



Bee Lab

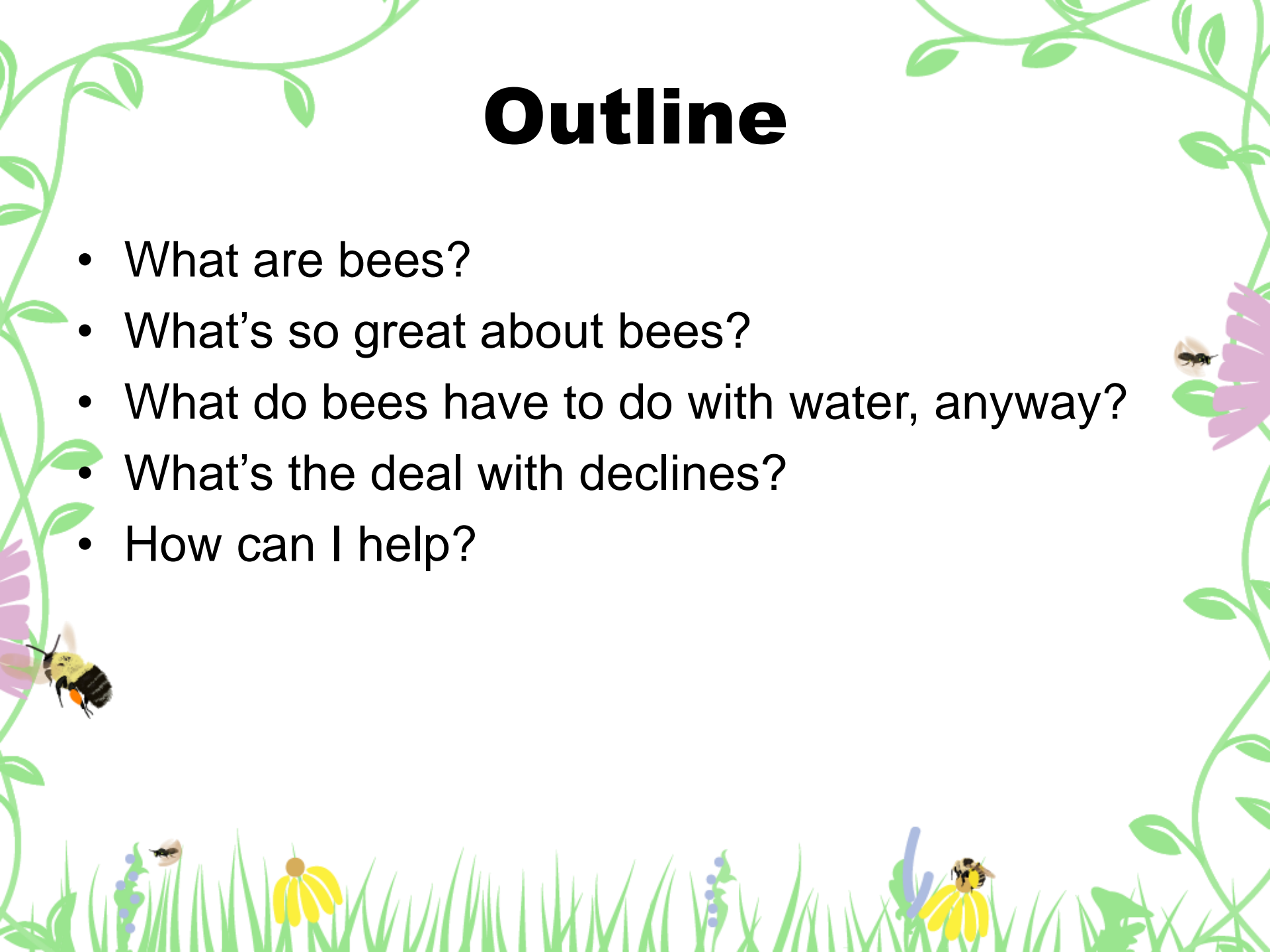


Pollinator Habitat as a Part of Watershed Protection

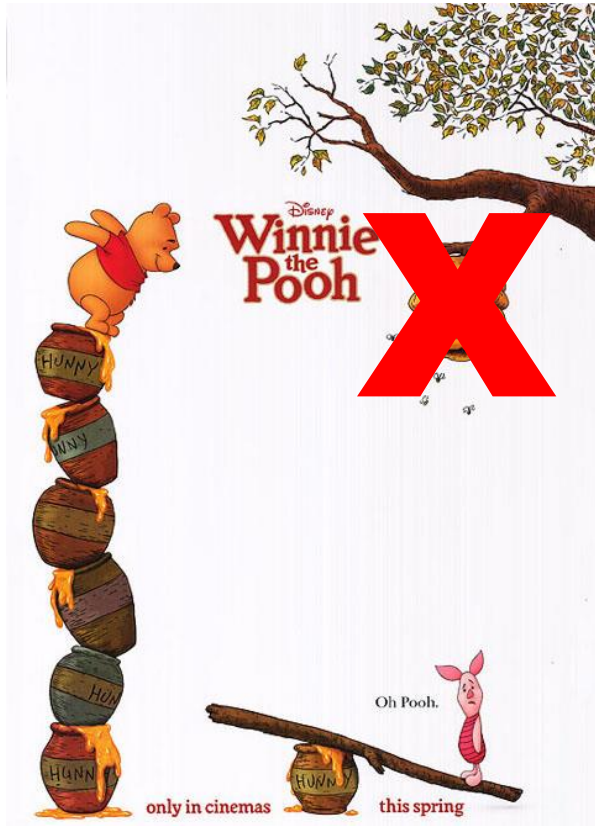
Presented by Joel Gardner

Outline

- What are bees?
- What's so great about bees?
- What do bees have to do with water, anyway?
- What's the deal with declines?
- How can I help?



What do you think of when you think of bees?





Jim Baker, NC State University, bugwood.org



Mohammed El Damir, bugwood.org



Gary Alpert, Harvard University, Bugwood.org



Morgan Carr-Markell

YES... but not the whole story.

What are bees?

- Technically, vegetarian wasps.

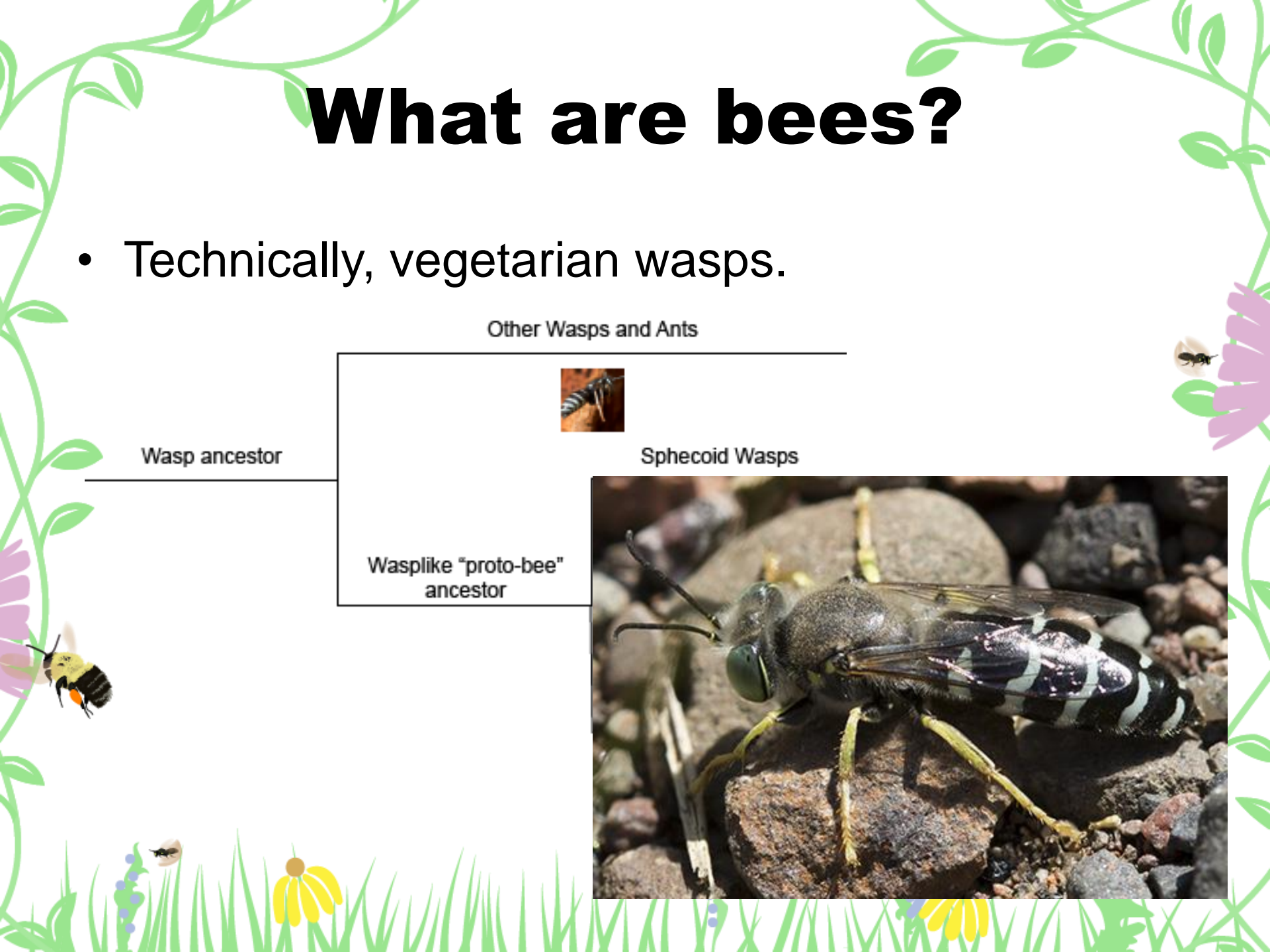
Other Wasps and Ants



Wasp ancestor

Sphecoid Wasps

Wasplike "proto-bee" ancestor



Bees vs. Wasps



- Usually very hairy
- Hairs branched
- Usually carry pollen masses
- Hind legs usually expanded
- Usually stout, bulky

