# Mission

Engaging university-trained volunteers to empower and sustain diverse communities with relevant, unbiased, research-based horticulture and environmental stewardship education.

# WSU Master Gardener Program

*Cultivating Plants, People & Communities Since 1973*


*Become a volunteer mastergardener.wsu.edu*

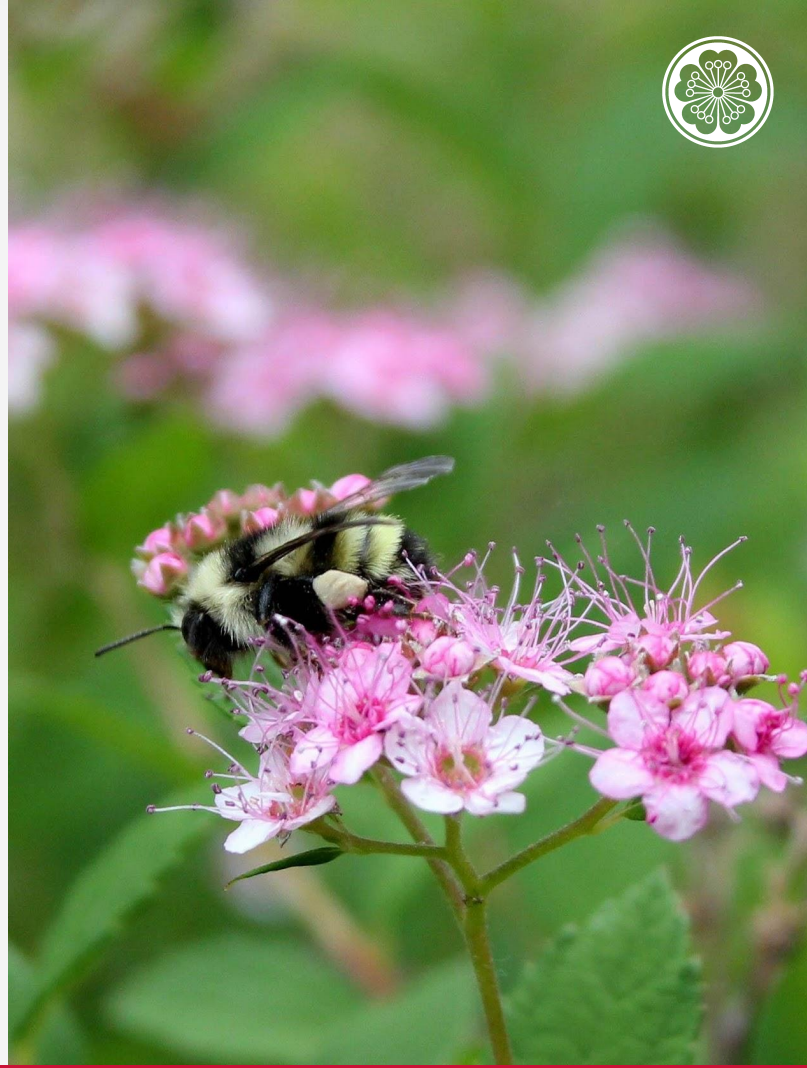
Master Gardener Program

WASHINGTON STATE UNIVERSITY EXTENSION

# Pollinator Health

Teaches ways to help native bees and other pollinators thrive in home and community landscapes.

- Pollinators are responsible for 1 in every 4 bites of food we eat
- We all have a role to play in pollinator conservation
- Pollinators support plant diversity




WSU EXTENSION
Cowlitz County

# Attracting Beneficial Insects to Your Garden

WSU Cowlitz County Extension
Master Gardener Program

# What we'll be talking about

Who are the beneficial insects?

How we can welcome them and keep them coming back?

- Create Habitats
- Food and Water
- Practicing Integrated Pest Management

# Why should we care about pollinators and other beneficial insects?


- Food crops—many depend on bees to pollinate
- Seed Crops-PNW grows many seed crops-clover, alfalfa, and vegetable seeds
- Native plants-rely on pollinators to reproduce and persist in the wild
- Insect predators and parasitoids keep garden pest under control

# Population decline

The decline in Bees and other insects threatens crops, wildflowers, and native plants

Threats to these insects:

- Loss of habitat
- Pesticide use
- Disease
- Climate change

Western Carpenter Bee - *Xylocopa californica*

# Who are the Beneficial Insects?

1. **Pollinators**
   - Bees, flies, butterflies and moths
     - Important pollinators: honeybees, bumblebees, orchard mason bees, and syrphid flies
     - Minor pollinators, such as wasps, ants, midges
   - Pollinators play a critical role in the production of our food crops and garden plants.

Western Aphid Eater (Syrphid fly)

Optimal pollination happens when there is a variety of pollinating insects with diverse body shapes and foraging habits that are active at various times throughout the year.

## 5 BEES COMMON TO THE PACIFIC NORTHWEST

There are an estimated 800 species of bees in the Pacific Northwest. Bees common to urban landscapes include:

**Honey bee**

Family Apidae, *Apis mellifera*, 1 species

- Highly social — thousands of nestmates and a queen.
- Only bee that makes honey.
- Females carry pollen in spoon-like structures on rear leg (corbicula).
- The only bee active November–January.

**Bumble bee**

Family Apidae, *Bombus* spp., 25 species

- Solitary phase — mated queens winter and start colonies in the spring.
- Social phase — 50–500 workers and a queen, annual nests.
- Females carry pollen in spoon-like structures on rear leg (corbicula).
- Active January–November (depending on the species).

**Mason bee**

Family Megachilidae, *Osmia* spp., 75 species

- Solitary.
- Builds nests above ground, repurposing narrow cavities.
- Females carry pollen on hairs on abdomen (scopa).
- Active April–September.

**Metallic sweat bee**

Family Halictidae, *Agopostemon* spp., 5 species

- Solitary/communal.
- Digs nests in the ground.
- Females carry pollen on hairs on rear legs (scopa).
- Active April–September.

**Small carpenter bee**

Family Apidae, *Ceratina* spp., 5 species

- Solitary/communal.
- Lives in pithy dead twigs.
- Females carry pollen on hairs on rear legs (scopa).
- Active April–September.

Photos: Oregon Department of Agriculture

# What's the buzz?

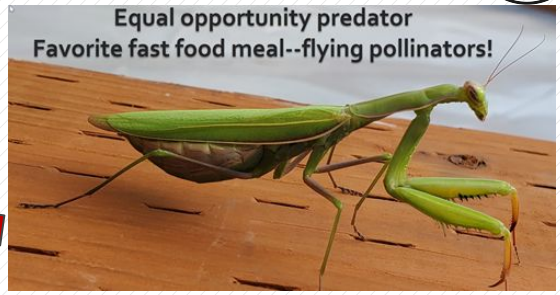
- **Bumblebees** help to pollinate flowers that are difficult for other pollinators to reach.
- They pollinate 30-60% more than honey bees!
- Examples--blueberry and tomato flowers.
- Grasp the petals, vibrate their wings creating their typical buzzing
- Pollen falls onto their undersides--they collect this pollen on their back legs and take it home
- This pollination method is called "sonication"
- Blunt end of electric toothbrush works, too!

