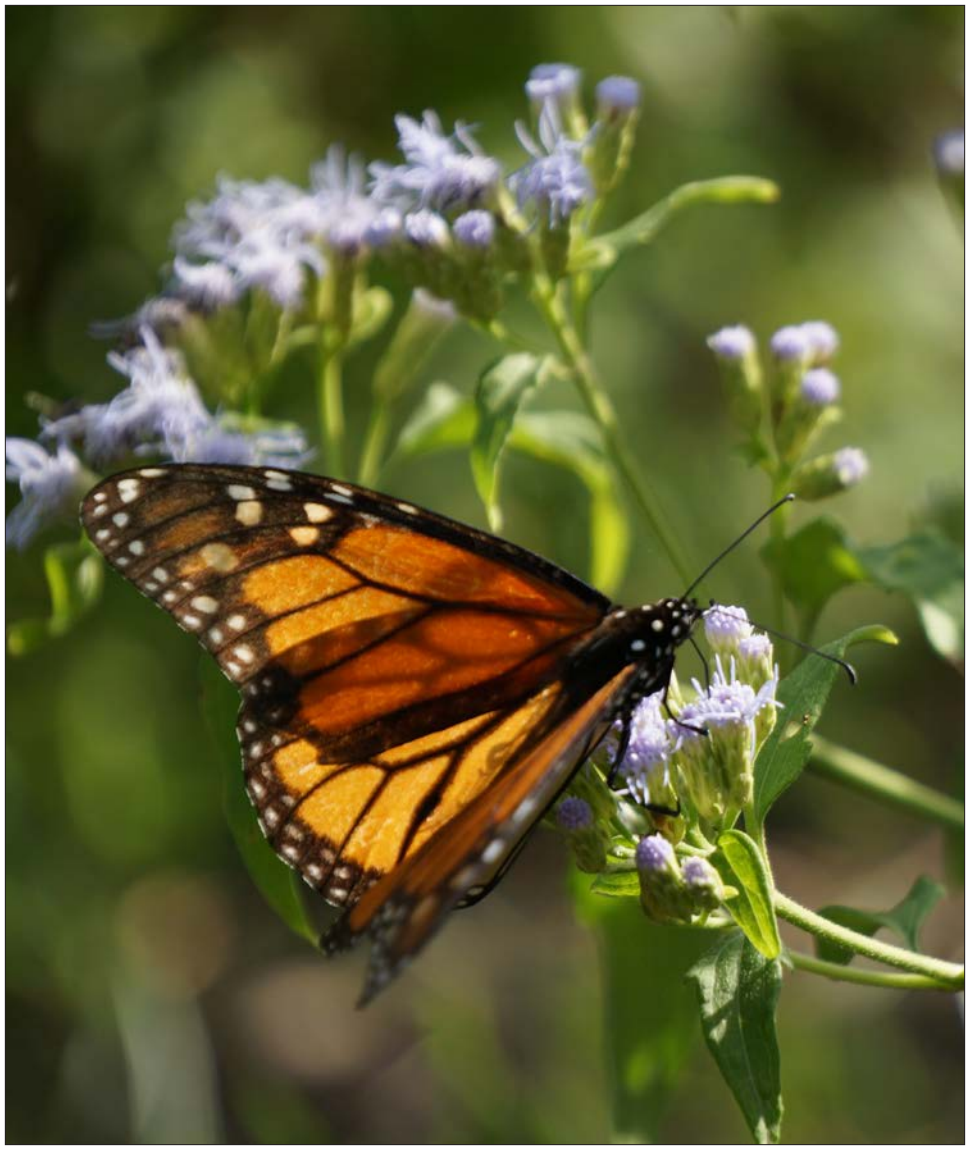
The Xerces Society
for Invertebrate Conservation

The Kerr Center
for Sustainable Agriculture

Tree/ Shrub Establishment (612) &
Hedgerow Planting (422) for Pollinators

Oklahoma

Installation Guide



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Cover: Monarch butterfly (*Danaus plexippus*) nectaring on blue mistflower (*Conoclinium coelestinum*). Photograph by Anne Stine, The Xerces Society. *Below:* Bumble bee (*Bombus* spp.) foraging on showy goldenrod (*Solidago speciosa*). Photograph by Eric Lee-Mäder, The Xerces Society.

