

Influence of Humans on Species Diversity Along an Urban-Rural Gradient

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Problem:

What impact do humans have on biomass? As human impact on the habitat increases or decreases, what is the effect on biodiversity? The objective of this study was to examine the gradient of species richness and diversity over different human impact gradients and compare our results to the Intermediate Disturbance Hypothesis. This hypothesis proposes that species richness and diversity peaks in areas where disturbance is neither too frequent nor too rare. We hypothesized that species richness and biomass would follow the Intermediate Disturbance Hypothesis, peaking in moderately human impacted areas. At the rural and urban core ends of the gradient, species richness will show the least amount of variability

Methods:

The following study sites, listed in order from low to high human impact, are locations in Southeastern Wisconsin where we collected tree, bird, and aquatic macroinvertebrate data:

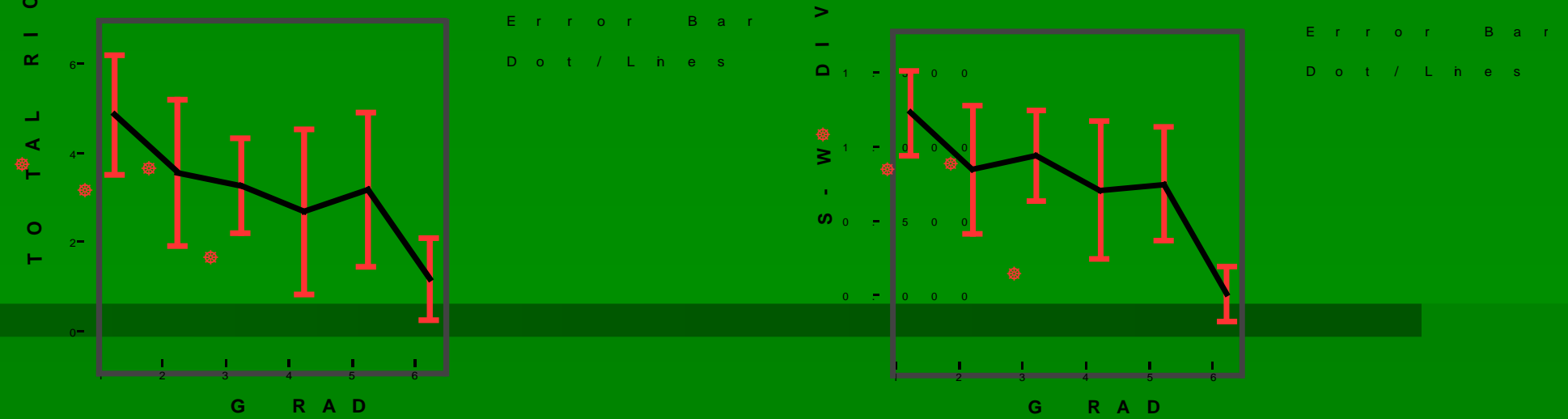
1. University of Wisconsin – Milwaukee Field Station (UWM Field Station)
2. Riveredge Park, Ozaukee County
3. Urban Ecology Center, Milwaukee (UEC)
4. Hubbard Park, Shorewood
5. Lake Park Golf Course, Milwaukee
6. East Side Neighborhood, east of the University of Wisconsin – Milwaukee campus
7. University of Wisconsin – Milwaukee campus (UWM)



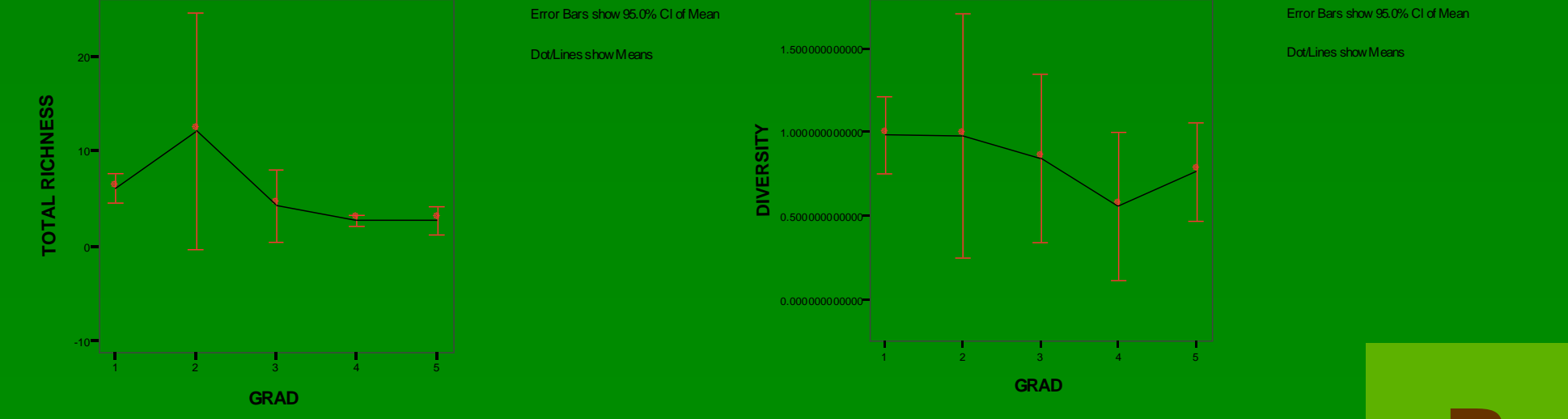
Bird surveys were done using point counts: all birds within a 50 meter radius were counted using visual observation during 10 minute intervals. Tree surveys were taken by measuring a 10 meter by 10 meter square plot. The circumference of the trees were measured at breast height and then converted to diameter at breast height (dbh). Macroinvertebrate collection was done using the technique of kick-netting for 2 minutes.

