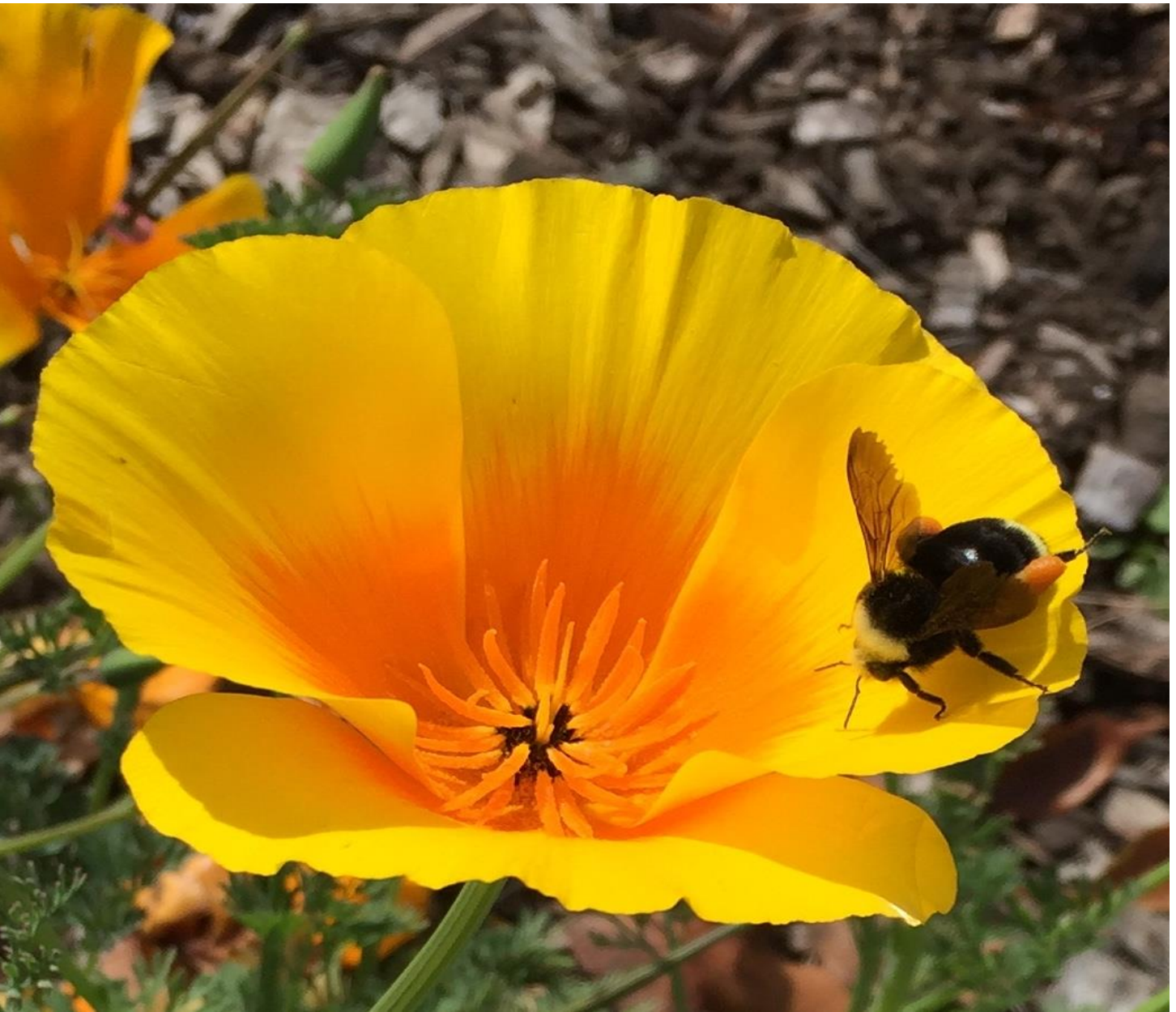
NATIVE PLANTS FOR POLLINATOR GARDENS

If You Plant It, They Will Come



Presented by

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CA Landscape Architect #5161

August 13, 2019

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Primrose Way Pollinator Garden

OVERVIEW

1. Why California native plants?
2. What plants to use and why.
3. What are pollinators?
4. How to create a habitat plan.
5. Maintenance protocols.

Phacelia bolanderi

PLANTS ARE THE BEGINNING OF EVERYTHING

(plants are the primary producers of food
and the ***basis of the food chain***)

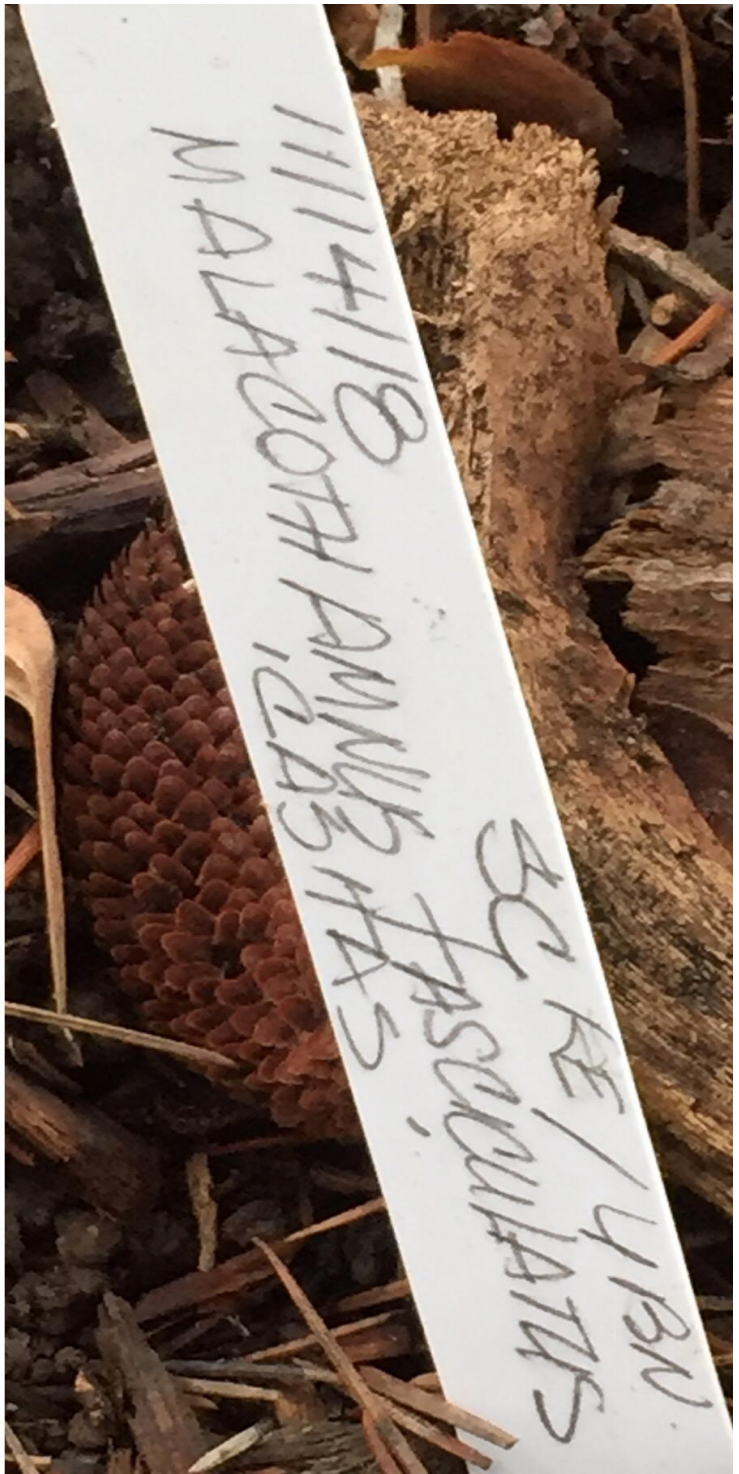
Energy from the sun...

