

Does Forest Cover Affect *Osmia* and Other Cavity-Nesting Bee Abundance?

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Introduction

- Native bees are essential pollinators for crops and wild forbs (Winfree 2007).
- Native cavity-nesting bees may be effective agricultural pollinators because they can be managed using artificial nesting habitats (Sheffield 2008; Bosch et. al. 2002).
- Genus *Osmia* are pollinators of popular orchard trees like apples and have been found to be more efficient than honeybees in certain apple orchards (Bosch & Kemp 2001; Viscens & Bosch 2000).
- Studies indicate that cavity-nesting bee abundance is positively correlated with forest cover (Watson et. al. 2011).
- Forest composition in urban and rural settings can be significantly different, but this correlation has not been studied in an urban/sub-urban setting.
- In this study, we compared the abundances of cavity-nesting bees, and *Osmia* specifically, among sites varying in forest cover in both rural and urban landscapes in Southeastern Massachusetts.

Study Sites

Table 1: Qualitative and quantitative assessment of land-use for six study sites located in Southeastern Massachusetts. Native Meadow and Beaver Brook are located on the Brockton campus of Massasoit Community College.

SITES→	Native Meadow	Leland Farm	Christo's	Beaver Brook	Sachem Rock	Dunrovin Farm
% Forest Cover	20.88%	23.77%	31.2%	33.89%	39.99%	67.77%
Classification	Urban	Rural	Urban	Urban	Rural	Rural
Sustainable practice	Native plantings, reduced pesticides	None	None	Riparian buffer, reduced pesticides	Community garden	Reduced pesticides
Mowed	Annually	Plowed	Never	Annually	Occasionally	Rarely

Methods

- Sampling took place during the months of April to October from 2016 to 2018.
- Bees were caught via sweep nets and pan traps to reduce collection bias (Roulston et al., 2007).
- Blue, white and yellow pan traps ($n=10$ per color) were deployed at each study site and retrieved after 24 hours (Droege, 2015).
- Sweep netting was performed by two researchers along a 100-m transect for 30 minutes following pan trap collection (Popic, 2013).
- Collection methods were normalized to sampling effort to account for damaged pan traps.
- Specimens collected from pan traps and sweep-netting were preserved and identified to genus.
- ArcGIS software and MassGIS map data (Bureau of Geographic Information), was used to estimate the percent forest cover within a 500-meter radius of each of the six study sites.
- Log-transformed *Osmia* and cavity-nesting bee abundances were compared among sites using ANOVA.
- Mean *Osmia* and cavity-nesting bee abundances were back-transformed by performing the mathematical inverse of the original log-transformation.

