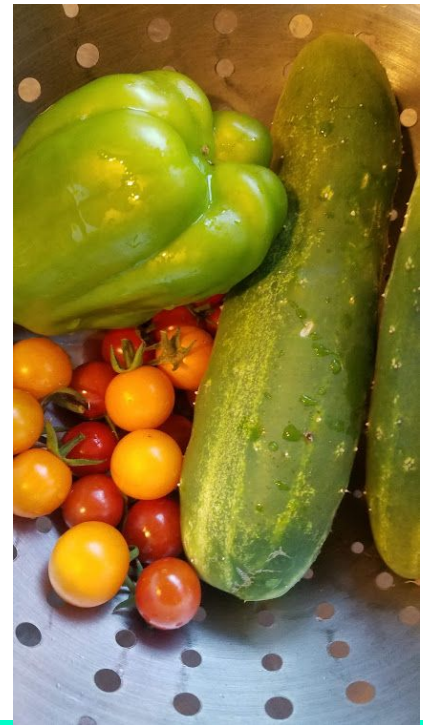


POLLINATORS AND EDIBLES



Sloat Seminar June 4, 2022
Relationships in your edible garden
Joan Pont, Pont Family Farm, a Hobby Farm

CAN'T HAVE ONE WITHOUT THE OTHER

Action item to improve
your harvest:

Support a diverse
population of
pollinators with a
variety of native plants



POLLINATOR LINEUP

Bees

Butterflies/Moths

Wasps

Flies/Gnats

Beetles

Birds

Bats

Even Mice



FARMERS VS RANCHERS

Channel your Inner Farmer:
Vegetables, fruits, wine
grapes, olives

Channel your Inner Rancher:
provide habitat for insects,
largely native bees.



Oklahoma, 1955

1600 SPECIES OF BEES NATIVE TO CALIFORNIA

Better pollinators than European Honey bees (naturally)

Some have exclusive relationships with particular flowers, but most are generalists

70% ground nesting, 30% cavity nesting

Special apparatuses carry pollen include branched hairs and pouches, scopae and corbicula



A green sweat bee, *Agapostemon texanus*, collecting pollen from a flower.

WHY RAISE YOUR OWN?

European honey bees are marathoners, travelling up to 4 miles to forage

Native bees stay closer to home, 400-1000 feet on average, you need your own

Co-evolved with local native plants

But will not nest **IN** your vegetable garden, so plan an area **AROUND** it

CALIFORNIA NATURAL HISTORY GUIDES

FIELD GUIDE TO

THE COMMON BEES OF CALIFORNIA

GRETCHEN LEBUHN ILLUSTRATIONS BY NOEL B. PUGH



I NEED SOME SPACE - REQUIREMENTS OF GROUND NESTING BEES

Bare soil

No compaction, no walking

No weeds (remove with a drone?)

No mulch

Scattered leaves and twigs -
light duff okay, but no soil
disturbance

Hence, your veggie beds do not
qualify



A female digger bee (*anthophora urbana*) coming out of her ground nest

INGREDIENTS FOR RAISING NATIVE BEES

Food: Multiple native plants with sequential flowering periods - pollen and nectar for feeding adults.

Nesting: Protected areas for nesting with twigs, dead wood, bare soil, and abandoned rodent nests. Let go of your Martha Stewart ambitions.



Kate Frey Garden: floral constancy

FOOD PACKED TO ADULTHOOD

The fertilized female bee lays an egg and nestles it with a “loaf” of pollen and nectar. The offspring larvae hatches, pupates and completes its growth cycle underground. They emerge as flying adult bees. All with no further maternal care.

On average, a bee spends 11 months in the ground and one month flying in its 1 year life



Illustration (left, Sarina Jepsen) showing ground nesting bees. Photo (right, Katharina Ullman) showing cavity nesting bees in a hollow stem.