...is converted by plants (first trophic level) into food that is eaten by insects and other animals (second trophic level).

Floral and vegetative resources

- Insects provide food for baby birds and other animals.
- 37% of animal species are plant-eating insects.
- Many other animals rely on insects as food to access the sun's energy stored in plants.

PLANTS ARE NOT DECORATIONS--PLANTS ARE FOOD



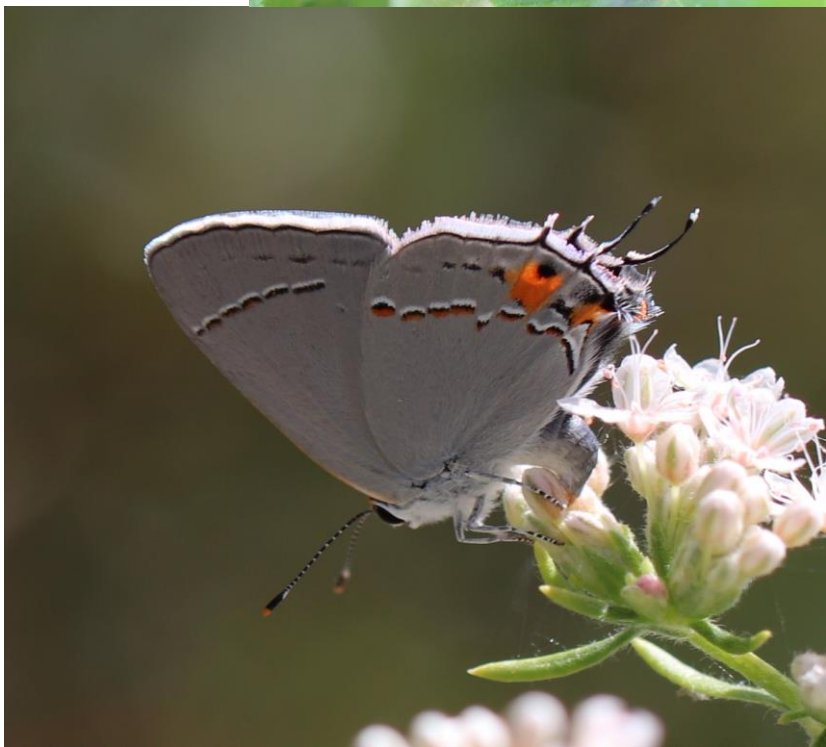
A MINIMUM OF 70% NATIVE PLANTS WAS FOUND TO BE NECESSARY TO MAINTAIN A POPULATION OF CHICKADEES

(Nonnative plants reduce population growth of an insectivorous bird. Narango, Tallamy and Marra. PNAS November 6, 2018)

Caterpillar on
Scropularia californica

Checkerspot
caterpillar on
Sidalcea calycosa

Grey hairsteak butterfly
Laying eggs on
Eriogonum fasciculatum



Anise swallowtail
caterpillar on
Perideridia gairdneri

Why California Native Plants?

“California hosts approximately 6,500 species, subspecies, and varieties of native plants, many of which are found nowhere else in the world, and many animal species depend on these native plants for food and shelter.

It is estimated that approximately 66 percent of California’s endemic plant species will experience decreases of up to 80 percent in the size of their ranges within the next 100 years.”[1]

1. Loarie SR, B.E. Carter, K. Hayhoe, S. McMahon, R. Moe, C.A .Knight, and D.D. Ackerly. 2008. Climate Change and the Future of California’s Endemic Flora. PLoS ONE. 3(6): 1-24.

https://www.wildlife.ca.gov/Conservation/Plants/Climate

Why California Native Plants?

California native plants evolved to thrive in different California climates. There are many native California plant species well-adapted to hot, dry summers and wet winters. These plants will be drought-tolerant ***after being established.***

Rules of Thumb

1. Use local, native California plants to create your plant palette.

- Native plants and pollinators evolved together and these plants provide nutrients and compounds required for reproduction. Native insects won't survive on non-native plants, which become “dead-ends” for transferring the sun's energy into the ecosystem, with a resulting cascade effect on other species.
- Native plants are largely preferred over nonnative plants by pollinators.
- Nonnative plants can escape cultivation and infest natural areas, and/or bring in disease and exotic insects.

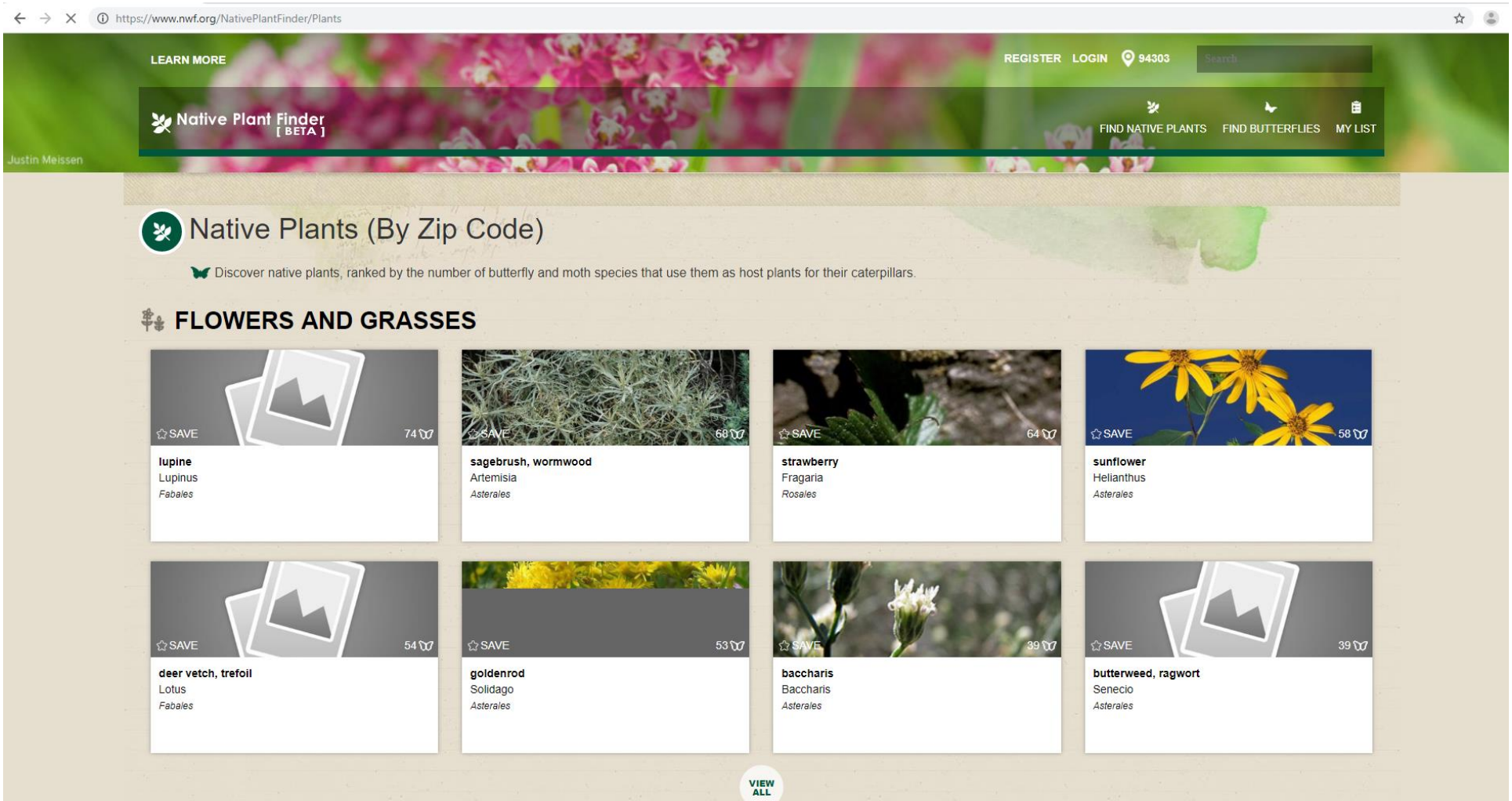
2. Use at least 3 species of plants that bloom during ***each*** of the early, mid and late seasons (i.e., 9 different species minimum).

