



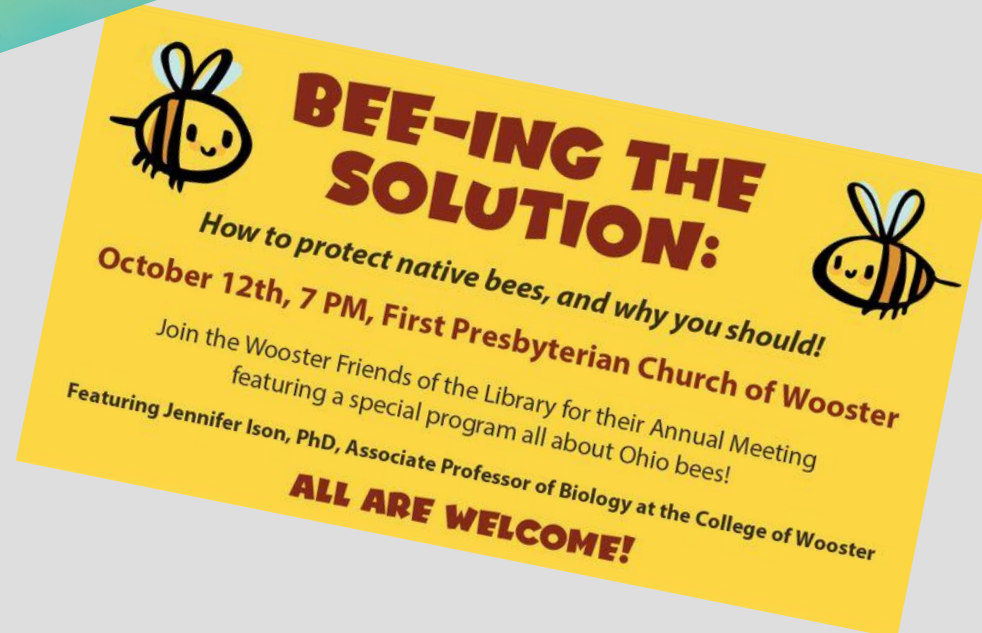
**BEE-ING THE SOLUTION: HOW TO
PROTECT NATIVE BEES, AND WHY
YOU SHOULD!**

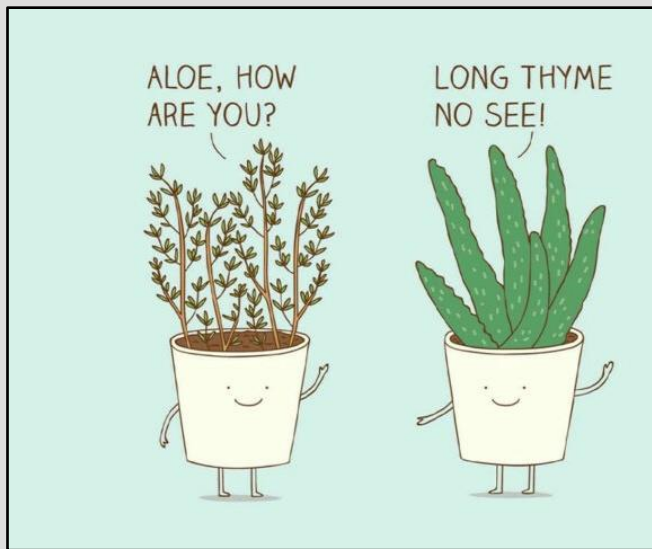
Jennifer L. Ison

**Associate Professor of Biology at the
College of Wooster**



THANK YOU, FRIENDS OF THE
LIBRARY!







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.

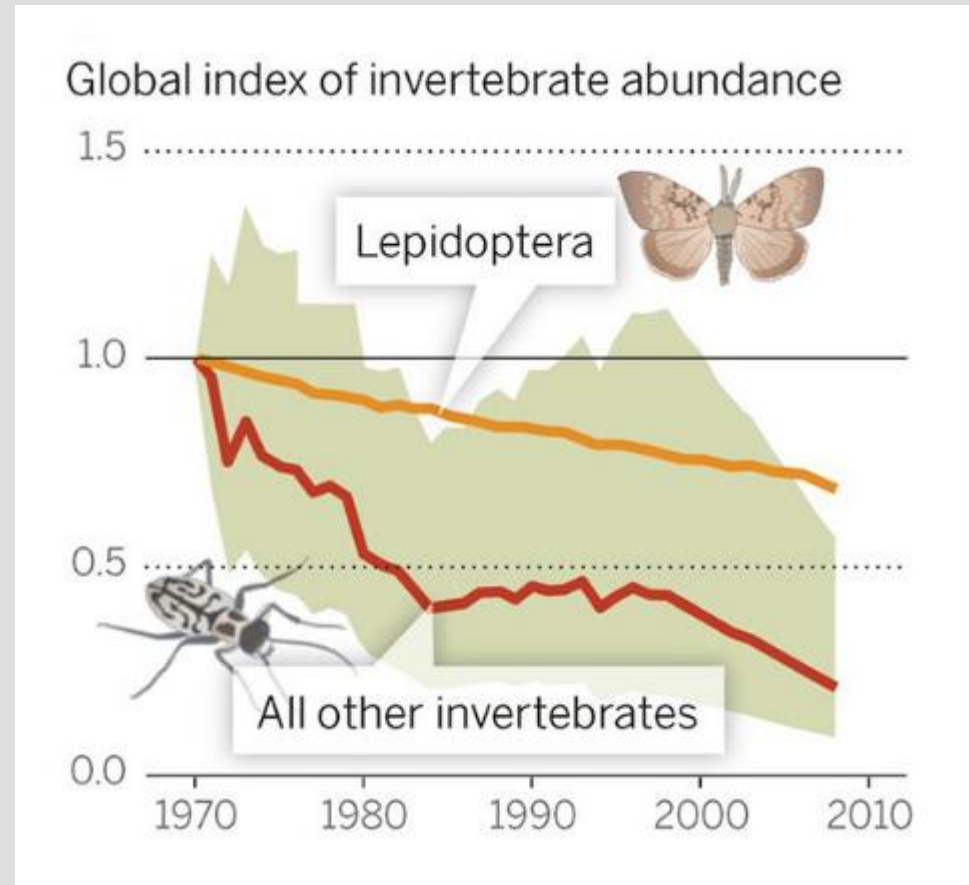


Wild bees, such as this Andrena bee visiting highbush blueberry flowers, play a key role in boosting crop yields. Left photo by Nilsu Inacio/AAK; Right photo courtesy of Daniel M. Turner.



GLOBAL DECLINE IN INSECTS

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



Interaction Disruption

Climate change is affecting ranges globally. Here ants are invading and consuming wildlife in cloud forest never before exposed to these marauders.

Fire

Global warming elevates fire risk. Fires in Australia, Amazonia, and California burned an unprecedented >5 million hectares of forest in 2019.

Global Warming

Arctic sea ice is declining precipitously, arctic-alpine and other cold-adapted communities are contracting, while sea-level rise threatens coastal ecosystems.

Storm Intensity

Climate changes bring stronger, more frequent storms and hurricanes; more fire-igniting lightning; and damaging flooding.

Droughts

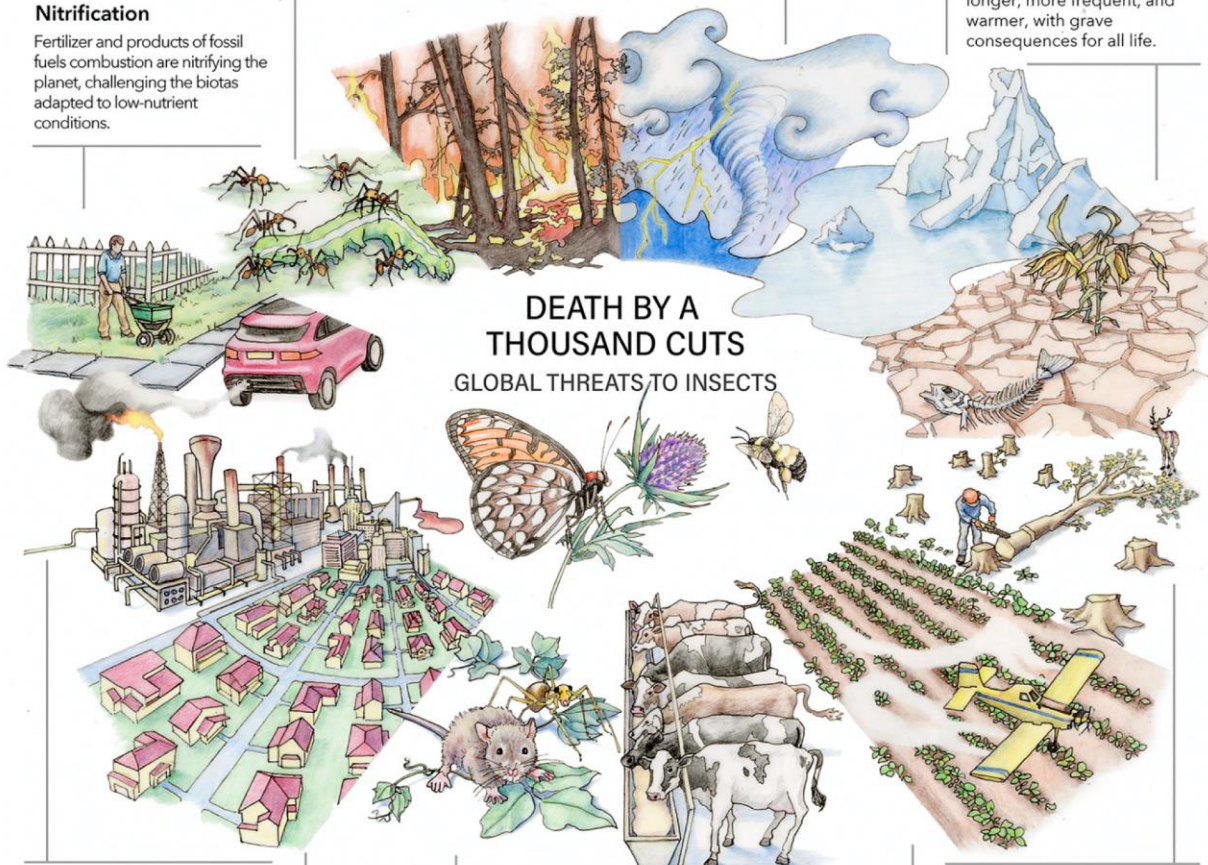
Periods with diminished precipitation are becoming longer, more frequent, and warmer, with grave consequences for all life.