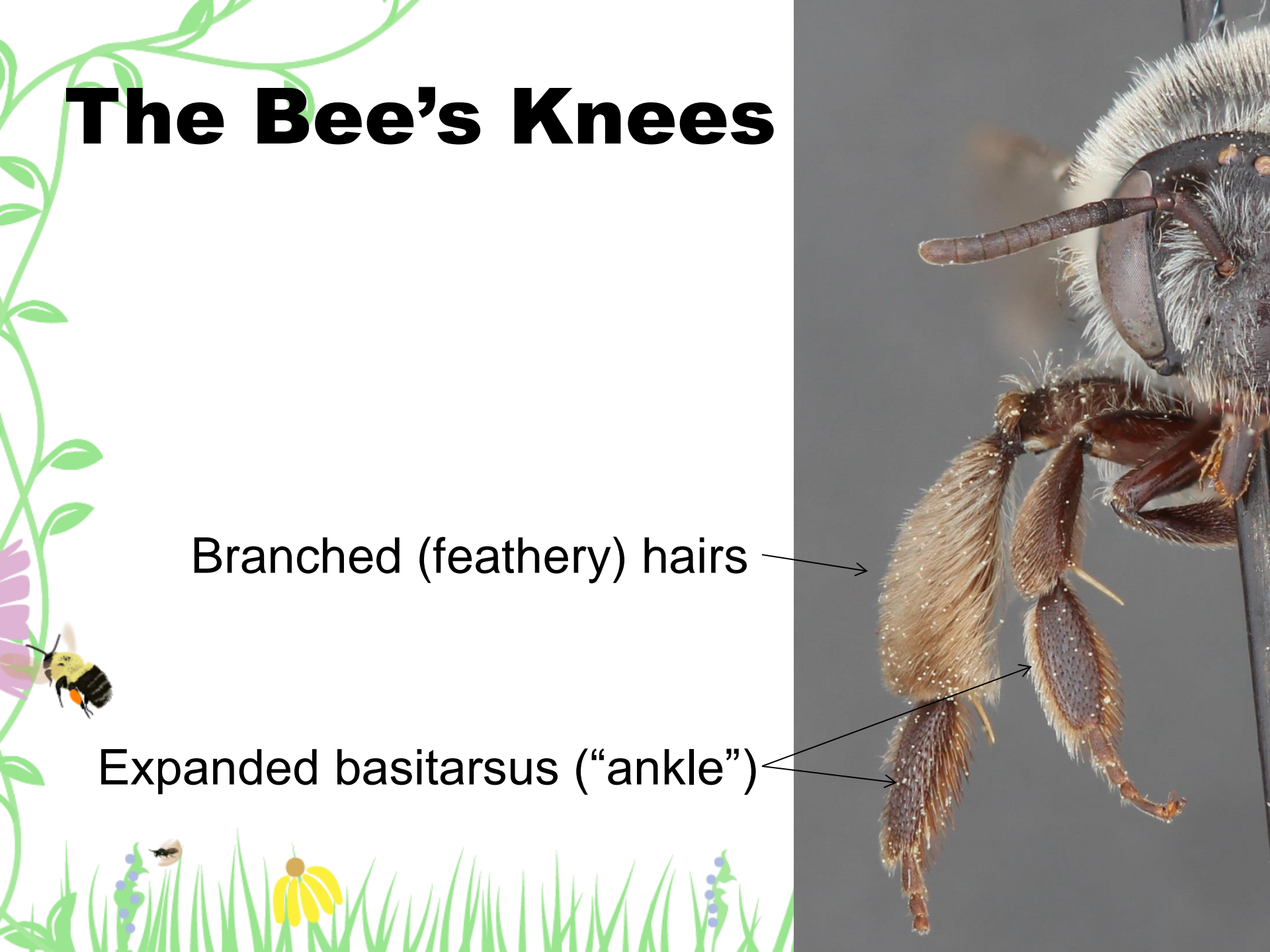


- Never very hairy
- Hairs simple
- Carry scattered pollen grains, if any
- Hind legs slender
- Long, slender, streamlined

The Bee's Knees

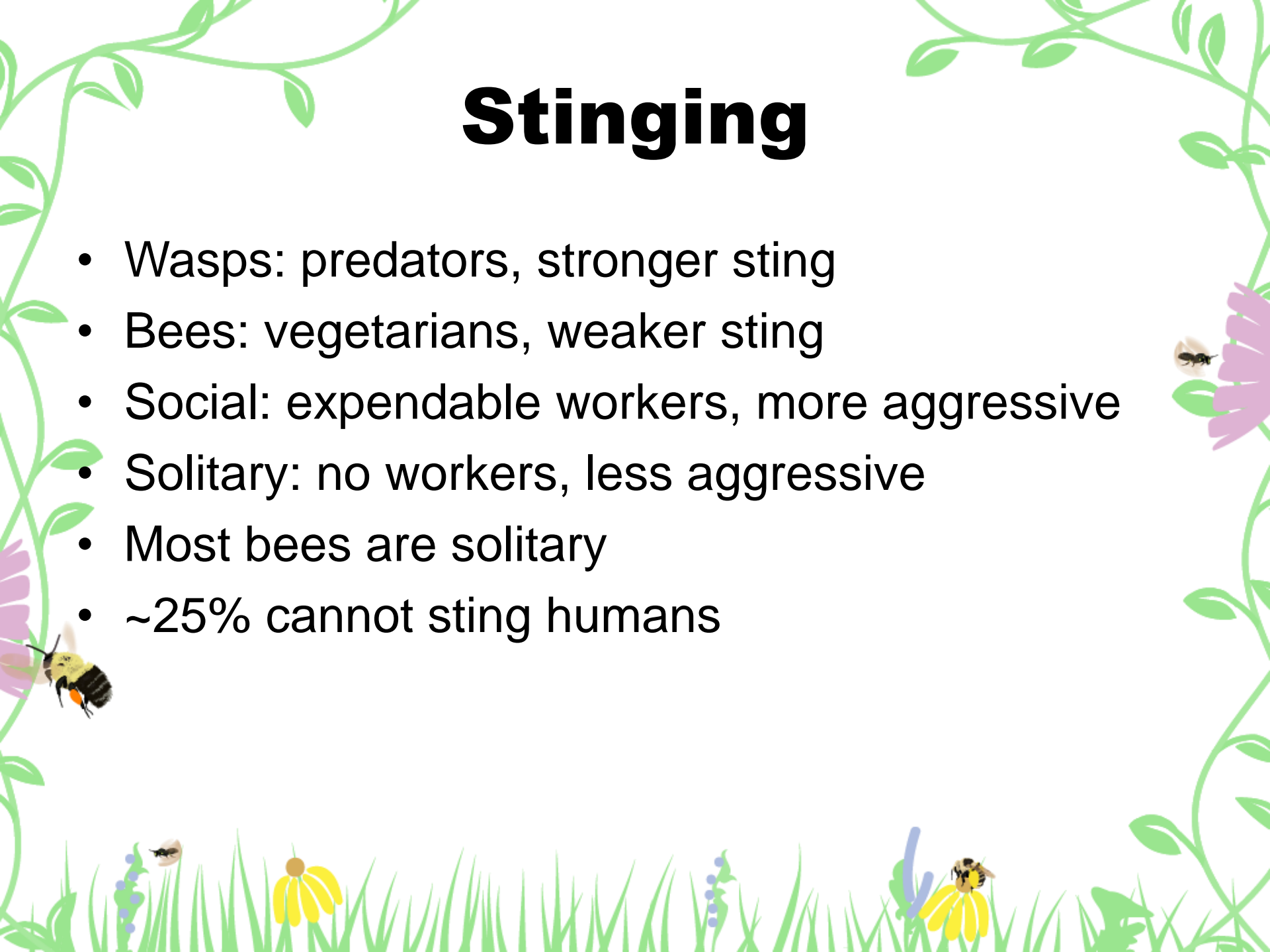
Branched (feathery) hairs

Expanded basitarsus ("ankle")



Stinging

- Wasps: predators, stronger sting
- Bees: vegetarians, weaker sting
- Social: expendable workers, more aggressive
- Solitary: no workers, less aggressive
- Most bees are solitary
- ~25% cannot sting humans



The Tickle Bees



Mace Vaughan, Xerces Society

Leafcutter Bees

Mason Bees

Parasitic Bees

Carpenter Bees

Celloph

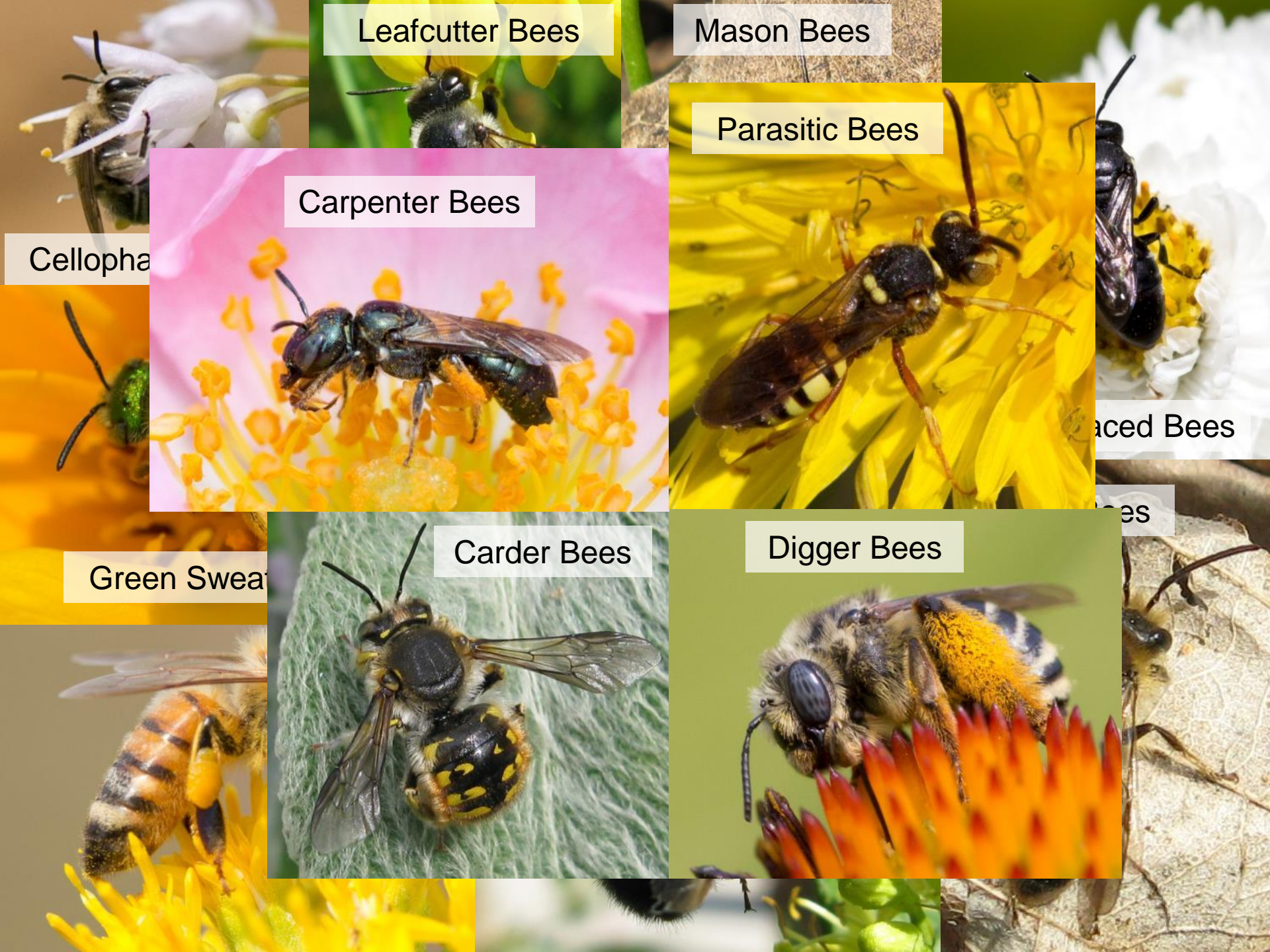
aced Bees

Green Swea

Carder Bees

Digger Bees

ees



A Bee's Life

- Honey bees: actually the rare exception
- ~90% of bees are solitary
 - Every bee her own queen
- Bumble bees: not as highly social as honey bees
- Sweat bees: sometimes social, sometimes not



