Arthropod Species Richness Across Standardized Urban Habitats: Evidence From NYC BioBlitz Data

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Introduction

Urbanization creates a patchwork of habitats that differ in vegetation structure, disturbance, and resource availability, which strongly shapes arthropod communities and their role in ecosystem function. Because arthropods respond quickly to environmental change, they are effective indicators of ecological health in cities (Bucher et al., 2019). Urban parks require investigation since arthropod species richness is mainly influenced by local habitat characteristics (Philpott et al., 2014) and habitat heterogeneity (Nielsen et al., 2014). This study examines how four standardized habitat types (Built/Pavement, Forest/Canopy, Grassland/Meadow, Riparian/Aquatic) affect arthropod species richness across NYC BioBlitz events from 2014 to 2025 (excluding 2020 and 2021 due to covid restriction). Using more than 3,000 citizen-science and field observations, we evaluate how habitat structure shapes biodiversity.

Question & Hypothesis

Question: To what extent do standardize urban habitat types predict variation in arthropod species richness across multiple BioBlitz surveys in New York City

Hypothesis: Arthropod species richness will be highest in habitats with greater vegetation complexity and lower disturbance, particularly Forest and Riverine sites. Built habitats, which have minimal vegetation and increased human disturbance, are expected to show the lowest species richness. Meadow habitats are predicted to fall between these extremes.

Methodology

Arthropod species richness data were collected from NYC BioBlitz events between 2014 and 2025 (excluding 2020 and 2021) at sites including but not limited to, the New York Botanical Garden, Green-Wood Cemetery, Randall's Island, and Brooklyn Bridge Park. Only arthropod groups such as ants, bees and wasps, beetles, flies, Lepidoptera, Odonates, spiders, and crustaceans were included. Sites were classified as Build/Pavement, Forest/Canopy, Grassland/Meadow and Riparian/Aquatic, based on ecological profiles. Species counts were aggregated and standardized across years, and richness was compared across habitat types to evaluate the effects of habitat complexity, disturbance, and management on urban arthropod diversity.

Assumption are made:

- **BioBlitz observations accurately represent true arthropod presence**
- **Effort Adjusted richness corrects for uneven sampling**
- **Standardized habitats types reflect ecological differences**

Results

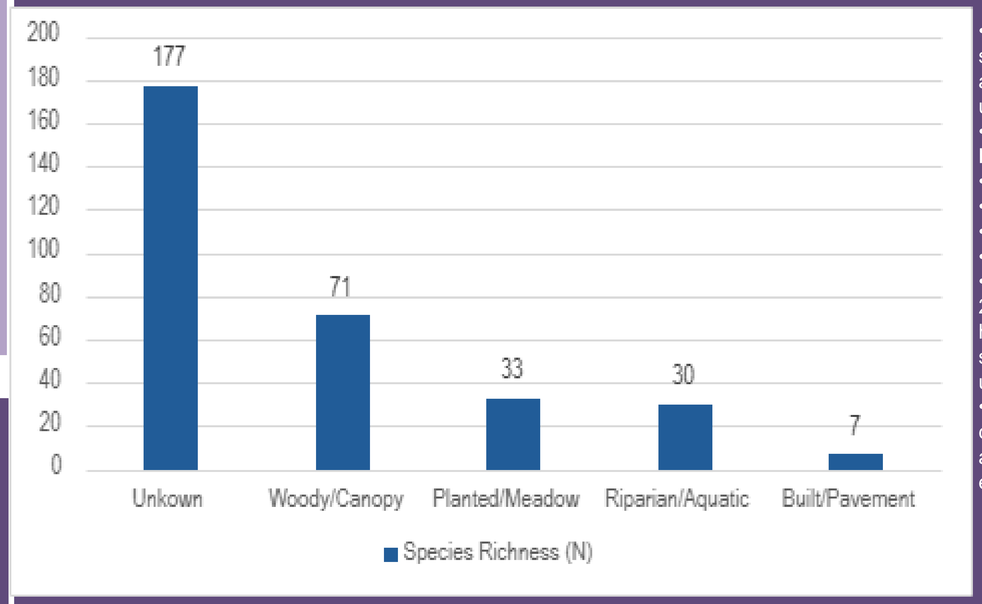

Figure I. Raw Arthropod Species Richness Across Standardized Urban Habitats types in New York City

- **Total observations**: NYC BioBlitz surveys collected 3,036 observation of arthropod records across multiple urban parks.
- **Species richness varies strongly by habitat type**:
  - Planted/Meadow:177 species
  - Wood/Canopy: 71 species
  - Riparian/Aquatic:30 species
  - Build/Pavement: 7 species
- **Pattern**: Species richness increases 2–3 times from highly built to natural habitats; forest and meadow habitats support 28–45% more species than urbanized areas.
- **Key drivers of richness**: Vegetation complexity, microhabitat availability, and reduced pesticide/pollution exposure in semi-natural habitats.

