Abundance and Space Use of White-footed Mouse (*Peromyscus leucopus*) in Indiana Mixed-hardwood Forests Invaded by Amur Honeysuckle (*Lonicera maackii* (Rupr.) Herder)

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Introduction

- Amur honeysuckle is a non-native shrub that has invaded many forests in the U.S.
- Little is known about the effects of this invasive shrub on mammal species
- The objectives of this study were to:

1. **Examine the short-term effects of removing Amur honeysuckle and other non-native shrubs on the white-footed mouse, a habitat generalist**
2. **Examine factors influencing space use of white-footed mice in forests invaded by Amur honeysuckle**

Field Methods

- Examined six mixed-hardwood forests in Indiana where Amur honeysuckle was the dominant invasive shrub
- Each forest contained a ~80m x ~80m Removal Grid and a ~80m x ~80m Reference Grid
- In Removal Grids, Amur honeysuckle and all other non-native shrubs were removed in fall/winter of 2010/2011 (no treatment was implemented in Reference Grids)
- In Removal Grids and Reference Grids, we used mark release recapture (MRR), with 49 Sherman traps per grid; trapping was done in the summer (six nights) and fall (four nights) of 2010 (before removal treatment) and again in summer and fall of 2011 (after removals)
- Plot-level environmental variables were collected in each grid (Fig. 1)

Data analyses

- Assumed population closure
- For each grid type, Bayesian parameter-expanded data augmentation (Kery and Schaub 2012), using closed-population model Mth, was used to estimate abundance of white-footed mouse; each grid was examined separately
- Permutation tests (assuming a paired design with 100 iterations per test) were used to examine differences in abundance between 2010 and 2011
- For each mouse considered a resident (captured in a minimum of two different Sherman traps in a grid), with a center of activity (Hayne 1949) ≥ 15m from forest interior boundaries of trapping grid, we calculated mean squared distance (MSD; Calhoun and Casby 1958, Slade and Swihart 1983) and used it as an index of space use
- Using MSD as the dependent variable, we pooled mice across grid types, seasons, and years (n = 66 mice) and used multiple linear regression to determine how the following predictor variables influenced space use by individual mice: abundance estimate for a given grid, distance from center of activity of focal mouse to nearest neighbor's center of activity (m), distance from center of activity to nearest forest edge (m), percent cover of native vegetation, percent cover of non-native vegetation, percent cover of coarse woody debris (cwd), percent cover of leaf litter, density of native woody stems in sapling stratum, density of non-native woody stems in sapling stratum, overstory canopy cover, and overstory basal area (BA)
- For each mouse in MSD model, plot-level (Fig. 1) predictor variable values were calculated by drawing a minimum convex polygon (MCP) based on Sherman trap visits, determining which sample plots were closest to MCP boundary, then calculating mean values for each predictor variable across those proximate sample plots

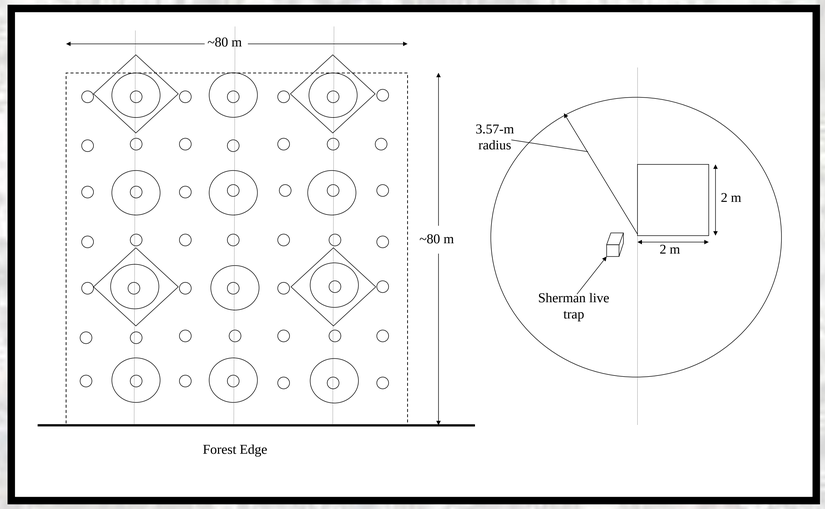

Fig. 1. ~80 m x ~80 m sample area at each Reference Grid and Removal Grid (left diagram). In the left diagram, the smaller, open circles denote the locations of 49 Sherman live traps (spaced 10 m apart). Diamonds denote four variable-radius plots (basal area factor of 2.296 m²/ha) spaced ≥ 40 m apart along two transects (lines with smaller dashes running perpendicular to forest edge), used to calculate basal area (BA) of overstory trees (woody stems ≥ 10 cm diameter at breast height [1.37 m; dbh]). Large circles denote 12, 40-m² (radius of 3.57 m) vegetation plots used to sample native and non-native woody stems in the sapling stratum (woody stems ≥ 1.37 tall and < 10 cm dbh). Right diagram shows a closer view of a sapling/shrub plot, Sherman live trap, and a 2 m x 2 m quadrat to record percent covers of native and non-native herbaceous vegetation, coarse woody debris (cwd), and leaf litter. At each sapling/shrub plot, canopy cover was recorded using a spherical densiometer. Note that not all Sherman live trap locations contained vegetation plots.

