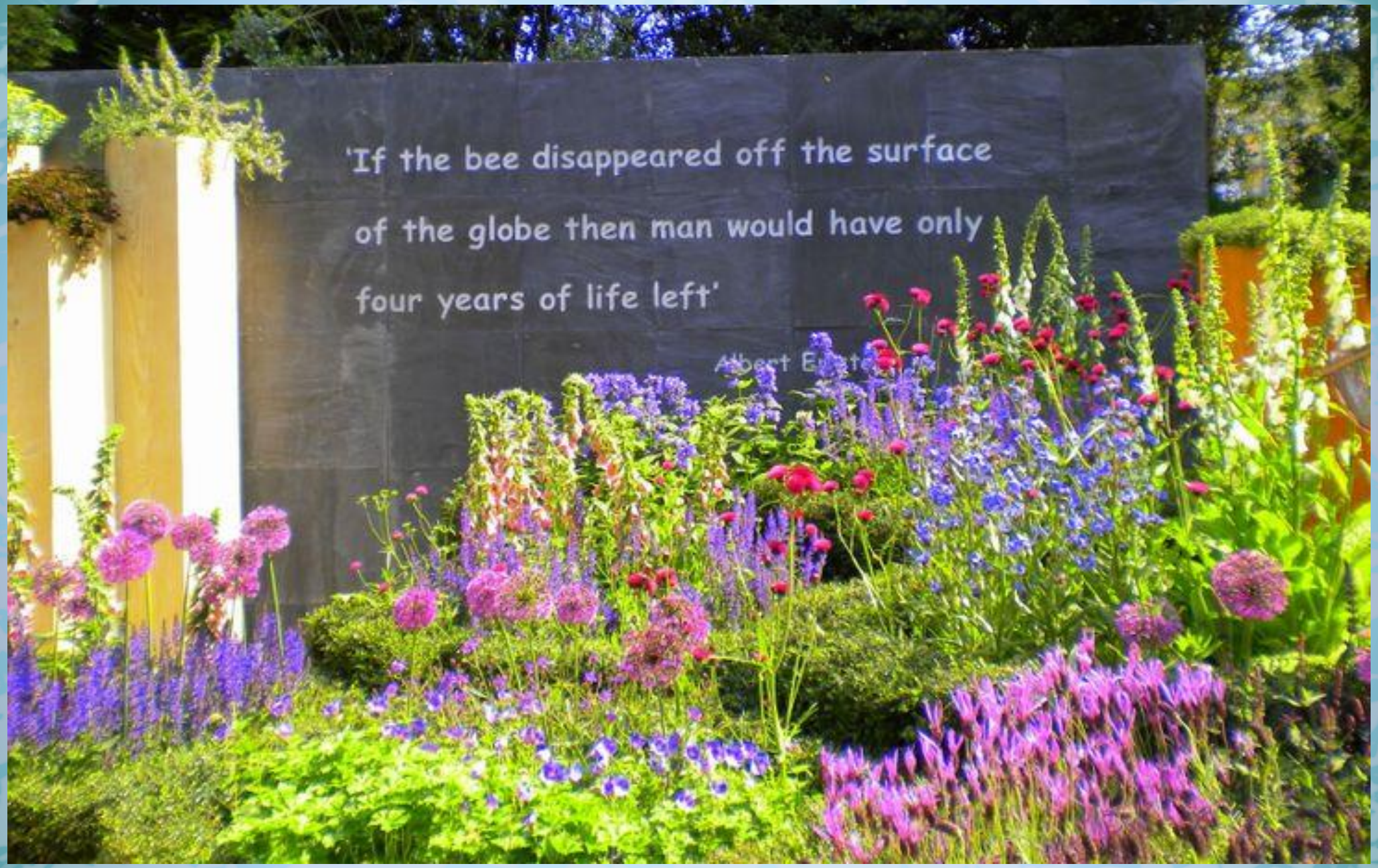
UCCE
El Dorado County Master Gardeners
Present

ECO-GARDENING:

ATTRACTING POLLINATORS & BENEFICIAL INSECTS


'If the bee disappeared off the surface
of the globe then man would have only
four years of life left'

Eco-Gardening

- Working with nature, not against it
- Provide food and shelter for
  - Pollinators
  - Beneficial Insects
  - Amphibians and Reptiles
  - Birds

Eco-Gardening

- **Do no harm to the environment**
- **Benefits:**
  - **improved water quality**
  - **improved wildlife habitat**
  - **create a safer environment for children and pets**
  - **create an attractive, healthy garden**

Eco-Gardening

- **Key Tenants**
  - **Avoid toxic pesticides, herbicides and synthetic fertilizers**
  - **Conserve water and soil resources**
  - **Create habitat for native species**

Eco-gardening

- **Why eco-garden?**
  - **Let the ecosystem work for you**
    - Reduce inputs
      - *Labor and effort*
      - *$$*
    - Improve the quality of the environment

16 Strategies for Eco-gardening

1. **Reduce or eliminate lawn aka "Green Desert"**

- ❖ **turf grass is an ecological wasteland**
- ❖ **don't replace one monoculture with another**
- ❖ **use regionally-appropriate native plants**

16 Strategies for Eco-gardening

2. Increase the health of your soil

- Everything starts with the soil: healthy soil, healthy plants
- Work with and improve the native soil you have
- Organic matter is key to increasing soil health

16 Strategies for Eco-gardening

3. Avoid synthetic pesticides

- ❖ **Not good for wildlife, not good for you, family, pets**

4. Limit the use of organic pesticides

- ❖ **Use organic pesticides only when absolutely necessary**
- ❖ **Use sparingly and carefully**
- ❖ **Organic does not mean harmless**

16 Strategies for Eco-gardening

5. Support beneficial insects

- ❖ **Nature's pest control**
- ❖ **Attract and feed local populations of beneficial insects**
  - ➢ **imported insects can introduce new diseases.**

16 Strategies for Eco-gardening

6. Tolerate some messiness to support wildlife

- ❖ Dead logs, tree snags, leaf litter and brush piles are habitat for many creatures
- ❖ Dead leaves are nature's mulch and compost

7. Tolerate some plant damage in your landscape

- ❖ Beneficial insects have to eat too!
  - ➢ Feed caterpillars if you want butterflies

16 Strategies for Eco-gardening

8. Let flowering perennials and native grasses stand through winter

- ❖ Provide food and cover for overwintering birds and insects

9. Utilize more native plants

- ❖ Native plants have co-evolved with each other and with the wildlife around them
  - ➢ Some plants and animals are dependent on each other

16 Strategies for Eco-gardening

10. Eradicate or reduce the exotic, invasive plants in your landscape

- ❖try organic, mechanical means first
- ❖Replace with native plants quickly to suppress invasives

16 Strategies for Eco-gardening

11. Limit exotic, ornamental plants and know their limitations

- ❖ **Plants that not evolved in our region will not provide the same ecological benefit**

12. Increase biodiversity by planting a wide variety of species

- ➢ **More diverse environments are more resilient to pests, diseases and climate change**

16 Strategies for Eco-gardening

13. Select natural forms of native plants

- Cultivars that vary greatly in form from a native plant may not offer the same resources

14. Avoid double-flowered plants

- often have less nectar, pollen, and seed or may be completely sterile
- Limited access for pollinators

16 Strategies for Eco-gardening

15. Provide a clean water source

- **Ponds, bird baths, water features**
- **Gently sloped sides**

16. Right plant - right place

- **Right light**
- **Water requirements**

Beneficial Insects

- **Ecological Services**
  - **Dung burial**
  - **Pest control**
  - **Pollination**
  - **Wildlife nutrition**

John E. Losey, Mace Vaughan; The Economic Value of Ecological Services Provided by Insects, *BioScience*, Volume 56, Issue 4, 1 April 2006, Pages 311–323

Garden Insects

- **3 types of Insects in the Garden**
  - **Beneficial Insects**
  - **Pollinators**
  - **Plant-eating Insects (Pests)**

Beneficial Insects

- Low-input = Natural biological control is free!
- Sustainable
  - Part of the ecosystem
- Enhances biodiversity
- Enhance species balance

Beneficial Insects

- “Good bugs” that prey on “bad bugs”
- 2 kinds of “bad bugs”
  - Chewing
  - Sucking
- Some presence of “bad bugs” needs to be tolerated