Adjustment reduces inflated richness caused by uneven sampling effort.

- **Adjusted richness by habitat**:
  - Riparian and Aquatic:14.98
  - Planted and Meadow: 12.91
  - Woody and Canopy:12.91
  - Built and Pavement:7
  - Unknown: !2.08

Adjusted values reduce inflation in raw species count but preserve the overall ranking of habitats

Vegetated Habitat, remain consistently richer in species compared to build environments

These results confirm that even after adjustment habitat structure and disturbance level remain strong predictors of arthropod diversity

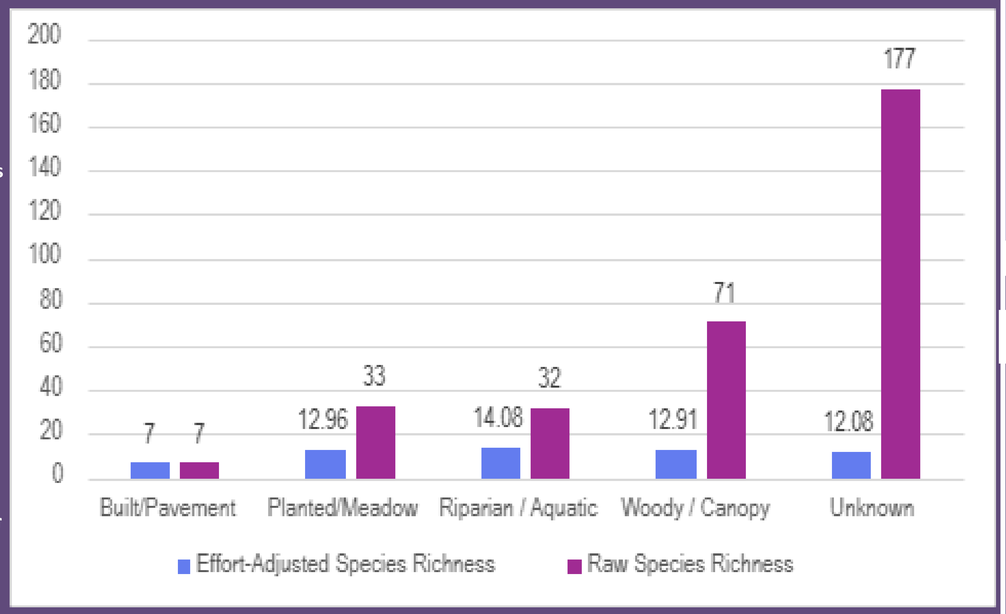

Figure II. Effort Adjusted Arthropod Species Richness Across Habitat Types in New York City

Conclusion

Arthropod species richness in New York City shows strong and consistent differences across standardized urban habitat types. Forest, Meadow, and Riparian habitats support significantly higher richness than Built environments, even after accounting for sampling effort. These patterns reflect well-established ecological driver such as, greater vegetation diversity, and reduced disturbance, allowing a wider range of arthropod groups to persist. Aquatic habitats also play a key role by supporting specialized taxa such as odonates.

Effort-adjusted results confirm that natural and semi-natural habitats remain the most biodiverse areas, indicating that habitat structure, vegetation quality, and management practices are stronger determinants of species richness than sampling intensity alone. Overall, the findings emphasize the importance of protecting and designing complex, vegetated urban habitats to maintain arthropod diversity and sustain the ecosystem services they provide in highly urbanized landscapes.

Future Work

Future research should incorporate standardized sampling protocols that record formal abundance counts rather than relying solely on opportunistic BioBlitz observations. Collecting consistent measures of individual abundance across habitat types would allow the calculation of Shannon Diversity Index values, providing an objective assessment. This would strengthen comparisons among habitats, reduce bias from uneven sampling effort, and enable more precise evaluations of how disturbance, vegetation structure, and habitat complexity shape arthropod communities. Establishing fixed sampling plots, using repeated surveys, and incorporating pitfall traps, sweep-netting, and timed observations would further support robust statistical analyses and improve long-term monitoring of urban arthropod diversity.

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