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California Bee-Friendly Garden Recipes

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Wild pollinators provide crucial—and cost-free—ecosystem services by pollinating fruits, vegetables, flowers, and wildland plants (Kremen et al. 2004, Ponder et al. 2013) (to learn more about the importance of pollinators and the types encountered in urban gardens, see UC ANR Publication 8498, *How to Attract and Maintain Pollinators in Your Garden*). Loss of habitat is one of the greatest threats to wildlife, from large mammals down to insects, especially as the human population continues to grow and urban areas spread (Pardee and Philpott 2014). Wild areas that once offered nesting materials, food, shelter, and a host of other resources for animals have been transformed into areas filled with homes, businesses, roads, and other infrastructure. Pollinators have been impacted by these changes (Geslin et al. 2013) and by other factors, including increased pesticide use, introduced disease, environmental toxins, and climate change (Buchmann and Nabhan 1996).

"Habitat gardening" is now becoming popular in urban areas as more people become aware of pollinator issues (Pawelek et al. 2009; Garbuzov and Ratnieks 2013) and come to recognize the benefits of welcoming wildlife into gardens, farms, and natural areas (Grissell 2001; Tallamy 2009). Many people have learned how to modify and construct gardens in ways that attract birds, butterflies, and other wildlife into their space. Native bees also have a place in these urban gardens, particularly as the continued decline of honey bees brings national attention to the loss of pollinators. Almost a quarter of the 1,600 known bee species in California have been recorded (unpublished data UCB Urban Bee Lab) as occurring in urban areas. This means that urban areas may have the potential to serve as important refuges for bees and other valuable wildlife if carefully constructed habitats are made available to them (Owen 1991, 2010).

In the following pages, we will offer guidelines for establishing habitat gardens for bees (both native bees and European honey bees). We developed the guidelines in response to requests from members of the public who have been asking, "How do I get my bee garden started?" In researching answers for this question, we found most available recommendations for habitat gardening to be too general in nature. In this publication we offer more specific start-up information for California gardeners.

Designing a garden to attract bees can be as simple or involved as time, interest, and resources allow. You can start your garden from scratch or transform an existing garden into an inviting native bee habitat by gradually introducing new, bee-attractive plants, and enlarging existing patches of these plants. Bee gardens can follow a formal, informal, or naturalistic form and style, but all share one common feature: they are filled with flowers for as many months of the year as the local climate allows. The same flowers that support bees may also attract other desirable flower visitors and wildlife, creating a colorful and engaging landscape that appeals to us as well.

Background

We based the information in this publication on general trends of bee activity as observed in numerous gardens in 15 cities throughout California, including botanical gardens and arboreta, community gardens, home gardens, city parks, and our lab's own bee-flower evaluation garden in Berkeley (figure 1) (Frankie et al. 2014). These gardens are sites for the *Urban California Native Bee Survey,* a project begun by our UC Berkeley Urban Bee Lab in 1999, when Berkeley and Albany were sampled for bees and their preferred flowers. The project's goal was to document bee diversity and abundance in cities throughout the state, from Redding to Palm Desert. Each month during the main bee-flower season (March–October), bees were counted and collected from flowers. To make site-to-site comparisons possible, 31 plant types (which include different species, subspecies, cultivars, and varieties) were selected for monitoring. These are some of the "plant types" referred to throughout this publication. The plants include bee-attractive natives and non-natives, and are common in most gardens and nurseries throughout the state. In some cases we had to add these plants to specific garden sites in order to make the necessary counts and collections possible. We recorded which plants were visited by bees and, in some cases, performed bee frequency visitation counts to determine the plants' level of attractiveness to bees (see Frankie et al. 2005 for detailed methodology of frequency counts).

These diverse gardens across the state have shown that, given the right selection and composition of plants, bees will visit. During this survey work, researchers identified several different types of garden. Some home gardens and arboreta focused on native plants only, while others incorporated both natives and exotics for year-round flowering. Still others integrated bee-friendly plants into edible gardens. The "garden recipes" presented here are inspired by these diverse gardens and are intended to help gardeners choose plant types that will work well in their own garden settings. These recipes build

Figure 1. The Oxford Tract Bee Flower Evaluation Garden (Berkeley) in spring of 2013. Photo by J. Pawelek.

on bee-friendly planting guidelines that are now becoming available online. While they represent an important first step, many of the online guidelines provide only general plant lists, often giving only common names for the plants, and many include some plants that are not commercially available to the home gardener. The garden recipes presented here focus on helping you create a habitat (plant types and quantities) that will provide high-quality, consistent resources for bees.

Native Bee Basics

Unlike the social European honey bee (*Apis mellifera*), most native bees are solitary: they do not have hives, queens, or workers. Bumble bees (*Bombus* spp.) and some sweat bees (*Halictus* spp. and *Lasioglossum* spp.) are social insects but their colonies are seasonal and do not remain active beyond a single year, whereas a honey bee colony is active year-round and continues from year to year.

Once mated, a female solitary bee works alone, visiting flowers for food resources (nectar and pollen) to provision nests for the next generation. The female bee forms the nectar and pollen she has collected into a small loaf that her larvae will consume when they hatch. Nectar provides sugars (carbohydrates) and amino acids (Gottsberger, Schrauwen, and Linskins 1984), and pollen provides proteins, fats/lipids, starch, vitamins, and minerals to the developing young (Roulston and Cane 2000). Adult native bees use nectar as fuel for their foraging activities.

The female solitary bee builds an individual nest by digging a tunnel in the ground or selecting a pre-existing cavity such as those made by boring moth and beetle larvae. The young will develop in the nest for several months before they emerge as adults the following year. Approximately 70% of native bees nest in the ground and 15 to 20% nest in crevices and cavities. The remainder are "cuckoo" bees, meaning that, like the cuckoo bird, they do not have nests of their own. Instead, they take over the nests and collected resources of other bees, co-opting them for use by their own young. You can make an inviting "bee condo" for cavity-nesting bees by drilling holes in untreated wood or bundling paper straws together (figure 2).