FEED A BEE - ADD A HEDGEROW

Arctostaphylos spp

Baccharis pilularis

Ceanothus spp

Cercis occidentalis

Eriogonum fasciculatum, others

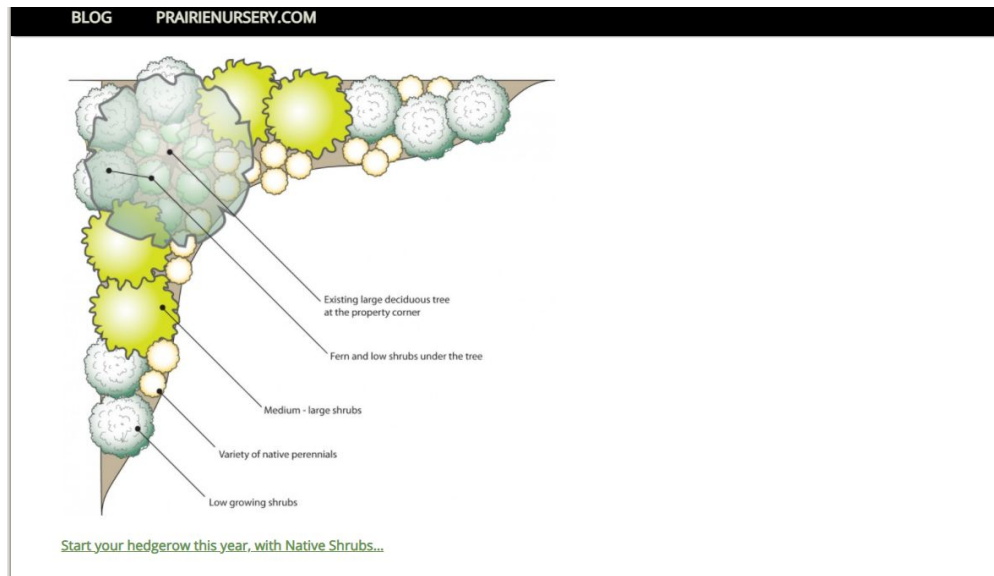
Heteromeles arbutifolia

Oaks

Prunus ilicifolia

Salvia mellifera, S brandegeei

Native Willows



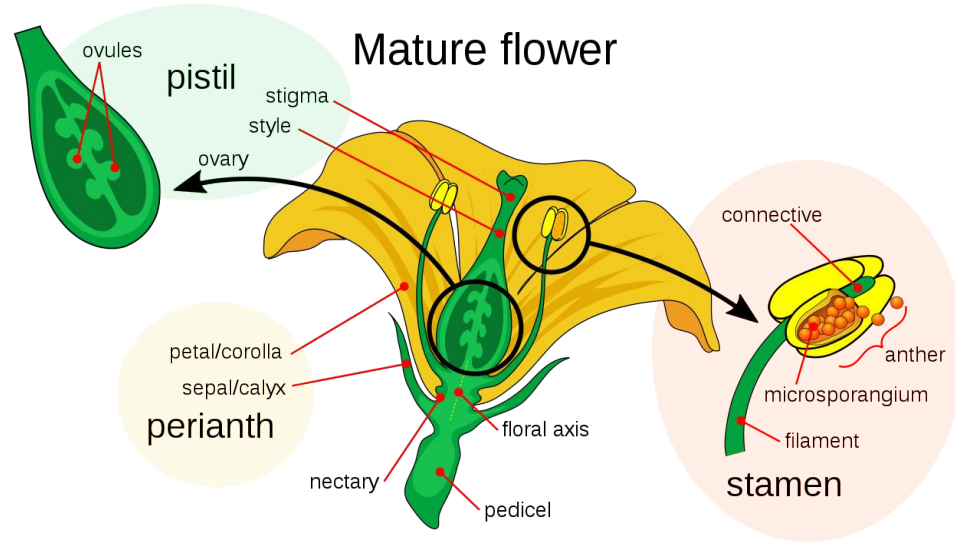
Full spacing allows open areas between plants

NEVER PICK A FLOWER

Well, almost never.

