THE CITY AS A BIODIVERSITY HOTSPOT FOR BEES

Gerardo R. Camilo
Saint Louis University
Bees 101
Bees 101

- Worldwide: 22,000+ species
- US: ~4,100 species
- Missouri: 454 species
Bees 101

✓ Most bees are solitary (90% NA)
  ▪ No queen-worker caste system
  ▪ No colony

✓ Nest location
  ▪ Ground nesters: 70% NA

✓ Specialist vs generalist
Wild Bee Status in the US

NATIONAL STRATEGY TO PROMOTE THE HEALTH OF HONEY BEES AND OTHER POLLINATORS

Pollinator Health Task Force

MAY 19, 2015
Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production (deliverable 3 (a) of the 2014–2018 work programme)
Bees in the City
Urban Population Migration

- 2010: 3.45 billion urban dwellers out of a world population of 6.9 billion
- 2030: 5 billion urban dwellers out of a world population of 8.3 billion
- 2050: 6 billion urban dwellers out of a world population of 9.2 billion
Species Richness

Camilo and Tonietto (UM-Flint). NSF – Ecology program (Jan 2018)
Urban Bee Diversity

Europe

• Berlin, Germany (Saure et al. 1998),
• Birmingham, Bristol, Cardiff, Dundee, Edinburg, Glasgow, Hull, Leeds, Leicester, London, Northampton, Reading, Sheffield, Southampton, Swindon, United Kingdom (Goulson et al. 2008; Baldock et al. 2015; Sirohi et al. 2015),

Melbourne, Australia (Threfall et al. 2015),
Guanacaste Province, Costa Rica (Frankie et al. 2013),
Vancouver, Canada (Tommasi et al. 2004)
Montreal and Quebec city (Normandin et al. 2017)
Urban Bee Diversity

USA

• **Berkeley, CA** (Frankie et al. 2005; 2016)
• **Chicago, IL** (Tonietto et al. 2011; Lowenstein et al. 2014)
• **New York City, NY** (Matteson et al. 2008; Matteson & Langellotto 2009)
• **Phoenix, AZ** (Cane et al. 2006), **San Francisco, CA** (McFrederick & LeBuhn 2006)
• **St. Louis, MO** (Camilo et al. 2017)

In several cases, more diverse and abundant populations of native bees in cities than in nearby rural landscapes

(Baldock et al. 2015; Cane et al. 2006; Frankie et al., 2009; Matteson et al. 2008; Osborne et al. 2008; Verboven et al. 2014; Sirohi et al. 2015; Camilo et al. 2017)
Essay

The city as a refuge for insect pollinators

Damon M. Hall,1* Gerardo R. Camilo,2 Rebecca K. Tonietto,1 Jeff Ollerton,3 Karin Ahrné,4 Mike Arduser,5 John S. Ascher,6 Katherine C. R. Baldock,7 Robert Fowler,8 Gordon Frankie,9 Dave Goulson,8 Bengt Gunnarsson,10 Mick E. Hanley,11 Janet I. Jackson,3 Gail Langellotto,12 David Lowenstein,12 Emily S. Minor,13 Stacy M. Philpott,14 Simon G. Potts,15 Muzafar H. Sirohi,3 Edward M. Spevak,16 Graham N. Stone,17 and Caragh G. Threlfall18

doi:10.1111/cobi.12840
Bees in the Lou
The Shrinking City

**Shrinking Cities**

Biggest population decreases since 2000 among major cities*

<table>
<thead>
<tr>
<th>City</th>
<th>2010 population</th>
<th>Change from 2000</th>
<th>Pct. change</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Orleans</td>
<td>343,829</td>
<td>-140,845</td>
<td>-29.1%</td>
</tr>
<tr>
<td>Detroit</td>
<td>713,777</td>
<td>-237,493</td>
<td>-25.0%</td>
</tr>
<tr>
<td>Cleveland</td>
<td>396,815</td>
<td>-81,588</td>
<td>-17.1%</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>296,943</td>
<td>-34,342</td>
<td>-10.4%</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>305,704</td>
<td>-28,859</td>
<td>-8.6%</td>
</tr>
<tr>
<td>Toledo, Ohio</td>
<td>287,208</td>
<td>-26,411</td>
<td>-8.4%</td>
</tr>
<tr>
<td>St. Louis</td>
<td>319,294</td>
<td>-28,895</td>
<td>-8.3%</td>
</tr>
<tr>
<td>Chicago</td>
<td>2,695,598</td>
<td>-200,418</td>
<td>-6.9%</td>
</tr>
<tr>
<td>Baltimore</td>
<td>620,961</td>
<td>-30,193</td>
<td>-4.6%</td>
</tr>
<tr>
<td>Santa Ana, Calif.</td>
<td>324,528</td>
<td>-13,449</td>
<td>-4.0%</td>
</tr>
</tbody>
</table>

*Cities with population of at least 250,000 in 2000. Based on data for the 45 states for which 2010 data are available. Source: U.S. Census Bureau

The rise and fall of Detroit's population

In millions

1900 | 1950 | 2010
---|---|---
0 | 1.5 | 2.0
0 | 1.0 | 1.5
0 | 0.5 | 0

Source: U.S. Census Bureau
The Shrinking City: Detroit
The Shrinking City: Detroit
The Shrinking City: St. Louis
The Shrinking City: What to do?