Data:

Bird Richness and Diversity:



Tree Richness and Diversity:



Results:

Results of Bird Data:

- Seven out of the eight community measures showed significant results (p-values < .05). The significant community measures included diversity, evenness, total richness, native richness, exotic richness, total biomass, and exotic biomass. Of the seven community measures, diversity, total richness, native richness, and exotic richness were best expressed using a linear model (based on the adjusted R² values).
- Evenness, total biomass, and exotic biomass were best expressed with a curvilinear model.
- Diversity, Evenness, Total Species Richness, and Native Species Richness all *decreased* along the rural-urban gradient.
- Exotic Species Richness, Total Biomass, and Exotic Biomass all *increased*.

Results of Tree Data:

- Two out of the eight community measures showed significant results, including total richness and native richness. Both of these measures were best expressed using a linear model.
- Total Species Richness and Native Species Richness *decreased* along the rural-urban gradient.

Results of Aquatic Macroinvertebrate Data:

- Results for the three community measures showed no significant differences between the two locations. The Hubbard Park location showed higher mean values for all three community measures.
- Diversity, Species Richness, and Evenness all *increased* along the rural-urban gradient.

Conclusion:

Based on the significant results from the data collection, species diversity, evenness, total species richness, and native species richness all decreased along the rural-to-urban gradient in the Milwaukee area. An increase in exotic species richness, total biomass, and exotic biomass was observed along the rural-urban gradient. This data most closely matches McKinney's Hypothesis and refutes our hypothesis of intermediate disturbance. The increase in exotic richness could be correlated with the intentional introduction of exotic species to a community for aesthetic reasons. This may be harmful to the community because exotic species have the potential to become invasive species. With these results it is easy to see that humans definitely have negative effects on the biological communities we coexist with. Unless this issue is addressed, the increase of urbanization will only lead to a further demise of community structure in ecosystems.

Bird Data			
Community Measure	Model	Adjusted-r ²	P-Value
Shannon Diversity	Line	0.254	0.000
	Curve	0.249	0.001
Evenness	Line	0.135	0.009
	Curve	0.303	0.000
Total Richness	Line	0.178	0.002
	Curve	0.162	0.007
Native Richness	Line	0.338	0.000
	Curve	0.323	0.000
Exotic Richness	Line	0.330	0.000
	Curve	0.314	0.000
Total Biomass	Line	0.067	0.043
	Curve	0.224	0.001
Native Biomass	Line	-0.003	0.353
	Curve	-0.004	0.407
Exotic Biomass	Line	0.196	0.001
	Curve	0.351	0.000

Tree Data			
Community Measure	Model	Adjusted-r ²	P-Value
Shannon Diversity	Line	0.082	0.080
	Curve	0.052	0.201
Evenness	Line	0.051	0.129
	Curve	0.053	0.194
Total Richness	Line	0.134	0.031
	Curve	0.139	0.059
Native Richness	Line	0.136	0.030
	Curve	0.125	0.072
Exotic Richness	Line	-0.035	0.755
	Curve	-0.044	0.653
Total Biomass	Line	0.021	0.223
	Curve	-0.017	0.468
Native Biomass	Line	0.041	0.159
	Curve	0.008	0.348
Exotic Biomass	Line	-0.016	0.448
	Curve	-0.045	0.646

Aquatic Macroinvertebrates									
Location	Diversity			Richness			Evenness		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Hubbard	15	1.453428	0.409357	15	6.466667	2.199567	15	0.7986	0.1226
Riveredge	9	1.316413	0.237637	11	5.090909	1.758098	11	0.6771	0.3452
	P-Value = 0.310848			P-Value = 0.089405			P-Value = 0.286228		