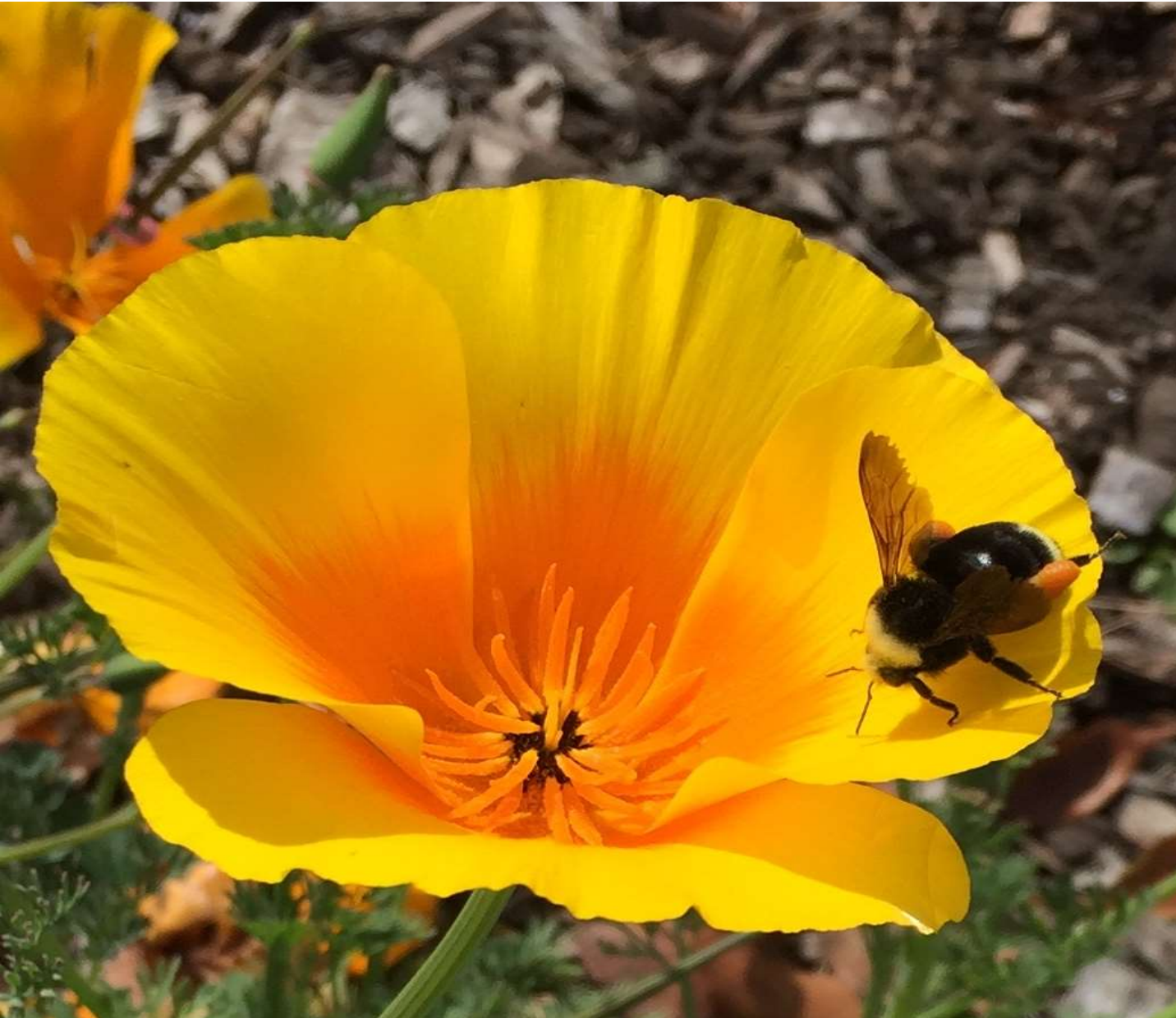


Pollinators in the Gardens

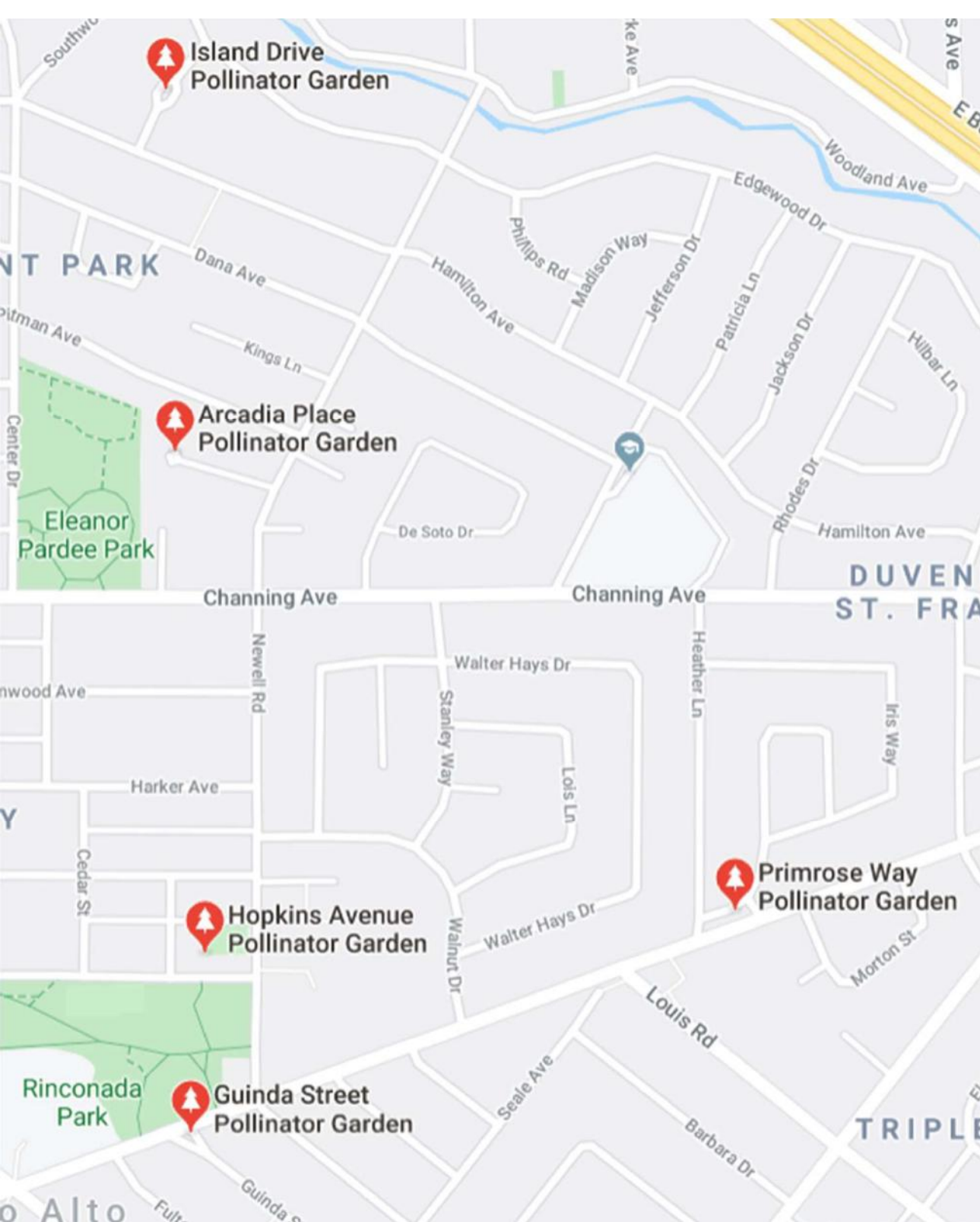


Presented by

Juanita Salisbury, PhD
CA Landscape Architect #5161

February 3, 2020

Follow us on
Facebook and Instagram
Primrose Way
Pollinator Garden
And
Primrose Way YouTube Channel



Visit the gardens in person or virtually.

Google: pollinator garden Palo Alto

For locations and a virtual tour

The gardens are always open.

OVERVIEW

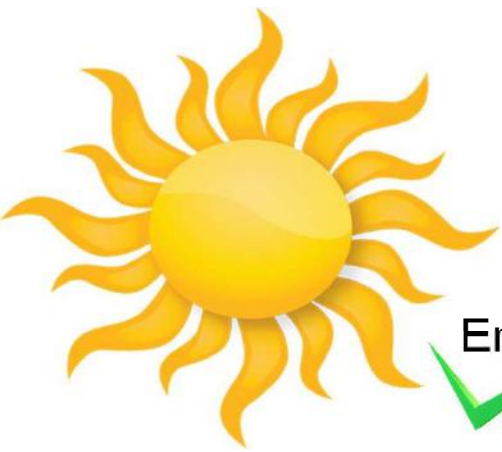
1. Considerations for choosing the best pollinator plants.
2. What are pollinators?
3. What do pollinators eat?
4. Why California native plants?
5. Best practices and final considerations.



Phacelia bolanderi

PLANTS ARE THE BEGINNING OF EVERYTHING

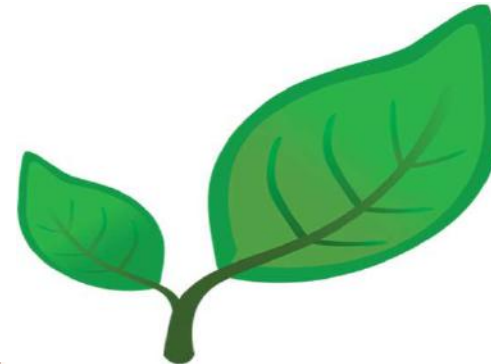
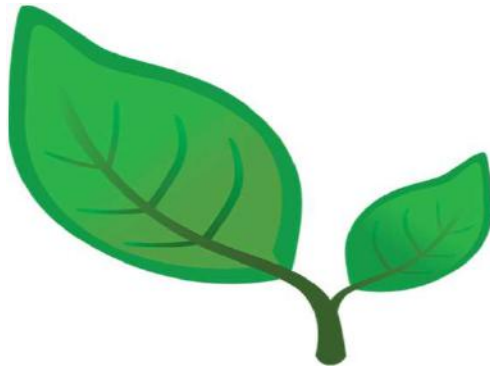
(plants are the primary producers of food and the *basis of the food chain*)



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.