# Did you know?

- Plants emit semiochemicals such as pheromones to communicate with other plants and insects.
- They also release herbivore-induced plant volatiles (HIPVs) to attract beneficial insects that feed on pests.
- Plants emit ultrasonic sounds to signal for help when they are experiencing stress
- Each type of plant and stress (e.g., aphids, spider mites, drought) emits a unique identifiable sound.
- These sounds are inaudible to humans, they can likely be detected by animals such as bats, mice, and insects.

# Who are the Beneficial Insects?


## 2. Predators




- Lady beetles, (*praying mantis), lacewings, ground beetles, minute pirate bugs, damsel bugs, syrphid fly larvae, and snake flies, spiders (arachnid, not insect).
- Learn what their immature forms look like!
- Encouraging predators = less need to control harmful insects.

# Who are the Beneficial Insects?

## 2. Parasitoids

- Insects that live on or in a host insect, feeding on the host and usually killing it over time.
- Tiny stingless wasps and tachinid flies.
- Important impact on pest insect populations.
- Attract parasitoids plants with umbrella-shaped clusters (umbels) of tiny flowers such as carrots, cilantro, dill, sweet clover, fennel, and Queen Anne's lace.

# Lady Beetles

# Green Lacewing


# Snakefly

# How to Encourage Beneficial Insects

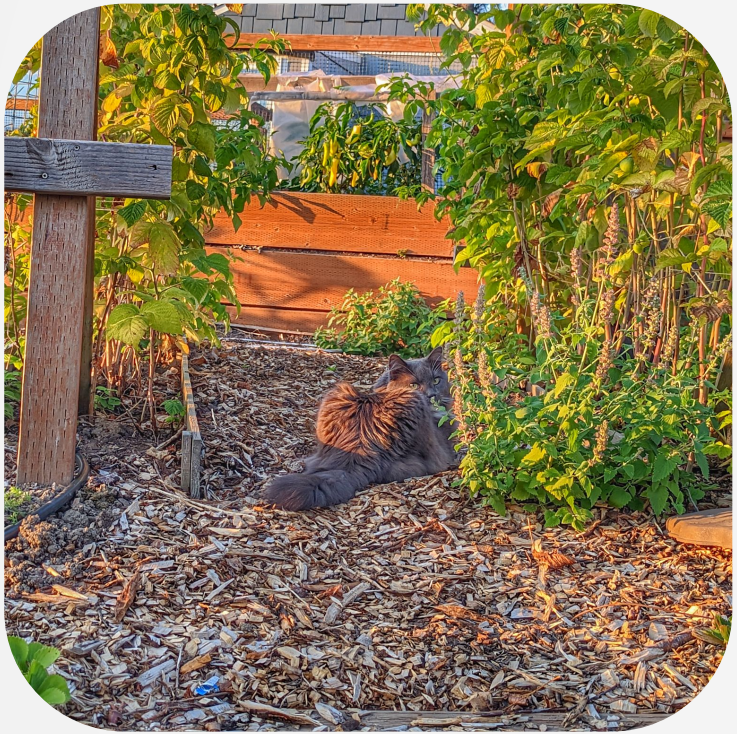
## Tolerate some garden chaos!

Beneficial insects require undisturbed areas to nest, lay eggs, and overwinter, so it's important to tolerate some garden disorder.

# How to Encourage Beneficial Insects

## Look who overwintered under some scruffy looking sword ferns!

# How to Encourage Beneficial Insects



## Create habitats

Ground covers and coarse mulches such as bark dust, straw, and organic leaf mulch

Ground beetles and rove beetles hide during the day and eat slugs and cutworms at night

Rove Beetle

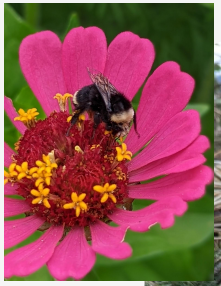
Ground Beetle

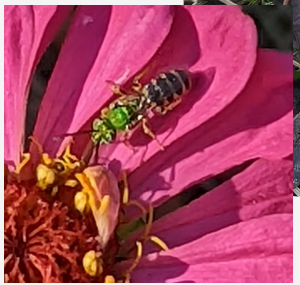
# How to Encourage Beneficial Insects

## Create habitats

To create nesting opportunities for bees, provide materials like hollow stems, mud, and nesting blocks in your garden.

- Patches of bare soil or sparsely planted native clump grasses
    - Ground nesting bees
- Cut perennial plant stems with hollow or pithy stems 6-18 inches.
    - Nesting areas for mason bees, leafcutting, small carpenter bees, and masked bees
    - E.g., raspberries, grape vines, elderberry, milkweed, Sedum autumn joy
- Mason bees need mud for their nests—keep patches of wet clay soil for them





Bicolored Sweat Bee--ground nesting

# How about bee condominiums?

- Can be a breeding place for for disease--
- **Must be cleaned out annually**
- Make your own--smaller, easier to clean.
- DIY instructions available

Univ. of Nebraska-Bee blocks
https://extensionpublications.unl.edu/assets/html/g2256/build/g2256.htm

Xerces-tunnel nests for bees
https://xerces.org/sites/default/files/2018-05/13-054_02_XercesSoc_Tunnel-Nests-for-Native-Bees_web.pdf

Crownbees--DIY:
https://crownbees.com/blog/diy-how-to-make-a-solitary-bee-house/

# How to Encourage Beneficial Insects

## Water

- Water source for insects: fill a saucer with pebbles and leave water in it, making sure to keep it full on hot and dry days.

A puddling dish is a simple dish or saucer filled with pebbles that can hold water. Photo by Ashley Gamell. https://www.bbg.org/gardening/article/make_your_garden_a_haven_for_insect_diversity

# How to Encourage Beneficial Insects

## Food

Flowers produce **nectar,** a sugary liquid that provides energy for the pollinators, while **pollen** is a source of protein that they can feed to their young.

**Best Practices:**

1. Have at least 3 species of flowering plants that provide continuous bloom from spring through fall.
2. Some flowers may be deadheaded to rebloom to extend the flowering season.
3. Plant in large groupings instead of many small planting areas

