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Bird Diversity in Arcata, California: A Study on Urban Influence

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Introduction

- Urbanization is a primary driver of native species loss [1].
- In the past 50 years, the U.S. alone has seen a 29% decline in bird abundance [2].
- This study aimed to assess how building density influences urban bird communities within Arcata.
- Hypothesis: As building density increases, non-native species abundance will increase. Overall bird diversity will also decrease with increased building density.

Study Area

- Arcata is wedged between a vast coastal redwood forest, and a narrow range of pastureland, with the Arcata Marsh and Humboldt Bay in the southwest [3].
- Common species: Gulls, Crows, Ravens, Steller's Jay, House Sparrows, European Starlings, Ruby-crowned Kinglet, Wrentit, Winter Wren, Yellow-rumped Warbler, Bushtit, and American Robin.

Methods

- Fixed radius 75m point counts for 10 mins, within 30 randomly selected study sites, using ArcGIS.
- Recorded bird species, abundance of birds, and building density by counting the number in all cardinal directions.
- To determine if there is a relationship between building density and bird species native and non-native status, I used a chi-squared formula [4].
- A linear regression model was used to compare Shannon diversity to building density (n = 30) [5].

Survey Sites, Arcata, California

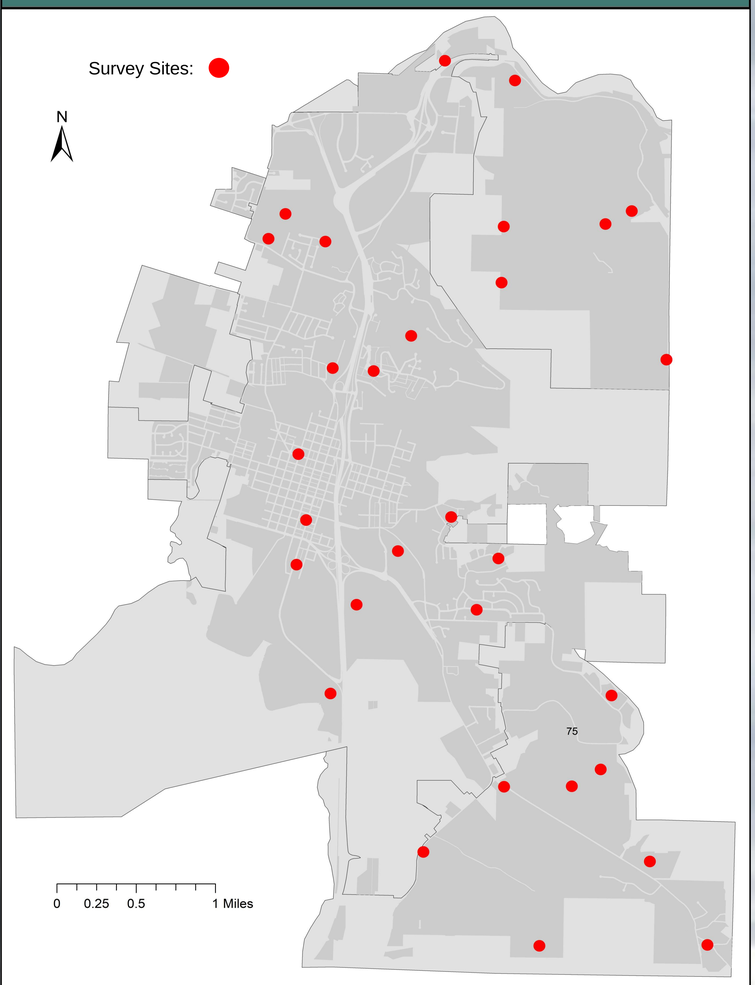

Figure 1. Thirty randomly selected survey sites using ArcGIS. Map created by Brittany Ocheltree using data from the Humboldt County GIS database 2023.

Citations
[1] McKinney, M. L. 2008. Effects of urbanization on species richness: A review of plants and animals. Urban Ecosystems 11:161–176.
[2] Haas, A. R., S. M. Kross, and J. M. Kneitel. 2002. Avian community composition, but not richness, differs between urban and exurban parks. Journal of Urban Ecology 6:1–11.
[3] Kalinowski, R. S., and M. D. Johnson. 2010. Influence of suburban habitat on a wintering bird community in coastal Northern California. The Condor 112:274–282.
[4] Pearson, K. 1900. On the criterion that a given system of deviations from the probable in the case of a correlated system of variables is such that it can be reasonably supposed to have arisen from random sampling. The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science 50:157–175.
[5] Shannon, C. E., and W. Weaver. 1963. The mathematical theory of communication. University of Illinois Press, Urbana, Illinois, USA.

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Results

Table 1. Average bird presence categorized by their native or non- native status, compared to building density (n = 138).

Build Density	Total Sites	Native Bird Average	Non-Native Bird Average
0	n = 3	7.33	0
1	n = 7	5	1
2	n = 5	4.6	0
3	n = 2	6.5	0
4	n = 2	13	0
5	n = 2	6.5	3
6	n = 3	8.67	3
7+	n = 6	4.5	4.33

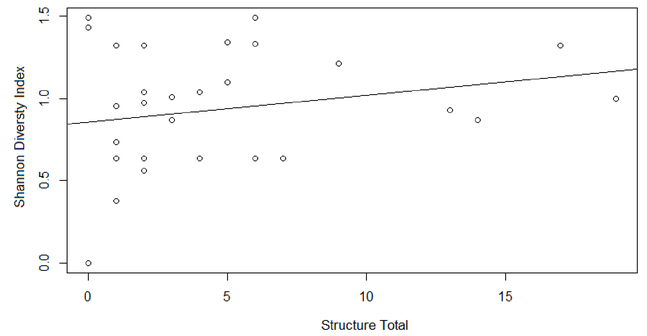

Figure 2. Linear regression model comparison of building total versus Shannon Diversity Index, in Arcata, California (n = 30).

- Chi-squared: Significant difference in the frequency of distribution of non-native species among increased building density ($\chi^2 = 8.60$, df = 3, P = 0.03).
- Linear regression model: There was no significance between species diversity and building density ($R^2 = 0.01$, df = 28, P = 0.24).

Discussion

- Results indicated that non-native species increased with building density (Table 1.)
- There was no correlation between building density and species diversity (Fig. 2).