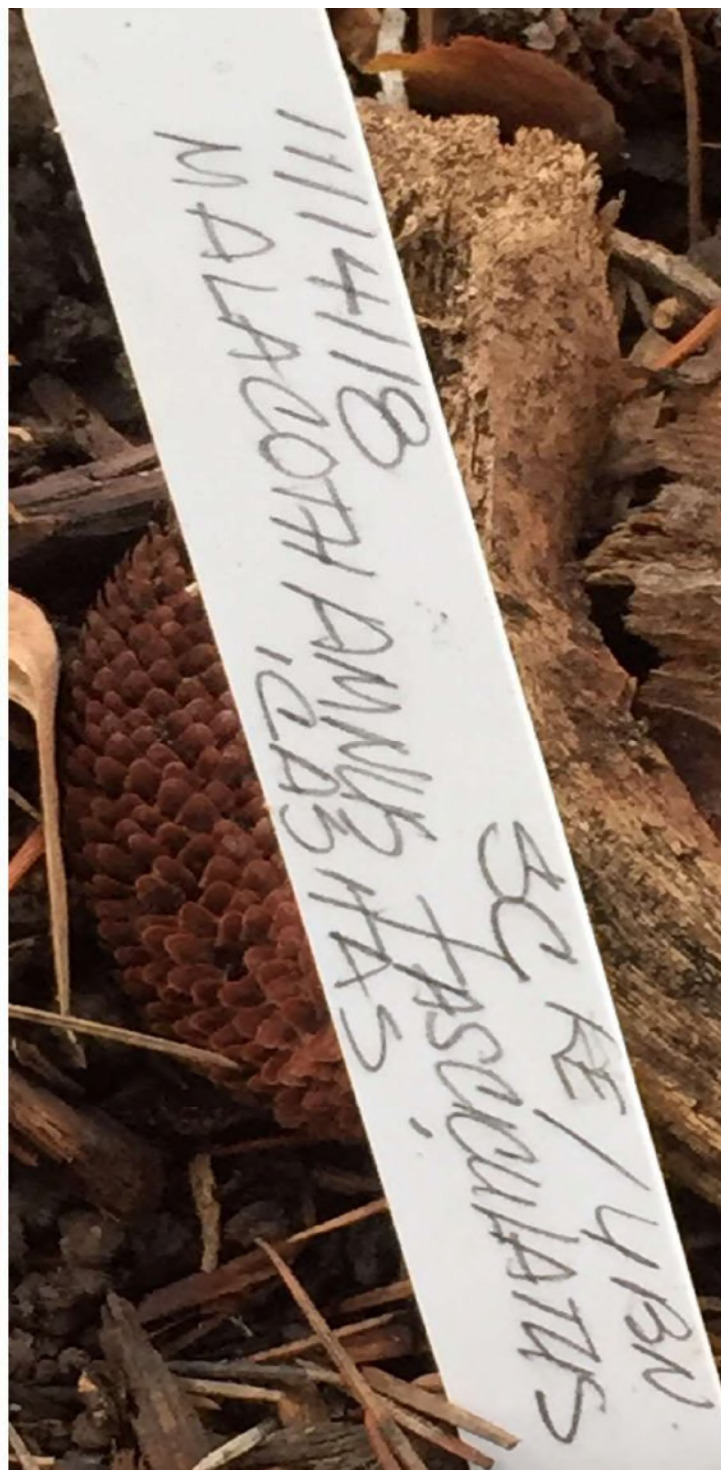
Gardens with at least 70% native plant species are needed to sustain populations of birds.

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



What to Plant in Atherton? What is Local? Calscape.org Database: Atherton

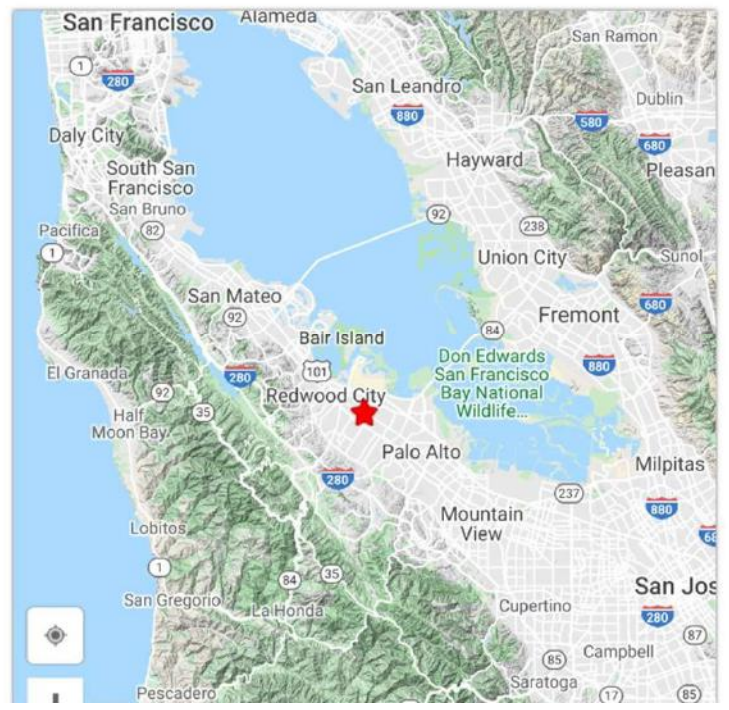


ADVANCED SEARCH

Enter a California address or click the map to see plants native to that location

523 plants native to 37.4613,-122.1977 (Atherton)

- | | | | |
|---|---|--|--|
| 
All Plants
523 | 
Trees
35 | 
Shrubs
94 | 
Perennials
183 |
| 
Annuals
184 | 
Grasses
64 | 
Succulents
1 | 
Vines
16 |
| 
Ferns
7 | 
Sun
294 | 
Shade
52 | 
Part Shade
219 |
| 
Groundcovers
46 | 
Butterfly Hosts
455 | 
Hedges
41 | 
Bank Stabilization
33 |
|  |  |  |  |



A Better Approach: Who to Feed?

Consider:

- Plant species need insects--pollinators to survive.
- Speciation occurs more rapidly with pollinators.
- **Biological factors may be more important considerations than abiotic factors like climate, geology, and water for determining what to plant.**

← → ↻ 🏠 <https://calscape.org/loc-/cat-Lep/ord-popular?srchr=sc5e34d159c0dc2> 📖 ☆ ⚙️ 📄 📧

🏠 ABOUT CALSCAPE CONTACT CALSCAPE PLANTING GUIDE NURSERIES MY PLANT LISTS BUTTERFLIES CALSCAPE SIGN IN

 CALIFORNIA NATIVE PLANT SOCIETY
Calscape
Restore Nature One Garden at a Time

Search for native butterflies by name 🔍

ADVANCED SEARCH

HOME > BUTTERFLIES & MOTHS FOR ATHERTON

Enter a California address to see butterflies & moths native to that location

141 butterflies & moths native to Atherton

[Options](#) [Host Plants](#) [What is a host plant?](#)

Select any species to see host plant info

 1 Monarch	 2 Painted Lady Vanessa cardui	 3 Common Buckeye Junonia coenia	 4 Anise Swallowtail Papilio zelicaon	 5 Variable Checkerspot Euphydryas chalcedona	 6 Western Tiger Swallowtail Papilio rutulus
 7 Gray Hairstreak Strymon melinus	 8 Red Admiral Vanessa atalanta	 9 Mylitta Crescent Phyciodes mylitta	 10 Common Checkered-Skipper Pyrgus communis	 11 Acmon Blue	 12 Pipevine Swallowtail Battus philenor
 13 Boisduval's Blue	 14 Pale Tiger Swallowtail Papilio eurymedon	 15 Mourning Cloak Nymphalis antiopa	 16 Northern Checkerspot Chlosyne palla	 17 Orange Sulphur Colias eurytheme	 18 Lorquin's Admiral Limenitis lorquini
 19 Queen Danaus gilippus	 20 California Sister	 21 Silvery Blue	 22 Edith's Checkerspot Euphydryas editha	 23 Checkered White	 24 Umber Skipper
 25 California Tortoiseshell Nymphalis californica	 26 Northern White-Skipper Heliopetes ericetorum	 27 Satyr Comma Polygonia satyrus	 28 Propertius Duskywing	 29 American Lady Vanessa virginiensis	 30 Woodland Skipper Ochlodes sylvanoides
 Common Ringlet	 Golden Hairstreak	 Sara Orangetip	 Rural Skipper Ochlodes	 Two-Tailed Swallowtail	 West Coast Lady

Handy Analogy:

When selecting a cat, you generally don't buy the cat food *first*.

Thus, the strategy is to support the *organisms already present in the environment*.

FOOD CONSIDERATIONS:

Who to feed? Recommendations based, in part, on consistent field observations from the last 3 years.

What organisms are already present?

What do they eat?

Why do they eat it?

How do they eat it?

When do they eat it?

How much do they need?

What are the nutritional requirements?

Where should the food be?

What are the preferences?



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 is generally yellow but comes in many colors, which comes from the sticky, lipid coating: the pollenkitt.
- Pollenkitt is made of saturated and unsaturated lipids, carotenoids, 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.

