Landscaping plants as invasive species in central Texas: positive correlations with development, proximity and age, but limited by aridity?

Gabriel L. De Jong and Norma L. Fowler

University of Texas at Austin

Introduction

- We investigated environmental factors that affect the distribution and abundance of non-native plant species in central Texas woodlands.
- Because many invasive woody species in this region are landscaping plants, **we hypothesized that the closer a site was to a developed area (e.g., a residential neighborhood) and the older the development, the more non-native woody species it would have**, as a result of ongoing propagule pressure.
- We also examined the effects of proximity to roads, creeks, and the city of Austin, and of native species richness, slope, aspect, and distance to the nearest stream, on invasive species richness.
- We identified the most common invasive species in central Texas natural areas as well as those that are not yet common but may become so.



Methods

- In 2011-2012, 344 circular plots (5m radius) were located in 13 sites in central Texas.
- At each site, 10-12 plots were located in each of three habitats: riparian, mesic woodland, and upland.
- Within each plot, the numbers of plants of each native and non-native woody species was recorded.
- Distance to central Austin, distance to development, distance to streams, distance to roads, slope, and percent cover were calculated using ArcGIS databases and verified in the field.

Site Locations



Habitats



Riparian:
- along a stream
- high probability of flooding



Mesic woodland:
- near a stream
- low probability of flooding
- high herbaceous and shrub layer cover

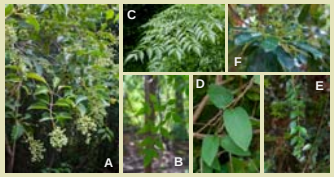


Upland:
- low herbaceous cover
- higher elevation than the surrounding landscape

Results

Common invasives

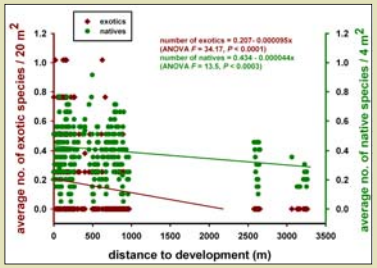
- The most common non-native woody species were landscaping species: *Ligustrum lucidum* (A), *Nandina domestica* (B), *Melia azedarach* (C), *Lonicera japonica* (D), and *Ligustrum sinense* (E).
- *Photinia serratifolia* (F), still uncommon, may be a future problem.

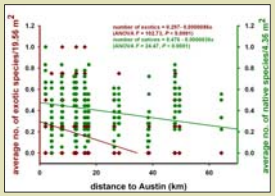


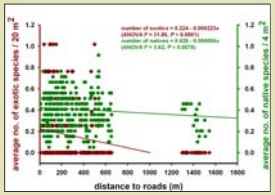
Results

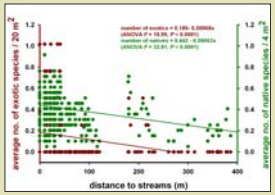
Environmental Variables and Species Richness

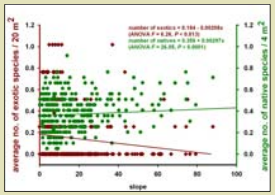
- The number of woody exotic species was **strongly negatively related** to distance to development, distance to central Austin, distance to roads, distance to streams, and slope.
- In contrast, relationships between these variables and the number of native woody species were much weaker .



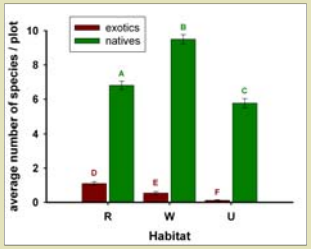








Habitat Effect



- Both exotic and native woody species richness differed significantly among habitats (Kruskal-Wallis test, exotics: $\chi^2 = 67.05$, $P < 0.0001$, natives: $\chi^2 = 80.11$, $P < 0.0001$).
- Non-native species richness was highest in riparian plots; native richness was highest in mesic woodland plots.
- Both exotic and native species richness were lowest in upland plots.

Results

Correlations

	distance to Austin	distance to development	distance to roads	distance to streams	slope
distance to Austin	--				
distance to development	**0.48**, ***P* < 0.0001**	--			
distance to roads	**0.39**, ***P* < 0.0001**	**0.76**, ***P* < 0.0001**	--		
distance to streams	0.094, *P* < 0.080	0.12, *P* < 0.028	-0.058, *P* < 0.283	--	
slope	0.10, *P* < 0.054	0.041, *P* < 0.44	**0.22**, ***P* < 0.0001**	**0.18**, ***P* < 0.0009**	--

Many of the dependent variables were significantly correlated with each other.

Discussion



- The results support our initial hypotheses: **sites closer to developments and especially to older developments had more exotic woody species**.
- **Landscaping is likely an ongoing source of propagules of exotic woody species.** The most common invasive woody species were all landscaping species. Future invaders are also likely to be landscaping species.
- These findings suggest that **propagule pressure** has had a dominating effect on distribution of invasive species richness in this region.
- We suggest that there is an **'invasion debt':** we expect the abundance of these non-native species to increase rapidly in more recently developed areas**.**
- At least some of the **common non-native invasive species may require a wetter habitat** and therefore may not spread to more xeric, upland habitats in the region.
- Environmental variables also had significant impacts on invasive species richness. However, due to strong correlations with each other, it is difficult to separate each effect.

Management Implications



- Riparian areas should receive the highest priority when controlling invasive woody species.
- Controlling the trade of known invasive woody species could be a effective tool for preventing future invasions and slowing those invasions that are already underway.
- Xeric habitats in central Texas remain mostly uninvaded by exotic woody species. However, with 'xeriscaping' becoming a more common landscaping practice, this could change. Greater effort should be directed at promoting the planting of native species in residential and commercial landscapes.

Acknowledgements

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Please direct questions or comments to Gabriel De Jong at gabe.l.dejong@utexas.edu