Results

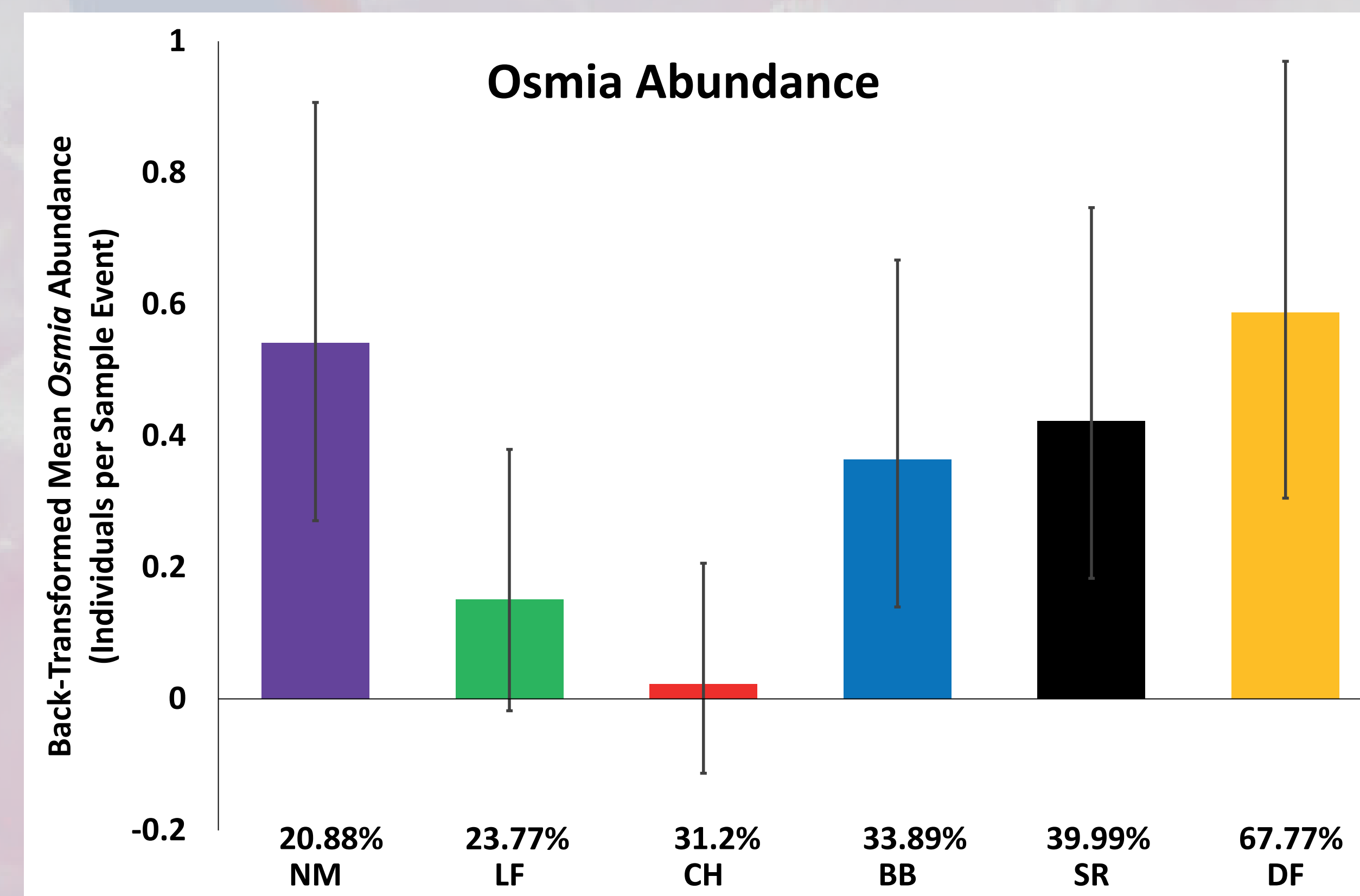


Figure 1: Back-transformed mean abundance of *Osmia* collected during the sampling season at each site. The error bars represent back-transformed 95% confidence intervals. There was a significant effect of site on *Osmia* abundance ($F_{5,131}=3.5, p < 0.05$). Pairwise comparisons revealed significant differences between the sites with non-overlapping confidence intervals (Tukey's HSD).