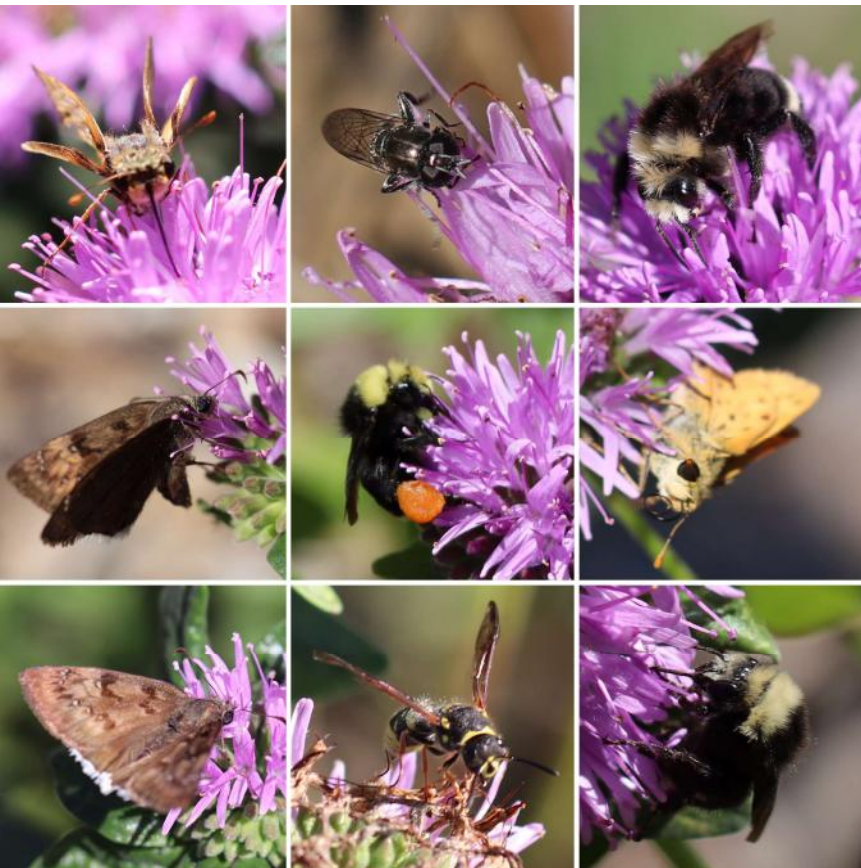
Floral Resources for Bees: Nectar and other substances

- 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*.

Bee Facts

Most bees don't see red, but can see ultraviolet.

In general:

Blue and purple = nectar.

White and yellow = pollen.

Some flowers may have ultraviolet patterns we can't see.

These colors 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.

Bumble bees prefer symmetrical flowers with two or more colors and a landing area.

Metallic sweat bee on
Aster chilensis



The Ability to Carry Pollen



Aster chilensis

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

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





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).

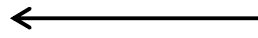


This small bee is gathering pollen from *Salvia apiana* flower.

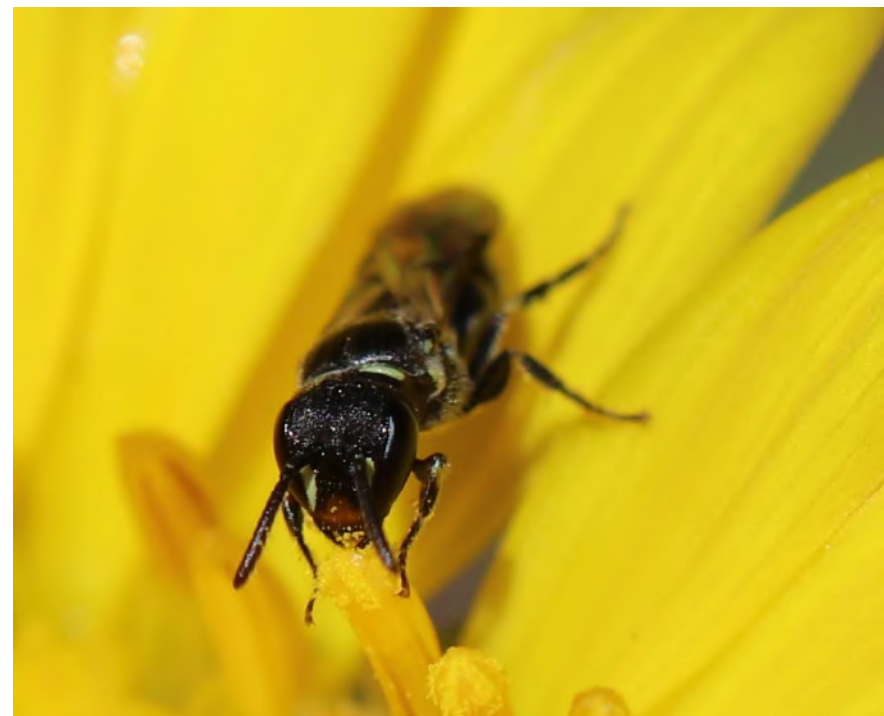
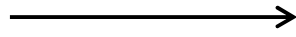
She is using her forelegs and mandible to gather the grains before packing for transport back to the nest.



Frangula
Californica



Grindelia
camporum

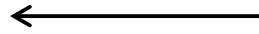


Isocoma
menziesii

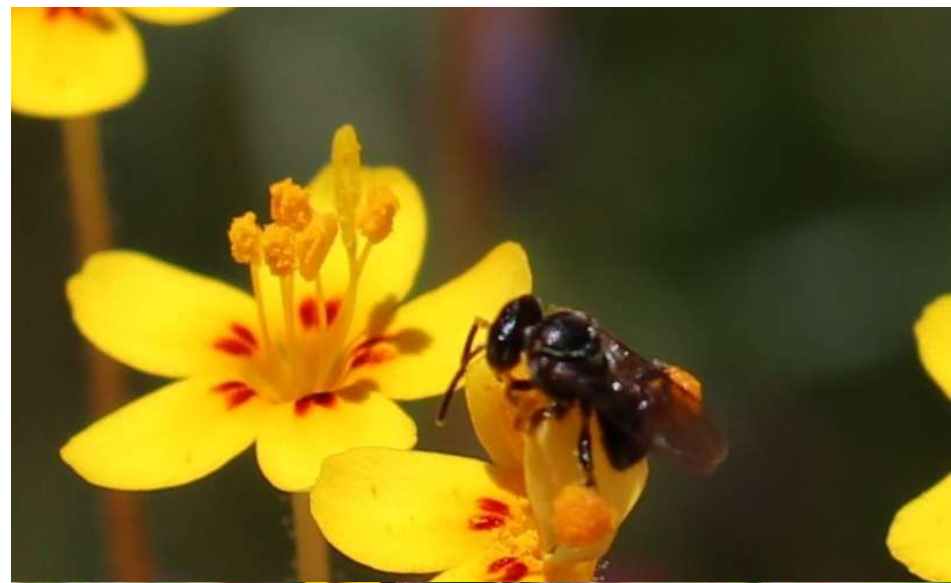




Clarkia
amoena



Leptosiphon

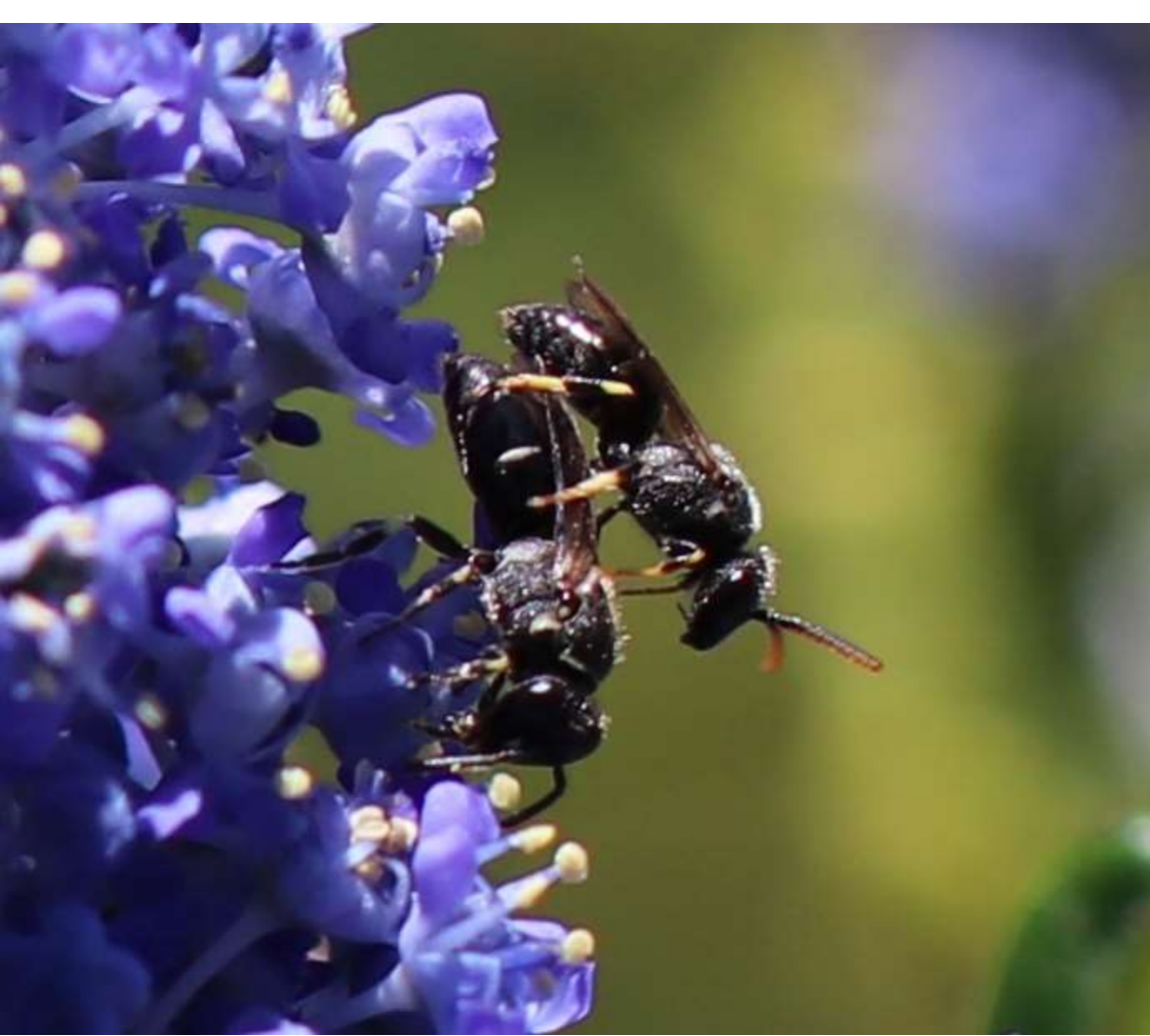


Monardella
villosa



Eschscholzia
californica





Nectar resources fuel not only flight but other important behaviors.

