Change in Avian Biodiversity after Restoration of North Campus Open Space

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Introduction

- North Campus Open Space (NCOS) existed as a golf course for ~50 years
- Restoration of NCOS by the Cheadle Center for Biodiversity and Ecological Restoration (Cheadle Center) in 2017 successfully reintroduced tidal flow and established multiple plant communities to the upper arms of Devereux Slough and adjacent upland areas
- Monitoring data continues to be collected for restoration maintenance, but no rigorous analyses of bird populations and community changes have been conducted
- This study asked:

1. How does Cheadle Center bird survey data compare to other sources of bird survey data collection (i.e., Cornell eBird)?
2. How has avian community composition changed following the restoration of NCOS?
3. Which species' changes in population trends are driving avian community composition differences after the restoration?

Methods

- Monthly bird surveys are conducted along two routes spanning NCOS by two teams starting 45 minutes after sunrise
- Surveys have been conducted since August 2017, providing 8 full years of survey data
- Data is cleaned and compiled before analysis using R
- To assess trends in bird species richness at NCOS, I calculated annual species richness across all 8 survey years for both Cheadle Center monthly bird survey records and all available eBird checklists
- To visualize change in community composition over time, I aggregated data to the survey-year level and performed non-metric multidimensional scaling (NMDS) with a Bray-Curtis dissimilarity matrix
- To evaluate individual species' abundance trends, I fit Bayesian integrated nested Laplace approximation (INLA) models following Wright-Ueda (et al. 2025)

Results

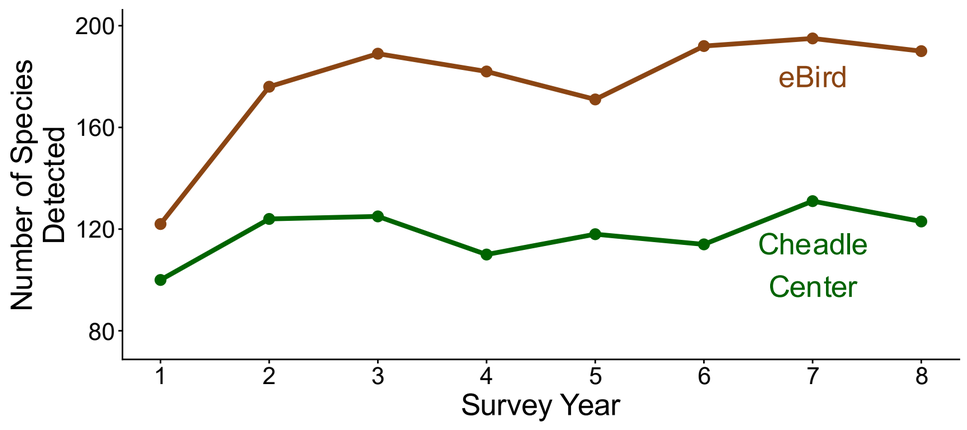

Figure 1: Species Richness by Survey Year. Species richness at NCOS as reported by eBird checklists and Cheadle Center monthly bird surveys.