Solitary Bee Life Cycle

Overwintering
~10 months



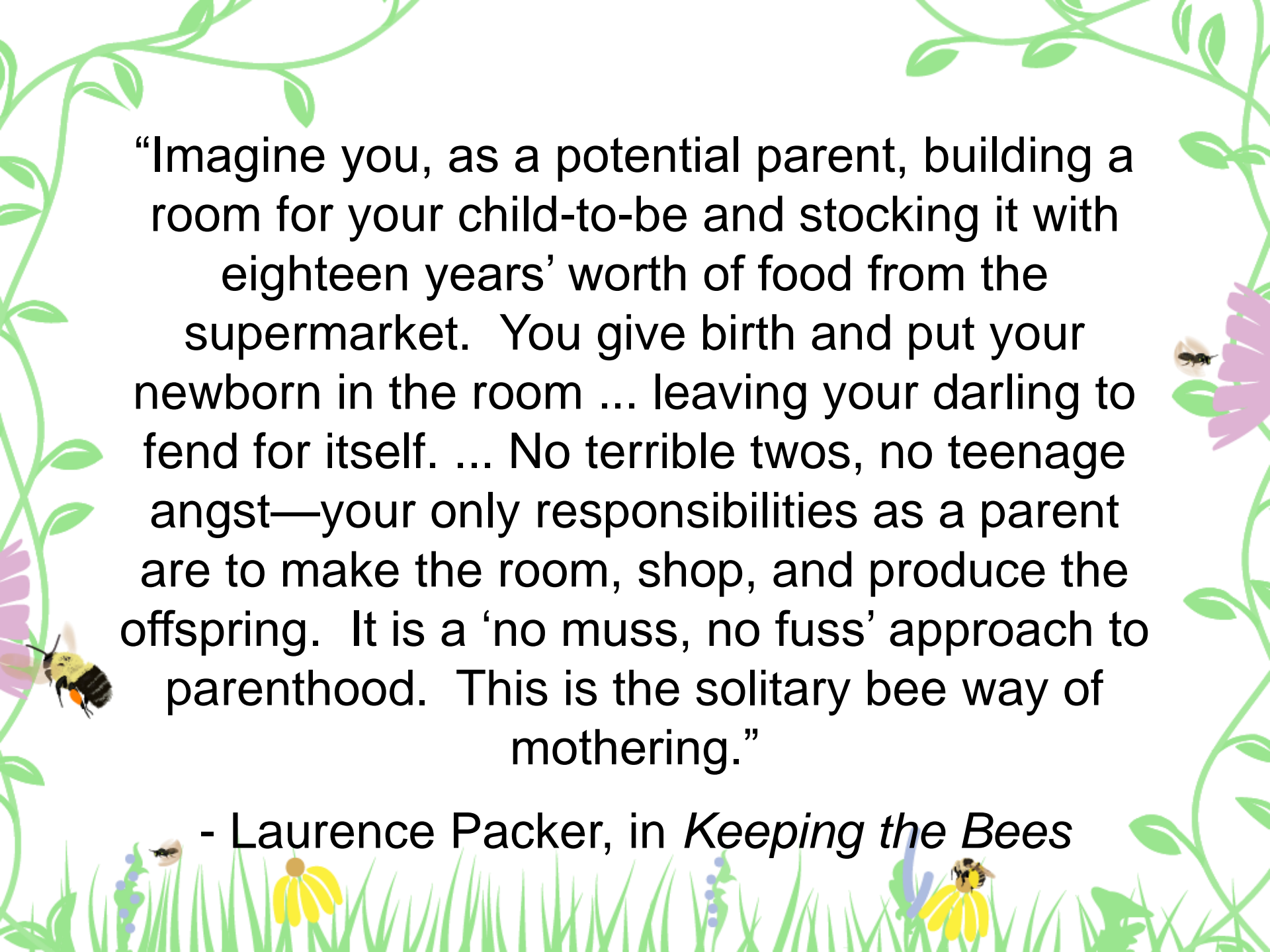
Emergence
1-10 days

Mating
1-3 days



Nest building (2-6 weeks)
and Growth (1-2 months)





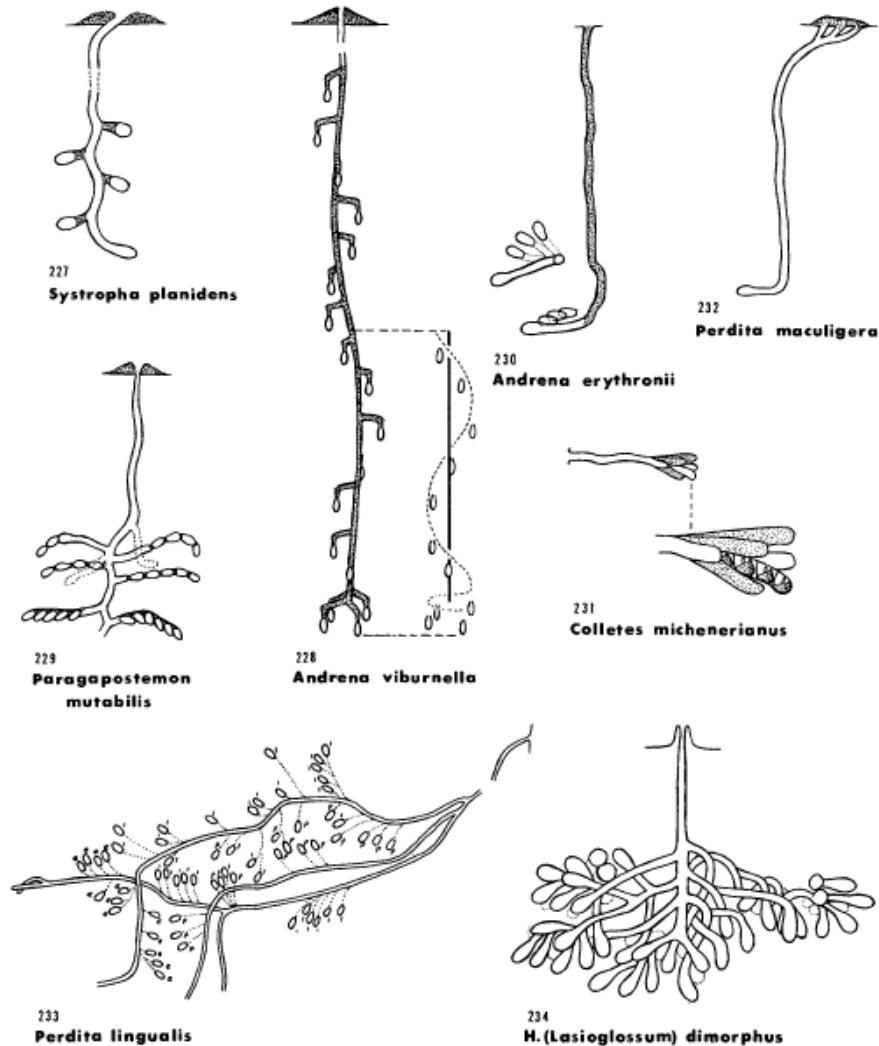
“Imagine you, as a potential parent, building a room for your child-to-be and stocking it with eighteen years’ worth of food from the supermarket. You give birth and put your newborn in the room ... leaving your darling to fend for itself. ... No terrible twos, no teenage angst—your only responsibilities as a parent are to make the room, shop, and produce the offspring. It is a ‘no muss, no fuss’ approach to parenthood. This is the solitary bee way of mothering.”

- Laurence Packer, in *Keeping the Bees*



Ground Nests

- Depth: <1" to 17 feet
 - Like digging a hole as deep as a football field is long
- Soil type: most prefer sand, but some use clay/silt loam
- Moisture: Desert to floodplain
- Terrain: Flat, sloped embankments or dunes, or vertical walls



Cavity Nests

- Locations:
 - soil, wood, stems/reeds, rock crevices, abandoned wasp/bee nests, snail shells, under bark, in galls, dried dung pats, termite nests
- Materials:
 - leaves, leaf pulp, dried mud, sand, resin, plant fibers, gravel, wood chips, and/or flower petals



Heather Holm



Bumble Bees

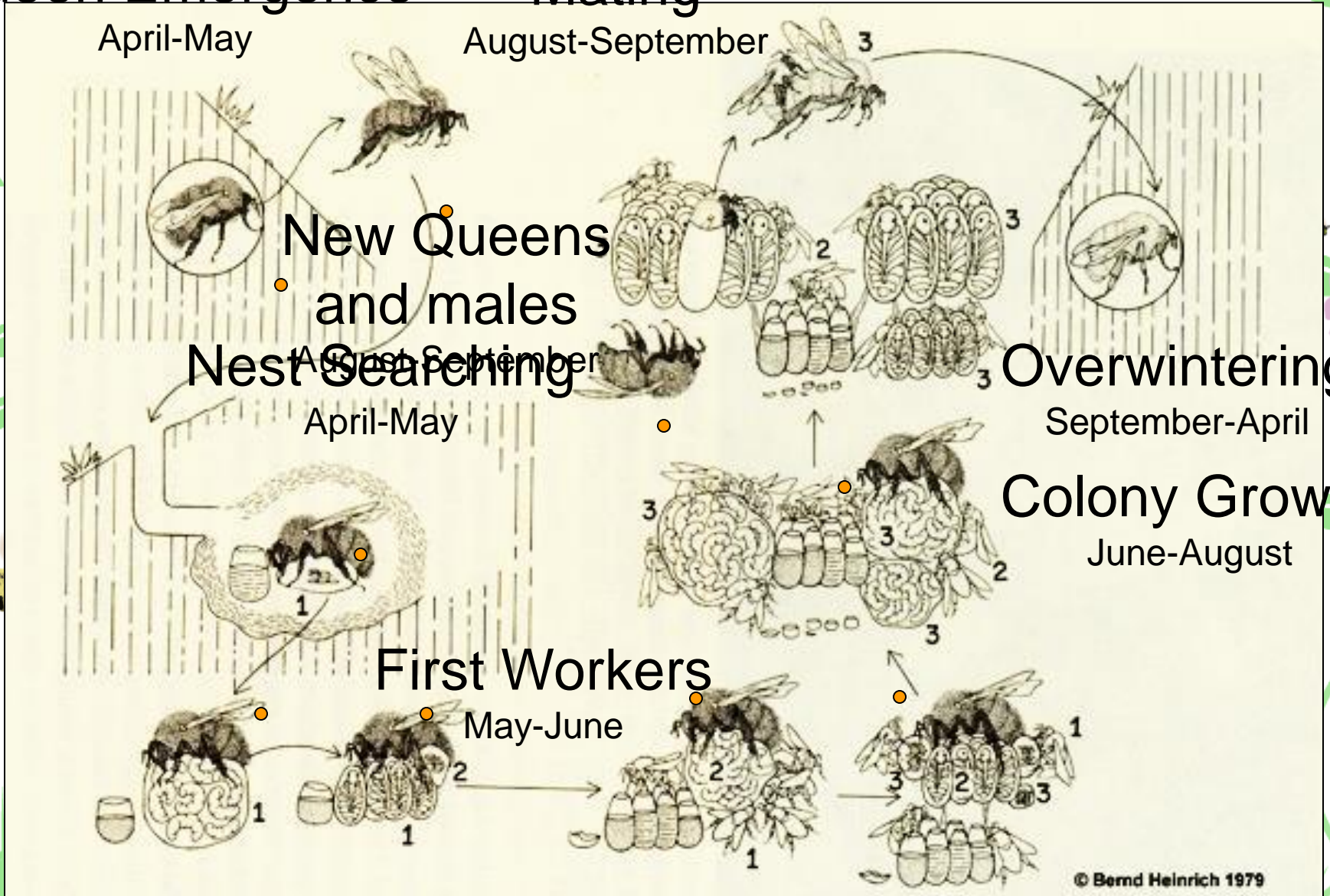
- Annual colonies
- No honey
- No advanced communication
- Queens are just bigger workers