- Pollinators emerge at different times, and providing overlapping bloom times will keep them foraging in the garden.
- Providing a diversity of blooms and plant resources will attract a diversity of pollinators.
- A garden with at least 20 different types of blooming plants is ideal for attracting a diversity of pollinators.

3. Consider plants as a buffet...or a salad bar, with nectar and pollen for bees, but also consider if that plant provides other vegetative resources (larval food).
   Helpful hint: Check out the plant finder tool: https://www.nwf.org/nativeplantfinder/

4. Plant trees, shrubs, perennials, annuals and bulbs. Think of these as layers that build in complexity.

5. Start small, unless starting from scratch (less disruption). Add more plants over time as appropriate.



What is Locally Appropriate?

Which native plants were here in the past?

1. Research if the plant was present in the past:
   Plant search by county, date (i.e., before 1900), etc.
   http://ucjeps.berkeley.edu/consortium/

2. Buy or order from local, reputable sources.

UC/JEPS: Consortium Se

ucjeps.berkeley.edu/cgi-bin/get_consort.pl

Consortium of California Herbaria

Participants News Search About Help Donate

Search Results – 2000 specimen records retrieved (1219 records with coordinates)
(That's the default maximum. Contact Jason Alexander for larger data requests.)
Results for search: County=SANTA CLARA; Year=1894;

Mapping Options:
BerkeleyMapper with county and bioregion layers
BerkeleyMapper without layers.
KML export
(Note: only records with coordinates are mappable)

Download Options:
Select all records · Select records with coordinates
Retrieve selected records as tab-separated list
Include annotations and voucher information

PLEASE NOTE: Due to changes in newer versions of Excel, directly copying text from the above selected results does not produce a usable table.
Follow these steps:
1. The contents of the selected results window must be copied into a text editor like TextEdit for Mac or WordPad for Windows
2. The selected results must be saved as a new text document.
3. This new text document can now be copied into Excel or imported as a tab delimited text file.

(For large data reqests, please contact Jason Alexander, jason_alexander@berkeley.edu.)

Please cite data retrieved from this page: Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/).
Records are made available under the CCH Data Use Terms.

Click on column header to sort data (* sorts by family); click in leftmost checkbox to select record. CCH Help Page.
Turn on yellow flags to show possible range discrepancies. Read more ...

?	Specimen ID	Determination *	Collector	Collection Date	Collection Number	County	Locality	Elevation in meters	Feedback
☐	CAS-BOT-BC203221	Abutilon	W. R. Dudley	1895-5-31	4134	Santa Clara	Coyote Creek		Comment
☐	CAS-BOT-BC219663	Acanthomintha lanceolata	W. R. Dudley	1895-5-31	4151	Santa Clara	Soda Springs Canon [Canyon], Pine Ridge		Comment
☐	CAS-BOT-BC219666	Acanthomintha lanceolata	W. R. Dudley	1895-5-31	4151	Santa Clara	Soda Springs Canon [Canyon], Pine Ridge		Comment
☐	UC204612	Acanthomintha lanceolata	W. R. Dudley	1895-5-31	4151	Santa Clara	Pine Ridge, Soda Springs Canyon Pine Ridge; Mount Hamilton Range, , Soda Springs Canyon		Comment
☐	UC25192	Acanthomintha lanceolata	Edw. L. Greene	July 1891		Santa Clara	Mount Hamilton		Comment Read comments Jan 17 2007
☐	CAS-BOT-BC333244	Acer macrophyllum	C. F. Leitholt	1894-8-13	s.n.	Santa Clara	Santa Cruz Mountain Peninsula. Black Mtn.		Comment
☐	CAS-BOT-BC333245	Acer macrophyllum	C. F. Leitholt	1894-8-13	s.n.	Santa Clara	Santa Cruz Mountain Peninsula. Black Mtn.		Comment

What Plants to Use and Why

California Native Trees

- Many species are drought-tolerant, once established.
- Trees form major “hubs” from which wildlife moves around an area.
- Trees can provide large nectar sources as well as other habitat resources and food for butterfly and moth larvae.
- Trees are “keystone species” supporting dozens of other species.

A few of the many native trees of California that are drought tolerant:

- Quercus agrifolia—Coast Live Oak. Evergreen. Leaves provide a rich mulch. The roots stabilize soil on hillsides. Provides food and habitat for many species. Other native Oak species as well, some deciduous and some evergreen.
- Prunus ilicifolia—Catalina Cherry. Evergreen, white flowers in the spring. 15'-40' tall. Relatively fast-growing.
- Fraxinus velutina—Velvet Ash. Deciduous, fast-growing 30'-50'. Good residential street tree but not especially showy.
- Cercis occidentalis—Western Redbud. Deciduous, early-blooming.
- Cercocarpus betuloides—Mountain Mahogany. Semi-deciduous to 20'. Very adaptable.
- Aesculus californica—California Buckeye. White to pink blooms, deciduous. 15' and up.
- Lyonothamnus floribundus ssp. asplenifolius—Santa Cruz Island Ironwood. Evergreen, 20'-50' tall, fast-growing.

Choose wisely: Select a tree that will fit your site in terms of size and local appropriateness (check to see if it grows in the area with the Calflora database: www.calflora.org).

A landscape without vegetation.

Quercus agrifolia. Long-lived, adding shade and a sense of place.

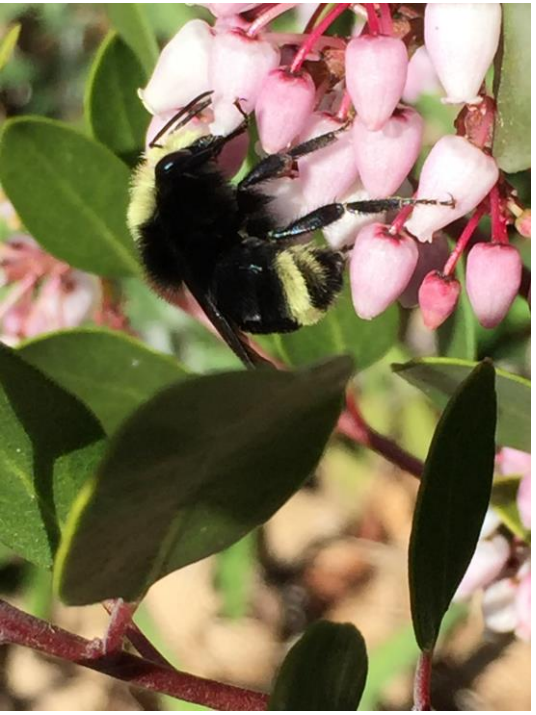
TREES HELP SAVE WATER

- Trees absorb water and release it into the air, cooling and cleaning it.
- Trees form *half of the rain cycle*, teaming up with the oceans, they help circulate water across land.
- Without trees, deserts can form.
- Trees improve water quality by filtering rain water and slow down the impacts of heavy rain.
- Trees reduce flooding and stabilize soil.