Figure 2. A native bee condo at the Living Desert, Palm Desert, California. Photo by J. Pawelek.

Native bees are seasonal, timing their emergence to match the bloom time for the flowers with which they co-evolved—their "preferred flowers." Native plants that flower in early spring, like manzanita (*Arctostaphylos* spp.), California lilac (*Ceanothus* spp.), and redbud (*Cercis occidentalis*), have associated bee visitors that emerge from the nest right on time to gather nectar and pollen from their flowers. As the seasons change, some plants fade while others come into bloom, and different bee species will appear in the garden to visit them. Some bees are very specialized in the type of pollen they collect and may only visit one plant type, while

many others are generalists and will forage from a variety of flower types. Native bees in California are typically active from early spring (February to early March, or earlier in warmer Southern California) through fall (October to November). For more information about the biology and ecology of native bees, visit www.helpabee.org.

Rules of Thumb

Native bee ecology heavily influences the garden planning process, and a successful garden will be designed to meet the seasonal, floral, and nesting needs of native bees throughout their life cycle. Our research has revealed several "rules of thumb" to attract a high diversity and abundance of native bees throughout the season. (See the section titled "Common Bees in California Gardens" near the end of this publication for a seasonal list of bees that commonly occur in urban gardens.)

1. Learn the seasonality of plants and bees. Since native bees are seasonal, the plant palette chosen should reflect the changing seasons of both bees and plants (Frey 2009; Frankie et al. 2014). With a few exceptions, most bee species are only active for a short time each year. Several plants should be blooming in each season to provide pollen and nectar to visiting bees. If you select plants with overlapping flowering times running from February to October (the main activity period for bees) you will encourage native bees to continually forage from garden blooms.

2. Provide a diversity of floral hosts. Gardens with a high diversity of plants are likely to attract a greater diversity of bees as well (Frankie et al. 2009a; Pardee and Philpott 2014). We recommend planting a minimum of 20 different plant types in order to provide sufficiently diverse sources of nectar and pollen, although fewer types can also be effective if they are highly attractive. Some plants provide both nectar and pollen, for example those in the Asteraceae family such as seaside daisy (*Erigeron glaucus*) and blanketflower (*Gaillardia* × *grandiflora*). Many salvias (*Salvia mellifera*, *S. chamaedryoides*, and *S. brandegeei*), which are in the Lamiaceae family, are largely nectar resources for bees. When you incorporate many different types of plants into the garden you will guarantee that bees' needs for both pollen and nectar are met. Gardens with more space can accommodate more plant types and may attract even more diverse bee species.

3. Give structure to the garden. The arrangement of plants will influence your ability to observe native bee visitors. Start by planting the tallest and largest plants in the back, tapering down to smaller ones in front to allow for easy observation. Or, plant all medium- to low-growing plants in an island-shaped bed so you can observe bees from all directions. Your selection of plant sizes will also depend on the size of your garden (figure 7). Before you plant, make note of how large each plant will grow so they will have the space they need when mature. Keep in mind that the more flowering plants you have blooming at one time, the more food there will be for the bees.

4. Plant in the sun. Bees prefer to visit flowers in the sun, so avoid planting bee-attractive plants in the shadier parts of your garden. On a clear day, track how the sun moves through the garden and pick out the sunniest patches for bee plants. There are always exceptions, such as bumble bees, which forage on plants like Chinese houses (*Collinsia heterophylla*) that grow in shade. But for the most part, bees like the sunshine!

5. Plant herbaceous shrubs, perennials, and annuals in patches. Most bees exhibit floral constancy, which means they visit only one or a few types of flowers each time they go out foraging. They don't stop at every flower they encounter. An abundance of the same variety of flowers blooming at one time will encourage a greater abundance and diversity of bees as it allows for efficient resource collection (Frankie et al. 2009b). This will also allow more time to observe bees as they linger in the patch. The ideal patch size for each flower type is at least 3.5 feet × 3.5 feet (figure 3). A garden area design that features dense plantings can help ensure a robust food supply for bees and will create a full and colorful garden.

6. Don't forget to seed annuals. Annual plants help keep the garden dynamic with changing colors and flower types throughout the year. Plant seeds for spring-blooming annuals like California poppies (*Eschscholzia californica*) and *Phacelia* species in late

Figure 3. A large patch of *Phacelia tanacetifolia* at the Oxford Tract Bee Flower Evaluation Garden (Berkeley) in spring 2013. Photo by J. Pawelek.

fall in order to take advantage of the winter rains. In cool-summer climates, they can also be planted in February and March. Summer-blooming annuals like cosmos (*Cosmos bipinnatus*, *C. sulphureus*) and sunflowers (*Helianthus annuus*) can be planted when the danger of frost has passed in April or May. Lightly scratch the surface of the soil with a rake or fingers, then sprinkle the seeds on generously. Next, sprinkle a layer of soil on top of the seeds to keep them from blowing away or washing away when watering. Water gently and keep the seeded ground consistently moist. Most annuals benefit from the addition of compost before planting and will, as a result of this, reward the bees with a longer blooming season. Allow annuals to drop their seeds after flowering is finished to encourage reseeding for the following year. Transplants can be more convenient and can be planted in the same seasons as the seeds. Many hard-to-find annual native plant seedlings can be mail ordered or purchased at selected nurseries.

7. Maintain flowers. Dead-heading spent flower heads from annuals like cosmos (*Cosmos bipinnatus*) and California poppies (*Eschscholzia californica*), perennials like bush sunflower (*Encelia californica*), and shrubs such as Chaste tree (*Vitex agnus-castus*) and Pride of Madeira (*Echium candicans*) will allow the plants to put more energy into producing new blooms and so extend their flowering period. High-quality and organic fertilizers, composts, or compost teas can boost plant health and blooming period as well, although over-fertilizing may lead to greater leaf production and less floral production.