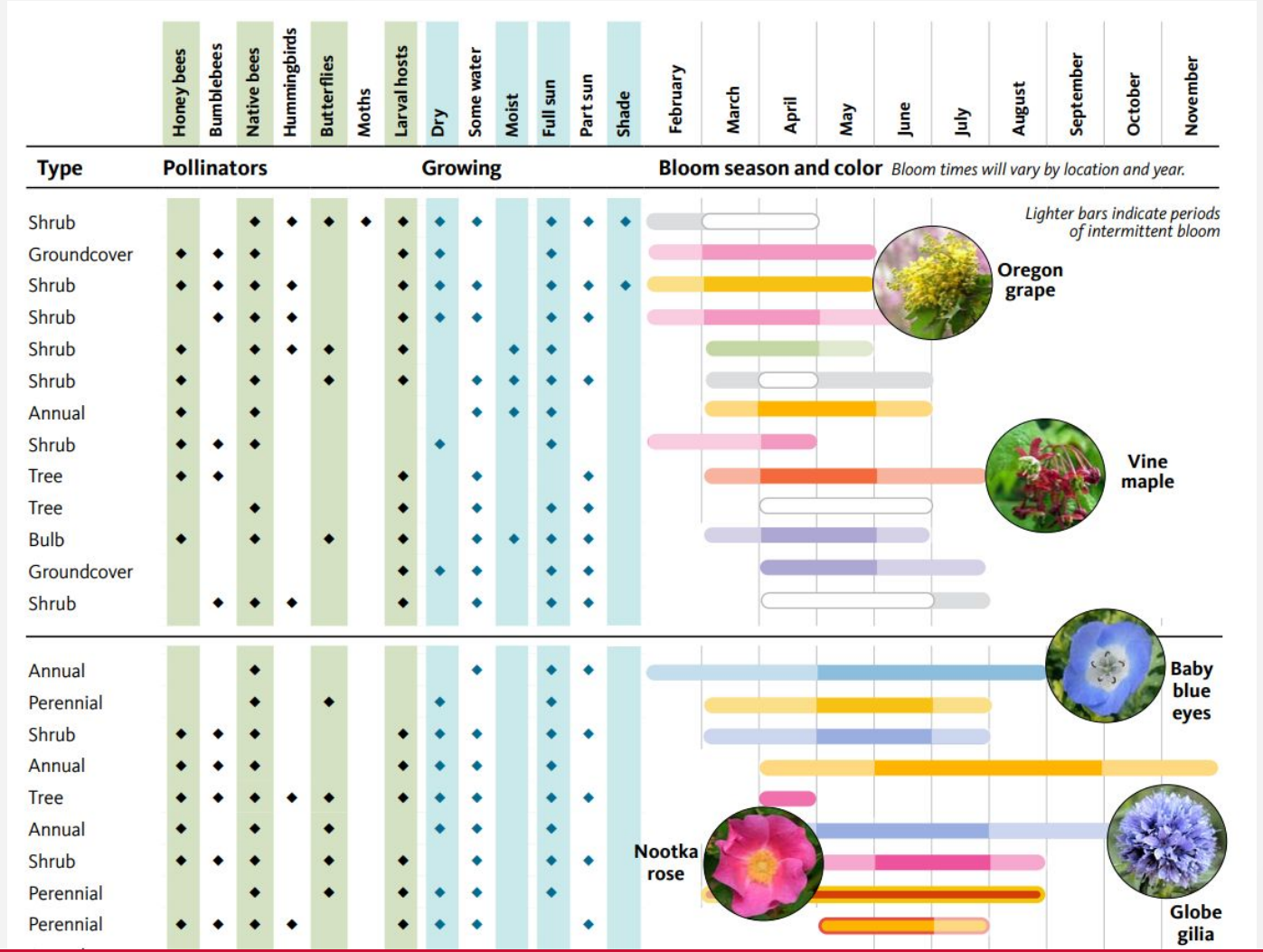
- California poppies
- Dahlias
- Lavender
- Sedum
- Cosmos
- Sweet alyssum
- Candytuft
- Siberian wallflower
- Catnip
- Korean mint(*Agastache rugosa),*
- Anise hyssop (*Agastache foeniculum*)
- Borage, sunflowers
- Green Mist (Amni)
- Bee balm (*Mondarda*)
- Marjoram
- Chives
- Lacy Phacelia
- Nodding onions (*Allium cernuum*)
- Sweet fennel
- Sitka willow
- Bigleaf maple

**My pollinator garden October until the first hard frost**

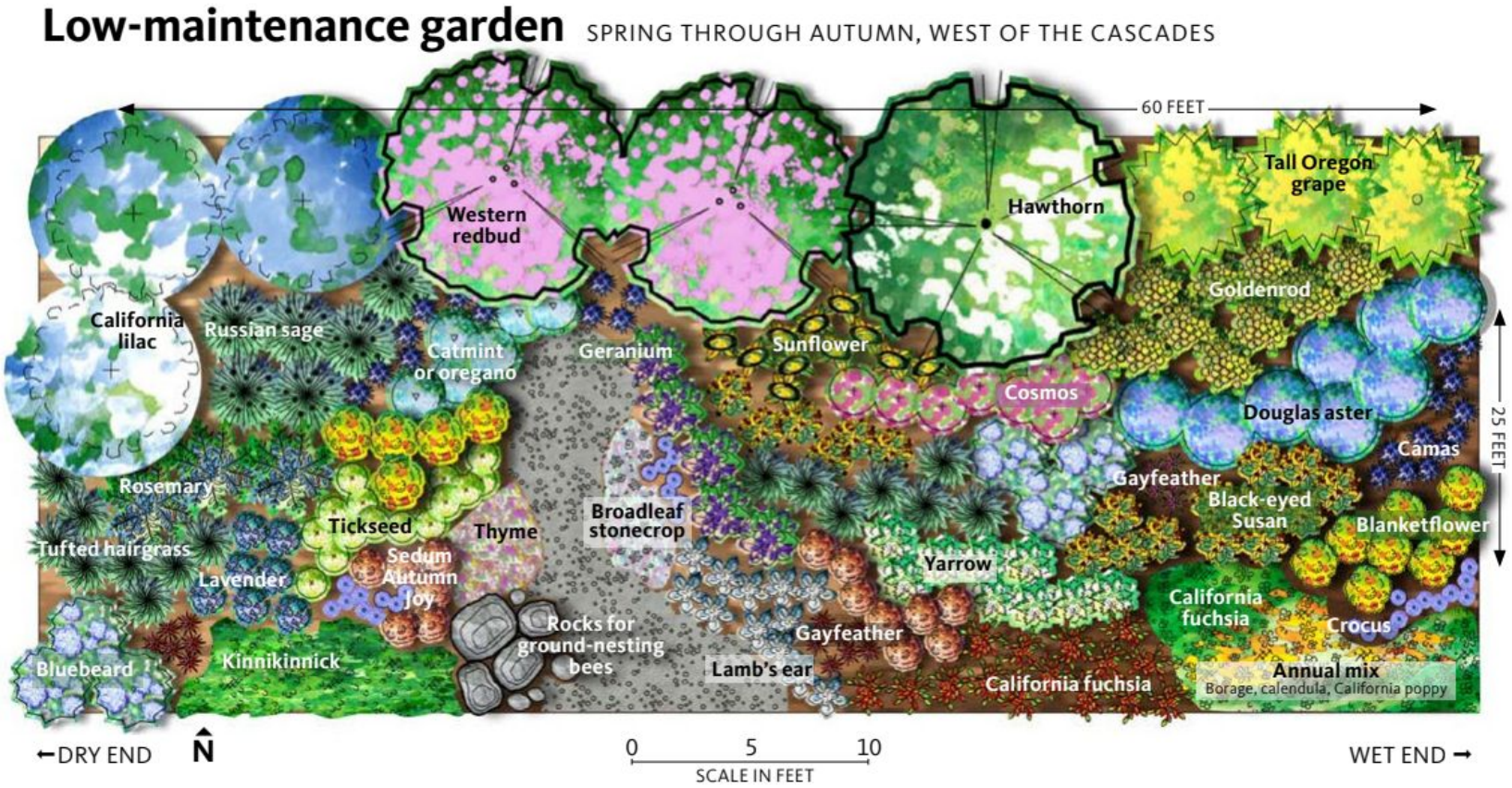
Also strawberries, clover, raspberries, apple trees, and feline pollinator assistant.