Nitrification

Fertilizer and products of fossil fuels combustion are nitrifying the planet, challenging the biotas adapted to low-nutrient conditions.

DEATH BY A THOUSAND CUTS

GLOBAL THREATS TO INSECTS



Pollution

Chemical, light, and sound pollution of water, air, and soil are impacting plant and animal life worldwide.

Introduced Species

Global trade is accelerating the movement of pernicious plants, animals, and pathogens to new regions—often with devastating consequences.

Agricultural Intensification

Industrialized agriculture, with its attendant increases in scale, monoculturalization, nutrient input, and pesticide use, is becoming increasingly nature unfriendly.

Deforestation

The tropics lost 11.9 million hectares of forest in 2019, mostly to agriculture.

Insecticides

Modern, industrialized agriculture, with its increasing reliance on chemical insecticides, has led to chronic contamination of wildlands and impacts to non-target insects.

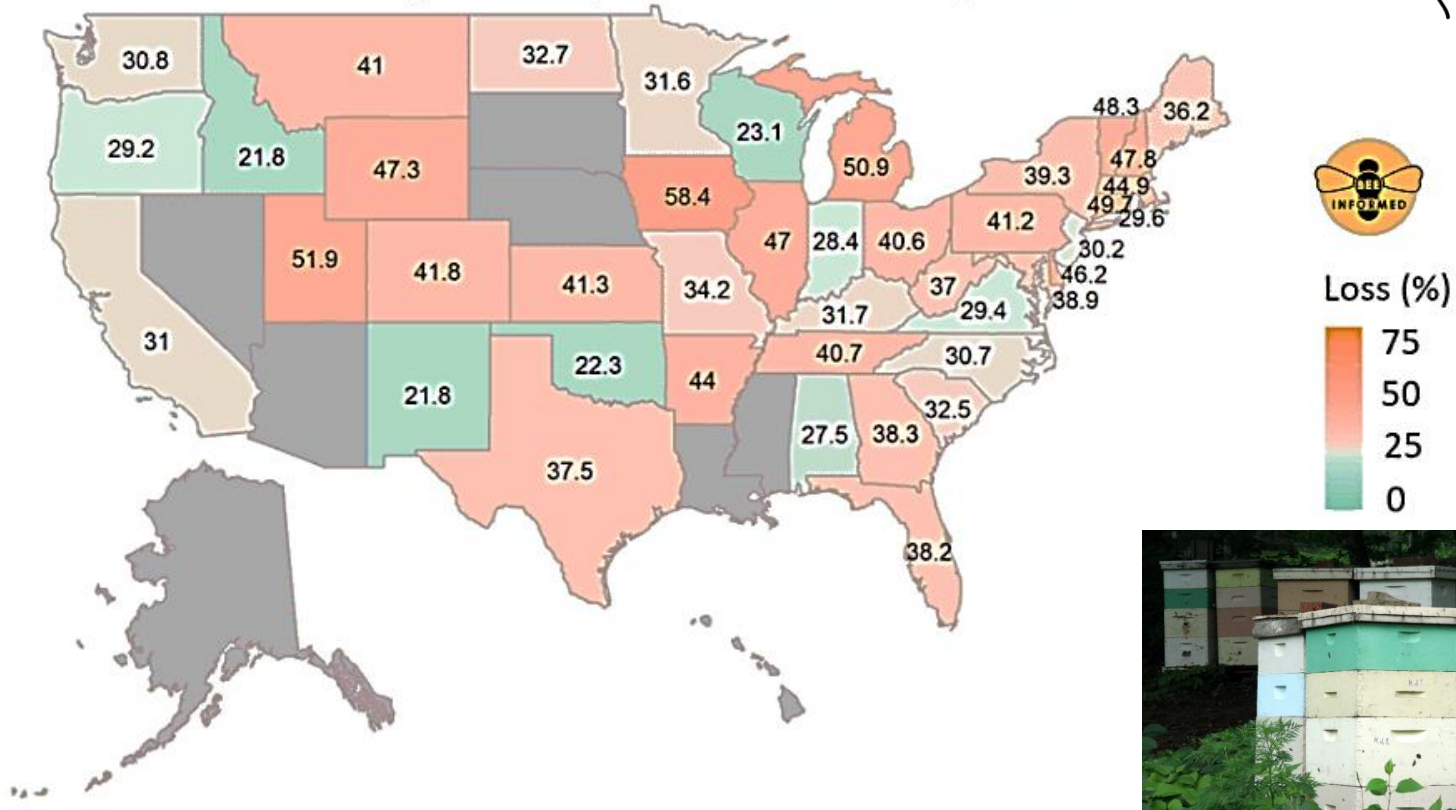


Insect decline in the Anthropocene: Death by a thousand cuts

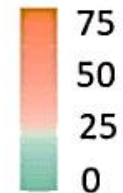
HONEYBEES HIVE LOSS RATES



2020-2021 Managed Honey Bee Winter Colony Loss Rates



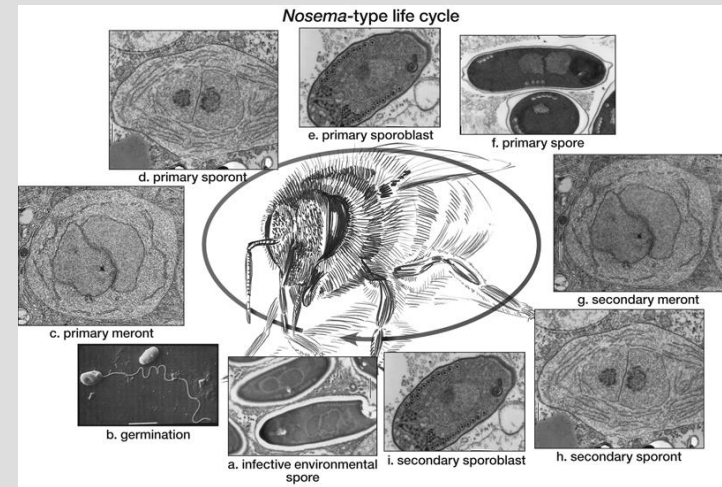
Loss (%)



