The conservation and ecology of native bees and other pollinators

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Outline

• Overview of pollination and bee biodiversity

• My research on forest bees at Rutgers University

• What you can do to support native bees

• Bee ID!
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Pollination: Transfer of pollen grains from anther to stigma
~ 87% of all flowering plants
>2/3 crop species use animal-mediated pollination

Klein et al. 2006 J. Applied Ecology
Bees
Native bees are important pollinators for many crops globally.

Garibaldi et al 2013 Science
3 bee life history strategies

Solitary
• 77% of bee species

Social
• 10% of bee species

Parasitic
• 13% of bee species
3 bee life history strategies

Solitary
• 77% of bee species

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Parasitic
• 13% of bee species
Bee life histories: solitary
The vast majority of bees!

Andrena erigeniae

Colletes inaequalis

Augochlora pura
spring
summer
fall
winter

Pupa

Egg
Pre-pupa

Adult bee
Only 2 to 3 weeks of a solitary bees’ life!
How a solitary bee spends most of its life.
3 bee life history strategies

Solitary
• 77% of bee species

Social
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• 13% of bee species
Cuckoo bees

Nomada bee
3 bee life history strategies

- **Solitary**
  - 77% of bee species

- **Social**
  - 10% of bee species

- **Parasitic**
  - 13% of bee species
Bombus, Lasioglossum, Halictus

Bombus impatiens

Lasioglossum spp.

Halictus spp.
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Threats to wild bees
**Forest Bees**
- Small
- Solitary/ Parasitic
- Emerge in the spring

**Agricultural/ Urban Bees**
- Large-bodied
- Social
- Emerge in the summer

Harrison et al. 2018
Forest loss
Forests are younger and smaller than they were historically.

Forest loss

Forest regrowth
Forest age
How does forest bee diversity change with

Forest area?

Forest age?
How does forest bee diversity change with

Forest area?

Forest age?

Time? 1870 → 2011
<table>
<thead>
<tr>
<th></th>
<th>Large</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature</td>
<td>8 sites</td>
<td>8 sites</td>
</tr>
<tr>
<td>Young</td>
<td>8 sites</td>
<td>8 sites</td>
</tr>
</tbody>
</table>
Results
5,381 forest bees of 31 species

• Most common forest bees:
  – *Osmia pumila* (a mason bee)
  – *Lasioglossum subviridatum* (a sweat bee)
  – *Andrena carlini* (a digger bee)
How does forest bee diversity change with

Forest area?

Forest age?
Forest area increases forest bee diversity
How does forest bee diversity change with

Forest area?

Forest age?
Forest age does not affect forest bee diversity.
How does forest bee diversity change with

Forest area?

Forest age?

Time? 1870 → 2011
Museum dataset: 1872-2011

Bartomeus et al. 2013 PNAS
30,135 individuals of 449 bee species

Native forest bees:
• 4,137 individuals
• 29 species
Number of forest bees

Time period

1872 to 1906
1907 to 1921
1922 to 1955
1956 to 1965
1966 to 1974
1975 to 1981
1982 to 2002
2003 to 2005
2006 to 2008
2009 to 2011

$p = 0.020$

21% increase
Large forests, of any age, are important for forest bee conservation
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Plant bee-friendly plants

www.xerces.org
How to Help Pollinators

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  • www.xerces.org

• Reduce pesticide (especially insecticides)

• Provide nest sites: nest boxes, bare soil, dead wood
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• Mow your lawn every other or every three weeks

Lerman et al 2018
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Bees vs Flies
Bees vs Wasps
Bee, wasp or fly?
Green bees: *Augochlora, Augochlorella, Augochloropsis*

Digger bees: *Andrena*

Small carpenter bees: *Ceratina*

Bumble bees: *Bombus*

Honey bees: *Apis*

Large carpenter bees: *Xylocopa*
Green bees: *Augochlora, Augochlorella, Augochloropsis*

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Learn more

• Check out Xerces Society website: xerces.org

• *Attracting Native Pollinators*, the Xerces Society

• winfreelab.rutgers.edu/outreach

• *Bees of the World* by Christopher O’Toole and Anthony Raw
Thank you

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- Winfree Lab
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- Funding: USDA
Questions?