# Great plant lists for 3 season flowers

***Enhancing Urban and Suburban Landscapes to Protect Pollinators*** **EM 9289**
https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9289.pdf

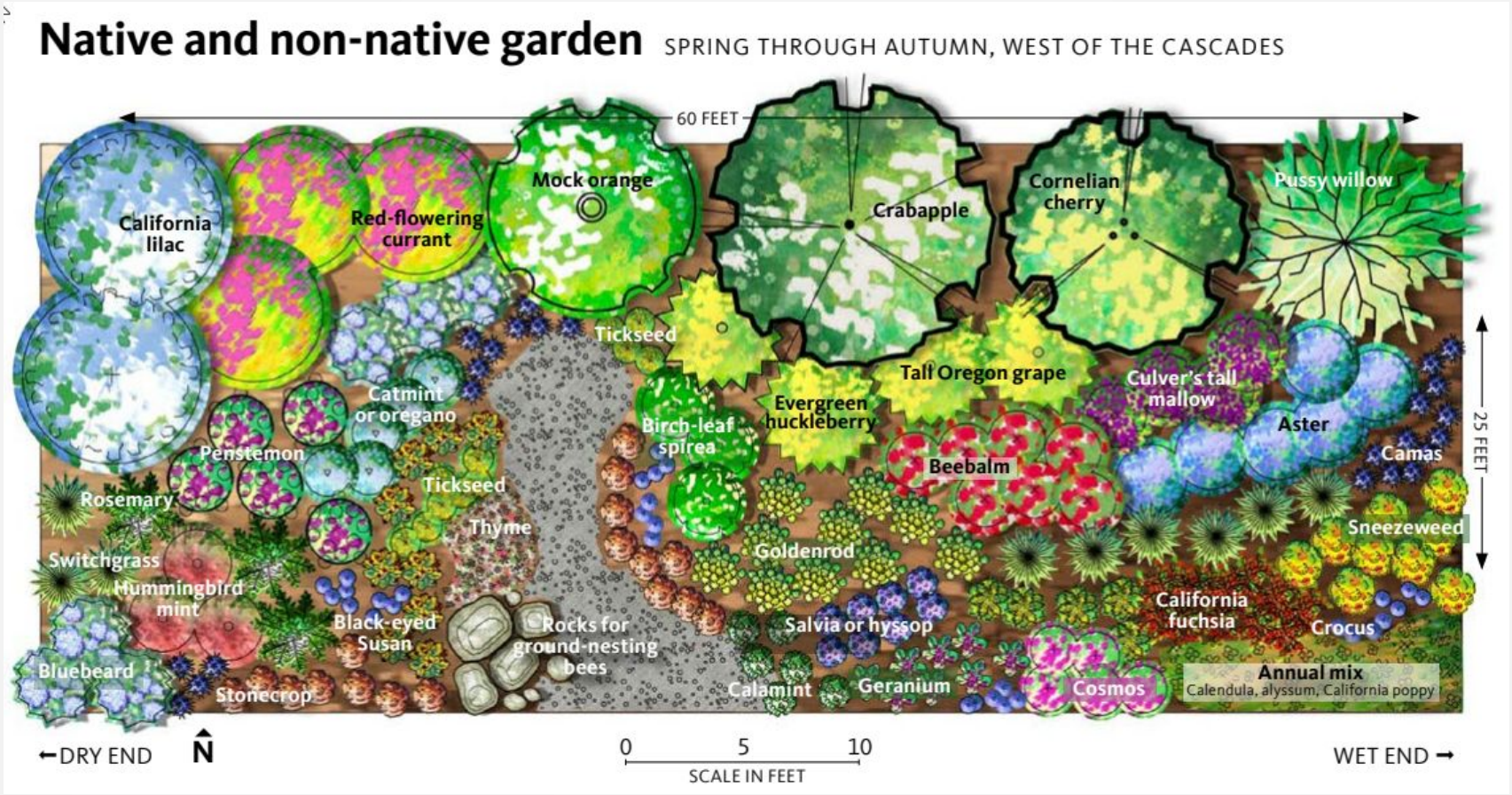


# Large Groupings-Pollinator Garden Designs




https://catalog.extension.oregonstate.edu/em9289/html

# Large Groupings-Pollinator Garden Designs




https://catalog.extension.oregonstate.edu/em9289/html

# How to Encourage Beneficial Insects

## Food

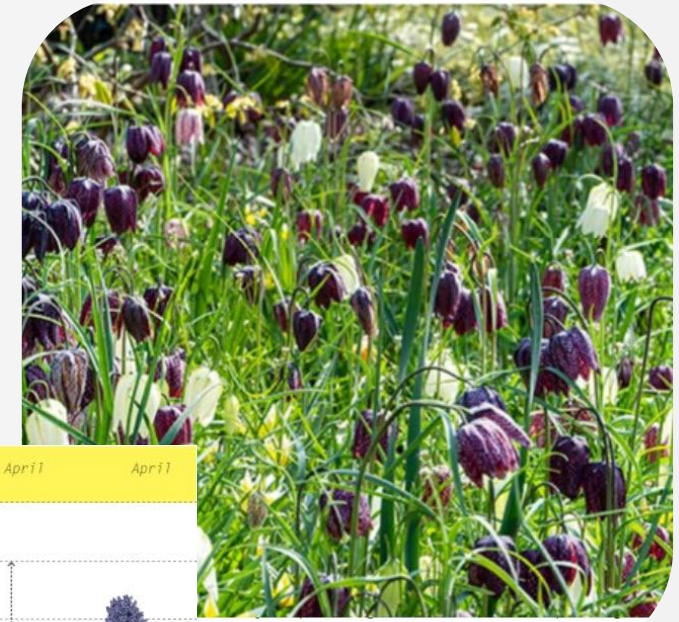
4. Choose a wide variety of flowering plant species with diverse textures, heights, and flower shapes.