HONEYBEES HIVE LOSS



Neonicotinoid pesticides



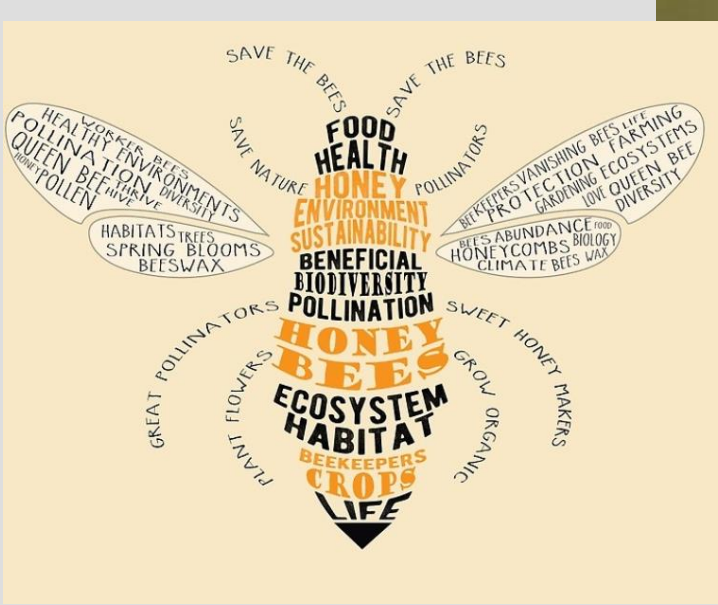
Nosema parasites



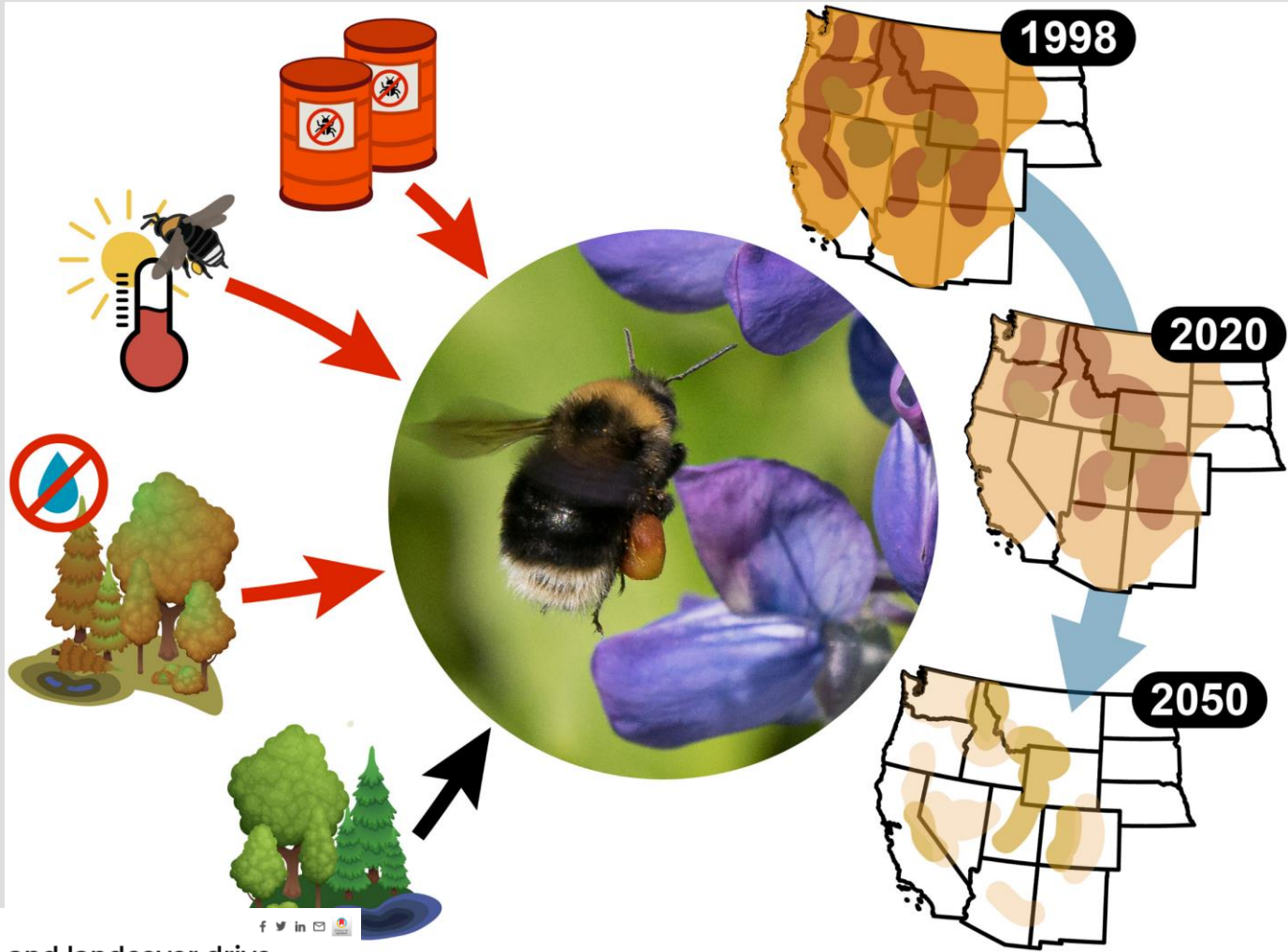
Varroa mites



Viruses (e.g., deformed wing virus)



LOCATION OF THE WESTERN BUMBLEBEES: HISTORIC, PRESENT, & PREDICTED

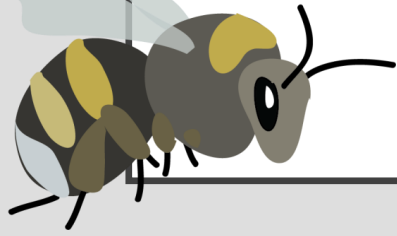


COMMENTARY | ECOLOGY |

Climate, pesticides, and landcover drive declines of the western bumble bee

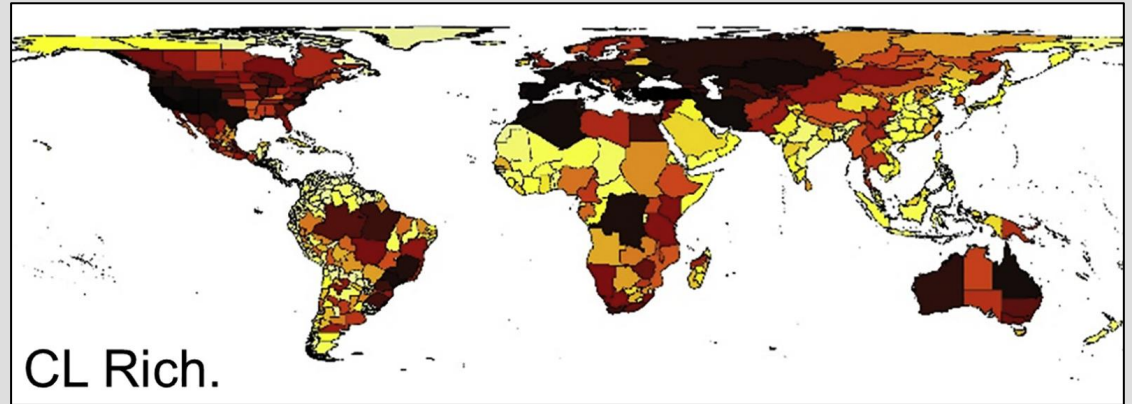
Neal M. Williams and Jeremy Hemberger Authors info & Affiliations

February 10, 2023 | 120 (7) e2221692120 | <https://doi.org/10.1073/pnas.2221692120>



WHAT IS A BEE?

- A **vegetarian** wasp
- Over **20,000** species worldwide
- **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



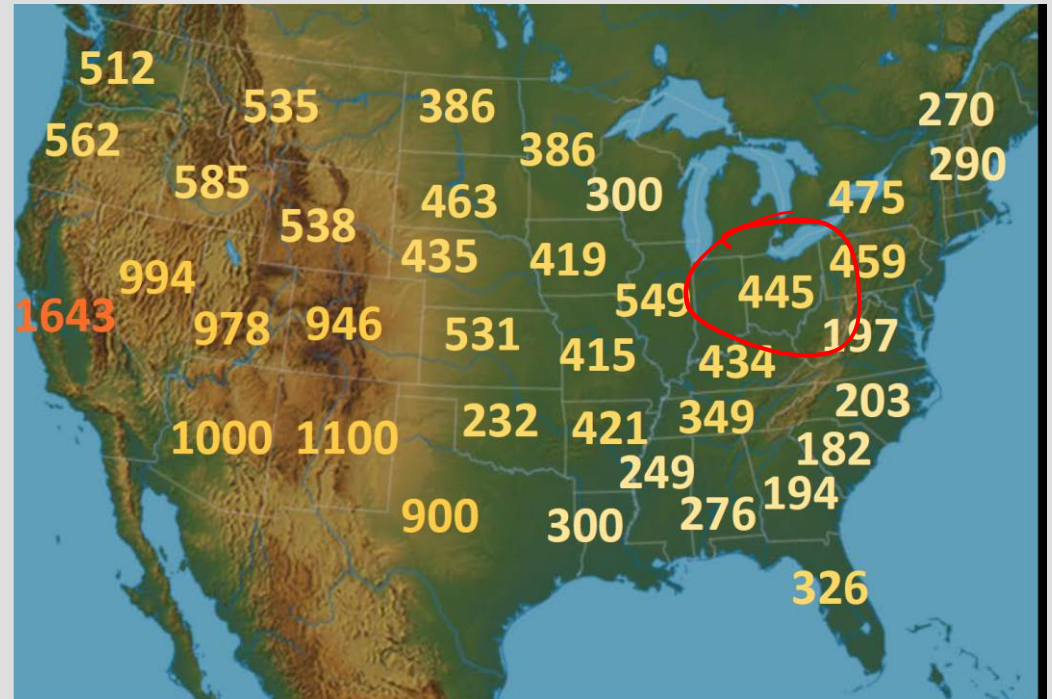
The smallest and the largest: a *Perdita minima* on a female carpenter bee's head. Photo: S Buchmann.

OVER 400 BEE SPECIES IN OHIO

BACKYARD BEES OF NORTH AMERICA



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<http://beesinyourbackyard.blogspot.com>

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

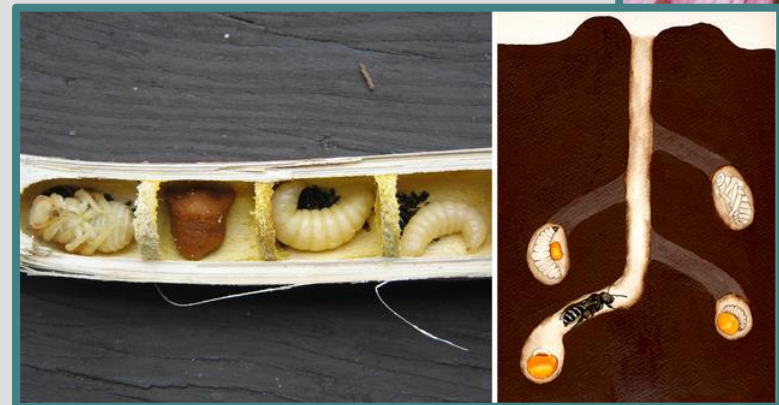
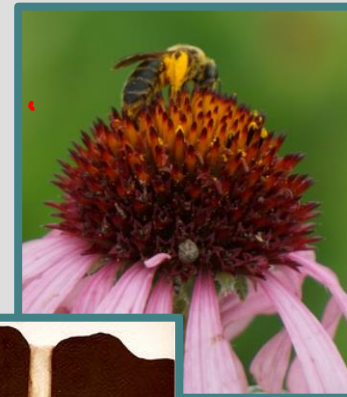
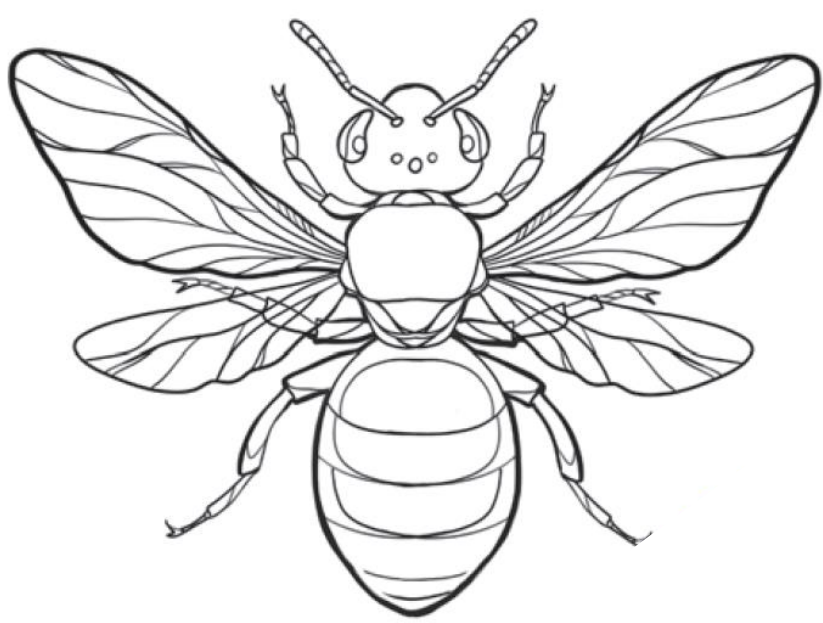


Photo (K Ullman) showing cavity nesting bees in a hollow stem/ Illustration (S Jepsen) showing ground nesting bees.