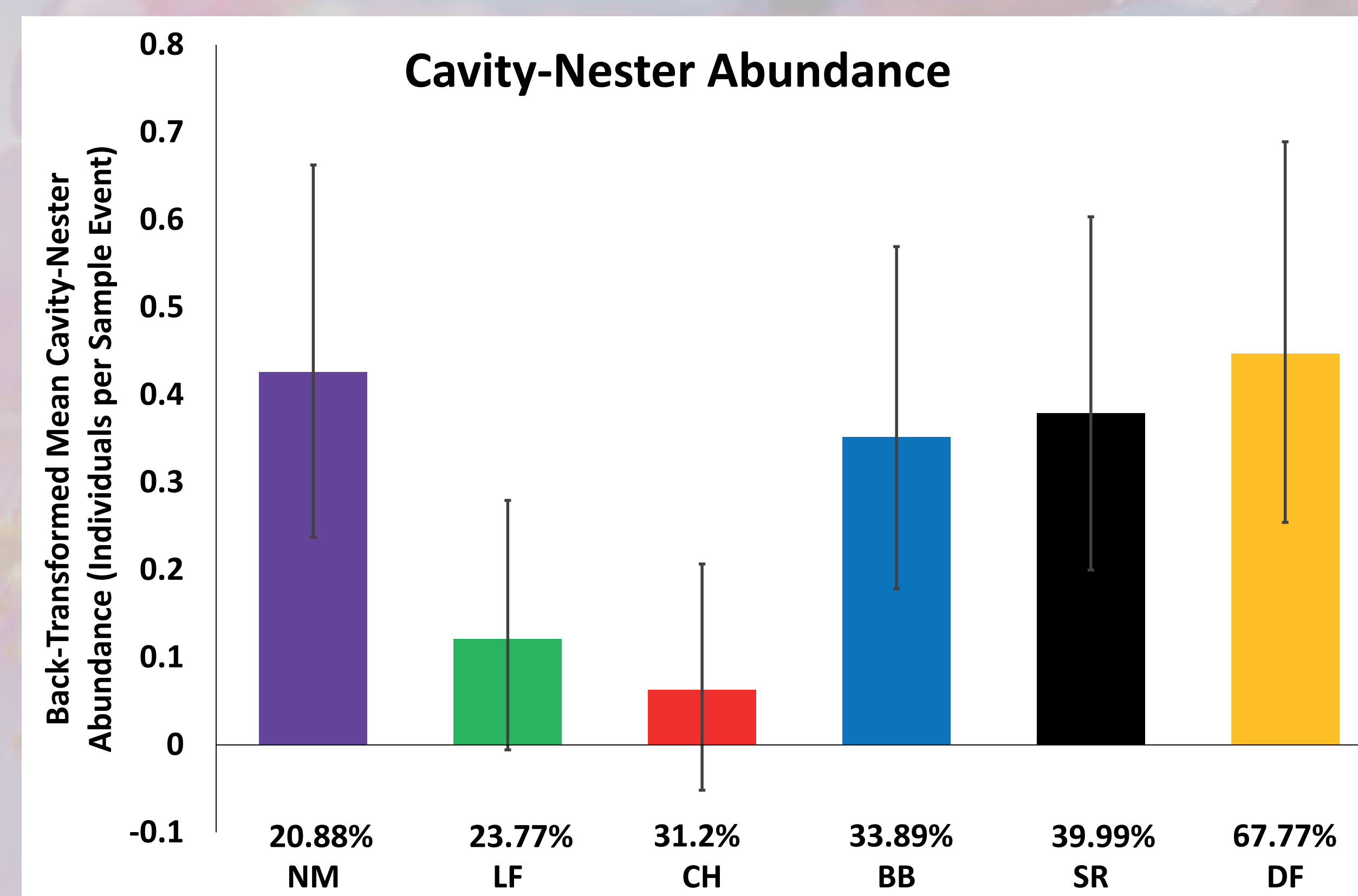


Figure 2: Back-transformed mean abundance of cavity-nesting bees collected at each site. Error bars represent back-transformed 95% confidence intervals. There was a significant effect of site on Cavity-nester abundance ($F_{5,233}=3.7, p < 0.05$). Pairwise comparisons revealed significant differences between the sites with non-overlapping confidence intervals (Tukey's HSD).

Discussion

- For both *Osmia* and other cavity-nesting bees, abundances were similar at the most and least forested sites, indicating no direct effect of forest cover on their abundances.
- The significant effect of site on *Osmia* and other cavity-nesting bee abundances may be due to factors other than forestation.
- Higher abundances of *Osmia* and other cavity-nesting bees were found at the most rural sites as well as the urban sites with sustainable land use practices.

Conclusion

- In an urban/sub-urban setting, cavity-nesting bee abundance does not seem to have a strong correlation with forest cover, suggesting other factors, such as sustainable land-use practices, may be more important to help promote their community.

