

327A Conservation Cover, Pollinators: Central Valley, Central Coast, Southern California

Conservation Practice Specification

CA, NRCS - August 2014



(Photo: Jessa Kay Cruz, The Xerces Society)

Specifications

These instructions provide in-depth guidance on how to install wildflower meadows for pollinators. To plan a specific project, use these *Specifications* to fill out the *Implementation Requirements* form. These requirements and considerations are in addition to those in the Conservation Cover (327) Specifications that are written for all purposes.

Definition and Purpose

Establishing and maintaining permanent vegetative cover to enhance habitat for pollinators.

Client Conservation Objectives

Depending on landowner objectives and project design, conservation cover for pollinators also will enhance wildlife habitat, may reduce soil erosion and sedimentation, improve soil, water or air quality, or help manage plant pests by removing weeds that harbor pest insects or by increasing habitat for predaceous and beneficial invertebrates as a component of an integrated pest management plan.

Planning Considerations

Key Site Characteristics

Site selection for pollinator habitat should take the following into consideration:

- **Pesticide Drift:** Habitat must be protected from pesticides (especially insecticides and bee-toxic fungicides and herbicides). Only sites with no to very low risk for pesticide drift should be established as new habitat. This includes some pesticides approved for use on organic farms.
- **Accessibility:** New habitat should be accessible to equipment for planting and maintenance operations.
- **Sunlight:** Most wildflowers and native shrubs grow best in full sunlight.
- **Slope:** Steep or highly erodible sites should not be disturbed. For re-vegetating such sites, consider Critical Area Planting (342) or other suitable Practice Standards.
- **Weed Pressure:** Areas with high weed pressure will take more time and effort to prepare for planting. It is also important to note the primary weed composition. Knowing the most abundant weed species on site, their reproductive methods, and whether they are grass or broadleaf, perennial or annual, and woody or herbaceous will help significantly in planning for site preparation and follow up weed management during establishment.

- **Site History:** Factors such as past plant cover (e.g. weeds, crops, grass sod, and/or native plants), use of pre-emergent herbicides or other chemicals, and soil compaction can affect plant establishment. It is also important to know if sites may have poor drainage, or may flood, as such conditions make habitat establishment more difficult or require a plant mix adapted to the site.
- **Soils and Habitat:** Most plants listed in the Appendix of this guide are tolerant of many soil conditions and types, however all plants establish better when matched with appropriate conditions.
- **Irrigation:** To establish plants from plugs, pots, or bare root will require irrigation. Irrigation is generally not needed for plantings established from seed if planted in the fall. Irrigation will also encourage weeds.
- **Other Functions:** The site may offer opportunities to serve other functions, such as run-off prevention, stream bank stabilization, or wildlife habitat. Those factors can influence plant choice and/or design.

Plant Selection

Plant species selection should be limited to plants providing pollen- and nectar-rich forage resources for bees. The inclusion of bunch grasses is appropriate at a low percentage of the mix by seed per square foot (e.g., 10% or less), but may limit options for use of grass selective herbicides if grass weeds are a primary concern. The Appendix provides specific seed mixes for upland and wet sites, and a master list of acceptable plants for various locations and/or environments in the California Central Coast. Forbs may be plug planted rather than planted from seed when appropriate. Woody shrubs or subshrubs may also be added to conservation cover plantings. For more information on planting shrubs and subshrubs for pollinators, refer to Specifications for (422A) *Hedgerow Planting, Pollinators*.

If you are designing a custom plant list, individual species should be chosen so that consistent and adequate floral resources are available throughout the growing season. To achieve this goal, aim for nine or more species total, but have at least seven, with at least two or three blooming during each part of the growing season (early, mid and late season).

Plant mix composition (i.e., percent of each species) can be designed to complement adjacent crop bloom time or other abundant species in the landscape, with more plants blooming immediately before and after adjacent crops.

Alternate Pest or Disease Hosts: In most cases, native pollinator plants do not serve as alternate hosts for crop pests or diseases, but selected plants should be cross-referenced for specific crop pest or disease associations. University of California research indicates that weedy borders harbor more pests than are found in diverse native plantings.

Requirements

Site Preparation

Site preparation is **one of the most important** and often inadequately addressed components of project success. It is also a process that may require more than one season of effort to reduce competition from invasive, noxious or undesirable non-native plants prior to planting. *In particular, site preparation should focus on the removal of perennial and aggressive weeds* (there are more options to address less aggressive annual or biennial weeds after planting). Previously cropped lands (those that have been cultivated for several years) usually have fewer weeds, but weed pressure still needs to be addressed. More effort and time spent eradicating undesirable plants prior to planting will result in higher success rates in establishing the targeted plant community. Site preparation methods are provided in **Table 1**.

Note: If weed pressure is high, then the weed abatement strategies detailed in Table 1 should be repeated for an additional growing season. High weed pressure conditions are characterized by:

- Persistent year-round cover of undesirable plants (covering the entire surface of the site);
- Sites where weeds have been actively growing (and producing seed) for multiple years;
- Sites dominated by introduced sod-forming grasses and rhizomatous forbs (e.g. Canada thistle).



(Photos: Brianna Borders, The Xerces Society)

Figure 1. The site on the left was prepared with a single glyphosate treatment, leaving a significant stubble layer and un-killed weedy grasses. It is not ready for planting.

The site on the right was treated for an entire growing season with repeated glyphosate treatments (applied whenever new weeds appeared). The stubble has been removed with a flail mower and it is ready for planting. Neither site has been cultivated.