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

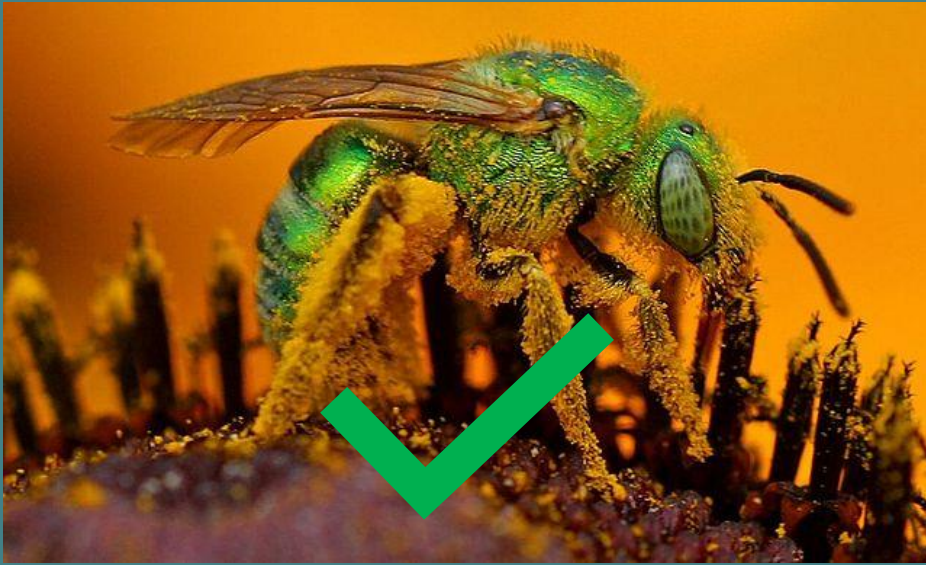
LET'S PRACTICE

TIME TO PLAY TWO BEES OR
NOT TWO BEES?

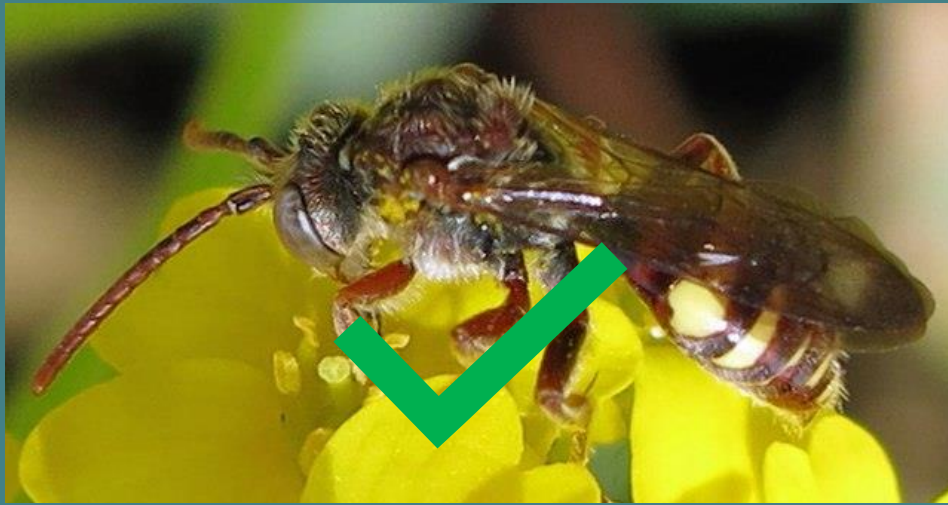
TWO BEES OR NOT TWO BEES?



TWO BEES OR NOT TWO BEES?

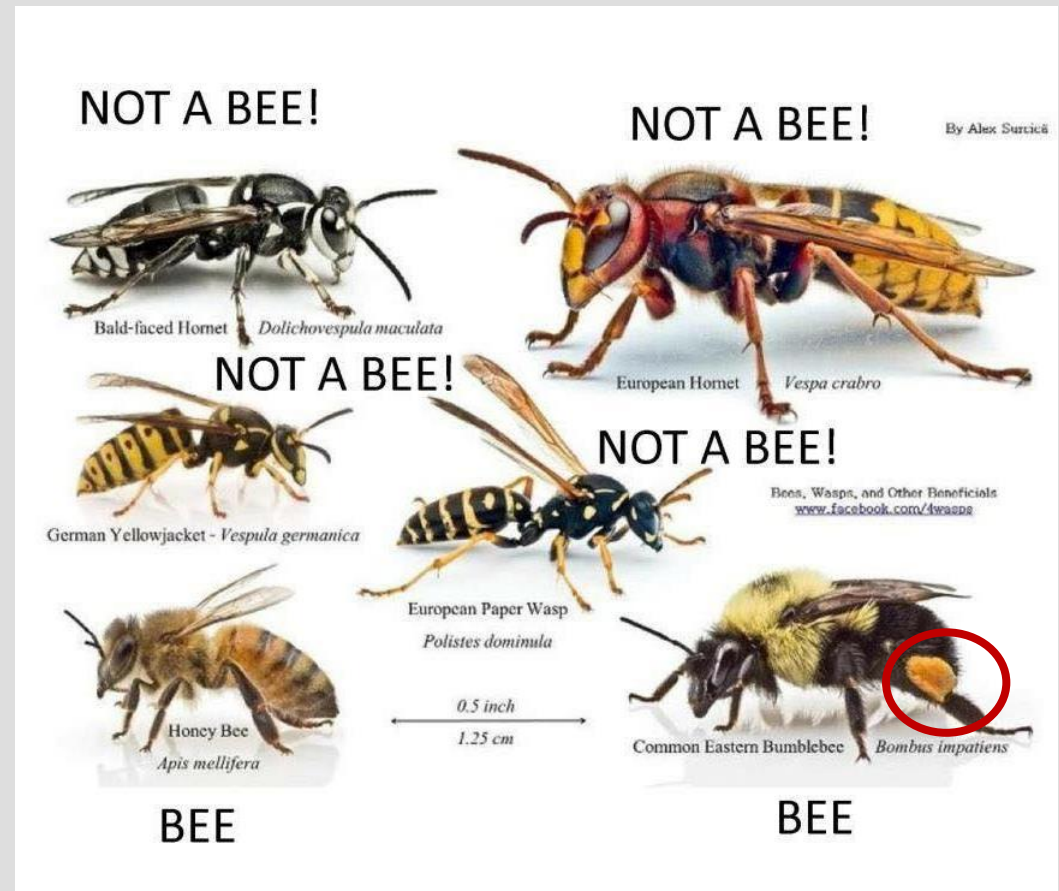


TWO BEES OR NOT TWO BEES?



BEE VS WASP: HARD TO DISTINGUISH

- **Wasp** 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



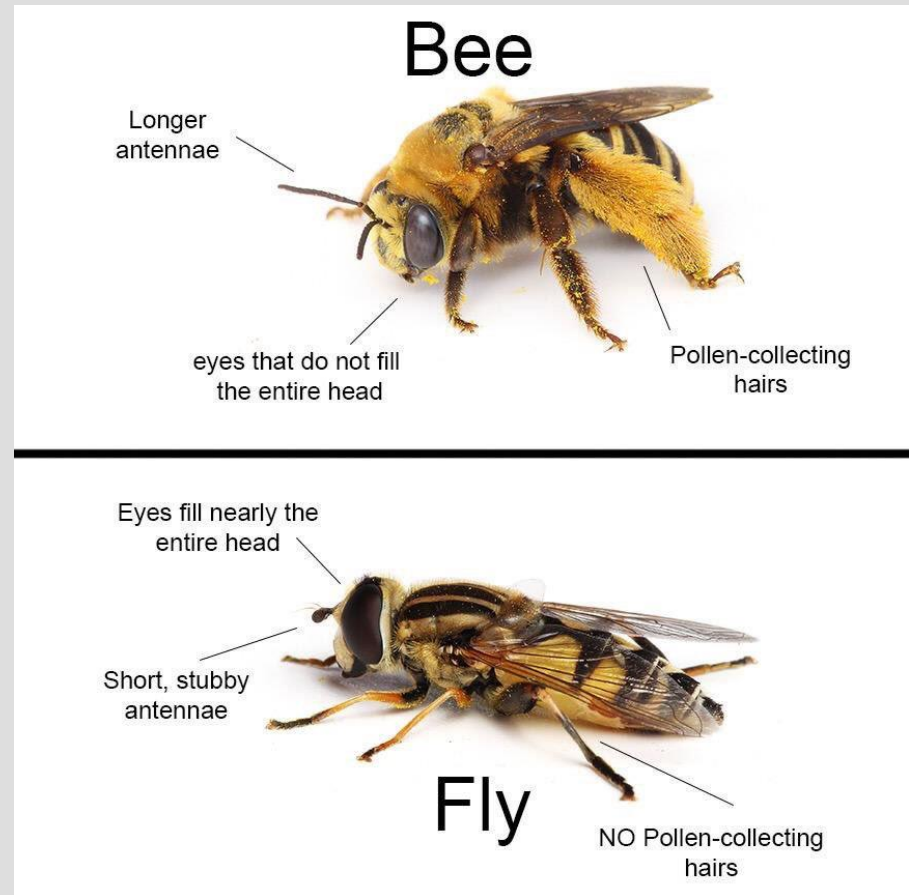
LAST ONE!