California Sister butterfly.
Caterpillars feed on Oaks, especially Quercus chrysolepis.

California Native Shrubs

- Provide a variety of floral/vegetative resources as well as habitat.
- Persist and provide the structure to a garden.
- Provide a “nurse” role for establishing other plants.



Arctostaphylos spp. (sub for Rhaphiolepis, Boxwood)
*Ceanothus spp. (sub for Oleander)
*Eriogonum spp. (sub for Rosemary)
Frangula californica--(good sub for Pittosporum)
Baccharis pilularis (sub for Juniper)
Salvia spp. (sub for Teucrium)
Artemisia spp.
*Monardella villosa
Ribes spp.
Vaccinium ovatum
Amelanchier alnifolia
Adenostoma fasciculatum
Fremontodendron californica
Symphoricarpos spp.
Amorpha californica
Berberis spp. (sub for Nandina)
Carpenteria californica (sub for Camellia)
Heteromeles arbutifolia (sub for Holly)
Garrya elliptica
Holodiscus discolor
Lavatera spp.
Malacothamnus spp.
Morella (Myrica) californica (sub for Ligustrum)
Rhus ovata (sub for. Ligustrum, Myoporum, Oleander, Photinia, Pittosporum, Raphiolepis, Xylosma

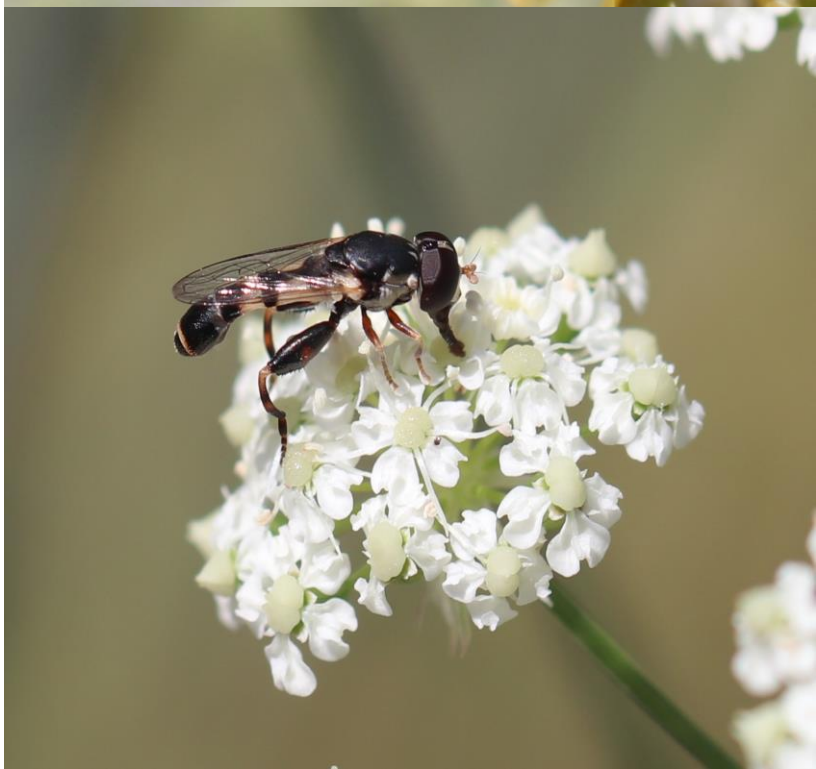
*casual observations in our gardens show multiple species/visits

California Native Perennials

Provide a variety of floral resources as well as habitat.

*Phacelia spp.
*Cirsium spp.
Mimulus spp.
Penstemon spp.
*Aster spp.
*Scrophularia californica
*Grindelia spp.
*Heterotheca spp.
Helianthus spp.
Achillea millefolium
Ranunculus
Epilobium spp.
Frageria spp.
*Hoita orbicularis
Plantain spp.
Wyethia angustifolia
Silene spp.
*Lepechinia spp.
Aquilegia spp.
Scutellaria spp.
Sidalcea spp.
Armeria maritima
*Erigeron glaucus
Eriophyllum spp.
Viola spp.
*Acmispon spp.
*Perideridia spp.
Asclepias spp.
Camissonia spp.
*Erysimum spp.
Heuchera spp.
Iris spp.
Keckiella spp.
Lessingia filaginifolia
Lomatium spp.
*Sisyrinchium spp.
Solanum spp.
Sphaeralcea spp.
Stachys spp.
*Solidago spp.
Etc.