Table 1. Site Preparation Methods

METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE	
Where to Use <ul style="list-style-type: none"> • Conventional farms and organic farms* • Areas with a low risk of erosion • Areas accessible to sprayer 	Timing <ul style="list-style-type: none"> • Total time: 9+ months • Begin: late fall after the first flush of cool season weeds • Plant: fall (after one year of weed eradication)
Basic Instructions: <ol style="list-style-type: none"> 1. Clear away existing thatch as needed before beginning herbicide treatments to expose new weed growth to the herbicide spray. 2. Apply a non-selective, non-persistent herbicide as per label as soon as weeds are actively growing after fall rains cause first flush of weed germination. 3. Repeat herbicide applications until the next fall, as needed (whenever emerging weed seedlings reach 4 - 6 inches). 4. If weeds are not responding to herbicide treatments, keep area mowed to prevent flowering and seed development or consider an alternative herbicide. 5. Plant pollinator seed mix (and any transplants) in the fall, waiting at least 72 hours after the last herbicide treatment. Refer to the Planting Methods section of this document for specific recommendations. <p>NOTE: <u>Do not till.</u> Avoid any ground disturbance that may bring up additional weed seed. An additional year of site preparation is recommended if weed pressure is particularly high. Avoid use of herbicides that are bee-toxic (e.g. Paraquat and Gramoxone).</p> <p>*Choice of herbicide must be acceptable to OMRI for organic operations or, if not, used outside of certified ground AND approved by an organic certifier.</p>	

Table 1. Site Preparation Methods (Cont.)

METHOD: SOLARIZATION	
Where to Use <ul style="list-style-type: none"> • Organic and conventional farms • Areas with a low risk of erosion • Areas accessible to mowing equipment • Locations with full sun 	Timing <ul style="list-style-type: none"> • Total time: 6+ months • Begin: spring • Plant: fall
Basic Instructions: <ol style="list-style-type: none"> 1. Mow, rake or lightly harrow and smooth the site in the spring (raking off debris, if necessary). 2. After smoothing the site, irrigate thoroughly and lay UV stabilized plastic (such as high tunnel plastic) burying the edges to prevent airflow between the plastic and the ground. Weigh down the center of the plastic if necessary to prevent the wind from lifting it. Use greenhouse repair tape for any rips that occur during the season. 3. Remove the plastic in early-fall before the weather cools and the area beneath the plastic is recolonized by nearby rhizomatous weeds. 4. Immediately plant pollinator seed mix and/or install transplants. Refer to Planting Methods section of this document for specific bed preparation recommendations. <p>NOTE: <u>Do not till.</u> Avoid any ground disturbance that may bring up additional weed seed. An additional year of site preparation is recommended if weed pressure is particularly high.</p>	

Planting Methods

Recommended planting methods are site-specific. Pre-project site conditions, especially weed competition, may affect planting success and should be addressed prior to planting. Factors such as equipment availability, weed pressure, and cost should be taken into consideration when choosing a planting method. Installing and maintaining habitat should fit into general farm-management practices as much as possible.

Planting seeds, rather than plugs, can be a less expensive way to establish wildflowers. Seeding requires **excellent** site preparation to reduce weed pressure because weed control options are limited when the wildflowers start to germinate. **Seed of most native wildflowers are best planted in late fall in California**, when winter rains are just starting.

Seed should be ordered in individual lots, not as a mix. Individual lots help ensure that all species are accounted for and, because size of wildflower seed varies dramatically, seed separated by species gives you the greatest flexibility in planting method. For example, native seed drills have hoppers to accommodate seed of different sizes, and even when broadcasting seed it is useful to divide the seed into batches of small and large seed.

Grain drills, unlike native seed drills, are usually not designed to handle the wide variation in wildflower seed size. However, with simple modifications most types of grass-seed planters or granulated fertilizer spreaders can be used with good results, especially if you plant small seeds at one setting (gate opening) and large seeds at another. **Table 2** outlines several possible seeding methods, including broadcast seeding, drills and the use of transplants.

Newly planted areas should be clearly marked to protect them from herbicides or other disturbances.

Table 2. Methods for Planting Wildflower Seed

METHOD: BROADCAST SEEDERS OR HAND BROADCASTING (THROWING SEED)	
<p>Pros</p> <ul style="list-style-type: none"> • Inexpensive • Easy to use • Can often accommodate poorly cleaned seed • Many models and sizes of broadcasters are commonly available, including hand-held crank and larger tractor or ATV-mounted models 	<p>Cons</p> <ul style="list-style-type: none"> • Requires a smooth seed bed • Seed should be pressed into the soil after planting • Difficult to calibrate • Some models of broadcast seeders cannot accommodate large seeds
<p>Basic Instructions:</p> <p>Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seedbed clear of vegetation residue. The soil surface can be lightly hand-raked or harrowed to break-up crusted surfaces, but <u>do not cultivate the site (cultivation will bring up additional weed seed)</u>.</p> <p>Seed of similar sizes can be mixed together and bulked up with an inert carrier ingredient such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or polenta (fine cornmeal). Use at least two to three parts bulking agent for each part seed by volume. These inert carriers ensure even seed distribution in the mix, visual feedback on where seed has been thrown, and make calibration easier.</p> <p>The broadcast seeding equipment used should have a flow gate that closes down small enough to provide a slow, steady flow of your smallest wildflower seed. Models with an internal agitator are also preferred. Planting should begin with the flow gate set to the narrowest opening, to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed can be planted separately with the flow gate set to a wider opening.</p> <p>For small sites (e.g. less than 2 acres), seed can be hand broadcast (similar to scattering poultry feed). When hand broadcasting, divide the seed into at least two batches, bulk the seed mix with an inert carrier, using at least two to three parts bulking agent for each part seed by volume. Sow each batch separately. To ensure that seed is evenly distributed, scatter the first batch over the site while walking in parallel passes across the site, and then walk in passes perpendicular to the previous passes to scatter the second batch.</p> <p>Regardless of how it is broadcast, do not cover the seed with soil after planting. A water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker should be used to press the seed into the soil surface. Natural precipitation or light overhead irrigation can also help ensure good seed-soil contact. Floating row-cover can be used if necessary to protect seeds and small seedlings against predation.</p>	

Table 2. Methods for Planting Wildflower Seed (Cont.)