Beneficial Insects

- Natural enemies or predators
- Pollinators
- Aerators
- Composters

Beneficial Insects

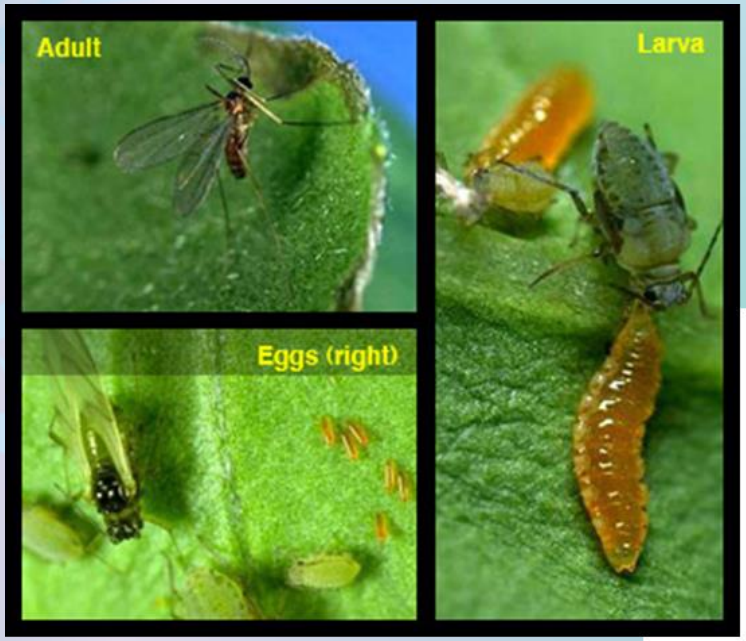
- **Increasing the biodiversity of the landscape will attract a diverse variety of "good bugs"**
  - **Plant species that attract and support "good bugs"**

Natural Enemies

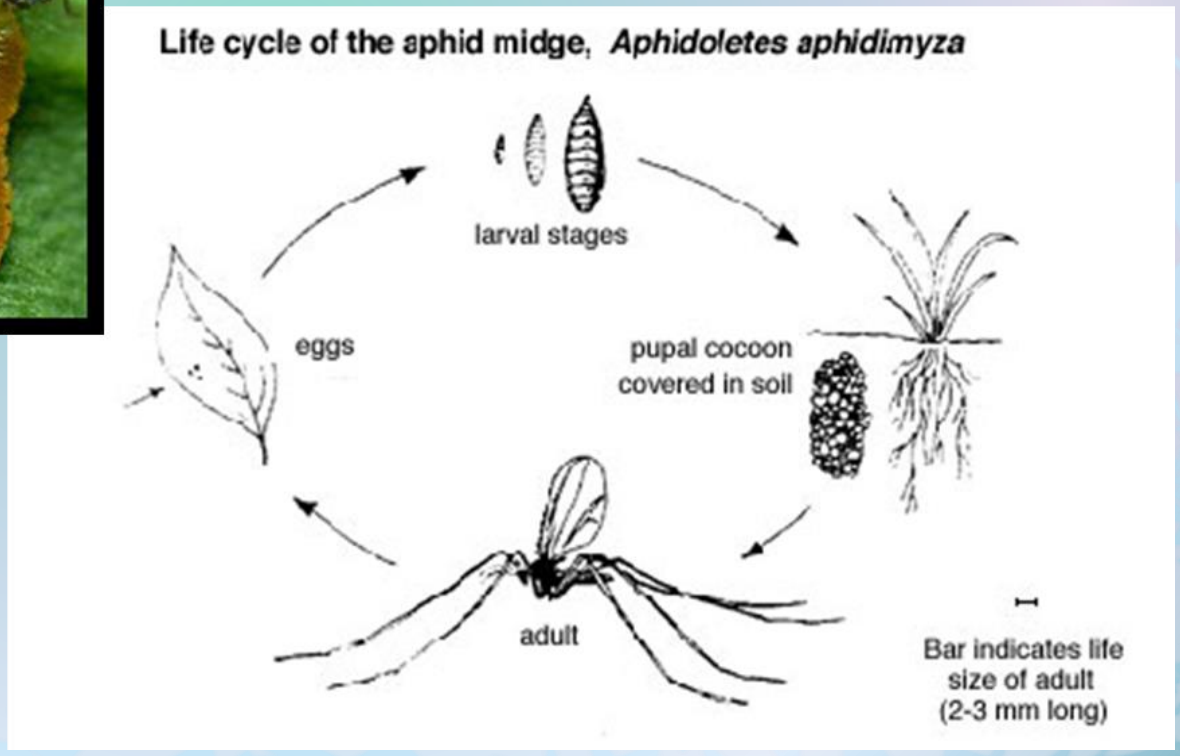
Aphid Midge

- Larvae feed on more than 60 species of aphids by paralyzing their prey with toxic saliva
- Plant: Pollen plants

Natural Enemies

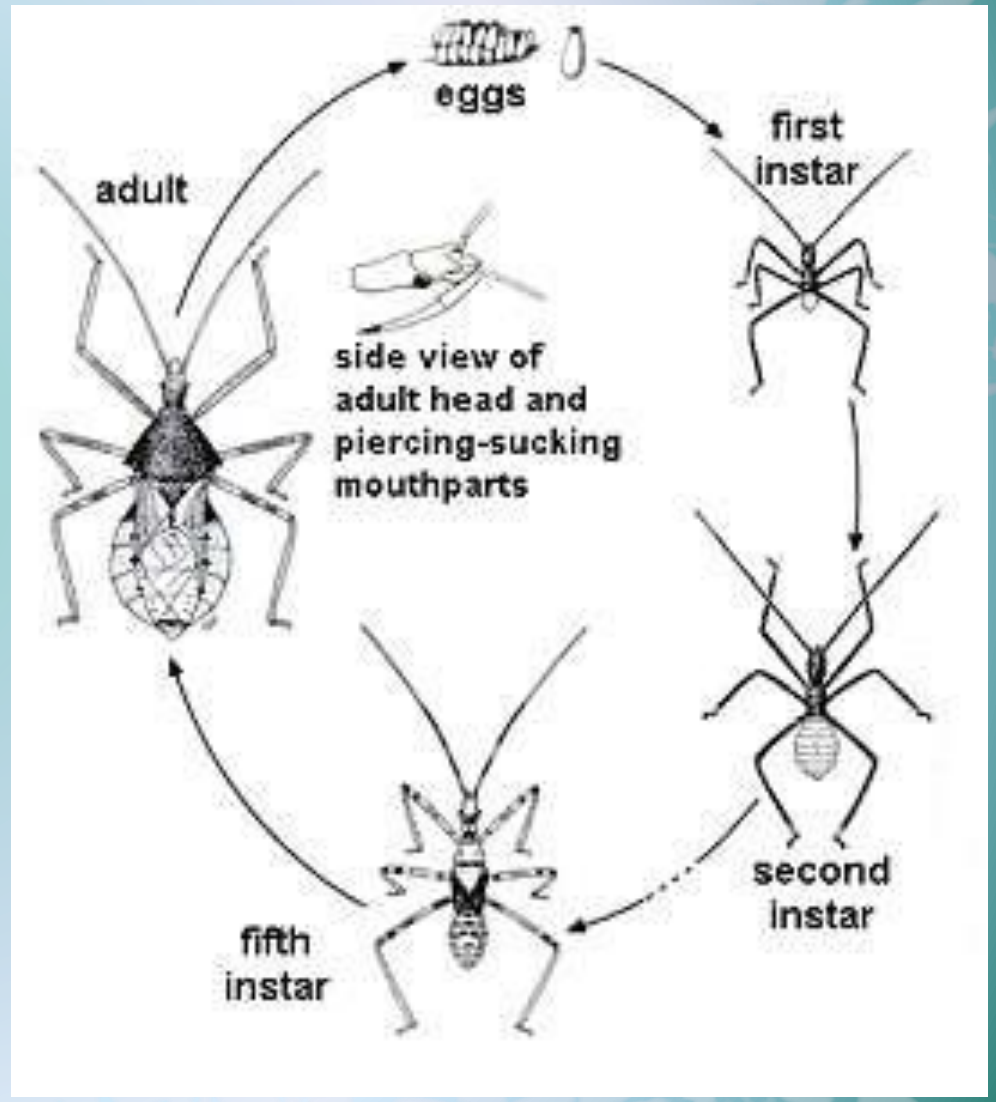


Aphid Midge life cycle



Natural Enemies

Assassin Bug



- 1” long feed on caterpillars, aphids, potato beetles, insect eggs, etc.