Elaine Evans

Bumble Bee Colony Cycle

Queen Emergence Mating



What's so great about bees?

What's *not* great about bees?

- One of the only animals that can grow from egg to adult and never harm another living thing.
- *Your* continued survival depends on the regular sacrifice of lesser life forms.



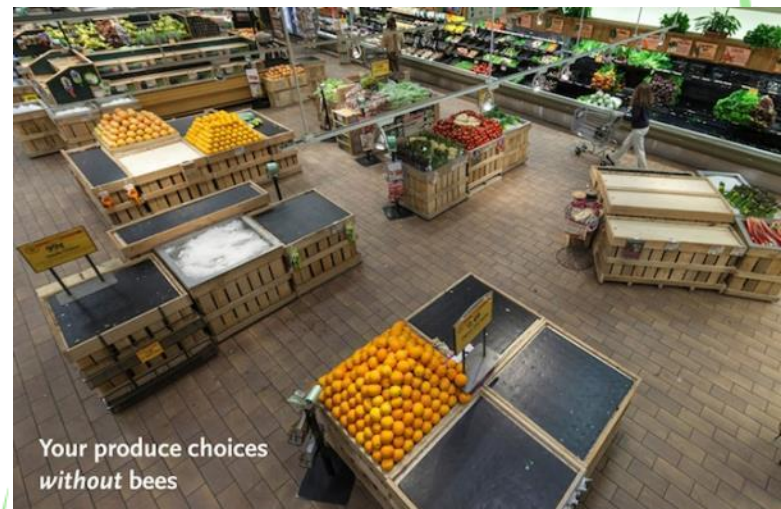
Pollination

- Most bees live on a pure nectar/pollen diet.
- Pollen = plant “sperm”
 - Protein source
- Nectar = incentive for bee visits
 - Carbohydrate source
- Pollination happens through bad table manners.



Pollination

- 35% of global food supply needs bee pollination (Klein et al. 2007)
- Most flowering plants need animal pollination
- Honey bees pollinate over \$14 billion worth of crops in U.S. (Morse and Calderone 2009)
- Honey bees are not alone



Native Bee Pollinators

- Blue Orchard Bee: solitary spring mason bee used mostly in fruit orchards
- Alfalfa Leafcutter Bee: solitary summer leafcutter bee used mostly in alfalfa
- More efficient pollinators than honey bees (Garibaldi et al. 2013)



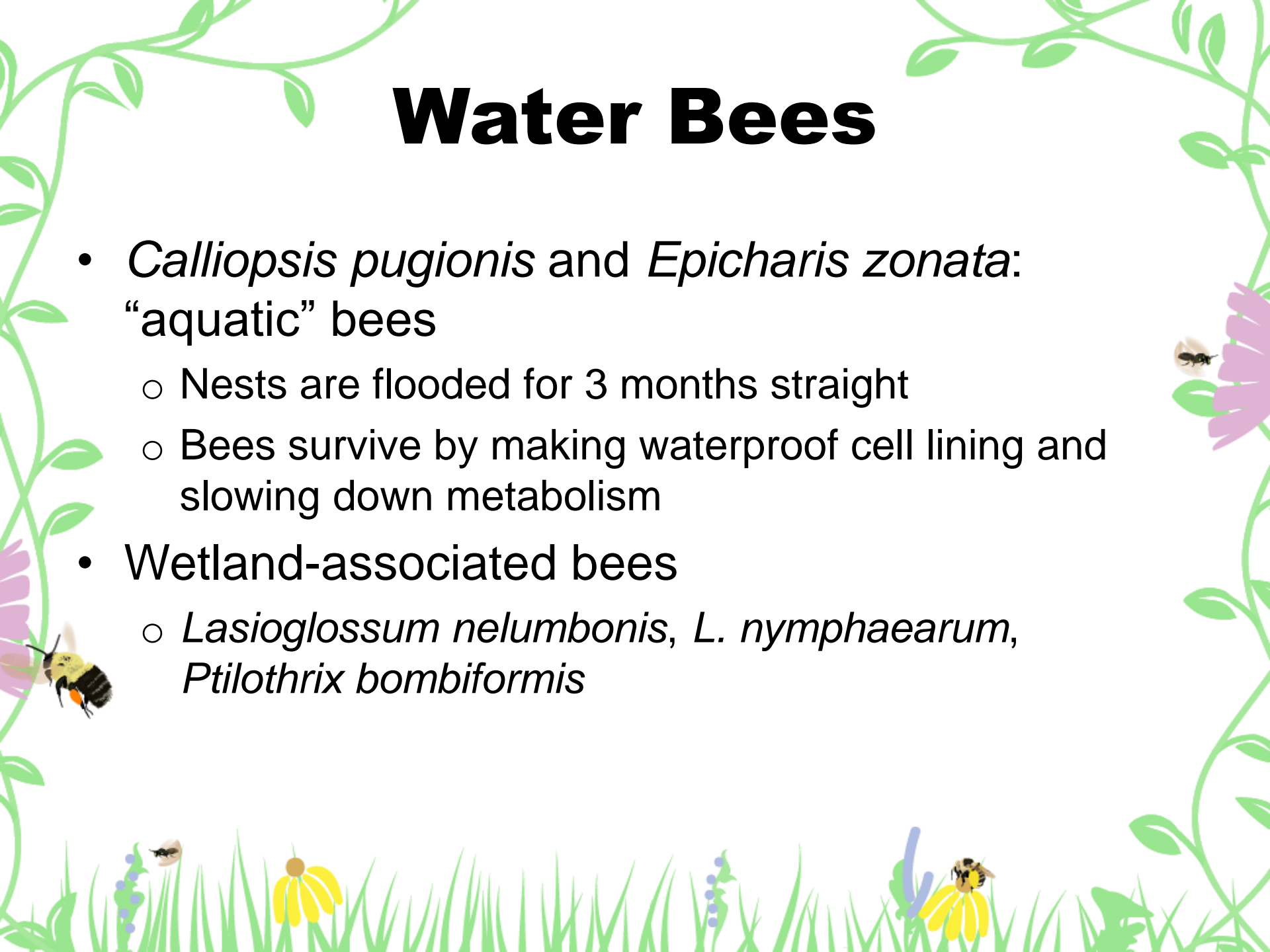
What do bees have to do with water?

- Not much. Bees are desert creatures.
 - Usually prefer dry, sandy soil; most diverse in SW.
- *But...* bees visit many of the same plants used in rain gardens.
- No pollination = no new plants = more runoff.

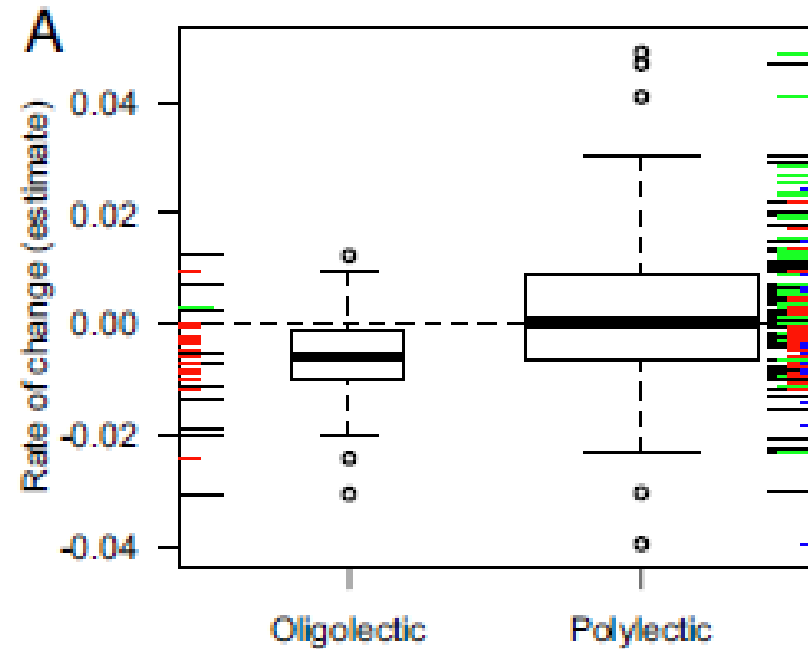
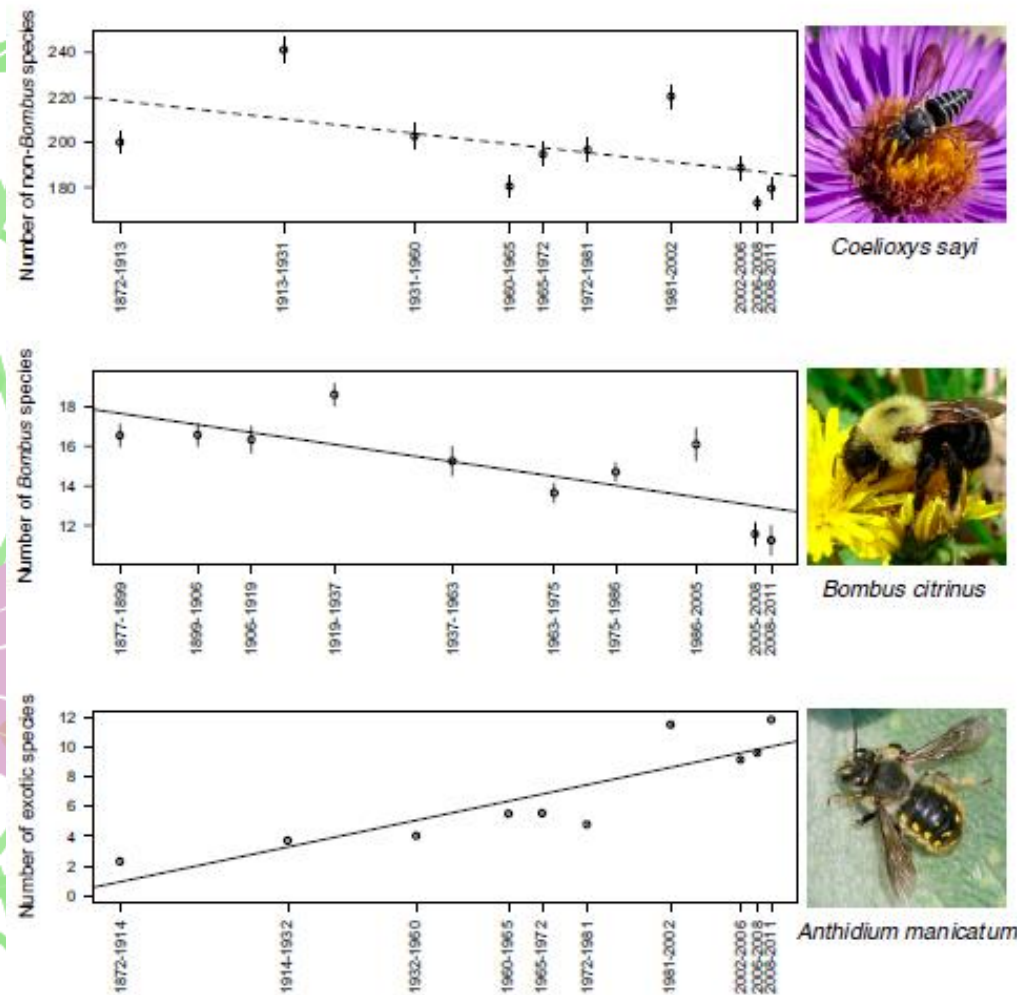