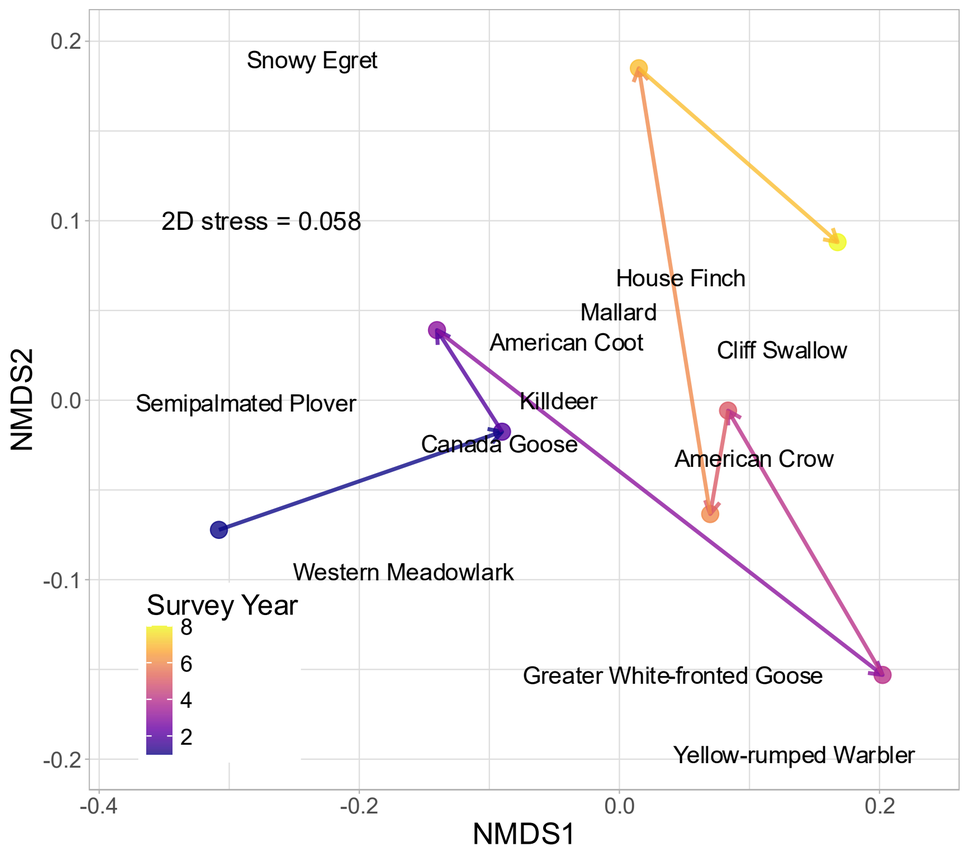

Figure 2: NMDS by Survey Year. Based on maximum species counts per survey year. Species labels are plotted in the same ordination space as community composition points, so a species' proximity to a survey year point indicates that it significantly contributed to the community composition of that year.

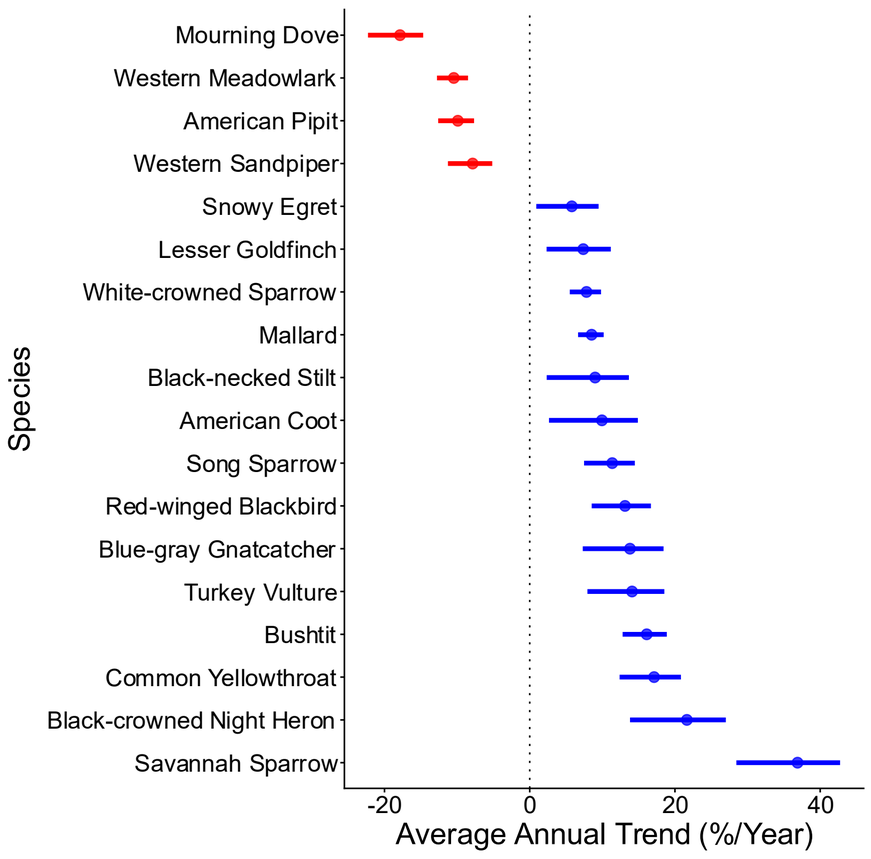

Figure 3: Abundance Trends. Average annual trend (AAT) is defined as the average change in abundance trend per species over all 8 survey years. Species with red lines have a decreasing trend whereas those with blue lines have an increasing trend. This visualization includes all species with greater than ~33% frequency across all 8 survey years, or all 96 monthly surveys, but excludes species with confidence intervals overlapping 0.

Results cont.

- **Species richness:** Annual species richness was always reported to be higher by eBird (Figure 1), consistent with greater survey effort. After survey year 2, species richness reached relative stability.
- **Community composition:** The most distinct survey years by species composition were years 1, 4 and 7 (Figure 2). Year 4 made a significant departure from years 2 and 3. Year 7 is noticeably separate from years 5 and 6.
- **Species trends:** Of the 55 species assessed, 4 had negative abundance trends and 14 had positive abundance trends (Figure 3). The species that declined favored open substrates like bare ground and mudflats. The species that increased favored taller vegetation, such as shrubs and trees, and water.

Discussion

- **Ecological implications:** Species richness and many species abundances are stable. Both positive and negative species abundance trends can be attributed in some part to the establishment and growth of vegetation since 2017.
- **Monitoring implications:** The frequency of Cheadle Center bird surveys is adequate for detection of significant trends in abundance.
- **Time caveat:** Time series with duration less than ~10 years may not yield reliable trend estimates (White, 2019). Thus, our AAT estimates may be misleading for future extrapolation.
- **Future directions:** Our analyses of avian abundance trends lack comparison to other data sources. Subsequent contrast of our findings or data with regional patterns would provide insight into the validity of NCOS based trend estimates.

References

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