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Tree/ Shrub Establishment (612) & Hedgerow Planting (422) for Pollinators: Oklahoma

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 Practice Installation Job Sheet found at the end of this document.

Client Conservation Objectives

Depending on landowner objectives and project design, pollinator habitat may also provide windbreaks, food and cover for other wildlife, reduce soil erosion, protect water quality, and attract other beneficial insects—such as predators and parasitoids 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 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 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, top soil loss, 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. Existing structures, such as shelter belts, hedges, or living fences, can be rehabilitated for increased pollinator benefits. These factors can influence plant choice and/ or design.

Figure 1 Pollinator plantings can serve other functions, such as habitat for wildlife or beneficial insects. This meadow and windbreak adjacent to a farm provides a variety of foraging and nesting sites for native bees, butterflies, and more.

(Photograph by Jim Gillis, Pennsylvania NRCS, courtesy of the USDA via flickr.com.)

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 Oklahoma.

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.

Non-Native Plants: Plant selection should focus on pollen- and nectar-rich native plants. Non-invasive, non-native plants may be used when cost or availability are limiting factors.

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. Research indicates that borders dominated by non-native weeds harbor more pests than are found in diverse native plantings.

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 weeds* (there are more options to address annual or biennial weeds after planting). Regardless of whether the objective is to establish herbaceous or woody vegetation, 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 or windbreak, see *Resources & References* in the Appendix.

Note: If weed pressure is high, then the weed abatement strategies detailed here 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 (e.g., Bermuda grass) 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). In areas where drainage is poor, they may support a wider range of plants. Hedgerow berms are often roughly 3′ 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 planting). Field stones are sometimes added to hedgerow berms as well, adding additional height and structure.

Figure 2 Site preparation should focus on removing existing weedy vegetation. The upper site is not ready for planting. Weedy vegetation has been removed from the lower site; creating a clean planting area where pollinator plants can become established with less competition for sunlight and water.

(Photograph courtesy of Ed Vaughn.)

(Photograph courtesy of the Oregon NRCS.)

Table 1 **Site Preparation Methods**

METHOD: MOWING OR STRIP TILLAGE	
Where to Use • Where weed pressure is low • Areas with a low risk of erosion • Areas accessible to mowing or tilling equipment	**Timing** • Total time: 1 month • Begin: Any time • Plant: Any time
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 planting. 2. If necessary, rake or lightly harrow the strip to create a clean surface for installing transplants.	
METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE	
Where to Use • Where weed pressure is high • Conventional farms and organic farms* • Areas with a low risk of erosion • Areas accessible to sprayer	**Timing** • Total time: 1+ month(s) • Begin: Any time • Plant: Any time
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 when weeds are actively growing. 3. If necessary, repeat herbicide applications at six-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. Avoid use of herbicides that are bee-toxic (e.g., Paraquat and Gramoxone).*** **** Choice of herbicides must be acceptable to OMRI for organic operations or, if not, used outside of certified ground AND approved by an organic certifier.***	
METHOD: SOLARIZATION	
Where to Use • Where weed pressure is high • Conventional farms and organic 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 to winter
Basic Instructions: 1. Mow, till, or lightly harrow and smooth the site (raking off debris, if necessary). 2. After smoothing the site, irrigate the site well 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 plastic is recolonized by nearby rhizomatous weeds. 4. Immediately install transplants. Refer to Planting Methods section of this document for specific bed preparation recommendations. ***NOTE: 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.***	

Figure 3 Bumble bee (*Bombus* spp.) foraging on Virginia sweetspire (*Itea virginica*), an excellent late spring floral resource that attracts numerous species of native bees and butterflies.