Ceanothus species above

and

Scrophularia californica to the right.



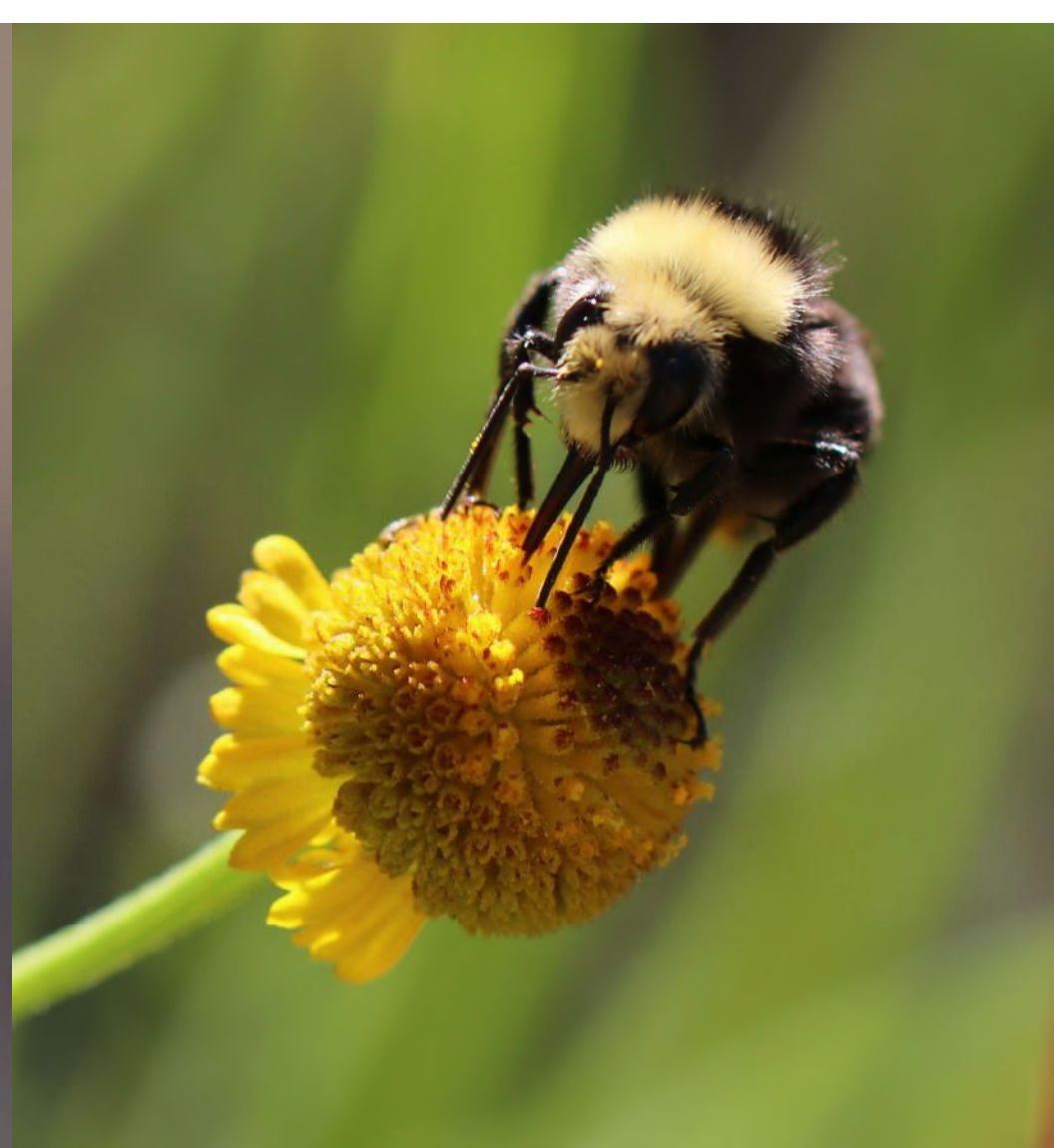


Phacelia tanacetifolia, Phacelia bolanderi
and Phacelia californica for nectar and
pollen.

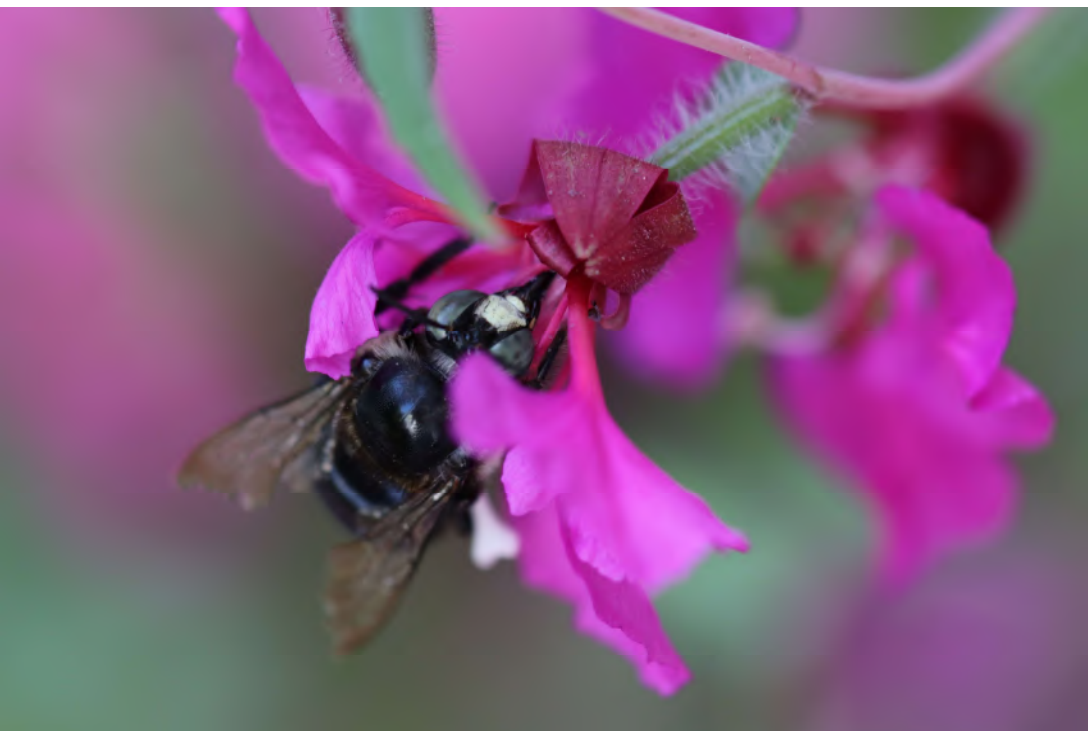


Asters



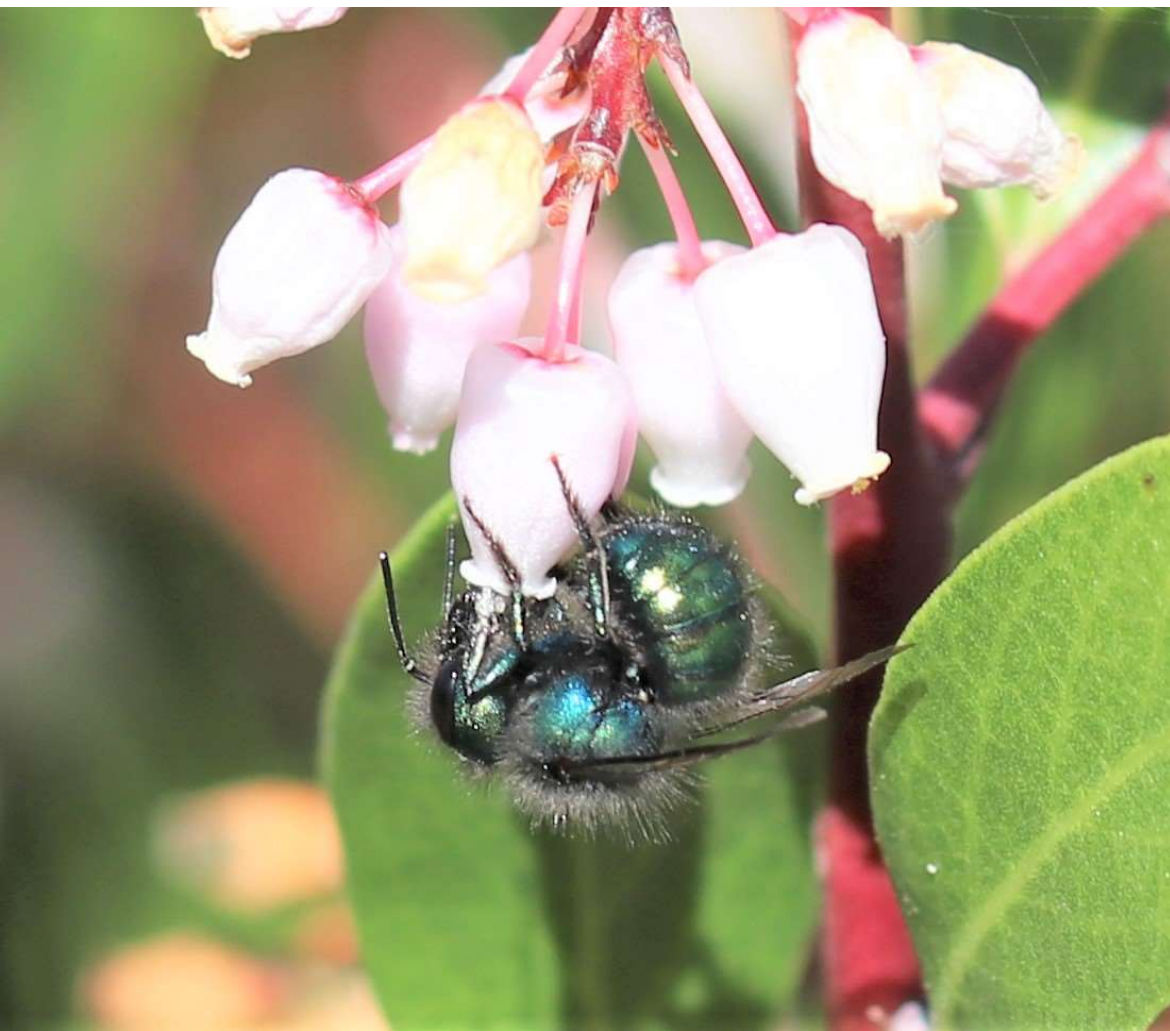


Helenium puberulum



Clarkia unguiculata and
Acemisson glaber for nectar
pollen.