Water Bees

- *Calliopsis pugionis* and *Epicharis zonata*:
“aquatic” bees
 - Nests are flooded for 3 months straight
 - Bees survive by making waterproof cell lining and slowing down metabolism
- Wetland-associated bees
 - *Lasioglossum nelumbonis*, *L. nymphaearum*,
Ptilothrix bombiformis



What's the deal with declines?



Data from Bartomeus et al. 2013. Data is a compilation of >30,000 northeast U.S. bee specimens from various museums and recent surveys.

Why are bees disappearing?

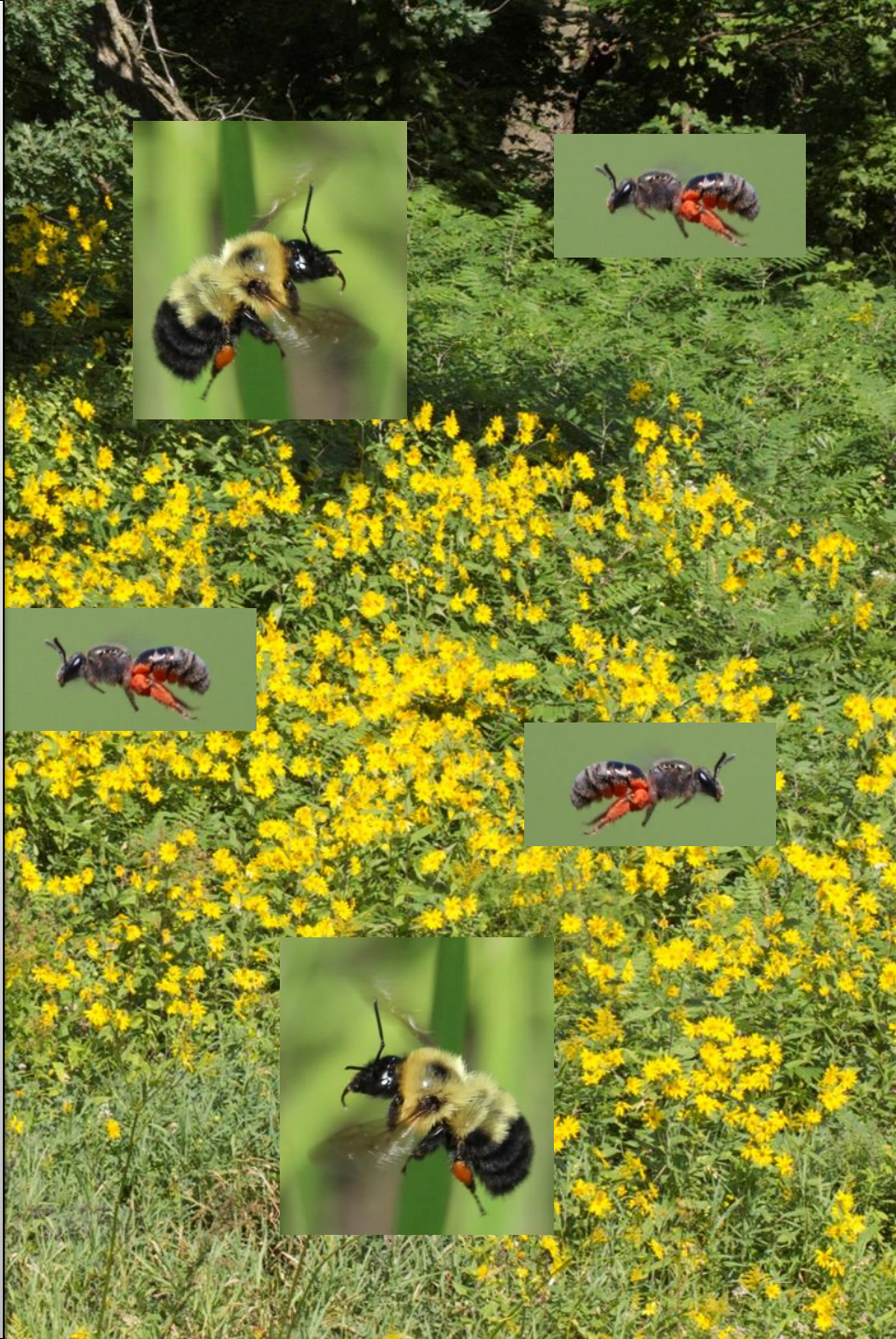
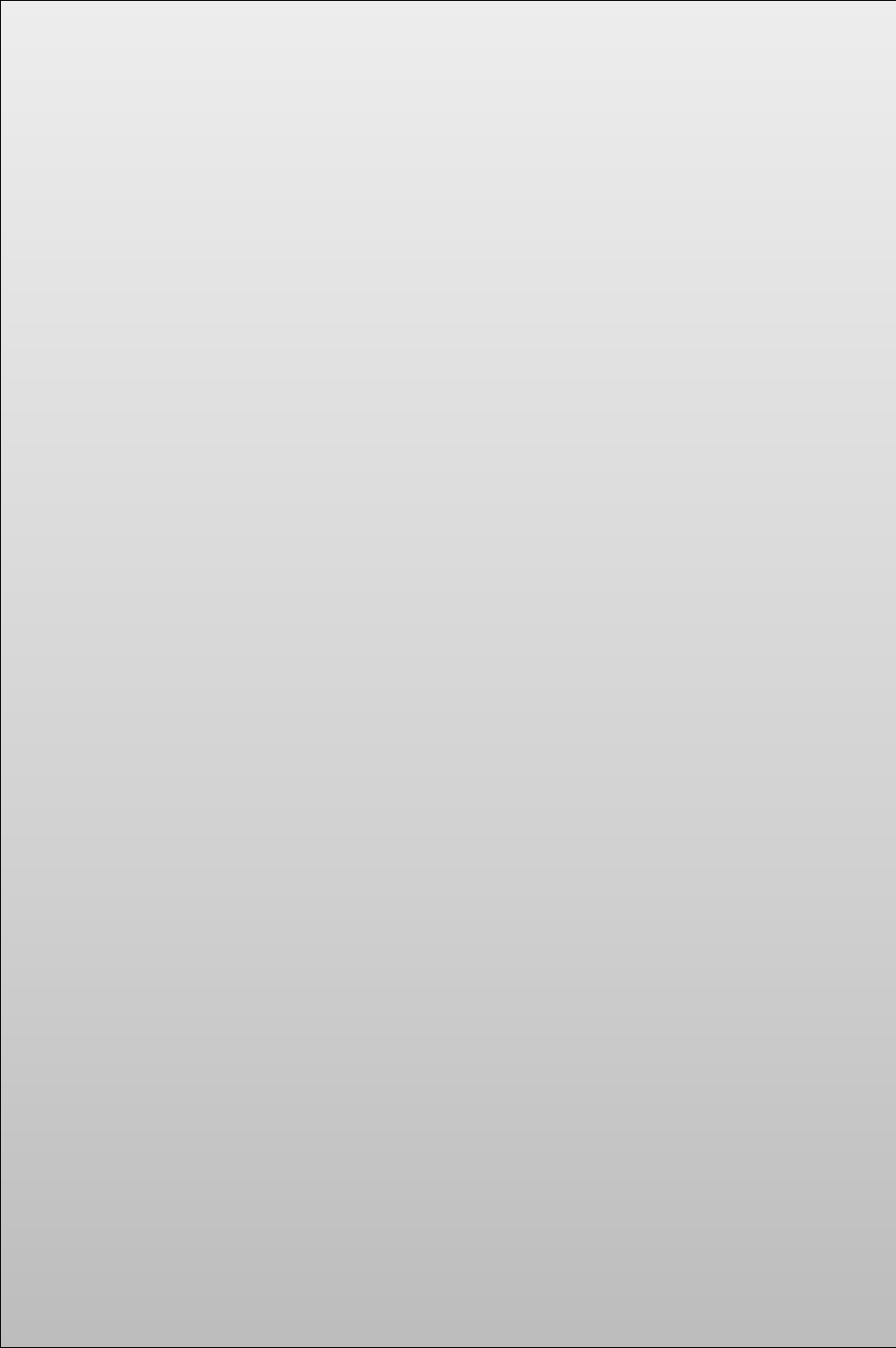
- Habitat loss/fragmentation
 - Agriculture (Burkle et al. 2013)
 - Urban growth (Frankie et al. 2006)
- Pesticide misuse (2013 Oregon bee kill)
- Disease (honey+bumble bees) (NRC 2007)
- Climate change (Burkle et al. 2013)