METHOD: DROP SEEDERS OR FERTILIZER SPREADERS (DROPPING SEED)	
Pros <ul style="list-style-type: none"> • Inexpensive • Easy to use • Even seed dispersal • Can accommodate both large and small seed • Many models and sizes are commonly available (hand-powered turf grass seeders are most common, but larger tractor-drawn “pasture-seeder” models also exist) 	Cons <ul style="list-style-type: none"> • Requires a smooth, level seed bed • Seed should be pressed into the soil after planting • Hand-powered models are time consuming for large areas (over ½ acre) • Calibration requires trial and error
Basic Instructions: Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seedbed clear of vegetation resi-due. The soil surface can be lightly hand-raked or harrowed to break-up crusted surfaces, but <u>do not cultivate the site (cultivation will bring up additional weed seed)</u> . Seed of similar sizes can be mixed together and bulked up with an inert carrier ingredient such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or polenta (fine cornmeal). Use two to three parts bulking agent for each part seed by volume. These inert carriers ensure even seed distribution in the mix, provide visual feedback on where seed has been dropped, and make calibration easier. Planting should begin with the drop gate set to the narrowest opening, to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed can be planted separately with the drop gate set to a wider opening. Do not cover the seed after planting. A water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker should be used to press the seed into the soil surface. Natural precipitation or light overhead irrigation can also help ensure good seed-soil contact. Floating row-cover can be used if necessary to protect seeds and small seedlings against predation.	
METHOD: NATIVE SEED DRILLS (DRILLING SEED)	
Pros <ul style="list-style-type: none"> • Convenient for planting large areas • Seed box agitators and depth controls are designed specifically for planting small and fluffy native seeds at optimal rate and depth • Can plant into a light stubble layer • Seeds are planted in even rows, allowing for easier seedling recognition • Does not require seed to be pressed into soil surface after planting (e.g., cultipacking) 	Cons <ul style="list-style-type: none"> • Expensive and not readily available in some areas • Difficult to calibrate for small areas (less than 1 acre) • Requires a tractor and an experienced operator to set planting controls • Seed with a lot of chaff can clog delivery tubes
Basic Instructions: Plant only when the soil is dry enough to prevent sticking to the coulters. Under wet conditions, small seed is likely to stick to mud-caked parts of the drill, rather than the ground. Keep seed separated by species until ready to plant. Prior to planting, seed should be organized into batches of large smooth seed, small smooth seed, and tufted seed that does not flow easily. Loosely fill seed boxes (do not compact seed into them) with the appropriate seed batch for each box. Seed quantities that do not cover the agitator should be planted using some other method, since the drill is difficult to calibrate for small volumes of seed. As a general rule, the planting depth for a particular seed should be no more than 1.5x its diameter. To achieve this for most wildflower seed, set the depth controls to plant no deeper than ¼ inch (consult with the seed vendor for specific guide-lines on very sandy soils). Small wildflower seed should be planted on the soil surface. Stop periodically to check planting depth.	

Table 2. Methods for Planting Wildflower Seed (Cont.)

<p>Operate the drill at less than 5 mph, stopping to check periodically for any clogging of planting tubes (usually observed as a seedbox that is remaining full). Clogging is most common with fluffy seed, or seed with a lot of chaff. Avoid backing up the drill as it will likely cause clogging.</p> <p>For information on native seed drill calibration, see NRCS publication: http://www.plant-materials.nrcs.usda.gov/pubs/mipmctn10591.pdf</p>	
METHOD: TRANSPLANTING FORBS AND WOODY PLANTS	
Pros <ul style="list-style-type: none">• Provides mature nectar and pollen resources more quickly• Does not require specialized planting equipment (except for large trees)• Preferred for plants with limited seed availability, which are expensive or difficult to establish from seed• Transplants can be established in weedy sites more easily with adequate mulching	Cons <ul style="list-style-type: none">• Expensive and time consuming for large areas• Transplants typically require irrigation during establishment
<p>Basic Instructions:</p> <p>Regular shovels are usually adequate for transplanting most container stock. However, dibble sticks or mechanical transplanters are sometimes helpful for plug-planting. Power augers and mechanical tree spades can be helpful for larger plants.</p> <p>Plant size at maturity should be considered when planting. Most woody shrubs can be spaced on 6' – 12' centers (depending upon size at maturity), with most herbaceous plants spaced closer on 3' – 5' centers. It is helpful to measure the planting areas prior to purchasing transplants, and to stage the transplants in the planting area prior to installing them in the ground.</p> <p>Transplanting can occur any time the ground can be worked, but should be timed to avoid prolonged periods of hot, dry, or windy weather. Regardless of when planting occurs however, the transplants should be irrigated thoroughly immediately after planting. Holes for plants can be dug and pre-irrigated prior to planting as well. Follow-up irrigation is dependent upon weather and specific site conditions, but generally even native and drought tolerant plants should be irrigated with at least 1" of water per week (except during natural rain events), for the first two years after establishment. Long, deep watering is best to encourage deep root system development and shallow irrigation should be avoided. Drip irrigation is useful, and other methods that allow for deep watering can be successful. It is advisable to irrigate at the base of plants and avoid overhead irrigation that would encourage weed growth. Once plants are established, irrigation should be removed or greatly decreased.</p> <p>Most of the plants in the Appendix are adapted to a variety of soil conditions and do not need any specific amendments. However, in areas where the soil is compacted, degraded, or depleted, compost should be used during planting. Compost should be free from weed seeds, aged properly, and mixed thoroughly with soil in the holes during planting.</p> <p>In cases where rodent damage may occur, below ground wire cages are recommended. Similarly, plant guards may be needed to protect plants from above ground browsing or antler damage by deer. Newly planted areas should be clearly marked to protect them from herbicides or other disturbances.</p> <p>Mulching is recommended to reduce weed competition and to retain moisture during the establishment phase. Recommended materials include wood chips, bark dust, weed-free straw (e.g. rice straw), nut shells, grape-seed pumice, or other regionally appropriate mulch materials that contain <u>no</u> viable seeds. Mulch is intended to remain on the surface and not be incorporated into the soil. For more details on establishing woody plants, see Specifications for <i>422A-Hedgerow Planting, Pollinators</i>.</p>	

Planting Method Photos



(Photos: Brianna Borders and Jessa Kay Cruz, The Xerces Society)

Figure 2. For broadcast seeding, seed of **similar size** is mixed together (left). Polenta, sand or another inert carrier is added (at a ratio of at least 2:1) and then mixed (middle left), and the mix is divided into separate batches (middle right) for broadcasting in perpendicular passes over the planting site. When hand-broadcasting seed, walk in perpendicular passes over the entire planting area (right).