Arctostaphylos and
Lupines for nectar.



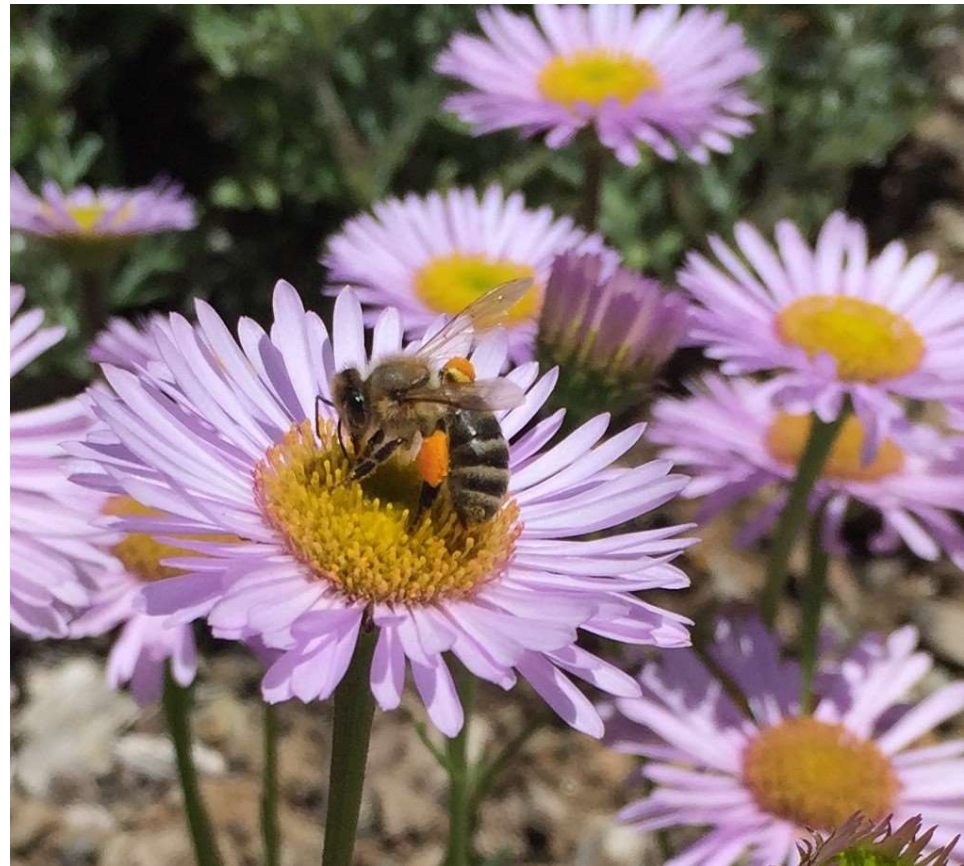


Penstemons for nectar.



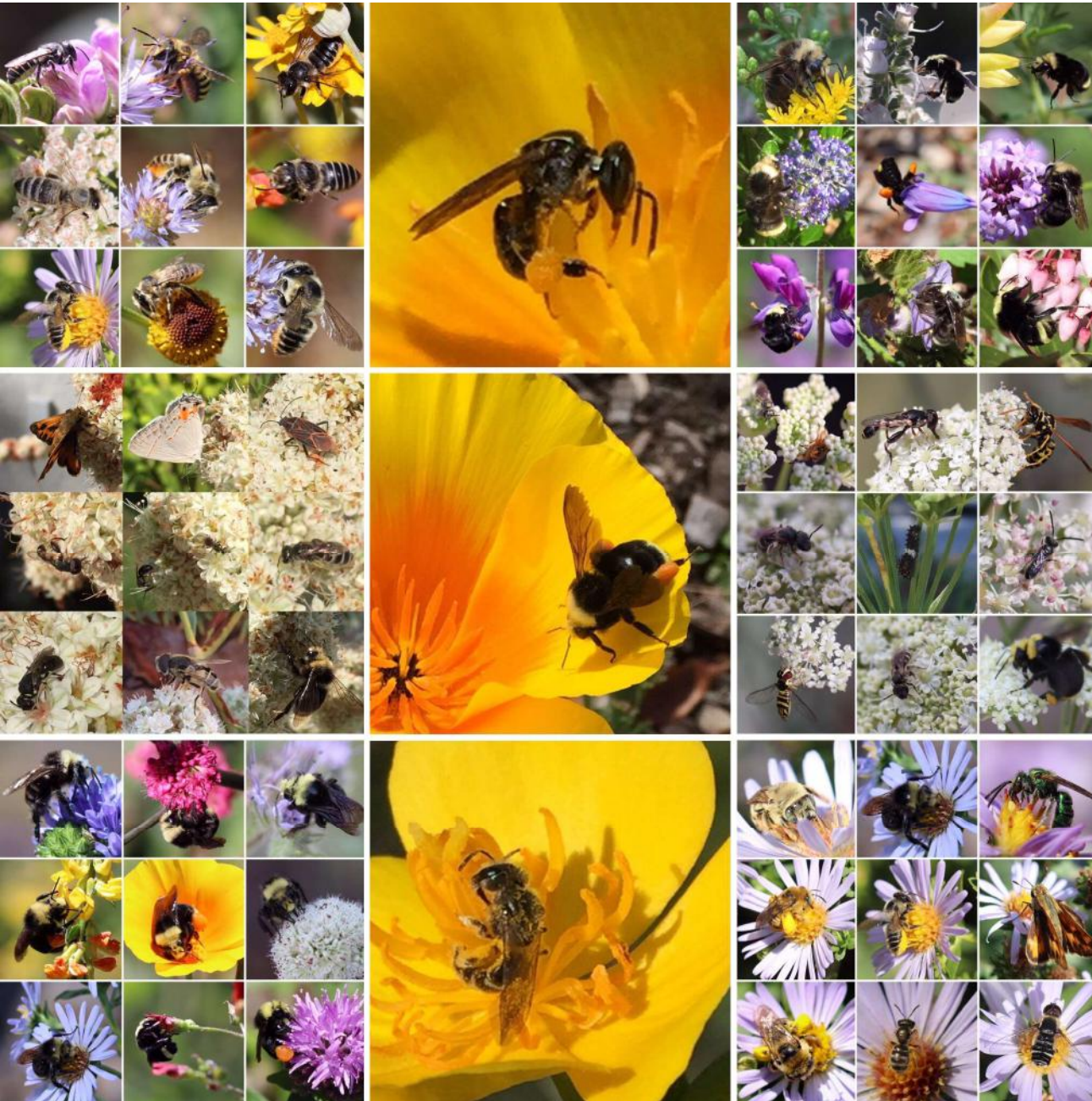


Erigeron sp. for nectar and pollen.



Why California Native Plants?

California is a Biodiversity Hotspot



- Almost 8,000 species of plants, some found nowhere else on the planet—more than any other state in the US
- Approximately 1,600 species of native bees (4,000 species across the U.S.; honeybees are not native)—more than any other state in the US
- We have such a huge number of native plant species largely because of:
 - a. Our unique ecosystems in California
 - AND
 - b. Our 1,600 species of native bees.

Insect species including pollinators are declining world-wide.

In some areas of the world, insect species have declined 70%.



We have rich ecosystems for inspiration.



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>



The Basics of Planting for A Successful Pollinator Garden

★ *Because pollinators and plants need each other, plant for pollinators.*

To start with: The **plant palette** should include at least **3 species for each** of the early, mid and late bloom times. (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. Some studies indicate 60-80 species is even better for attracting diverse pollinators.

Planting should occur in **masses** of single species at least 3' or more in diameter to enhance foraging efficiency.

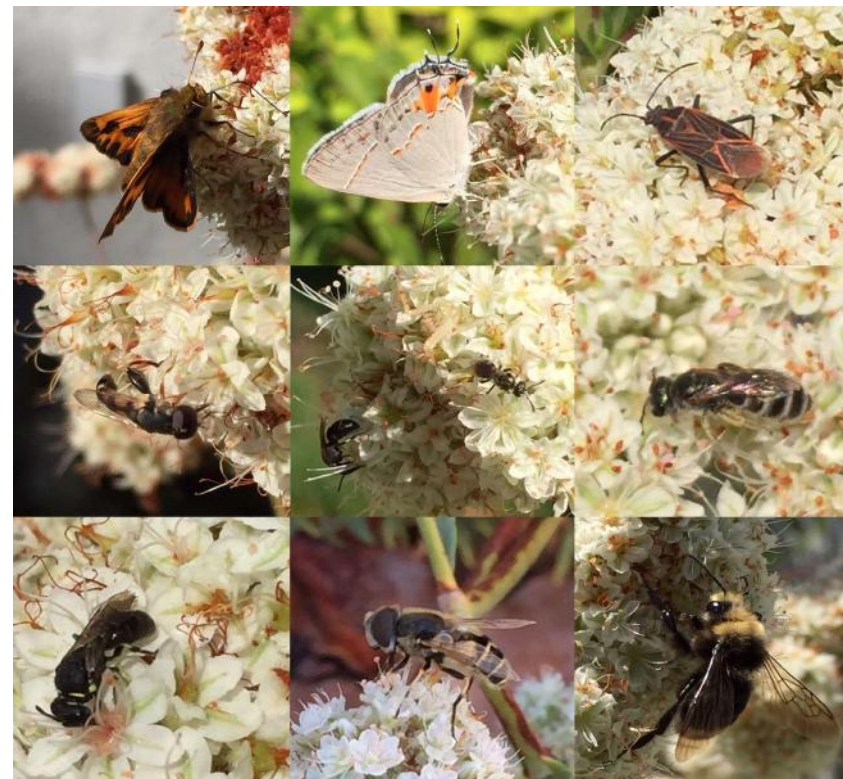
In one study, 85% of 41 bee species required **ALL** the pollen from more than 30 flowers for **one** larva. Other species required **ALL** the pollen from over 1,000 flowers.