5. If you plant  native plants along with other plants you will attract a wider variety of pollinators.

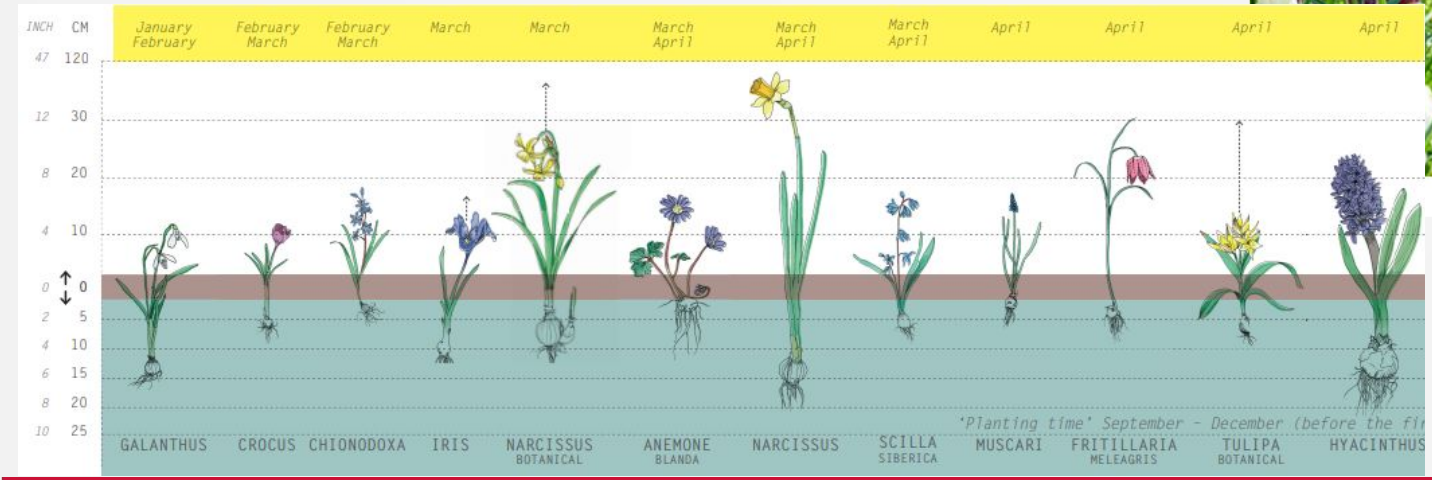
6. Plant some bulbs, shrubs and trees (preferably natives, for butterfly and moth caterpillars)

# Plant early spring-flowering bulbs

| | |
|---|---|
| Crocus | Grape hyacinth |
| Dwarf irises | Snowdrops |
| Woodland tulips | Winter aconites |
| Miniature daffodils | Checkered Fritillaria |
| Glory-of-the-snow | Grecian windflower |
| Spring star | Small alliums |
| Siberian squill | Striped squill (Puschkinia). |



(Photo Credit: Flowerbulbs.com)




Peggy Anne Montgomery
flowerbulbs.com

# How to Encourage Beneficial Insects

## Food

Insectary plants serve as a food source for several adult predators and parasitoids who feed on their nectar and pollen.

*Texas Striped Bee (Agapostemon texanus)*

# INSECTARY GARDEN!
# Plant Picks

- The following plants attract beneficial insects
  - Carrot family (Apiaceae)

Cilantro

Yarrow

Anise

# INSECTARY GARDEN!
# Plant Picks

- Daisy family (Asteraceae)
  - Black-eyed Susan
  - Shasta Daisy
  - Creeping Daisy

Sunflower

Coreopsis

Cosmos

Chamomile

Gay Feather (*Liatris*)

# INSECTARY GARDEN! Plant Picks

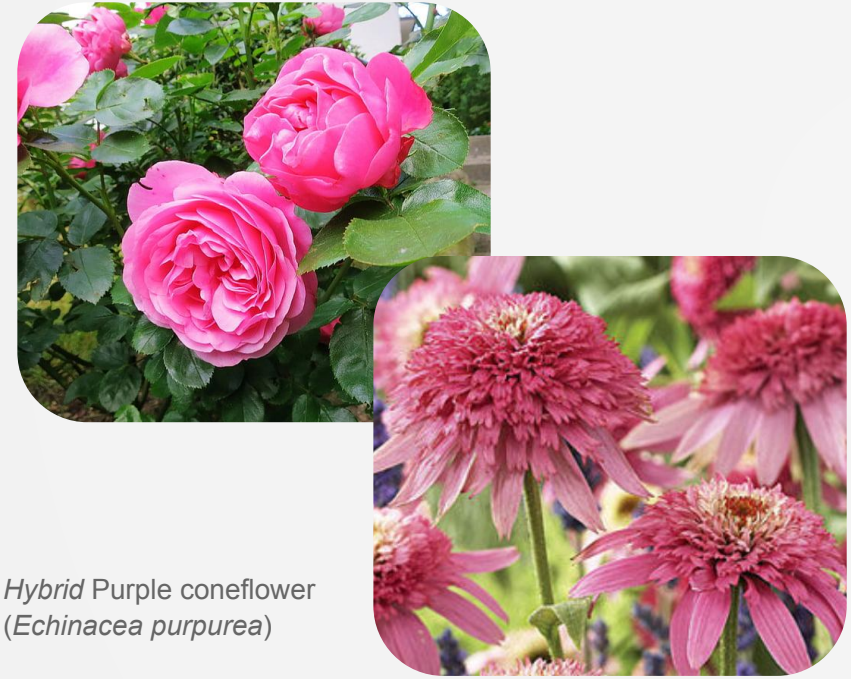
- Mustard family (Brassicaceae)—Sweet alyssum—one of the best. In our climate it usually re-seeds itself, too.

Candy Tuft

Sweet Alyssum

Basket of Gold

# Avoid “showy” ornamental flowers.



*Hybrid* Purple coneflower (*Echinacea purpurea*)

https://xerces.org/blog/cultivar-conundrum

Those who seek to preserve pollinators must broaden their range of plants beyond these attractive varieties.

- Double flowers attract pollinators through their color or odor signals.
- Pollinators visit double flowers even if they cannot extract nectar from them.
- When pollinators try to feed on double flowers, they find no sustenance.
- Pollinators end up going from flower to flower on the same plant, which also lacks nectar and pollen.
- This results in a waste of the pollinators' energy.

