



# THE SCIENCE OF URBAN POLLINATOR ECOLOGY

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# 90% OF PLANTS ARE INSECT POLLINATED



**Plants: reproduction**  
**Insects: food**

# CROPS BEES POLLINATE

## Some crops pollinated by bees

Three-quarters of the world's crops need to be pollinated by insects, mostly bees. Fruits, vegetables, nuts and edible oil crops are most at risk from the decline of pollinators.

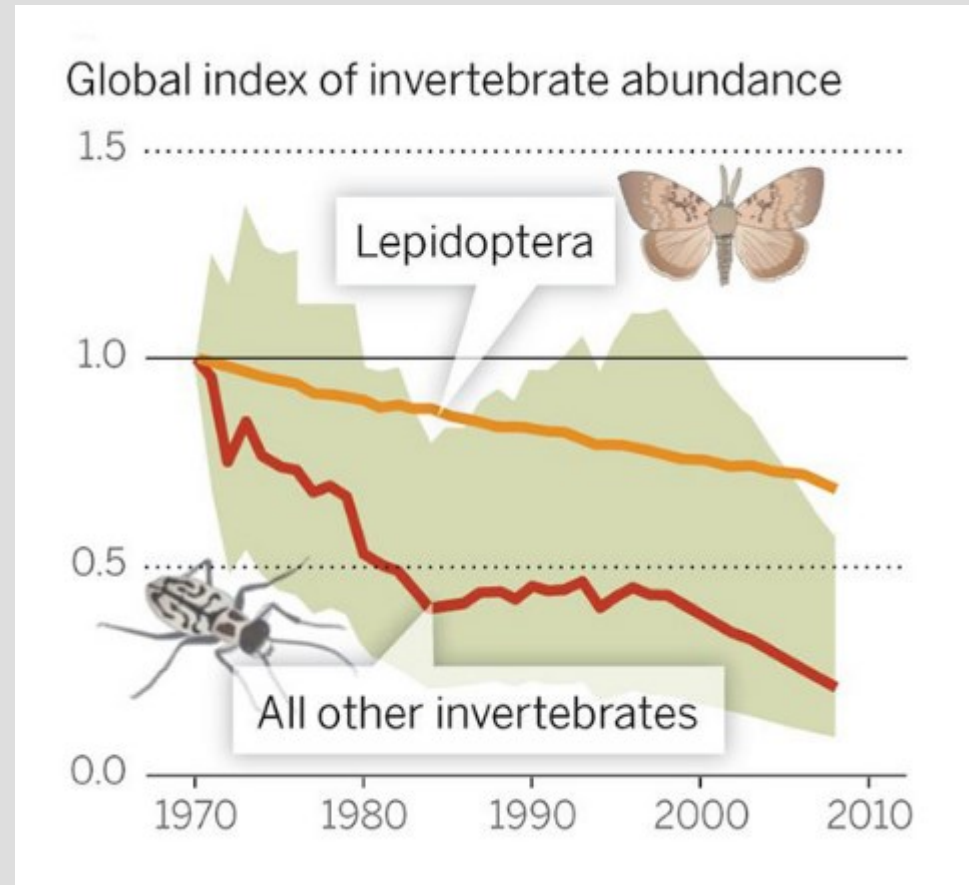


Wild bees, such as this Andrena bee visiting highbush blueberry flowers, play a key role in boosting crop yields. Left photo by Nilsu Inacio/AAAS, Right photo courtesy of Daniel M.N. Turner