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

Choose and then plant: trees first, then shrubs, then perennials, bulbs, etc.

Provide abundant nectar and pollen resources.

Eriogonum fasciculatum



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)

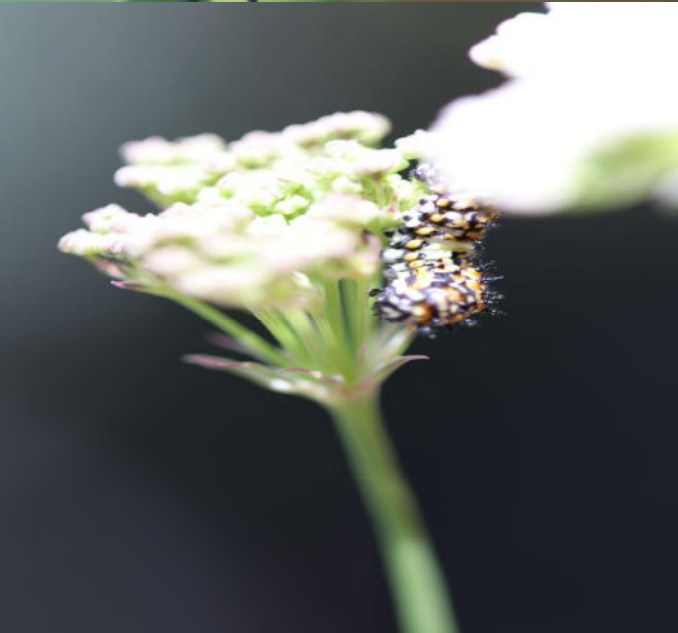


Caterpillar on Scropularia californica

Checkerspot caterpillar on Sidalcea calycosa



Grey hairstreak butterfly laying eggs on Eriogonum fasciculatum



Anise swallowtail caterpillar on Perideridia gairdneri





Many insects spend a lot of time as an egg or a larva.



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.**

Native plants are largely preferred over nonnative plants by pollinators.

Native plants depend on largely on native pollinators for reproduction.

Nonnative plants can escape cultivation and infest natural areas, and/or bring in disease and exotic insects.

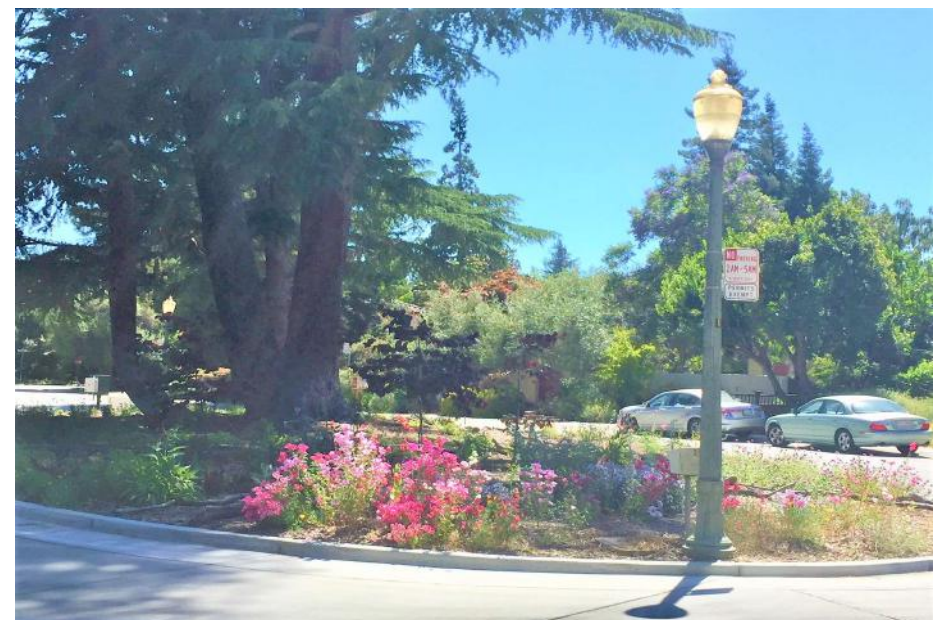
Planting native keeps California looking like California.

Even just a few appropriate native plant species will help improve biological resiliency and can help prevent local extinctions of species.

They provide an abundance of ecosystem services.



Island Drive
Before
and
After





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 or hundreds 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*—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.



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.





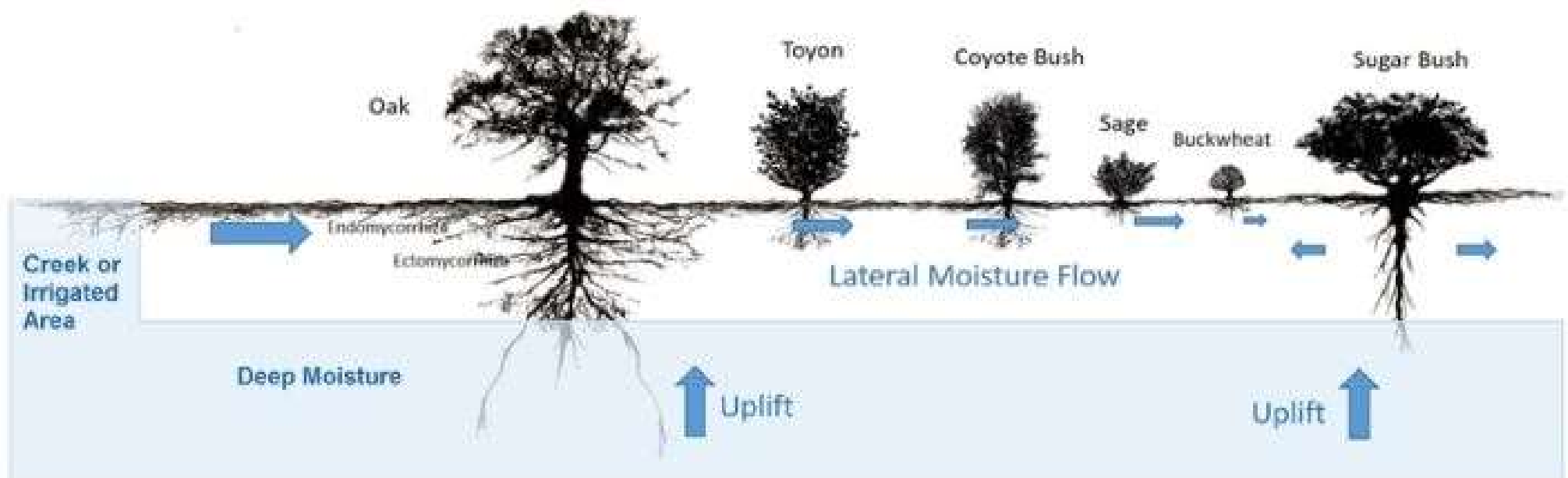
TREES HELP SHARE WATER

The screenshot below is from the Calscape.org planting guide page.

Native plant gardeners can bring a substantial amount of moisture up from the water table and other deeper groundwater reserves by interspersing deep root trees and shrubs like the ones shown above around their landscape. Oaks are probably the single best plants that support these natural irrigation systems given their deep and wide root networks. Once the moisture is lifted to the surface soil, it will be shared laterally across the grid of interconnected plant roots and mycorrhiza. The more extensive the root system of your plants is, the healthier your garden is likely to be.

Natural Irrigation system, transferring water from moist to dry areas

Natural Irrigation Example



By employing these two techniques you can keep your native plant gardens more verdant year-round, you can often grow a wider range of locally native plants and it will support a much greater range of biodiversity than would otherwise be possible.



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.
*Ceanothus spp.
*Eriogonum spp.
*Monardella villosa
*Lupinus spp. !!!!
Ribes spp.
Rosa spp.
Frangula californica
Baccharis pilularis
Salvia spp.
Artemisia spp.
Vaccinium ovatum
Amelanchier alnifolia
Adenostoma fasciculatum
Fremontodendron californica
Symphoricarpos spp.
Amorpha californica
Berberis spp.
Carpenteria californica
Heteromeles arbutifolia
Holodiscus discolor
Lavatera spp.

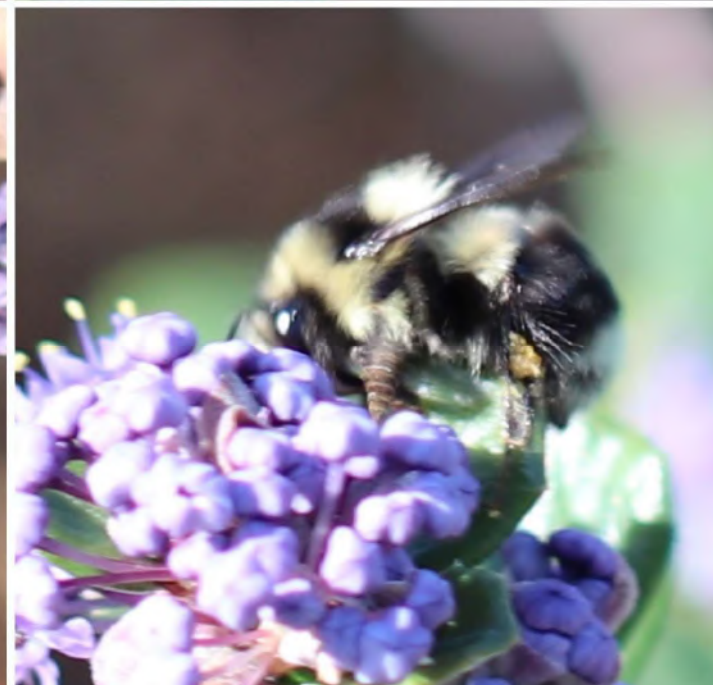
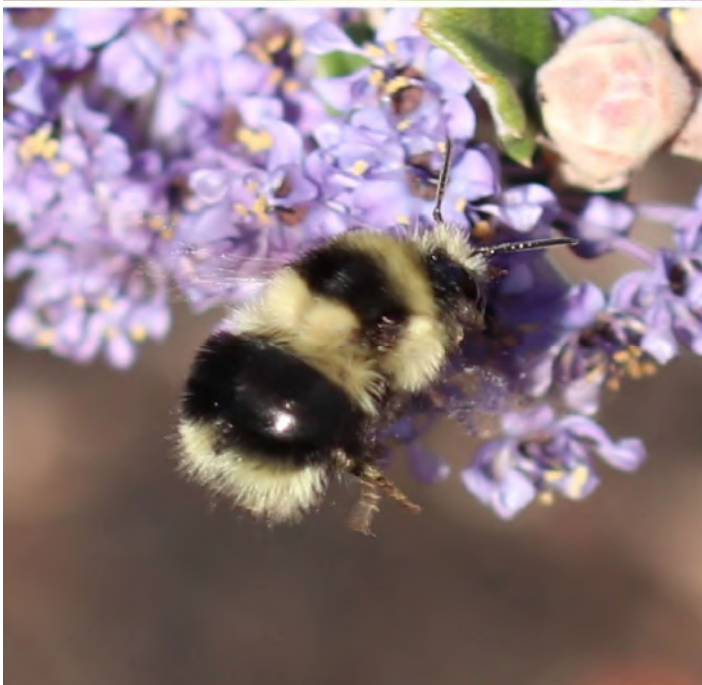
Malacothamnus spp.
Morella (Myrica)
Rhus ovata

