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’

Albert Einstein
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.
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
10. Eradicate or reduce the exotic, invasive plants in your landscape
    try organic, mechanical means first
    Replace with native plants quickly to suppress invasives
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

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

Life cycle of the aphid midge, *Aphidoletes aphidimyza*
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

[Images of soldier beetles and plants]
Natural Enemies

Tachnid & Hover flies

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

Hover fly
Tachnid fly
Hover fly larvae
Natural Enemies

Parasitic (Braconid) wasps

- 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.

Aphid parasitoid

Tomato hornworm with parasitoid cocoons on it

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

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

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

Orchard Mason Bees
“The Super Pollinator”
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**

## 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. californium –
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.ucdavis.edu
- http://www.farmerfred.com/plants_that_attract_benefi.html
UCCE
El Dorado County
Master Gardeners

- Contact us:
  - 530-621-5512 (Tues-Fri 9:00AM-Noon)
  - mgeldorado@ucdavis.edu
  - Visit us at 311 Fairlane, Placerville