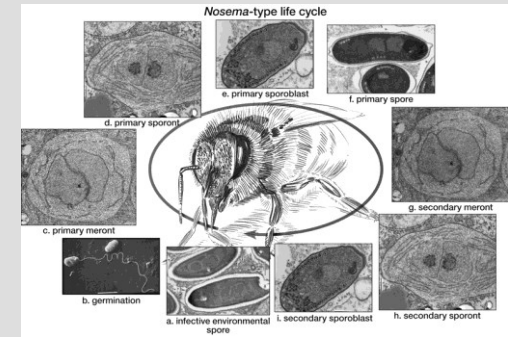
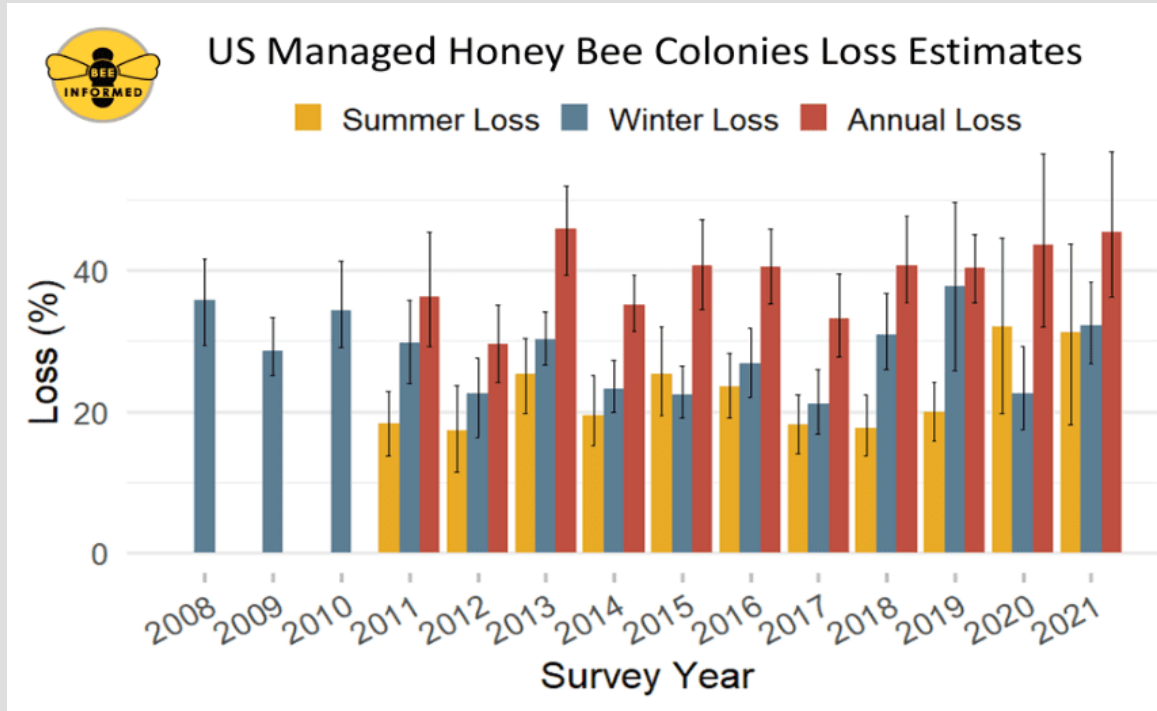


# GLOBAL DECLINE IN INSECTS

- **Based on 452 monitored species, there has been 45% decline in invertebrate populations** (*Dirzo et al. 2014, Science*).
- **Insect apocalypse**