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!



THESE ARE ALL SYRPHID (BEE MIMIC) FLIES!



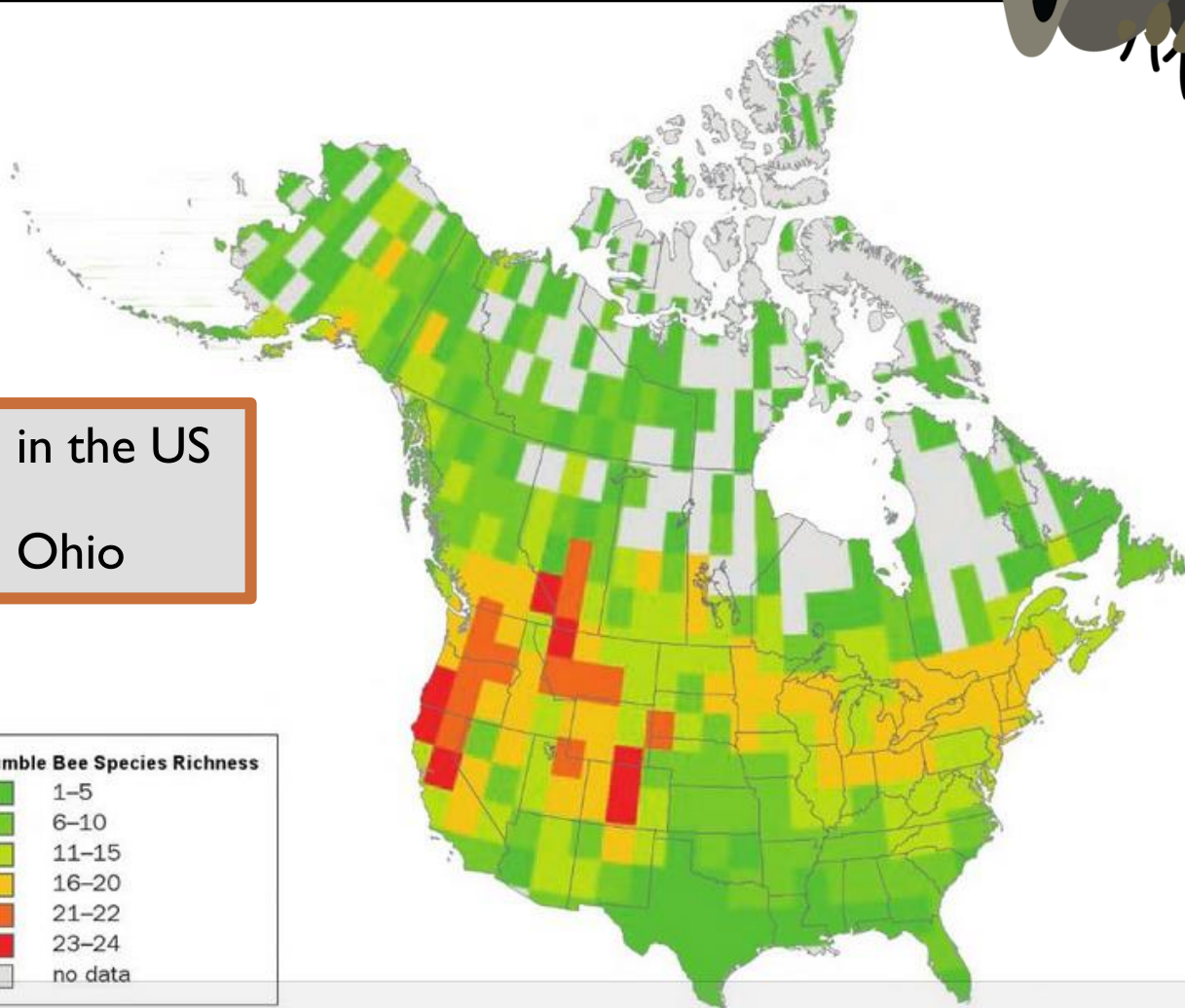
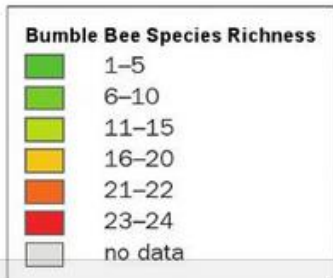
BUMBLEBEES: FLYING PANDAS



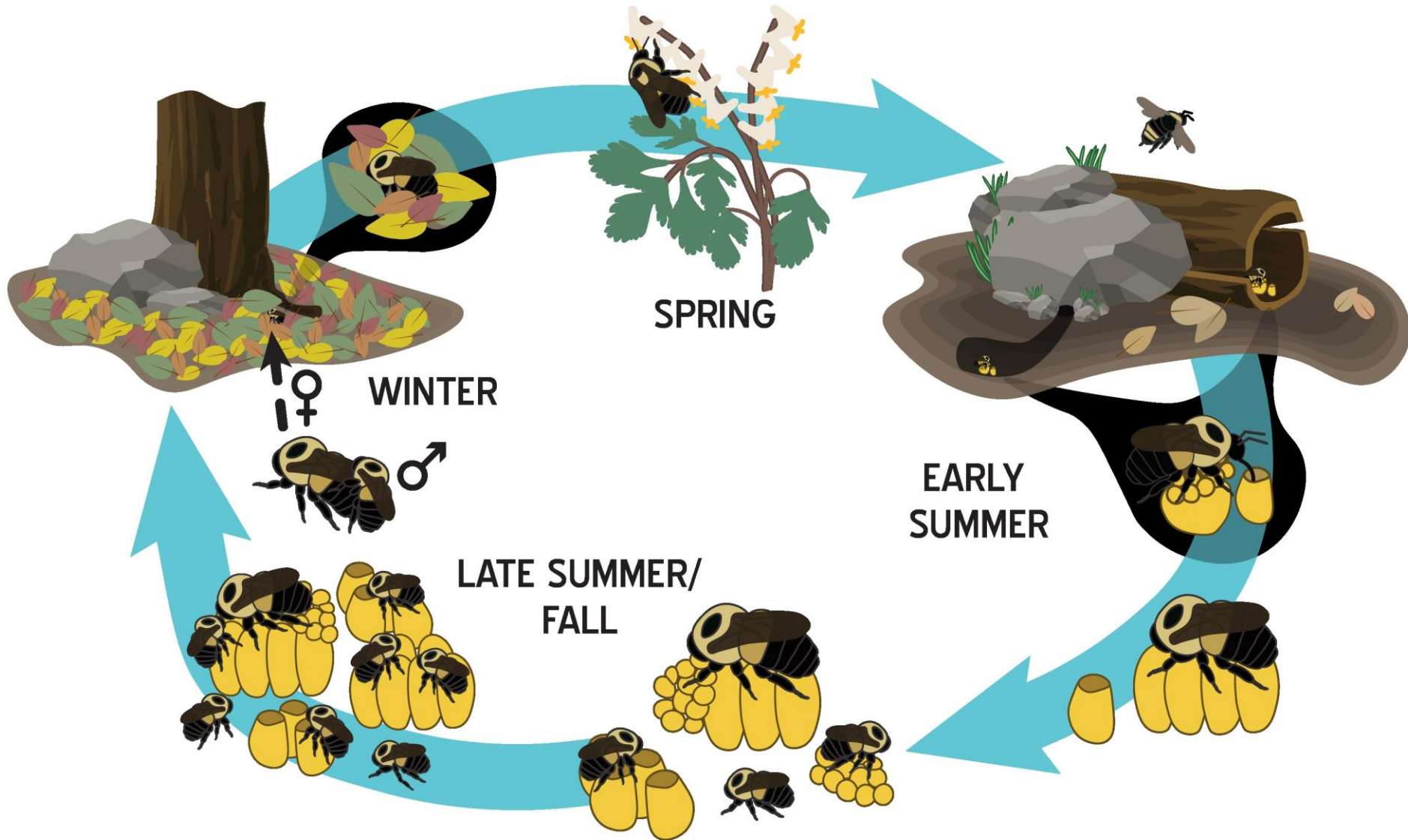
BUMBLEBEE SPECIES



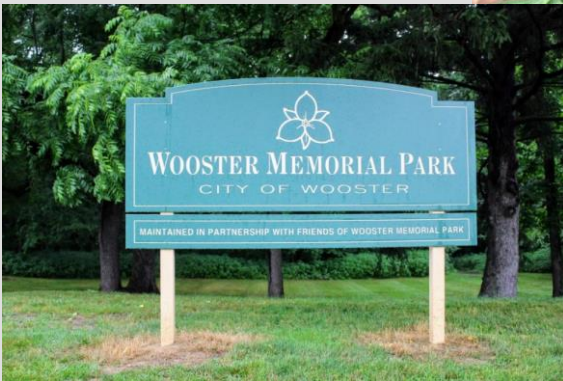
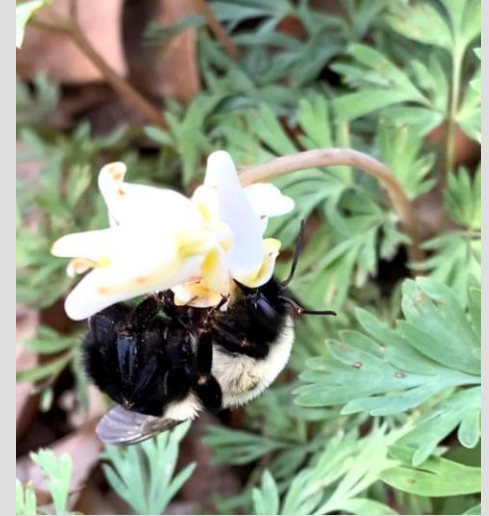
- 47 species in the US
- 16 species Ohio



