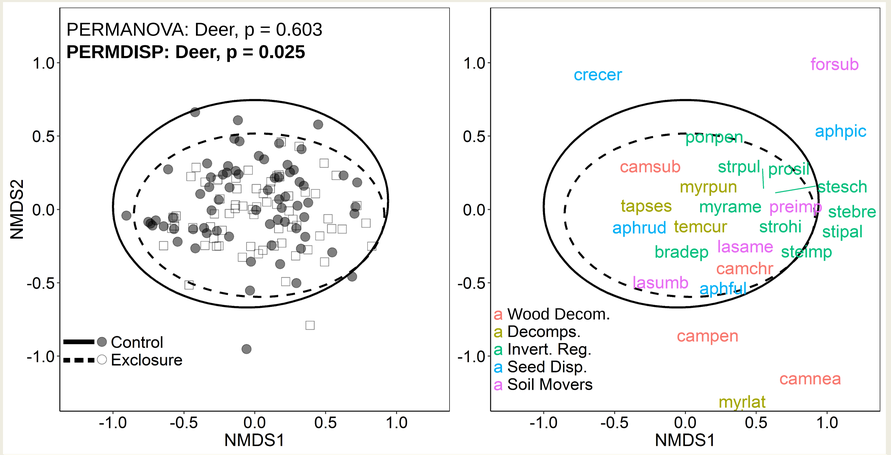


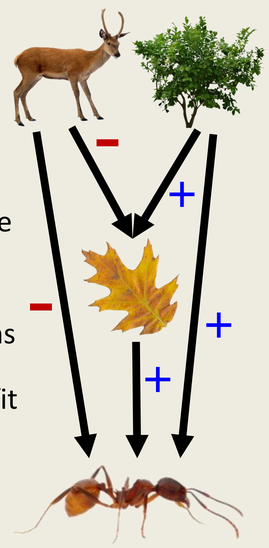
Figure 4. NMDS ordination (k = 4, stress = 0.138) of ant community composition. Site scores (left) with 95% CIs of deer access (solid ellipses; grey symbols) and deer exclosure (dashed ellipses; open symbols). Species scores (right) are represented by their functional group.

Summary

	Ant Rich & Abun	Ant Community
Deer Exclosure	↑ ✓	SHIFT ✓
Honeysuckle Removal	↓ ✓	SHIFT ✗

Conclusions

- Deer and honeysuckle effects on litter dwelling ants are mediated through changes to vegetation structure and litter biomass
- Little functional redundancy in temperate litter dwelling ants
- Reductions in litter ant abundance and richness due to reductions in litter biomass may lead to loss of ant-mediated ecosystem functions
- Honeysuckle presence may benefit litter dwelling invertebrates
- Reduction of deer populations may promote biodiversity of litter dwelling invertebrates



Further Information

Online Version: mahonmb.weebly.com/posters

Email: mahonmb@miamioh.edu

Twitter: @GlobalWorming19

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Acknowledgements

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