Wild bee communities in non-crop land cover in the Maine (USA) wild blueberry production landscape
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• What wild bee species are found in the wild blueberry production landscape? • Do wild bee communities in this landscape differ by growing region? •

Background:
• Wild bees in the Maine wild blueberry (Vaccinium angustifolium) agroecosystem are not well studied outside of crop fields.
• We surveyed bees in wild blueberry and seven non-crop land cover types to increase predictive capability of the InVEST Crop Pollination model in this landscape.
• Wild bees respond to landscape context in other agricultural systems.

Results:
• We collected 1709 specimens in 119 species, 23 genera, and five families.
• Wild blueberry fields had the greatest bee abundance, followed by urban and forest edge cover types (Figure 3a).
• Forest edge habitats was the most diverse, followed by wild blueberry fields and emergent wetland (Figure 3b).
• NMDs created significantly distinct communities based on land cover type (p<0.001, R2=0.58) (Figure 4a), but found no significant difference in communities based on region (p=0.71, R2=0.05) (Figure 4b).

Common species found in our surveys include:
• Bombus ternarius, Maine’s most common bumblebee (331 specimens)
• Lasioglossum cressoni, a common cavity nesting small sweat bee (108 specimens)
• Lasioglossum mucrosum, almost all from blueberry fields (67 specimens) (Fig. 5)
• Augochlorella aurata, a common bright green sweat bee (110 specimens) (Figure 5)

Interesting specimens we collected are:
• An aggregation of Agapostemon vespers at one urban site (89 specimens)
• Megachile inermis and Megachile rotundata (Figure 5) (4 specimens each) exclusive to edge habitat
• Anthidium manicatum (1 specimen) and Anthidium oblongatum (Figure 5) (15 specimens) exclusive to one growing region
• Callippos andreniformis (6) and Andrena miserabilis (16) exclusive to urban land cover
• The generalist Andrena nivalis (Figure 5) was the only bee collected in all eight cover types (28 specimens)
• Two state records: Andrena personata and Lasioglossum platypus

Study Area:
• Maine’s two blueberry growing regions differ in landscape context (Figure 1, Table 1).
• Downeast region: simple landscape structure dominated by large crop fields with more coniferous forest (Figure 1b, Table 1).
• Midcoast region: complex landscape structure including more urban and agricultural areas in a deciduous/mixed forest matrix (Figure 1c, Table 1).

Sampling Methods:
• Early, mid-, and late summer surveys of bees and flowers in 2015
• Five sampling blocks, eight sites per block (one per cover type).
• Blue, yellow, and white bee bowls placed every 10 m along a 100 m transect
• 24 hour bowl sampling, 30 minutes hand netting
• Transect survey of flowering species, estimated patch size, and % bloom

Data Analysis:
• Bees identified to species; all specimens were verified by taxonomic experts
• Descriptive statistics calculated by study region and land cover type
• Regions and cover types compared with Non-metric Multidimensional Scaling (NMDS).

Study Area:

Figure 1: Study area. a) Growing regions, b) Downeast landscape, and c) Midcoast landscape.

Table 1: Landscape metrics in Maine wild blueberry growing regions, average value (min-max).

<table>
<thead>
<tr>
<th>Growing region</th>
<th>Number of patches</th>
<th>Patch Size (LPI)**</th>
<th>Patch Shape (LSI)**</th>
<th>U***</th>
<th>% Deciduous****</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downeast (8 sites)</td>
<td>664.5 (45.3-852)</td>
<td>87.75 (2-24)</td>
<td>22 (17-26)</td>
<td>68.875 (61-78)</td>
<td>28.125% (17-35%)</td>
</tr>
<tr>
<td>Midcoast (16 sites)</td>
<td>664.6875 (476-846)</td>
<td>9.875 (5-13)</td>
<td>25.375 (22-28)</td>
<td>64.0625 (57-68)</td>
<td>46.125% (34-66%)</td>
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</tbody>
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*Length Patch Index. **Area of landscape comprised by the larger patch (L). ***Univariate Landscape Index. ****Measure of forest complexity by total patch edge length (LPI).

Figure 2: Sampling methods. a) An urban bee bowl transect, b) Blooming shrub at a wetland site.

Figure 3: Community composition with standard error.

a) Bee abundance and b) Bee diversity by land cover type.

Figure 5. Bees collected in samples (L-R): L. leucocomum, M. rotundata, A. nivalis, A. aurata, and A. oblongatum. All photos © Laurence Packer via Discover Life.

Conclusions and Next Steps:
• Wild bees do not differ by growing region when pooled across land cover types.
• Bee communities differ by land cover type within growing regions.
• Land cover patch size differs among cover types between regions.
• Future analyses: explore relationships of landscape characteristics (patch size, patch shape, patch density, and cover type composition) and bee communities
• Does bee community composition reflect limits in foraging distance related to land cover patch size?
• Incorporate these data into the InVEST Crop Pollination model for Maine wild blueberry.

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