Natural Enemies

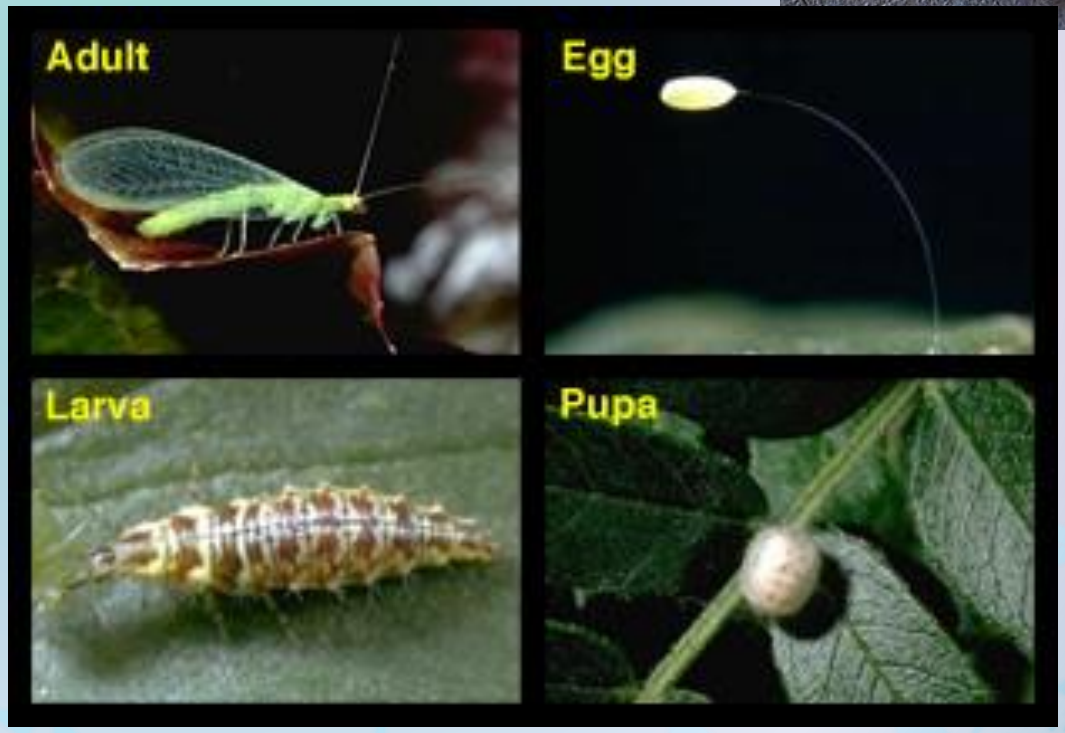
Lady beetles

- Eat aphids, mites, and mealybugs, and more; hungry larvae eat even more
- Plant: angelica, coreopsis, dill, fennel, and yarrow

Natural Predators

Green lacewings

- Adults and larvae eat aphids, caterpillars, mealybugs, scales, thrips, and whiteflies
- Plant: Angelica, coreopsis, cosmos, and sweet alyssum

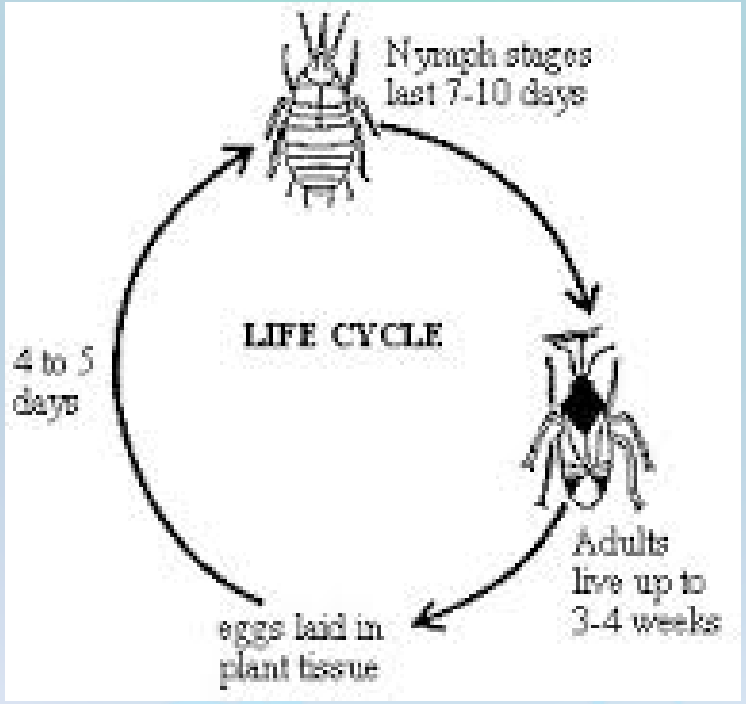


Natural Enemies

Minute pirate bugs

They're very tiny!

- **Attack almost any insect**
- **Plant: goldenrods, daisies, alfalfa, and yarrow**



Natural Enemies

Damsel bugs

- Feed on aphids, small caterpillars, leafhoppers, thrips, and other pests

Natural Enemies

- Feed on aphids, caterpillars, and other insects, including harmless and beneficial species
- Plant: catnip, goldenrod, and hydrangea

Soldier beetles

Adults

Natural Enemies

Tachnid & Hover flies

Tachnid fly

Hover fly

Hover fly larvae

- **Prey on aphids, thrips, and other plant-sucking insects**

Natural Enemies

Aphid parasitoid

Parasitic (Braconid) wasps

Tomato hornworm with parasitoid cocoons on it

- **Larvae feed inside their hosts, which include moth and beetle larvae and aphids**
- **Plant: nectar plants with small flowers, such as dill, parsley, wild carrot, and yarrow**

Parasitized aphid “mummies”

Natural Enemies

- **Social Wasps**
  - **Paper wasps (Polistes spp.) are important predators of caterpillars**
    - wooden boxes that are open on the bottom; old birdhouses can be reused
    - Attach the nest shelter to a post or tree at least 3 to 4 feet (1 to 1.2 m) off the ground

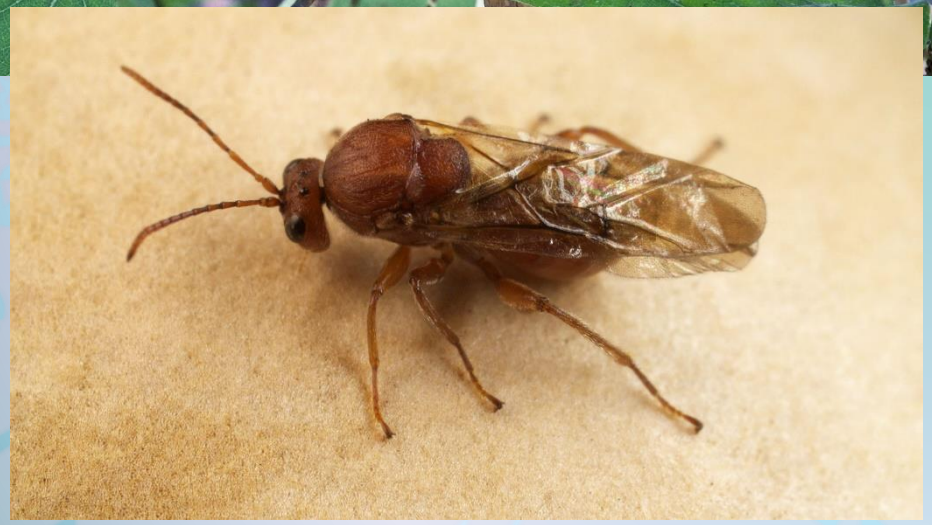
Natural Enemies

- **Solitary Wasps**
  - **Wooden nest blocks**
  - **Stem bundles**

www.Motherearthnews.com

Natural Enemies

Gall wasps



Natural Enemies

Ground beetles

- Voracious predator of slugs, snails, cutworms, cabbage maggots, mites, earwigs, vine borers, aphids and more
- Plant: perennials to provide stable habitats, or white clover as a groundcover in orchards

Natural Enemies

❖Build a Beetle Bank

- Location: Anywhere not too shady; in close proximity to problem areas
- Size and shape: 2’ x 4’ or smaller bumps

Natural Enemies

- **Beetle Banks (cont.)**
  - **Place a layer of dead branches and twigs down**
  - **Mound 18” of soil over wood (it will settle)**
  - **Plant: use at least 3 species of bunch grasses**
    - blue wild rye (*Elymus glaucus*), California oatgrass (Danthonia californica), slender wheatgrass (*Elymus trachycaulus*), and Roemer’s fescue (*Festuca idahoensis roemerii*)

Natural Enemies

- **Beetle Banks (cont.)**
  - **Maintenance**
    - Water until the grasses are established
    - Keep weeded
    - Annually trim or mow the grasses after they have gone to seed to a height of six to eight inches
    - Leave clippings in place as they'll create winter habitat for your ground beetles

Natural Predators

- Spiders

Plants to Attract Natural Predators

- Alyssum
- Aster family
  - Yarrow
  - Cosmos
  - Asters
- Buckwheats
- Carrot family
  - Dill
  - Fennel
  - Parsley
  - Wild carrot
- Mints