# Integrated Pest Management (IPM)

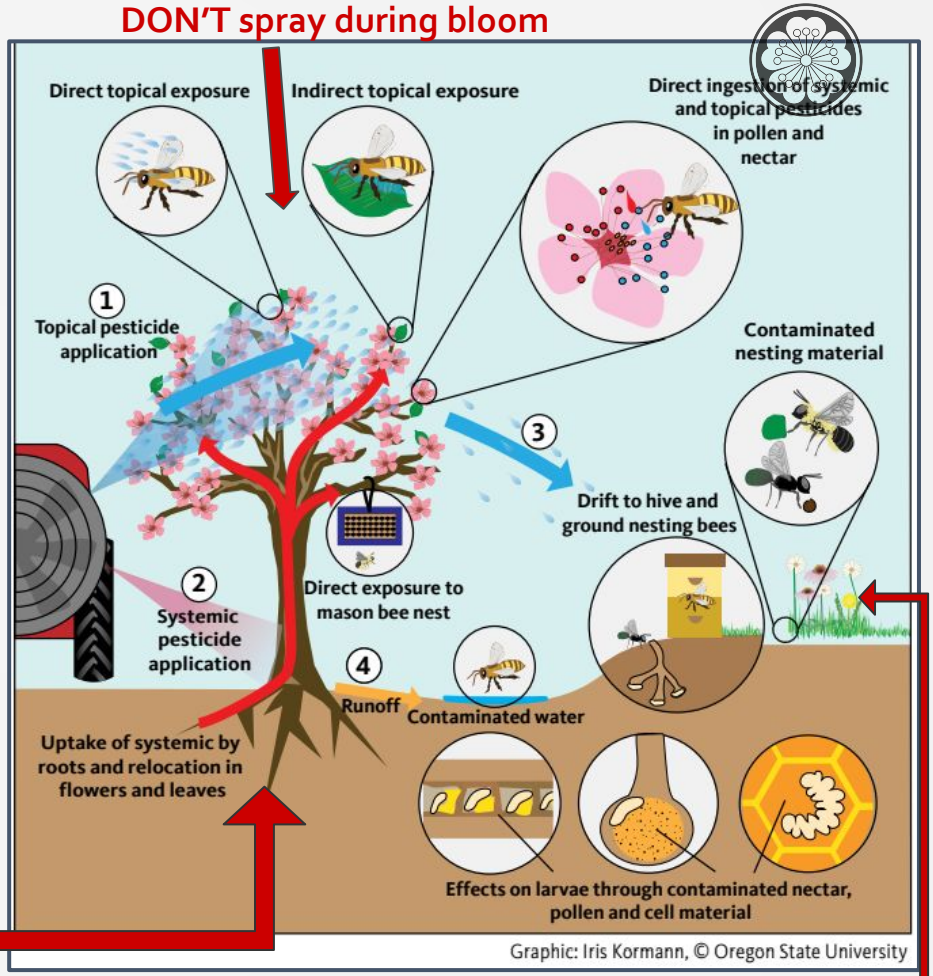
Minimizing the use of pesticides by employing a variety of pest-fighting techniques

- Can prevent pesticide runoff from contaminating water resources,
- Reduce the risk of exposure to pesticides for humans, pets, and wildlife
- Establish a sustainable and consistent approach to pest control, rather than relying on the unpredictable and unstable outcomes of using broad-spectrum pesticides.
    - When we use insecticides to control invasive pests, it can harm pollinators, as well as other helpful insects and mites like predators and parasitoids that naturally keep plant pests in check.

# How they are exposed

- Directly touching pesticides or residues that remain active on plants
- Consuming nectar and pollen that have systemic pesticide treatments
- Being exposed to pesticide drift in areas where they forage or nest
- Encountering pesticide runoff that contaminates their food or nesting areas.

DON'T spray during bloom




DON'T use soil drenches or tree trunk injections

DON'T allow spray to drift onto blooming weeds

# Eliminate or reduce pesticide exposure

## Many are toxic to pollinating insects

**Herbicides** kill many of the nectar producing flowers needed by pollinators.

**Insecticides** vary in their toxicity, ranging from very toxic to relatively safe

- The level of toxicity is determined by the **specific chemical used and the frequency of exposure**
- Pollinating insects can be killed directly by these chemicals or have their ability to navigate, reproduce, or develop impaired by them.

**Most insect pests in our landscapes can be managed without using insecticides!**

# Eliminate or reduce pesticide exposure

## Many fungicides are toxic to pollinating insects

**Fungicides** are used to control plant disease.

- Fungicides control plant diseases
- Fungicides are generally not toxic to insect pollinators, *BUT*
- Fungicides can impact bees' ability to digest food and fight disease
- Certain fungicides disrupt the detoxification process of insect pollinators
- This can turn relatively non-toxic pesticides into highly toxic ones for pollinators

**Most insect pests in our landscapes can be managed without using insecticides!**

### Guidelines

- Fungicide containing copper, sulfur, chlorothalonil **should not be used** when pollinators are present
- Alternatives: Biocontrol-E.g. Serenade (Bacillus subtilis)
- Good list of harmful and safe alternatives: https://www.canr.msu.edu/news/appendix-1

# Common sense approach to plant problems

1. **Monitor** the pest's activity and adjusting methods over time. **This means going out into your garden every day.** It's easier to stop small problems than to correct large ones.

2. Use a **variety of common-sense methods** to control problems in the garden, not just using pesticides!

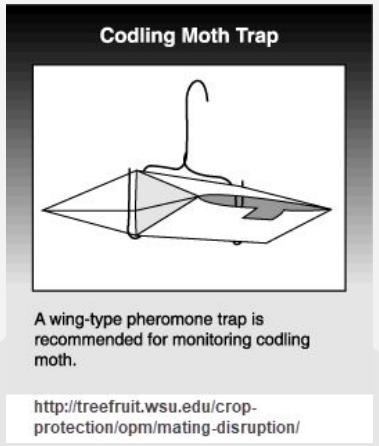
3. **Tolerate** harmless pests.

4. **Set** a threshold to decide when it's time to act.  Not every problem needs to be "treated."

5. **REPEAT** steps 1-5 all growing season long

# Common-sense methods to control problems

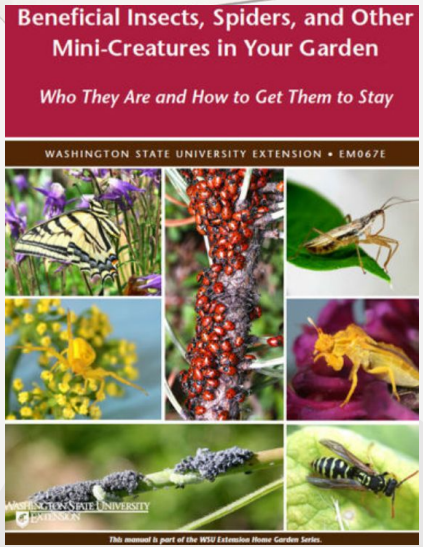
- **Have a healthy garden**
  - Stressed plant attract pests!
  - Good airflow, fertilize, and water properly.
  - Keep a very close watch for problems.
- **Control access to your plants**
  - Row cover
  - Crop rotation
  - Mulch
  - Weed control
  - Stem collars
  - Trap crops
- **Repellant**
  - Diatomaceous earth (crawling insects)
  - Pheromone lures
    - insect specific
    - Monitoring,
    - Mating disruption

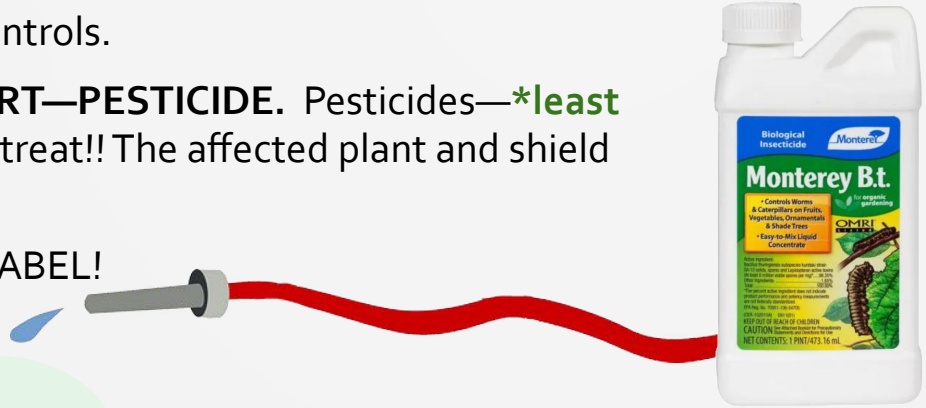


# Common-sense methods to control problems in the garden

**Remember-pesticides kill beneficial insects, too!**

- FIRST: **VISUALLY IDENTIFYING INSECT PEST** (Plant and Insect Clinic)
- Use the **LEAST TOXIC** methods first
  - Best control: Your thumb and index finger, despite the "YUK factor"!
  - Strong spray of water.
- Biological controls.
- **LAST RESORT—PESTICIDE.** Pesticides—***least toxic*** (spot treat!! The affected plant and shield others
- READ THE LABEL!