*casual observations in our gardens show multiple species/visits



Early Blooming Plants for Bumblebees

Bombus melanopygus, the Black Tailed Bumble Bee on *Ceanothus* 'Valley Violet' in January. Early-blooming *Arctostaphylos* is a favorite as well.





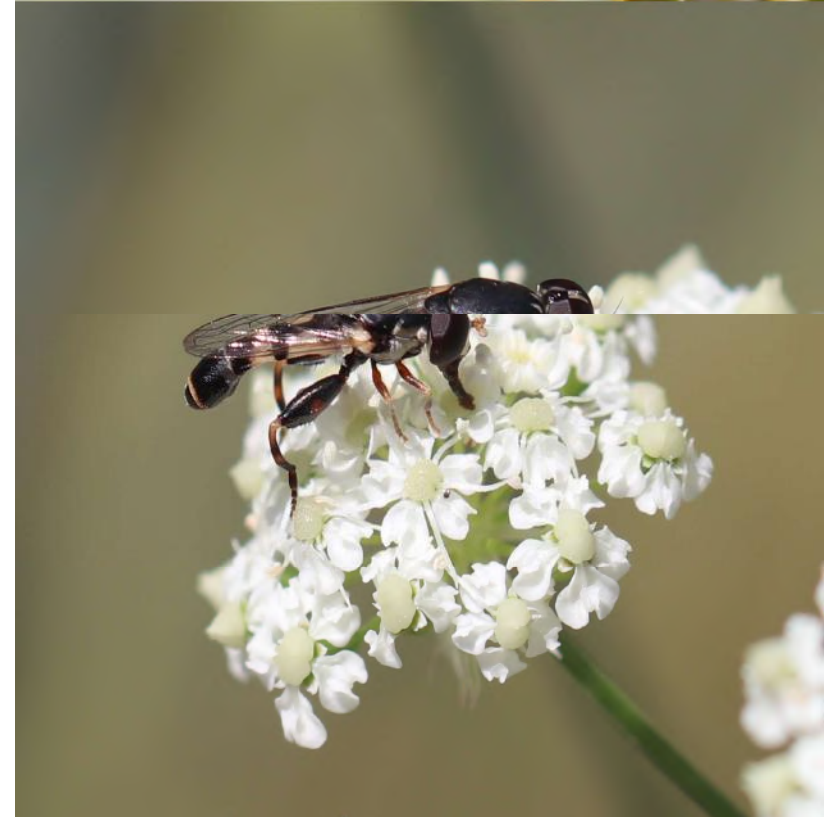
California Native Perennials

Provide a variety of floral resources as well as habitat.

*Phacelia spp.
 *Cirsium spp.
 *Aster spp.
 *Scrophularia californica
 *Grindelia spp.
 *Heterotheca spp.
 *Lepechinia spp.
 *Acmispon spp.
 *Perideridia spp.
 *Erysimum spp.
 *Helianthus spp.
 *Sisyrinchium spp.
 *Hoita orbicularis
 *Solidago spp.
 *Erigeron spp.
 Achillea millefolium
 Ranunculus
 Epilobium spp.
 Frageria spp.
 Plantain spp.
 Wyethia angustifolia
 Mimulus spp.
 Penstemon spp.
 Silene spp.

Viola spp.
 Asclepias spp.
 Camissonia spp.
 Heuchera spp.
 Iris spp.
 Keckiella spp.
 Lessingia filaginifolia
 Lomatium spp.
 Solanum spp.
 Sphaeralcea spp.
 Stachys spp.
 Aquilegia spp.
 Scutellaria spp.
 Sidalcea spp.
 Armeria maritima
 Eriophyllum spp.

*casual observations in our gardens
 show multiple species/visits





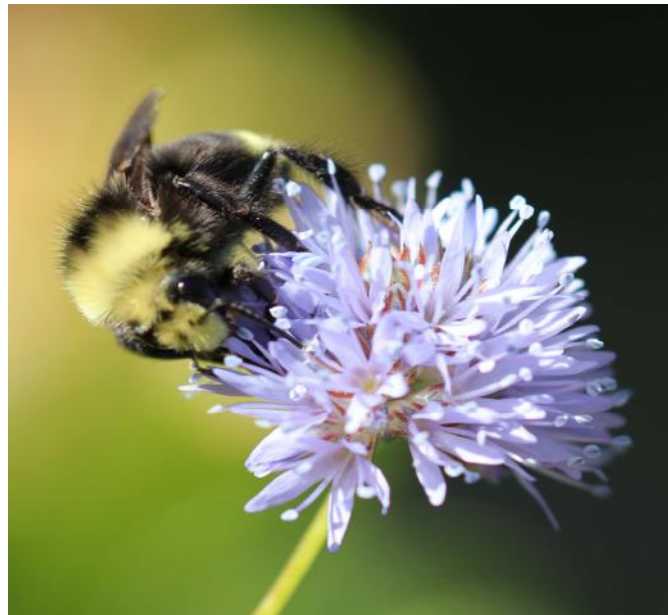
California Native Annuals

- 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.

Benefits of Plants

Being in nature has calming effects on the nervous system.

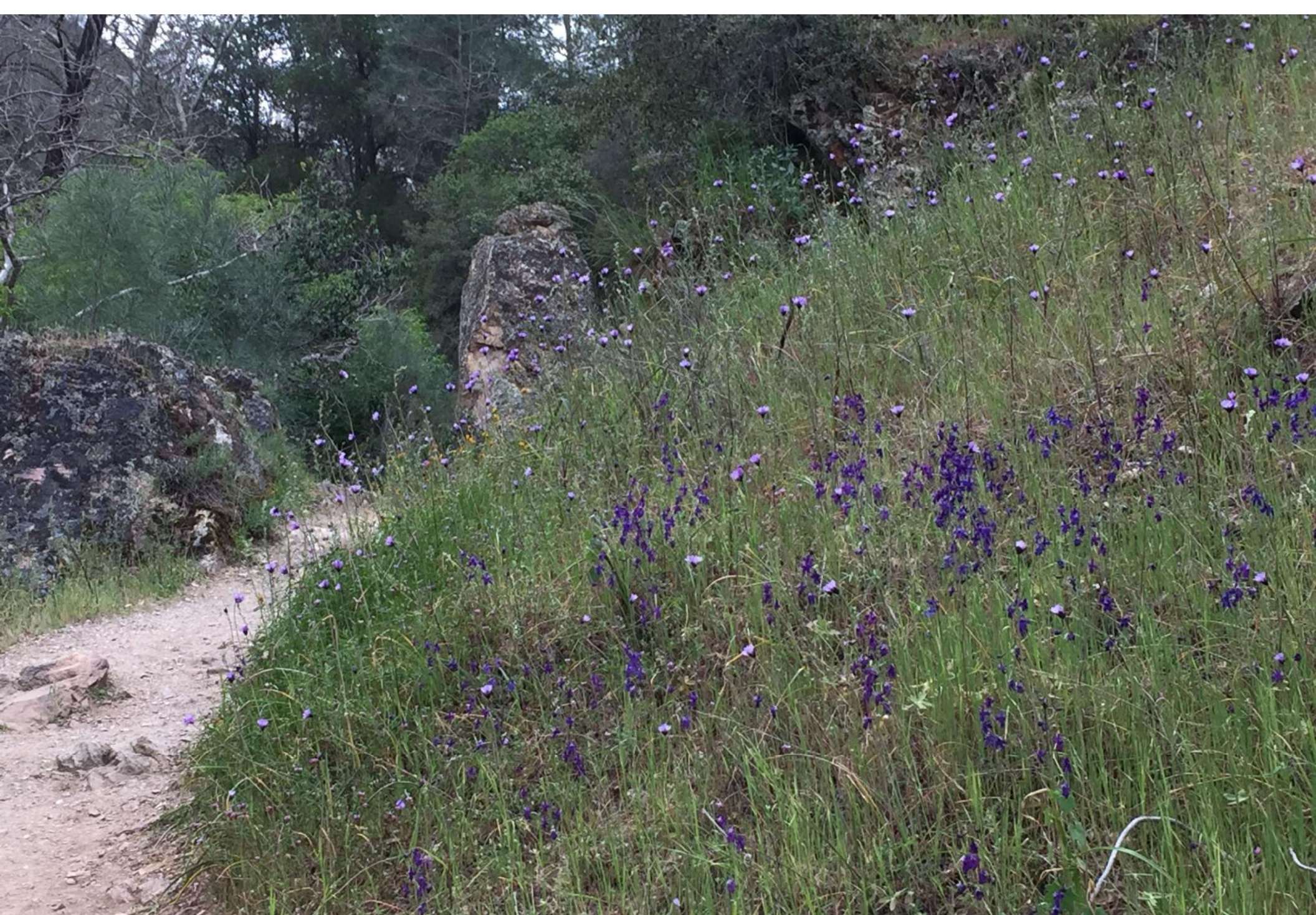
Fragrance from plants can strengthen the immune system.