8. Create a watering regime. When a plant is stressed for water it won't put as much energy into producing new flowers and nectar production declines. Regular watering during the blooming season (even for some natives) will allow the plant to produce more flowers for a longer period of time. If you water by hand, make sure to water in the early morning or late afternoon or evening. Watering during the hottest part of the day is inefficient, as much of the applied water may be lost to evaporation. Irrigation may be cut back after flowering for some native woody shrubs, like California lilac and manzanita (*Ceanothus* spp. and *Arctostaphylos* spp.). Many native plants have low water needs and are already adapted to California's Mediterranean climate with wet winters and dry summers.

9. Do not use pesticides! Pesticide applications may kill beneficial insects like bees as well as parasites and predators of garden pests that provide natural pest control. Many plants now come pretreated with systemic insecticides that protect the plants from pests throughout their life. These types of insecticides are then present in the nectar and pollen and can cause harm to flower visitors, so be sure to shop from reputable nurseries and always question their growing practices as well as those of their growers. Plant only species that are appropriate for local soil and climate conditions and, instead of spraying, be willing to tolerate a few springtime aphids and other seasonal insects. If pests continue to be a problem, consider removing the affected plant type and replacing it with another that is better suited to the garden conditions. Other organic methods of pest removal include hand picking, spraying affected areas with water (or soapy water), and using natural insecticides like Bt (*Bacillus thuringiensis*).

10. Consider plant climate zones. A plant's native climate range is important in determining whether it is likely to attract bees. Some plants, like the seaside daisy (*Erigeron glaucus* 'Wayne Roderick'), thrive in both coastal and inland regions, while others, like Chaste tree (*Vitex agnus-castus*) and desert willow (*Chilopsis linearis*), need a warmer, inland climate to be good attractors. Refer to *The New Sunset Western Garden Book* (2012 ed.) in the section on plant climate zones for guidance on where different plants will have the greatest success.

11. Provide homes for nesting bees. A complete bee habitat garden will also have areas where bees can build their nests, either in the ground or in pre-existing cavities in wood. If the garden is directly adjacent to wild areas, nesting sites may not be necessary. Bees will need a place to call "home" in most urban areas, however. Ground-nesting bees can't dig through mulch, so be sure to leave parts of the garden ground bare. Stepping stone pathways with soil between the stones can serve as attractive sites for ground-nesting bees, as can vertical rock walls with small spaces between the rocks. Bee condos made by drilling holes in untreated wood or by bundling paper straws together can provide homes to the cavity-nesting bees in the garden. For more information about these homes, please see UC ANR Publication 8498, *How to Attract and Maintain Pollinators in Your Garden*.

12. Provide nesting materials. Bees may also need materials to build their nests with, like mud, plant leaves, and resins. Unlike honey bees, native bees don't require a source for drinking water. They may use a water source, however, to make mud for nest construction; such is the case with many mason bee species (*Osmia* spp.). To provide water for honey bees and for bees making mud, put up a shallow birdbath and add exposed rocks or floating cork for bees to land on so they don't drown. Circular holes in the leaves of roses and redbuds (figure 4) indicate the presence of leaf-cutter bees (*Megachile* spp.), which use the leaf cuttings to line and seal the inside of their nests. A leaf-cutter bee nest, if dug up or seen inside a cavity, looks like a green, leafy cigar!

Figure 4. Evidence of leaf-cutter bees using redbud leaves for nest construction. Photo by J. Pawelek.

Garden Preparation, Establishment, and Maintenance

Preparation of the garden space and choosing its location (preferably in full sun) are the first steps for making a bee garden (figures 5 and 6). Begin by cleaning the area out and removing any weeds and pest plants like oxalis, dandelion, mallow, and bindweed. If removing a lawn, try sheet-mulching the space before you plant to help prevent weeds and grass from coming back. This involves covering the ground with a layer of overlapped cardboard and topping that with a thick (3- to 6-inch) layer of compost. The pest plants and grass will get shaded out and will eventually die. Plant bee-friendly plants directly into the ground by cutting holes in the cardboard.

Figure 5. Home garden in Richmond, California, before removing the lawn and planting a bee habitat garden. Photo by R. Coville.

Figure 6. Same home garden, 3 years after bee-attracting plants have begun to mature, bloom, and attract bees. Photo by R. Coville.

Fall, with its cooler temperatures, shorter days, and imminent rainfall, is the best time to plant a bee garden in California. Much of the plants' growth at this time will be in the roots rather than vegetative growth, and that gives the new plants an advantage when temperatures warm up and the soil dries in spring. Fall and winter are usually the wet seasons in California, and a bee garden will benefit from the natural pattern of rainfall that helps plants get established.

Many native California plants do best with a top dressing of compost rather than fertilizer. Compost added to garden beds will amend the soil, provide nutrients for new plants and soil organisms, and improve the texture and structure of the soil (Abawi and Widmer 2000). Spread 4 to 6 inches of compost on top of the soil, then work it in to a depth of about 6 inches. The heavier and more compacted or sandy the soil is, the more compost should be incorporated. An alternative to working compost into the entire soil area is to spread 4 to 6 inches of compost on top of the ground and then work it in as you put plants into the ground. One to two inches of compost may be spread around the base of plants in fall, giving time for its beneficial components to work their way into the plants' root zone with the winter rains so they will be available for spring growth. Be careful to use high-quality compost that is not too high in salts or soluble nitrogen.

If you are modifying an existing garden to include more bee-attractive plants, begin by making a list of the plants that will remain in the bee garden and their corresponding flowering times. Next, dig up any plants that will be removed and pull weeds from any additional patches. New plants to be added should fill in any gaps you have identified in flowering times. For example, if all existing plants in the garden bloom in the summer or fall, choose new plants that flower in the spring and early summer.

Take time to think about the water needs of each plant type, especially as drought conditions persist for much of the state. Many native plants are drought-tolerant and will have low water needs after they become established. When plants are first put in the ground or when seeds are beginning to sprout, it is essential that they receive a consistent watering regime. A good rule of thumb is to give plants a deep watering at least three times a week for the first four to six weeks. This will help ease the plants' transition to their new home. Then as plants begin to establish, cut back to twice a week. Be sure to check soil moisture often and check the plants' appearance to look for signs of stress—if there are wilted leaves or

poor growth due to heat stress or drought, they may need watering more often. If you use a drip irrigation system, set the timer to water plants for roughly 5 to 10 minutes every other day at first, and then readjust to twice a week after four to six weeks. As plants mature, drip irrigation 1 to 2 times a week for an hour during summer may suffice, depending on plant species, soil, and climate.