(Photos: Brianna Borders and Jessa Kay Cruz, The Xerces Society)

(Photo: Regina Hirsch, University of Wisconsin)

Figure 3. Native wildflower seed should be planted directly on the soil surface (left). After broadcasting, roll the site with a cultipacker (middle) or turf roller (right).



(Photo: New Hampshire NRCS)

(Photo: Cindy Lashbrook, Merced Resource Conservation District)

Figure 4. Hand-crank “belly grinder” type seeders (left) are low cost and can broadcast seed more evenly than hand-scattering on larger sites. Similarly, lawn fertilizer spreaders (right) are another commonly available tool for broadcasting seed. In both cases, models with internal agitators are preferred to prevent clogging. For best results divide the seed into separate batches, grouping seed of similar sizes for planting together with the flow gate adjusted accordingly. It can be difficult to plant very large and very small seed together in a single seed mix using mechanical broadcasters. Use an inert carrier (such as sand) and walk in at least two perpendicular paths to ensure the most even seed distribution possible.



(Photo: Jessa Guisse, The Xerces Society)

Figure 5. Native seed drills are the ideal tool for large planting sites (5+ acres). Typical models can plant in a light stubble layer, have depth controls for optimal seed placement, and have separate seed boxes for different sizes of seed. **Such drills need an experienced operator and careful calibration.**

Post Planting Establishment Requirements

Maintenance During Establishment (Short Term)

Weed control is critical in the first and second years after planting. If the site is well prepared, then less effort will be required for weeding after project installation. Maintenance practices must be adequate to control noxious and invasive species and may involve tools such as mowing, burning, hand hoeing, or spot spraying with herbicides.

Weeds should be prevented from going to seed in, or adjacent to, the project area during the first two (and possibly three) years after planting to help ensure long-term success. Familiarity with the life cycle of weeds will facilitate appropriate timing of management activities. Since young wildflower and weed seedlings may look alike, care should be taken to properly identify weeds before removal.

Common weed-management strategies include:

- **Spot Spraying:** Spot spraying with herbicides can be effective, relatively inexpensive, and require minimal labor, even on larger project areas. Care should be taken that herbicides do not drift or drip onto desirable plant species. Spot spraying is usually performed with backpack sprayers, or occasionally with rope-wick implements (when weed growth is substantially taller than newly established wildflowers). Dye can be added to herbicide mixes to assist the applicator in keeping the herbicide on target plants.
- **Selective Herbicides:** Grass-selective herbicides can be used to control weedy grasses in broadleaf plantings. Contact a local crop advisor or Extension specialist for appropriate herbicide selection and timing.
- **Managing Irrigation:** Most wildflowers established from seed thrive with little or no supplemental irrigation. Keeping irrigation to a minimum helps native wildflowers out-compete non-native weedy species that sometimes have higher soil moisture requirements. Similarly, when irrigation is needed for transplants, it should be supplied at the base of the transplant when possible (through drip irrigation, for example) to avoid watering nearby weeds.
- **Mowing / String Trimming:** Mowing or string trimming can be utilized to keep weedy species from shading out other plants, and to prevent them from going to seed. Mowing is especially useful when establishing wildflower plots of perennial species. When planted with perennial seed mixes, sites can be mowed occasionally (at 8 inches or higher) during the first year after planting to prevent annual and biennial weeds from flowering and producing seed. Perennial wildflowers are slow to establish from seed, and are usually not harmed by incidental mowing in the first year after planting. Mowing can also be used on plots of re-seeding annuals at the end of the growing season to help shatter wildflower seedpods, and to reduce woody plant encroachment. Mowing and string trimming can also be useful around woody transplants to manage nearby weeds.
- **Hand Weeding:** Hand-weeding (including hoeing) can be effective in small areas with moderate weed pressure. Hand-weeding will likely be necessary in forb plots to eliminate broadleaf weeds during the first few seasons.

Operations and Maintenance (Long-Term)

Manage herbivores as needed. As soon as possible after establishment, remove tree guards or other materials that could impede plant growth. In most cases, irrigation can be removed from transplants by the end of the second year after planting. Continue to protect habitat from pesticides and herbicides except when necessary to control noxious or invasive plants. On-going herbicide use (spot-treatment) or occasional hand weeding may be necessary to control noxious weeds. Maintain the long-term plant diversity of pollinator habitat by re-seeding or re-planting as necessary.

Wildflower plantings generally need to be managed over time to maintain open, early successional characteristics. The actual management will depend on the size and location of the habitat. Possible management tools/techniques include mowing or burning. If mowing is used, be sure all equipment is clean and free of weed seed. Do not mow or burn during critical wildlife nesting seasons (consult your state wildlife biologist for specific guidance). After establishment, no more than 30% of the habitat area should be mowed or burned in any one year to ensure sufficient undisturbed refuge areas for pollinators and other wildlife.

Finally, note that some common farm-management practices can cause harm to bees and other beneficial insects. Insecticides are especially problematic, including some insecticides approved for organic farms. Therefore, if insecticide spraying is to occur on the farm, it is critical that the Conservation Cover planting area is outside of the sprayed area and/or protected from application and drift.



Figure 6. Newly planted areas should be clearly marked to protect them from herbicides or other disturbances. Using signs such as the one on the above can be a useful tool to designate protected pollinator habitat.

Appendix A: Seed Mixes and Plant Lists for CA-Central Valley

Example Seed Mixes

These example seed mixes are formulated for a 1-acre area. For larger areas, increase the rate accordingly. To create a custom seed mix, see recommended species master list on page 13 and the references section for a downloadable seed mix calculator. For details on woody plants, see Specifications for (422A) *Hedgerow Planting, Pollinators*.