List of Plant to Attract Natural Predators

Plant	Bloom Time
Sweet alyssum (a)	spring through frost
Hairy vetch (a)	spring to summer, depending on seeding time
Angelica (p)	late spring
Common garden sage (p)	late spring to early summer
Orange stonecrop (p)	late spring to early summer
Thyme (p)	late spring to early summer
Catmint (p)	late spring to midsummer
Buckwheat (a)	three weeks after planting; continues up to 10 weeks
Dill (a)	summer
Fennel (p)	summer
Shasta daisy (p)	summer
Mints (p)	midsummer
Coreopsis (p)	summer to fall
Cilantro (a)	summer to fall, if reseeded
Cosmos (a)	summer to fall

Pollinators

- **Pollinators include:**
  - **Insects**
    - Bees
    - Wasps
    - Flies
    - Butterflies
    - Moths
    - Ants
    - Beetles

Pollinators

- **Hummingbirds**
- **Bats**

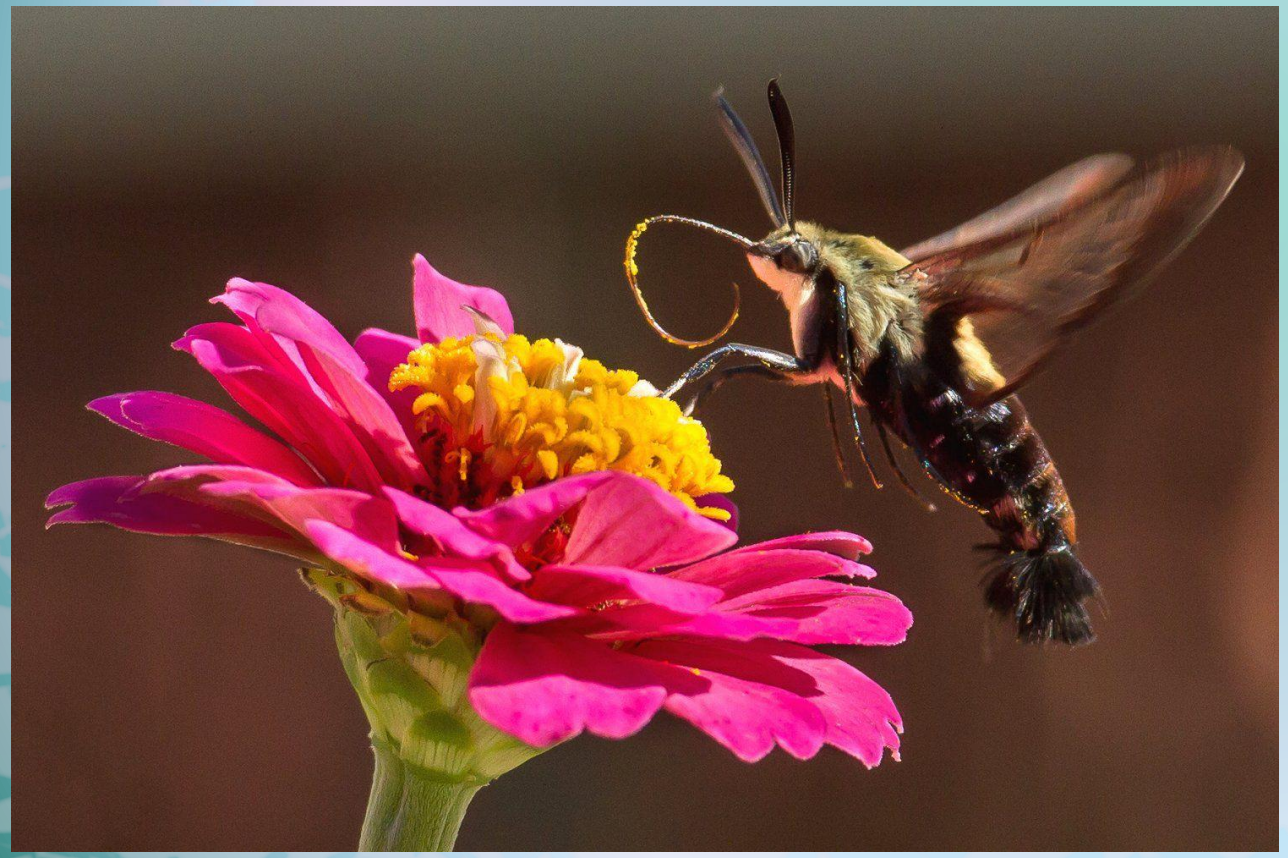
Pollinators

- Flies
  - Flesh flies
  - Soldier flies
  - Blowflies

Pollinators

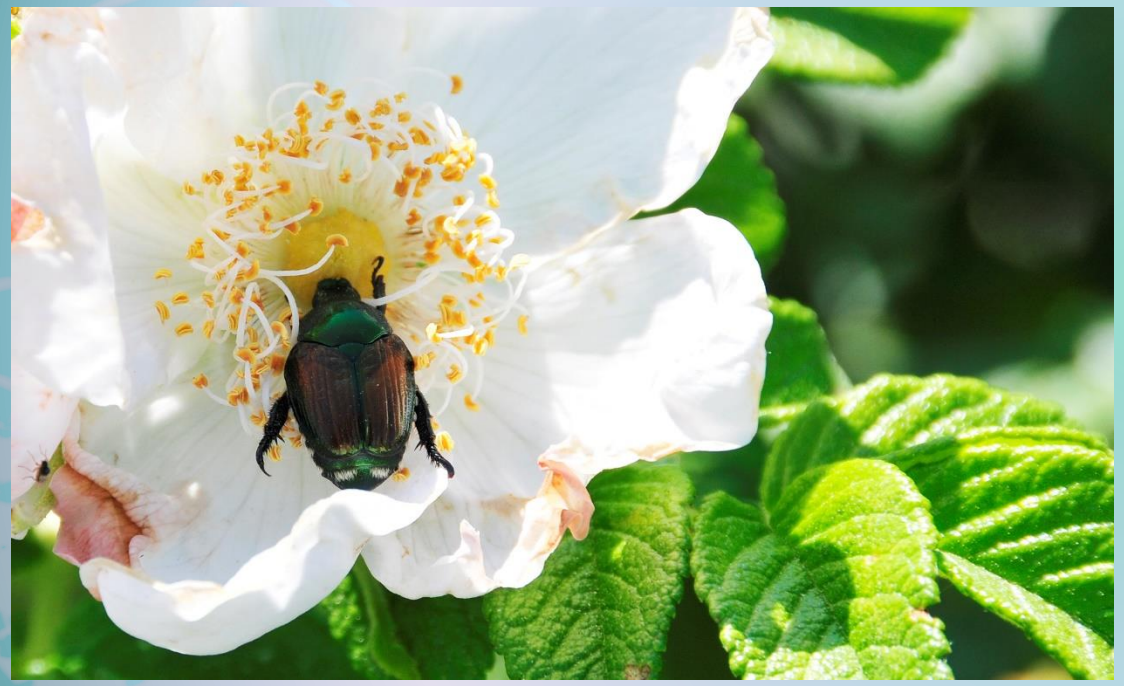
- **Butterflies and Moths**
  - **Bodies hairy**
  - **Have no way to groom**
  - **Tongues also collect pollen**
  - **Generally pollinate tubular flowers**
  - **Visit many different flowers**

Pollinators



- **Hawk moths aka Hummingbird moths**

Pollinators



- **Beetles pollinate flowers with:**
  - **Open corollas**
  - **Many tiny clustered flowers**
  - **Many exposed anthers**
- **Shed pollen easily**

