The Xerces Society
for Invertebrate Conservation

NRCS
Natural Resources Conservation Service
USDA United States Department of Agriculture

Hedgerow Planting (422) for Pollinators

California Central Coast

Job Sheet Installation Guide

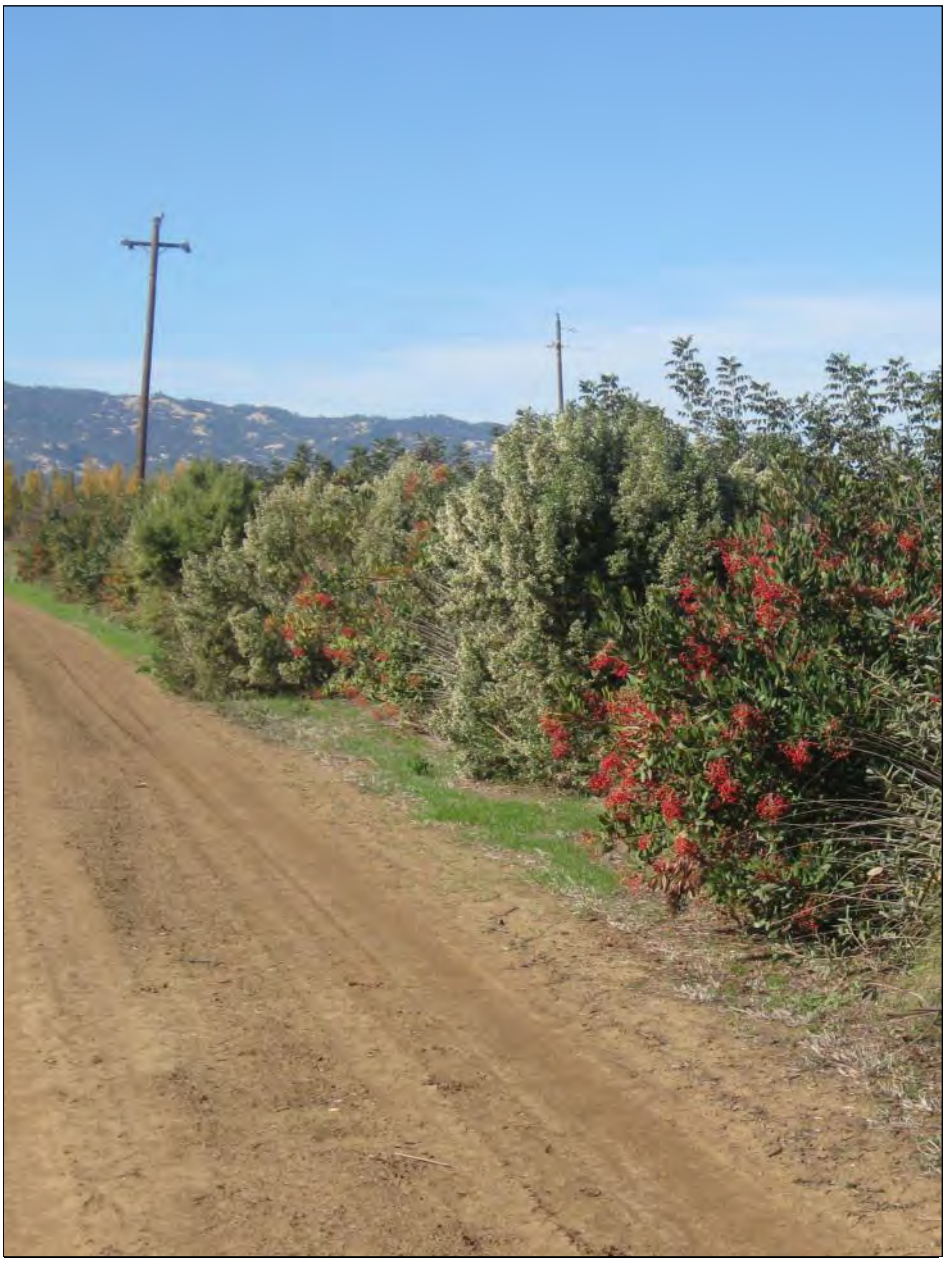

Photo credit: Jessa Guisse, Xerces Society

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www.xerces.org

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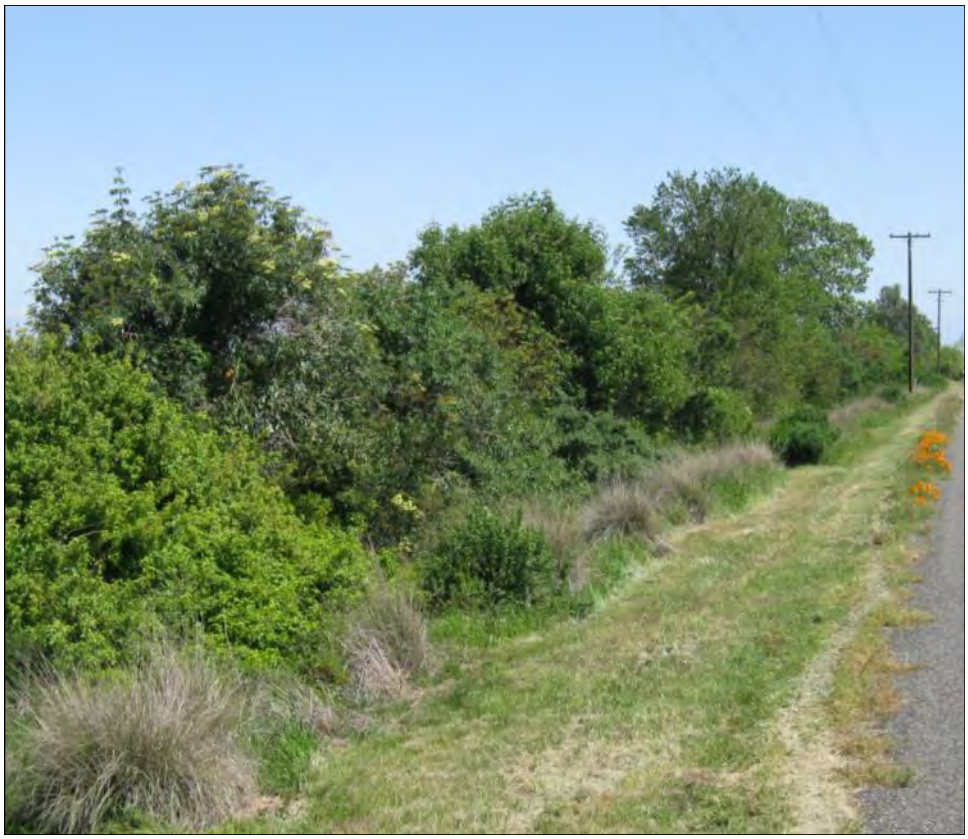

(Photo credit: Jessa Guisse, Xerces Society)

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Hedgerow Planting for Pollinators: California Central Coast

Job Sheet Installation Guide

Purpose

These instructions provide in-depth guidance on how to install nectar and pollen habitat for bees in the form of linear rows of native flowering shrubs. To plan a specific project, use this guide with the *Hedgerow Planting for Pollinators Practice Installation Job Sheet: California Central Coast.*

Client Conservation Objectives

Depending on landowner objectives and project design, pollinator habitat may also provide food and cover for other wildlife, provide windbreaks, reduce soil erosion, protect water quality, and attract other beneficial insects such as predators of crop pests.

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). Only sites with no to very low risk for insecticide drift should be established as new habitat.
- **Accessibility:** New habitat should be accessible to equipment for planting and maintenance operations.
- **Sunlight:** Most 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 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, 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.
- **Other Functions:** The site may offer opportunities to serve other functions – such as run-off prevention, stream bank stabilization, wildlife habitat, or windbreaks. 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 Appendix provides information on acceptable plants in the California Central Coast.

If you are designing a custom plant list, individual species should be chosen so that there are consistent and adequate floral resources throughout the season. In order to achieve this goal, a minimum of three species from each blooming period (early, mid and late season), should be included. Plant 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: It is rare for native pollinator plants to serve as alternate hosts for crop pests or diseases, but selected plants should be cross-referenced for specific crop pest or disease associations.