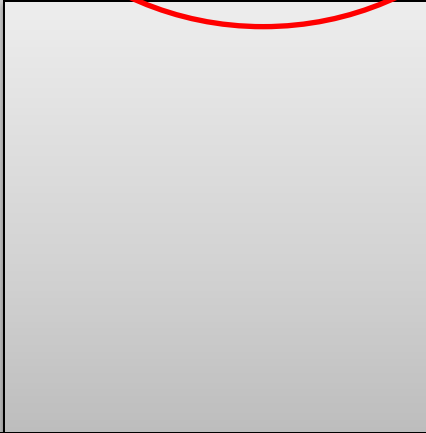
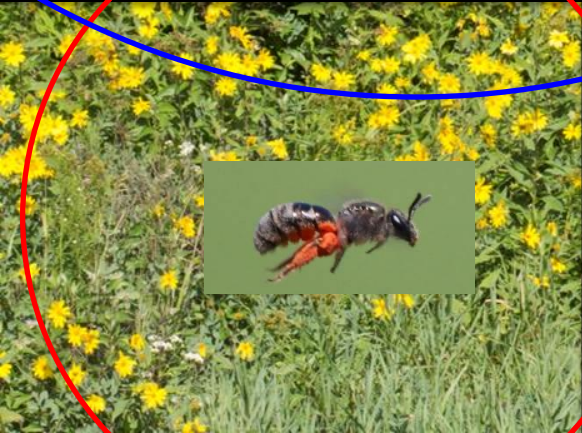
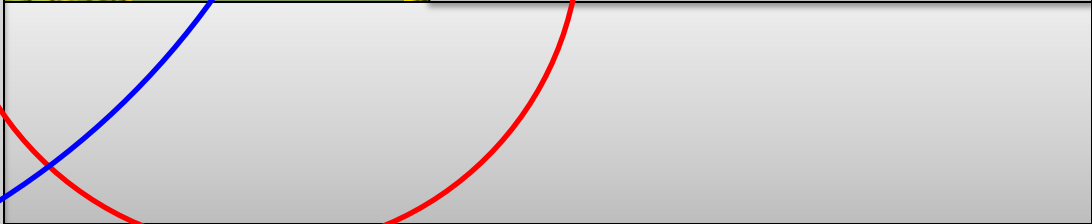
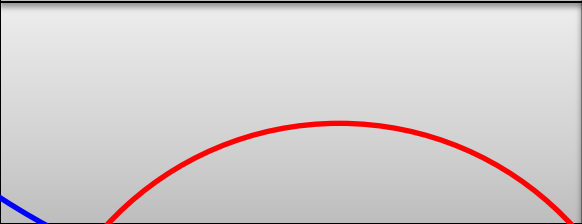
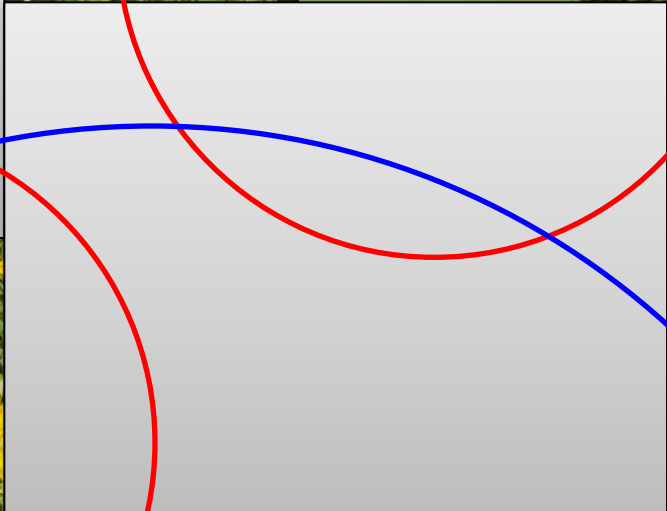
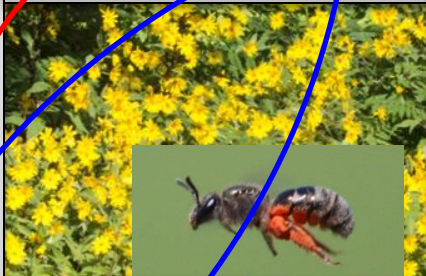
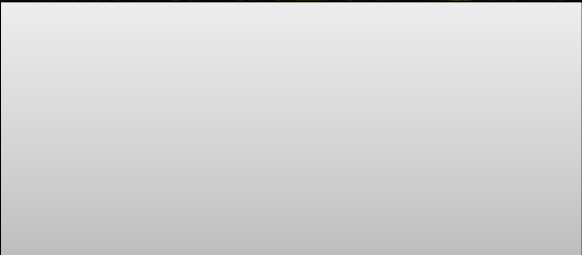
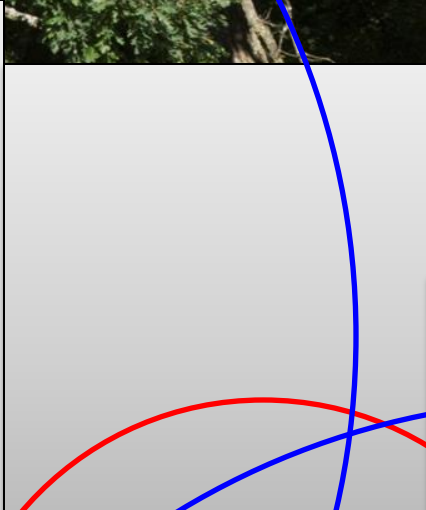


Flickr / Graylight



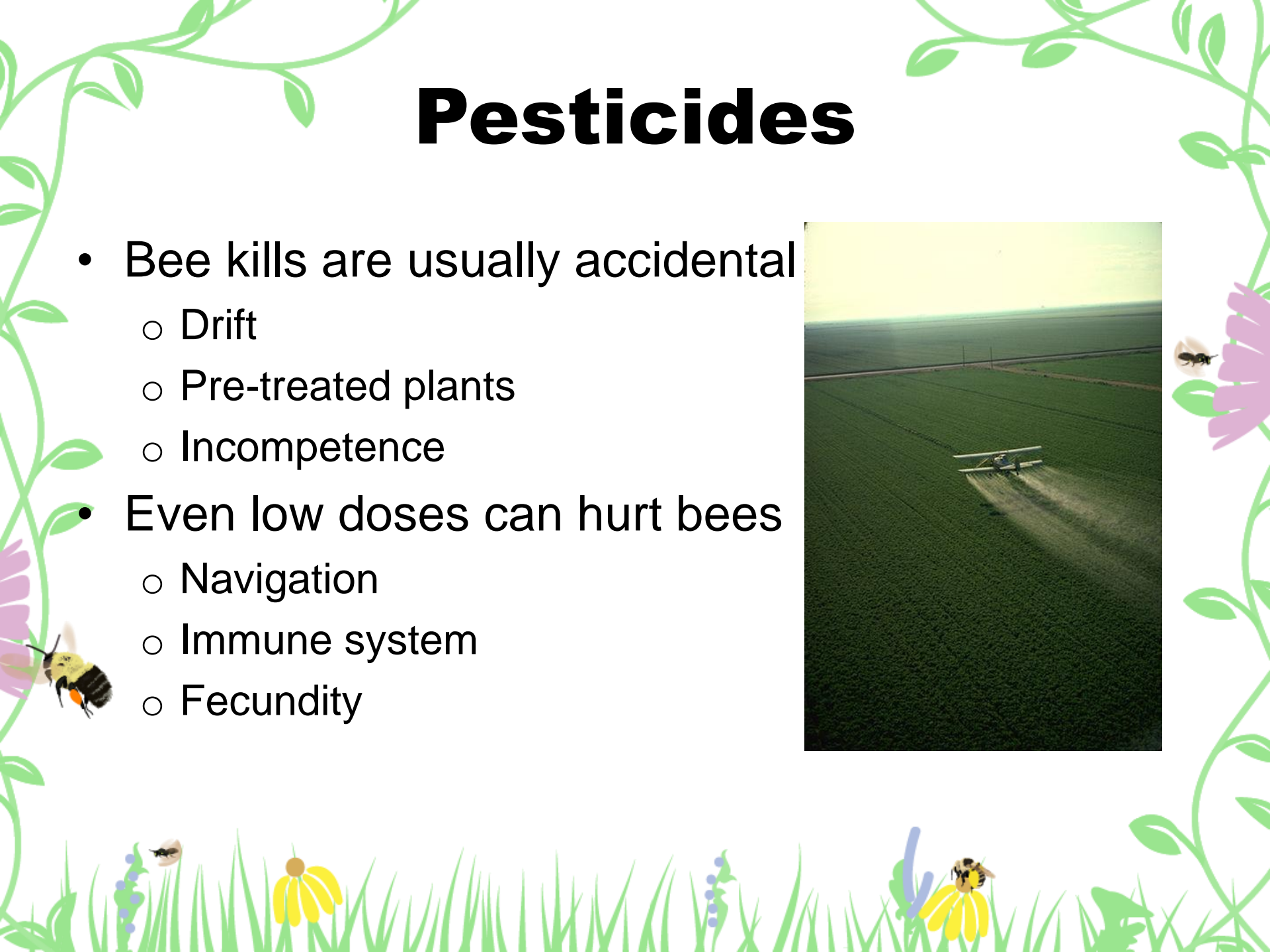
Rich Hatfield / Xerces Society





Pesticides

- Bee kills are usually accidental
 - Drift
 - Pre-treated plants
 - Incompetence
- Even low doses can hurt bees
 - Navigation
 - Immune system
 - Fecundity