# Taking action-- Pesticides

**Rules of thumb**

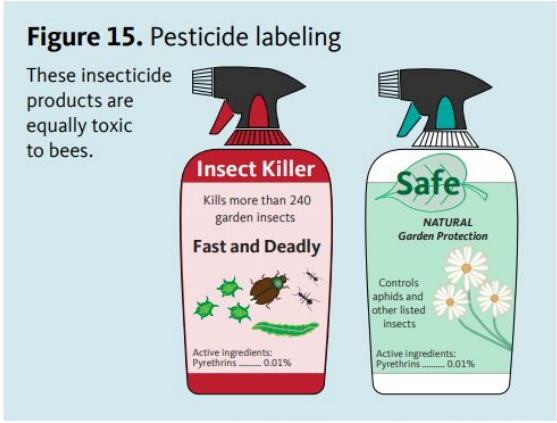
- Follow the **label instructions** carefully. This includes applying the correct concentration of the pesticide, choosing appropriate weather conditions, and targeting the correct part of the plant.
- Do not apply a product where it could run into ponds, creeks, or other water supplies and **contaminate drinking water and kill wildlife**
- Don't spray on a **windy day**
- Never pour pesticides or other lawn and garden products down the drain.
- Don't use **systemic pesticides**
- **Don't treat plants when they're blooming** (Including nearby flowering weeds)
- **Spray at dusk or dawn** when pollinators are less active

# Labels

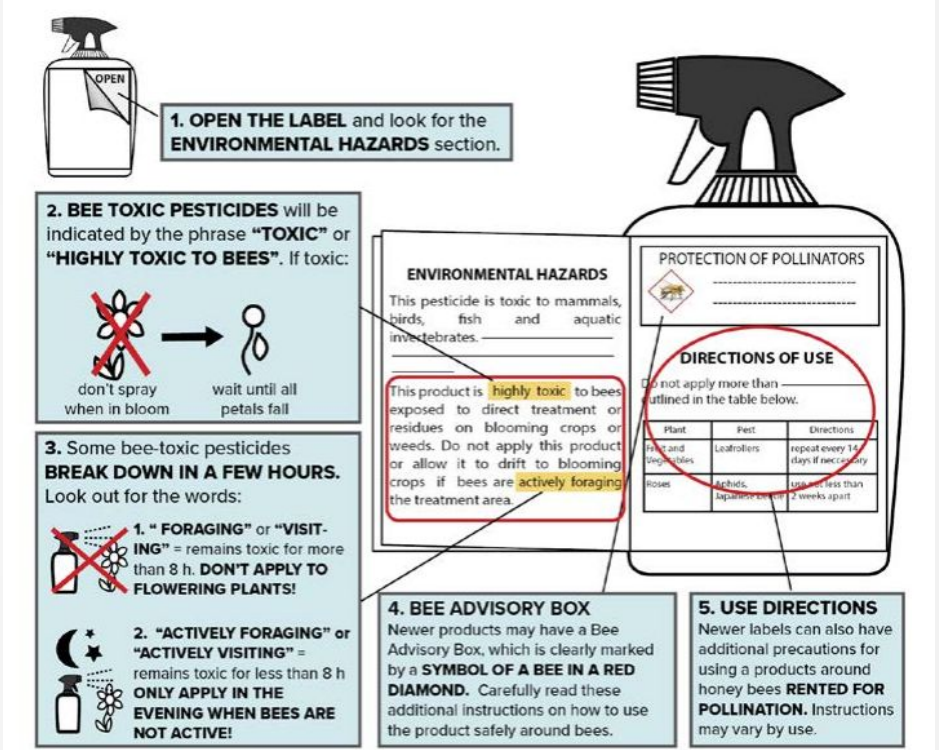
READ THE LABELS—it's the law!

- How to use
- Target use and insects

- How to dispose
- Protect yourself, the environment, and pollinators



Graphic: Iris Kormann, © Oregon State University



Graphic: Iris Kormann and Andony Melathopoulos, © Oregon State University

# Label example


## HOW TO MIX

Add the required amount of this product to the specified amount of water, mix thoroughly, and apply uniformly to both upper and lower surfaces of plant foliage. Mix only as much spray as needed for a single treatment. In vegetable gardens, for best results, do not use more than 3 gallons of spray for 1000 sq ft of area. Do not use kitchen utensils for measuring. Keep measuring utensils with product and away from children.

| | Amount of this product to Use per Pint, Quart or Gallon of Spray | | |
|---|---|---|---|
| Unit of Measure[1] | Per Pint (16 fl oz) of Spray | Per Quart (32 fl oz) of Spray | Per Gallon (128 fl oz) of Spray |
| Fluid Ounces (fl oz) | 0.25 fl oz | 0.5 fl oz | 2 fl oz |
| Tablespoons (Tbs) | ½ Tbs | 1Tbs | 4 Tbs |

[1]Conversion factors: 2 tablespoons (Tbs) = 6 teaspoons (tsp)

## HOW TO APPLY

**Shake Well Before Use**

This product may be applied with trigger sprayer, hand-held, backpack, or hose-end sprayers. Use a hose-end sprayer that can be adjusted to provide a dilution ratio of about 2 fl oz of this product (4 Tbs) per gallon of spray.

## WHEN TO APPLY

Apply when listed pests are present. Repeat applications may be made as indicated in the Home Gardens section. See your state extension service recommendations for treatment guidelines in your area.

| Crops | Pests Controlled | Maximum Number of Applications per Season | Minimum Days to Wait Before Reapplying | Minimum Days to Wait from Last Application to Harvest |
|---|---|---|---|---|
| **cole crops (Brassica regetables),** including, ut not limited to: broccoli, roccoli raab, brussels sprouts, cauliflower, avalo, Chinese broccoli, abbage, Chinese abbage (bok choy), Chinese cabbage (napa), Chinese mustard cabbage gai choy), collards, kale, ohlrabi, mizuna, mustard greens, mustard spinach nd rape greens | cabbage looper<br>diamondback moth<br>imported cabbage worm<br>leafminers<br>worms | 6 | 4 | 1 |
| **ucurbits,** including, ut not limited to: ucumber, edible gourds, nuskmelons (cantaloupe, oneydew, etc.), pumpkin, ummer and winter quash, and watermelon | leafminers<br>thrips<br>worms (caterpillars) | 6 | 5 | all except cucumber, 3<br>cucumber, 1 |
| **ruiting vegetables,** ncluding, but not limited o: eggplant, ground cherry, okra, pepino, pepper, tomatillo, and tomato | Colorado potato beetle<br>leafminers<br>thrips<br>worms (caterpillars) | 6 | 4 | 1 |

## ENVIRONMENTAL HAZARDS

This product is toxic to bees exposed to treatment for 3 hours following treatment. Do not apply this pesticide to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period. This product is toxic to aquatic invertebrates. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run off to water bodies or drainage systems.