Site Preparation

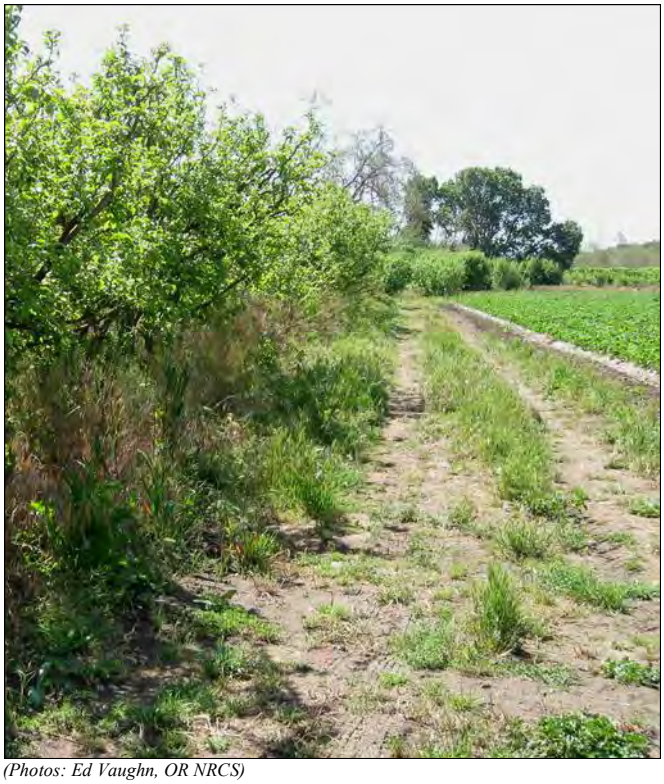
Site preparation is **one of the most** important and often inadequately addressed components of project success. It is also a process that may require more than one season of effort to reduce competition from invasive, noxious or undesirable non-native plants prior to planting. Site preparation should focus on the removal of perennial and aggressive annual weeds. More effort and time spent eradicating undesirable plants prior to planting will result in higher success rates in establishing the targeted plant community. Weed removal methods are provided in **Table 1** (for site preparation where wildflowers will be seeded within or adjacent to a hedgerow, see the *Conservation Cover for Pollinators Job Sheet and Installation Guide: California Central Coast).*

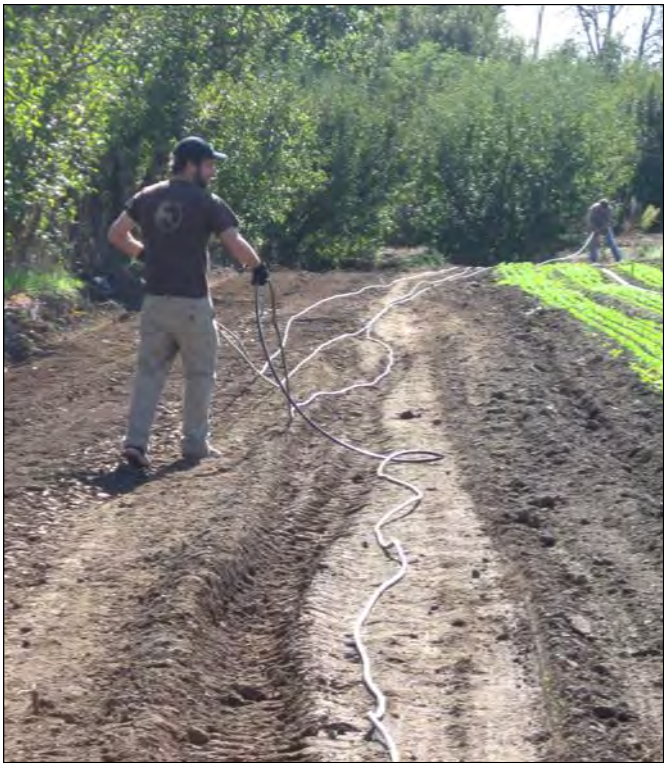
Note: If weed pressure is high, then the weed abatement strategies detailed in Table 1 should be repeated for an additional growing season. High weed pressure conditions are characterized by:

- 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).

If desired, site preparation can also include the creation of a berm to serve as the hedgerow base. Hedgerows with berm-bases are preferred in some regions for greater windbreak and screening benefits (due to the raised base). Hedgerow berms are often roughly 3 feet in width and height, and are created using soil excavated from the sides of the berm (creating a parallel ditch on both sites of the hedgerow). Field stones are sometimes added to hedgerow berms as well, adding additional height and structure.