Pollinators

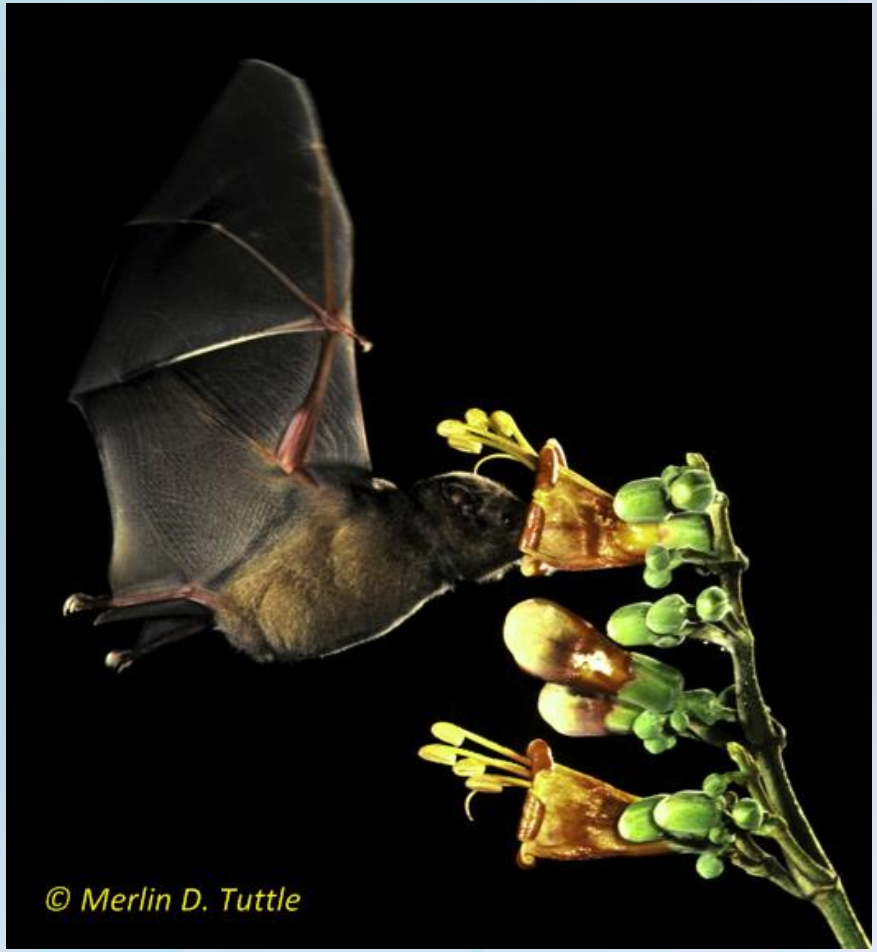
- **Soldier beetles & long-horned beetles**

Pollinators

- **Hummingbirds**
  - **Pollinate flowers with tubular corollas**
  - **Anthers dust feathers around front of head**
  - **Stigma touches this area when bird visits**

Pollinators

- Bats



Pollinators

- **Bees**
  - **There are over 20,000 species**
    - More diversity than all: Mammals + Birds + Reptiles + Amphibians summed together
  - **Diversity of bee species in:**
    - North America = 4,000 species
    - California = 1,600 species

Pollinators

- **Bees**
  - **Most are solitary**
  - **70% nest under ground**
  - **30% nest above ground, i.e. “cavity nesting”**

Pollinators

❖**Commons bees in the garden**

- **Honey bees**
- **Carpenter bees**
- **Bumble bees**
- **Long-horned bees**
- **Sweat bees**
- **Leafcutter bees**

Pollinators

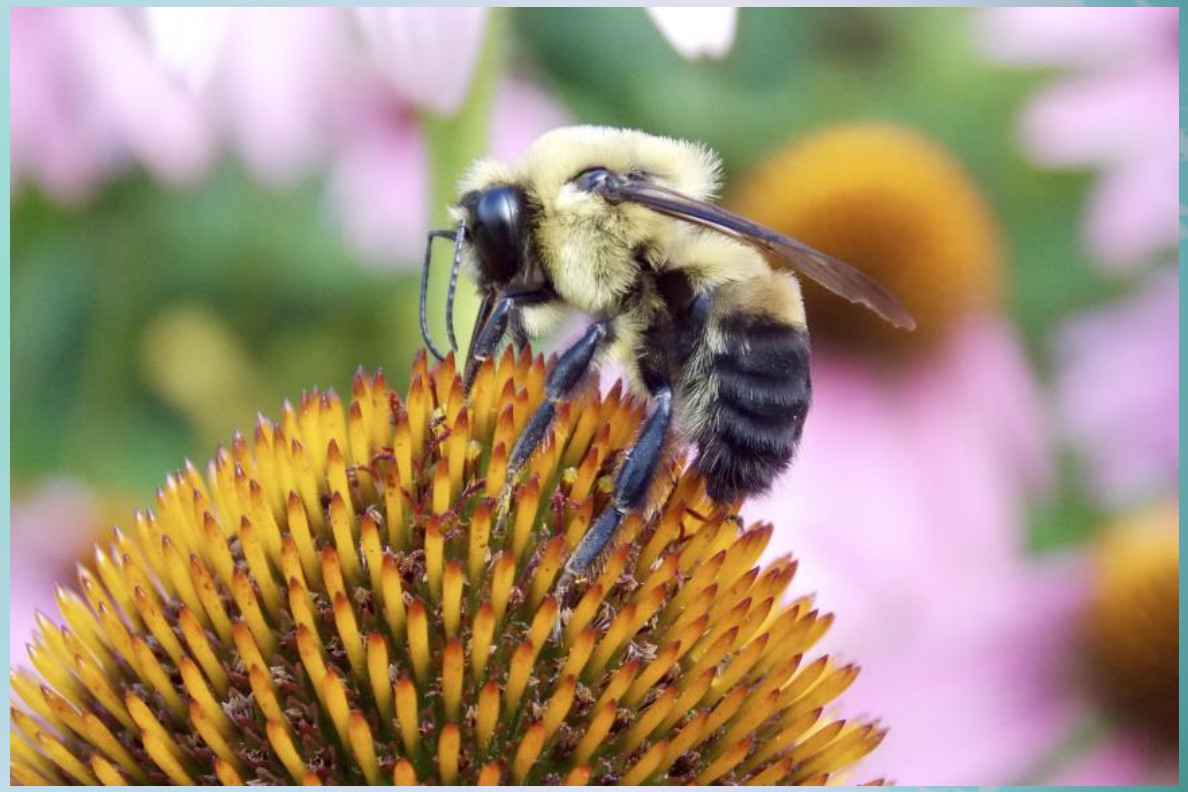
- **Honey bees**
  - **European transplants**
  - **Colony Collapse Disorder**
    - Mites
    - Pesticides
    - Poor nutrition
    - Pathogens

Pollinators

- **Carpenter bees**
  - **Resemble bumble bees**
  - **Nest in soft wood & pithy stems**

Pollinators

- **Bumble bees** *(Bombus spp.)*
  - **Very social**
  - **Generalists**
  - **Pollinate flowers that honeybees cannot**
    - Tomatoes
    - Eggplant
    - Blueberries



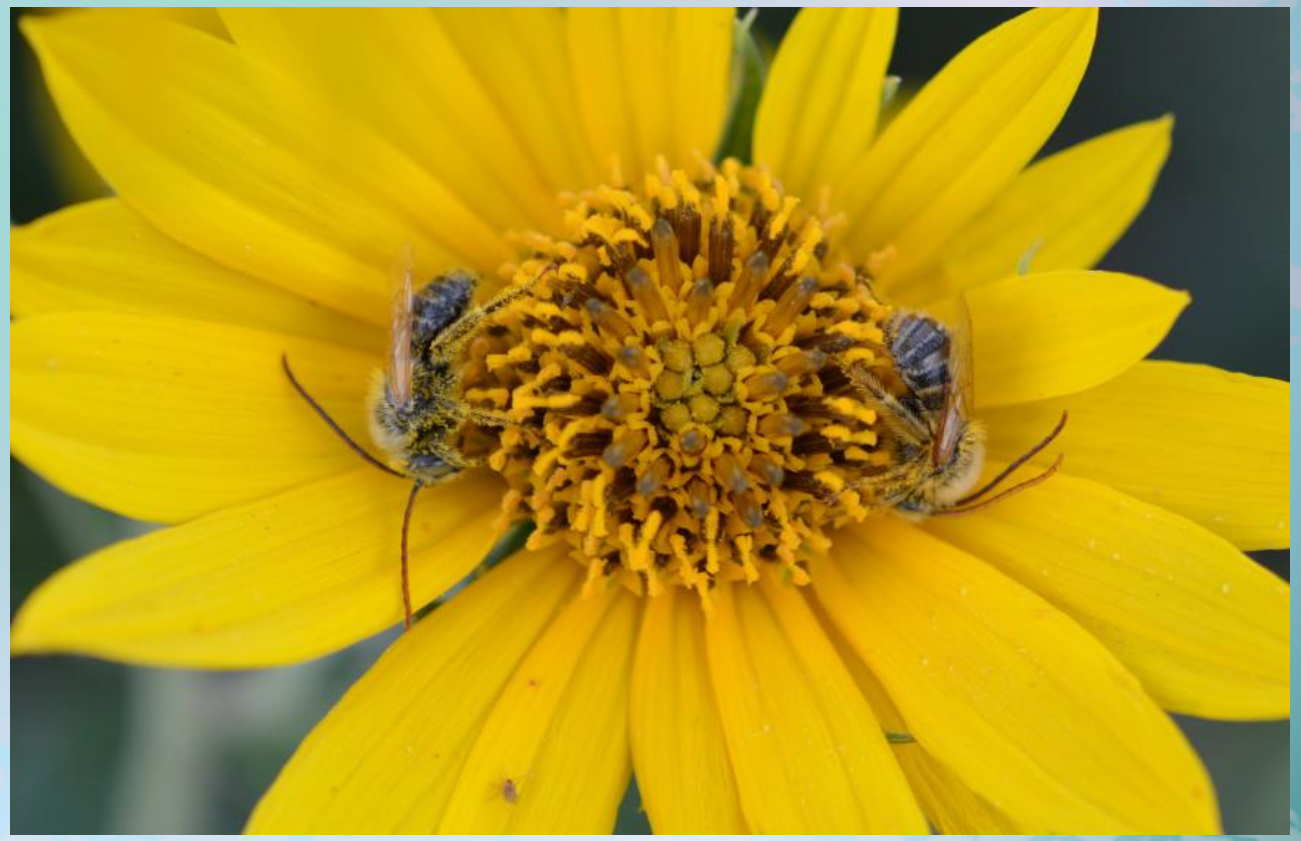
Pollinators

Orchard Mason Bees
"The Super Pollinator"