**ALWAYS read the label!**
**ALWAYS follow directions!**

# Check the label for active ingredients




Don’t use systemic insecticides!

# Labels

## Organic-Least to most toxic to beneficials

**Bt** -caterpillars--little or no toxicity to any other organism

**Diatomaceous Earth**

**Horticultural oils** (Smothers--Needs complete coverage)

**Neem Oil--**Check active ingredients--No azadirachtin (Contact-smothers)

**Azadirachtin** (Derived from neem tree but is not neem oil) (Repellent and insecticide—**apply at night**-insect must ingest)

**Insecticidal Soap** - Potassium salts of fatty acids (Contact spray-needs complete coverage--not preventive)

**Spinosad** - E.g., Entrust, Success, Regard, Bonide Captain Jack's Deadbug Brew R-T-U; **apply at night** (contact, but most effective when larvae ingest it)

**Boric Acid** - ants (Ingest)

**Pyrethrin** - highly toxic--apply at night

**IMPORTANT: NEVER spray a pesticide on a plant that's flowering**

# Labels

## Synthetic Pesticides- ALL highly toxic to bees

Acetamiprid
Acephate
Bifenthrin
Carbaryl (E.g., Sevin)
Cyfluthrin
Esfenvalerate
Cyhalothrins
Malathion
Permethrin
Imidacloprid

**IMPORTANT: NEVER spray a pesticide on a plant that's flowering**

# How about home remedies?

Remember, all **home remedies are also chemicals** and aren't necessarily s
How about home remedies?

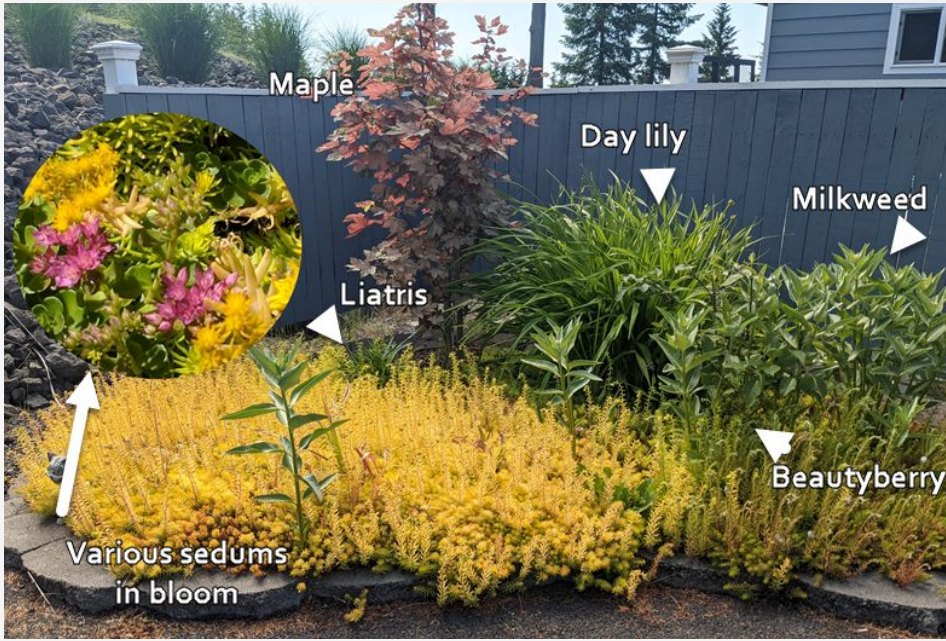
- Vinegar
  - Household vinegar has 3% to 5% acetic acid and can cause eye irritation
  - Pesticide vinegar has 20% acetic acid and can cause permanent eye damage
- Milk
  - No clear scientific research about use on roses, but it doesn't prevent black spot
- Baking Soda
  - Can be useful under specific circumstances
- Dawn Dish Detergent
  - Use insecticidal soap—it's been tested and is effective without harming plant tissue. Dish detergents can wash away the leaf's protective waxy cuticle, and the plant becomes vulnerable to sun damage.
- Table Salt as an herbicide
  - Yes it can kill weeds, but the sodium left in the soil builds up to levels that are toxic to plants.
- Alcohol
  - Can cause leaf burn

# What can you do to help? Winter cleanup

- Wait! Don't cut down your perennials until spring--trim plants 6-12 inches from ground for cavity nesting insects
- Be lazier- Don't rake up your leaves--provides protection for ground dwelling/nesting insects

# Ways to get started

- Start small! 30 sq.ft is only a 5x6 patch!
- Lawns are not pollinator friendly-consider transforming your lawn to planting areas over time. See #1
- Use what you already have--cluster together
- Ask a friend for seedlings or cuttings, start your own seeds, haunt the Native plant sales.
- Use a combination of methods



# Tell the pollinator story

Share your knowledge to raise awareness about the challenges they face and the possible solutions to help them.

# Resources

Enhancing Urban and Suburban Landscapes to Protect Pollinators Highly Recommended

https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9289.pdf

Pollinator Garden Designs Highly Recommended

https://catalog.extension.oregonstate.edu/sites/catalog/files/project/supplemental/em9289/pollinatorgardendesigns062020.pdf

Common Natural Enemies of Nursery Crops and Garden Pests in the PNW (excellent pocket guide)
https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec1613.pdf

Beneficial Insects Spiders Creatures in Garden
http://pubs.cahnrs.wsu.edu/publications/wp-content/uploads/sites/2/publications/em067e.pdf

Encouraging Beneficial Insects in Your Garden-what to plant

https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/pnw550.pdf

# Resources

Bee impact and recommendations for use for fungicides (great list!)

https://www.canr.msu.edu/news/appendix-1

The Xerces Society https://www.xerces.org/

The Audubon Society https://www.audubon.org/

The Pollinator Partnership https://www.pollinator.org/

The Native Plant Society https://www.wnps.org/

Your local Conservation District https://wadistricts.org/

The Woodland Park Zoo https://www.zoo.org/pollinator

The Washington Butterfly Association https://wabutterflyassoc.org/

The Washington Native Bee Society

https://www.wanativebeesociety.org/

DIY--good behouse designs and instructions

Xerces https://xerces.org/sites/default/files/2018-05/13-054_02_XercesSoc_Tunnel-Nests-for-Native-Bees_web.pdf

Crownbees--DIY: https://crownbees.com/blog/diy-how-to-make-a-solitary-bee-house/