The Buzz in Your Garden: Helping Native Bees 2/26

Judy Cardin

Judy Cardin- Presenter

- Educator, WDNR Bumble Bee Brigade Citizen Science Program
- UW-Madison Arboretum volunteer, mentored on native plants by Susan Carpenter, Arboretum Native Plant Curator
- Chair, Friends of the Arboretum Grass to Garden Program, Co-chair FOA Native Plant Sale
- Wild Ones Native Plant Certification Instructor
- Converted our urban yard over a 20 year to native habitat: over 350 native plant species and 25,000 native plants
- Bee surveyor: conducted hundreds of surveys for Bumble Bee Brigade, UW Arboretum, and the USGS
- Author "Rusty Patched Bumble Bee Floral Phenology" https://online.flippingbook.com/view/810946527/
- Co-Administrator of Wisconsin/Midwest Bumble Bee Observers Facebook page

Training Topics

- Midwest Bees
- Pollinators Need Our Help: Native Habitat is Needed
- Endangered Rusty Patched Bumble Bee
- Native Solitary Bee Nest and Hibernation Habitat
- Bumble Bees:
  - Life Cycle
  - Nest and Hibernation Habitat Needs
  - Flower and Habitat Needs
  - Community Science
  - Bumble Bee ID

What bees will be buzzing in your yard?

Your habitat decisions make a difference. Let’s talk possibilities.

Midwest Bees

Over 500 bee species

- 80% solitary bees
  - 30% stem, cavity and wood nesters
  - 70% ground nesters
- 20% social bees
  - Bumble bees
  - Species of Halictidae sweat bees
  - Honey bees- non native managed agricultural bee

Andrenidae

4 genera, 112 species

Mining bees *Andrena*, *Calliopsis*, *Protandrena*

Fairy bees *Perdita*

MORE INFO

MORE INFO

Apidae

15 genera, 133 species

Bumble bees *Bombus*

Longhorn bees *Epimelissodes*, *Eucera*, *Melissodes*

Carpenter bees *Ceratina*, *Xylocopa*

Honey bees *Apis*

Digger bees *Anthophora*

Cuckoo bees *Brachymelecta*, *Epeolus*, *Holcopasites*, *Nomada*, *Neolarra*, *Triepeolus*

Squash bees *Xenoglossa*

Colletidae

2 genera, 39 species

Cellophane (Plasterer) bees *Colletes*

Masked (Yellow-faced) bees *Hylaeus*

MORE INFO

MORE INFO

Halictidae

10 genera, 134 species

Metallic green sweat bees *Agapostemon*, *Augochlora*, *Augochlorella*, *Augochloropsis*

Large sweat bees *Dieunomia*, *Nomia*

Short-faced bees *Dufourea*

Sweat bees *Halictus*

Small sweat bees *Lasioglossum*

Cuckoo (blood) bees *Sphecodes*

MORE INFO

Megachilidae

14 genera, 86 species

Resin and pebble bees *Anthidiellu*
Dianthidium, *Heriades*, *Paranthidiu*

Carder bees *Anthidium*, *Pseudoanthidium*

Mock orange bees *Chelostoma*

Mason bees *Osmia*, *Hoplitis*

Leafcutter bees *Megachile*

Sharp-tailed cuckoo bees *Coeliox*

Dark cuckoo bees *Stelis*

Melittidae

1 genus, 3 species

Loosestrife oil bees *Macropis*

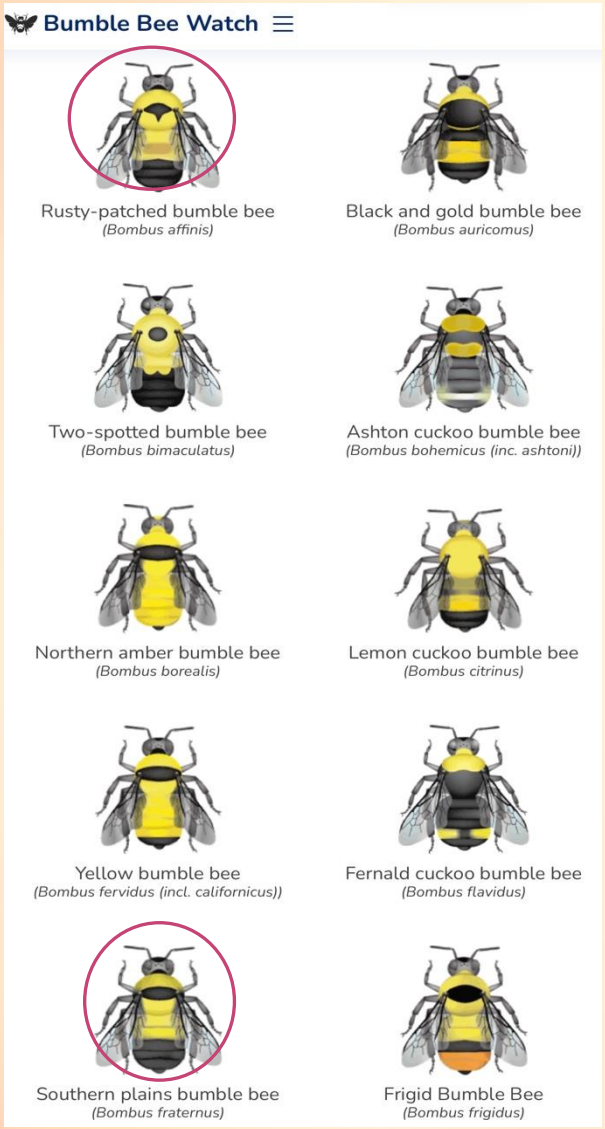
MORE INFO

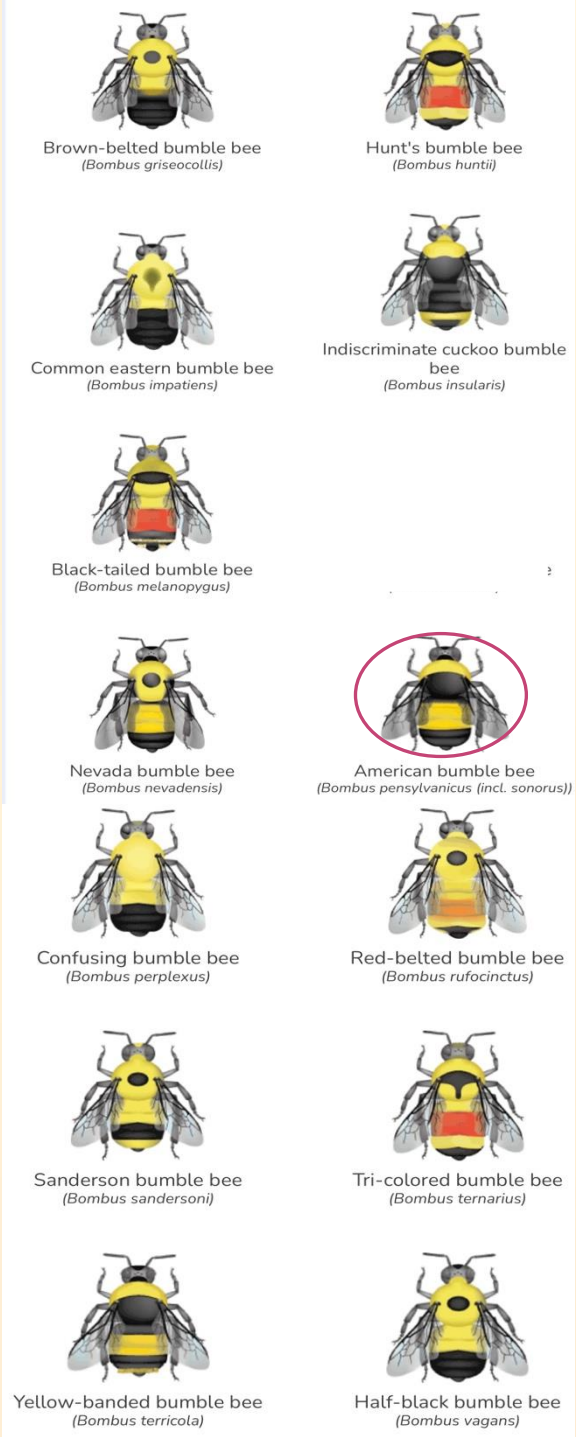
Minnesota Native Bees

Honeybees: Agricultural pollinator that does not need our help

- Non native bee
- Perennial colonies of thousands of bees that need huge floral resources
- Can spread disease to native bees
- Please don’t keep backyard urban hives

Midwest Bumble Bee Species

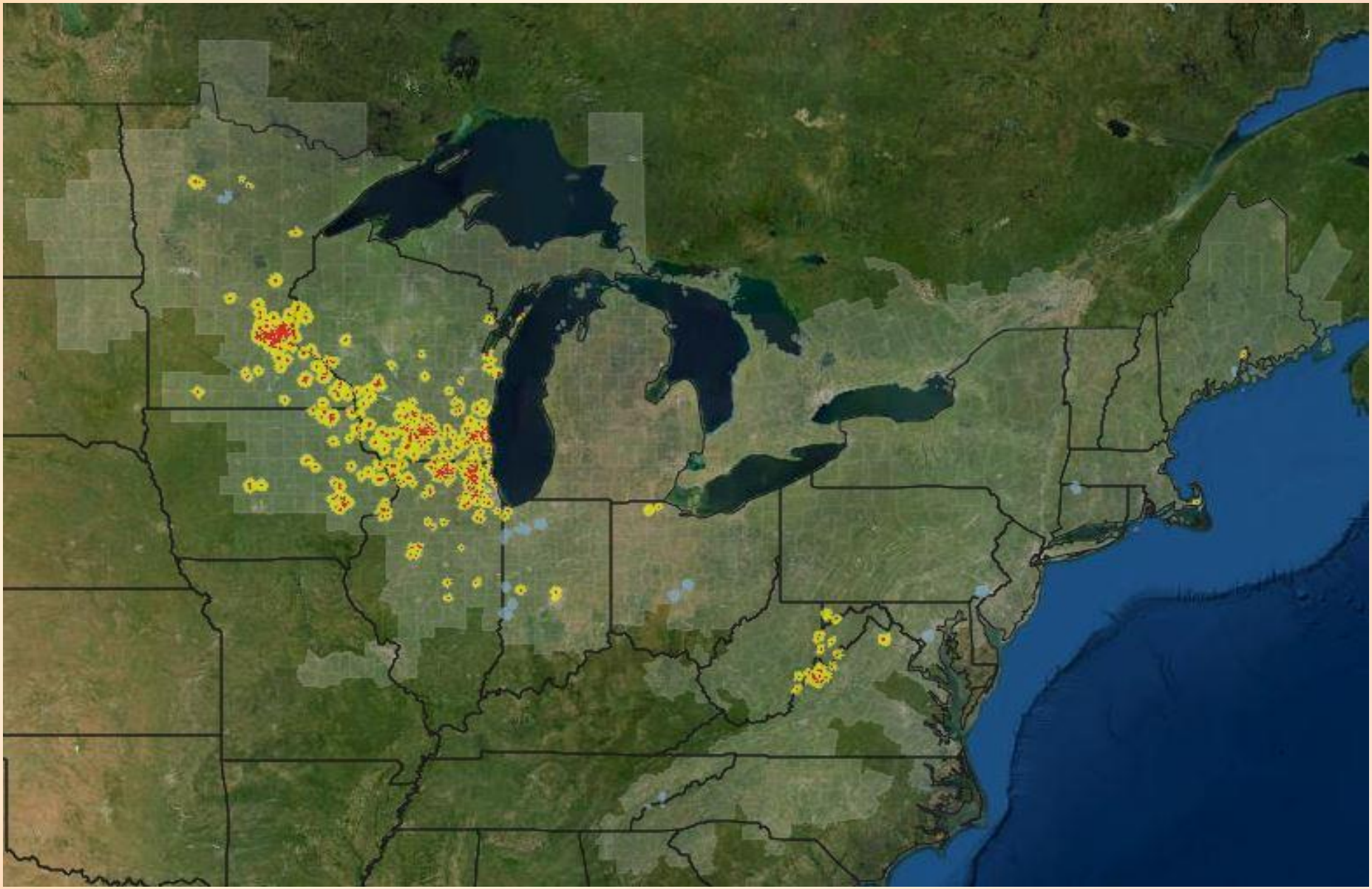




About 1/3 of bumble bees face serious threat of extinction

Native bees, and the Rusty patched bumble bee in particular, need our help

Rusty Patched Bumble Bee has population declined by nearly 90%, declared federal endangered species in 2017



Threats to Pollinators

Photos: Xerces Society/Rich Hatfield; istock.com; Xerces Society/Eric Lee-Mäder; Xerces Society/Candace Fallon

Conservative estimates are that world insect population declined by 25% in the last thirty years. In North America, we are currently losing over 2% of our insect population per year.

What can we do to help?

Pollinators need native habitat in urban yards to replace lost habitat

- Shrink turf lawn, grow diverse native plants with nectar and pollen rich flowers that collectively bloom from April through October
- Allow natural habitat that supports nests and hibernation
  - leave the leaves, stems, rocks, sticks
  - Keep a brush pile
  - leave rodent holes
- Avoid all pesticide use: herbicides, insecticides, fungicides and rodenticides

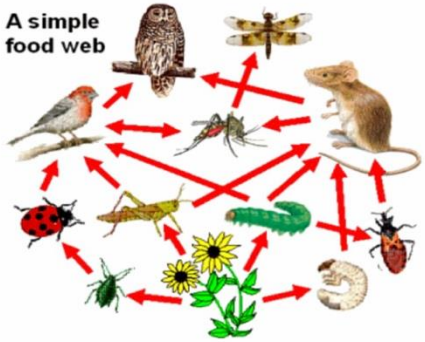
A tiger swallowtail on coneflower

A bumblebee on Virginia bluebell

Monarch chrysalides on milkweed

WHY PLANT NATIVE SPECIES?

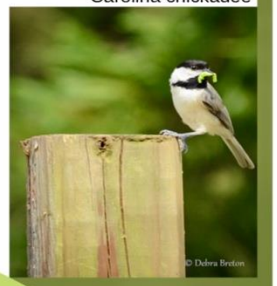
As primary producers, plants form the foundation of food webs. The wildlife of a region co-evolve with its plant communities, making local native plants the best food sources. Many insects, in particular, are entirely dependent on specific plant species. Insects, in turn, feed animals higher in the web.