# HONEY BEE HIVE LOSS



**Nosema parasites**



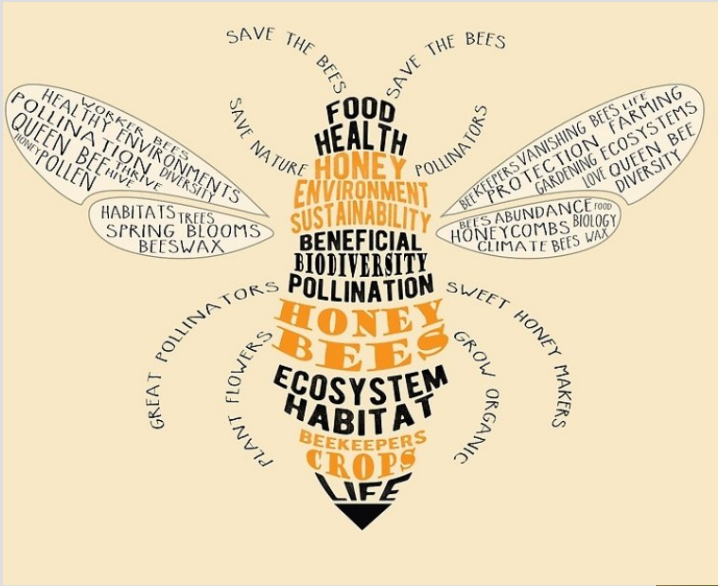
**Neonicotinoid pesticides**



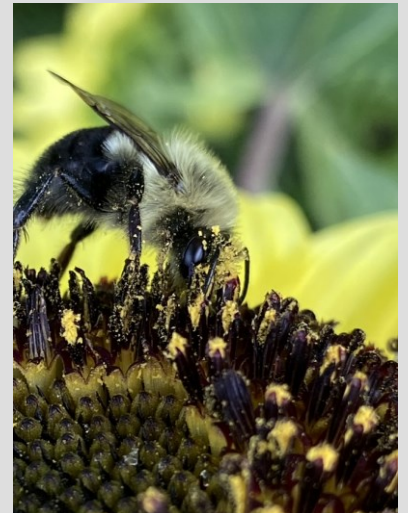
**Varroa mites**



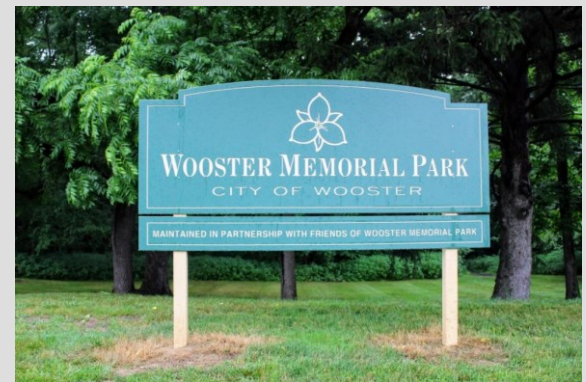
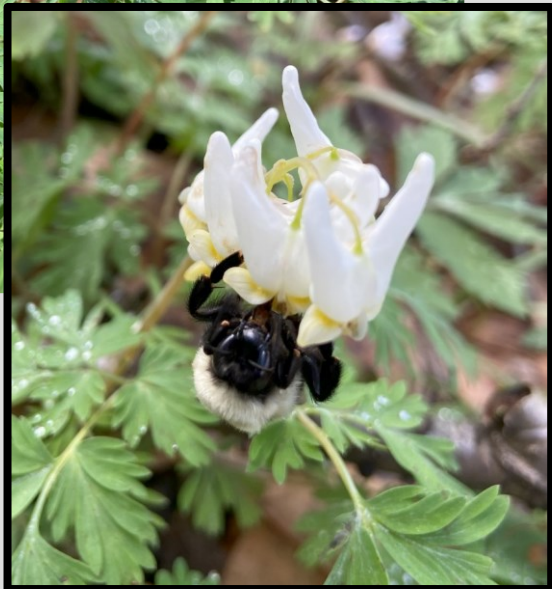
**Viruses (e.g., deformed wing virus)**



# BUMBLEBEES: FLYING PANDAS



# LOCAL EXAMPLE: DUTCHMAN'S BREECHES AND QUEEN BUMBLEBEES





# SEVEN BUMBLEBEE SPECIES VISITED DUTCHMAN'S BREECHES IN THE 1970S

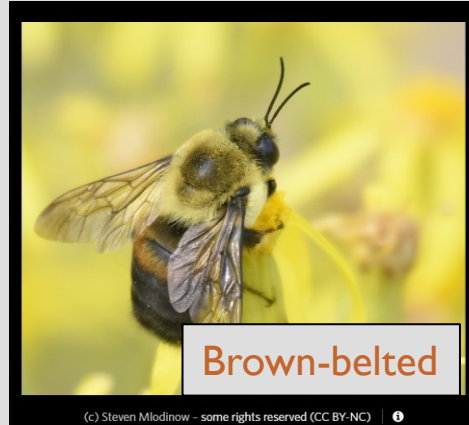


Rusty-patched

(c) Debbie Johnson - some rights reserved (CC BY-NC) | 1



Two-spotted



Brown-belted

(c) Steven Mlodinow - some rights reserved (CC BY-NC) | 1



Common eastern



Black-gold

(c) Mark Nofsinger - some rights reserved (CC BY-NC) | 1



American

(c) Buddy - some rights reserved (CC BY-NC) | 1



Perplexing

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POLLINATION INTERACTIONS IN SYMPATRIC  
DICENTRA SPECIES<sup>1</sup>

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# BUMBLEBEES WE HAVE OBSERVED OVER THREE SEASON



Rusty-patched

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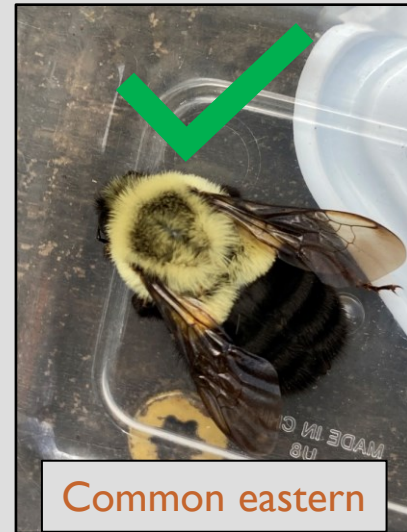


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American

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Perplexing

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# RUSTY-PATCH BUMBLEBEE: LISTED AS ENDANGERED IN MARCH 2017

Historic range of rusty-patched bumble bee (from museum records)



Current range of rusty-patched bumble bee (from recent survey efforts)