*casual observations in our gardens show multiple species/visits



Acmispon glaber

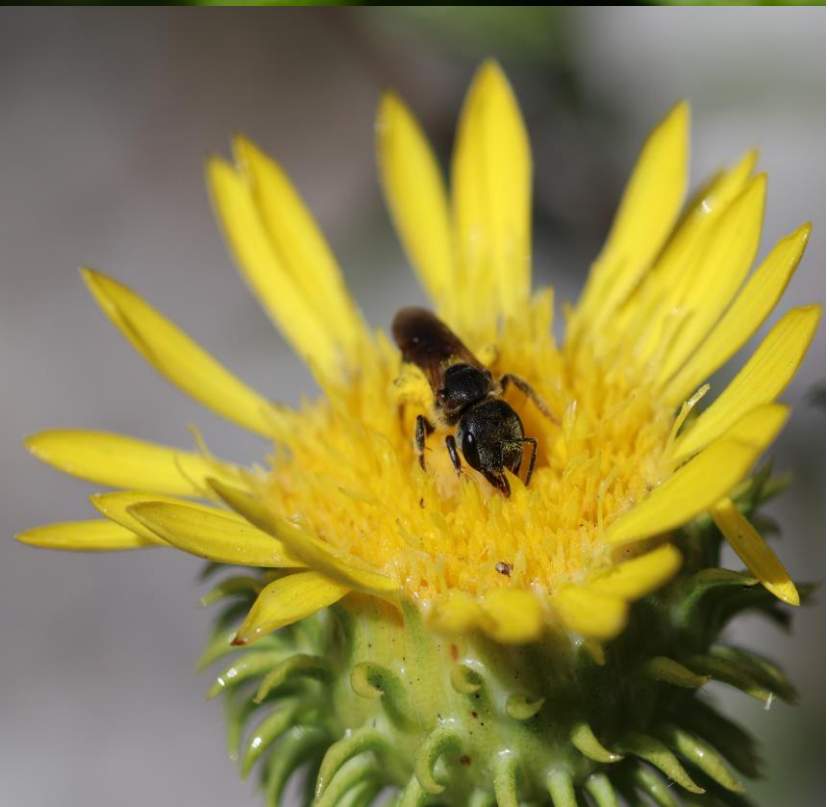
Hoita orbicularis

Erigeron glaucus

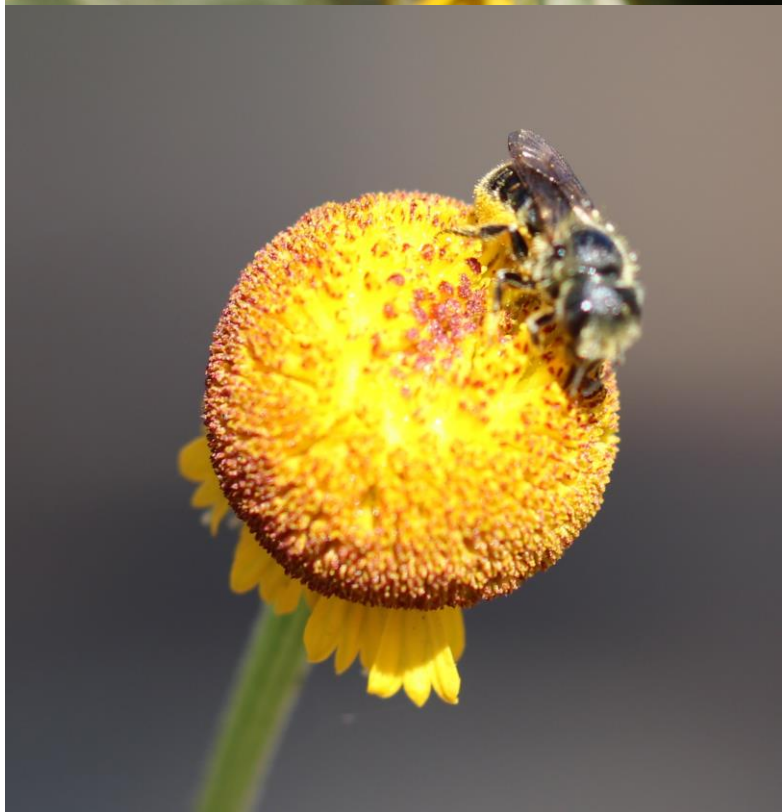
Cirsium occidentale

Aster chilensis

Eriophyllum confertifolium



Grindelia camporum



Helenium puberulum

Scutellaria californica

←

Salvia 'Pozo Blue'

→

Scrophularia californica (“Bee Plant”, prolific nectar producer)

←

Penstemon heterophyllus 'Margarita BOP'

→

California Native Annuals

- Provide a huge variety of floral resources
- Annuals are the most under threat natives from competition from non native grasses
- A ***huge*** variety not typically available in nurseries
- Early color, many EASY and affordable from seed with a long bloom time
- Successive sowing extends bloom time
- Many reseed in place with a surplus to gather and give as gifts
- Low-growing annuals can be layered under taller shrubs
- Many easy for growing in pots
- Preserve genetic diversity

Three easy annuals:

Poppies—pollen only (pollen bowl). Easy to sow in place. Reseeds.

Gilia capitata—pollen and nectar. Very easy to sow in place. Reseeds.

Phacelia tanacetifolia—pollen and high-quality nectar. Very easy to sow in place and reseeds.

Tips on Choosing and Planting Annuals

1. Plant in large swaths, either in combination (mixes, which may have 4 or 5 species blooming at a time) or single species (which is easier for foraging). Think: ***Bee Pasture***.

2. Enjoy wildflowers in containers (good for beginners).

3. Buy wildflowers already grown and plant them (even better for beginners).

4. Try different germination techniques to increase the number of species in your garden, such as cold stratification, smoke exposure, etc.

Clarkia amoena mix. Very easy from seed, reseeds, long bloom season.
Note the nectar guides on the petals.

Phacelia tanacetifolia.
Super easy to direct sow, reseeds, high quality nectar attracts masses of bumble bees.

What are Pollinators?

A pollinator is an organism that moves pollen from the male part of a flower to the female part. This causes fertilization of the flower to produce seeds.

The vast majority of pollinators are insects: bees—**1,600 species** in California—do most of the work, but other insects--butterflies, moths, beetles, flies, wasps, and ants—pollinate incidentally.

A few animals such as hummingbirds, bats, etc. also pollinate incidentally.

The pollinator effectiveness depends on:

- The ability to carry pollen
- Grooming habits
- Foraging behavior
- Body size and shape
- Tongue length—long vs. short
- Generalists (visiting a variety of flowers although typically one species at a time) vs. specialists (visiting one species of flower)

Fact: 75% of native bees live in nests underground or pre-existing cavities.

Calochortus luteus

Floral Resources for Bees: Pollen

- Few insects other than bees rely on pollen as a sole protein source to feed their larvae.
- A source of protein (2.5-61%), fats, starches, vitamins and minerals.
- Pollen's very stable structure allows it to persist for thousands of years.
- All pollen is not created equally. Bee species vary in their ability to digest different pollens. Bees raised on non-host pollen fail to survive.
- Pollen comes in many colors, which comes from the sticky, lipid coating: the pollenkitt.
- Pollenkitt is made of saturated and unsaturated lipids, carotinoids, flavonoids, proteins and carbohydrates and is easily digestible. May also play a role in cloud formation (has the ability to absorb water from the air).

Bombus vosnesenskii (yellow-faced bumble bee). Long-tongued, prefers tubular flowers and higher protein pollen.

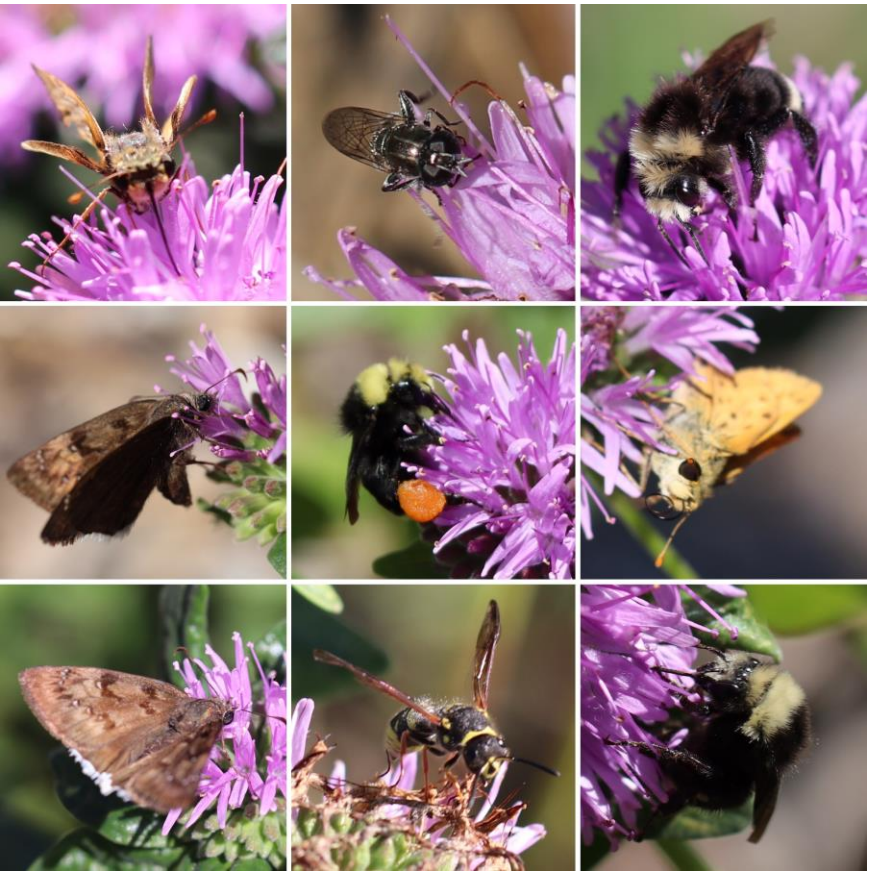
Floral Resources for Bees: Nectar and other substances

- Nectar—a source of sugars (sucrose, glucose, fructose, maltose, etc. in varying proportions and concentrations). Proportions and presence of each type of sugar varies from and within species to species. Less concentrated nectar is easier for long-tongued bees to drink.

