

# Effects of Land Use on *Bombus* Abundance

I. Ruesch, R. Patten, A. Germaine, P. Sanon, A. Oguma, F. Ajayi, and M. Bankson

Division of Math and Science, Massasoit Community College, Brockton, Massachusetts, USA

Twitter: @MassasoitSTEM; Email: STEMstarter@Massasoit.edu



## Introduction

- Bees pollinate the majority of agricultural crops (Neff et al., 1993), suggesting that if native bee communities decline food production may also decrease (Gallai et al., 2009).
- *Bombus* (Bumblebees) are effective generalist pollinators due to their morphological features and ability to sonicate (Switzer et al., 2017).
- *Bombus* loss may reduce local plant diversity (Beckham, 2015; Mills et al., 1993), suggesting that reductions in abundance of this genus may be an early indicator of ecosystem impairment.
- This work investigated the effect of different land-use practices on *Bombus* abundance.

## Methods

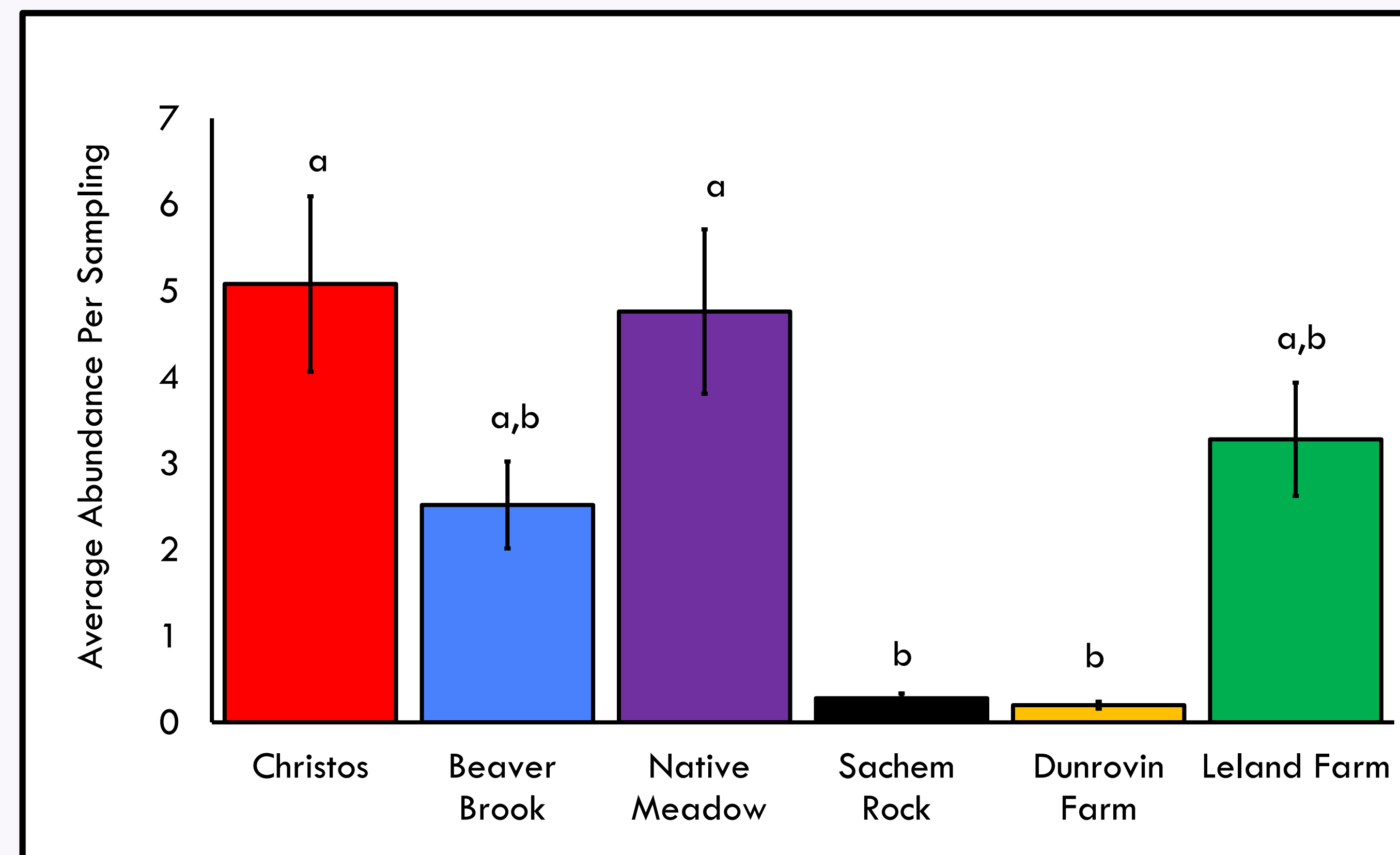
- Bees were sampled by sweep-net from April to October in both 2016 and 2017 at six sites with differing land-use practices (Roulston et al., 2007; Droege et al., 2015).
- Specimens were preserved in 70% ethanol, pinned, and identified to genus.
- *Bombus* abundance was analyzed, apart from other bees abundance.
- Percent impervious surface within a 300-m buffer zone of each site was estimated using geographic information systems software (ArcGIS).
- *Bombus* abundance was statistically compared using Kruskal-Wallis analysis (abundance data did not meet parametric assumptions of ANOVA). *Post hoc* pairwise comparisons were made using the Dunn-Sidak correction of alpha.

## Study Sites

Overview of six study sites located in southeastern Massachusetts, Plymouth County. Beaver Brook and Native Meadow are both located on Massasoit Community College's Brockton campus.