Disease



Disease



Disease



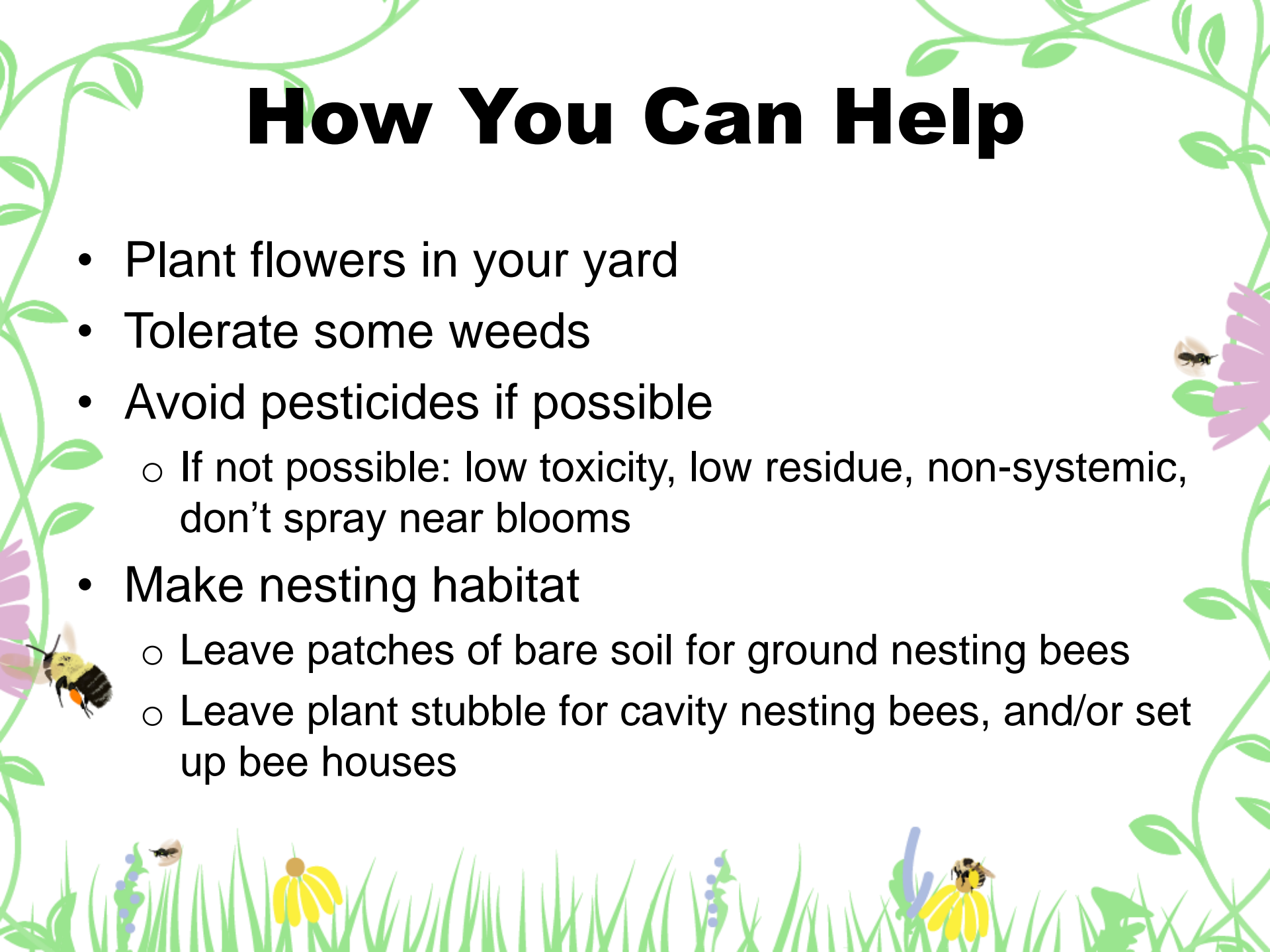
Disease

- *Bombus affinis* endangered in Canada
- *B. franklini* feared extinct
- *B. terricola*, *B. occidentalis*, *B. ashtoni*, possibly others declining



How You Can Help

- Plant flowers in your yard
- Tolerate some weeds
- Avoid pesticides if possible
 - If not possible: low toxicity, low residue, non-systemic, don't spray near blooms
- Make nesting habitat
 - Leave patches of bare soil for ground nesting bees
 - Leave plant stubble for cavity nesting bees, and/or set up bee houses



Bee Houses



Gardening for Bees

- Year-round bloom
- Native/wild varieties
 - Domestic cultivars bred for appearance, not nutrition
 - Systemic pesticides???
- Variety of flower depths
- Bees can't see red
 - Red flowers: great for butterflies and hummingbirds, not so much for bees
- Consider specialist bees



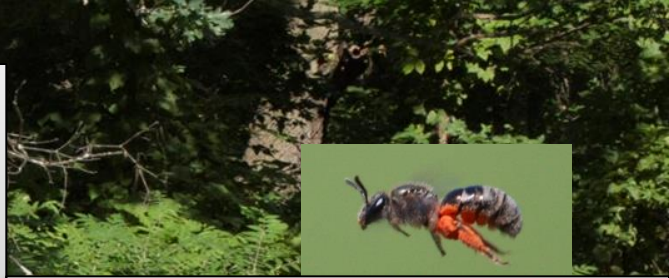
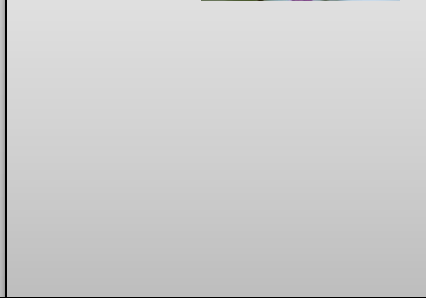
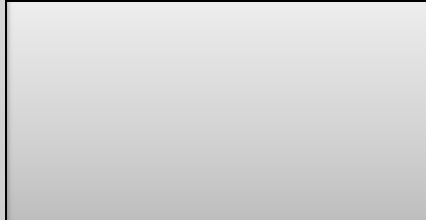
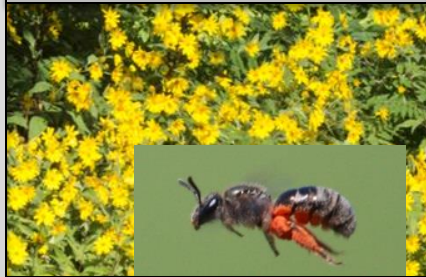
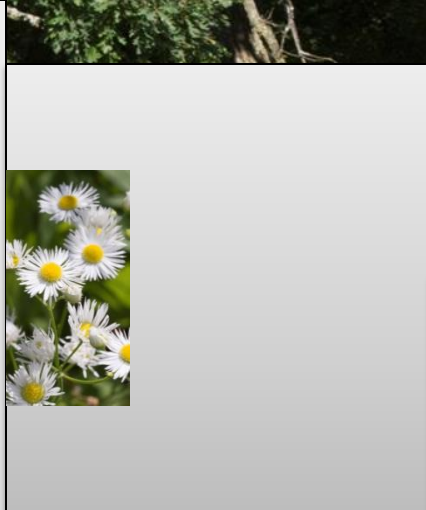
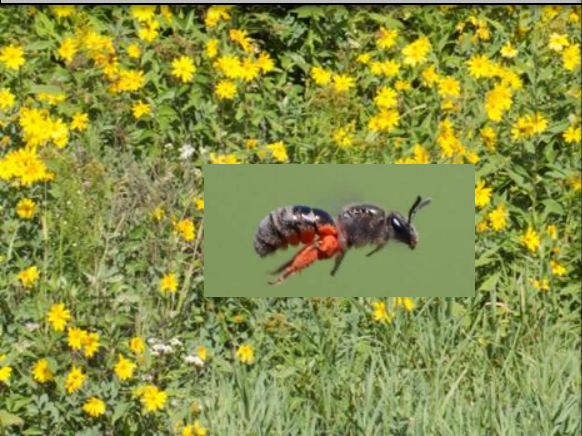
Short-tongued bee



Long-tongued bee



Here there be dragonflies



Here there be dragonflies



Willows

Salix spp. (Polycitoridae)

- Bloom: Early spring
- Wet soil
- Many specialist bees (*Andrena* spp.)



Black Willow (*Salix nigra*)
SB-Johnny

Pussy Willow
(*Salix discolor*)
Mick Garratt

Weeping Willow
(*Salix x sepulcralis*)
Liné1

Andrena sp.
Joel Gardner

Wild Geranium

Geranium maculatum (Geraniaceae)

- Bloom: Early-mid spring
- Shade (woodlands)
- Specialist bee: *Andrena distans*



Bombus impatiens queen
Joel Gardner



Lasioglossum (*Dialictus*) sp.
Joel Gardner

Beardtongues

Penstemon spp. (Scrophulariaceae)

- Bloom: Late spring/early summer
- Specialist bees: *Osmia distincta*, *O. proxima*, others



Penstemon digitalis
Kurt Stüber



Penstemon gracilis
Kurt Stüber



Osmia distincta
Tom Murray

Raspberries & Blackberries

Rubus spp. (Rosaceae)

- Bloom: Late spring/early summer/fall
- Old canes provide nest sites



Blackberry

Rubus sp.

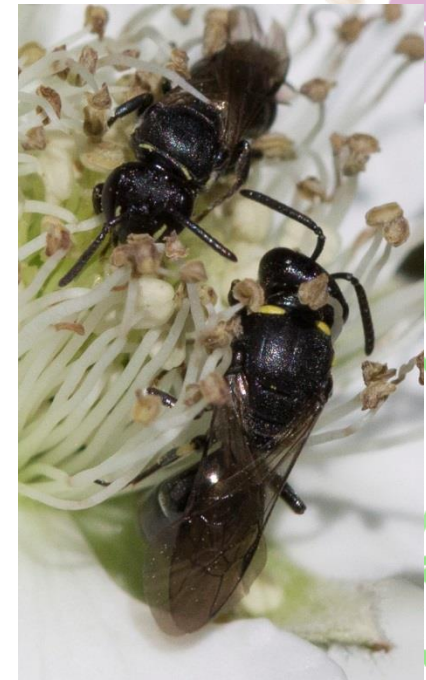
Joel Gardner



Black raspberry

Rubus occidentalis

Jennifer Anderson



Hylaeus sp.

Joel Gardner

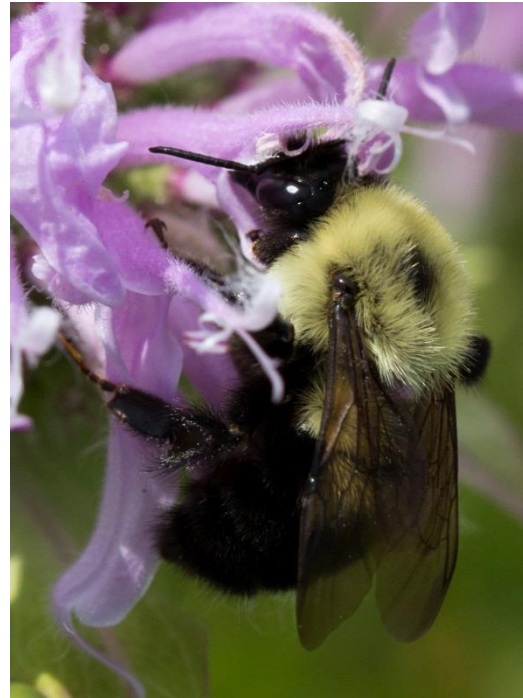
Bee Balm

Monarda spp. (Lamiaceae)

- Bloom: Midsummer
- Specialist bee: *Dufourea monardae*



• Wild bergamot
• *Monarda fistulosa*
• Jerry Friedman



Bombus bimaculatus
Joel Gardner



Dufourea monardae
Jason Gibbs

Anise Hyssop

Agastache foeniculum (Lamiaceae)

- Bloom: Midsummer to fall



Joel Gardner



Megachile sp.
Heather Holm

Sunflowers

Helianthus spp. (Asteraceae)