- **Attributes:**
  - Primarily gathers pollen not nectar
  - 90 time more effective than honey bees for pollination
  - Only travels about 100 meters from the nest
  - Disease free and few predators
  - Totally non-aggressive
  - 500 mason bees EQUALS 60,000 honey bees
  - 250 bees will pollinate 1 acre orchard

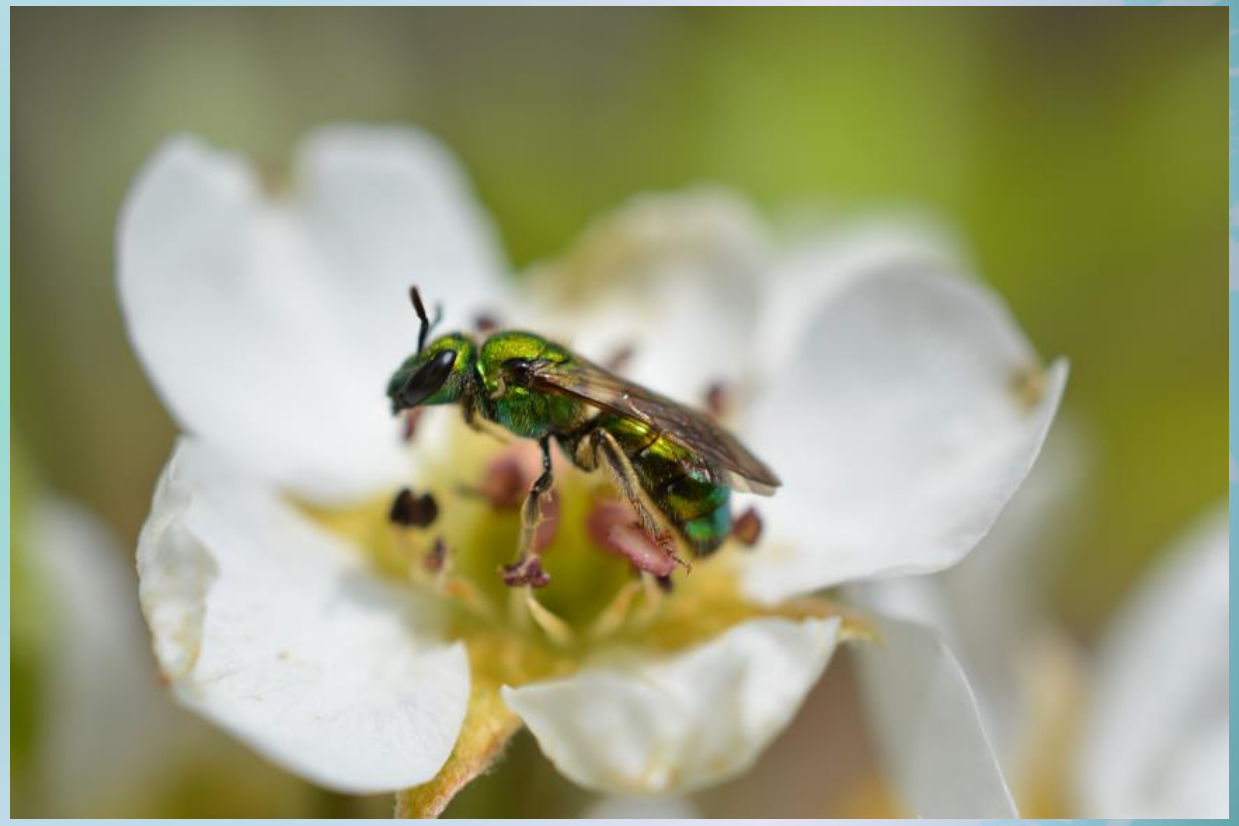
Pollinators

- **Long-horned bees (*Melissodes spp*.)**
  - **Exta-long antennae**
  - **120 species**



Pollinators

- **Sweat Bees**
  - **Ground- and wood-nesting**
  - **Generalist pollinators**

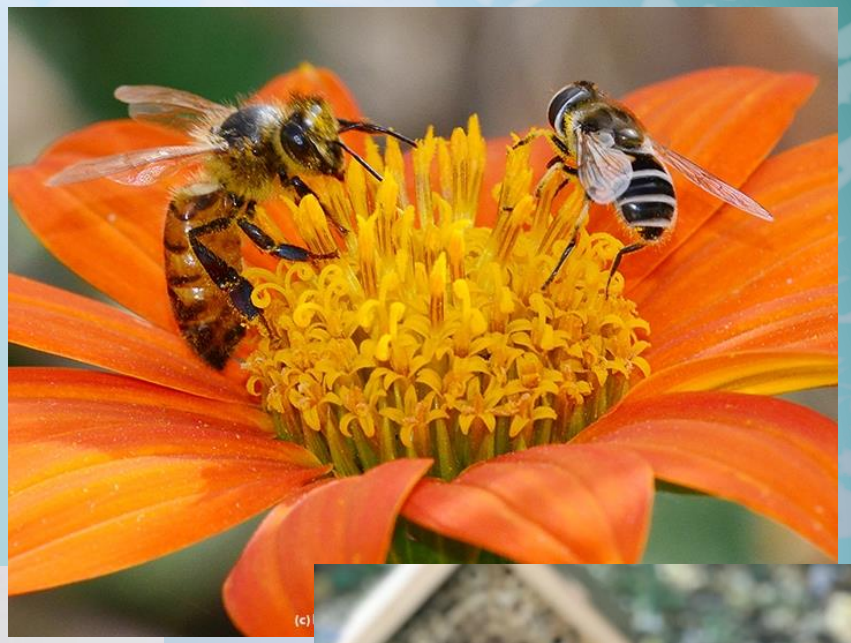


Pollinators

- Leaf cutter bees
  - Cut holes in leaves to line brood chambers
  - Benefits as pollinators outweighs the little damage they do to plants

Pollinators

- **What do pollinators need in gardens?**
  - **Food**
  - **Water**
  - **Shelter**



Pollinators

- **Food**
  - **Nectar**
    - **Attracts insects to the flowers**
    - **A primary energy source, especially in spring**
    - **Supplies a complex range of carbohydrates**

Pollinators

- Pollen
  - Sperm cells of plants
  - Provides vital protein and fats for insect larvae
  - Vital for sustaining queens

Pollinators

- **Flowers Regulate Who Pollinates**
  - **Nectar**
  - **Pollen**

Pollinators

- **Flower structure:**
  - **Corolla length vs tongue length**
  - **Pollinator body size and weight to open flower**

Pollinators

- **Color & UV Pattern**
  - **Insects cannot see red or orange**
  - **UV patterns guide insects**

Plants for Pollinators

- **2 Primary Factor affecting Beneficial Insect Populations**
  - **Plant selection**
  - **Plant diversity**
  - **Landscape arrangement**

Plants for Pollinators

- **Plant Selection**
  - **Native bees co-evolved to utilize and pollinate native plants**
  - **Fewer native plant populations = fewer native pollinators**
  - **Include more native plants**

Plants for Pollinators

- **Of 1000 plants studied only 50 were natives and 950 non-natives, yet:**
  - **80 percent of natives attracted bees (40 taxa)**
  - **8 percent of non-natives (76) attracted bees**

Plants for Pollinators

- **Plant characteristics**
  - **Flower appearance**
    - **Color**
    - **Plant height**
    - **Flower shape**
    - **Flower type**

The key is diversity and lots of it!!