Results

- For both summer and fall trapping, differences in white-footed mouse abundance were generally positive in Removal Grids whereas changes were more inconsistent in Reference Grids (Fig. 2)
- Permutation test p values for Removal Grids in the summer and fall were 0.08 and 0.04, respectively, whereas p values for Reference Grids in the summer and fall were 0.79 and 0.94, respectively
- Using best subsets regression, we determined that for the best multiple linear regression model (lowest Akaike information criterion [AIC] and all significant [$p < 0.05$] predictor variables), the most important predictors of MSD were BA and percent cover of leaf litter

Multiple Linear Regression Equation (n = 66 mice):

$\sqrt{MSD} = -0.24 + 1.30(\sqrt{[\text{percent cover of leaf litter}]};\ p = 0.007) + 0.46(BA;\ p = 0.03)$; Adjusted $R^2 = 0.19$

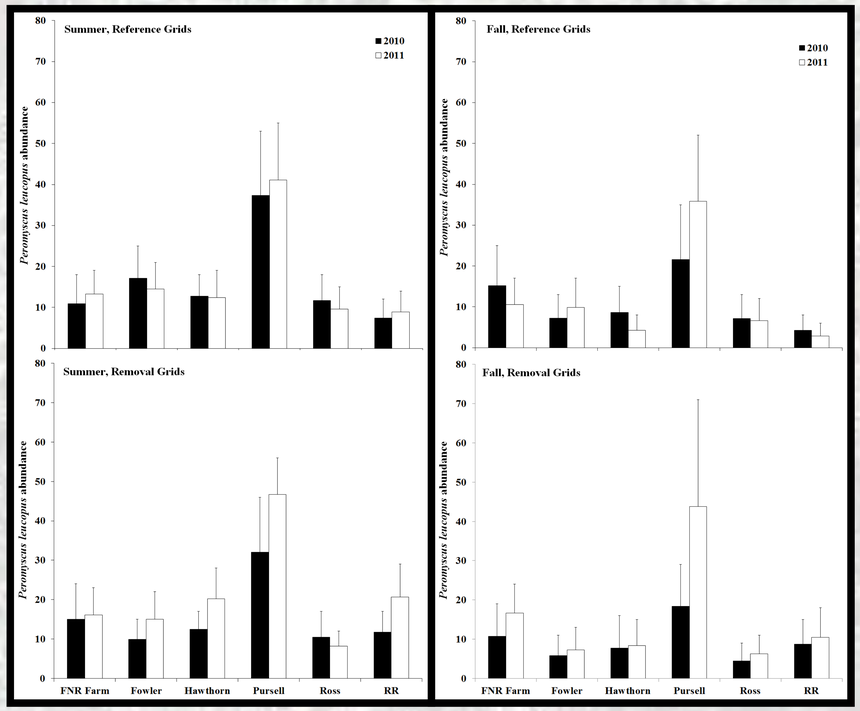

Fig. 2. Mean abundance estimates (+ upper bound of 95% Credible Interval) of white-footed mice by study site, grid type (Removal or Reference), season (Summer or Fall), and year (2010 or 2011). Estimates are based on Bayesian parameter expanded data augmentation, using closed-population model Mth.

Conclusions

- **Our results suggest that management efforts to control the spread of Amur honeysuckle may lead to short-term increases in the abundance of generalist rodents such as white-footed mice**
- **Factors such as basal area and leaf litter cover may influence space use by individual mice in a population**
- **Future MSD analyses will include separate examinations of summer and fall data**

References

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Acknowledgements

The authors thank John "Barny" Dunning, Kevin Gibson, and Gene Rhodes for help with the study design. Thanks to Rob Quackenbush, Kyle Leffel, Lindsay Jenkins, Amanda Parks, Amy Wetzel, Taryn Clark, Crystal Bevis, Michael Loesch-Fries, Brian Bailey, Caleb Brown, Justin Schmal, Brian Beheler, Oriana Krauss, Seth Howard, Lindsey Purcell, Jeff Clark, Rick Meilan, Shelly Newman, and Randy Newman for helping implement removal treatments, lending us equipment, and/or collecting/entering data. We also thank Burk Thompson, Andy Meier, Don Carlson, Keith Ruble, Brent Pursell, Kerry Rabenold, Dave Rader, Roy Dane, and Doug Ucci for helping find study sites and/or granting permission to work on properties. Thanks to Matt Kraushar, Zach Lowe, Keith Ruble, and Greg Ressler for advice on herbicide application. We also thank Purdue Forestry and Natural Resources and the Hardwood Tree Improvement and Regeneration Center for their support. Other financial support was provided by the Purdue Doctoral Fellowship and the Andrews and Blosser Environmental Travel Grant.