



Introduction

- Urbanization and greenspace importance:** Cities fragment habitats and reduce resources, but urban greenspaces (parks, reserves) can partially support biodiversity, though their conservation value varies by size, connectivity, and habitat complexity.
- Seasonal and functional gaps in knowledge:** Most studies focus on breeding season or single taxa, overlooking how species use greenspaces differently across the full-annual cycle and how functional diversity responds to urban landscapes.

The figure consists of two maps of Florida. The left map shows county boundaries with green circles indicating the locations of 89 urban greenspaces. A legend on the right indicates sample sizes: 1000 (light blue), 2000 (medium blue), and 3000 (dark blue). The right map shows the state of Florida with county boundaries.

Totals:

- Greenspaces: 89
- Species: 371
 - Migrants: 265
 - Residents: 106

Figure 1. Map showing the study area and sample size.

Objectives

Question 1 – Species-Area Relationship

- Determine how species-area relationships in urban greenspaces change seasonally and across urban gradients.

Question 2 – Patch Connectivity & Isolation

- Determine how the spatial isolation of greenspaces affects species occupancy across different phases of the annual cycle.

AVIAN USE OF URBAN GREENSPACES VARIES ACROSS THE FULL ANNUAL CYCLE

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Methods

- Study system and bird data:** Examined 89 urban greenspaces (5.6–364.6 ha) across South Florida (Broward, Miami-Dade, Palm Beach; **Figure 1**). Bird observations came from complete eBird checklists (2010–2024), with species classified as migratory or residential (from the AVONET database).
- Greenspace attributes:** Measured area, isolation (distance to nearest greenspace), urbanization intensity (Global Human Modification Index), and vegetation type (Dynamic World dataset) to capture habitat heterogeneity.
- Statistical analysis:** Modeled species richness (migratory, residential, total) using negative binomial GLMMs in glmmTMB, accounting for seasonal variation and checklist effort; effects of size, isolation, and habitat heterogeneity visualized with partial dependence plots.

The figure contains two bar charts. The top chart is for 'residential' species and the bottom for 'migratory'. Each chart has six bars representing different habitats: Crop, Grass, Built-Area, Trees, Flooded Vegetation, and Water. The bars are color-coded by season: Overwintering (purple), Spring Migration (green), Breeding (blue), and Fall Migration (red). Error bars are shown above each bar.

Figure 2. Dominant habitat type influence on species richness during parts of the full-annual cycle.

Discussion and Management Practices

- Enhance connectivity:** Even modest reductions in isolation can help maintain species richness; consider creating habitat corridors or stepping-stone greenspaces between urban patches.
- Prioritize habitat diversity:** Cropland-dominated sites support fewer species; managers should promote a mix of natural and semi-natural habitats to support a wider range of birds.

Results

01 Dominant habitat significantly influences species richness, with the largest declines in crop lands (**Figure 2**). Note the significant difference in built area between migration statuses.

02 Species richness significantly increases with site size and sampling effort, but significantly declines with human modification (GHMI) in migratory species, and shows an increasing trend for residential species (**Figure 3**).

03 Isolation has a significant negative effect: its impact does not depend on season or analysis (**Figure 4**). The interactions between isolation, season, and migration status were not significant, meaning this negative effect is consistent across all seasons and species status.

The figure contains two partial dependence plots. The left plot is for 'residential' species and the right for 'migratory'. Both plots show 'Predicted Species Richness' on the y-axis (0 to 50) against 'GHMI (Global Human Modification Index)' on the x-axis (0.5 to 0.9). Four lines represent different seasons: Overwintering (purple), Spring Migration (green), Breeding (blue), and Fall Migration (red). Shaded areas around the lines indicate uncertainty.

Figure 3. Global human modification influence on species richness during parts of the full-annual cycle.

The figure consists of four panels arranged in a 2x2 grid. The top row is for 'Overwintering' and 'Spring Migration', and the bottom row is for 'Breeding' and 'Fall Migration'. Each panel shows 'Marginal Slope of Nearest Distance' on the y-axis (ranging from -0.06 to 0.00) against migration status on the x-axis (residential, migratory, total). Data points are colored by season: Overwintering (purple), Spring Migration (green), Breeding (blue), and Fall Migration (red). Vertical error bars are included for each point.

Figure 4. Season-specific effects of nearest greenspace distance on bird species richness for migratory and residential species.