After one or two seasons, you may be able to diminish watering to once a month or even no watering at all if the plants are truly adapted to local conditions. Always observe how the plants are growing and adjust watering accordingly. If the garden will include ornamental bee plants, research their water needs before you buy them to make sure they fit with the overall watering scheme of the garden. Group plants with the same water needs together for better irrigation efficiency.

If time allows, hand-watering is a good option for controlling how much water plants receive. Building a "well" with raised sides around each plant and watering only into the well is one way to help conserve water. Shallow watering promotes shallow root growth, so we recommend deep watering a couple of times a week. A less time-intensive method such as drip irrigation also works as it promotes controlled watering. Setting up a drip irrigation system can seem daunting at first, but staff and educational materials at a local drip irrigation supply store or garden center can help make choosing and installing parts and setting irrigation times and periods clear and easy. They can help you learn how to set up a simple timer and lay out your system if you bring a diagram of how the garden will be set up, including dimensions. The installation will be a good day's worth of work, but the benefits of controlled, efficient watering will be worth it. Plants respond well to a consistent watering regime.

After you install the garden, a small amount of garden maintenance will keep things looking tidy, prolong the bloom periods, and keep the garden attractive to potential bee visitors. Cut back dead or dying parts of plants and keep most plants dead-headed by cutting off spent flower heads in order to promote the growth of new flowers. Plants should also be trimmed and pruned to keep them from shading out other important plants.

The Recipes

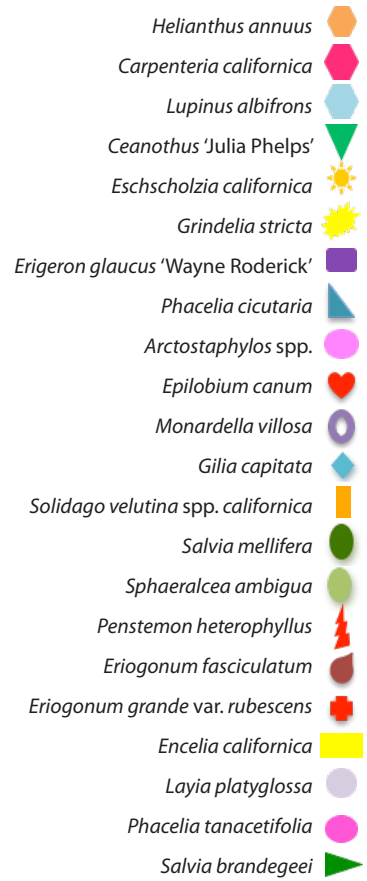
The following garden recipes combine the 12 rules of thumb while taking into consideration spatial and climatic constraints. An estimate of the number of plants needed to make up a "patch" is provided in parentheses before each plant name. Several options are offered, but the size of the garden will determine the actual number of plant species and number of individual plants you will need. These plants were chosen because of their ability to attract diverse bees as well their availability in local nurseries. If the named cultivars are not available, experiment with others to find what works best in your garden. Based on these general guidelines, you can tailor a habitat garden to suit your individual goals, bioregion, lifestyle, and taste.

These recipes include wildflowers, flowering fruits and vegetables, and shrubs. Many trees are beneficial to bees as well, but we have not included them in the recipes as they may take up too much valuable garden space. If space allows, include a few flowering trees, such as redbud (*Cercis occidentalis*), desert willow (*Chilopsis linearis*), wild plum (*Prunus* spp.), or large varieties of coffeeberry (*Rhamnus californica*) and California lilac (*Ceanothus* spp.). The California native plants included in the following recipes are presented in **boldface type**. You will find a list of the gardens and matching websites for these recipes in the Appendix.

"Bringing Back the Natives" Garden

The name of the "Bringing Back the Natives" habitat garden (figure 7) is drawn from a garden tour held once a year in the East Bay (San Francisco Bay Area). To learn more about the garden tour, visit www.bringingbackthenatives.net.

A California native garden is a magnet for native bees, which greatly prefer native plants to non-natives (Frankie et al. 2005). It will use less water than many other gardens, and has a lot of potential to attract other beneficial insects and birds, and so become a mini-sanctuary for wildlife. It is important to note that many California native plants tend to flower in spring and through the first part of summer, but this recipe includes many that flower through fall.



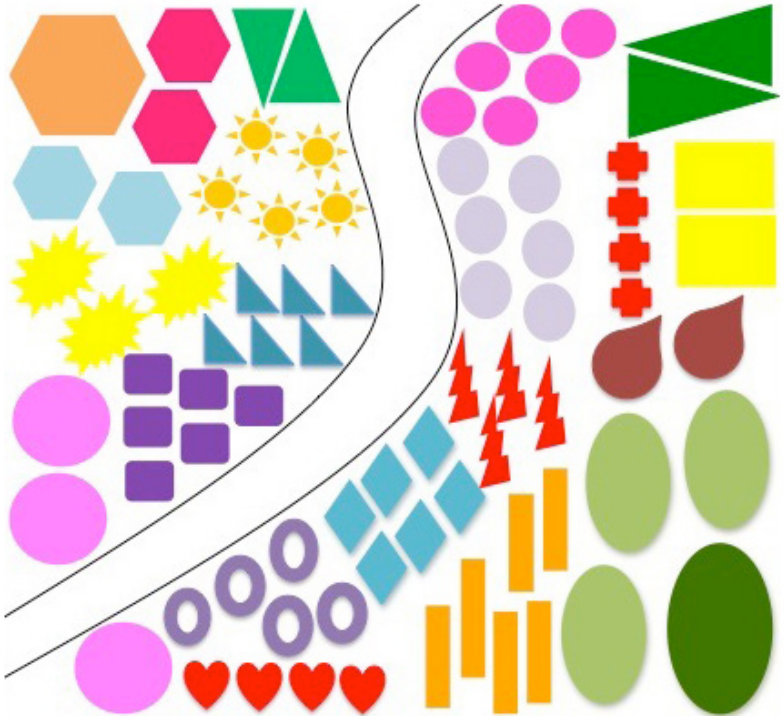


Figure 7. "Bringing Back the Natives" potential garden design (approx. 20 ft. × 20 ft.)