Figure 1





(Photos: Ed Vaughn, OR NRCS)

Site preparation should focus on removing existing weedy vegetation (above) and creating a clean planting site (right).

The site above is a clean site where hedgerow plants can become established with less competition for sunlight and water.

Table 1 Weed Removal Methods

METHOD: MOWING

Where to Use

- Where weed pressure is very low
- Areas with a low risk of erosion
- Areas accessible to equipment

Timing

- Total time: 1 + months
- Begin: anytime
- Plant: fall or early spring

Basic Instructions:

1. Where weed pressure is low, mow or till the existing vegetation as low to the ground as possible for the length of the hedgerow.

2. If necessary, rake or harrow the strip to create a clean surface for installing transplants.

METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE

Where to Use

- Where weed pressure is moderate to high
- Conventional farms
- Areas with a low risk of erosion
- Areas accessible to sprayer

Timing

- Total time: 6 + month(s)
- Begin: late winter
- Plant: fall

Basic Instructions:

1. Mow 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 whenever weeds are actively growing in the early spring.

3. If necessary, repeat herbicide applications at 6 week intervals until the desired level of weed control is achieved.

4. Plant the transplants, waiting at least 72 hours after the last herbicide treatment. Refer to the Planting Methods section of this document for specific recommendations.

NOTE: Do not till. 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.

Table 2 (Cont.) Weed Removal Methods

METHOD: SOLARIZATION	
Where to Use • Where weed pressure is moderate to high • Organic and conventional farms • Areas with a low risk of erosion • Areas accessible to mowing equipment • Locations with full sun	**Timing** • Total time: 6+ months • Begin: spring • Plant: fall
Basic Instructions: 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 late-fall and immediately install transplants. Refer to Planting Methods section of this document for specific bed preparation recommendations. ***NOTE: Solarization may not be as effective in coastal climates where temperatures are lower and summer sun is limited. Do not till. 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.***	

Planting Methods

Regular shovels are usually adequate for transplanting most woody nursery 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.

Depending on weed pressure, hedgerow plants can be installed through planting holes cut into landscape fabric (after which the fabric is typically covered with mulch). While this practice may be highly effective for weed control, it likely reduces nesting opportunities for ground-nesting pollinators and other wildlife. Hedgerows should be installed without landscape fabric when possible.

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.

Transplanting can occur any time the ground can be worked, but should be timed to avoid prolonged periods of hot, dry, windy or wet 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 planting. 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.

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.

Where rodent damage may occur, underground wire cages around roots are recommended. Plant guards also 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.

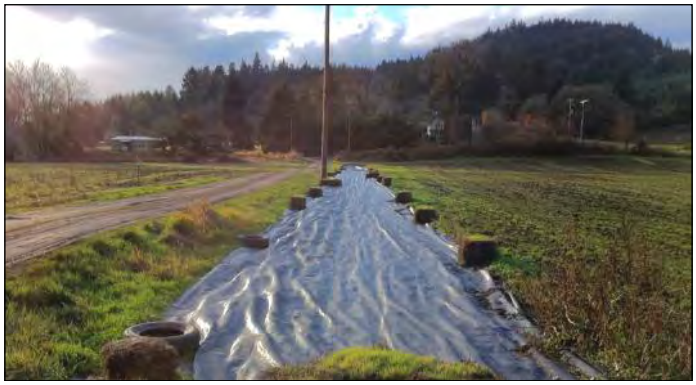
Mulching is recommended to reduce weed competition and to retain moisture during the establishment phase. Recommended materials include wood chips, bark dust, weed-free straw, nut shells, grapeseed pumice, or other regionally appropriate weed free mulch materials.

Seeding Wildflowers: Wildflowers can also be planted from seed within or adjacent to hedgerows to provide additional plant structure and diversity. Seeding requires **excellent** site preparation to reduce weed pressure since weed control options are limited when the wildflowers start to germinate. For more information on establishing wildflowers from seed, see the *Conservation Cover for Pollinators Job Sheet and Installation Guide: California Central Coast*.

Planting Method Photos

Figure 2

(Photo: Jessa Guisse, The Xerces Society)



(Photo: Gwendolyn Ellen, Oregon State University)

Hedgerow plants can be staggered in multiple rows, providing a wider habitat feature, with greater secondary benefits (such as screening, wind reduction, and dust control) (left). Where weed pressure is particularly severe, the ground below the hedgerow can be covered in weed barrier landscape fabric (right). The use of weed barrier however may reduce the value to ground-nesting wildlife, including many species of bees.