Define a sense of place and helps provide a feeling of connection between people and other living things.

Improve climate, temperature, air quality, water quality and more.

Impact: Plants efficiently solve many issues and provide inspiration.





Planting inspiration: Pinnacles National Park- which has the highest concentration of bee species in California. Delphinium and Dichelostemma spp. in masses.

Be inspired by nature: Dudleya growing on a moss-covered rock.





Planting inspiration from Edgewood Park. Bulbs and annuals.

***Design Tip from Nature:
Plants are Layered Together.***



The Primrose Way garden in Spring: abundance of nectar and pollen with annuals.



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



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.



Look before digging. It's safe to assume there are insects nesting in the soil.





Gilia capitata

Maintenance

Keep weeds at bay.

Irrigate the first 1-3 years to establish and then adjust to a drier regimen as the plants need. But don't water on hot days.

Wait to prune and clean up the garden to later in the spring after insects have emerged.

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.

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***. Insects eating tree leaves may drop down to the ground underneath and burrow into leaf litter until spring.

Encourage fungal decomposition and quickly break down.

Don't shred leaves: many insects hibernate in leaves. Some are disguised as leaf look-alikes.

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 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 overwintering, 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. And then pile up twigs and branches for even more habitat.



PRUNING DECISIONS

A number of species nest in hollow stems, such as the 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.

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.

Turn off outside lights at night and use black-out shades on windows to protect nocturnal species from light pollution. Up to 30% of insects can die **each night** because of night lighting. Use motion sensors on outside lights for security.



On-going Decisions

Planting and maintenance decisions should be influenced by observation and research.

Does this plant provide forage for local insect species?

How much water is needed?

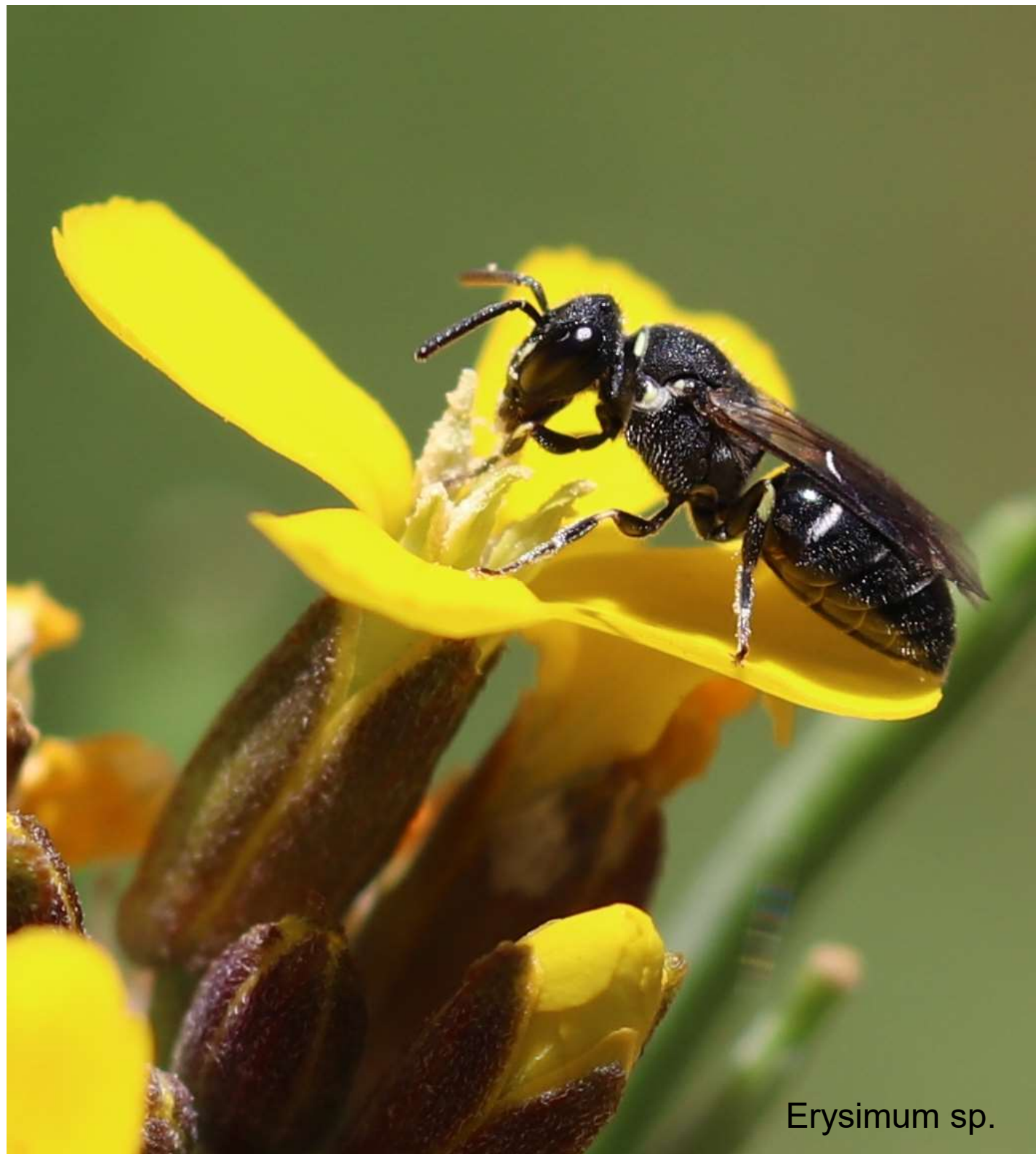
Does this plant provide nesting opportunities?

How hard is it to grow?

How will this plant enhance pollinator resources in the garden?

Am I assisting a northerly migration of this species?

How connected is this garden to other natural spaces?



Erysimum sp.

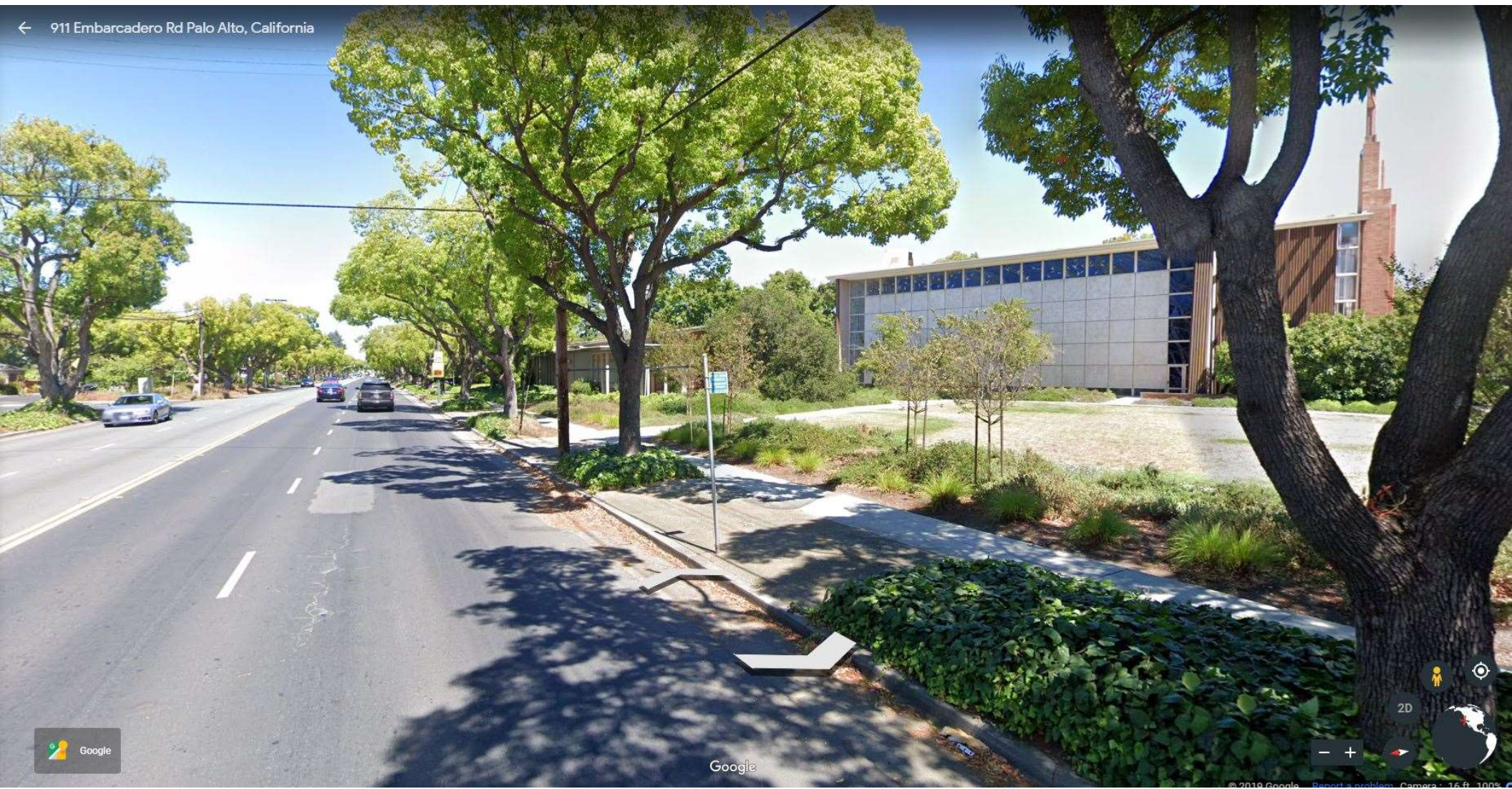
Look Closely Before Acting

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



Silene scouleri with juvenile katydid—it saw me before I saw it...consider the insect perspective.

Next big project: Across from Primrose Way, the “hell strip” along Embarcadero Road in Palo Alto.



*Final Thoughts: Among other ecosystem services,
the more you understand the interrelationships in nature,
your appreciation and enjoyment of nature's complex beauty will be enhanced.*





Get out and explore....