BUMBLEBEE LIFE CYCLE



THE QUEEN'S PANTS: DUTCHMAN'S BREECHES AND QUEEN BUMBLEBEES



THE QUEEN'S PANTS: DUTCHMAN'S BREECHES AND QUEEN BUMBLEBEES



THE QUEEN'S PANTS: DUTCHMAN'S BREECHES AND QUEEN BUMBLEBEES



YouTube channel: Ison lab
Only video uploaded in 'shorts'

<https://www.youtube.com/shorts/WalmiGA4iAg>

WHAT HAVE WE FOUND?



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

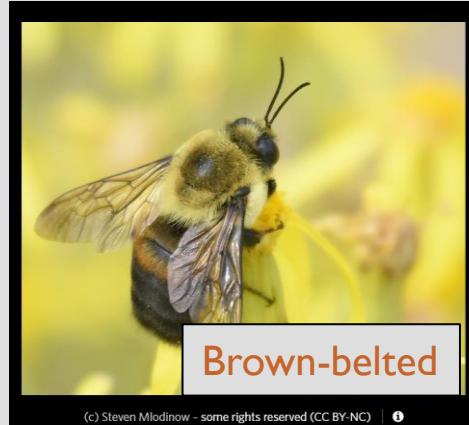


Rusty-patched

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



Two-spotted

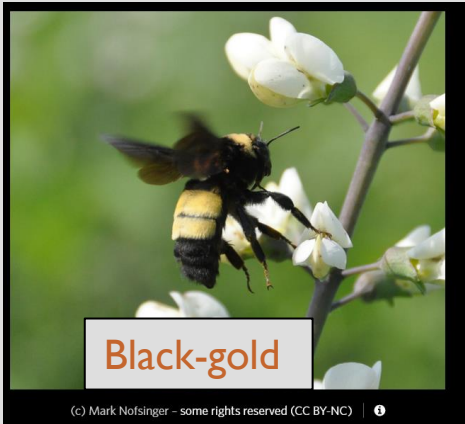


Brown-belted

(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



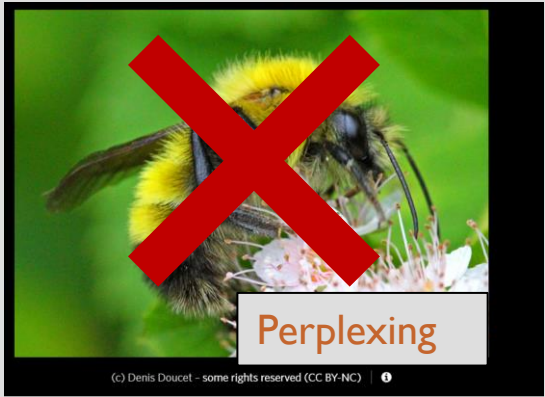
Perplexing

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

POLLINATION INTERACTIONS IN SYMPATRIC
DICENTRA SPECIES¹

LAZARUS WALTER MACIOR
Department of Biology, University of Akron, Akron, Ohio 44325

BUMBLEBEES WE HAVE OBSERVED OVER TWO SEASON



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

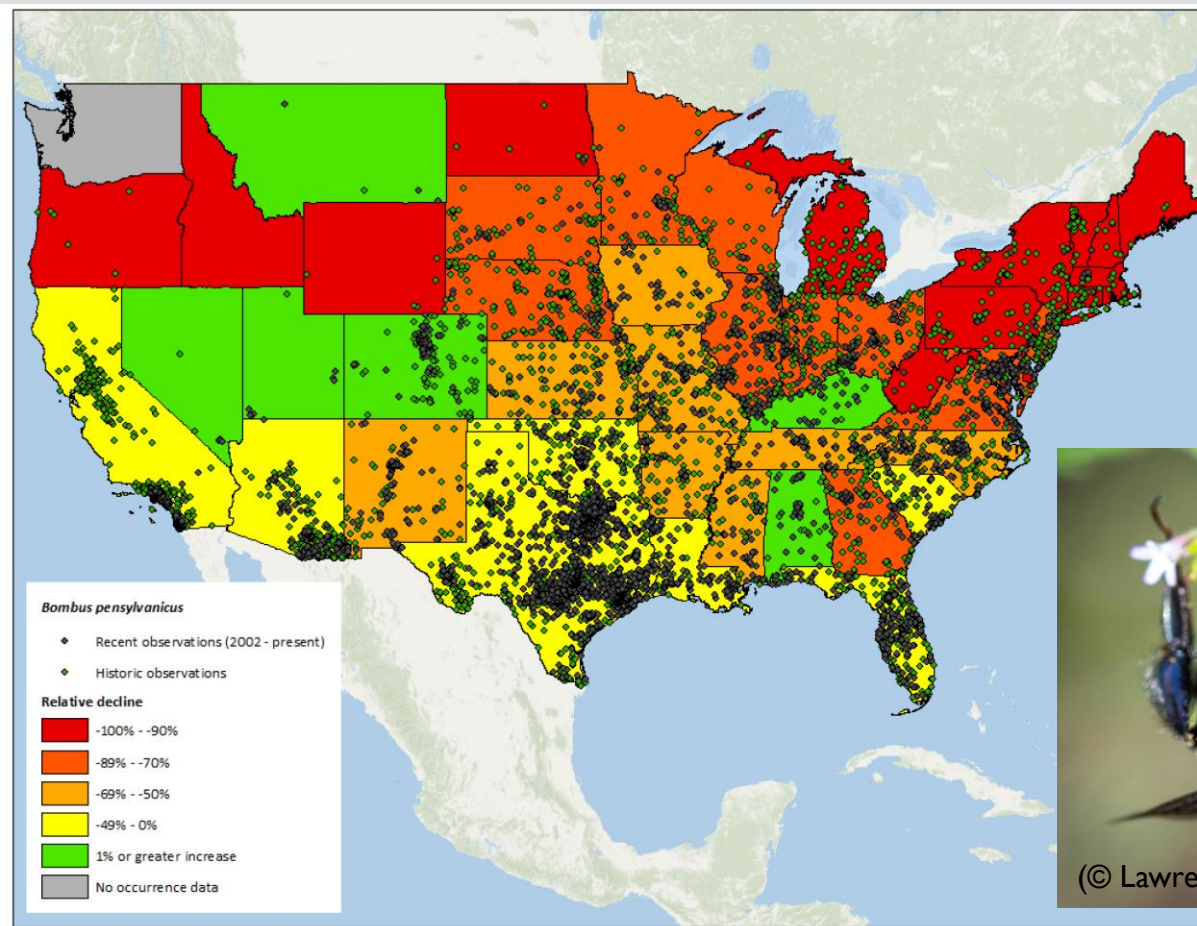


Figure 8. Decline in relative abundance of the American bumble bee with historic and recent observations. The change for each state represents the relative decline or gain of relative abundance from historic relative abundance to recent relative abundance. The recent period is 2002-2020.



HOW CAN YOU BEE THE
SOLUTION?

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!



Photo by Paul Skawinski.



Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee



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

Philip Donkersley^{a,*}, Sammy Witchalls^a, Elias H. Bloom^b, David W. Crowder^c

^a Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, United Kingdom

^b Department of Entomology, Michigan State University, East Lansing, MI, USA

^c 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**



COLLEGE OF WOOSTER'S POLLINATOR GARDENS

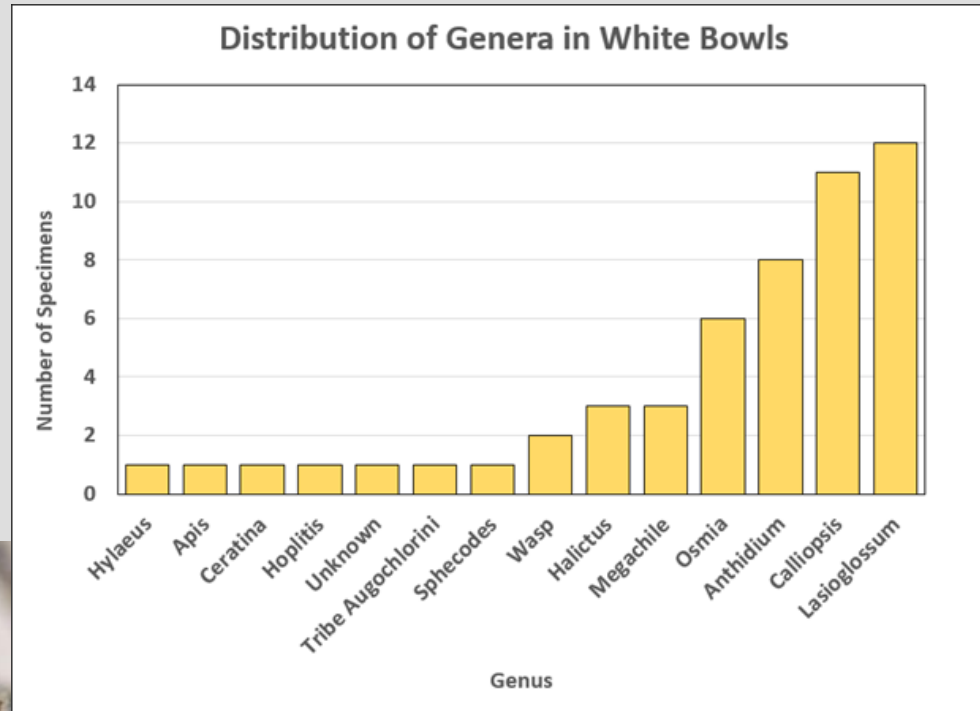
- **Two dedicated pollinator gardens**
 - **On Pine St near Beall Ave**
 - **Corner of College Ave and Pearl St**
- **First planting in summer 2020**
- **Nearly 30 native Ohioan plants species**