Standard Conservation Cover Seed Mix for the Central Valley

The mix is designed to provide season-long pollen and nectar resources on any sunny upland site.

COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS / FT ²	LBS / ACRE	PRICE / LB	TOTAL PRICE	BLOOM TIME
Arroyo Lupine	<i>Lupinus succulentus</i>	2.0%	1.00	3.57	\$15.00	\$53.56	early
Baby Blue Eyes	<i>Nemophila menziesii</i>	12.0%	6.00	1.58	\$37.50	\$59.21	early
Tansy Leaf Phacelia	<i>Phacelia tanacetifolia</i>	8.0%	4.00	0.52	\$30.00	\$15.47	early
Yellow Lupine	<i>Lupinus densiflorus</i>	1.0%	0.50	2.22	\$22.50	\$50.01	early
Elegant Clarkia	<i>Clarkia unguiculata</i>	25.8%	12.90	0.36	\$52.50	\$18.67	early to mid
California Poppy	<i>Eschscholzia californica</i>	7.0%	3.50	0.49	\$25.50	\$12.50	early to mid
Globe Gilia	<i>Gilia capitata</i>	25.0%	12.50	0.94	\$24.00	\$22.51	early to mid
California Phacelia	<i>Phacelia californica</i>	8.0%	4.00	0.84	\$57.00	\$47.75	mid
Gumplant	<i>Grindelia camporum</i>	7.0%	3.50	0.95	\$12.75	\$12.15	mid to late
Narrowleaf Milkweed	<i>Asclepias fascicularis</i>	1.0%	0.50	0.34	\$142.50	\$47.75	mid to late
Summer Lupine	<i>Lupinus formosus</i>	0.2%	0.10	0.57	\$180.00	\$103.17	mid to late
Bolander's Sunflower	<i>Helianthus bolanderii</i> **	3.0%	1.50	0.59	\$142.50	\$84.65	late
TOTALS		100%	50.00	12.96		\$527.38*	

*Costs may vary by season and seed producer

**Do not plant Bolander's Sunflower within 1/2 mile of commercial sunflower fields

*** Do not add this species into the overall mix, but sow separately in only 10% of the total project area (*this comes out to 1 seed / ft² of L. formosus in the 10% section of the project area*).

Central Valley Almond Orchard Conservation Cover or Cover Crop Seed Mix

The mix is designed to provide pollen and nectar resources in almond orchards to support early season solitary bees and managed honey bee hives, but can also be used in other orchards such as apples and stone fruits.

COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS / FT ²	LBS / ACRE	PRICE / LB	TOTAL PRICE	BLOOM TIME
Crimson Clover	<i>Trifolium incarnatum</i>	32.0%	14.40	6.67	\$4.00	\$26.67	early
Five Spot	<i>Nemophila maculata</i>	1.0%	0.45	0.44	\$24.00	\$10.56	early
Baby Blue Eyes	<i>Nemophila menziesii</i>	6.0%	2.70	0.72	\$24.00	\$17.28	early
Great Valley Phacelia	<i>Phacelia ciliata</i>	5.0%	2.25	0.45	\$45.00	\$20.36	early
Chinese Houses	<i>Collinsia heterophyllus</i>	9.0%	4.05	0.70	\$30.00	\$20.96	early
California Poppy	<i>Eschscholzia californica</i>	15.0%	6.75	1.18	\$18.00	\$21.18	early to mid
Globe Gilia	<i>Gilia capitata</i>	30.0%	13.50	1.28	\$30.00	\$38.44	early to mid
Tidy Tips	<i>Layia platyglossa</i>	2.0%	0.90	0.23	\$60.00	\$14.00	early to mid
TOTALS		100%	45	12.54		\$169.00*	

Wetland to Semi-Riparian Pollinator Seed Mix for the Central Valley

The mix is designed for wetland to semi-riparian sites, including along irrigation ditches, streams, flood-prone areas, etc.

COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS / FT ²	LBS / ACRE	PRICE / LB	TOTAL PRICE	BLOOM TIME
Tansy Phacelia	<i>Phacelia tanacetifolia</i>	10.0%	5.00	1.09	\$128.00	\$140.12	early
Chinese Houses	<i>Collinsia heterophylla</i>	16.0%	8.00	1.05	\$24.00	\$25.10	early
Goldfields	<i>Lasthenia glabrata</i>	16.0%	8.00	0.20	\$52.50	\$10.69	early
California Poppy	<i>Eschscholzia californica</i>	16.0%	8.00	1.61	\$22.50	\$36.17	early to mid
Globe Gilia	<i>Gilia capitata</i>	16.0%	8.00	0.60	\$24.00	\$14.41	early to mid
Gumplant	<i>Grindelia camporum</i>	12.0%	6.00	1.71	\$12.95	\$22.08	mid to late
Sunflower	<i>Helianthus annuus</i>	8.0%	4.00	4.38	\$45.00	\$196.88	mid to late
Hooker's Evening Primrose	<i>Oenothera elata</i>	6.0%	3.00	2.74	\$37.50	\$102.75	mid to late
TOTALS		100.0%	50	13.37		\$548.21*	