Flowers are the sexual reproductive organ of plants, providing genetic diversity for the next generation. Plus they mature to seeds and fruit.

Enticing insects, birds and mammals to do the heavy lifting of getting pollen to the stigma is the sine qua non of flowers. 90% of species of flowering plants are animal pollinated; 10% use wind but even some of them benefit from animal pollination.



PERFECT FLOWER

Bisexual, both androecium and gynoecium present in single flower

Some self pollinate, others require cross pollination, like this pear



FLOWERS PROVIDE HOSPITALITY

125 million years of divergent evolution with insects

Custom options: Nectar has 10-30% sugar for bees, higher for hummingbirds, and highest for bats

Engineering: Nectar can be protected from both evaporation and dilution from rainwater (think hoods, downward facing flowers)



Ballerina orchid. White Egret Orchid (*Habenaria radiata*)
The Darth Vader (*Aristolochia salvadorensis*)

FLOWERS USE ADVANCED DESIGNS: FABACEAE

Protect pollen

5 Petals: banner, 2 wings, and 2 more fused into the keel

Keel encloses 10 stamens and single superior ovary

Weight of a bee trips the keel. Upcurved filaments bring the anthers in contact with bee's abdomen.



Lupine visitor, Bee photos by Jeremiah Bender

MORE PROTECTION: BUZZ POLLINATION OR SONICATION

9% of species of flowers need buzz pollination. European honey bees cannot buzz pollinate

Tomatoes and other Solanaceae, blueberries, huckleberries, cranberries

Anthers have a tiny holes or slits and need to be vibrated to release pollen

Bumble bees vibrate their whole body instead of flapping their wings, holding onto the anthers, releasing pollen



Check out Buzz Pollination videos

NOT COMPLETELY SELF-POLLINATING

Tomato flowers produce no nectar, and their pollen can only be accessed from poricidal anthers by high frequency vibration.

Bumble bees in the greenhouses demonstrate 100% coverage



IMPERFECT FLOWERS

Members of the Cucurbitaceae family have unisexual flowers and can be either monoecious or dioecious.



ILLUSTRATION: KEITH WARD

WHY HAVE IMPERFECT FLOWERS?

Ensures cross pollination
between flowers (monecious)
and between plants
(dioecious)

Special treat: enjoy male
squash blossoms without
reducing your fall squash
harvest!



Cucurbita foetidissima

NOW ON TO BUTTERFLIES

Completely different
parenting model

Surround your garden with
vegetation providing leaves
for caterpillars, host plants

Lots of caterpillars means
well fed birds and fast and
healthy growing chicks



Monarchs require specific larval host
plant, *Asclepias* sp

KEYSTONE SPECIES - SUPPORTS MANY DIFFERENT INSECT SPECIES

Be a hero, stave off the insect apocalypse

Oaks, willows, native Prunus, Eriogonums, Salvias

One mature oak can support 1,500 different animal species, and it does not even need a pollinator

Leave the understory alone. No walking, raking, mowing. Caterpillars drop to pupate; that's their nursery



The Great Pont Oak Tree

MORE KEYSTONES: ADD A BUCKWHEAT OR MANY

Eriogonum fasciculatum, California
Buckwheat

In San Francisco, choose Coast
Buckwheat (*Eriogonum latifolium*)
and Naked Wild Buckwheat
(*Eriogonum nudum* var. *nudum*)