U.S. Fish & Wildlife Service

Search ECOS

**ECOS Environmental Conservation Online System**

Conserving the Nature of America

ECOS /

Rusty patched bumble bee (*Bombus affinis*)

[Range Information](#) | [Candidate Info](#) | [Federal Register](#) | [Recovery](#) | [Critical Habitat](#) | [SSA](#) | [Conservation Plans](#) | [Petitions](#) | [Biological Opinions](#) | [Life History](#)

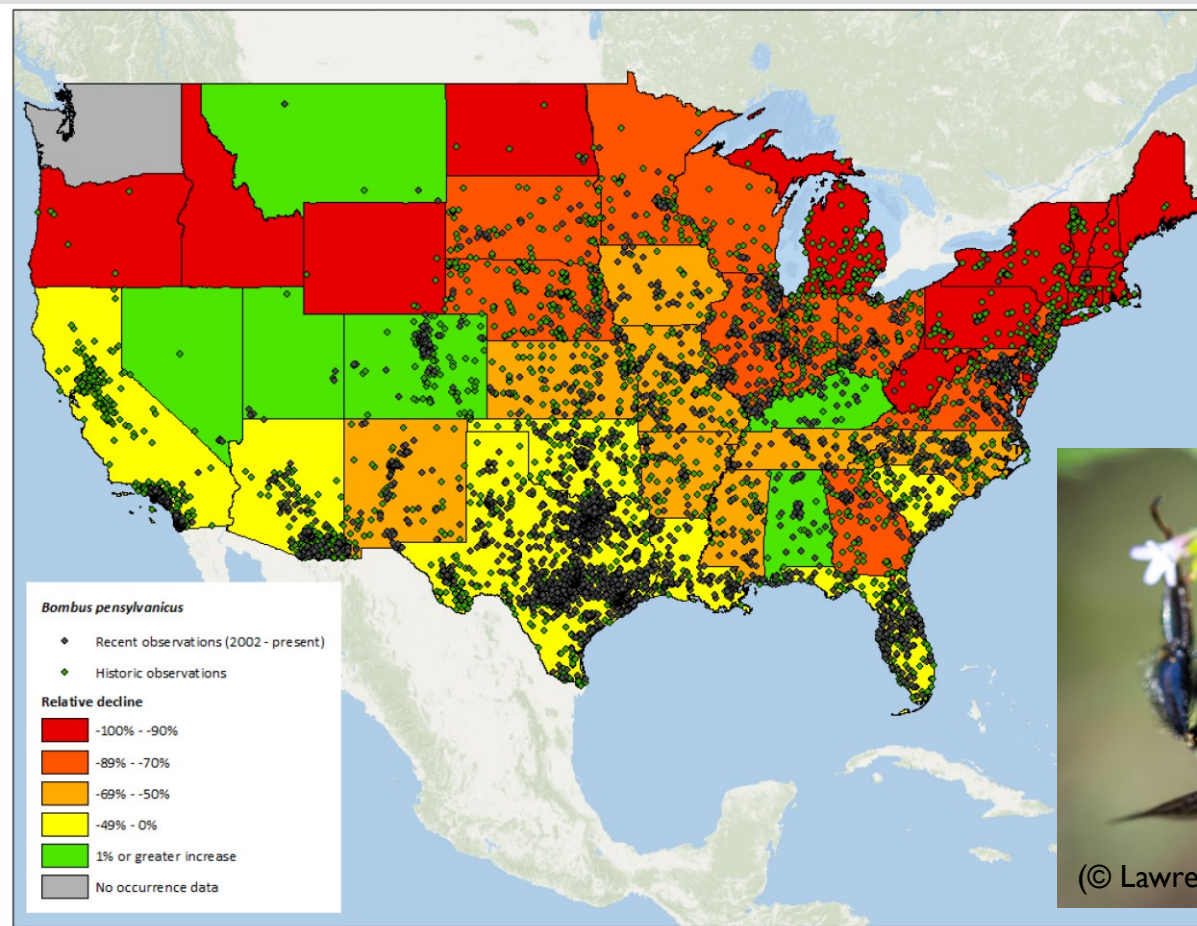
Taxonomy: [View taxonomy in ITIS](#)

Listing Status: **Endangered**

Where Listed: **WHEREVER FOUND**



# THE AMERICAN BUMBLEBEE COULD GET LISTED AS ENDANGERED IN THE NEXT FEW YEARS



**Figure 8.** Decline in relative abundance of the American bumble bee with historic and recent observations. The change for each state represents the relative decline or gain of relative abundance from historic relative abundance to recent relative abundance. The recent period is 2002-2020.