Master Plant List for the Central Valley

Recommended Native Wildflowers for Pollinators

COMMON NAME	SCIENTIFIC NAME	† LIFE CYCLE	MATURE HEIGHT	WATER NEEDS	NOTES
Early Season Blooming Species					
Arroyo Lupine	<i>Lupinus succulentus</i>	A	3.0 ft	Low	
Baby Blue Eyes	<i>Nemophila menziesii</i>	A	0.25 ft	Low	
Chinese Houses	<i>Collinsia heterophylla</i>	A	0.5 ft	Medium	
Golden Lupine	<i>Lupinus densiflorus</i>	A	3.0 ft	Low	
Goldfields	<i>Lasthenia glabrata</i>	A	0.5 ft	Medium to High	Wetland-riparian
Great Valley Phacelia	<i>Phacelia ciliata</i>	A	0.25 ft	Low	Tolerates clay soils
Tansy Leaf Phacelia	<i>Phacelia tanacetifolia</i>	A	3.0 ft	Low	Can reseed aggressively; tolerates clay soils
Tidy Tips	<i>Layia platyglossa</i>	A	0.25 ft	Low	Tolerates clay soils
Early to Mid Season Blooming Species					
California Poppy	<i>Eschscholzia californica</i>	P	0.5 ft	Low	Tolerates clay soils
Elegant Clarkia	<i>Clarkia unguiculata</i>	A	0.5 ft	Low	
Globe Gilia	<i>Gilia capitata</i>	A / P	1.0 ft	Medium	
Showy Penstemon	<i>Penstemon spectabilis</i>	P	3.0 ft	Low	Establishes better from transplant than from seed
Mid Season Blooming Species					
California Phacelia	<i>Phacelia californica</i>	P	1 ft	Low	Tolerates clay soil; can re-seed aggressively
California Buckwheat	<i>Eriogonum fasciculatum</i>	P	3 ft	Low	Can be extremely drought tolerant; establishes better from transplant than from seed

Appendix B: Seed Mixes and Plant Lists for CA-Central Coast

Example Seed Mix

The following example seed mix is formulated for a 1-acre planting area. For larger areas, increase the rate accordingly. To create custom seed mixes, see recommended species master list and the references section for a downloadable seed mix calculator. For details on woody plants, see *Hedgerows for Pollinators (422A): Specifications*. To maximize flexibility in planting method, order seed of each species separately.

Standard Conservation Cover Seed Mix for the Central Coast

The mix is designed to provide season-long pollen and nectar resources on any sunny upland site.

COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS / FT ²	LBS / ACRE	PRICE / LB	TOTAL PRICE	BLOOM TIME
Baby Blue Eyes	<i>Nemophila menziesii</i>	8.0%	4.00	1.05	\$37.50	\$39.47	early
Bicolor Lupine	<i>Lupinus bicolor</i>	4.0%	2.00	1.33	\$32.00	\$42.52	early
Tidy Tips	<i>Layia platyglossa</i>	8.0%	4.00	0.78	\$36.00	\$28.01	early
California Poppy	<i>Eschscholzia californica</i>	8.0%	4.00	0.80	\$22.50	\$18.09	early to mid
Farewell to Spring	<i>Clarkia amoena</i>	12.0%	6.00	0.44	\$45.00	\$19.88	early to mid
Globe Gilia	<i>Gilia capitata</i>	12.0%	6.00	0.45	\$24.00	\$10.81	early to mid
California Phacelia	<i>Phacelia californica</i>	12.0%	6.00	1.07	\$57.00	\$61.22	mid
Common Sunflower	<i>Helianthus annuus</i>	6.0%	3.00	3.28	\$45.00	\$147.66	mid to late
Seaside Woolly Sunflower	<i>Eriophyllum staechadifolium</i>	15.0%	7.50	0.22	\$120.00	\$25.81	mid to late
Marsh Gumplant	<i>Grindelia stricta</i>	15.0%	7.50	1.04	\$45.00	\$46.79	late**
TOTALS		100%	50	10.47	-	\$440.26*	

*Costs may vary by season and seed producer.

** For additional late season wildflowers, see Master Plant List for suggested transplants.

Master Plant List for the Central Coast

Recommended Native Wildflowers for Pollinators

COMMON NAME	SCIENTIFIC NAME	†LIFE CYCLE	MATURE HEIGHT	WATER NEEDS	NOTES
Early Season Blooming Species					
Baby Blue Eyes	<i>Nemophila menziesii</i>	A	0.5 ft	Low	
Bicolor Lupine	<i>Lupinus bicolor</i>	A	0.5 ft	Medium	
Chinese Houses	<i>Collinsia heterophylla</i>	A	0.5 ft	Medium	
Golden Lupine	<i>Lupinus densiflorus</i>	A	2.5 ft	Low	
Tidy Tips	<i>Layia platyglossa</i>	A	0.5 ft	Low	Tolerates clay soils
Early to Mid Season Blooming Species					
California Poppy	<i>Eschscholzia californica</i>	P	0.5 ft	Low	Tolerates clay soils
Farewell to Spring	<i>Clarkia amoena</i>	A	0.5 ft	Medium	
Foothill Penstemon	<i>Penstemon heterophyllus</i>	P	3.0 ft	Low	Establishes better from transplant than from seed
Globe Gilia	<i>Gilia capitata</i>	P	1.0 ft	Medium	
Sticky Monkey Flower	<i>Mimulus aurantiacus</i>	P	2.0 ft	Medium	Establishes better from transplant than from seed

Recommended Native Wildflowers for Pollinators (Cont.)

COMMON NAME	SCIENTIFIC NAME	† LIFE CYCLE	MATURE HEIGHT	WATER NEEDS	NOTES
Mid Season Blooming Species					
Black Sage	<i>Salvia mellifera</i>	P	2.0 ft	Low	Establishes better from transplant than from seed
California Phacelia	<i>Phacelia californica</i>	P	2.0 ft	Low	
Deerweed	<i>Lotus scoparius</i>	P	3.0 ft	Low	Very long blooming; tolerates wet or dry conditions
Narrowleaf Milkweed	<i>Asclepias fascicularis</i>	P	2.5 ft	Medium	Does not do well in seed mixes or from small transplants; sow seed individually, or transplant larger than plug sized; host plant for monarch butterfly; tolerates clay soils, tolerates wet or dry conditions
Summer Lupine	<i>Lupinus formosus</i>	P	1.5 ft	Low	
Mid to Late Season Blooming Species					
California Fuchsia, Hummingbird trumpet	<i>Epilobium canum</i>	P	2.0 ft	Low	Establishes better from transplant than from seed
Common Sunflower	<i>Helianthus annuus</i>	A	5.0 ft	Medium	Tolerates clay soils
Seaside Woolly Sunflower	<i>Eriophyllum staechadifolium</i>	P	3.0 ft	Low	
Late Season Blooming Species					
California Buckwheat	<i>Eriogonum fasciculatum</i>	P	2.5 ft	Low	Can be extremely drought tolerant; establishes better from transplant than seed
Canada Goldenrod	<i>Solidago canadensis</i>	P	2.5 ft	Medium	Establishes better from transplant than from seed; tolerates wet or dry conditions
Marsh Gumplant	<i>Grindelia stricta</i>	P	3.0 ft	Medium	
Pacific Aster	<i>Symphyotrichum chilense</i>	P	5.0 ft	Low	Establishes better from transplant than from seed; tolerates clay soils; tolerates wet or dry conditions

† Life Cycle abbreviations: P = perennial, A = annual, B = biennial

Appendix C: Seed Mixes and Plant Lists for Southern California

Example Seed Mix

The following example seed mix is formulated for a 1-acre planting area. For larger areas, increase the rate accordingly. To create custom seed mixes, see recommended species in the master list on pages 11-12 and the references section for a downloadable seed mix calculator. For details on establishing woody plants, see *Hedgerows (422) for Pollinators: Southern California Specifications*. To maximize flexibility in planting method, order seed of each species separately.

Standard Conservation Cover Seed Mix for Southern California

The mix is designed to provide season-long pollen and nectar resources on any sunny upland site.

COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS / FT ²	LBS / ACRE	PRICE / LB	TOTAL PRICE	BLOOM TIME
Bicolor Lupine	<i>Lupinus bicolor</i>	4.0%	2.00	1.33	\$32.00	\$42.52	early
Tidy Tips	<i>Layia platyglossa</i>	8.0%	4.00	0.78	\$36.00	\$28.01	early
Baby Blue Eyes	<i>Nemophila menziesii</i>	8.0%	4.00	1.05	\$37.50	\$39.47	early
California Poppy	<i>Eschscholzia californica</i>	10.0%	5.00	1.00	\$22.50	\$22.61	early to mid
Farewell to Spring	<i>Clarkia amoena</i>	12.0%	6.00	0.44	\$45.00	\$19.88	early to mid
Globe Gilia	<i>Gilia capitata</i>	12.0%	6.00	0.45	\$24.00	\$10.81	early to mid
Imbricate Phacelia	<i>Phacelia imbricata</i>	12.0%	6.00	1.08	\$128.00	\$137.93	mid
California Goldenrod	<i>Solidago californica</i>	14.0%	7.00	0.65	\$135.00	\$87.36	mid to late
Seaside Woolly Sunflower	<i>Eriophyllum staechadifolium</i>	15.0%	7.50	0.22	\$120.00	\$25.81	late
Common Sunflower	<i>Helianthus annuus</i>	5.0%	2.50	2.73	\$45.00	\$123.05	late
TOTALS		100%	50.00	9.73		\$537.45*	

*Costs may vary by season and seed producer

Master Plant List for Southern California

Recommended Native Wildflowers for Pollinators

COMMON NAME	SCIENTIFIC NAME	† LIFE CYCLE	MATURE HEIGHT	WATER NEEDS	NOTES
Early Season Blooming Species					
Baby Blue Eyes	<i>Nemophila menziesii</i>	A	0.5 ft	Low	
Bicolor Lupine	<i>Lupinus bicolor</i>	A	0.5 ft	Medium	
Golden Lupine	<i>Lupinus densiflorus</i>	A	2.5 ft	Low	
Tidy Tips	<i>Layia platyglossa</i>	A	0.5 ft	Low	Tolerates clay soils
Early to Mid Season Blooming Species					
California Poppy	<i>Eschscholzia californica</i>	P	0.5 ft	Low	Tolerates clay soils
California Encelia	<i>Encelia californica</i>	P	4.0 ft	Low to Medium	Tolerates clay soil; establishes better from transplant than from seed
Farewell to Spring	<i>Clarkia amoena</i>	A	0.5 ft	Medium	
Foothill Penstemon	<i>Penstemon heterophyllus</i>	P	3.0 ft	Low	Establishes better from transplant than from seed
Globe Gilia	<i>Gilia capitata</i>	P	1.0 ft	Medium	
Purple Sage	<i>Salvia leucophylla</i>	P	3.0 ft	Low	Establishes better from transplant than from seed
Showy Penstemon	<i>Penstemon spectabilis</i>	P	3.0 ft	Low	Establishes better from

Recommended Native Wildflowers for Pollinators (Cont.)

COMMON NAME	SCIENTIFIC NAME	† LIFE CYCLE	MATURE HEIGHT	WATER NEEDS	NOTES
Mid Season Blooming Species					
California Buckwheat	<i>Eriogonum fasciculatum</i>	P	2.5 ft	Low	Establishes better from transplant than from seed; extremely drought tolerant
Deerweed	<i>Lotus scoparius</i>	P	3.0 ft	Low	Drought tolerant, but also tolerates wetter conditions
Imbricate Phacelia	<i>Phacelia imbricata</i>	P	2 ft	Low	
Island Buckwheat	<i>Eriogonum arborescens</i>	P	2.0 ft	Low	Establishes better from transplant than from seed
Narrow Leaf Milkweed	<i>Asclepias fascicularis</i>	P	2.5 ft	Medium	Does not do well in seed mixes or from small transplants; sow seed individually, or transplant larger than plug sized; host plant for monarch butterfly; tolerates clay soils, tolerates wet or dry conditions
Summer Lupine	<i>Lupinus formosis</i>	P	2.5 ft	Low	
Mid to Late Season Blooming Species					
Black Sage	<i>Salvia mellifera</i>	P	2.0 ft	Low	Establishes better from transplant than from seed
California Goldenrod	<i>Solidago californica</i>	P	3.0 ft	Medium	Tolerates wet or dry conditions
Cleveland Sage	<i>Salvia clevelandii</i>	P	2.5 ft	Low	Establishes better from transplant than from seed
St. Catherine's Lace	<i>Eriogonum giganteum</i>	P	5.0 ft	Low	Very long blooming
Late Season Blooming Species					
California Fuchsia, Hummingbird Trumpet	<i>Epilobium canum</i>	P	2.0 ft	Low	Establishes better from transplant than from seed
Common Sunflower	<i>Helianthus annuus</i>	A	5.0 ft	Medium	Tolerates clay soils
Seaside Woolly Sunflower	<i>Eriophyllum staechadifolium</i>	P	3.0 ft	Low	

† Life Cycle abbreviations: P = perennial, A = annual, B = biennial

Native Seed Vendors and Native Plant Nurseries

Inclusion on this list does not constitute an endorsement or a recommendation. Other vendors not listed below may also have suitable plant materials. If you know of another source or if you are a vendor and would like to be included on this list, please contact Tom Moore, NRCS State Biologist. Tom.Moore@ca.usda.gov 530-792-5652

Before ordering, ensure that all plants or seeds purchased for pollinator habitat have **NOT** been treated with systemic insecticides.