MONITORING THE BEES IN THE GARDENS



MONITORING THE BEES IN THE PLOTS

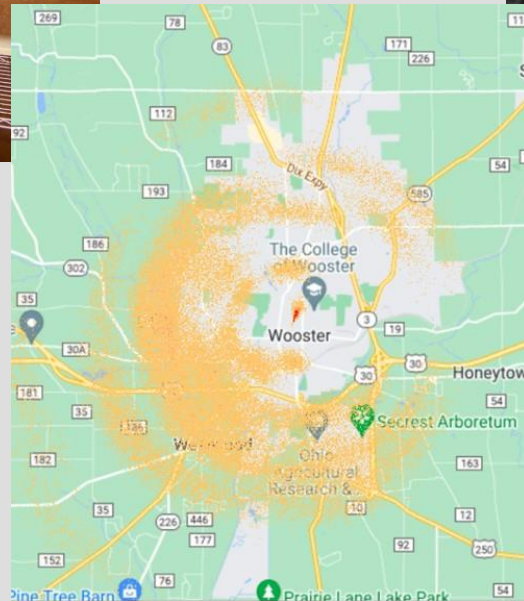
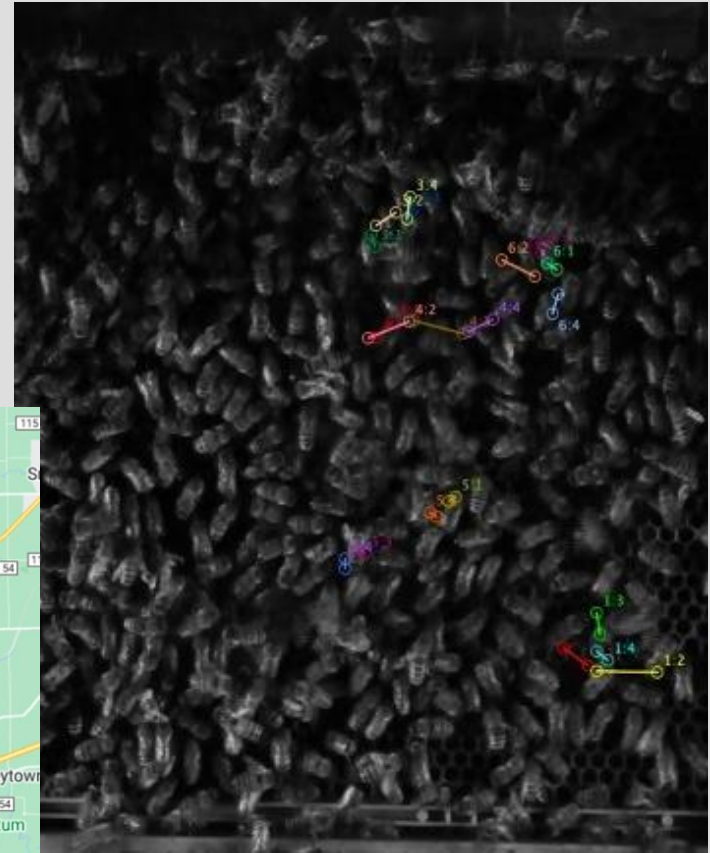


HONEYBEE AND NATIVE BEE COMPETITION IN THE GARDENS

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



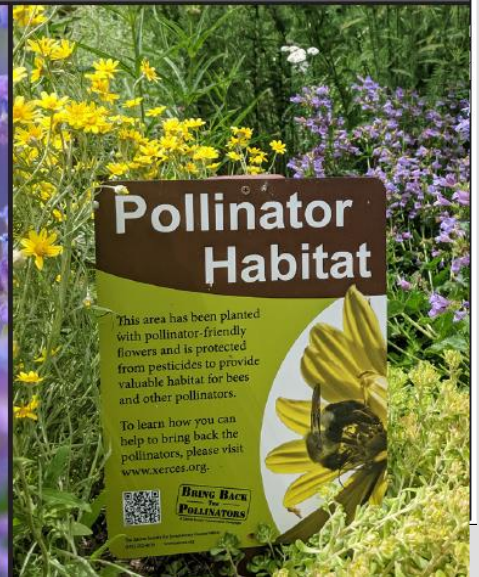
HONEYBEE AND NATIVE BEE COMPETITION IN THE PLOTS



SUPPORTING NATIVE BEES: GO PESTICIDE FREE

PROTECTING POLLINATORS FROM PESTICIDES

Buying Bee-Safe Plants



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

SUPPORTING NATIVE BEES: PLANT NATIVE PLANTS

What to plant

To support Ohio Pollinators



Mountain mint



Brown-eyed susan



Goldenrod



Purple coneflower



Butterfly milkweed



Bergamot

SUPPORTING NATIVE BEES: 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 garden'



SUPPORTING NATIVE BEES: 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**



It is good to be a little lazy!





RESOURCES FOR SUPPORTING NATIVE BEES

Slides from talk are posted here:



BOOKS AT WAYNE COUNTY LIBRARY

KEY WORD: POLLINATOR GARDEN

1.



The pollinator victory garden : win the war on pollinator decline with ecological gardening : how to attract and support bees, beetles, butterflies, bats, and other pollinators

by Eierman, Kim author

Language English

2020

Summary "The passion and urgency that inspired WWI and WWII Victory Gardens is needed today to meet another..."

Show more >

[Summary](#) | [About The Author](#) | [Look Inside](#) | [You May Also](#)

[Like](#) | [Librarian Lists](#) | [Reader Reviews](#) | [Also Available As](#) | [Tags](#)

Available: 1

Holds: 0

Place Hold

10.



The bee-friendly garden : design an abundant, flower-filled yard that nurtures bees and supports biodiversity

by Frey, Kate, 1960- author

Language English

2016

Summary "For every gardener who cares about the planet, this guide to designing a bee garden helps you crea..."

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[Like](#) | [Librarian Lists](#) | [Professional Reviews](#) | [Reader Reviews](#) | [Also](#)

[Available As](#) | [Tags](#)

Available: 1

Holds: 0

Place Hold

1.



Pollinator Gardens

by Rebman, Nick

2021

Summary "This book examines how pollinators affect the environment, the threats these species face, and how..."

Show more >

[Summary](#) | [Professional Reviews](#) | [Reading Level](#)

Available: 1

Holds: 0

Place Hold



Grow a living wall : create vertical gardens with purpose : pollinators - herbs & veggies - aromatherapy - many more

by Coronado, Shawna author

Language English

2015

Summary In Grow a Living Wall, you'll find clear, step-by-step information that explains everything you need...

Show more >

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[Lists](#) | [Professional Reviews](#) | [Also Available As](#) | [Tags](#)

Available: 1

Holds: 0

Place Hold

1.



Lawns into meadows : growing a regenerative landscape

by Wormser, Owen author

Language English

2022

Summary "Landscape designer Owen Wormser explains how to replace the deadscape we call lawn with low-mainte..."

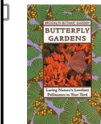
Show more >

[Summary](#) | [About The Author](#) | [Look Inside](#) | [Librarian Lists](#)

Available: 2

Holds: 0

Place Hold



Butterfly gardens : luring nature's loveliest pollinators to your yard

by Lewis, Alcinda C., 1949-

Language English

1995

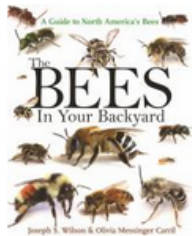
[Series](#) | [You May Also Like](#) | [Librarian Lists](#) | [Also Available As](#) | [Tags](#)

Available: 1

Holds: 0

Place Hold

MY FAVORITE BEE ID GUIDE: BEES IN YOUR BACKYARD



The bees in your backyard : a guide to North America's bees

Place Hold

by Wilson, Joseph S., 1980-

Language English

2016

Summary This book provides an introduction to the roughly 4,000 different bee species found in the United S...