INGREDIENTS:

(Unless otherwise noted, plants should be 1-gallon pots; 4" pots also work well if larger sizes are not available.)

Spring Plants

- (3) ***Arctostaphylos* spp. ('Monica'** or **'Howard McMinn') (Manzanita)**
- (2) ***Ceanothus* 'Julia Phelps,' 'Concha,'** or **'Skylark' (California lilac)**
- (6 4" pots or 1 seed packet) ***Gilia capitata* (Blue globe gilia)**
- (2) ***Salvia brandegeei* (Brandegee's sage)**
- (6 4" pots or 1 seed packet) ***Phacelia tanacetifolia* (Tansy leafed phacelia)**
- (6 4" pots or 1 seed packet) ***Phacelia cicutaria*** or ***Phacelia viscida* (Caterpillar phacelia** or **tacky phacelia)**
- (6 4" pots or 1 seed packet) ***Layia platyglossa* (Tidy tips)**
- (2) ***Carpenteria californica* (Bush anemone)**
- (2) ***Lupinus albifrons* (Silver bush lupine)**

Late Spring/Summer Plants

- (1) ***Salvia mellifera, Salvia clevelandii*** cultivars **(Black sage** or **Cleveland's sage)**
- (6) ***Erigeron glaucus* 'Wayne Roderick' (Seaside daisy)**
- (4) ***Penstemon heterophyllus* 'Blue Springs' (Foothill penstemon)**
- (3) ***Grindelia stricta*** or ***G. hirsutula* (Gumplant)**
- (2) ***Encelia californica* (Bush sunflower)**
- (1 seed packet) ***Eschscholzia californica* (California poppy)**

Summer/Fall Plants

- (1 seed packet or 6 4" pots) ***Helianthus annuus* (Sunflower)**
- (6) ***Solidago velutina* ssp. *californica* (California goldenrod)**
- (2) ***Eriogonum fasciculatum* (Eastern Mojave buckwheat)**
- (4) ***Eriogonum grande* var. *rubescens* (Red buckwheat)**
- (3) ***Sphaeralcea ambigua* (Desert mallow)**
- (4) ***Epilobium canum* (California fuschia)**
- (5) ***Monardella villosa* (Coyote mint)**

Examples:

Nathanson Park Garden (Sonoma); UCSC Arboretum (Santa Cruz); Leaning Pine Arboretum, Cal Poly (San Luis Obispo); Santa Barbara Botanical Garden (Santa Barbara).

Native Bee Sanctuary Garden

While native plants are generally much more attractive to native bees, there are also many non-natives that consistently attract large numbers of native bees (Frankie et al. 2005, 2009a). Furthermore, as few California natives bloom past midsummer, the addition of some highly attractive non-natives can help sustain bees, particularly non-native bees like honey bees, throughout the year. Non-native plants are also easier to come by in most local nurseries. Plant selection for this garden recipe can vary from predominately native to predominately non-native, or a balance of the two.

INGREDIENTS:

(Unless otherwise noted, plants should be 1-gallon pots; 4" pots also work well if larger sizes are not available.)

Spring Plants

- (1) ***Ceanothus*** **'Ray Hartman,' 'Concha,'** or **'Skylark' (California lilac)**
- (1) *Echium candicans* (not hardy past zone 9) (Pride of Madeira)
- (6 4" pots or 1 seed packet) ***Phacelia tanacetifolia*** **(Tansy leafed phacelia)**
- (6 4" pots or 1 seed packet) ***Phacelia cicutaria, P. grandiflora,*** or ***P. campanularia*** **(Caterpillar phacelia, largeflower phacelia,** or **desertbells)**
- (3) *Lavandula stoechas* (Spanish lavender)
- (1) *Salvia melissodora* (Not hardy past zone 10), *Salvia* 'Pozo Blue,' or 'Winifred Gilman' (Grape-scented sage)
- (4) ***Penstemon heterophyllus*** **'Blue Springs'** or **'Margarita Bop' (Foothill penstemon)**
- (3) *Nepeta* × *faassenii* 'Walker's Low' (Catmint)

Late Spring/Summer Plants

- (3) *Echium plantagineum* 'Blue Bedder' (Salvation jane)
- (3) *Salvia chamaedryoides* (Germander sage)
- (4) *Gaillardia* 'Oranges and Lemons' (Blanketflower)
- (1 seed packet) ***Eschscholzia californica*** **(California poppy)**
- (4) *Bidens aurea* (Apache beggarticks)
- (4) *Erigeron karvinskianus* (Santa Barbara daisy)
- (4) *Lavandula* × *intermedia* 'Provence' or 'Grosso' (Lavender)
- (4) ***Grindelia stricta*** or ***G. hirsutula*** **(Gumplant)**
- (2) *Helenium* 'Mardi Gras' (Sneezeweed)

Summer/Fall Plants

- (6 4" pots) ***Helianthus annuus*** **(Sunflower)**
- (2) ***Eriogonum fasciculatum*** **(Eastern Mojave buckwheat)**
- (4) *Nepeta* × *faassenii* 'Walker's Low' (Catmint)
- (2) *Perovskia atriplicifolia* (Russian sage)
- (1) *Vitex agnus-castus* (Chaste tree)
- (6) *Aster* × *frikartii* 'Monch' (Monch aster)
- (2) *Salvia* 'Indigo Spires' or 'Mystic Spires' (Indigo Spires sage or Mystic Spires sage)

Figure 8. Turtle Bay's McConnell Arboretum and Botanic Gardens (Redding) in late summer 2009. Photo by J. Pawelek.