Central Valley

Cornflower Farms (Transplants Only) • Elk Grove, CA • 916-689-1015 • www.cornflowerfarms.com.
Floral Native Nursery (Transplants Only) • Chico, CA • 530-892-2511 • www.floralnativenursery.com
Hedgerow Farms (Seeds and Transplants) • Winters, CA • 530-662-6947 • www.hedgerowfarms.com
Intermountain Nursery (Transplants Only) • Prather, CA • 559-855-3113 • www.intermountainnursery.com
Kamprath Seed, Inc (Seeds Only) • Manteca, CA • 800-466-9959 • www.kamprathseed.com
Pacific Coast Seeds (Seeds Only) • Livermore, CA • 925-373-4417 • www.pcseeds.com
S&S Seeds, Inc. (Seeds Only) • Carpinteria, CA • 805-466-9959 • www.ssseeds.com

Central Coast

California Flora Nursery (Transplants Only) • Fulton, CA • 707-528-8813 • www.calfloranursery.com
Central Coast Wilds (Transplants Only) • Santa Cruz, CA • 831-459-0656 • www.centralcoastwilds.com
Elkhorn Slough Native Nursery (Transplants and Seeds) • Moss Landing, CA • 831-763-1207 • www.elkhornnursery.com
Growing Solutions (Transplants and Seeds) • Santa Barbara, CA • 805-452-7561 • growingsolutions@hughes.net
Hedgerow Farms (Seeds Only) • Winters, CA • 530-662-6847 • www.hedgerowfarms.com
Kamprath Seed, Inc. (Seeds Only) • Manteca, CA • 831-763-1207 • www.kamprathseed.com
Las Pilitas Nursery (Transplants Only) • Escondido and Santa Margarita, CA • 760-749-5930 • www.laspilitas.com
Native Here Nursery (Transplants and Seeds) • Berkeley, CA • 501-549-0211 • nativehere@ebcnps.org
Native Revival Nursery (Transplants Only) • Aptos, CA • 831-684-1811 • www.nativerivival.com
Pacific Coast Seeds (Seeds Only) • Livermore, CA • 925-373-4417 • www.pcseeds.com
S&S Seeds, Inc. (Seeds Only) • Carpinteria, CA • 805-684-0436 • www.ssseeds.com

Southern California

Growing Solutions (Transplants and Seeds) • Santa Barbara, CA • 805-452-7561 • www.growingsolutions.org
Hedgerow Farms (Transplants and Seeds) • Winters, CA • 530-662-6847 • www.hedgerowfarms.com
Las Pilitas Nursery (Transplants Only) • Escondido and Santa Margarita, CA • 760-749-5930 • www.laspilitas.com
Pacific Coast Seeds (Seeds Only) • Livermore, CA • 925-373-4417 • www.pcseeds.com
Kamprath Seed, Inc (Seeds Only) • Manteca, CA • 800-466-9959 • www.kamprathseed.com
S&S Seeds, Inc. (Seeds Only) • Carpinteria, CA • 805-684-0436 • www.ssseeds.com
Tree of Life Nursery (Transplants Only) • San Juan Capistrano, CA • 949-728-0685 • www.californianativeplants.com

References

Xerces Society Seed Mix Calculator

Develop your own pollinator conservation seed mix using this seed rate calculator.

www.xerces.org/wp-content/uploads/2009/11/XERCES-SEED-MIX-CALCULATOR.xls

USDA-NRCS Seedling ID Guide for Native California Plants

Many of the plant species recommended in this guide are featured in a series of seedling photos in this downloadable resource. www.plant-materials.nrcs.usda.gov/pubs/capmctn10340.pdf

Weed Identification and Management California Invasive Plant Council

www.cal-ipc.org

Pollinator Biology and Habitat in California (USDA-NRCS: technical note) TN – BIOLOGY – CA-19 April 2009

This California NRCS Technical Note describes the biology and habitat needs of native bees

ftp://ftp-fc.sc.egov.usda.gov/CA/technical/technotes/TN_Biology_19_Pollinator_Biology_CA_5-09.pdf

Soil Solarization: A Nonpesticidal Method for Controlling Diseases, Nematodes, and Weeds

This fact sheet, produced by the University of California Cooperative Extension discusses the solarization process, including plastic selection, installation, removal, and underlying principles.

www.vric.ucdavis.edu/pdf/soil_solarization.pdf

Seed Quality, Seed Technology, and Drill Calibration

This Washington NRCS Plant Materials Technical Note (no. 7. 2005) features extensive information on calibrating native seed drills, and the use of inert carriers.

www.plant-materials.nrcs.usda.gov/pubs/wapmctn6331.pdf

Attracting Native Pollinators: Protecting North America's Bees and Butterflies

This comprehensive book on pollinator conservation includes information about pollinator ecology, guides for identifying common bees, and habitat designs for multiple landscapes.

www.xerces.org/announcing-the-publication-of-attracting-native-pollinators/

Pollinator Conservation Resource Center

For additional information on pollinator plant lists, conservation guides, pesticide protection and more.

www.xerces.org/pollinator-resource-center

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(Photo credit: Jessa Kay Cruz, The Xerces Society)

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