Figure 3

(Photos: Jessa Guisse, The Xerces Society)

Grow tubes or trunk protectors may help during establishment to reduce browsing by herbivores and trunk damage from mowers or weeding operations (top left). Wildflowers can be seeded in linear strips alongside newly planted hedgerows to provide pollen and nectar resources while slower growing shrubs become established (top right). Most species will benefit from an inch of water per week during the first two years of establishment, either from natural rainfall, or from irrigation, such as the drip irrigation lines used on this hedgerow (left).

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, string trimming, hand hoeing, or spot spraying with herbicides.

Weeds should be prevented from going to seed in, or adjacent to, the hedgerow 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.

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.
- **Selective Herbicides:** Grass-selective herbicides can be used to control weedy grasses in hedgerows. Contact a local crop advisor or Extension specialist for appropriate herbicide selection and timing.
- **Managing Irrigation:** Whenever possible, irrigation should be supplied at the base of the transplant (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 going to seed and shading out hedgerow plants.
- **Hand Weeding:** Hand-weeding (including hoeing) can be effective in small areas with moderate weed pressure.

Operations and Maintenance (Long-Term)

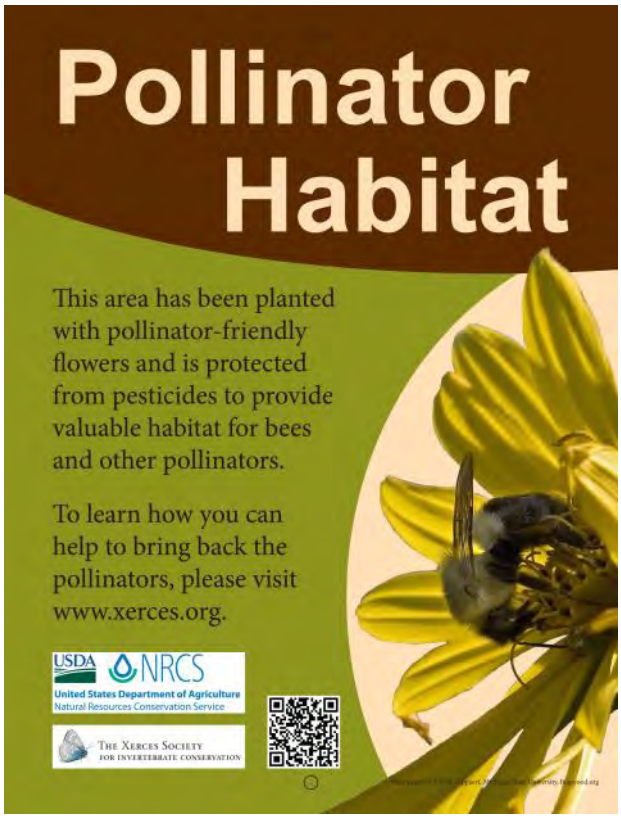
Control herbivores as needed, but remove tree guards or other materials that could impede plant growth as soon as possible after establishment. In most cases, irrigation can be removed from transplants by the end of the second year after planting. Continue to protect habitat from pesticides and herbicides 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-planting as necessary.

Hedgerow plantings may need to be managed over time to prevent shrub encroachment into adjacent fields or roadsides or to cut back large trees that shade out other hedgerow species. Depending on management goals (e.g., preferred wildlife structure) larger hedgerow species are sometimes cut back to a stump and allowed to re-sprout (called coppicing) to produce multiple bushy stems. Regardless of management needs, do not prune hedgerow plants 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 disturbed in any one year to ensure sufficient undisturbed 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 pollinator hedgerow is outside of the sprayed area and/or protected from application and drift.