Oaks alone feed the caterpillars of over 500 species of butterflies and moths

And it requires at least 6,000 caterpillars to raise one clutch of chickadees

Carolina chickadee



nature forward

Evolved Native Plant/ Pollinator Relationships

1. Larval host plants for moths and butterflies
2. Pollen host plants for pollen specialist bees- about 1/3 of all bee species
3. Diverse flower species for generalist pollinators that meet specific needs:
   - shapes and sizes for long and short tongued bees
   - immune properties
   - phenology- the right flowers at the right time

Native Habitat

NATIONAL WILDLIFE FEDERATION

Keystone Native Plants

Eastern Temperate Forests – Ecoregion 8

Native plants have tight relationships with wildlife, formed over many thousands of years, providing natural sources of food, cover and places to raise young. Without healthy native plant communities, wildlife cannot survive. Every ecoregion has different native plant communities.

Keystone plants are native plants critical to the food web and necessary for many wildlife species to complete their life cycle. Without keystone plants in the landscape, butterflies, native bees, and birds will not thrive. 96% of our terrestrial birds rely on insects supported by keystone plants.

There are two types of keystone plants:

Host plants that feed the young caterpillars of approximately 90% of butterflies and moths (Lepidoptera).

Plants that feed specialist bees who only eat pollen from specific plants. Keystone plants for native bees feed both specialist and generalist bees.

Entomologist Dr. Doug Tallamy, and his University of Delaware research team have identified the keystone plants that support butterfly and moth species. Native host plants of pollen specialist bees were researched by pollinator conservationist Jarrod Fowler.

Top Keystone Plant Genera in Eastern Temperate Forests - Ecoregion 8

A genus is a taxonomic category of plants that contains one or more species of plants with similar characteristics. Species within each genus have adapted to local conditions and are the appropriate native species or varieties suited to a specific ecoregion. To find species by zip code, check out the Native Plant Finder.

Plant type	Plant genus	Sample of common species (not all encompassing)	# of caterpillar species that use this as a host plant	# of pollen specialist bee species that rely on this plant
Trees	*Quercus*	White oak *(quercus alba)*, black oak *(quercus velutina)*	436	
	Prunus	American plum *(prunus americana)*, black cherry *(prunus serotina)*, chokecherry *(prunus virginiana)*	340	
	Betula	River birch *(betula nigra)*, sweet birch *(betula lenta)*	284	
	Populus	Eastern cottonwood *(populus deltoides)*	249	
	Acer	Box elder *(acer negundo)*, silver maple *(acer saccharinum)*, sugar maple *(acer saccharum)*	238	
	Malus	Southern crabapple *(malus angustifolia)*, sweet crabapple *(malus coronaria)*	237	
	Alnus	Gray alder *(alnus incana)*	213	
	Pinus	Pitch pine *(pinus rigida)*, Eastern white pine *(pinus strobus)*, Virginia pine *(pinus virginiana)*	200	
Shrubs	*Vaccinium*	Northern highbush blueberry *(vaccinium corymbosum)*, black highbush blueberry *(vaccinium fuscatum)*, hillside blueberry *(vaccinium pallidum)*	217	14
1	*Salix*	Prairie willow *(salix humilis)*, black willow *(salix nigra)*	289	14
Flowering perennials	*Solidago*	Stiff leaf goldenrod *(solidago rigida)*, Atlantic goldenrod *(solidago arguta)*	104	42
	Symphyatrichum	Blue wood aster *(symphyotrichum cordifolium)*, smooth aster *(symphyotrichum laeve)*	100	33
	Helianthus	Woodland sunflower *(helianthus divaricatus)*, small woodland sunflower *(helianthus microcephalus)*	66	50
	Rudbeckia	Black-eyed susan *(rudbeckia hirta)*, green-headed coneflower *(rudbeckia laciniata)*	20	29
	Heterotheca	Camphorweed *(heterotheca subaxillaris)*		24
	Grindelia	Curlycup gumweed *(grindelia squarrosa)*		31
	Chrysopsis	Maryland golden-aster *(chrysopsis mariana)*	5	20
	Coreopsis	Lanceleaf coreopsis *(coreopsis lanceolata)*, large flower coreopsis *(coreopsis grandiflora)*	7	22
	Bidens	Devils's beggartick *(bidens frondosa)*, small beggartick *(bidens discoidea)*		15
	Verbesina	Wingstem *(verbesina alternifolia)*	20	17

Top 30 Keystone Plant Genera for Butterfly and Moth Caterpillars

Genus	Common plant name	# of caterpillar species that use this as a host plant
Quercus	Oak	436
Prunus	Almond, apricot, cherry, peach, plum	340
Salix	Willow	289
Betula	Birch	284
Populus	Aspen, cottonwood, poplar	249
Acer	Maple	238
Malus	Apple	237
Vaccinium	Blueberry, cranberry, deerberry	217
Carya	Hickory	213
Pinus	Pine	200
Alnus	Alder	173
Ulmus	Elm	164
Picea	Spruce	132
Tilia	Basswood	132
Rubus	Blackberry, raspberry	127
Juglans	Walnut	125
Fraxinus	Ash	121
Fagus	Beech	116
Castanea	Chestnut	115
Abies	Fir	112
Larix	Larch	110
Corylus	Hazel	108
Solidago	Goldenrod	104
Myrica	Bayberry	103
Rosa	Rose	102
Symphyotrichun	Aster	100
Cornus	Dogwood	98
Tsuga	Hemlock	92
Amelanchier	Serviceberry	92

Top 30 Native Host Plants for Pollen Specialist Bees

Genus	Common plant name	# of pollen specialist bee species that rely on this plant
Helianthus	Sunflower	50
Solidago	Goldenrod	42
Symphyotrichum	Aster	33
Grindelia	Gumweed	31
Rudbeckia	Black-eyed Susan	29
Heterotheca	Goldenaster	24
Coreopsis	Tickseed	22
Chrysopsis	Goldenaster	20
Verbesina	Wingstem	17
Bidens	Beggartick	15
Cirsium	Thistle	15
Salix	Willow	14
Vaccinium	Blueberry, cranberry, deerberry	14
Erigeron	Fleabane	12
Vernonia	Ironweed	12
Pityopsis	Silkgrass	11
Ratibida	Prairieconeflower	11
Silphium	Rosinweed	10
Baccharis	Baccharis	8
Euthamia	Goldentop	8
Dalea	Prairie clover	7
Oenothera	Evening primrose	7
Echinacea	Coneflower	6
Gaillardia	Blanketflower	6
Balduina	Honeycombhead	5
Helenium	Sneezeweed	5
Heliopsis	Heliopsis	5
Pectis	Chinchweed	5
Cornus	Dogwood	4
Lyonia	Staggerbush	4

But many flower genera have few specialist bees: 13 spring pollen specialist bees

Colchicaceae

Plant Genus: *Uvularia* (bellwort)

1 bee species in Minnesota specializes on plants in the genus *Uvularia*: ***Andrena uvulariae***.

Geraniaceae

Plant Genus: *Geranium* (cranesbill)

1 bee species in Minnesota specializes on plants in the genus *Geranium*: ***Andrena distans***.

Bumble Bees:

Portulacaceae

Plant Genus: *Claytonia* (spring beauty)

1 bee species in Minnesota specializes on plants in the genus *Claytonia*: ***Andrena erigeniae***.

Liliaceae

Plant Genus: *Erythronium* (trout lily)

1 bee species in Minnesota specializes on plants in the genus *Erythronium*: ***Andrena erythronii***.

Boraginaceae

Plant Genera: *Hydrophyllum*, *Phacelia* (waterleaf, Phacelia)

3 species of bees in Minnesota specialize on plants in the family Boraginaceae including 2 *Andrena* and 1 *Colletes*.


Phacelia (Phacelia/Scorpionweed)

Scientific Name	Likely Lecty	Host
Andrena phaceliae	oligolectic	Phacelia (Arduser)
Andrena geranii	narrow oligolectic	Hydrophyllum (Arduser)

Apiaceae

Plant Genus: *Zizia* (golden Alexander)

2 species of bees in Minnesota specialize on plants in the genus *Zizia*: ***Andrena vernalis*** and ***Andrena ziziae***.

1 bee species, *Hylaeus sparsus*, specializes on spring-flowering plant genera in the family Apiaceae.

Polemoniaceae

Plant Genus:
Polemonium (Jacob's ladder)

1 bee species in Minnesota specializes on plants in the genus *Polemonium*: ***Andrena polemonii***.

Plantaginaceae

Plant Genus:
Penstemon (beardtongue)

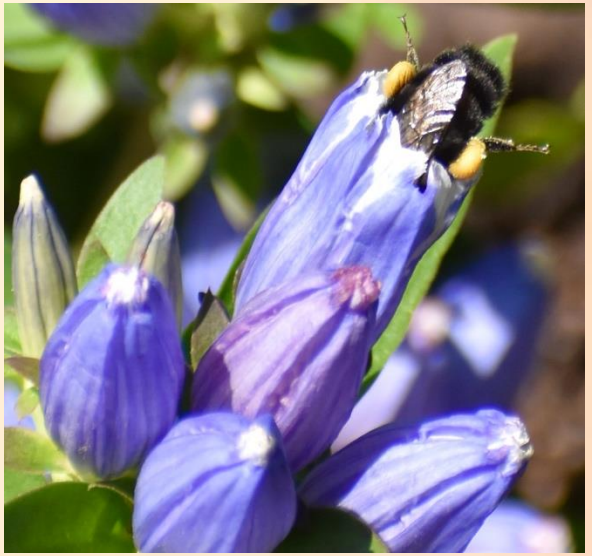
2 species of bees in Minnesota specialize on plants in the genus *Penstemon*: ***Osmia cyaneonitens*** and ***Osmia distincta***.

Minnesota Native Bees

Bumble Bees Queens: Spring Ephemerals and Woodland Flowers, Shooting Star Buzz Pollination

Bumble Bees and Bottle Gentian: Evolutionary Relationship in a Native Ecosystem





- Bottle gentian blooms in late summer and fall, when:
  - workers need to collect enough pollen to feed the huge gyne larva
  - new gynes need to feed heavily to build body fat stores for winter hibernation
- Bumble bees almost exclusively pollinate Bottle gentian because of their size and strength

Diverse native species and natural habitat matter. Your yard can be the universe for small pollinators.

1. **Shrink turf grass.**

2. **Transition gradually**. Give yourself time to learn the microclimates in your yard. Areas with different sun, soil moisture, slope etc. support different plants

3. **Have a plan for intentional growth of native habitat,** but realize habitat adapts and grows according to conditions. Assess every year where you are at, how much you want to accomplish, and if you need to change plans based on reality. Some plants won't make it, some won't be doing well, many may very happy and spreading. Most of the best pollinator plants spread easily, and many grow tall Appreciate their contribution to the ecosystem. 😊. Move plants that aren't in the right conditions and not doing well, decide if you want to cull or move some of the spreading plants to a different area.

4. **Plant in drifts of at least three to five plants**. Bees practice floral fidelity

5. **Plant densely, and multi-layered. About 50% of plants should be grasses, sedges, rushes.** Include trees, shrubs, vines, all heights of perennials/ annuals. Use green mulch instead of wood mulch. Every additional native plant species contributes to insect and ecosystem biodiversity.

Our yard

Smothering Turf Grass for Native Plantings: Step by Step Guide

Judy Cardin

Step 1
Mark the area you want to smother with flags of some kind. Popsicle sticks with bright tape on the end work fine. You can take the time to cut a wedge trench along the border with a spade or your favorite garden tool to interrupt turf grass roots and create a crisp sharp edge, if you like that look. We took a different approach, and haven't had problems with encroaching turf grass at all. We planted a dense soft border edge in the outer 1-2 ft of smothered area of short flowers, sedges and grasses that grow into the garden to create green mulch, and also grow into the turf grass we roughed up along the grass edge of the native planting to create pollinator lawn.

If you are interested in this approach, native plants we use in this soft border next to grass walkways and sidewalks and streets include:
Flowers: wild strawberries, common blue violet, prairie pussytoe(Antennaria neglecta), golden groundsel(Packera aurea), prairie groundsel(Packera plattensis), heart-leaf Alexander(Zizia aurea), Upland white goldenrod, prairie smoke, wood betony(Pedicularis canadensis), prairie blue eyed grass, stout blue eyed grass, common blue eyed grass, rattlebox(Crotalaria sagittalis), downy wood mint(Blephilia ciliata), leafy prairie clover(Dalea foliosa)
Sedges: ivory, ivory tinged, common wood, Pennsylvania, Eastern star, James, and Rosy, Long-beaked(Carex sprengelii)
Grasses: blue grama, June, poverty oat, buffalo, path rush, prairie dropseed, side oats grama

Step 2
Mow the grass as short as possible in your area to smother. Leave the grass clippings.

Step 3. Cover the mowed area with either unwaxed corrugated cardboard or Ram board type builder's paper. The Ram board is thin cardboard in a roll that you can buy direct from Ram board, or at a home improvement store like Home Depot. Use one layer of cardboard or builder's paper, but overlap edges by at at least 3-4 inches so gaps don't develop for grass to grow through. You can split open and flatten large shipping boxes. Be sure to remove tape and staples.

Step 4
Water the cardboard well to flatten it, especially the edges to the ground, and to help start decomposition of the cardboard. The cardboard takes a year or more to decompose- you don't remove it when you plant. The chips take a few years to decompose.

Step 5
Cover the cardboard with about two-three inches of arborist's wood chips. Many arborists provide free chips and delivery if you give them enough notice.

Step 6.
Water the wood chips. Keep the edges and smothered area watered enough that the cardboard stays flat. Leave it alone over winter.

Step 7
Select and purchase flowers. You need to plant plugs(plants) not seed with this method. Seed needs soil contact to germinate. You can winter sow seeds so you have plants from seed to plant in spring. If you are smothering in fall, you are ready to plant in May. If you are smothering in spring, do smothering by early April so the area is covered 4-6 weeks before you plant. You should plant native flowers, sedges and grasses densely, no more than a foot apart. Plant about 50% native grasses, sedges and additional plants that I mentioned in step 1, green mulch plants, and 50% native flowers. I will be posting separately some garden kit lists with suggested flowers for spring planting. I will post separately over winter native plant nurseries that ship, and some other resources to find native plants.

Step 8
When you are ready to plant, you will be cutting holes through the cardboard. The cardboard will decompose in about a year, and the wood chips take longer. In the meantime they provide a weed suppressant until your plants have a chance to grow. I use 2 1/2 inch plugs rather than larger plants for most native perennials. They are least expensive, and many native perennial grow quickly, so the larger planting container size isn't worth the cost. I get at least a 1 gallon size for most shrubs since they are often slower growing. I find it helpful to place plants before cutting holes to ensure they are all spaced correctly and in a design I want.

Step 9

Push chips at least a few inches from where you will be cutting a hole(box cutter works) or drilling a hole with a garden auger(these are nice if you are planning a lot of planting). Moist cardboard is easier for the auger to drill through. You don't want to mix the chips in with the soil when digging to plant. Also cut the holes a few inches larger than the plug to help the plant and soil breathe. Once planted, the plants also need some space between them and the wood chips. Check the roots of your plug before planting to make sure they aren't root bound or wrapping around. If the roots are tight, you should gently loosen them. Dig or drill your hole deep enough so the crown of the plant is at the same level in the soil it was in the plug container. Make sure you aren't leaving air spaces under or on the sides of the plant. Push the plug down enough to eliminate air spaces under, keeping the crown at soil level, and move dirt firmly enough on the sides of the plant to eliminate air spaces.

Step 10

Water, but don't fertilize. We never fertilize with chemical fertilizers or manure. Fertilizers kill soil bacteria that naturally provide plants with nitrogen, phosphorus and potassium in a healthy soil. New plants need to be watered for the first several weeks, and monitored in the first season to not let them get too dry if you aren't getting rain. Please never use any herbicides, insecticides, fungicides or rodenticides in your native yard. They all harm pollinators and aren't necessary. We haven't used any in our yard, as a healthy ecosystem balances itself. Holes in the leaves mean a healthy ecosystem! You have caterpillars and leaf cutter bees🎉

Turf Grass Smothered in March, Plugs Planted in May

Friends of the Arboretum

Green Mulch Grass & Sedge Garden Kit

Photos: Judy Cardin/Bob Plamann

Common wood sedge

Purple love grass

Prairie dropseed

		# plugs flat & half flat	Height	Sun req	Soil
Sedges					
Common wood sedge	Carex blanda	4 & 2	12"	Full-Shade	Wet-Med dry
Rosy sedge	Carex rosea	4 & 2	12"	Partial-Shade	Med wet-dry
Palm sedge	Carex muskingumensis	4 & 2	3'	Full-Shade	Med wet-Med dry
Long-beaked sedge	Carex sprengelli	4 & 2	2'	Full-Shade	Med wet-Med dry
Pennsylvania sedge	Carex pensylvanica	4 & 2	8-12"	Full-Shade	Med-Dry
Grasses					
Side oats grama	Bouteloua curtipendula	4 & 2	1-3'	Full-Partial	Med-Dry
Purple love grass	Eragrostis spectablis	4 & 2	1-2'	Full	Med-Dry
Prairie drop seed	Sporobolus heterolepis	4 & 2	2-3'	Full-Partial	Med wet-Dry

Use short stature native plants to grow as the understory in the canopy of taller flowers and shrubs. Double diversity in the same space!

See garden kits: https://foamadison.org/product-category/plant-type/garden-mix/

Green mulch nourishes and allows soil to breath, increasing health and humus layer. Eliminate the use of harmful chemical fertilizers and wood mulch while creating pollinator habitat.

Friends of the Arboretum

Short and Sweet Borders Garden Kit

Photos: Judy Cardin/Bob Plamann

Wild petunia

Aromatic aster

Prairie pussytoes

Wild strawberry

Prairie smoke

Short and Sweet Borders Garden Kit

		# plugs flat & half flat	Height	Sun req	Soil	Bloom time	Color
Prairie Pussytoes	Antennaria neglecta	3 & 2	4"	Full-Partial	Med-Dry	April-June	White
Downy woodmint	Blephilia ciliata	4 & 2	12"	Full-Partial	Med-Med dry	June-July	Purple
Common wood sedge	Carex blanda	3 & 1	6-20"	Full-Shade	Wet-Med dry		
Purple love grass	Eragrostis spectabilis	3 & 2	1-2'	Full-Partial	Dry	July-Sept	Purple
Wild strawberry	Fragaria virginiana	3 & 1	6"	Full-Shade	Med wet- Dry	April-June	White
Prairie smoke	Geum triflorum	4 & 2	12-16"	Full-Partial	Med dry-Dry	April-May	Pink
Midland shooting star	Primula meadia	4 & 2	12"	Full-Partial	Med wet-Med dry	May-June	Pink
Wild petunia	Ruellia humilis	4 & 2	12"	Full	Med-Dry	June-Aug	Purple
Aromatic aster	Symphyotrichum oblongifolium	4 & 2	1-2'	Full	Med dry-Dry	Aug-Nov	Purple

Short and Sweet Borders Garden Kit

Photos: Judy Cardin/Bob Plamann


Wild petunia


Wild strawberry


Aromatic aster


Prairie pussytoes


Prairie smoke

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Wild strawberry	Fragaria virginiana	3 & 1	6"	Full-Shade	Med wet- Dry	April-June	White
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Aromatic aster	Symphyotrichum oblongifolium	4 & 2	1-2'	Full	Med dry-Dry	Aug-Nov	Purple

Short & Sunny Street Terrace Garden Kit

Photos: Judy Cardin/Bob Plamann


Aromatic aster


Butterfly milkweed


Spotted bee balm


Lance-leaf coreopsis


Ohio spiderwort

		# plugs flat & half flat	Height	Sun req	Soil	Bloom time	Color
Butterfly milkweed	Asclepias tuberosa	3 & 2	2'	Full-Partial	Med-Dry	June-Aug	Orange
Lance-leaf coreopsis	Coreopsis lanceolata	3 & 1	2'	Full	Med dry-Dry	May-Aug	Yellow
Purple prairie clover	Dalea purpurea	3 & 2	2'	Full-Partial	Med-Dry	July-Sept	Purple
June Grass	Koeleria macrantha	3 & 1	2'	Full	Med-Dry	June-July	
Rough Blazing Star	Liatris aspera	3 & 2	3'	Full-Partial	Med-Dry	July-Oct	Purple
Spotted bee balm	Monarda punctata	3 & 1	2'	Full-Partial	Med dry-Dry	July-Sept	Purple
Little bluestem	Schizachyrium scoparium	2 & 1	3'	Full-Partial	Med-Dry	July-Oct	
Gray Goldenrod	Solidago nemoralis	3 & 2	2'	Full-Partial	Med dry-Dry	Aug-Sept	Yellow
Prairie Dropseed	Sporobolus heterolepis	3 & 1	2'	Full-Partial	Med wet-Dry	Aug-Sept	
Aromatic Aster	Symphyotrichum oblongifolium	3 & 2	2'	Full	Med dry-Dry	Aug-Nov	Purple
Ohio Spiderwort	Tradescantia ohiensis	3 & 1	3'	Full-Partial	Med wet-Dry	May-July	Blue

foamadison.org/product-category/plant-type/garden-mix/

Fall Glory: Asters & Goldenrods Garden Kit

Photos: Judy Cardin/Bob Plamann


Blue wood aster


Aromatic aster


Zig zag goldenrod


Riddell's goldenrod


Sky blue aster

		# plugs in flat/half flat	Height	Sun req	Soil	Bloom time	Color
Riddell's goldenrod	Oligoneuron riddellii	4 & 2	3'	Full	Wet-Med	Aug-Sept	Yellow
Zig zag goldenrod	Solidago flexicaulis	4 & 2	3'	Partial-Shade	Med wet-Med dry	Aug-Oct	Yellow
Gray goldenrod	Solidago nemoralis	4 & 2	2'	Full-Partial	Med dry-Dry	Aug-Sept	Yellow
Elm-leaved goldenrod	Solidago ulmifolia	4 & 2	3'	Partial-Shade	Med-Med dry	July-Sept	Yellow
Blue wood aster (Heart-leaved aster)	Symphyotrichum cordifolium	4 & 2	3'	Partial-Shade	Med-Med dry	Sept-Oct	Blue
Aromatic aster	Symphyotrichum oblongifolium	4 & 2	1-2'	Full	Med dry-Dry	Aug-Nov	Purple
Sky Blue aster	Symphyotrichum oolentangiense	4 & 2	3'	Full-Partial	Med-Dry	Aug-Oct	Blue
Short's aster	Symphyotrichum shortii	4 & 2	3'	Partial-Shade	Med-Med dry	Aug-Oct	Purple

Sunny Pollinator Garden Kit:
Hummingbirds, Butterflies, and Bees

Photos: Judy Cardin/Bob Plamann


New England aster


Meadow blazing star


Wild bergamot


Golden alexanders


Swamp milkweed

		# plugs flat & half flat	Height	Sun req	Soil	Bloom time	Color
Anise hyssop	Agastache foeniculum	3 & 1	3-4'	Full-Partial	Med-Med dry	June-Sept	Purple
Swamp milkweed	Asclepias incarnata	3 & 2	4'	Full-Partial	Wet-Med	June-Aug	Pink
Side oats grama	Bouteloua curtipendula	3 & 1	1-3'	Full-Partial	Med-Dry		
Meadow Blazing Star	Liatris ligulistylis	3 & 2	5'	Full-Partial	Med wet-Med dry	Aug-Sept	Purple
Wild Bergomot	Monarda fistulosa	3 & 1	4'	Full-Partial	Med wet-Dry	July-Aug	Purple
Upland white goldenrod	Oligoneuron album	3 & 2	1-2'	Full-Partial	Med dry-Dry	June-Sept	White
Sweet black-eyed Susan	Rudbeckia subtomentosa	3 & 2	5'	Full-Partial	Med wet-Med dry	Aug-Oct	Yellow
Prairie drop seed	Sporobolus heterolepis	3 & 1	2-3'	Full-Partial	Med wet-Dry		
New England Aster	Symphyotrichum novae-angliae	3 & 2	5'	Full-Partial	Wet-Med dry	Aug-Oct	Purple
Ohio Spiderwort	Tradescantia ohiensis	3 & 1	3'	Full-Partial	Med wet-Dry	May-July	Blue
Golden Alexander	Zizia aurea	2 & 1	3'	Full-Partial	Med wet-Med dry	April-June	Yellow

Shade Pollinator Garden Kit

Photos: Judy Cardin/Bob Plamann


Elm-leaved goldenrod


Tall bellwort


Red columbine


Wild geranium


Jacob's ladder

		# plugs in flat & half flat	Height	Sun req	Soil	Bloom time	Color
Red columbine	Aquilegia canadensis	3 & 2	2'	Full-Shade	Med-Dry	April-June	Red
Hairy wood mint	Blephilia hirsuta	3 & 2	2-3'	Partial-Shade	Med wet-Med	June-Sept	White
Tall bellflower	Campanulastrum americanum	3 & 2	5'	Partial-Shade	Med wet-Med dry	July-Oct	Blue
Long-beaked sedge	Carex sprengelli	3 & 1	2'	Full-Shade	Med wet-Med dry		
Bottle brush grass	Elymus hystrix	3 & 1	3'	Partial-Shade	Med-Med dry		
Big leaved aster	Eurybia macrophylla	3 & 1	2-3'	Partial-Shade	Med wet-Dry	July-Oct	White
Wild geranium	Geranium maculatum	3 & 1	12"	Full-Shade	Med-Med dry	April-June	Purple
Jacob's ladder	Polemonium reptans	3 & 1	12"	Full-Shade	Med wet-Med dry	April-June	Blue
Late figwort	Scrophularia marilandica	2 & 1	6'	Full-shade	Med-Med dry	July-Oct	Red
Elm-leaved goldenrod	Solidago ulmifolia	3 & 2	3'	Partial-Shade	Med-Med dry	July-Sept	Yellow
Short's aster	Symphyotrichum shortii	3 & 2	3'	Partial-Shade	Med-Med dry	Aug-Oct	Purple

Endangered Rusty Patched Bumble Bee Garden Kit

Photos:Judy Cardin/Bob Plamann


Apr-May Virginia bluebells


Apr-June Virginia waterleaf


June-Oct Giant hyssop


June-Aug Lead plant


July-Aug Culver's root


July-Aug Wild bergamot


Aug-Sept Joe pye weed


Sept-Oct New Eng. aster

		# plugs flat & half flat	Height	Sun req	Soil	Bloom time	Color
Anise hyssop	Agastache foeniculum	4 & 2	3-4'	Full-Partial	Med-Med dry	June-Sept	Purple
Lead plant	Amorpha canescens	4 & 2	2-3'	Full-Partial	Med-Dry	June-Aug	Purple
Spotted Joe Pye weed	Eutrochium maculatum	3 & 1	5'	Full-Partial	Med-Wet	July-Sept	Pink
Virginia waterleaf	Hydrophyllum virginianum	3 & 1	2'	Partial-Shade	Med wet-Med	April-June	Purple
Virginia bluebells	Mertensia virginica	4 & 2	2'	Partial-Shade	Med wet-Med	April-May	Blue
Wild bergamot	Monarda fistulosa	3 & 2	4'	Full-Partial	Med wet-Dry	July-Aug	Purple
Showy goldenrod	Solidago speciosa	3 & 2	5'	Full-Partial	Med-Dry	Sept-Nov	Yellow
New England aster	Symphyotrichum novae-angliae	4 & 2	5'	Full-Partial	Wet-Med dry	Aug-Oct	Purple
Culver's root	Veronicastrum virginicum	4 & 2	5'	Full-Partial	Med wet-Dry	June-Aug	White

Native Solitary Bees:

Nest and Hibernation Habitat Needs

- Ground nesting bees - 70%
- Stem/cavity nesting bees - 30%

Midwest Stem-Nesting Solitary Bees

Leaf cutter bee on Sneeze weed:Tufts University Pollinator Initiative

- 30% of native bees:
  - Leafcutter bees
  - Resin bees
  - Mason bees
  - Small Carpenter bees
  - Masked bees
- Pithy/hollow stem plants
- Stem diameter: 1/8 - 5/16”

Providing Stem-Nesting Bee Habitat

Photos: University of MN Extension

Plants used for nesting

Scientific name	Common name
Agastache	hyssop
Andropogon gerardii	big blue stem
Arnoglossum atriplicifolium	pale Indian plantain
Artemisia	native sages
Asclepias incarnata	swamp milkweed
Baptisia australis	blue wild indigo
Echinacea	cone flowers
Eupatorium perfoliatum	common boneset
Cirsium	native thistles
Eutrochium	Joe Pye weeds
Helianthus	sunflower
Heliopsis helianthoides	smooth oxeye, early sunflower
Liatris	blazing stars
Monarda fistulosa	wild bergamot, bee balm
Panicum virgatum	switchgrass
Pycnanthemum	mountain mints
Ratibida pinnata	pinnate prairie coneflower
Rhus	sumacs
Rosa	roses
Rubus	raspberries
Sambucus	elderberry
Silphium perfoliatum	cup plant
Solidago	goldenrods
Sorghastrum nutans	indiangrass
Symphyotrichum	asters
Thalictrum	meadow rues
Vernonia fasciculata	prairie ironweed
Veronicastrum virginicum	Culver's root
Zizia aurea	golden Alexander

Plants Used for Stem Nesting: Observations

Many other plants also likely hosts

Plants listed are from surveys and observations of authors. Many more plants are likely hosts. Please share your observations of bee nests to help this list grow.

Content by Colleen Satyshur, Research Scientist and Elaine Evans, Extension Educator with contributions from Sarah Foltz Jordan, Xerces Society and Heather Holm. Photos by Heather Holm, Colleen Satyshur and Thea Evans.

For more information visit **www.beelab.umn.edu**

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ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Year 1

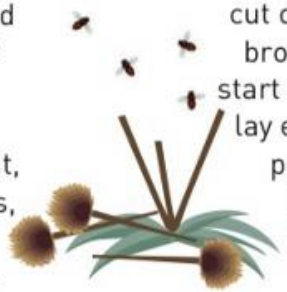
How to Create Habitat for Stem-nesting Bees

WINTER

Leave dead flower stalks standing over the winter.

SPRING

Cut back dead flower stalks leaving stem stubble of varying height, 8 to 24 inches, to provide nest cavities.



Female bees find cut or naturally broken stems, start a nest, and lay eggs on the pollen balls. Larvae eat the pollen.

SUMMER

New growth of the perennial hides the stem stubble.

Bee larvae develop in cut dead stems during the growing season.

Year 2

FALL

WINTER

Bees hibernate in stems during the winter.

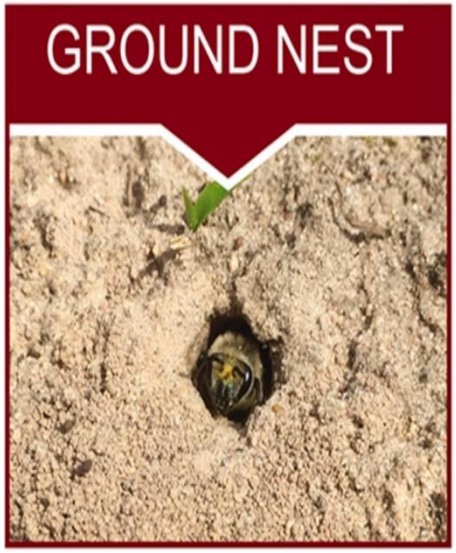
SPRING

Cut back dead flower stalks. Old stem stubble will naturally decompose.

Adult bees emerge and start nests in newly cut dead stems or in naturally-occurring open stems.

Ground Nesting Solitary Bees

Ground Nesting Bees



Most bees (between 60 and 70%) dig burrows in the ground. These bees are very diverse and have diverse preferences. Providing both disturbed and undisturbed soil, covered and bare soil, and keeping pesticides away from areas where you notice nesting activity can help these bees thrive. Most of these bees are extremely gentle and only active as adults for a few weeks every year, so even in high traffic areas, you can leave nests and not worry about stings.

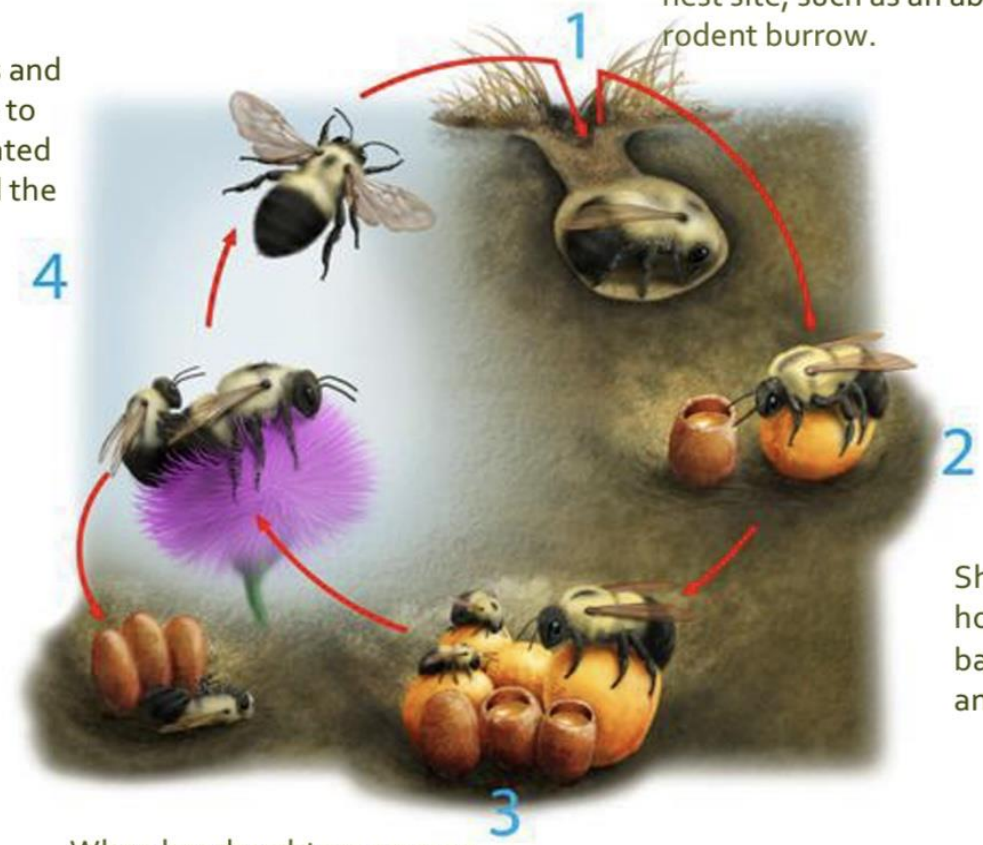
Xerces Society

- 70% of native bees
  - Mining bees
  - Cellophane bees
  - Squash bees
  - Longhorned bees
  - Sweat bees
- Diverse, natural ground-nest habitat
  - Bare
  - Sandy
  - Grassy
  - Leafy
- Wood nesting
  - Snags
  - Downed branches
  - Brush piles

Bumble Bees: Native Ground-Nesting Social Bees

Bumble Bee Annual Life Cycle

A queen emerges from hibernation in spring and finds a nest site, such as an abandoned rodent burrow.



She creates wax pots to hold nectar, and pollen balls in which she lays and incubates her eggs.

When her daughters emerge as adults, they take over foraging and other duties

In late summer and autumn the colony produces new queens and male bees, who leave to find mates. Newly mated queens hibernate and the rest of the bees die.

Queens live about 1 year, female workers and males about 1 month

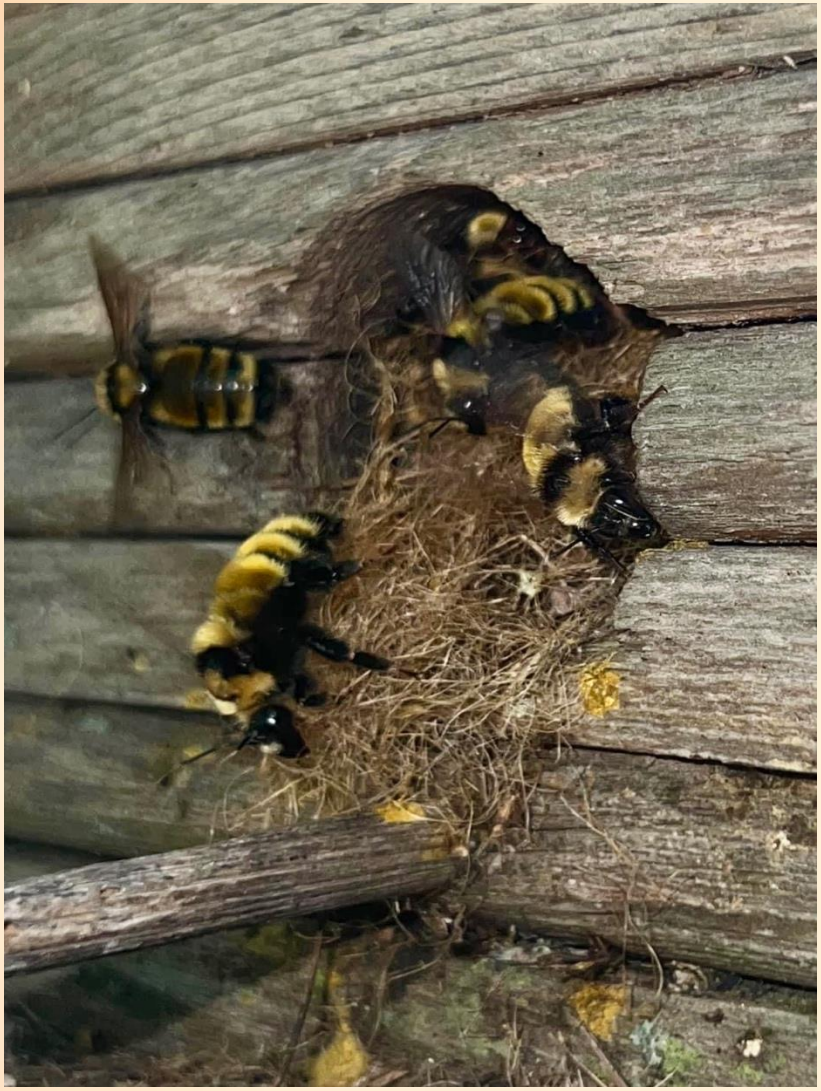
Bumble Bee Habitat Needs

Bumble Bee Nest, Shelter and Hibernation Habitat Needs

- Plant native grasses and sedges
- Leave the leaves and vegetation to provide sheltered areas with rich soil where gynes can dig 2-4” deep hibernation chambers and remain undisturbed
- Leave leaves, vegetation mats, sticks, rocks, and rodent holes for nest sites. Avoid spring and fall cleanup.
- Avoid raking, tilling and mowing natural areas
- Eliminate pesticide use

Common Eastern Gynes (Next Year Queens) Digging Winter Hibernation Chambers

Bumble Bee Nest Sites

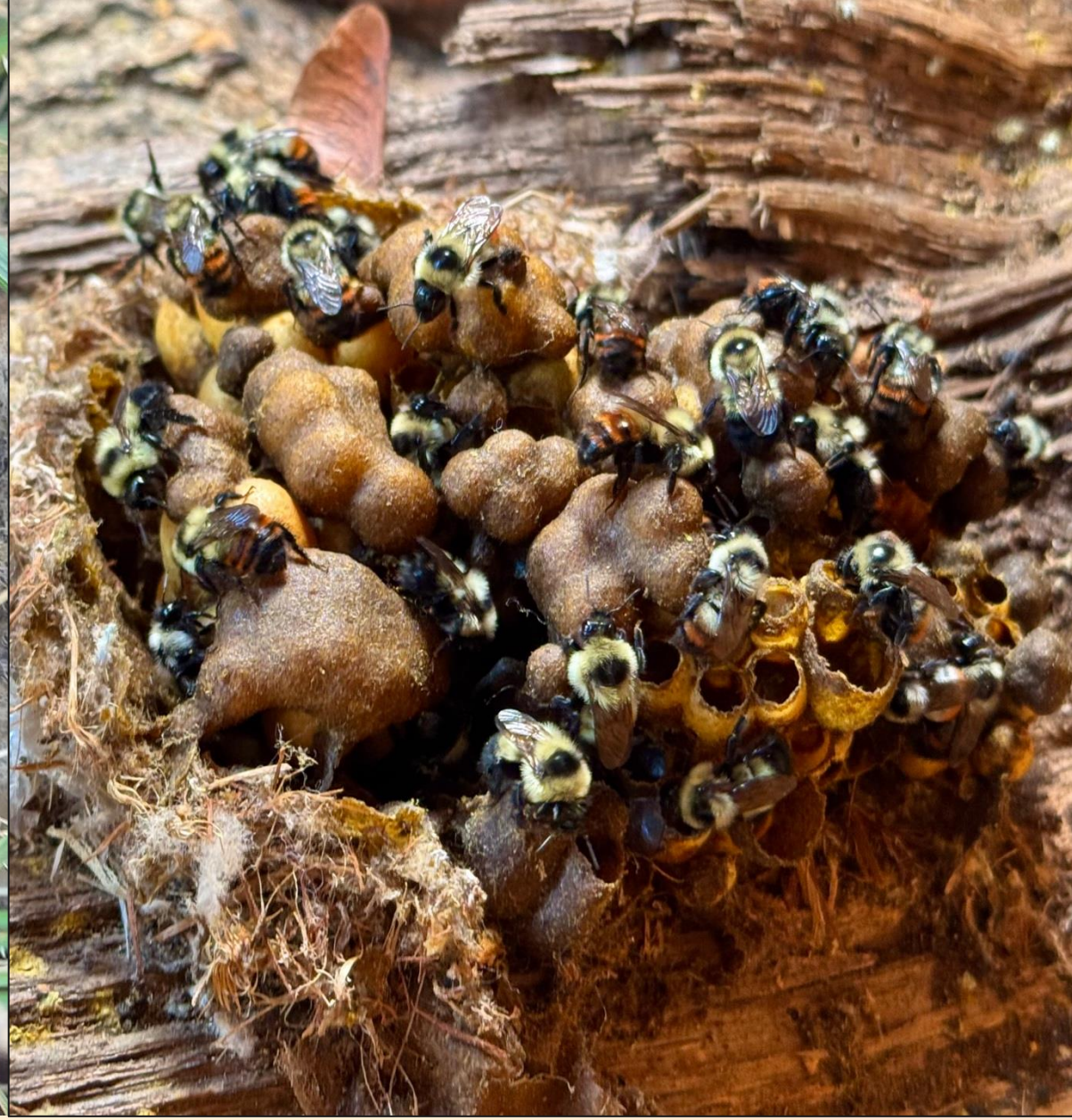


Northern Amber bumble bee nest- abandoned bird nest
Photo: Lisa Dachel West

Rusty patched bumble bee nest – abandoned chipmunk burrow.
Photo Judy Cardin & Bob Plamann

- Pre-existing holes and cavities
- Pre-existing nesting material
- 60-70% below ground, often old rodent holes
- 30-40% above ground, often in vegetation mats or structures

Half black bumble bee nest in ground level garden wool mulch
Photo: Rozetta Hahn

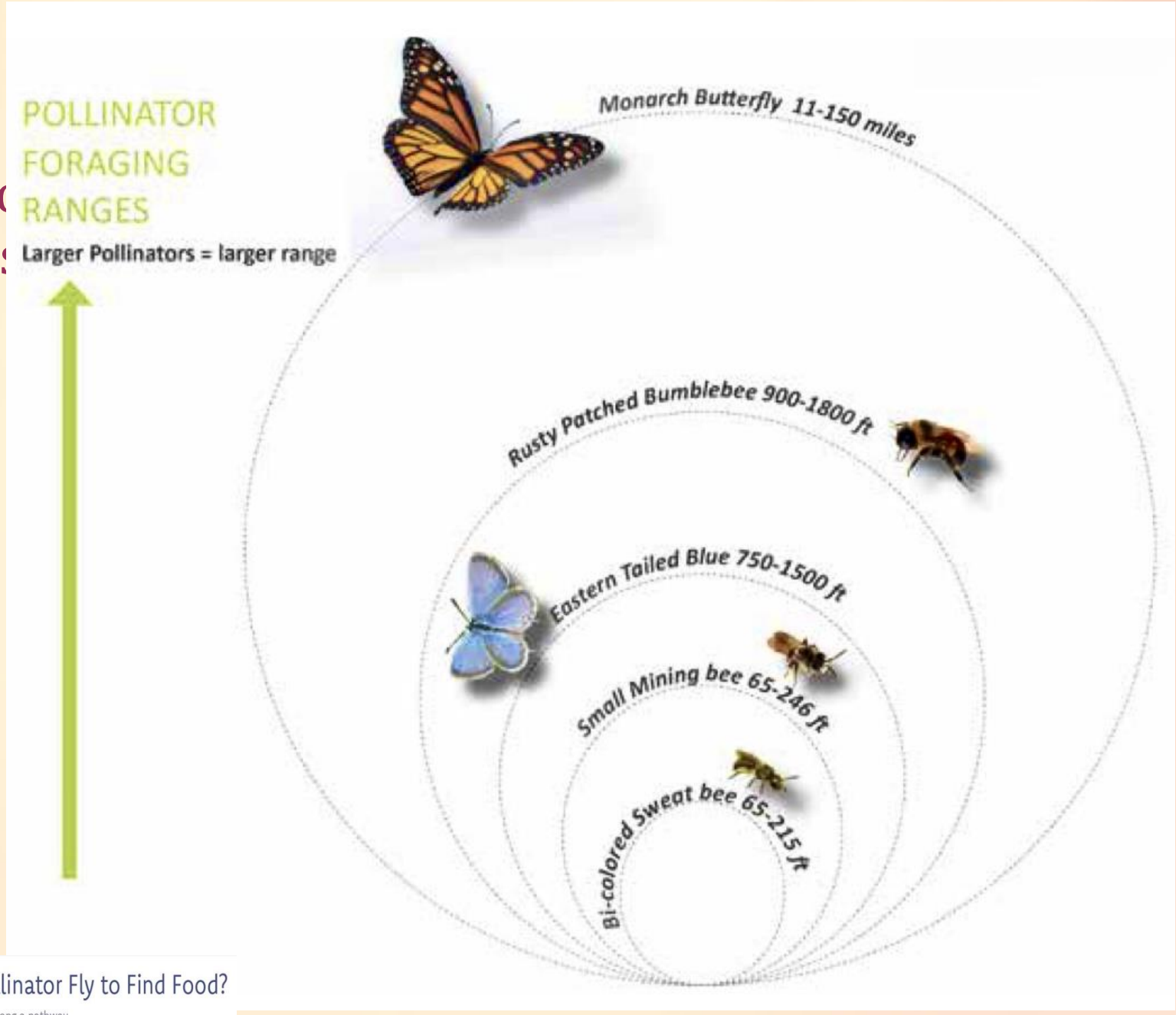


Redbelted bumble bee nest on top of a wood pile in a garden shed. Right next to where the lawn mower was stored! Photo: Judy Cardin/Bob Plamann

How to establish native plantings in your yard

- Transition over time to native plants, with at least a 70% native goal. Start by using natives only for any flower additions and replacements
- Remove first invasive plants, eventually nonnatives and replace with natives
- Smother turf lawn in sections, replace with native plantings. Reduce lawn size by at least 50% is a good goal.
- Use native alternatives in reduced lawn area to create bee lawn: violets, self heal, sorrel, yarrow, pussytoes, blue-eyed grass, Pennsylvania sedge, Path rush, strawberries. Great green mulch too!
- Eliminate pesticide and chemical fertilizer use
- Buy native plants are that are neonicotinoid free- ask the seller!
- Plant native bumble bee flowers that will bloom April-October
- Leave the leaves and stems sticks, rocks and holes- Mother nature doesn't rake and tidy 😊 Skip winter and spring cleanup

How far do pollinators typically fly to find flowers?



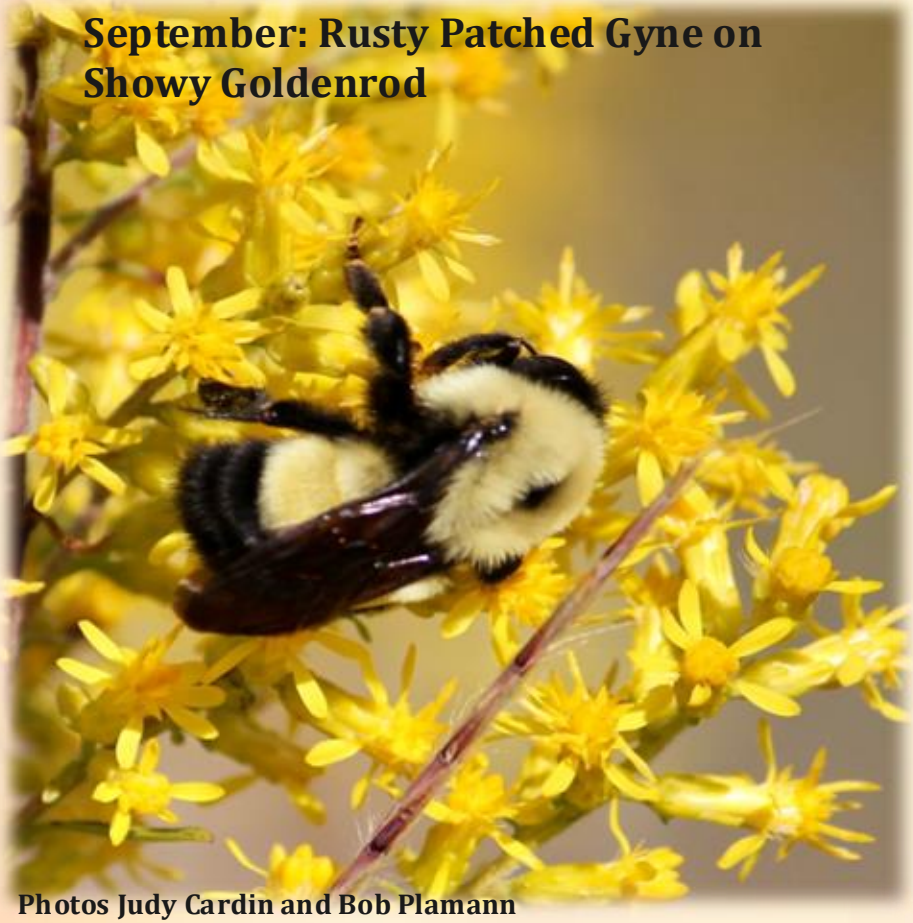
How Far Can A Pollinator Fly to Find Food?

Connecting our pollinator gardens along a pathway helps bees and butterflies thrive.

BOARD OF WATER AND SOIL RESOURCES

Each of us, with every flower we plant, can make a difference

July: Rusty Patched Worker on Virginia Mountain Mint



September: Rusty Patched Gyne on Showy Goldenrod

April: Rusty Patched Queen on Dutchman's Breeches

Photos Judy Cardin and Bob Plamann

Midwest Bumble Bee Phenology: Survival Needs April-Early June

Queens emerge from hibernation early April through May. It takes about a month for a queen to raise the first brood of workers on her own Spring queens need:

- Good nest site habitat- rodent holes, downed branches, leafy and grassy areas
- Nearby pollen and nectar rich flowers. Energy used to search for flowers is energy lost to raise their young

April-May Bumble Bee Queen Flowers

Woodland	Sunny	Shrubs/Thickets
Dutchman's Breeches*	Wood Betony(Lousewort)*	American Plum*
Virginia Bluebells*	Prairie Smoke *	Missouri Gooseberry*
Virginia Waterleaf*	Sundial Lupine*	American Black Currant*
Wild Geranium*	Cream Wild Indigo	Prairie Willow*
Common Blue Violet		Pussy Willow*
Jacob's Ladder		Native Service Berry*
Shooting Star*		
Large Flower Bellwort		*Rusty Patched Flower

Midwest Bumble Bee Phenology: Survival Needs June-August

- Bumble bee worker populations increase from June through August. Workers care for young and forage for food.
- Workers live about a month. Successful nests replace workers and increase nest size with a goal of producing a healthy number of new queens and males by the end of summer
- Peak bee populations in July and August require peak available flowers during those months

June-August Bumble Bee Flowers

Woodland	Sunny	Sunny
Sweet Joe Pye Weed*	Culver's Root*	Cream Gentian
Dwarf Bush Honeysuckle*	Native Roses*	Native Penstemons
Hairy Wood Mint*	Wild Bergamot*	Nodding Onion
Early figwort	Native St. John's Wort*	Early sunflower
Thickets	Mountain Mint*	New Jersey Tea
Native Blackberry	Native Hyssop*	Canada Milk Vetch
Black Raspberry	Spotted Joe Pye Weed*	White Wild Indigo
	Leadplant*	Native Blazing Star*
*Rusty Patched Flowers	Native Thistles*	Marbleseed

Midwest Bumble Bee Phenology: Survival Needs September-October

Bumble bees have an annual life cycle. Only new queens, called gynes, that leave the nest in late summer and fall survive winter. They need:

- Native flowers blooming August through October to build body fat stores to survive winter hibernation. Larger queens have a higher survival rate.
- Natural leafy areas with loose soil to dig hibernation chambers that remain undisturbed in spring.

September-October Bumble Bee Flowers



Woodland	Sunny	Sunny
Late Figwort	Obedient Plant*	Bottle Gentian*
Goldenrods: Zigzag, Elm-leaved	Great Blue Lobelia*	Goldenrods: Showy*, Stiff, Riddell's
Heart-leaved, Arrow-leaved, Big-leaved, Calico, Short's Aster	Spotted Joe Pye Weed*	Western Sunflower
Native Hyssop*	Native Hyssop*	Asters: New England*, Aromatic Aster
Tall Bellflower	Sneezeweed	Ironweed
Hairy Wood Mint*		* Rusty Patched Flowers

Midwest Bumble Bee Phenology: Survival Needs

Every gyne that can't find blooming flowers and a hibernation site and spring queen that can't find a nest site and early flowers to feed her first brood means the loss of that bumble bee line.

Community Science: another way to make a difference!

Friends of the UW-Madison Arboretum Native Plant Sale

Online sales through March 31- May pickup at Arboretum
foamadison.org

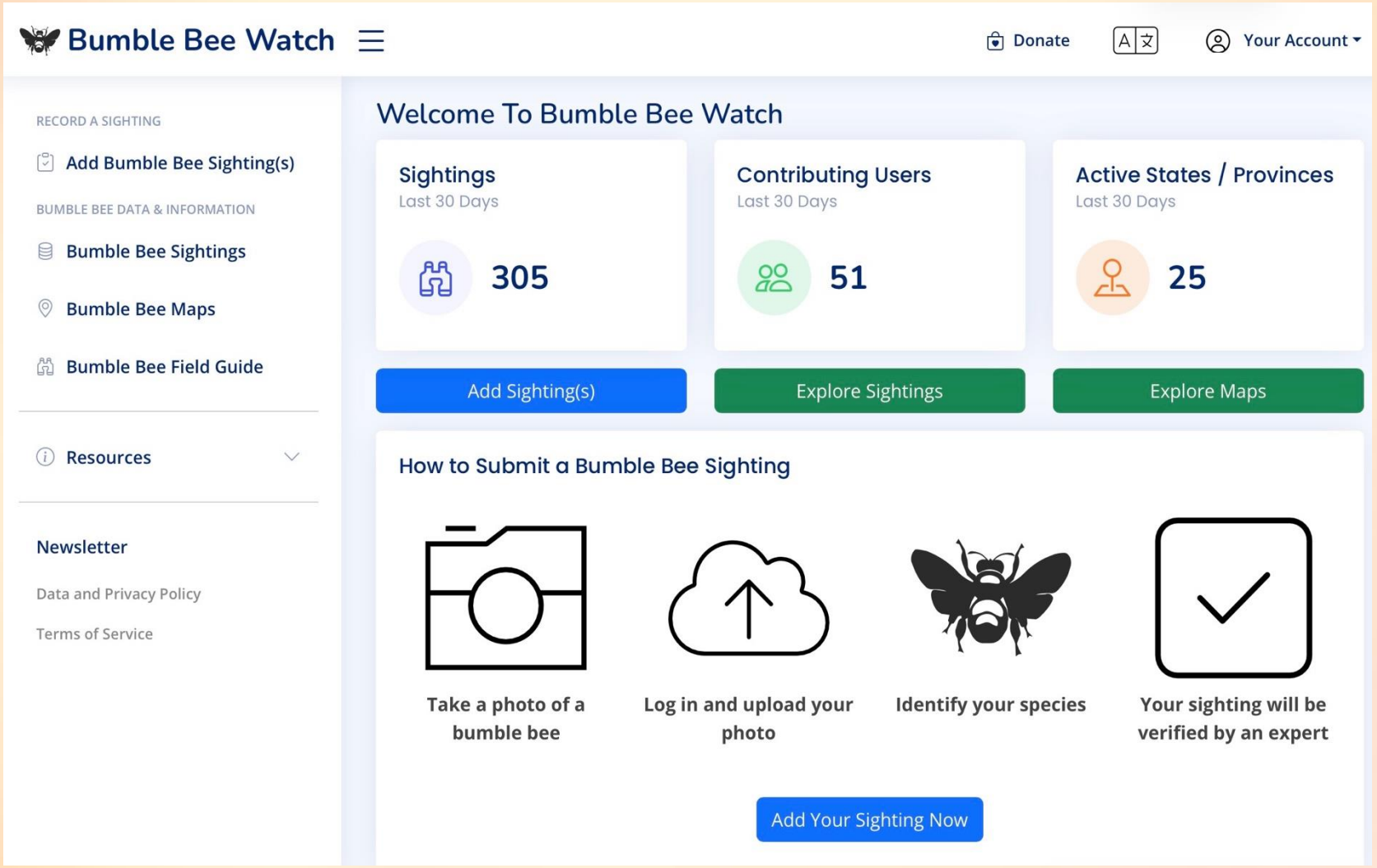
Tent Sale
May 16 at Arboretum

Getting started in B3: visit our website

https://dnr.wi.gov/tiny/3096

Submit your bumble bee observations to Bumble Bee Watch

- https://www.bumblebeewatch.org/



Facebook Page: Bumble Bees, Native Bees and Native Habitat Community

Wisconsin/Midwest Bumble Bee Observers ›

Public group · **14.5K** members

Photo: Judy Cardin

Bumble Bee ID

Bumble Bees in Your Garden

- Most bumble bees seen April-May are huge queens
- Most of the bumble bees seen June-July are female workers foraging for food for the nest
- Bumble bee populations peak in July and August. Males start flying in July, and can have different color patterns than females of the same species
- Six species of bumble bees account for about 75% of the bees reported. We will look at how to identify the female and males of those six species

Bumble Bees Species Likely to Buzz in Your Garden

- Common Eastern
- Two Spotted
- Brown Belted
- Red Belted
- Half Black
- Rusty Patched

Key Identification Traits for Wisconsin's Bumble Bee Species

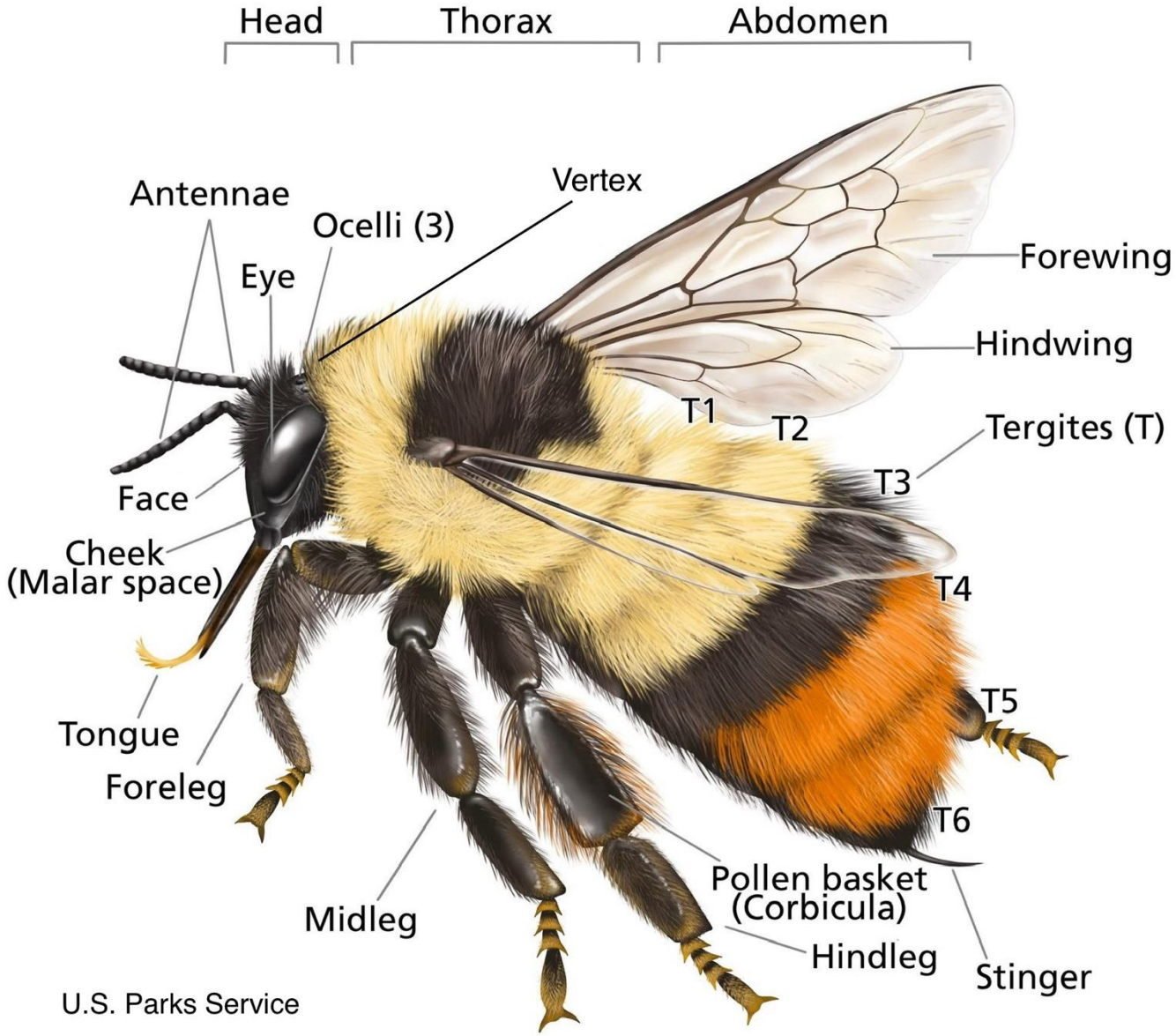
Created by Judy Cardin

6.3.2024

Key ID Traits Photo Cards

https://dnr.wi.gov/tiny/3106

Female Bumble Bee



Male Bumble Bee Traits:

~ seven terga

~ longer antenna

~ no stinger point

~ no corbicula on tibia of hind leg

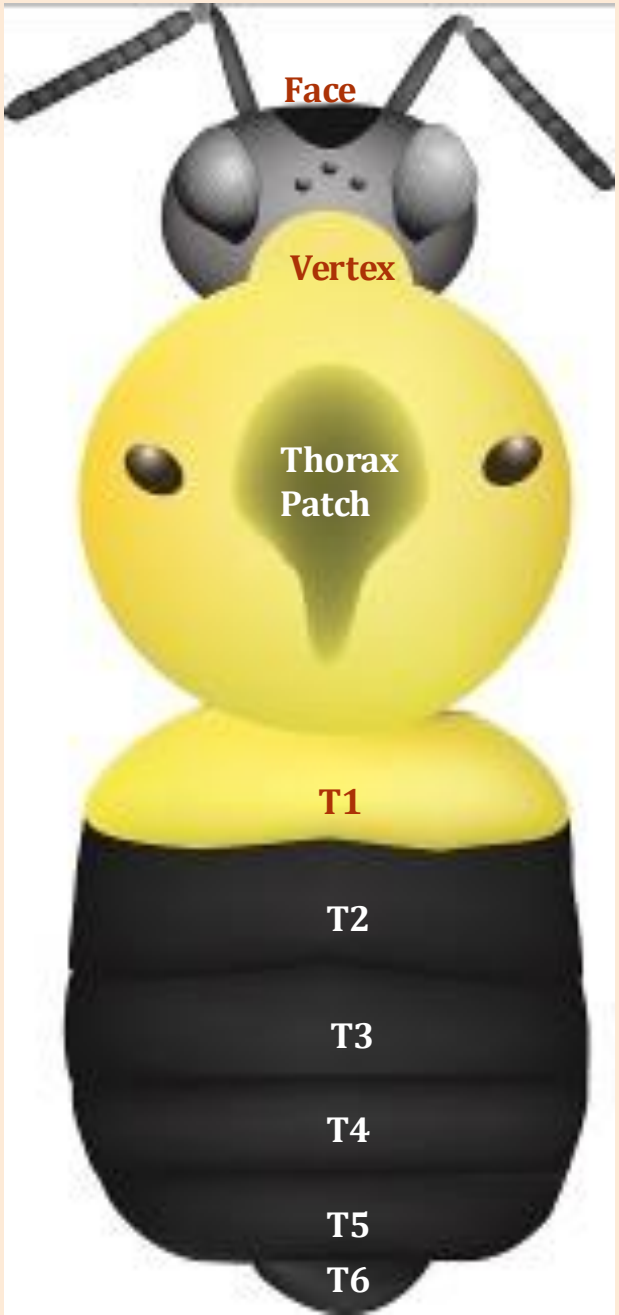
~ more yellow hair on face, vertex, body

~ longer shaggier hair

~ five species have enlarged eyes

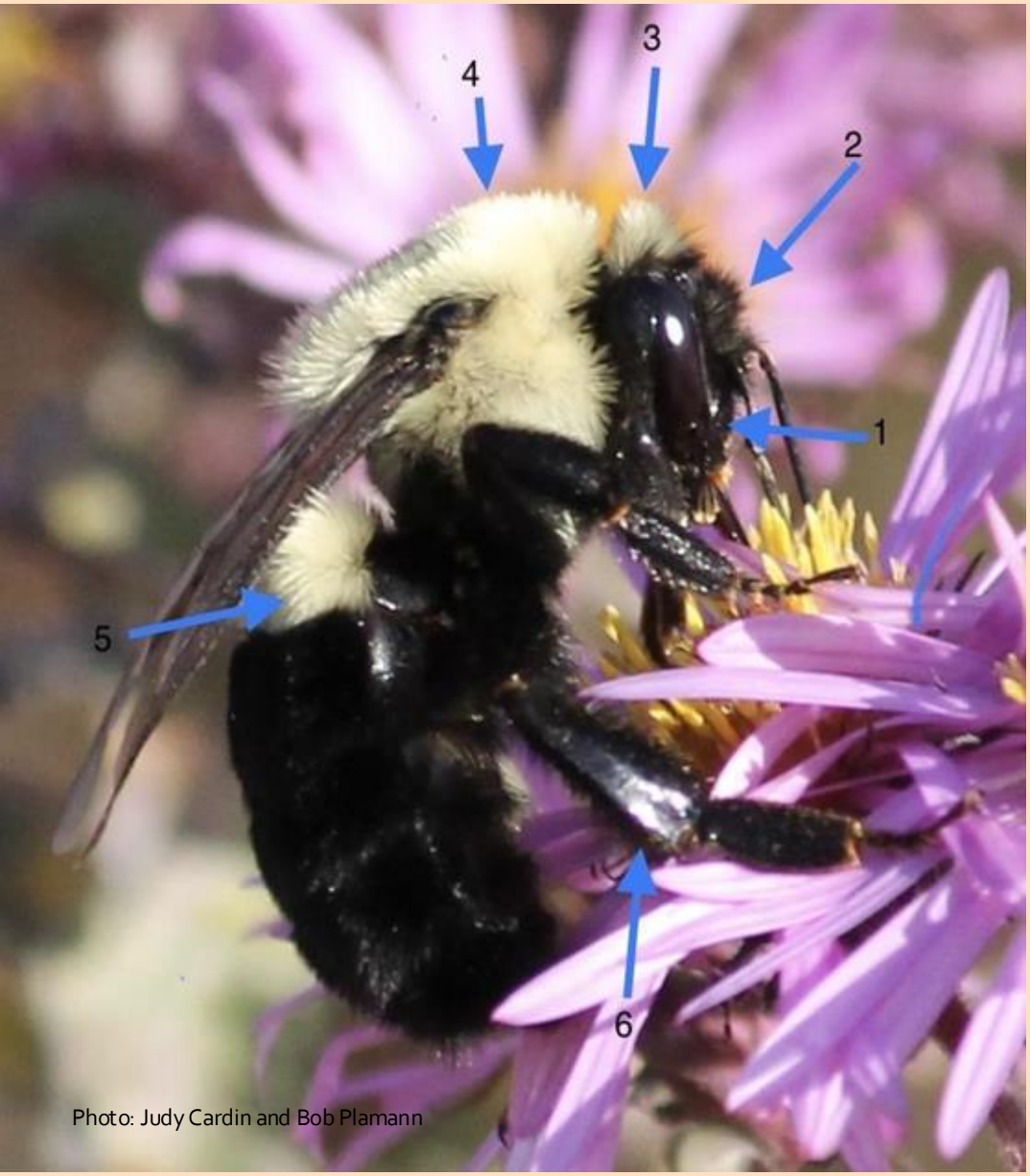
~ perching behavior

Four Key ID Characteristics



- Face: Hair color on front of face
- Vertex: Hair color on top of head and nape of neck
- Thorax Patch: The size, shape and color of the patch between the wing pads
- Abdominal Sections: the color pattern of the ab sections, which are called terga, T1-6

Common Eastern Bumble Bee (*Bombus impatiens*)



1. medium length cheek/face
2. black or very lightly intermixed face
3. yellow vertex, sometimes heavy yellow like this example, sometimes lighter yellow
4. short, even hair
5. **T1 fully yellow, T2-6 black.**
6. corbicula on hind legs(pollen baskets)

Common Eastern Bumble Bee (*Bombus impatiens*)

- **large square intermixed thorax patch. Note the wave pattern of the hairs.**
- dark face with a very few intermixed yellow hairs
- intermixed yellow vertex
- **T1 yellow, rest of abdomen black**
- short even hair

Male Common eastern Bumble Bee (*Bombus impatiens*)

Photo: Judy Cardin and Bob Plamann

- Medium length yellow face with yellow mustache
- Long antennae
- Yellow vertex
- **Large keyhole shaped thorax patch- can be intermixed or black**
- Thorax hair long
- **T1 fully yellow**
- **T2-7 usually black, but can have varying amounts of intermixed yellow**
- No corbicula, no stinger

Twospotted Bumble Bee (*Bombus bimaculatus*)

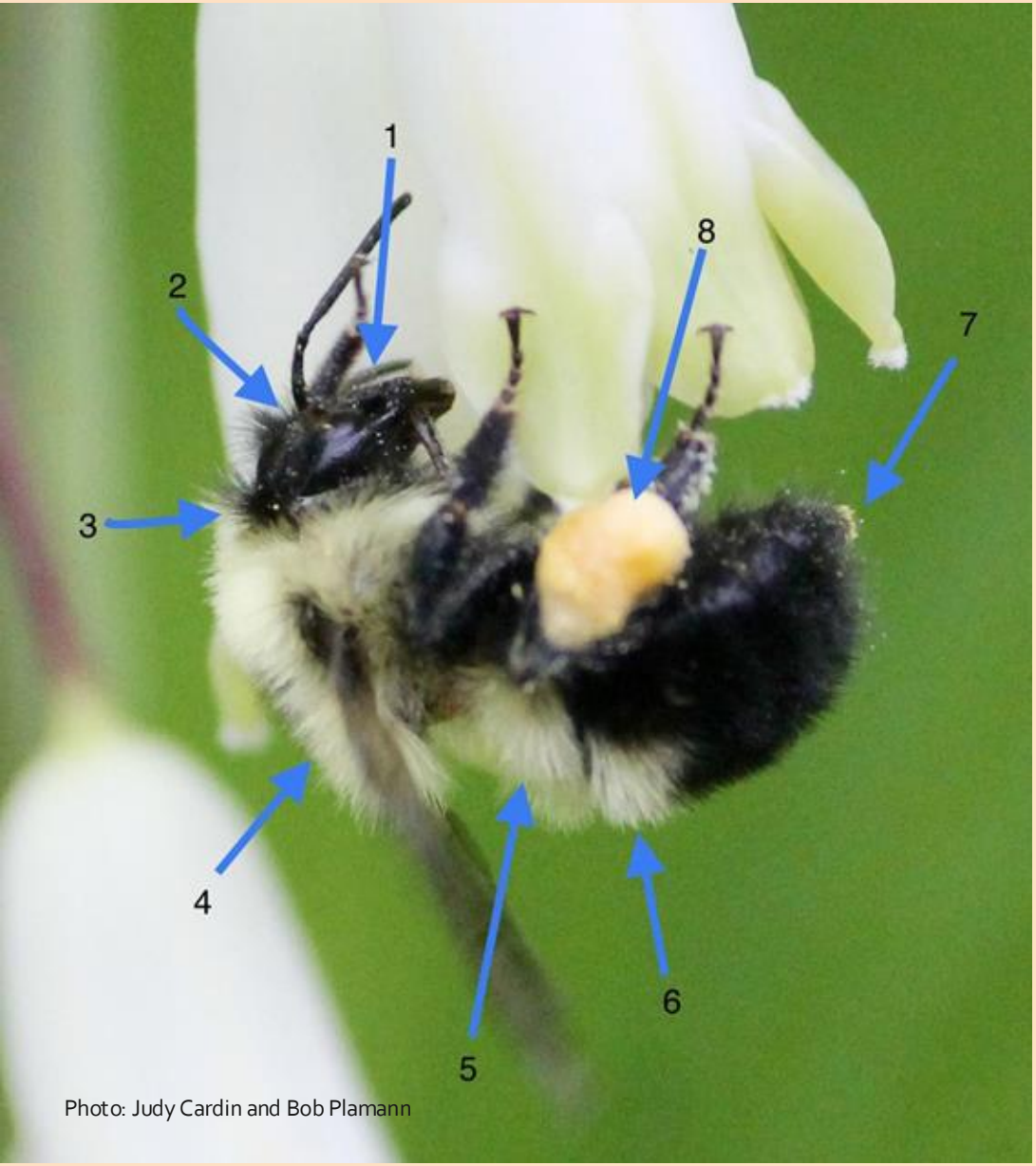


Photo: Judy Cardin and Bob Plamann

1. medium length cheek/face
2. black face, occasionally with a very few yellow hairs
3. yellow vertex
4. long uneven hair
5. T1 yellow
6. **T2 centrally yellow, often in a w shape, T3-6 black**
7. **stinger point on T6**
8. **pollen in corbicula**

Twospotted Bumble Bee (*Bombus bimaculatus*)

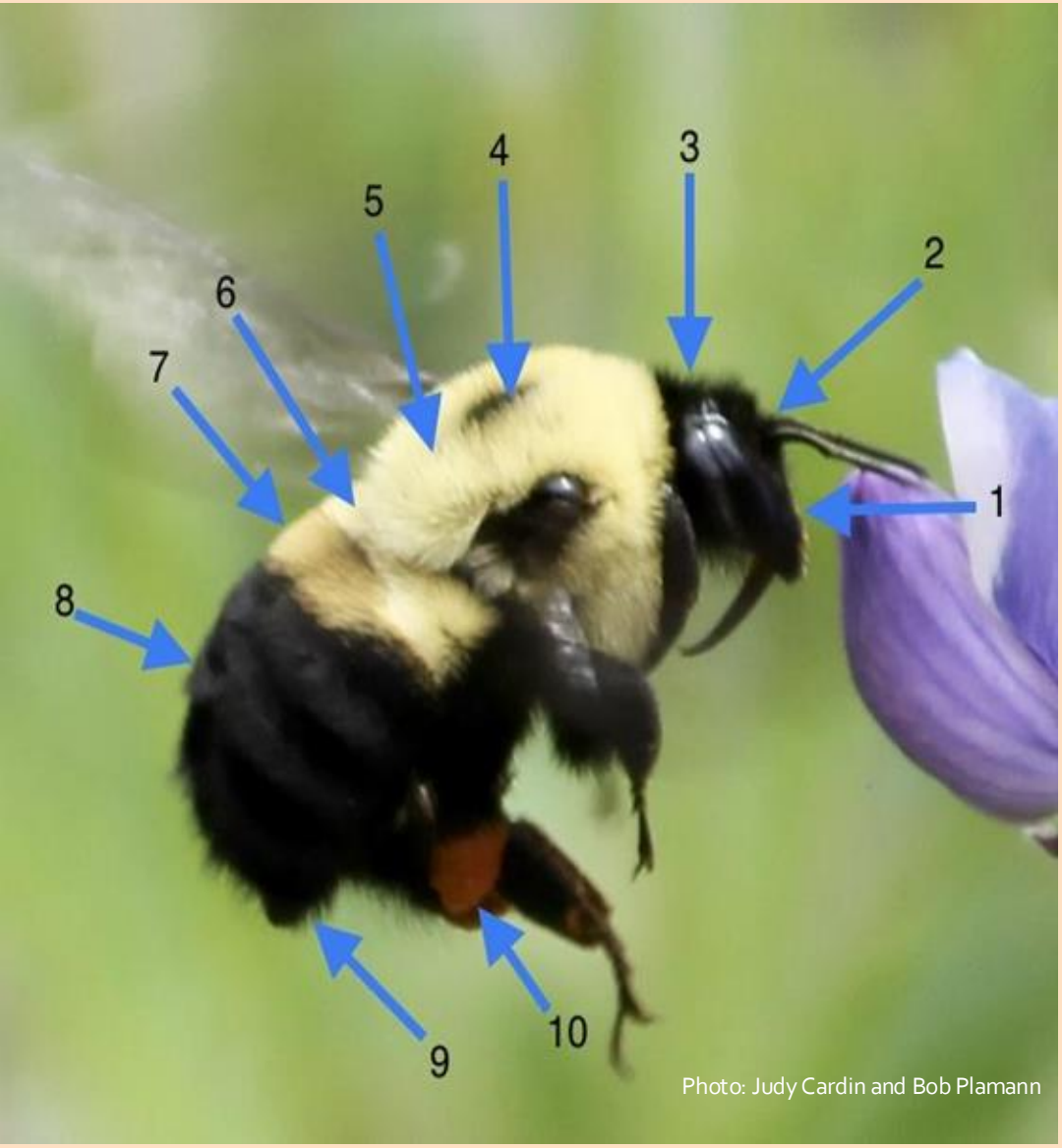
- yellow vertex
- black thorax patch, can be larger, or partially intermixed so the black area is smaller. This is an example of a small partially intermixed thorax patch
- T1 yellow
- **T2 centrally yellow, frequently in the W shape in this example**
- T3-6 black
- long uneven hair

Male Twospotted Bumble Bee (*Bombus bimaculatus*)

Photo: Judy Cardin and Bob Plamann

- Long antennae
- **Normal sized eyes**
- Medium length yellow face
- Yellow vertex
- **Small intermixed or yellowed over thorax patch**
- **T1-T2 yellow. T2 usually centrally yellow, or with a dark smudge at side edge of T2**
- **T3-T6 primarily black, but can have varying partial yellow pattern. T7 black**

Brownbelted Bumble Bee (*Bombus griseocollis*)



1. very short face
2. black face, occasionally a few yellow hairs
3. black vertex, occasionally a few yellow hairs
4. small black thorax dot,
5. short even hair
6. T1 usually yellow. Occasionally the brown in T2 extends into T1
7. **T2 usually brown half moon bordered by black. Occasionally, the half moon can be yellow. Also occasionally the entire T2 section can be brown**
8. T3-6 usually black.
9. stinger point on T6
10. corbicula carrying pollen

Brownbelted Bumble Bee (*Bombus griseocollis*)

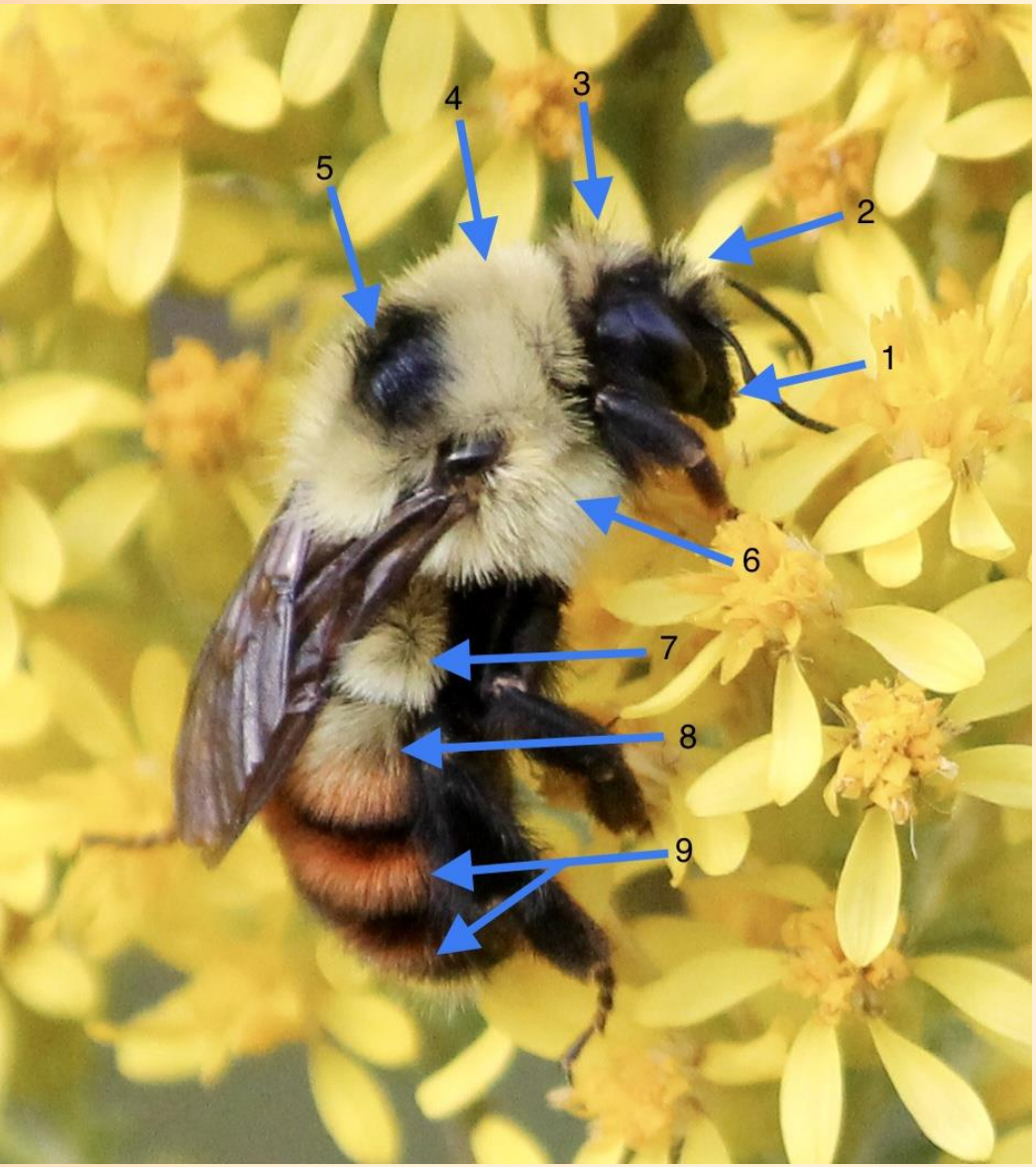
- black face and vertex
- **small black thorax dot**
- yellow thorax sides
- T1 yellow
- **T2 brown and yellow half moon bordered by black**
- T3-6 black
- short even hair

Male Brownbelted Bumble Bee (*Bombus griseocollis*)

Photo: Judy Cardin and Bob Plamann

- Yellow face and vertex
- **Greatly enlarged eyes**
- Long antennae
- **Small black thorax dot**
- T1 yellow
- **T2 brown half moon bordered by black on bottom of section**
- T3-7 black
- No corbicula, 7 abdominal sections , no stinger
- Hair longer than a female griseocollis, but still relatively short and even

Redbelted Bumble Bee (*Bombus rufocinctus*)



Red Morph

1. very short face

2. face can be black or yellow In this example, dense yellow around the antenna base

3. yellow

4. short or long hair

5. **oval shaped thorax band or patch. This is an important ID characteristic**

6. sides of thorax usually yellow

7. T1 usually full yellow

8. T2 on red morphs can be yellow, but often a combination of yellow and orange with the yellow in the center

9. T3-5, T6 black

Redbelted Bumble Bee (*Bombus rufocinctus*)