Also contains water, some amino acids (may influence taste), anti-oxidants, minerals and can contain scents to attract pollinators.

Nectar secretion increases with pollinator visits and declines after pollination and is frequently reabsorbed into the plant. Flower structure can preserve viscosity.

- Resin and oil—used by some bees to water-proof brood cells and mix with pollen. May have anti-microbial properties to help protect developing bee larvae.



A variety of species nectaring on Monardella villosa.

The Ability to Carry Pollen

Aster chilensis

Depending on the species, the legs or abdomens of females are equipped with specialized hairs or scopae. These hairs hold pollen for transport. Other bees have areas on the hind legs that are bare, flattened or slightly concave—the corbiculae or “pollen basket”--surrounded by hairs. They then groom pollen into these areas for transport. Some bees also carry pollen in their crops.

Hoita orbicularis

Fact: Although bees can fly longer distances, most bees prefer to travel between 150'-1,500' between nests and flowers.

Note the anthers brushing on the thorax and abdomen of this Bombus melanopygus.

Pollen grains stick to the hairs (which are finely branched). Bees carry opposite electrical charges than flowers, so pollen then 'jumps' from the flower onto the bee.

She's ingesting nectar and then grooming pollen into the scopae on her hind legs.

The Ceanothus 'Valley Violet' blooms early—a good choice to provide for Bombus species that emerge during Winter.

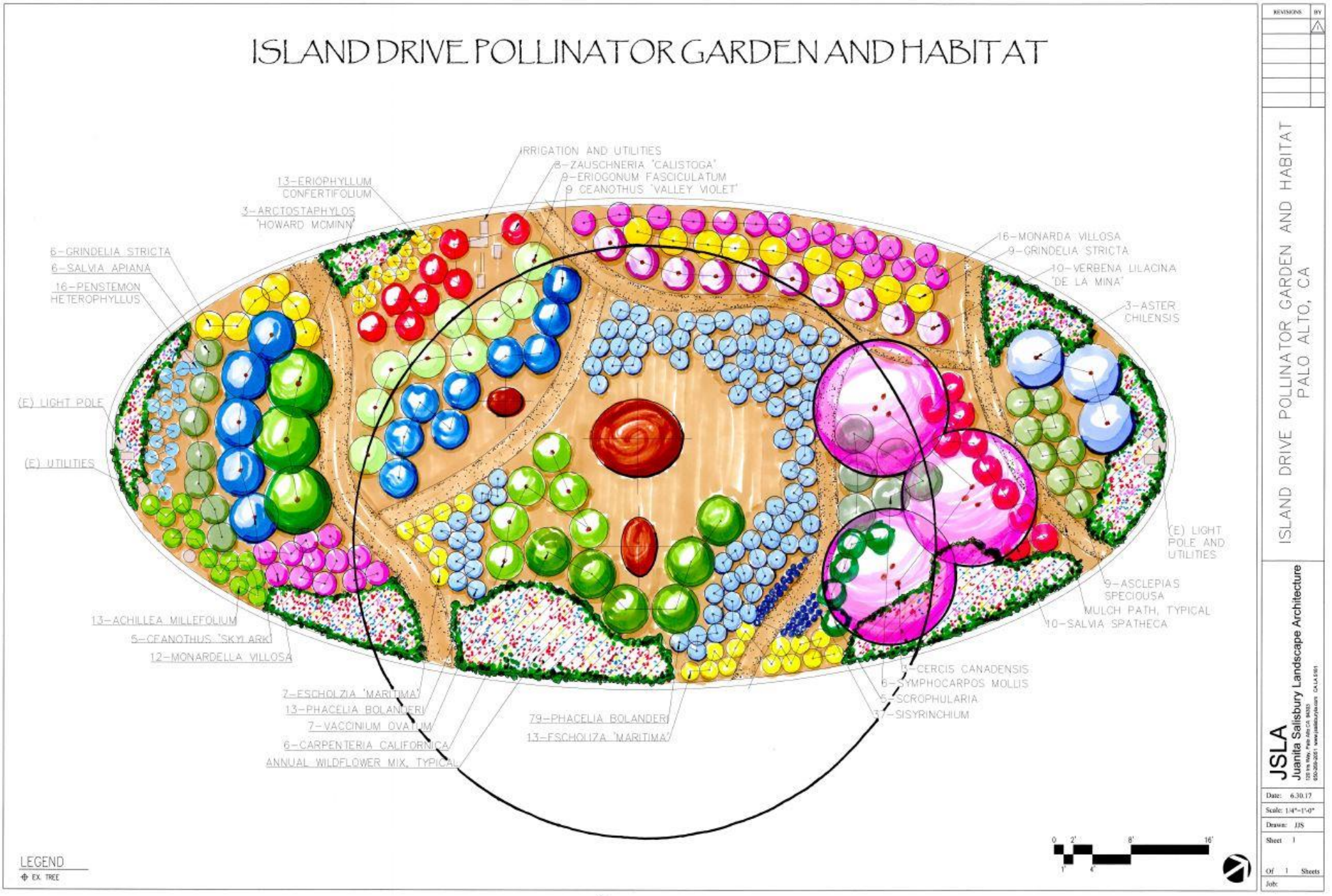
This small bee is gathering pollen from a Grindelia flower. Note the abdomen curled under like an apron to catch the grains.

Also note the antennae which provide a sense of touch, smell, taste and a kind of hearing (vibrations picked up by the touch receptors).

This small bee is gathering pollen from Salvia apiana flower.

She is using her forelegs and mandible to gather the grains before packing for transport back to the nest.

How to Create a Habitat Plan



How to Create a Habitat Plan—The Basics

To start with: The **plant palette** should include at least **3 species for <u>each</u>** of the early, mid and late bloom times.

Twenty or more different species will provide excellent resources.

Planting should should occur in ***masses*** of species at least 3' or more in diameter. In one study, 85% of 41 bee species required **<u>ALL</u>** the pollen from more than 30 flowers for ***<u>one</u>*** larva. Other species required **<u>ALL</u>** the pollen from over 1,000 flowers.

Leave bare dirt areas (morning sun, afternoon shade is good) for ground-dwelling bees.

Many species use Eriogonum, as well as Ceanothus and Arctostaphylos.

Eriogonum fasciculatum

How to Create a Habitat Plan

1. Measure your site--noting utilities, existing vegetation and locations, and other features.

Gilia capitata

1. Measure your site.

2. Using your site measurements, create an accurate, to-scale base map. Use graph paper to show the area. For example, 1 square (which might be 1/4”) = 1 foot.