Figure 4

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: Recommended Plants, Sources, and References

Recommended Native Hedgerow Plants

COMMON NAME	SCIENTIFIC NAME	MATURE HEIGHT (FT)	WATER REQUIREMENTS	NOTES
Early Season Blooming Species				
Bigberry Manzanita	*Arctostaphylos glauca*	10.0 ft	low	
California Lilac	*Ceanothus 'Julia Phelps'*	6.0 ft	low	
McMinn Manzanita	*Arctostaphylos 'Howard McMinn'*	5.0 ft	low	Tolerates clay soils
Oregon Grape	*Berberis (Mahonia) aquifolium*	5.0 ft	low	Drought tolerant, but also tolerates semi-riparian conditions
Early to Mid Season Blooming Species				
California Bee Plant	*Scrophularia californica*	4.0 ft	medium	Tolerates clay soils. Can spread seed
Foothill Penstemon	*Penstemon heterophyllus*	3.0 ft	low	
Golden Bush Lupine	*Lupinus arboreus*	5.0 ft	low	
Hollyleaf Cherry	*Prunus ilicifolia*	15.0 ft	medium	
Sticky Monkey Flower	*Mimulus aurantiacus*	2.0 ft	medium	
Mid Season Blooming Species				
Black Sage	*Salvia mellifera*	2.0 ft	low	
Purple Sage	*Salvia leucophylla*	2.0 ft	low	
Blue Elderberry	*Sambucus mexicana*	15.0 ft	medium	Host plant for the endangered Elderberry Longhorn Beetle. Drought tolerant, but also tolerates semi-riparian conditions.
California Rose	*Rosa californica*	8.0 ft	medium	Tolerates clay soils. Can be a host for Drosophila
Coffeeberry, California Buckhorn	*Frangula (Rhamnus) californica*	5.0 ft	low	
Narrow Leaf Milkweed	*Asclepias fascicularis*	2.5 ft	medium	Transplant larger than plug size container. Host plant for Monarch butterfly. Tolerates clay soils. Tolerates wet or dry conditions.
Deerweed	*Lotus scoparius*	3.0 ft	low	Long blooming. Tolerates wet or dry conditions.
Toyon	*Heteromeles arbutifolia*	10.0 ft	low	Can be an alternate host for fireblight
Mid to Late Season Blooming Species				
California Fuchsia, Hummingbird Trumpet	*Epilobium canum*	2.0 ft	low	
Canada Goldenrod	*Solidago canadensis*	2.5 ft	medium	Tolerates wet or dry conditions
Seaside Wooly Sunflower	*Eriophyllum staechadifolium*	3.0 ft	medium	
Late Season Blooming Species				
California Buckwheat	*Eriogonum fasciculatum*	2.5 ft	low	Can be extremely drought tolerant.
Coyotebrush	*Baccharis pilularis*	10.0 ft	low	Spp is dioecious. Plant male plants to avoid unwanted seeding. Can be extremely drought tolerant
Dwarf Coyotebrush	*Baccharis pilularis 'Pigeon Point)*	2.0 ft	low	Spp is dioecious. Plant male plants to avoid unwanted seeding. Can be extremely drought tolerant
Pacific Aster	*Symphyotrichum chilense*	5.0 ft	low	Establishes better from transplant than from seed. Tolerates clay soils. Tolerates wet or dry conditions.

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

California Flora Nursery • Fulton, CA • 707-528-8813 • www.calfloranursery.com

Central Coast Wilds • Santa Cruz, CA • 831-459-0656 • www.centralcoastwilds.com

Elkhorn Slough Native Nursery • Moss Landing, CA • 831-763-1207 www.elkhornnursery.com

Growing Solutions • Santa Barbara, CA • 805-452-7561 • ww.growingsolutions.org

Las Pilitas Nursery • Escondido and Santa Margarita, CA • 760-749-5930 • www.laspilitas.com

Native Here Nursery • Berkeley, CA • 501-549-0211 • http://ebcnps.org/index.php/nativehere_nursery

Native Revival Nursery • Aptos, CA • 831-684-1811 • www.nativerevival.com

References

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

Conservation Buffers (US Forest Service Technical Guide)
Design guidelines for buffers, corridors, and greenways. Includes extensive information on hedgerows and windbreaks.
www.unl.edu/nac/bufferguidelines/docs/conservation_buffers.pdf

Windbreaks Designed with Pollinators in Mind. (Inside Agroforestry)
An overview of multi-purpose windbreaks designed with pollinator-friendly trees and shrubs.
www.unl.edu/nac/insideagroforestry/vol20issue1.pdf

Weed Identification and Management
California Invasive Plant Council
www.cal-ipc.org

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

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

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.
http://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

Aerial Sketch of Farm Conservation Plan:

Notes:

Notes: