THE STATUS OF BEES IN NEW YORK

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Cornell University
### Value of Pollination in NY

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Harvested Acres</th>
<th>Value of Production ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>40,000</td>
<td>240,355,000</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>290,000</td>
<td>160,602,000</td>
</tr>
<tr>
<td>Soybeans</td>
<td>327,000</td>
<td>144,207,000</td>
</tr>
<tr>
<td>Beans</td>
<td>9,800</td>
<td>52,137,000</td>
</tr>
<tr>
<td>Squash</td>
<td>4,300</td>
<td>31,371,000</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>5,200</td>
<td>20,493,000</td>
</tr>
<tr>
<td>Peach</td>
<td>1,600</td>
<td>12,640,000</td>
</tr>
<tr>
<td>Cucumber</td>
<td>1,700</td>
<td>10,091,000</td>
</tr>
<tr>
<td>Strawberries</td>
<td>1,000</td>
<td>7,520,000</td>
</tr>
<tr>
<td>Pears</td>
<td>1,000</td>
<td>3,472,000</td>
</tr>
<tr>
<td>Cherries</td>
<td>700</td>
<td>3,042,000</td>
</tr>
<tr>
<td>Blueberries</td>
<td>700</td>
<td>2,800,000</td>
</tr>
</tbody>
</table>

| Total     | 683,000         | 1,157,963,000           |

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1. New York State Agricultural Overview. 2014. USDA
Value of wild and managed bees
Wild Bees

- ~450 species, 6 families, 47 genera, 17 non-native
  - Majority are solitary ground nesters

- 20% of species are specialist foragers and depend on certain plants to survive

Photo: Chris Kitchen
Some Species in Decline in NY

- 8 species are rare
  - *Macropis ciliata*
  - *Macropis nuda*
  - *Macropis patellata*
  - *Melitta americana*
  - *Melitta eickworti*
  - *Bombus insularis*
  - *Bombus terricola*
  - *Bombus fernaldae*

- 2 species are endangered
  - *Epeoloides pilosulus*
  - *Bombus affinis*
Honey Bees

- New York Honey Production 2014
  - 3.5B pounds
  - $8.98B

Honey Bees

- 3000 – 4000 beekeepers
  - 80,000 colonies
Honey Bees

- 3000 – 4000 beekeepers
  - 80,000 colonies

- Total Colony Loss 2014/2015
  - 54%
Winter Loss in NY

Bee Informed Partnership Survey Results

- Total Winter Loss US
- Total Winter Loss NY

Bee Informed Partnership Survey Results
Summer Loss in NY

Total Summer Loss US
Total Summer Loss NY

Bee Informed Partnership Survey Results
Other Managed Bees

- Ordered from companies and used to pollinate specific crops
Managed Bees: Bumble Bee

- *Bombus impatiens* is good for greenhouse pollination and tomatoes
Managed Bees: Alfalfa Leafcutter Bee

- *Megachile rotundata* is very effective at pollinating alfalfa
Managed Bees: Mason Bees

- *Osmia cornifrons* and *Osmia lignaria* pollinate orchard trees effectively
Factors Affecting Bee Health

- Pests & Pathogens
- Agrochemicals
- Climate Change
- Management Practices
- Habitat
Pests & Pathogens

- Honey bees
  - 2 mites
  - 20 viruses
  - 2 bacterial diseases
  - 2 fungal diseases
How can we help?

- Monitor for pests & disease for early detection
- Integrated pest management to help reduce resistance to treatments
- Develop new treatments and methods to combat pests & disease
- Understand pathogen transmission to develop methods to reduce spread
Climate Change

- Bumble bees are unable to track climate change

Climate Change

- Mismatch in pollinator synchronies\textsuperscript{5,6,7,8}

How can we help?

- Start regularly monitoring to identify which species are affected
- Research ways to help ameliorate range reductions
- Buffer pollination deficits by increasing bee diversity, buffer bee declines by increasing floral diversity
Habitat Loss

- Land Use in NYS⁹

<table>
<thead>
<tr>
<th>Land Type</th>
<th>% Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>24.8</td>
</tr>
<tr>
<td>Urban/Residential</td>
<td>5.4</td>
</tr>
<tr>
<td>Parks, Golf, Lawns</td>
<td>0.8</td>
</tr>
<tr>
<td>Natural (Forest, Water, Wetland)</td>
<td>68.9</td>
</tr>
</tbody>
</table>

⁹. New York State Department of Environmental Conservation, Habitats of New York State
Habitat Loss

- Reduces forage and nest sites
- Reduces abundance and diversity\(^\text{10}\)
- Fragmentation leads to reduced genetic diversity and increased risk of extinction

Sex determination in bees
Increasing Connectivity
Increasing Connectivity

- Field margins
- Roadsides
- Power lines

increases species abundance & diversity
Habitat Loss: Urbanization

- Urbanization leads to changes in the pollinator community
  - New York City has more nonnative and cavity nesting species than natural areas within 90 miles\textsuperscript{11,12}