Photo: Judy Cardin and Bob Plamann

Red Morph

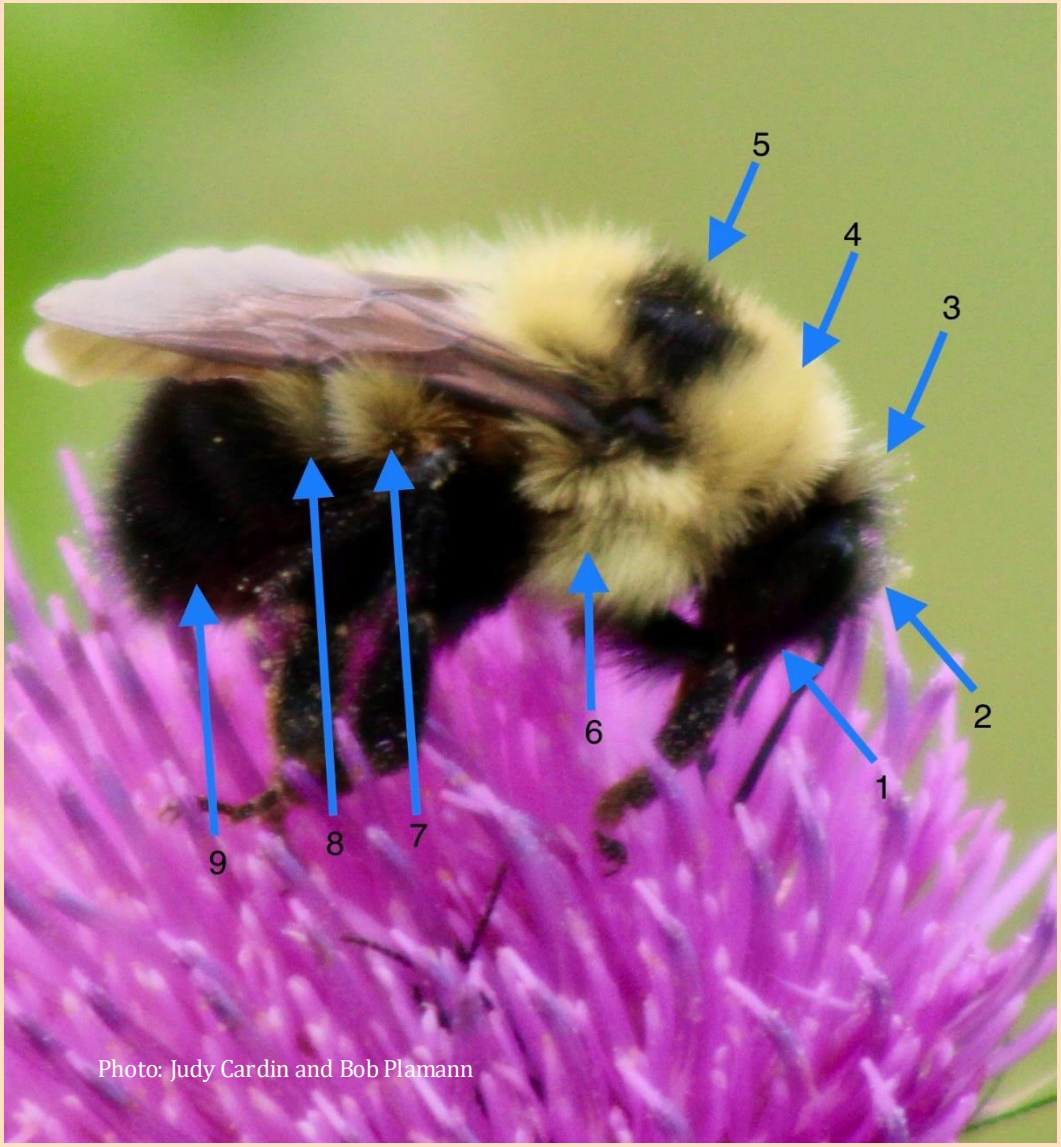
- **oval thorax patch**
- T1 yellow
- T2 yellow on top, orange on bottom
- T3 black on top, orange on bottom
- T4 black on top, orange on bottom
- T5-6 black. T6 stinger point
- short even hair

Male Redbelted Bumble Bee (*Bombus rufocinctus*) Red Morph

Photo: Judy Cardin and Bob Plamann

- Long antennae
- Short yellow or intermixed face
- **Moderately enlarged eyes**
- Yellow vertex
- **Oval shape to thorax band. Upper side of band often intermixed with yellow**
- Thorax "hunch"
- **T1 yellow, T2 at least centrally yellow. The rest of abdominal sections can vary in color**
- No corbicula, 7 abdominal sections
- No stinger point

Redbelted Bumble Bee (*Bombus rufocinctus*)



Dark Morph

1. short face

2. yellow, black or intermixed face. This bee has a dark face with yellow hairs at the antenna base

3. yellow vertex.

4. short and even or long and shaggy hair.

5. **oval shaped thorax patch/ band**

6. side of thorax yellow

7. T1 yellow

8. **T2 at least centrally yellow. This side view shows the top portion of T2 is yellow, and the yellow decreases as it approaches the edge of the section .**

9. T3-6 black - common in dark morph

Redbelted Bumble Bee (*Bombus rufocinctus*)

Dark Morph

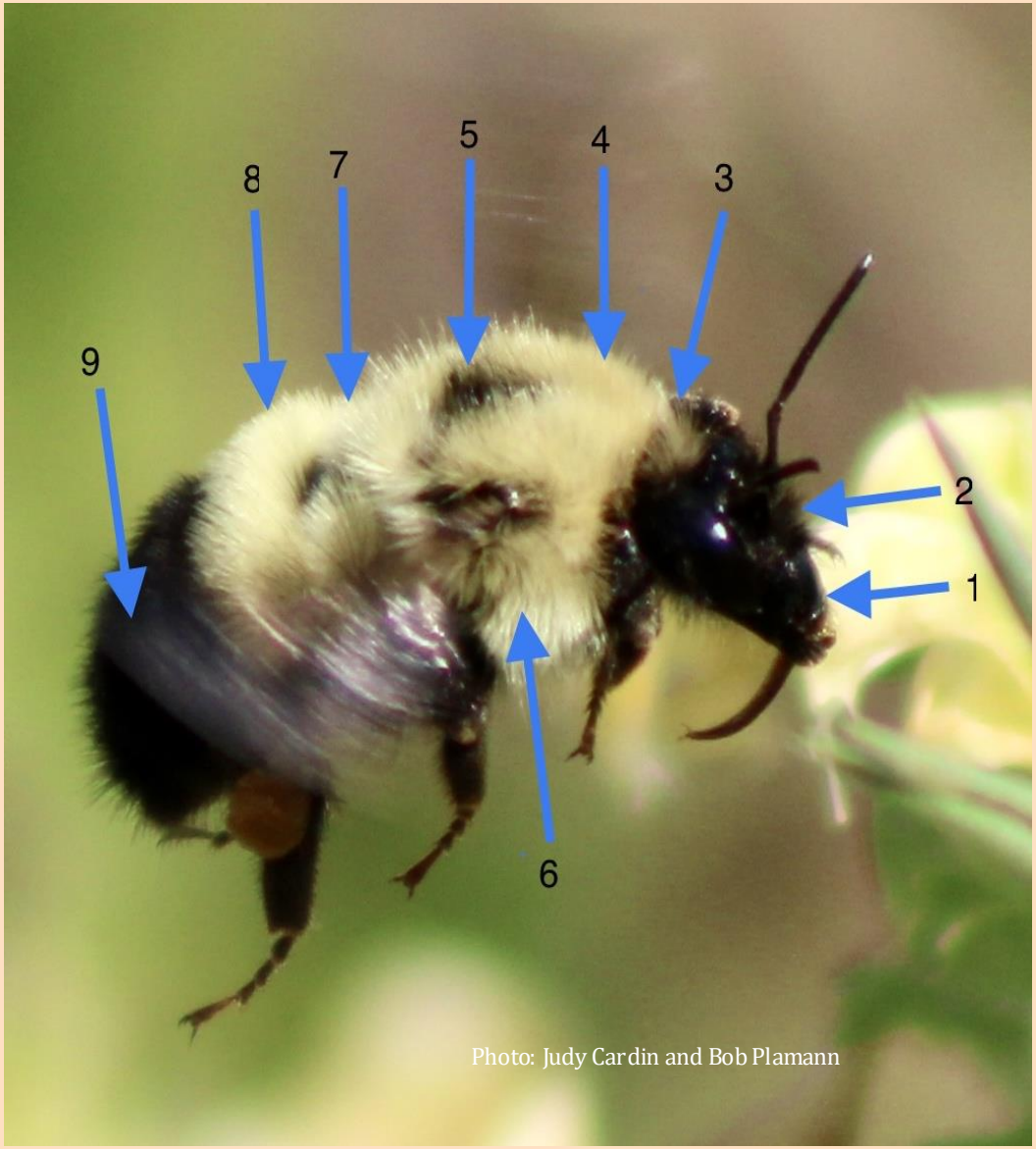
- centrally yellow vertex
- oval thorax patch
- T1 yellow
- T2 yellow slightly arced-decreases as it approaches edge of section
- T3-6 black
- hair short and even

Male Redbelted Bumble Bee (*Bombus rufocinctus)* Dark Morph

Photo: Judy Cardin and Bob Plamann

- Long antennae
- **Moderately enlarged eyes**
- Yellow vertex
- **Oval shape to thorax band. Upper side of band often intermixed with yellow**
- Thorax "hunch"
- **T1 yellow, T2 at least centrally yellow. The rest of abdominal sections vary in color**
- **Seven abdominal sections, nostinger point**

Half-black Bumble Bee (*B. vagans*)



1. long horsey face 😊

2. black face, often with a few yellow hairs around antenna base

3. centrally yellow vertex

4. long hair

5. small thorax patch, often arrowhead shaped, pointing towards head

6. sides of thorax yellow

7. T1 yellow, sometimes black centrally on top of section.

8. T2 yellow, sometimes with black centrally. Edges of section full yellow

9. T3-6 usually black. Occasionally yellow fringe on sides of T5.

Half-black Bumble Bee (*B. vagans*)

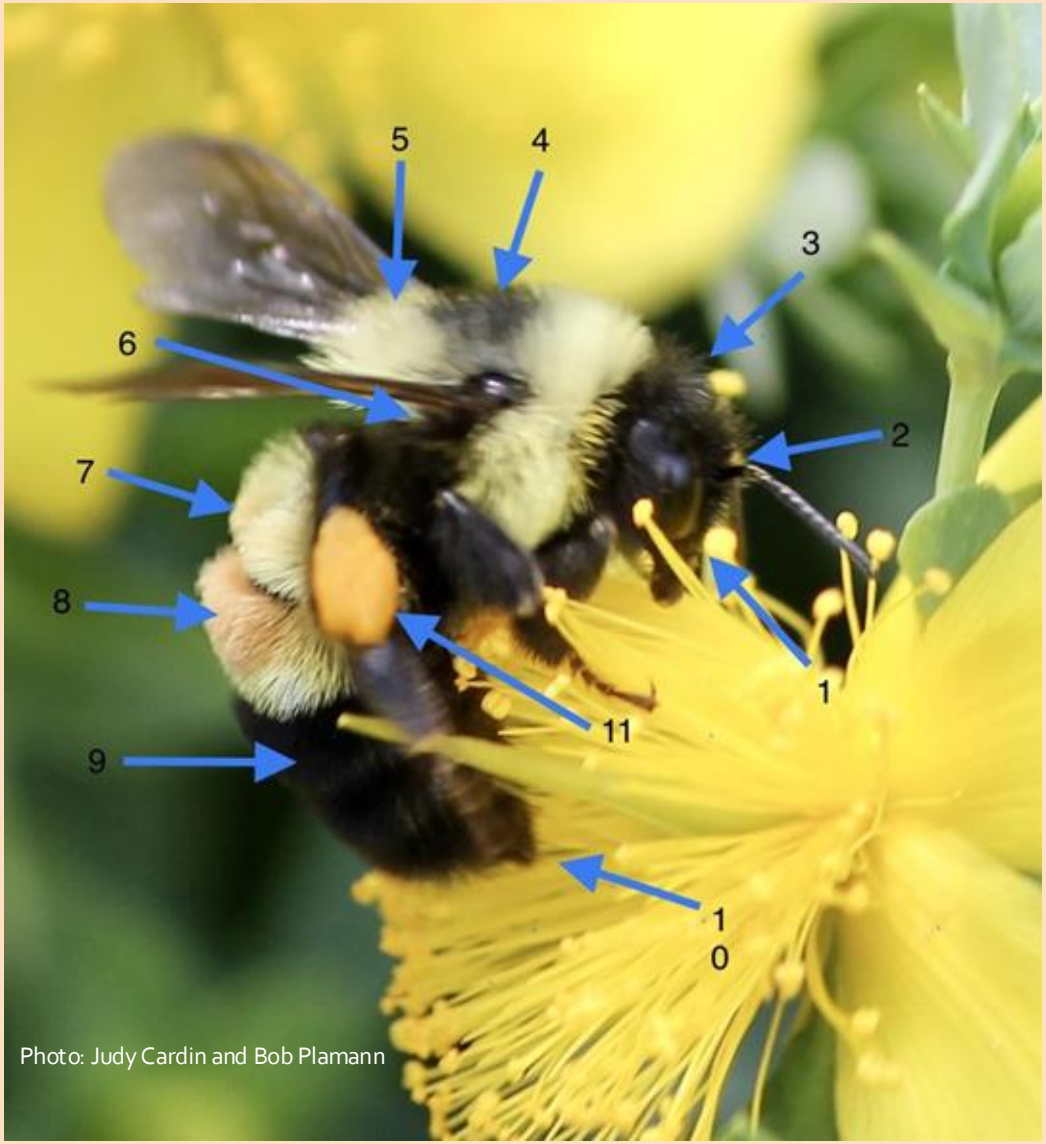
- black face
- centrally yellow vertex
- **arrowhead shaped thorax patch pointing towards head**
- sides of thorax yellow
- T1 yellow, with black centrally on top of section
- **T2 fully yellow on sid edges**
- T3-4 black
- long hair
- carrying pollen in corbicula

Male Half-black Bumble Bee (*Bombus vagans*)

- Long antennae
- **Long yellow face, normal sized eyes**
- Yellow vertex
- **Small often arrowhead shaped thorax patch, can be intermixed or yellowed**
- **T1-T2 yellow. Sometimes yellow on T5-6, and/or yellow running down the sides of T3-6**
- **Seven abdominal sections**

Photo: Judy Cardin and Bob Plamann

Rusty patched Bumble Bee (*Bombus affinis*)



1. short face
2. black face
3. black vertex, occasionally a very few yellow hairs
4. **black "thumbtack" thorax band that points towards abdomen**
5. long even hair
6. thorax side black behind wing pad
7. T1 usually yellow
8. **T2 usually yellow with a rusty patch bordered by yellow**
9. T3-6 black
10. stinger point on T6
11. corbiculum with pollen

Rusty patched Bumble Bee (*Bombus affinis*)

- **thumbtack thorax bar pointing down towards abdomen**
- black behind wing pads
- T1 yellow
- **T2 yellow with rusty patch bordered by yellow**
- T3-6 black
- stinger point on T6
- carrying pollen
- long even hair

Male Rusty patched Bumble Bee (*Bombus affinis*)

Photo: Judy Cardin and Bob Plamann

- Short black face
- Yellow or intermixed vertex
- **Thumbtack shaped thorax band, often intermixed with yellow**
- Thorax hair shaggier than a female
- Thorax side black behind wing pad
- T1 usually yellow
- **T2 yellow with a central rusty patch bordered by yellow on the bottom**
- T3-7 usually black, occasionally some yellow or orange hairs
- No stinger point

How do I know I am looking at a Rusty patched bumble bee?

Look for the rusty orange patch with a yellow skirt!


Rusty patched queen:
-small upside down tear-drop shaped thorax patch
-no rusty patch on T2

Thanks!