Defining edge gradients using plant species composition in oak-hickory forest patches

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Introduction

•Forest conservation is greatly enhanced with an increased understanding of the transitional nature of edges

•Most forests in east-central Illinois exist as small patches, making the region an ideal location for studying edge effects

•A quantitative assessment and predictive model of the penetration of edges into interior forests using plant composition are needed

•**Objective** – 1) identify mechanisms and processes that determine gradients of plant composition 2) develop a predictive model of edge effects using plant species composition as an indicator of edge influence.

Methods

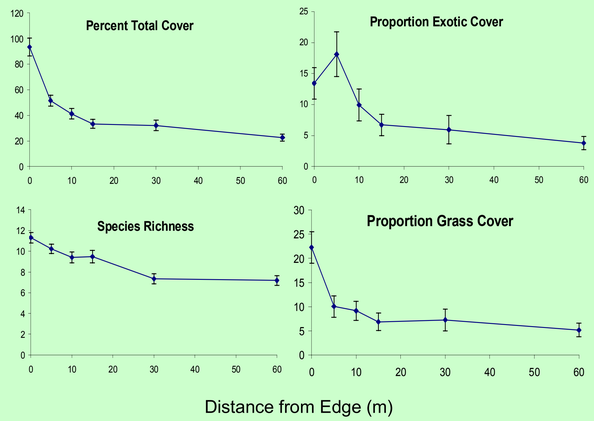
•A large data set was gathered to relate species composition to several environmental and community composition variables.

•Data were analyzed in several multiple regressions to find the most important variables controlling edge responses.

•Non-Metric Multidimensional Scaling (NMDS) ordination was performed to determine if there were compositional changes across the forest edge

Results

•Study system had a sharply defined edge gradient, with vegetation cover highest at the edge and decreasing dramatically 15-30 meters into the forest



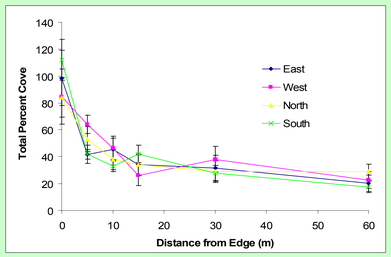
•Total percent understory cover of plots was the best indicator of edge response for any of the models

•Percent canopy cover, distance from the edge, and plot slope were the most important controllers of edge influence for most responses.

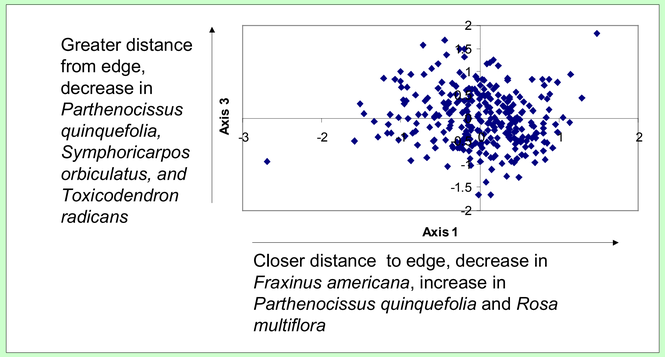
Multiple Regression Equations for community variables (response) and environmental variables (predictors).

Response	R^2	Predictors	Beta	P
Total Percent Cover	.396	Intercept	443.228	.0001
		% Canopy Cover	-3.917	.0001
		Distance from Edge	-.531	.0001
		Plot Slope	-.835	.0001
Species Richness	.181	Intercept	11.116	.0001
		Distance from Edge	-.049	.0001
		Plot Slope	-.091	.0001
Proportion Exotic Cover	.113	Intercept	104.454	.0001
		% Canopy Cover	-.911	.0001
		Distance from Edge	-.157	.001
		Adjacent Cover Type	-5.475	.009
Proportion Grass Cover	.076	Intercept	78.321	.001
		Distance from Edge	-.157	.001
		% Canopy Cover	-.674	.005
Shannon-Weiner Diversity	.047	Intercept	1.631	.0001
		Plot Slope	-.007	.026
		Distance from Edge	-.003	.038
Evenness	.019	Intercept	.690	.0001
		Distance from Edge	.001	.021

•Edge orientation had no effect on response of the community (P=.961)



•NMDS produced 3 informative axes that explained 41% of total variation in composition, Axis 1 and 3 were more strongly correlated with distance



Discussion

•Canopy cover controlled light intensity to forest floor → more open canopies allow more light, plots experience greater understory plant growth

•Distance from the edge reflected the plot landscape position

•slope reflected the control of microtopography on plant growth

- Steeper plots had less total cover than flatter plots regardless of distance from the edge
- Understory growth in steep plots was severely limited by light and also leaf litter from the forest canopy

•Lack of effect of orientation on plant community contrary to most studies of edge effects in forest-field systems

•Ordination showed Axis 1 is mostly a measure related to forest edges, Axis 2 appeared to explain variation related to different types of edges than Axis 1 and Axis 3 was mostly related to forest interiors

Conclusion

•Model serves as useful tool for predicting the effect of edges on plant composition

- Can be calibrated to work for other types of systems

•Microtopography can be an important controller of edge effects, which has been previously overlooked in studies of edge effects

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