\textsuperscript{11} Jha et al. 2013. Ecological Entomology, 38: 570-579.
\textsuperscript{12} Harrison and Winfree, 2015. Functional Ecology 29:879-888
Urban Enhancement

- Enhancing backyards with wildflowers\textsuperscript{13,14}

- Pollinators do not discriminate between native and ornamental flowers\textsuperscript{11,12}

- The most beneficial urban green spaces are community gardens and botanical gardens, the least beneficial are mowed lawn backyards\textsuperscript{15}

- The use of bee hotels are not recommended

\textsuperscript{11} Jha et al. 2013. Ecological Entomology, 38: 570-579
\textsuperscript{12} Harrison and Winfree, 2015. Functional Ecology 29:879-888
\textsuperscript{13} Gunnarsson and Federsel 2014. Journal of Insect Conservation, 18: 1185-1191
\textsuperscript{14} Hennig and Ghazoul, 2012. Urban Ecosystems, 15:149-166
\textsuperscript{15} Tommasi et al. 2004. Canadian Entomologist, 136: 851-869
Habitat Loss: Agriculture

Latest recommendations are to provide 1-4 ha of forage and 0.5-2 ha of nesting resources per 100 ha of farmland\textsuperscript{16}

<table>
<thead>
<tr>
<th>Enhancement</th>
<th>Increases Abundance?</th>
<th>Increases Diversity?</th>
<th>Reference</th>
</tr>
</thead>
</table>

\textsuperscript{16} Dicks et al. 2015. Ecological Entomology, S1: 22-35
Orchards

- **Trap nests in orchards help recruit solitary bees to nest for many years**\(^\text{17}\)

- **Wildflower strips within orchards**\(^\text{18}\) and natural areas surrounding orchards\(^\text{19,20}\) increase bee populations and pollination services

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\(^{17}\) Sheffield et al. 2008. Journal of the Entomological Society of Ontario 139: 3-18


How can we help?

- Promote bee-friendly gardening: forage & nest sites
- High levels of floral diversity (15 different flowers)\textsuperscript{20}
- Restoration is most effective when flowers are planted instead of an area being left to develop on its own\textsuperscript{21,22,23,24,25}

\textsuperscript{20} Nicholls and Altieri. 2013. Agronomy for Sustainable Development 33(2): 257-274
\textsuperscript{21} Hannon and Sisk 2009 Biological Conservation 142: 2140-2154
\textsuperscript{22} Hopwood 2008. Biological Conservation 141:2632-2640
\textsuperscript{23} Lye et al. 2009. Biological Conservation, 142: 2023-2032
\textsuperscript{24} Blake et al. 2011. Journal of Insect Conservation, 15: 221-232
\textsuperscript{25} Pywell et al. 2012. Biology Letters, 8: 772-775
Bees are often exposed to several pesticides at a time.
## Insecticides

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>honey bees?</th>
<th>other managed bees?</th>
<th>bumble bees?</th>
<th>Wild bees?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrethroids</td>
<td>Yes</td>
<td></td>
<td>Yes + No</td>
<td></td>
</tr>
<tr>
<td>Carbamates</td>
<td>Yes</td>
<td></td>
<td>Yes+ No</td>
<td></td>
</tr>
<tr>
<td>Fipronil</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Organophosphates</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes + No</td>
<td></td>
</tr>
<tr>
<td>Spinosad</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Neonicotinoids</td>
<td>Yes + No</td>
<td>Yes</td>
<td>Yes + No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Fungicides

- Certain fungicides are also emerging as health threats to bees
  - Often detected in bee pollen samples

- Sublethal effects for bumble bees\textsuperscript{26} and honey bees\textsuperscript{27,28}

- Interaction effects with
  - Miticides\textsuperscript{29}
  - Pyrethroids\textsuperscript{30,31}
  - Neonicotinoids\textsuperscript{32,33}
  - Fungal diseases\textsuperscript{34}

\textsuperscript{26} Sprayberry et al. 2013. Plos One 8: 10
\textsuperscript{27} Yoder et al. 2013. Journal of Toxicology and Environmental Health, 76: 587-600
\textsuperscript{28} Mussen et al. 2004. Environmental Entomology 33: 1151-1154
\textsuperscript{29} Johnson et al. 2013. Plos One 8: e54092
\textsuperscript{31} Vandame et al. 1998. Neuroscience Letters 251: 57-60
\textsuperscript{33} Biddinger et al. 2013. Plos One 8: e72587
\textsuperscript{34} Pettis et al. 2013. Plos One 8:7
How can we help?

- Follow Label Laws
- Apply when bees are not foraging and before flowers bloom
- Practice IPM and reduce pesticide use when possible
Management Practices

- Beekeeping practices can also impact hive health
  - Nutrition
  - Transportation
  - Monitoring & treating disease
  - Overwintering practices
How can we help?

- Develop best management practices tailored to the 3 types of beekeepers in New York
- Education
Pests & Pathogens

Agrochemicals

Climate Change

Management Practices

Habitat
Thanks!