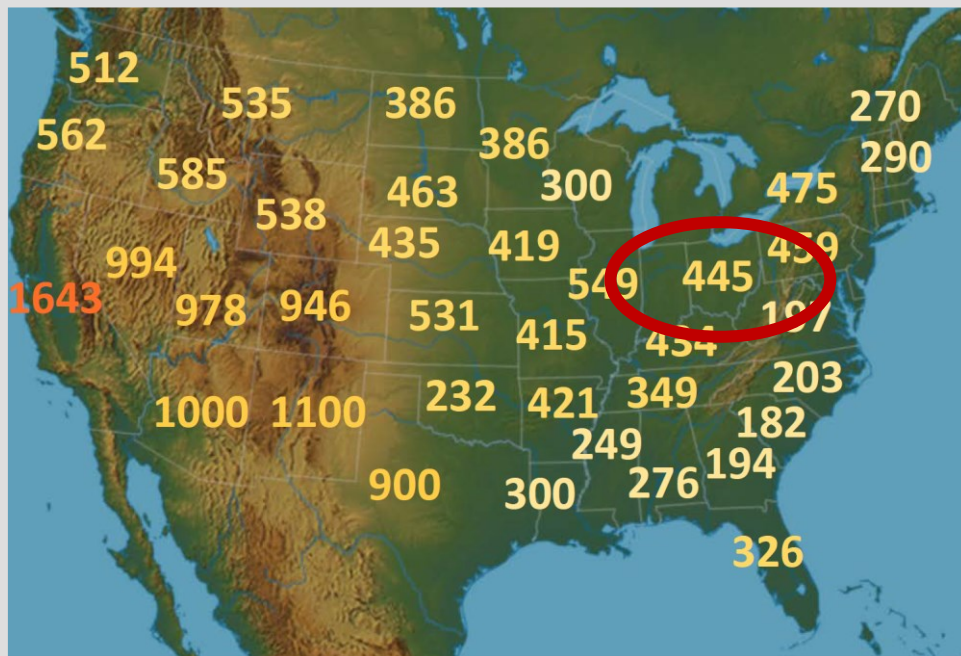
# WHAT ARE WE LOSING?:BEE DIVERSITY

## BACKYARD BEES OF NORTH AMERICA



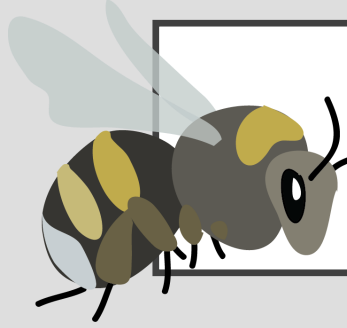
**>4,000 SPECIES IN THE USA**  
**>20,000 SPECIES IN THE WORLD**

**OVER 400 SPECIES IN OHIO**



<http://beesinyourbackyard.blogspot.com>

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# WHAT IS A BEE?

- A **vegetarian** wasp
- **Not all bees sting**
  - Male bees cannot sting
  - There are 500 species of stingless bees (mostly tropical)
  - Even female bees with stingers tend to be less aggressive than wasps



The smallest and the largest: a *Perdita minima* on a female carpenter bee's head. Photo: S Buchmann.

# MOST BEES ARE SOLITARY AND DO NOT LIVE IN HIVES

- **10% of bees are social**
  - Colonies with queen and worker bees
- **15% of bees are cleptoparasitic**
  - Bees that lay their eggs in nests of other bees
- **75% of bees are solitary**
  - Lone female with a nest where she provisions eggs

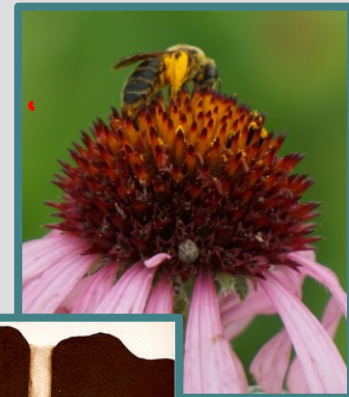
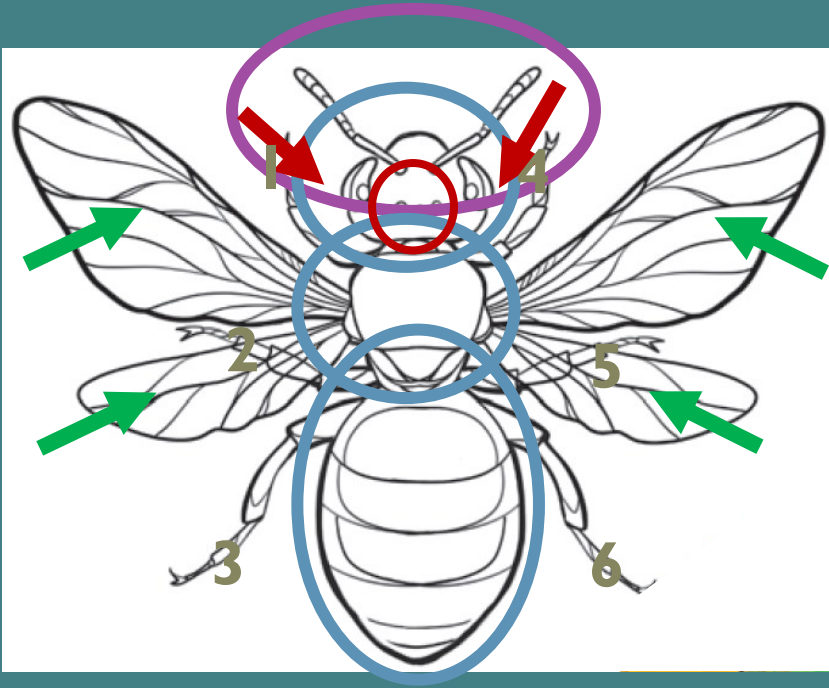