Plants for Pollinators

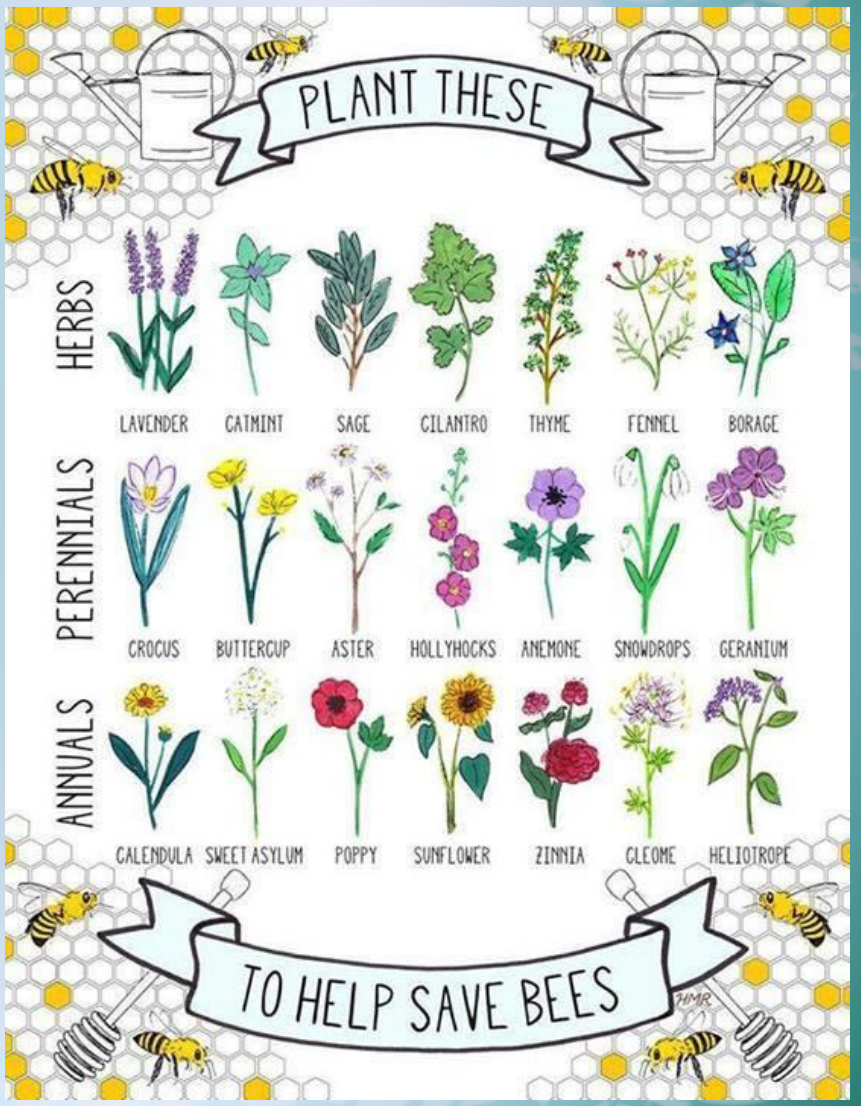
- **Pollinator View**
  - **Plants with lots of nectar and pollen**
  - **Large masses of flowers (10 sf min)**
  - **Bloom over a long period**
  - **Lots of diversity**
    - Variety of flower shapes, sizes and color
    - Sequential and overlapping bloom times

Plants for Pollinators

- **Lists abound online**

		Bloom Period	Common Name	Scientific Name	Annual, Perennial, or Biennial	Flower Color	Max. Height (feet)	Water Needs (L: low; M: med.; H: high)	Notes
			Forbs						
	1	Early	Baby blue eyes	*Nemophila menziesii*	A	blue	0.25	L	Stunning sky blue flowers attract native bees, including mason bees (*Osmia* spp.); tolerates moderate shade and moisture
	2	Early	Common tidytips	*Layia platyglossa*	A	yellow	0.25	L	Sunny yellow and white flowers are very attractive to butterflies and native bees; tolerates clay soils
	3	Early	Lacy phacelia	*Phacelia tanacetifolia*	A	purple	3	L	Easy to establish, with prolific, showy blooms; tolerates clay soils
	4	Early – Mid	California poppy	*Eschscholzia californica*	A, P	orange	0.5	L	Easy to establish and long blooming; attracts a diversity of bees, bumble bees in particular
	5	Early – Mid	Elegant clarkia	*Clarkia unguiculata*	A	pink	0.5	L	Strikingly unique flowers attract bees and butterflies; larval host for Clark's sphinx moth
	6	Early – Mid	Globe gilia	*Gilia capitata*	A, P	blue	1	M	Globe-shaped, periwinkle-blue flower clusters attract a diversity of bees and butterflies
	7	Mid	California phacelia	*Phacelia californica*	P	purple	1	L	Tightly coiled flower heads are very attractive to bumble bees and other native bees; tolerates clay soils
	8	Mid	Cleveland sage	*Salvia clevelandii*	P	purple	3	L	Showy flowers attract bees, butterflies, and hummingbirds; extremely fragrant foliage; requires good drainage
	9	Mid	Foothill penstemon	*Penstemon heterophyllus*	P	blue	3	L	Iridescent violet flowers attract bees, butterflies, and hummingbirds; requires good drainage; heat and drought tolerant
	10	Mid	Narrowleaf milkweed	*Asclepias fascicularis*	P	pink/white	1.5	M	Monarch butterfly host plant; high-quality nectar source for many bees; easier to establish from transplants than from seed
	11	Mid	Summer lupine	*Lupinus formosus*	P	purple	1.5	L	This and other lupines are highly attractive to bumble bees and visited by many other native bees
	12	Mid – Late	Common sunflower	*Helianthus annuus*	A	yellow	5	M	Sunflowers are a favorite of many bee species; easy to establish and tolerant of clay soils
	13	Mid – Late	Gumplant	*Grindelia camporum*	P	yellow	4	L	Long-lasting flowers; attracts small, native bees; tolerates clay soils and wet or dry conditions
	14	Late	California aster	*Symphyotrichum chilense*	P	purple	5	L	One of the latest fall blooming plants; important for pre-hibernation bumble bee queens; tolerates clay soils
	15	Late	California fuchsia	*Epilobium canum*	P	orange/red	3	L	Abundant scarlet-colored flowers; critical late-season nectar source for hummingbirds and bees
	16	Late	California goldenrod	*Solidago californica*	P	yellow	3	M	Important late-season forage for bees, butterflies, beneficial solitary wasps, pollen-eating soldier beetles, and more
			Shrubs						
	17	Early	California lilac	*Ceanothus 'Concha'*	P	purple	4	L	Attracts bees and butterflies with a profusion of bright violet-blue flowers; tolerates clay soils
	18	Early	McMinn manzanita	*Arctostaphylos 'McMinn'*	P	white	5	L	Clusters of small, bell-shaped flowers provide early season forage for bumble bees and other spring bees; tolerates clay soils
	19	Early	Oregon grape	*Berberis aquifolium*	P	yellow	5	L	Attracts honey bees and native bees, including mason bees (*Osmia* spp.); tolerates shade and wet or dry conditions
	20	Early	Redbud	*Cercis orbiculata*	P	pink/red	15	M	Rose-colored blooms clustered on bare branches; tolerates some shade and moisture; can be pruned to a shrub or small tree
	21	Early – Mid	California buckthorn	*Frangula californica*	P	white	5	L	Attractive, evergreen shrub that attracts small, native bees; its berries are a favorite of birds; tolerates some shade
	22	Early – Mid	California flannelbush	*Fremontodendron californicum*	P	yellow	15	L	Prolific bloomer with large, bell-shaped yellow flowers; does not need summer water
	23	Early – Mid	Silver bush lupine	*Lupinus albifrons*	P	purple	3	L	Showy, deep purple flowers with contrasting silver foliage; attracts numerous bee species; requires good drainage
	24	Mid	California buckwheat	*Eriogonum fasciculatum*	P	white	2.5	L	Favored nectar source of many blue and hairstreak butterflies, also very attractive to native bees; drought tolerant

Xerces Society – xerces.org



Native Woody Perennials – Tall Shrubs

- Chamise
  Adenostoma fasciculatum
- Wild lilac
  Ceanothus species
- Manzanita
  Arctostaphylos spp
- Hollyleaf Cherry
  Prunus illificifolius
- Toyon
  Heteromeles arbutifolia
- Mountain mahogany-
  Cercocarpus betuloides
- Coffeeberry
  Rhamnus californica

Native Woody Perennials - Shrubs

(for moister, shadier areas)

- Oregon grape
  Mahonia species
- Western redbud
  Cercis occidentalis
- Willows
  Salix species
- Elderberry
  Sambucus mexicana
- Wild rose
  Rosa species
- Currants
  Ribes species