[Show more >](#)

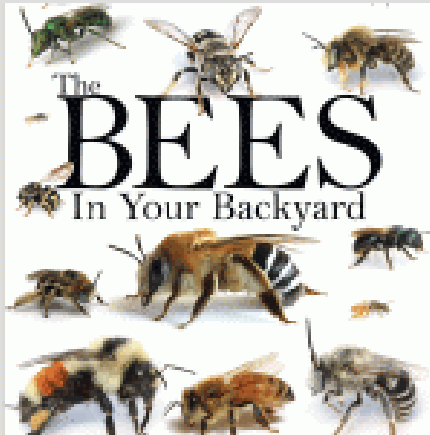
[Summary](#) | [About The Author](#) | [Look Inside](#) | [You May Also Like](#) | [Librarian Lists](#) | [Professional Reviews](#) | [Also Available As](#) | [Tags](#) | [Book Profile](#) | [Awards](#)

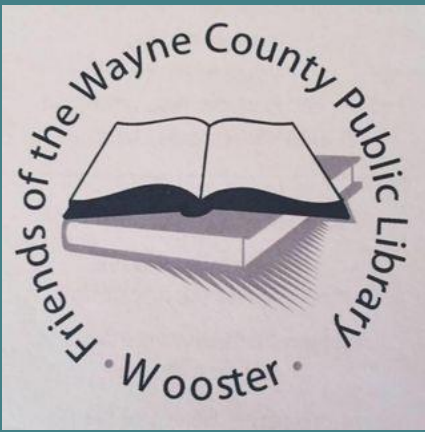
Available: 9

Holds: 0

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>





NATIONAL **Friends** OF **Libraries** WEEK

OCTOBER 15-21, 2023

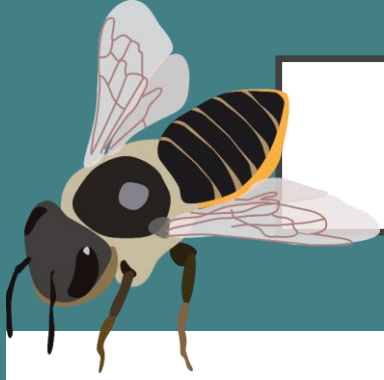
AN INITIATIVE OF UNITED FOR LIBRARIES



ACKNOWLEDGEMENTS



WHERE TO FIND SLIDES FROM THESE TALK

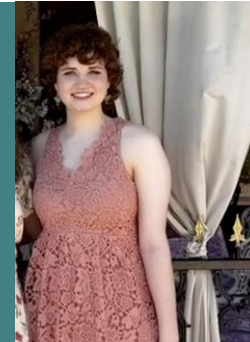


The College of Wooster's
**POLLINATOR
GARDEN**
Instagram

<https://isonlab.voices.wooster.edu/resources/>



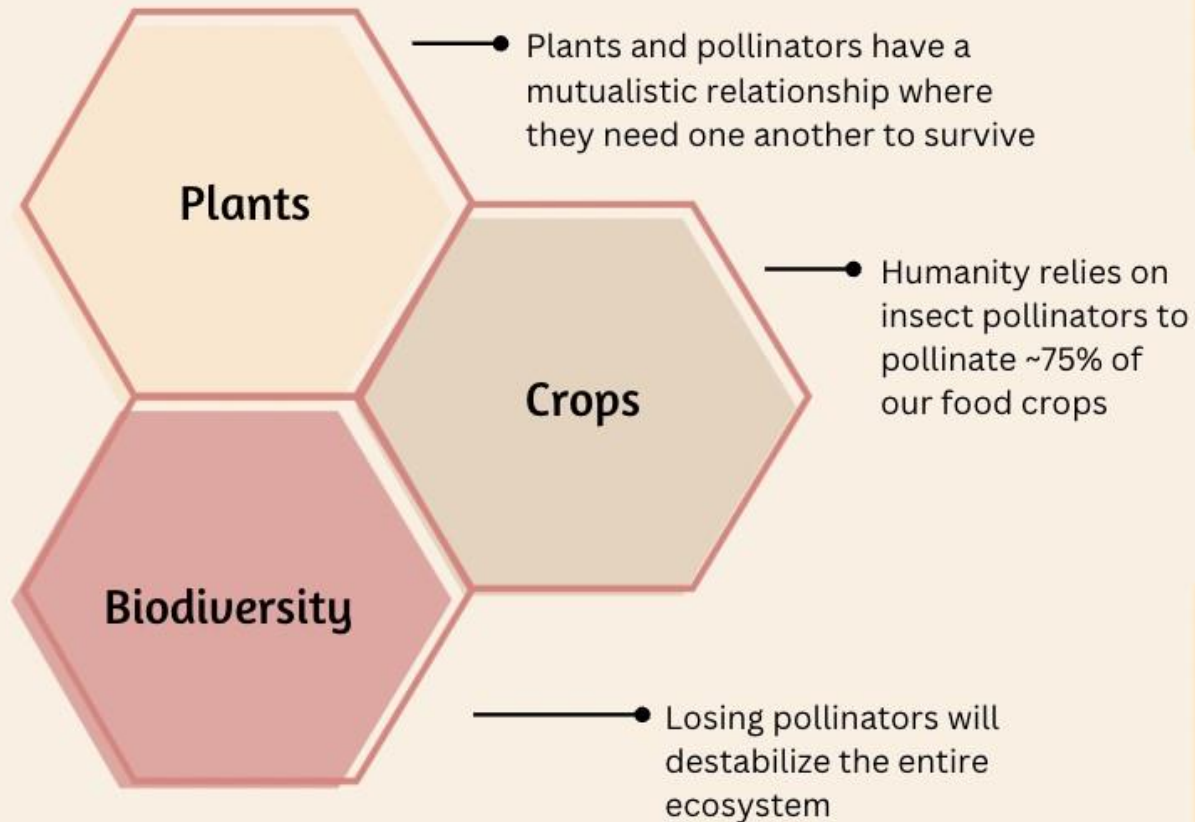
Bee drawings by KJD Bai



EXTRA SLIDES



Why We Need Pollinators



Key Features of a *Pollinator Garden*

Diverse nectar and pollen producing plants



Dead plant material

Water sources

Native plants

Plenty of sun

No pesticides



Getting started

PLANTING A POLLINATOR GARDEN



1. Choose a location
2. Identify soil type and amount of sun
3. Choose the right plants
4. Prepare area
5. Plant!
6. Water and weed your garden as it grows

Planting Guide for your native pollinator garden

Use the arrangement below to have a continuous garden - spring, summer, & fall

MIDWEST REGION

IA, IL, IN, KY, MI, MO, MN, OH, WI



BLOOM SEASON

-  Spring
-  Summer
-  Fall

For best results, use multiple plants of each species.



Follow these steps to create your beautiful native pollinator garden

MIDWEST REGION

IA, IL, IN, KY, MI, MO, MN, OH, WI

1 Identify your garden spot:

- ✓ Find a 3' x 6' plot that gets 6+ hours of sun.
- ✓ Have a larger area? Include more choices and clump the same species together.
- ✓ Remove or smother existing lawn or vegetation.
- ✓ Enhance hard-packed soil with organic compost.

2 Buy plants at a local native plant nursery, if possible.

3 Plant!

- ✓ Arrange plants with different seasonal blooms in your plot.
- ✓ Dig holes twice as large as each plant's pot.
- ✓ Remove the plant from the pot, loosen the roots, place it in the hole, backfill, tamp soil, and water.
- ✓ Mulch plot to depth < 1 inch, keeping mulch away from stems and avoid using hardwood chips and shreds.




4 Maintain your garden:

- ✓ Water to keep moist throughout the first two weeks, then as needed or when plants droop.
- ✓ Weed as needed.
- ✓ Avoid using insecticides, herbicides, or fungicides.
- ✓ Be patient - your garden may take a few years to fully establish and fill in!

Add your garden: www.millionpollinatorgardens.org

BLOOM SEASON | NATIVE PLANT OPTIONS

*Your state's native plant society can recommend locally appropriate native species in the genus below. See **North American Pollinator Protection Campaign Ecoregional Planting Guides** for additional information: www.pollinator.org/guides.

SEASON	FIRST OPTION	SECOND OPTION
 <p>Spring</p>	Eastern columbine <i>Aquilegia canadensis</i>	wild geranium <i>Geranium maculatum</i>
	wild indigo <i>Baptisia spp.*</i>	spiderwort <i>Tradescantia spp.*</i>
	beardtongue <i>Penstemon spp.*</i>	golden Alexanders <i>Zizia aurea</i>
 <p>Summer</p>	button blazing star <i>Liatris aspera</i>	blazing star <i>Liatris spp.*</i>
	common milkweed <i>Asclepias syriaca</i>	butterfly milkweed <i>Asclepias tuberosa</i>
	yellow coneflower <i>Ratibida pinnata</i>	black-eyed Susan <i>Rudbeckia hirta</i>
 <p>Fall</p>	cardinal flower <i>Lobelia cardinalis</i>	common boneset <i>Eupatorium perfoliatum</i>
	stiff goldenrod <i>Oligoneuron rigidum</i>	showy goldenrod <i>Solidago speciosa</i>
	New England aster <i>Symphotrichum novae-angliae</i>	smooth blue aster <i>Symphotrichum laeve</i>

● color dots above indicate bloom color
Photo credits on reverse side of card.

Bumble Bees of Illinois, Missouri, Indiana and Ohio (*Bombus*)



<http://beespotter.org>

Females Look for females in late April through August.

B. impatiens Common eastern bumble bee

B. bimaculatus Two-spotted bumble bee

B. griseocollis Brown-belted bumble bee

WATCH OUT FOR THIS ONE!
The Carpenter Bee, *Xylocopa virginica*, is often confused with bumble bee queens in the spring; note how similar the color pattern is to *Bombus impatiens*. One might consider this species of carpenter bee to be a mimic of *B. impatiens*.

B. vagans Half-black bumble bee

B. affinis Rusty-patched bumble bee

B. fraterus Southern plains bumble bee

B. auricomus Black and gold bumble bee

Saint Louis Zoo
Animals Always®

B. pensylvanicus American bumble bee

B. fervidus Yellow bumble bee

Cuckoo Bumble Bees

B. citrinus absent from MO

B. variabilis Variable bumble bee

B. citrinus Lemon cuckoo bumble bee

Males start here.

Males
Don't look for us until August and September.

B. impatiens

B. bimaculatus

B. griseocollis

B. vagans

B. affinis

B. fraterus

B. auricomus

B. pensylvanicus

B. fervidus

Cuckoo Bumble Bees

B. citrinus

B. variabilis