Photo (K Ullman) showing cavity nesting bees in a hollow stem/ Illustration (S Jepsen) showing ground nesting bees.

# ALWAYS BEE COUNTING



- **One** bee has....
- **two** antenna
- **three** body segments
  - head, thorax, abdomen
- **four** wings
  - two forewings, two hindwings
- **five** eyes
  - two compound eyes and three eye spots (ocelli)
- **six** legs



**LET'S PRACTICE**

TIME TO PLAY TWO BEES OR  
NOT TWO BEES?

# TWO BEES OR NOT TWO BEES?



# TWO BEES OR NOT TWO BEES?



# ALL BEES!!



Sweat bee: *Halictus*



Polyester bee: *Colletes*



Mason bee: *Osmia*



Fairy bee:  
*Perdita*



Digger bee: *Anthophorula*



European honey bee:  
*Apis mellifera*



Mining bee: *Andrena*



Sweat bee:  
*Lasioglossum (Dialictus)*



Green sweat bee:  
*Agapostemon*



Small carpenter bee:  
*Ceratina*



Leaf-cutter bee:  
*Ashmeadiella*

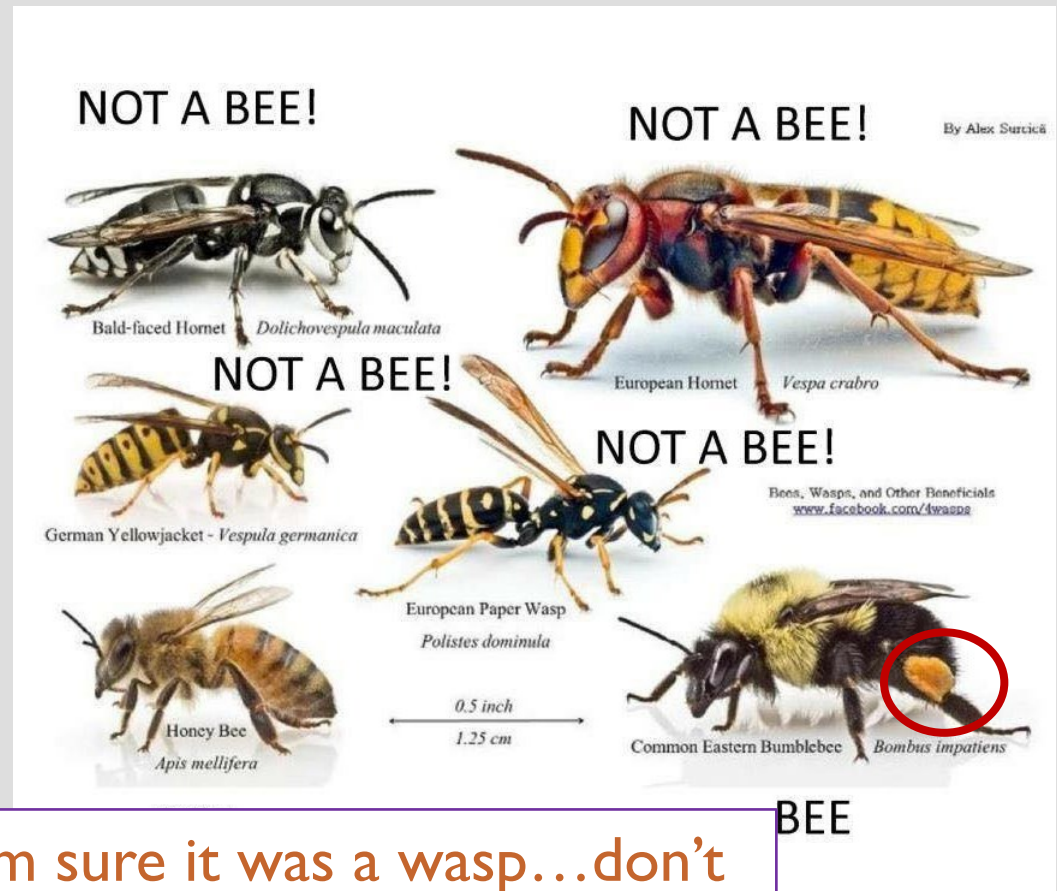


# TWO BEES OR NOT TWO BEES?



# BEE VS WASP: HARD TO DISTINGUISH

- Wasps have a thin connection between the thorax and abdomen