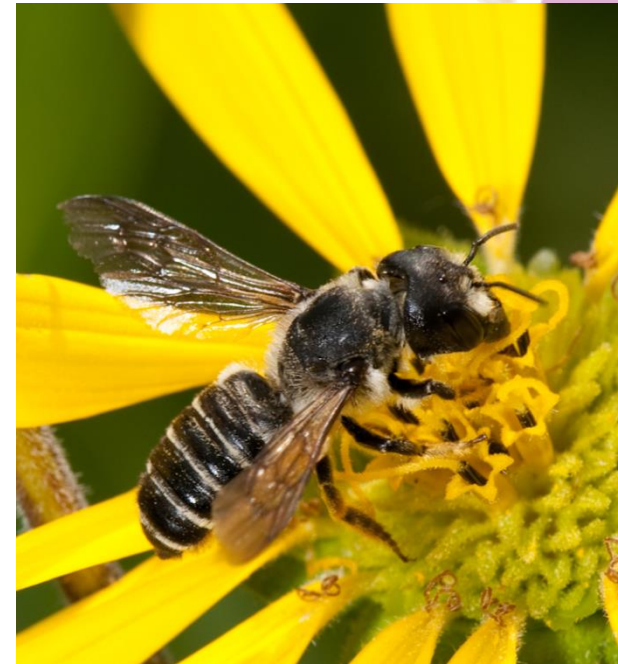
- Bloom: Midsummer to fall
- Specialist bees: Many *Andrena* and others



Early sunflower
Heliopsis helianthoides
Bokske



Dianthidium simile
Joel Gardner



Megachile pugnata
Heather Holm

Thistles

Cirsium spp. (Asteraceae)

- Bloom: Late summer
- Specialist bee: *Melissodes desponsa*



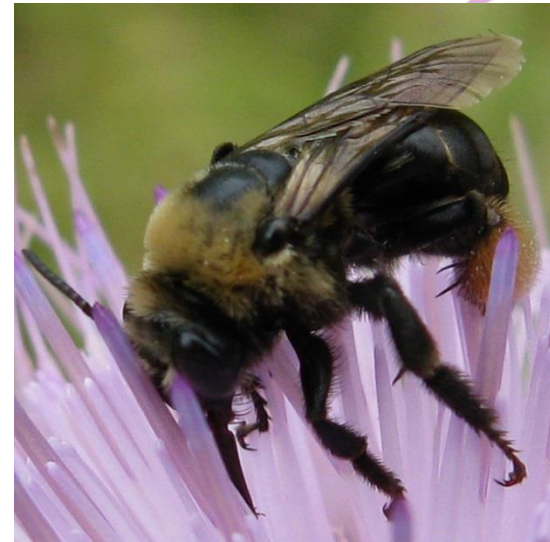
Field thistle
Cirsium discolor
George Mayfield



Bull thistle
Cirsium vulgare
Lionel Allorge



Canada thistle
Cirsium arvense
Lionel Allorge



Melissodes desponsa
Joel Gardner



Joe Pye Weed

Eutrochium spp. (Asteraceae)

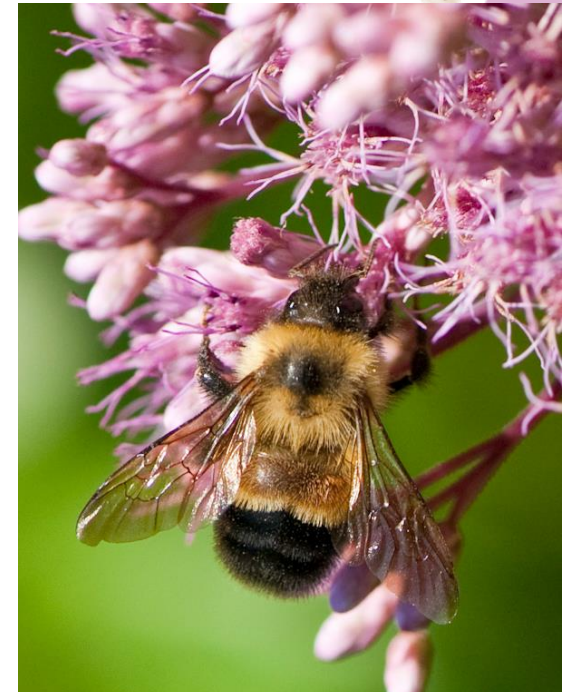
- Bloom: Late summer
- Wet soil



Sweet joe pye weed
Eutrochium purpureum
Kurt Stüber



Bombus rufocinctus
Joel Gardner



Bombus affinis
Heather Holm

Goldenrods

Solidago spp. (Asteraceae)

- Bloom: Late summer to fall
- Specialist bee: *Andrena hirticincta*



Rigid goldenrod
Solidago rigida
Matt Lavin



Green sweat bee on
Canada goldenrod
Joel Gardner



Andrena hirticincta
Heather Holm

Asters

Aster, Symphyotrichum spp. (Asteraceae)

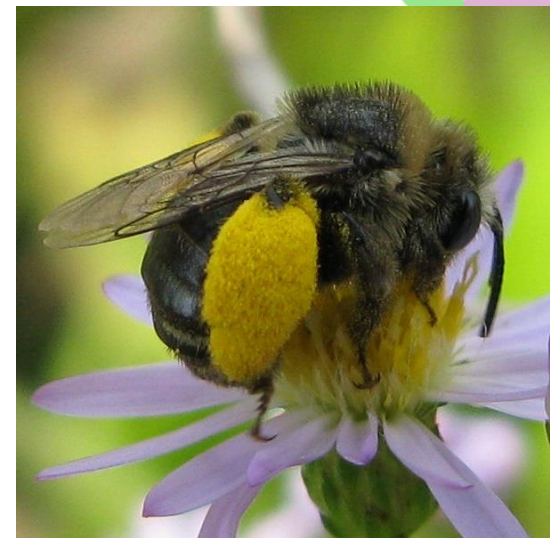
- Bloom: Late summer to fall
- Often last plants to bloom before winter



Heath aster
Symphyotrichum ericoides
Joel Gardner

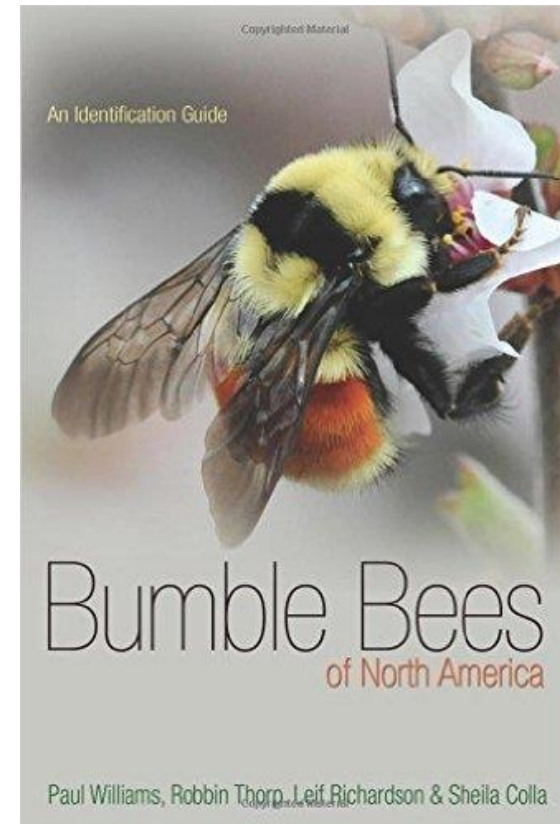
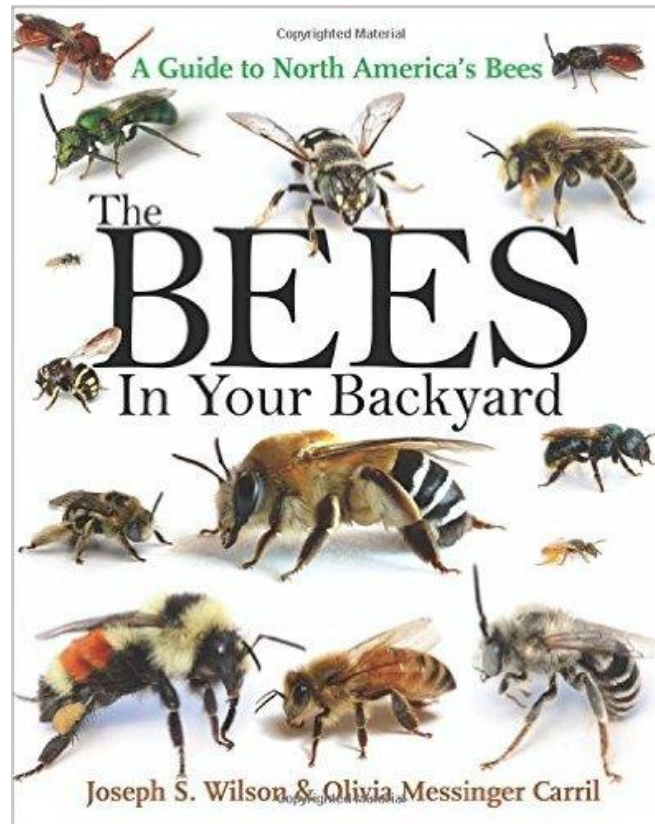
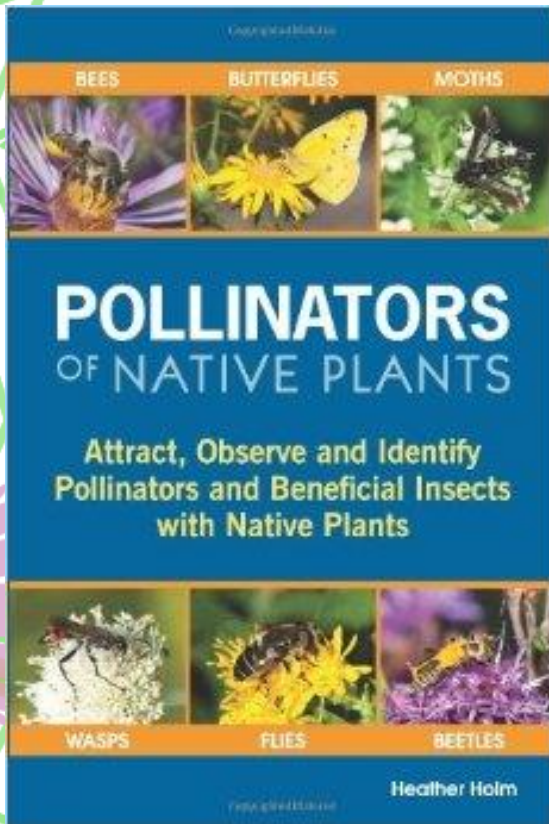


New England aster
S. novae-angliae
Joel Gardner



Melissodes druriella
Joel Gardner

More Information



www.beelab.umn.edu

Citizen Science

- Bumble Bee Watch (bumblebeewatch.org)
- Queen Quest (bumbleboosters.unl.edu)
- MN Bumble Bee Survey (facebook.com/minnesotabumblebeesurvey)
- UF Native Buzz (ufnativebuzz.com)
- Great Sunflower Project (greatsunflower.org)



Questions



Bee Lab