Examples:

WPA Rock Garden (Sacramento); UC Berkeley Urban Bee Lab Evaluation Garden (Berkeley); The Melissa Garden (Healdsburg Guerneville); California Garden, Descanso Gardens, (La Cañada/ Flintridge); Turtle Bay's McConnell Arboretum and Botanic Gardens (Redding) (figure 8).

Bee-Attractive Food Garden

The goal of this garden is to provide floral resources for pollinators while maintaining a functional food garden. Bee-attractive veggies and herbs should be supplemented with other highly attractive plant types to increase overall native bee diversity and abundance. We provide suggestions of herbs, fruits, and vegetables that are attractive to diverse native bees. As might be expected, the addition of these will greatly improve the health and productivity of plants in a food garden!

INGREDIENTS:

(Unless otherwise noted, plants should be 1-gallon pots; 4" pots also work well if larger sizes are not available.)

Spring Plants

- (3) *Rosmarinus officinalis* 'Ken Taylor' (Rosemary)
- (1 seed packet or 6 4" pots) ***Phacelia minor, P. viscida,*** or ***P. cicutaria*** **(Wild Canterbury bells, tacky phacelia,** or **caterpillar phacelia)**
- (4) ***Phacelia californica*** **(California phacelia)**
- (4) *Vaccinium corymbosum* cvs. (Blueberry) or ***Amelanchier alnifolia*** **(Serviceberry)**
- (4) *Rubus* spp. (Blackberry/raspberry)
- (1 seed packet) *Vicia faba* (Fava beans)

Late Spring/Summer Plants

- (2 seed packets) ***Eschscholzia californica*** **(California poppy)**
- (4 4" pots) *Origanum laevigatum* 'Hopely's' or other cultivars (Oregano)
- (4) ***Helianthus annuus*** **(Sunflower)**
- (4 4" pots) *Thymus* spp. (Thyme)
- (1 seed packet) *Borago officinalis* (Borage)
- (6 4" pots) *Fragaria* spp. (Strawberry)
- (3) ***Monardella villosa*** **(Coyote mint)**

Summer/Fall Plants

- (1 seed packet) *Citrullus lanatus* (Watermelon)
- (8 4" pots) *Cosmos sulphureus* (Sulphur cosmos)
- (1 seed packet) *Coriandrum sativum* (Cilantro)
- (1 seed packet) *Cucumis* spp. (Culinary melons)
- (1 seed packet) *Cucumis sativus* (Cucumber)
- (1 seed packet) *Cucurbita pepo* (Zucchini)
- (3) *Cyanara scolymus* (Globe artichoke)
- (3) *Scabiosa atropurpurea* or *Calamintha nepetoides* (Pincushion flower or calamint)
- (4) *Helianthus tuberosus* (Sunchoke, Jerusalem artichoke)
- (4–5) *Solanum lycopersicum* cvs. (Tomatoes)
- (4) *Ocimum basilicum* (Basil) or *Ocimum kilimandscharicum* × *basilicum* 'Dark Opal' (African blue basil)

Figure 9. The Emerson Park Community Garden (San Luis Obispo) native bee plot in summer 2009. Photo by J. Pawelek.

Examples:

Emerson Park Community Garden (San Luis Obispo) (Pawelek et al. 2009) (figure 9); Häagen-Dazs Honey Bee Haven (UC Davis); Goathead Community Garden (Visalia); Bishop Community Garden (Bishop).

"Brown Thumb" Garden

This garden type is ideal for those with limited gardening experience, time, or resources. It requires low levels of everyday maintenance and will still attract diverse bee species. Selections include drought-tolerant, deer-resistant, and frost-resistant plant types. Gardens of this type are best kept at smaller sizes to limit maintenance requirements.

INGREDIENTS:

(Unless otherwise noted, plants should be 1-gallon pots; 4" pots also work well if larger sizes are not available.)

Spring Plants

- (3) ***Abutilon palmeri*** **(Palmer's Indian mallow)**
- (3) ***Arctostaphylos*** **spp. ('Monica'** or **'Howard McMinn') (Manzanita)**

- (3) *Bulbine frutescens* (blooms year-round) (Bulbine)
- (2 seed packets) ***Phacelia cicutaria, P. viscida, P. minor,*** or ***P. campanularia*** **(Caterpillar phacelia, tacky phacelia, wild Canterbury bells, desertbells)**
- (2 seed packets) ***Phacelia tanacetifolia*** **(Tansy leafed phacelia)**
- (2) ***Salvia brandegeei*** or ***Salvia clevelandii*** **'Allen Chickering' (Brandegee's sage** or **Cleveland's sage)**
- (2) ***Salvia mellifera*** **(Black sage)**

Late Spring/Summer Plants

- (2 seed packets) ***Eschscholzia californica*** **(California poppy)**
- (4) ***Helianthus annuus*** **(Sunflower)**
- (3) *Lavandula* × *intermedia* 'Provence' or 'Grosso' (Lavender)
- (3) *Lavandula stoechas* (Spanish lavender)
- (3) ***Mondardella villosa*** or *Nepeta* × *faassenii* 'Walker's Low' (**Coyote mint** or catmint)
- (1) *Salvia* 'Indigo Spires' or 'Mystic Spires' (shorter than 'Indigo Spires') (Indigo Spires sage or Mystic Spires sage)
- (1 seed packet) *Scabiosa atropurpurea* (Pincushion flower)

Summer/Fall Plants

- (10 4" pots) *Cosmos bipinnatus* (Garden cosmos)
- (10 4" pots) *Cosmos sulphureus* (Sulphur cosmos)
- (3) *Gaillardia* × *grandiflora* 'Oranges and Lemons' (Blanketflower)
- (3) ***Grindelia camporum*** **(Great Valley gumweed)**
- (3) *Calamintha nepetoides* (Calamint)
- (2) ***Eriogonum giganteum*** or ***E. fasciculatum*** **(St. Catherine's lace** or **Eastern Mojave buckwheat)**
- (2) ***Sphaeralcea ambigua*** **(Desert mallow)**

Examples:

Peralta Garden (Berkeley); Sheffield Reservoir Garden (Santa Barbara).