- Wasp bodies are hairless
  - But so are cleptoparasitic bees
- Wasps do not collect pollen
  - But neither do male bees or cleptoparasitic bees



If it stung you, I'm sure it was a wasp...don't blame the bees

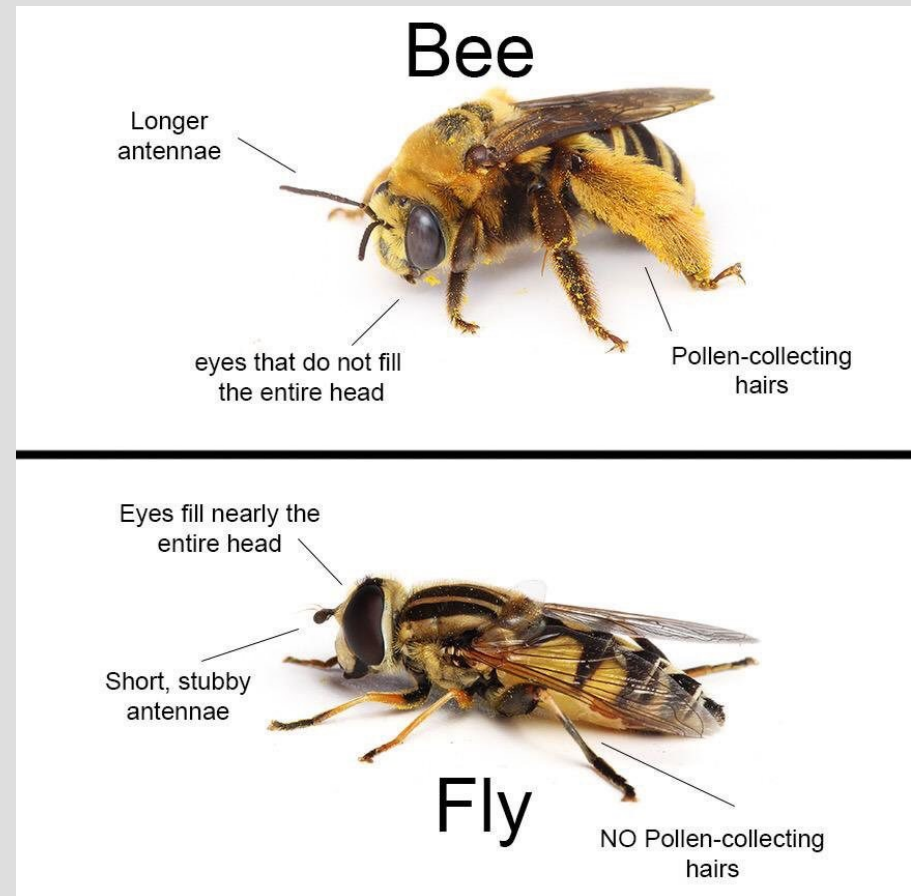
**LAST ONE!**

**TWO BEES OR NOT TWO BEES?**



# BEE VS. FLY: SEEMS TRICKY, BUT YOU GOT THIS!

- Many flies are bee mimics
- Flies have a big eyes that take up most of their head
- Fly antennae are short and stubby
- Bee antennae are long
- Fly wings lay flat and angled, like a fighter jet
- Bees fold theirs on top of each other across their back
- Careful, flies can be fuzzy!





# HOW CAN YOU SUPPORT URBAN BEE POPULATIONS?



# PLANT A POLLINATOR GARDEN!

## What is a Pollinator Garden?



A garden of diverse  
nectar and pollen  
producing plants  
=  
A habitat for insect  
pollinators!



# DO POLLINATOR GARDENS HELP?

- **YES!** Even small plots, particularly when near other small plots, significantly benefit native bees!



