Effects of Native Prairie Plantings on Insect Diversity

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ABSTRACT

This research looked at the effects of native prairie plantings in an urban setting on insect diversity. The research revealed that the more native plant species in a planting, the greater the insect diversity. Additionally, it was found that the greater percentage of the planting's edge was concrete, the lower the insect diversity. These findings lend support to the move towards planting in urban areas with more native species by indicating that urban native plantings do in fact have ecological significance, in this case through the promotion of greater insect diversity.

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INTRODUCTION

In many situations plant diversity is important in determining animal diversity (Haddad et al. 2001; Siemann 1998; Murdoch et al. 1972). This stems from the idea that a diversity of resources should support a diversity of consumers (Siemann 1998). In the context of urban ecology, the question of plant diversity's effects on insect diversity becomes complicated with plantings containing both native and non-native species in small isolated islands among a sea of monoculture grass and concrete. Do these islands show a similar relationship between plant and insect diversity as found in more natural continuous settings? Further, do native and non-native plants exhibit the same relationship between plant and insect diversity, or does one support more insect diversity than the other? This is an especially important question, with the move towards native plantings. Are these native plantings any better than their non-native counterparts at sustaining insect diversity? As the field of urban ecology is relatively new, virtually no research has yet been published on this important topic. This project is an important starting point for future studies in this area.

This research examined the relationship between insect diversity and plant diversity, along with the specific effects of the presence of native plant species, in campus plantings throughout the Grinnell College Campus (Grinnell, IA, USA).

METHODS

This investigation was carried out during the fall of 2004 on the Grinnell College campus (Grinnell, Iowa, U.S.A.). Ten campus plantings were included in the study, selected for maximum variation in plant diversity and plant types between plots. Plots ranged in size from 36 m^2 to 155m^2. A one-meter squared permanent quadrat was established in each plot, and it was from within each of these quadrats that all the data were collected. Insect diversity was measured through both sweep netting and pitfall traps (Bell & Wheater 2002). Four pitfall traps were installed in each quadrat. The traps were emptied two to four days after they were installed, and all the insects caught were preserved for identification purposes. Plant diversity was measured in each quadrat by estimating percent cover of each species per plot; percent bare ground and percent concrete around the edge of the plot were also measured. Insects were identified in the lab using the Peterson Insect guide (1970). The insects were disposed of after identification.

Both insect and plant biodiversity were calculated using the "FCStats" Excel spreadsheet program. The Simpson's Index of biodiversity was chosen because of its low sensitivity to small sample size (Magurran 2004). Multiple regression analysis was carried out using the statistics package Minitab with the following four predictor variables, percent bare ground, percent concrete edge, plant diversity (Simpson Index), and percent native plant species versus the response variable, insect diversity (Simpson Index).

RESULTS

Multiple regression analysis of overall insect diversity (Simpson Index) versus plant diversity (Simpson Index), percent bare ground, percent concrete edge, and percent native plant revealed significant and positive associations between insect diversity and percent native plant (table 1). A significant but negative association was detected between insect diversity and both plant diversity and percent concrete edge (table 1).

Table 1. Results of multiple regression analysis of insect diversity (Simpson Index) versus the predictors plant diversity (Simpson Index), % bare ground, % native plant, and % concrete edge. (Statistically significant predictors denoted by *)

Predictor	**Coef**	**SE Coef**	**T**	**P**
Constant	1.4314	0.1744	8.21	0.000
Plant Diversity (Simpson)	-0.4172	0.1152	-3.62	0.015*
% Bare Ground	-0.005240	0.002664	-1.97	0.106
% Native Plant	0.005092	0.001449	3.51	0.017*
% Concrete	-0.006831	0.001611	-4.24	0.008*

DISCUSSION

The significant and positive association revealed between percent native plants and insect diversity (Simpson Index) is the most striking finding of this research (table 1). This provides evidence for the practice already being promoted in many urban areas of planting native species whenever possible. These findings indicate that urban native plantings do in fact have ecological significance, in this case through the promotion of greater insect diversity. This research also revealed that even heavily treated turf grass is better at promoting insect diversity than concrete, as indicated by the negative and significant association between insect diversity and percent concrete edge (table 1).

One of the more difficult results to explain in this research is the negative and significant association between insect diversity and plant diversity (table 1). This result contradicts previous research that has found greater plant diversity supported greater insect diversity (Haddad et al. 2001; Siemann 1998; Murdoch et al. 1972). However, none of the previous research was carried out in an urban garden setting, and this difference might be significant. Follow up research would be necessary to fully understand this seemingly contradictory finding.

Given the findings of this research and the little existing published research on the topic, future research to better understand the ecological impacts of urban native plantings would clearly be very useful. These could include studies of the impacts of native plantings on things such as bird diversity, soil microbe diversity, and pollinator diversity, just to name a few. Studies such as these could help to reveal the most effective ways for urban native plantings to support greater levels of biodiversity, vitally important information for the growing sea of concrete we call home.

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