- Turn abandoned lots into usable and beneficial “green” spaces such as community gardens or parks.
Location

![Map and chart showing location data](image)
Location
Location
Bees in the Lou

- 201 species (45% of MO)
- 47 genera
- 5 families

Megachile rotundata
Xylocopa virginica
Colletes inaequalis
Lasioglossum pilosum

Camilo et al. In Press. JKES
Rusty Patched Bumble Bee (*Bombus affinis*)

**Status:** Endangered

**Listing as Endangered Effective March 21, 2017**

Listing the rusty patched bumble bee as endangered under the Endangered Species Act became effective on March 21, 2017. The final rule to list this bumble bee published in the *Federal Register* on January 11, 2017 with an effective date of February 10, 2017. The effective date was subsequently extended to March 21, 2017.
Rusty patch bumble bee

- Litzinger Road Ecology Center (MoBot)
- July 1999: 5 workers, 2 males
- Observed in 2003

Camilo et al. In Press. JKES
*Bombus* spp.
Kleptoparasitic bees

- Nomada sp.
- Holcopasites sp.
- Triepeolus sp.
- Coeloxis sp.
- Stelis sp.
- Epeolus sp.

18 spp.
12 spp.
5 spp.
Community Garden Management

A picture is worth a thousand p-values.
Results

$y = 1.3408 \ln(x) + 0.5799$

$R^2 = 0.8352$
Abundances: North vs South

<table>
<thead>
<tr>
<th>Most abundant species on North side</th>
<th># individuals</th>
<th>Most abundant species on South side</th>
<th># individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthidium manicatum</td>
<td>300</td>
<td>Anthidium oblongatum</td>
<td>120</td>
</tr>
<tr>
<td>Xylocopa virginica</td>
<td>205</td>
<td>Xylocopa virginica</td>
<td>109</td>
</tr>
<tr>
<td>Agapostemon virescens</td>
<td>201</td>
<td>Megachile rotundata</td>
<td>106</td>
</tr>
<tr>
<td>Apis mellifera</td>
<td>174</td>
<td>Melissodes agilis</td>
<td>105</td>
</tr>
<tr>
<td>Melissodes agilis</td>
<td>136</td>
<td>Anthidium manicatum</td>
<td>89</td>
</tr>
</tbody>
</table>
Results

Found at all 9 sites:
1. Anthidium manicatum
2. Anthidium oblongatum
3. Apis mellifera
4. Megachile rotundata
5. Xylocopa virginica
### Functional Traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>N</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>31</td>
<td>21</td>
</tr>
<tr>
<td>M</td>
<td>23</td>
<td>15</td>
</tr>
<tr>
<td>L</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td><strong>Lecty</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generalist</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Specialist</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>K</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Sociality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solitary</td>
<td>47</td>
<td>33</td>
</tr>
<tr>
<td>Sociality</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>K</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td><strong>Origin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native</td>
<td>57</td>
<td>38</td>
</tr>
<tr>
<td>Introduced</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trait</th>
<th>N</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phenology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Spring to Fall</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Spring to Summer</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>Summer</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Unknown</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td><strong>Nest Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above &amp; Below Ground Cavity</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Below Ground Cavity</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ground</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>Cavity</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Wood Cavity</td>
<td>15</td>
<td>10</td>
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<tr>
<td>K</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
• All cavity nesters
• All are out in summer
• 4/5 solitary
• 4/5 generalist
• 4/5 introduced

1. *Anthidium manicatum*
2. *Anthidium oblongatum*
3. *Apis mellifera*
4. *Megachile rotundata*
5. *Xylocopa virginica*

Photos: Sam Droege, Flickr
25 Species unique to 1 garden

*Colletes inaequalis*
- Only *Colletes* sp. found in our study
- Spring
- Generalist
- Ground nester

*Megachile montivaga*
- AKA: Petal-cutter bee
- Garden with highest floral diversity

*Lasioglossum pilosum*
- Sand obligate ground nester
- Garden brought in sand to stabilize greenhouse

Photos: Sam Droege, Flickr
Species Richness

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Camilo and Tonietto (UM-Flint). NSF – Ecology program (Jan 2018)
Acknowledgements

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Acknowledgements

Saint Louis Zoo
Animals Always®

Gateway Greening

Conservation Department Missouri

NSF

Center for Sustainability

Smith Fellows

Great Rivers Greenway
¡Muchas Gracias!