Agriculture, Ecosystems and Environment

journal homepage: [www.elsevier.com/locate/agee](http://www.elsevier.com/locate/agee)



A little does a lot: Can small-scale planting for pollinators make a difference?

Philip Donkersley<sup>a,\*</sup>, Sammy Witchalls<sup>a</sup>, Elias H. Bloom<sup>b</sup>, David W. Crowder<sup>c</sup>

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<sup>b</sup> Department of Entomology, Michigan State University, East Lansing, MI, USA

<sup>c</sup> WSU Department of Entomology, Washington State University, Pullman, WA, USA



# COLLEGE OF WOOSTER'S POLLINATOR GARDENS

- **Two dedicated pollinator gardens**
  - **On Pine St near Beall Ave**
  - **Corner of College Ave and Pearl St**
- **First planting in summer 2020**
- **Nearly 30 native Ohioan plants species**



# MONITORING THE BEES IN THE GARDENS

- Observed over a dozen genera and nearly 50 species of bees



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## CoW Pollinators and Plants

[Add Observations to This Project](#)

### Stats

<b>Totals</b>	<b>Most Observations</b>	<b>Most Species</b>	<b>Most Observed Species</b>
<b>255</b> Observations »	greene26 171 observations	bubbleninjas 17 species	Bicolored Striped Sweat Bee 31 observations
<b>48</b> Species »	bubbleninjas 42 observations	greene26 16 species	Eastern Miner Bee 23 observations
<b>6</b> People »	mpwoo23 21 observations	rmjohnson 7 species	Bristle Sweat Bee 17 observations
	rmjohnson 19 observations	mpwoo23 6 species	Confusing Furrow Bee 15 observations
	adavis25 1 observation	jison 1 species	Brown-belted Bumble Bee 10 observations

# HONEY BEE AND NATIVE BEE COMPETITION IN THE GARDENS

The presence of the honeybee hive did not affect the visitation by native bees



# SUPPORTING NATIVE BEES: 1) GO PESTICIDE FREE

PROTECTING POLLINATORS FROM PESTICIDES

## Buying Bee-Safe Plants



<https://xerces.org/publications/fact-sheets/buying-bee-safe-plants>

# SUPPORTING NATIVE BEES: 2) PLANT NATIVE PLANTS

## What to plant

To support Ohio Pollinators



Mountain mint



Brown-eyed susan



Goldenrod



Purple coneflower



Butterfly milkweed



Bergamot



# SUPPORTING NATIVE BEES: 2) PLANT NATIVE PLANTS

- Use plants that have the **resources** the bees need.
  - Bees may not be able to access pollen and nectar in cultivars
- **Plant resource rich plants** anywhere not just in 'pollinator gardens'



# SUPPORTING NATIVE BEES:

## 3) BEE A BIT MESSY

- Native bees need:
  - Places to build their nests or colonies.
  - Get out of the weather.
  - Spend the winter.
- Leave some dead stems
- Have areas of bare soil
- Leave the leaves
- Mow less often



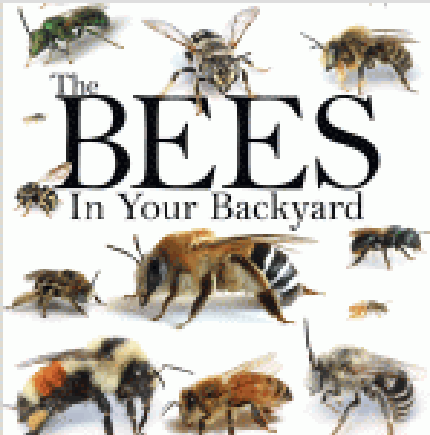
This fall, leave the leaves and save the stems!  
Leaving your yard a little wild helps provide habitat for bumble bees, butterflies, moths, and many more beneficial insects.  
#leavetheleaves



It is good to **bee** a little lazy!

# ONLINE RESOURCES

- Ohio State's Bee Lab: <https://u.osu.edu/beelab/>
- Xerces Society for Invertebrate Conservation: <https://xerces.org/>
- Bees in Your Backyard: <http://beesinyourbackyard.blogspot.com/>
- Pollinator Pathways: <https://www.pollinator-pathway.org/>
- CoW' pollinator plot page: <https://pollinatorpatches.voices.wooster.edu/>
- NPS Pollinator page: <https://www.nps.gov/subjects/pollinators/index.htm>



# ACKNOWLEDGEMENTS & WHERE TO FIND SLIDES FROM THIS TALK



THE COLLEGE OF  
WOOSTER

*Wooster Science Café*



Bee drawings by KJD Bai

