ABSTRACT

VIDRA, REBECCA LYNN. Implications of exotic species invasion for restoration of urban riparian forests. (Under the direction of Dr. Theodore H. Shear).

Urban forests serve as remnant natural areas in otherwise degraded landscapes. Yet, these forests are commonly threatened by invasion of exotic plant species, which may compromise the structure and ecological functions of native communities. Restoration of these forests will inevitably require removal and continued control of exotic species invasions.

I focused my research on urban riparian forests within Raleigh and Cary, North Carolina, USA. My goals are to understand the impacts of exotic species invasion on these forest communities, identify factors that make these sites susceptible to invasion, and make appropriate restoration recommendations. To address these goals, three major studies structured my research.

First, I tested two major paradigms of current exotic species ecology using observational data from 23 urban riparian buffers. The competition paradigm was borne out by negative relationships between exotic and native species richness (r = -0.66, p = 0.0009). I also detected shifts in species composition away from native woody species in sites that have been invaded by exotic species. As suggested by the resource availability paradigm, certain environmental conditions do seem to favor exotic species in this study system. While light availability was not significantly correlated to invasion of exotic species, several measures of soil fertility were negatively correlated to native species and positively correlated to exotic species. Therefore, efforts to reduce fertilization from adjacent and upstream landscapes should be part of any restoration plan.

My second approach involved conducting an experimental removal study at the North Carolina Museum of Art. I compared the species composition and native species recovery in
three treatments: control, initially removing all vegetation and allowing regeneration, and initial removal with additional continual removal of new exotic recruits. While the continual removal treatment featured a different species composition than either of the other two treatments, this difference can be attributed to the lack of exotic species, not to the recovery of native species. These results indicate that continual removal is necessary to prevent invasion in urban forests but that native supplemental plantings may be necessary to create a diverse community.

My third approach involved evaluating the influence of landscape structure on patterns of exotic species invasion in urban riparian buffers. I found that invasion, measured as total percent cover of exotic species, is highest in the narrowest buffers. Buffers surrounded by developments with more canopy cover are also more heavily invaded than those surrounded by less canopy cover. These findings suggest that processes outside the buffer, such as bird dispersal and vegetative spreading of ornamental plantings, may contribute to the invasion inside the buffer.

Exotic species invasion does have implications for restoration of urban forests. Not only is native species richness threatened, but native woody species appear to be most at risk for extirpation from these sites, with potential consequences for long-term forest succession. Because these forests are invaded by a suite of exotic plants, targeted efforts to remove those that are likely outcompeting native species is a good first step. Managing land use practices outside of the forests, while difficult, is necessary to reduce both the stress on the forest (e.g., fertilization) and invasion opportunities (e.g., bird dispersal, ornamental plantings). The results of this research will help managers identify sites at future risk for invasion and focus efforts on managing both the exotic species and site conditions to restore the health of these ecologically valuable forest communities.