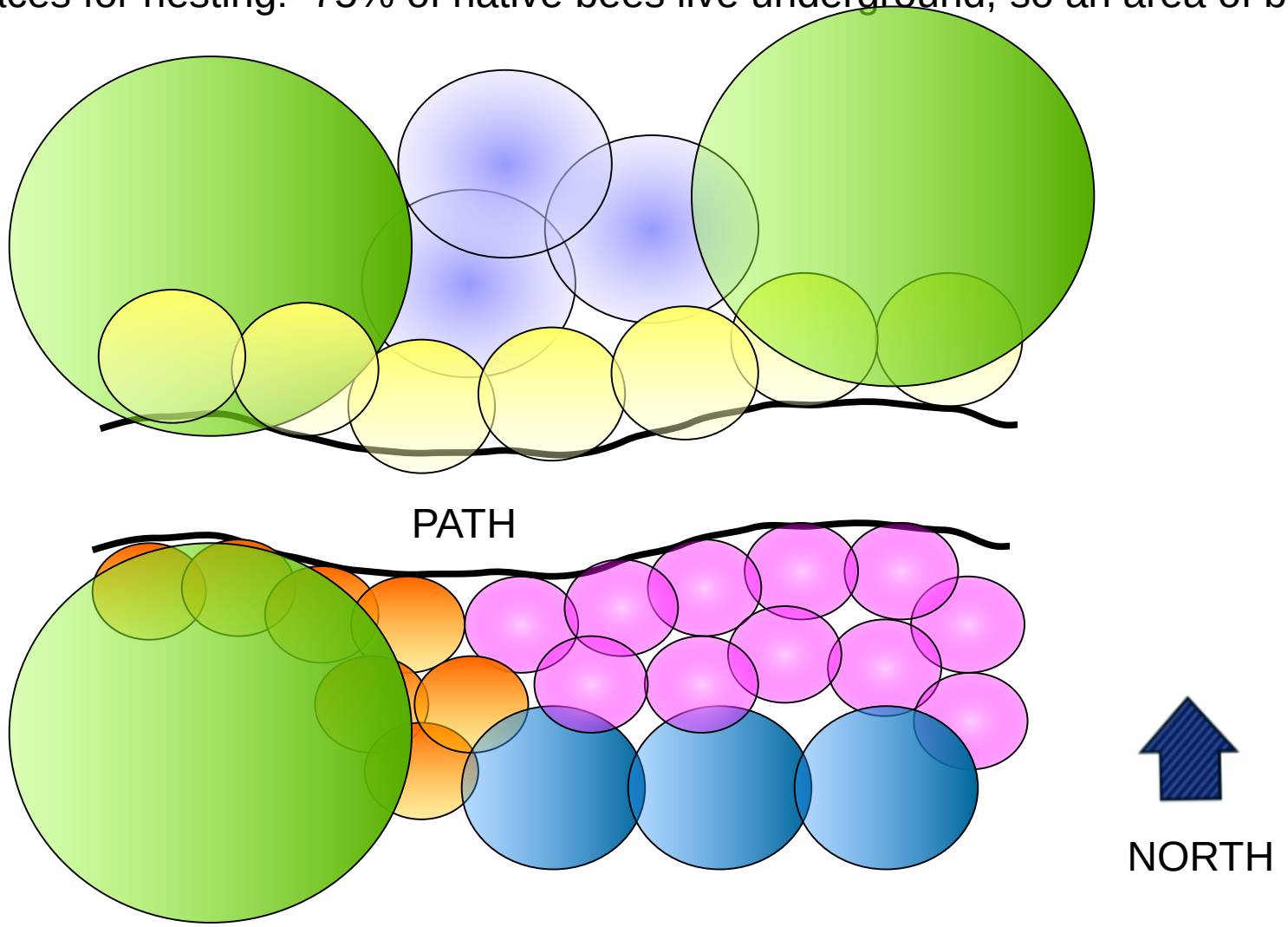
3. Show any existing items on your plan that will stay (hose bibs, fences).

4. Add a north arrow.

Example of a square garden area →

NORTH

5. Add paths for structure and maintenance purposes.
6. Add plants (from your plant palette) as circles at their mature diameter. Most circles should just touch or overlap slightly for spacing.
7. Plant in odd numbers for massing.
8. Plants the same species in masses of at least 3' in diameter to enhance foraging efficiency (less time flying between plants) and attractiveness to bees.
9. Place large trees and shrubs first, then layer in perennials, annuals and bulbs.
10. Leave spaces for nesting: 75% of native bees live underground, so an area of bare dirt is fine.



Observation is Key

Most bees don't see red, but can see ultraviolet. **Blue, purple, white, and yellow flowers** (which may have ultraviolet patterns we can't see) will be attractive to bees.

Flowers with petals or a globe shape and orientation patterns help a bee to land and find it's way to the nectar reward.

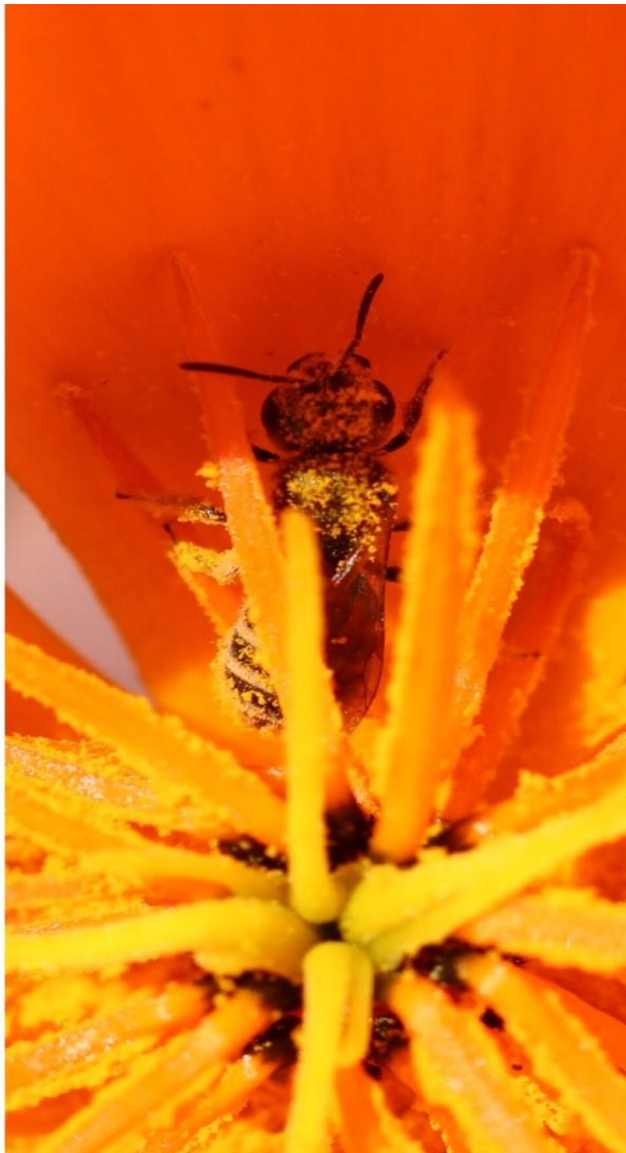
Eriogonum, Ceanothus and Asteraceae are examples.

Metallic sweat bee on Aster chilensis

BARE SOIL IS IMPORTANT

Most native bees nest underground. Look for a lot of low-flying, buzzing around at ground level, and then follow the insects to a burrow. Nesting behavior means a successful habitat!

Below are pictures of a bee burrow, and the colony residents at the Island Drive habitat. We observe the same species foraging on flowers in this habitat. Small bees prefer not to travel far for food. No additional planting will happen in the colony area.



Maintenance Protocols

- Keep weeds at bay.
- Irrigate the first 1-3 years to establish and then adjust to a drier regimen as the plants need.
- Wait to prune and clean up the garden when activity is low (late winter).
- Don't fertilize, amend sparingly.
- Mulch to control weeds and establish, then mulch with leaves (use a bit of wood bark on top to hold in place).
- Leave areas of bare dirt for nests.
- Don't use leaf blowers.
- Don't use pesticides, herbicides, or fungicides.
- Let annuals dry out, then trim them back and collect seed.

·Everything is connected·

·Use a light hand·

·Work on small areas at a time·

LEAVES AS MULCH

Helps prevent weeds, holds in soil moisture, insulate the soil, keeps soil cool. Provides a place for some insect species to over-winter, as the birds quickly discover.

Encourage fungal decomposition (unless finely shredded) and quickly break down.

Shred large, dry leaves with a mower or let them break down in a compost bin before adding them to the garden. You can also bag them up and use as needed.