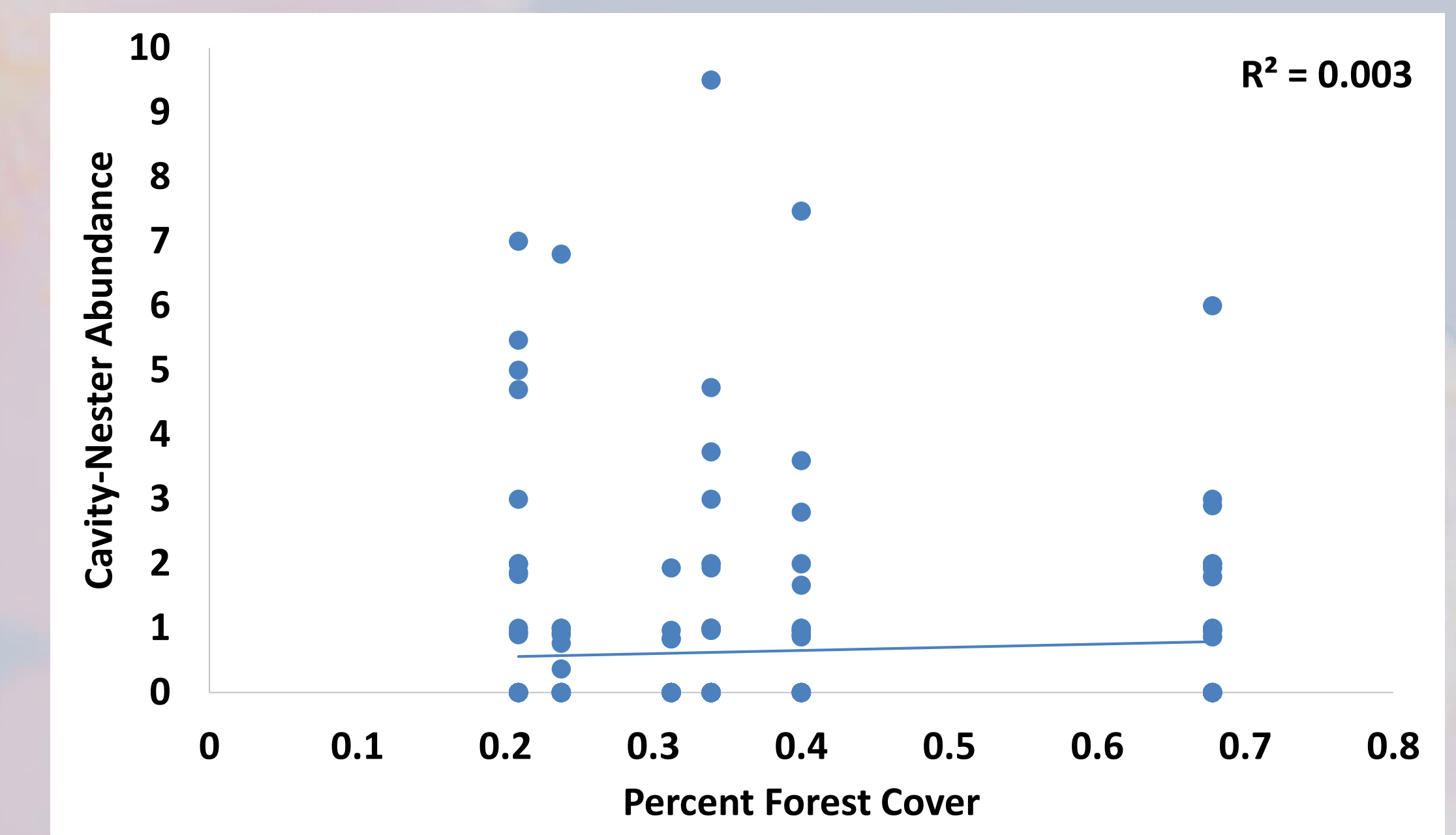


Figure 3: Correlation of cavity-nesting bee abundances, including *Osmia*, and percent forest cover.

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