	Christos	Beaver Brook	Native Meadow	Sachem Rock	Dunrovin Farm	Leland Farm
Site Type	Urban Parking Lot	Semi-Urban College	Semi-Urban College	Semi-Rural Public	Rural Farm	Rural Farm
Mowed	Never	Annually	Annually	Frequently	Rarely	Plowed
Percent Impervious	46.85%	46.03%	32.03%	7.88%	1.93%	0.5%
Land-Use Practices	None	Riparian Buffer Zone	Native Flower Meadow	Community Garden	Commercial Dog Breeder	Agricultural Land

## Results



Average *Bombus* abundance is compared by site (error bars represent  $\pm$  SEM,  $n = 25$ ). The Kruskal-Wallis comparison revealed a significant effect of site on *Bombus* abundance ( $H_5 = 19.3$ ,  $p < 0.001$ ). Bars with the same letters were not statistically different (results of Dunn-Sidak adjusted *post hoc* pairwise comparisons).

## Discussion & Conclusion

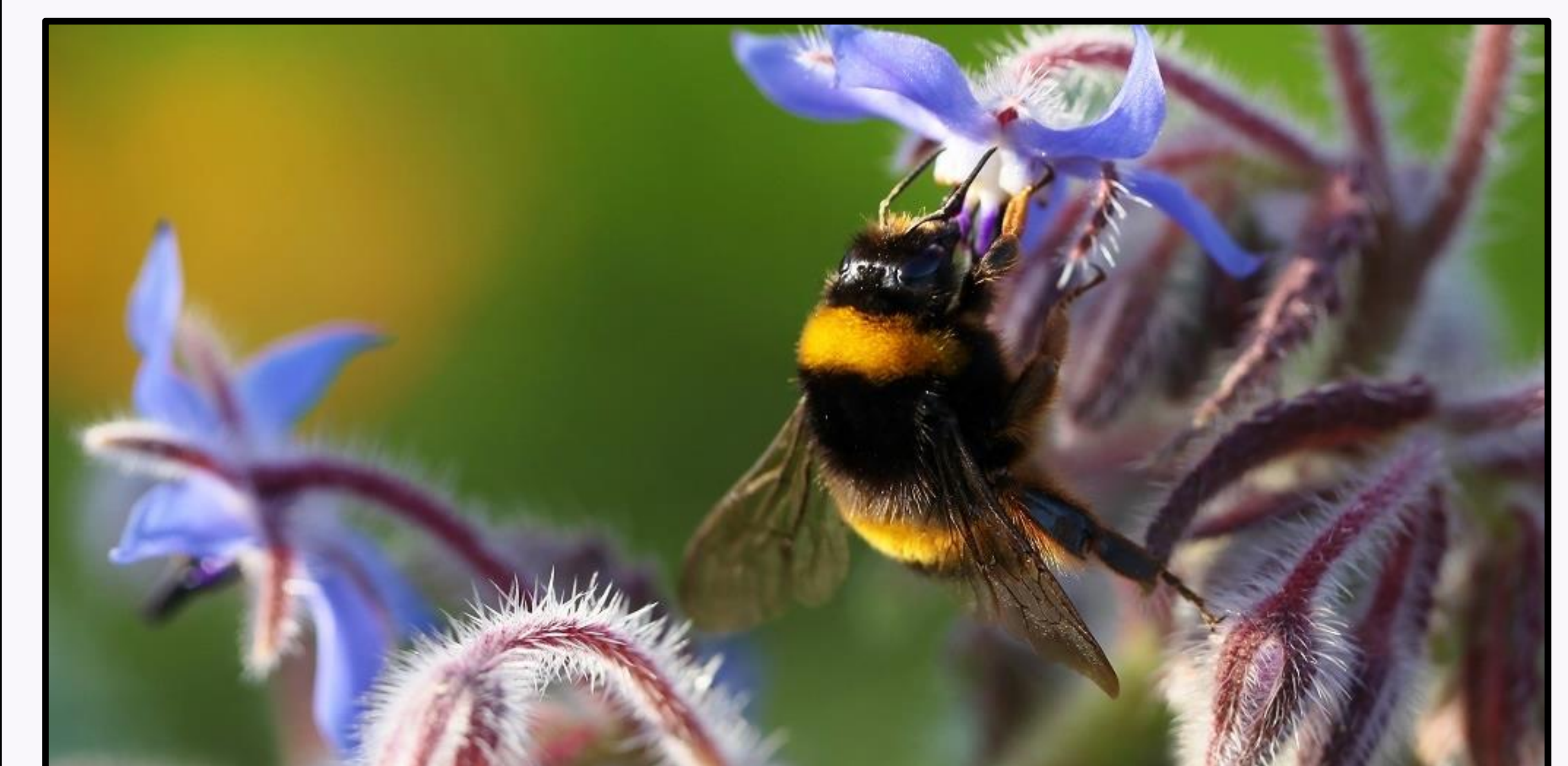
- *Bombus* abundance was significantly different amongst sites, suggesting that land-use practices impact this genus.
- *Bombus* abundance was generally higher at the more impervious urban sites, which is consistent with another study (Gunnarsson, & Federsel, 2014).
- Christos, a site with consistently low bee abundance and diversity, showed the highest *Bombus* abundance, suggesting that this genus may be well suited to small patches of foraging habitat.



Aerial view of Christos Study Site

## Future Research

- More study sites are needed to potentially substantiate this trend of *Bombus* abundance being higher at more impervious sites.
- An evaluation of local plant diversity may determine whether *Bombus* abundance is influenced by floral resources.



*Bombus terrestris* foraging on *Borago officinalis*

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