Native Perennials - Subshrubs

- Buckwheat - *Eriogonum species*
- Coyote bush - Baccharis pilularis varieties
- Deerweed - *Lotus scoparius*

Native Herbaceous Perennials

- Coyote mint
  Monardella species
- certain Penstemon species
- Woolly Sunflower
  Eriophyllum lanatum
- Yarrow
  Achillea millefolium
- Sierra lessingia
  Lessingia leptoclada
- Milk vetch
  Astragalus species
- Needlegrass
  Nassella viridula
- California figwort
  Scrophularia californica

Native Herbaceous Perennials

❖**For moister, shadier areas:**

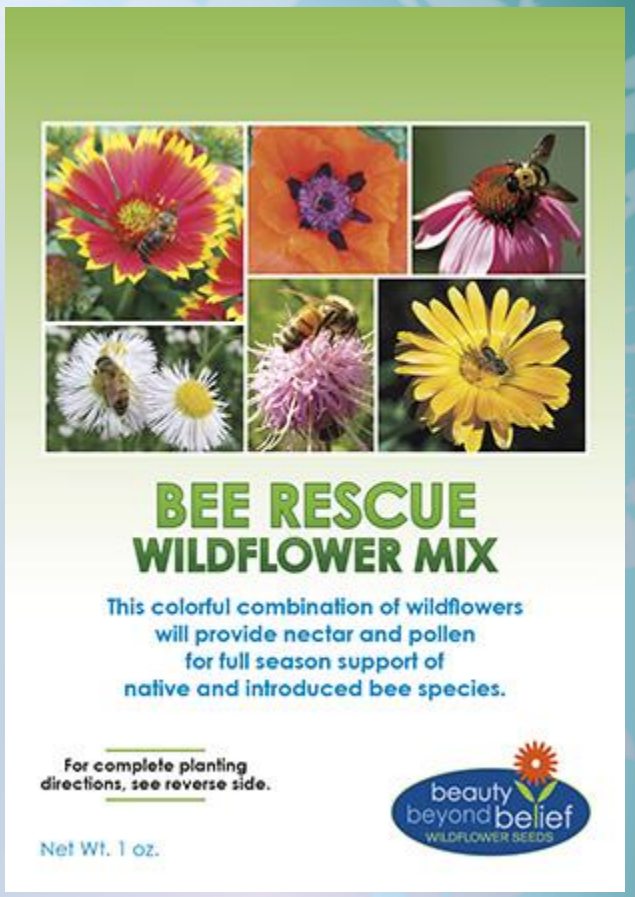
- Deergrass
  Muhlenbergia rigens
- Dusky horkelia
  Horkelia fusca
- Common verbena
  Verbena lasiostachys
- Slender cinquefoil
  Potentilla gracilis
- California aster
  Symphyotrichum chilensis
- Goldenrod
  Solidago species

Native Wildflowers

- Dichelostemma
- Lupine species
- Eschscholzia species
- Agoseris species
- Trifolium species
- Lotus species
- Monardella species
- Gilia species
- Astragalus species
- Phacelia species
- Chaenactis species
- Hemizonia species
- Stephanomeria species
- Trichostema species
- Heterotheca species
- Lessingia
- Gnaphalium
- Salvia species
- Lasthenia species
- Layia species

Native Wildflowers

- Seed mixes are readily available



Native Thistles

- **Often confused with invasive cousins**
- **Nectar attractive to pollinators**
- **Seeds attractive to bird**

Native Thistles

- **Thistles native to El Dorado County**

1. **Cirsium andersonii – Anderson's thistle**
2. **Cirsium occidentale – Cobweb or Western thistle**
3. **C. o. var. californimum – Bigelow or California thistle**
4. **C. o. var. candidissium – Snowy thistle**
5. **C. o. var. venustum – Cobwebby or Coulter's thistle**
6. **Cirsium scariosum – Dwarf or Elks thistle**
7. **C s var. americanum – Dinnerplate thistle**

Native Thistles

***Cirsium andersonii* –**
Anderson's thistle

***Cirsium occidentale* –**
Cobweb or Western thistle

Native Thistles

***C. o. var. californimum* –**
Bigelow or California thistle

***C. o. var. candidissium* –**
Snowy thistle

Native Thistles

***C. o. var. venustum* –**
Cobwebby or Coulter's thistle

***Cirsium scariosum* –**
Dwarf or Elks thistle

Native Thistles

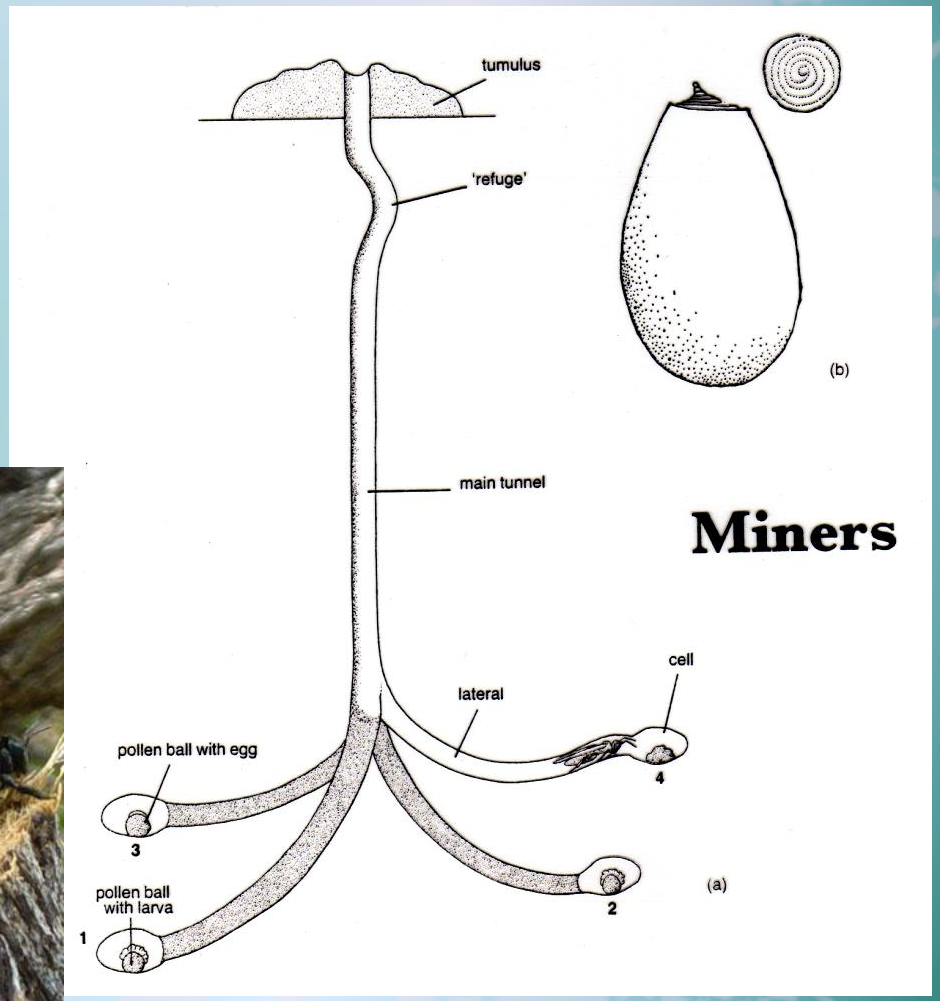
***C. scariosum var. americanum* –**
Dinnerplate thistle

Shelter for Pollinators

- **Above-ground nesting bees**
  - **Abandoned beetle galleries in the wild**
  - **Bee houses mimic habitat in gardens**
  - **Nest close to foraging areas**
  - **Tend to nest in the same area each year**
- **Size matters: a bee will use cavities corresponding to its body size**

Shelter for Pollinators

- **Ground-nesting bees**
  - **Bare ground in sunny places**
  - **Rock and stone crevices**
  - **Stumps and logs**



Shelter for Pollinators

❖**Bee Blocks**

Shelter for Pollinators

- **Mason bee nests**
  - **Put them up and forget about them!**

Water for Pollinators

- **Honey bees prefer “dirty” water**
- **Butterflies need bare, moist soil patches**

Habitat Management

- Maintain a continuous supply of flowers
- Provide bare patches of soil for ground-nesting "friends"
- Don't use pesticides/herbicides
- Don't till
- Leave the leaves

Resources

- Bees and Blooms
- The Bee Friendly Garden
- UC Berkeley Urban Bee Lab info
- www.helpabee.org
- https://hbhgarden.uc davis.edu
- http://www.farmerfred.com/plants_that_attract_benefi.html

UCCE
El Dorado County
Master Gardeners

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