Calscape.org lists 261 species of
Eriogonums

Seeds are a food source for people
and animals

Long flowering season

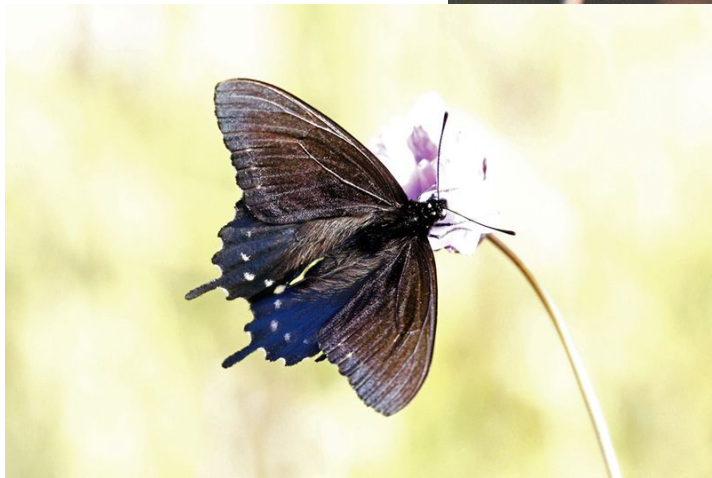


OPPOSITE EXTREME FROM KEYSTONE

Dutchman's Pipevine

Aristolochia californica

Leaves are the obligate food
for the Pipevine Swallowtail
Butterfly larvae



AFTER POLLINATION - SEEDS AND FRUIT

Caterpillars munch leaves

Bees and butterflies enjoy flowers

Birds need the concentrated calories of seeds and insects for their metabolic requirements. Ever been on a diet?

Never deadhead, after all a flower is just a phase.

Some seed collection allowed!



MILLION TO ONE ODDS

Lab Girl by Hope Jahren

Million to one odds, many plants create a million seeds to ensure it can replace itself...once.

Wasteful? Profligate? Wait a minute. Plants are the only organisms than can make food. Seeds pack in more calories than leaves, complete with carbohydrates, fats and proteins.



BIRDS IN THE GARDEN

Hummingbirds weigh 2-8 grams

Heart pumps 1200 times a minute

Wings beat 70 times a second

They eat several times their weight in nectar daily

Protein comes from small insects in their diet



Black-chinned Hummingbird

LATE SEASON HUMMINGBIRD PLANT, SEPTEMBER BLOOMING

California Fuchsia

Epilobium canum

Lesson learned: letting the plant decide where it wants to grow

Prune down to just a few inches in December once all the flowers are gone for a stunning plant next year.



OTHER JOBS

Predation: Western Bluebird

Hunts by dropping to ground from low perch

Supplements diets with berries

Cavity nesters: plans from Right bird, Right house, Cornell Lab of Ornithology

<https://nestwatch.org/learn/all-about-birdhouses/right-bird-right-house/>



PERFECT SEEDS CAPSULES FOR BIRDS

Oenothera elata ssp hookeri

Hooker's Evening Primrose

5' tall, huge blooms August/Sept

Upright seed capsules visited by
seed eating birds like
Goldfinches

Clarkias, others in the family
Onagraceae, have bird friendly
seed capsules as well



OTHER PREDATORS: PARASITOIDS

Parasitoids can hone in on insects in their larval, pupal or adult stages

They drill and lay their own egg. The resulting larva lives off the host, eventually killing it

Parasites live inside another organism getting all their nutrients from the host, causing illness or worse.



A parasitoid wasp (*Trioxys complanatus*, Aphidiidae) ovipositing into the body of a spotted alfalfa aphid, a behaviour that is used in biological pest control

COYOTE BRUSH SUPPORTS PARASITOIDS

Baccharis pilularis

Dioecious - staminate flowers (male) and pistillate flowers (female) occur on separate plants, guaranteeing cross pollination

Male plants: tidy pollen producing-flowers in the late fall and winter

Female plants: seeds with pappus for dispersal, giving the common name Coyote with its shaggy coat.

