Just a Small Town Bee: The uneven effects of urbanity on wild bee populations

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Background

The global decline in wild bee populations and the critical threat it poses to agricultural and wild pollination services was recently highlighted by the 2016 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. While it is recognized that much of this decline stems from human land use change, there are numerous unanswered questions regarding how wild bees interface with one particular type of human land use, urban development. Using general metrics of abundance, diversity, and richness, numerous studies found a collection of non-significant or inconsistent effects of urbanity on wild bee populations. My colleagues and I proposed using more fine-scale analyses focusing on specific genera and functional groups with distinct natural histories.

To this end, we first focused on bumblebee (genus *Bombus*) populations sampled across natural and urban environments in southeast Michigan. Bumblebees have a relatively well-studied natural history making them well suited for this study. We demonstrated how incorporating natural history and behavior into statistical analyses exposed distinct categories in *Bombus* responses to urbanity depending on individuals' roles in the colony. After completing species-level IDs on the entire sample set of wild bees caught in the same Michigan sites, we can now ask further: How does the effect of urbanity on wild bees change across different functional groups of all sampled wild bees? Additionally, what implications are there for pollination services in urban environments?

Methods

Wild bees were sampled in 26 sites across a gradient of urbanity. Environmental profiles for each site were created using GIS (Geographic Information Systems) coupled with the National Landcover Database, temperature data loggers, and periodic floral surveys throughout the growing season. Sampled bees were identified to species with the assistance of professional taxonomists, and split into functional groups according to nesting substrate, degree of sociality, known floral preferences, and native status. Functional group categories were used to aid statistical analyses.

Results/Conclusions

Upon completion of the full data set, we found that the effects of urban development differ greatly across nesting strategies. Evidence suggests that cavity nesting bees, in particular, can actually benefit from urban development. On the other hand, ground nesting species experience a divergent set of changes dependent on a series of secondary characteristics. This has implications for the degree of wild bee sociality in urban settings as each nesting strategy is more commonly associated with different levels of social behavior. The disparate effects of urbanity also have implications for the type of pollination services wild bee communities may be able to offer. Overall, the results point toward the importance of wild bee nesting habitat and behavioral diversity when considering wild bee conservation and pollination services. Furthermore, much of our work occurs in urban garden centers and demonstrates the educational outreach potential of urban ecology.