Small Space/Container Bee Garden

Even a small garden has potenial for attracting native bees by using a few key plants or utilizing containers and vertical space. Instead of planting large patches of 20 plant species, focus on slightly smaller patches of a few carefully chosen plants. Hanging baskets are great for cascading flowers that utilize vertical space as well as providing nectar and pollen for garden visitors.

Plant suggestions are provided; space will dictate the number of plants that can be utilized. Plants in 4" pots work well in small containers.

Spring Plants

- ***Phacelia cicutaria, P. campanularia,*** or ***P. grandiflora*** **(Caterpillar phacelia, desertbells,** or **largeflower phacelia)** (*Phacelia cicutaria* has cascading flowers and would do well in hanging baskets.)
- ***Gilia capitata*** **(Blue globe gilia)**
- ***Gilia tricolor*** **(Bird's-eye gilia)**
- ***Nemophila menziesii*** **(Baby blue eyes)**
- ***Layia gaillardioides*** **(Woodland tidy tips)**
- ***Eschscholzia californica*** **(California poppy)**
- ***Collinsia heterophylla*** **(Chinese houses)**

Late Spring/Summer Plants

- *Echium plantagineum* 'Blue Bedder' (Salvation jane)
- ***Grindelia hirsutula*** **(Gumplant)**
- *Nepeta* × *faassenii* 'Six Hills Giant' or 'Walker's Low' (Catmint) (Has cascading flowers and would do well in hanging baskets.)
- ***Erigeron glaucus*** **'Bountiful'** or **'Wayne Roderick' (Seaside daisy)**
- *Bidens aurea* (Apache beggarticks) (Has cascading flowers and would do well in hanging baskets.)

Summer/Fall Plants

- *Cosmos sulphureus* (Sulphur cosmos)
- *Aster* × *frikartii* 'Monch' (Monch aster)
- *Linaria purpurea* (Toadflax)
- *Caryopteris incana* 'Bluebeard' (Bluebeard)

Deer-Resistant Garden

Many gardeners share with us their desire to plant a bee-attractive garden that will not attract deer (figure 10). Gardens located on or near the edge of wild areas are prone to deer visits, especially when roses are prominent. Here are some of our suggestions for plants that we hope will stand up to any four-legged visitors.

Figure 10. Large patch of toadflax *(Linaria purpurea)* of 2 cultivars, with both purple and white flowers. Photo by J. Pawelek.

INGREDIENTS:

(Unless otherwise noted, plants should be 1-gallon pots; 4" pots also work well if larger sizes are not available.)

Spring Plants

- (2) ***Arctostaphylos* 'Howard McMinn' or 'Monica' (Manzanita)**
- (1) ***Ceanothus* 'Dark Star' (California lilac)**
- (6 4" pots or 1 seed packet) ***Phacelia cicutaria, P. tanacetifolia, P. campanularia,*** or ***P. grandiflora* (Caterpillar phacelia, tansy leafed phacelia, desertbells, largeflower phacelia)**
- (6 4" pots or 1 seed packet) ***Gilia capitata* (Blue globe gilia)**
- (1 seed packet) ***Eschscholzia californica* (California poppy)**
- (6 4" pots or 1 seed packet) ***Collinsia heterophylla* (Chinese houses)**
- (6 4" pots or 1 seed packet) ***Layia gaillardioides* (Woodland tidy tips)**

Late Spring/Summer Plants

- (1) ***Salvia clevelandii* 'Pozo Blue' (Cleveland's sage)**
- (6 4" pots or 1 seed packet) ***Clarkia unguiculata* (Woodland clarkia)**
- (3) *Echium plantagineum* 'Blue Bedder' (Salvation jane)
- (3) *Eryngium tripartitum* (Sea holly)
- (3) ***Grindelia hirsutula* (Gumplant)**
- (4) *Coreopsis grandiflora* 'Sunburst' (Largeflower tickseed)
- (3) *Nepeta* × *faassenii* 'Walker's Low' (Catmint)
- (4) ***Erigeron glaucus* 'Wayne Roderick' (Seaside daisy)**
- (3) ***Helenium puberlum* (Sneezeweed)**
- (4) *Gaillardia* 'Oranges and Lemons' (Blanketflower)
- (2) ***Mimulus aurantiacus* (Bush monkey flower)**
- (3) *Lavandula lanata* (Lavender)

Summer/Fall Plants

- (3) ***Epilobium canum* (California fuschia)**
- (6 4" pots) ***Monardella villosa* (Coyote mint)**
- (3) *Origanum vulgare* 'Compacta Nana' or other oregano cultivars (Oregano)
- (6 4" pots) *Linaria purpurea* (Toadflax)
- (3) *Caryopteris incana* 'Bluebeard' (Bluebeard)

Common Bees in California Gardens

The following is a list of bees as they will appear in the garden throughout the year. Several groups, like sweat and carpenter bees, are active nearly the entire growing season. Others, like mason and long-horned bees, will be present for only a short time. Results from our statewide survey suggest that certain plant types can attract certain bee visitors and that this relationship can be seen throughout the state (Frankie et. al. 2009a). Use this general guideline to identify some of the bees visiting the garden throughout the year. To learn more about how to identify California bees see *California Bees and Blooms: A Guide for Gardeners and Naturalists,* published by Heyday Books (Frankie et al. 2014). The websites discoverlife.org and bugguide.net also offer bee identification resources for interested individuals.

Spring Bees

- Bumble bees (*Bombus* spp.)
- Carpenter bees (*Xylocopa* spp.)
- Mason bees (*Osmia* spp.)
- Digger bee (*Habropoda depressa*)
- Mining bee (*Andrena* spp.) (figure 11)

Figure 11. *Andrena nigrocaerulea* foraging on spring flowering bird's-eyes *(Gilia tricolor)*. Photo by R. Coville.