Important insect and bird winter food source, including parasitoids

Survives in areas with precipitation of **3 inches of rain per year**



NO POLLINATOR NEEDED

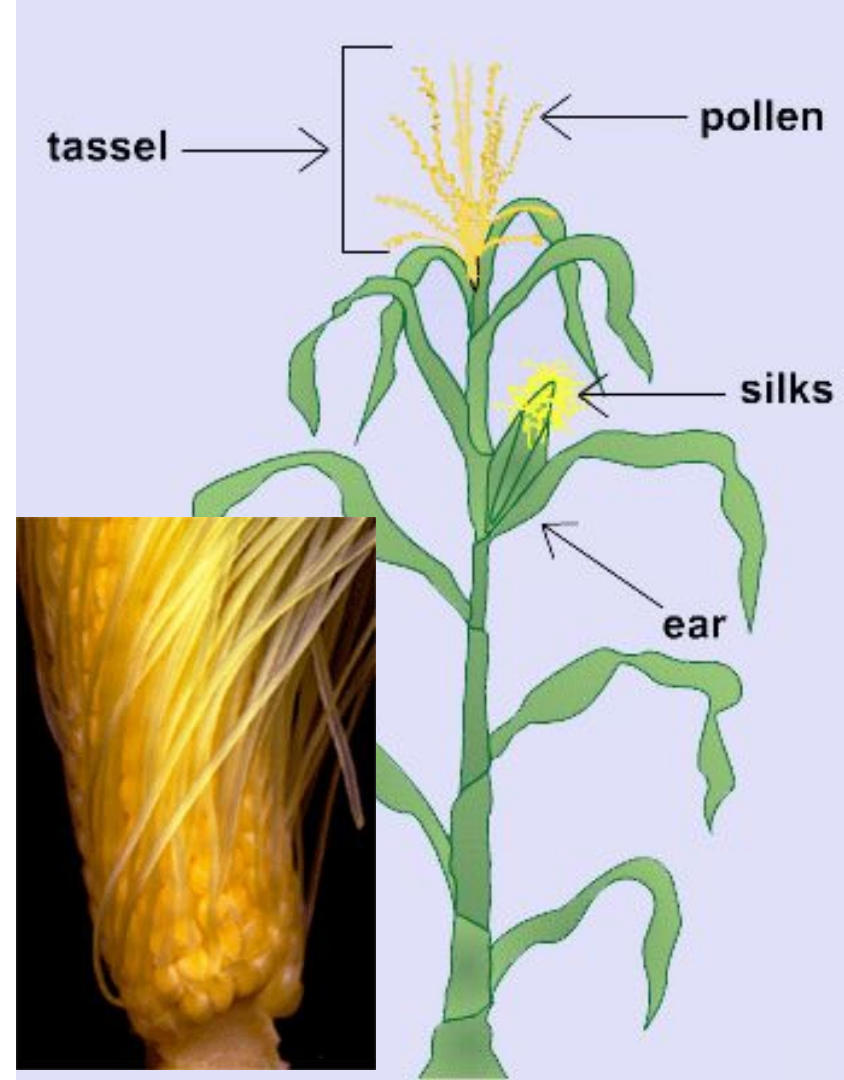
Cereal grains are wind pollinated

Corn is monoecious, every silk leads to one kernel

Cross pollinating affects harvest!

Endosperm of grains is what we eat.
One sperm combines with a binucleate cell creating a triploid that replicates as endosperm

Compare with apple when we are eating the fruit, genetically all the single parent plant



FLOWER DESIGN FOR WIND POLLINATION

True, they don't need signal patches (like petals) or tight entrances to ensure contact to anther and stigma

But, they require sophisticated materials to make up the filament, strong enough to not break in the wind but flexible enough to respond to a slight breeze and shake out the pollen.



[Pseudoroegneria spicata](#)
Blue bunch wheat grass

CONCLUSION

Edibles benefit from being a part of a diverse ecosystem

Complement the edibles with native plants that support insects and birds. They will happily spill over to your edible patch with luscious rewards!



Winter Morning at the Pont Family Hobby Farm