

DO MATURE FORESTS PRESENT BARRIERS TO NONNATIVE PLANT INVASION? *LONICERA MAACKII* INVASION IN DECIDUOUS FORESTS OF CENTRAL KENTUCKY

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ABSTRACT

Nonnative invasive plants can negatively affect the abundance and survival of native plant species and alter ecosystem function. Amur honeysuckle (*Lonicera maackii*) is an invasive shrub that is an increasingly onerous problem for forest management in eastern North America. While much is known about the effects of Amur honeysuckle on native plant communities, less is known about the invasion process and the factors that influence the encroachment of Amur honeysuckle into forested sites. Factors that have been implicated in the spread of invasive shrubs include canopy openness, proximity to urban/suburban areas and roads, and historical disturbance. We examined site-specific characteristics that correlated with the establishment of Amur honeysuckle and other nonnative invasive plants in mature forests in central Kentucky. Data were gathered from 15 mature forest remnants throughout the Inner Bluegrass region (IBG) of Kentucky. Forest age was determined from tree core samples, which showed that tree age averaged 70 years. To characterize individual sites, we measured frequency and cover of nonnative invasive shrubs, and co-occurring native shrubs, as well as the basal area of overstory trees. Trees commonly found throughout forest stands included sugar maple (*Acer saccharum*), white oak (*Quercus alba*), chinkapin oak (*Q. muhlenbergii*), shagbark hickory (*Carya ovata*), and white ash (*Fraxinus americana*), with a few other species interspersed. Total basal area of trees > 10 cm diameter at breast height ranged from 23.9 to 41.9 m² ha⁻¹, with a total stem density of 339.4 to 841.7 stems ha⁻¹. Forest floor litter depth, species composition of the leaf litter, and soil chemical characteristics were also measured. Litter depth was measured along transects in each study site and samples were separated into oak and 'other' species in the lab. Soil pH, percent carbon (C) and nitrogen (N), and C/N were measured. Amur honeysuckle was found in 13 of 15 study sites; percent cover ranged from 0.03 to 64 percent. The percent cover of Amur honeysuckle in a forest was significantly related to forest floor litter depth (P = 0.03): as the depth of the leaf litter increased, the percent cover of Amur honeysuckle decreased. Of the variables measured, only forest floor litter depth (P=0.01) and the percent of oak litter on the forest floor (P=0.004) were significantly related to Amur honeysuckle presence, and the relationship was also negative. Although previous investigations have found basal area to be a significant predictor of invasive plant presence, it was not a predictor of Amur honeysuckle presence (P=0.36) or cover (P=0.60) in this study. Co-occurring native shrubs, as a group, had no significant effect on the presence (P=0.91) or abundance (P=0.46) of Amur honeysuckle. Further, none of the individual species used in analysis, including coralberry (*Symphoricarpos orbiculatus*, P=0.31), pawpaw (*Asimina triloba*, P=0.13), and spicebush (*Lindera benzoin*, P=0.93), were significant in explaining Amur honeysuckle cover. Similarly, soil characteristics such as soil pH (P=0.08; P=0.34) and soil percent C (P=0.96; P=0.16) did not explain either the presence or cover, respectively, of the exotic shrub.

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Nonmetric multidimensional scaling (NMDS) ordination was used for spatial analysis of all our invasive species and environmental variables. NMDS also showed a clear separation (in ordination space) among species (Axis 1 $R^2 = 0.678$, Axis 2 $R^2 = 0.229$, final stress 7.2), where the axes show the strength of the relationship between the invasive species and the environmental variables. The strongest relationships between the two sets of variables were for soil pH, litter depth, oak basal area, and percent oak in the leaf litter; invasive species generally arrayed directly opposite of the forest floor leaf litter vector.

Our data suggest that forest floor mass creates a barrier to invasion by exotic plants and that forests dominated by oak species are more resistant to invasion and establishment by Amur honeysuckle.

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