Rake smaller leaves to areas around trees and shrubs, being careful not to place them directly against trunks and stems. You can weigh them down and make the garden look more tidy with with a thin layer of bark chips on top.

The leaf layer should be 3” or less deep.

PRUNING DECISIONS

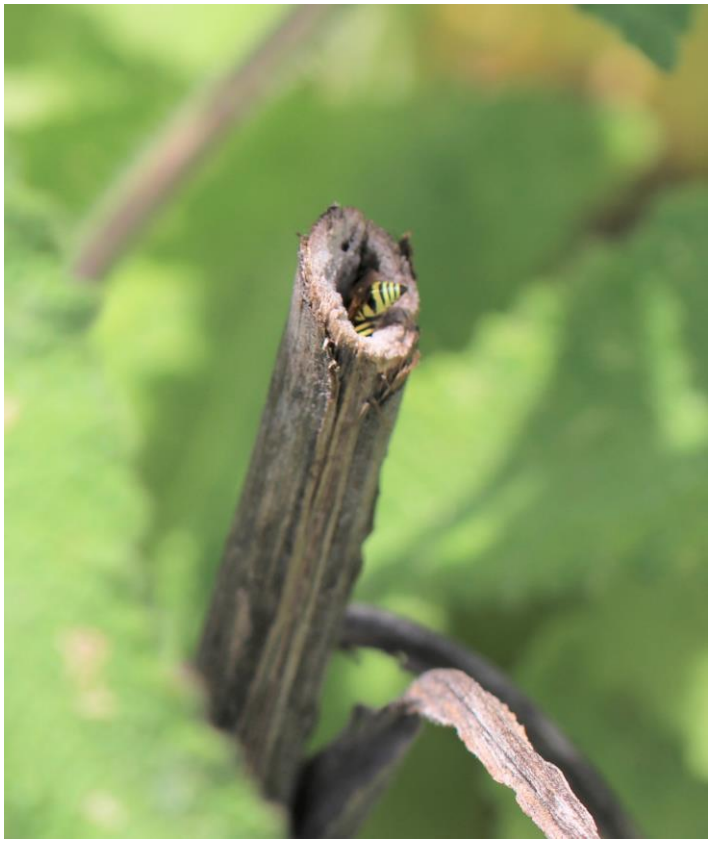
Insects occupy different places on plants, depending on what they are doing. For those over-wintering, they might have pulled a leaf blanket in close.

Other insects may be in the form of eggs, pupae, or parasitized mummies.

Thus, look closely before pruning...or simply ***wait to prune***. Nesting, mating, overwintering behaviors are signs that the habitat is providing for reproduction. Success!

PRUNING DECISIONS

A number of species nest in hollow stems, such as the European tube wasp shown below. We dead-headed a large patch of hummingbird sage, and lots of dry stems remained.



The protocol is to leave piles of dry stems in place in the habitat. They will eventually break down, but in the meanwhile can provide nesting sites.

PRUNING DECISIONS

Male bees do not have nests to sleep in at night and often can be found sleeping in flowers or on dried stems, as is the male digger bee (Anthophora species) below.

Maintenance decisions and plant additions should be influenced by observation and research.

How many insect species on one plant?

Nesting behavior? Eggs?

Times of day when active?

How hard is it to grow?

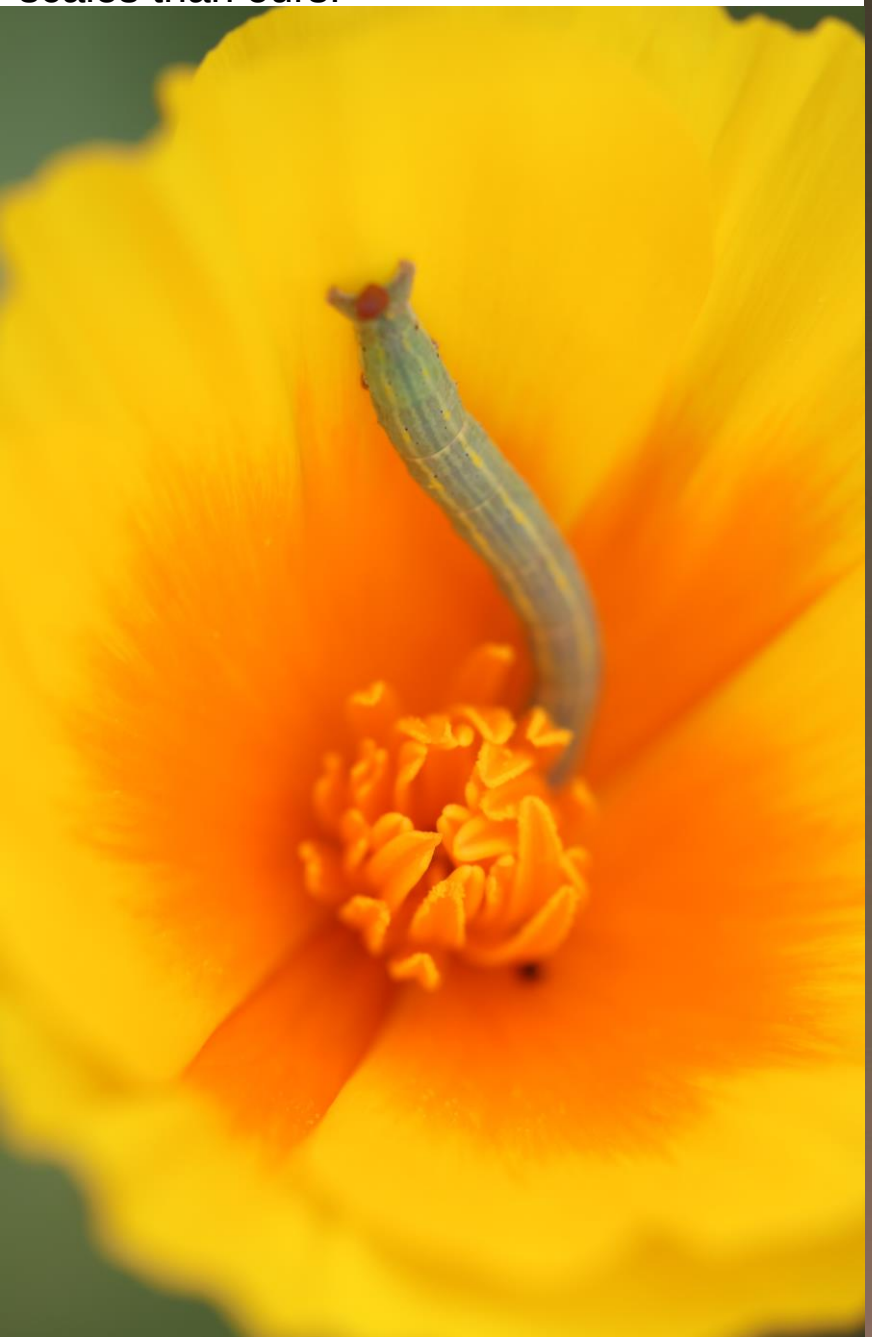
How will this plant enhance pollinator resources in the garden?

Is this a rare species I must have?

Erysimum sp.

Look closely before acting

Information is not revealed all at once.
The world of bees and insects is at different scales than ours.



Silene scouleri with juvenile katydid

Life span and conservation:

Remember that many species live only a short time as adults, spending most of their time as larvae or eggs.

This Sicya macularia, or Sharp-lined Yellow moth was observed at the Primrose Way Pollinator Garden in March 2019. Conservation status is considered vulnerable in Canada, where it is also observed.

Enjoy the garden. Habitat = Home