Late Spring/Summer Bees

- Leaf-cutting bees (*Megachile* spp.)
- Small carpenter bees (*Ceratina* spp.)
- Masked bees (*Hylaeus* spp.)
- Bumble bees (*Bombus* spp.)
- Ultra green sweat bee (*Agapostemon texanus*) (figure 12)
- Sweat bees (*Halictus* and *Lasioglossum* spp.)
- Miner bees (*Anthophora* spp.) (figure 13)

Figure 12. A male Ultra Green Sweat bee *(Agapostemon texanus)* visiting Monch *(Aster × frikartii)*. Photo by R. Coville.

Figure 13. A female *Anthophora californica* sipping nectar from toadflax *(Linaria reticulata)*. Photo by R. Coville.

Summer/Fall Bees

- Squash bees (*Peponapis pruinosa*)
- Long horned bees (*Melissodes* [figure 14] and *Svastra* spp.)
- Cuckoo bees (*Nomada*, *Triepeolus*, *Coelioxys*, and *Xeromelecta* spp.)
- Wool carder bees (*Anthidium* spp.)(figure 15)
- Leaf-cutting bees (*Megachile* spp.)
- Sweat bees (*Halictus* and *Lasioglossum* spp.)

Figure 14. A female *Melissodes robustior* collecting nectar and pollen from garden cosmos *(Cosmos bipinnatus)*. Photo by R. Coville.

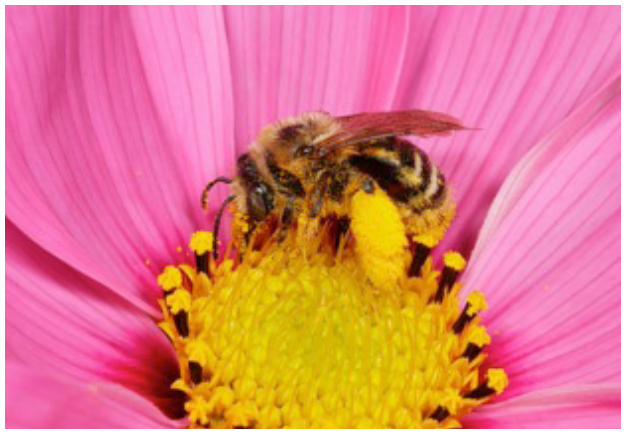


Figure 15. *Anthidium manicatum* foraging on germander sage *(Salvia chamaedryoides)*. Photo by R. Coville.

Monitoring and Observations

What to Expect

It may take one full growing season before the benefits of the garden (i.e., bees visiting flowers and making their homes) become apparent, but many bees will begin foraging as soon as flowers start to blossom. The relatively short flowering periods of most native plant species once required that native bees search constantly for new resources. Bees have thus evolved to spend a portion of their time investigating new habitats, and will travel significant distances from their nests to locate their preferred flowers. It is amazing how quickly bees will find the first blooms in a newly planted bee garden, especially if the bees are diverse and vigorous. Research has shown that mature flowering plants often increase in productivity, offering more nectar and pollen, so one can expect the abundance and diversity of bee visitors to grow over time. Gardens located near a natural area will have even more bee diversity and abundance, since natural, wild areas are less disturbed and often house more native plants.

How to Monitor and Observe

The best times to observe bees are on warm sunny days with little to no breeze. When a flower patch is in full bloom, sit and observe it during the warmest part of the day (figure 16). Are there bees buzzing around? Are they buzzing from bloom to bloom in search of nectar and pollen? Are there different types of bees, maybe in different sizes or colors, visiting the flowers? Observe a plant's flowers on different days and at different times of day throughout its blooming period to get a good idea about its level of attraction. Some flowers only release pollen or nectar early in the morning. As the garden develops with each year, more native bee species will visit the flowers. Some of these species may also begin nesting in the soil, and can be observed diving into or emerging from the ground as they busily build their nests.

Make sure to take notes of your observations so you will be able to compare from year to year the new and different visitors in the garden. Photographing bees can be a challenge and may take some patience, but it is the best way to track bee visitation. You can send photos of bees to urbanbeelab@gmail.com for identification. If, after a few seasons, one of the plants isn't attracting many bees, try something new. Our recommendations are based on experiences in many gardens throughout the state, but certain plants may be more attractive in some areas than others.

Figure 16. The Oxford Tract Bee Flower Evaluation Garden (Berkeley), full of summer blooms. Photo by J. Pawelek.

"Bee plants" are not just good for bees. The resources they provide will attract a wide variety of flower-loving organisms, including other beneficial insects, hummingbirds, and small seed-eating birds. A whole ecosystem can arise as bee plants mature, transforming the garden into a small wildlife sanctuary.

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Appendix

Gardens in the recipes section and their corresponding websites

Bishop Community Garden (Bishop):
www.easternsierragardens.org

California Garden, Descanso Gardens, (La Cañada/Flintridge):
www.descansogardens.org

Emerson Park Community Garden (San Luis Obispo):
www.slocity.org/parksandrecreation/emersongarden.asp

Goathead Community Garden (Visalia): No website, located on N. Leslie St. between W. Goshen Ave. and Connelly Ave.

Häagen Dazs Honey Bee Haven (UC Davis):
hhbhgarden.ucdavis.edu/welcome

Leaning Pine Arboretum, Cal Poly (San Luis Obispo):
www.leaningpinearboretum.calpoly.edu

The Melissa Garden (Healdsburg Guerneville):
www.themelissagarden.com

Nathanson Park Garden (Sonoma):
www.sonomaecologycenter.org/our-projects/

Peralta Garden (Berkeley):
communitygarden.org/find-a-garden/gardens/peralta-community-garden/

Sheffield Reservoir Garden (Santa Barbara):
www.lotsafunmaps.com/Santa_Barbara/Sheffield_Reservoir_Walk.html

Turtle Bay's McConnell Arboretum and Botanic Gardens (Redding):
www.turtlebay.org/gardens

UC Berkeley Urban Bee Lab Evaluation Garden (Berkeley):
www.helpabee.org

UCSC Arboretum (Santa Cruz):
arboretum.ucsc.edu

Santa Barbara Botanical Garden (Santa Barbara):
www.sbbg.org

WPA Rock Garden (Sacramento):
www.cityofsacramento.org/parksandrecreation/parks/sites/land_map.htm

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