Photograph courtesy of Tom Potterfield, flickr.com.)

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, woody 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. Approximately 70% of North American native bee species nest in the ground, making the undisturbed ground beneath hedgerows and windbreaks potential nest sites. As landscape fabric can deter bees from accessing the soil, pollinator habitat should be installed without landscape fabric whenever possible.

Plant size at maturity should be considered when planting. Most woody shrubs can be spaced on 4′ to 10′ centers (depending upon size at maturity), with most herbaceous plants spaced closer on 2′ to 3′ 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, or windy weather. Fall is often a good time to transplant shrubs and trees. 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 would benefit from 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 of 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, mowing, 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, woody transplants 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 *Resources & References* in the Appendix.

Figure 4 Pollinator habitat provides more than forage for pollinators, as many native bee species nest in the stems of plants (left) or in the undisturbed ground underneath plants (right).

(Photograph by Nancy Lee Adamson, The Xerces Society.)

(Photograph courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org.)

Planting Method Photos

Figure 5 Woody plants 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 new habitat 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.

(Photograph by Eric Lee-Mäder, The Xerces Society.)

(Photograph courtesy of Gwendolyn Ellen, Oregon State University.)

Figure 6 Grow tubes or trunk protectors may help during establishment to reduce browsing by herbivores and trunk damage from mowers or weeding operations (left). Wildflowers can be seeded alongside newly-planted woody transplants to provide pollen and nectar resources while slower-growing shrubs become established (middle). Site preparation and weed eradication needs to be very rigorous prior to planting seeds. See the *Resources & References* in the Appendix. Most species will benefit from 1" of water per week during the first two years of establishment, either from natural rainfall or irrigation, such as the drip-irrigation lines used on this hedgerow (right).

(Photograph by Jessa Kay Cruz, The Xerces Society.)

(Photograph by Jessa Kay Cruz, The Xerces Society.)

(Photograph by Eric Lee-Mäder, The Xerces Society.)

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 site 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 pollinator plantings. 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 (e.g., drip irrigation) to avoid watering nearby weeds.
- **Mowing or String-Trimming:** Mowing or string-trimming can be utilized to keep weedy species from going to seed and shading out slower-growing woody 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. Ongoing 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.

Hedgerows and windbreaks 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 desired species. Depending on management goals (e.g., preferred wildlife structure), larger woody species are sometimes cut back to a stump and allowed to re-sprout (called 'coppicing') to produce multiple bushy stems. Another practice—hedge-laying—involves cutting most of the way through upright trunks, then pushing the still partially attached trunks over at an angle in line with the hedgerow. New growth from the stumps and laid trunks results in denser habitat and fills in gaps where other shrubs may have died. Regardless of management needs, do not prune woody 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 habitat is outside of the sprayed area and/ or protected from application and drift.

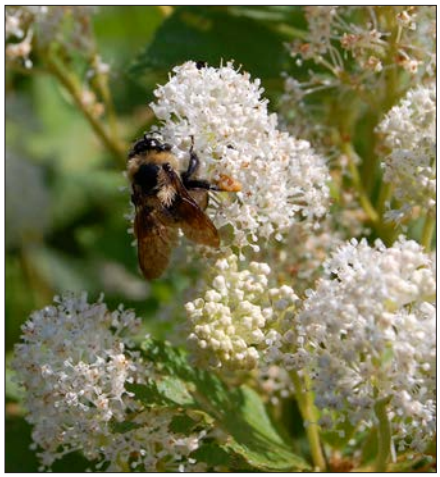
Figure 7 Newly-planted areas should be clearly marked to protect them from herbicides or other disturbances (left). Using signs (right) can be a useful tool to designate protected pollinator habitat. (*Note: Due to wildlife safety concerns, we recommend attaching habitat signs to the top hole of the fence post or plugging the top hole of a typical t-post with a bolt and nut. Alternatively, posts which do not have holes—such as solid wood stakes—should be used.)*

(Photograph by Kelly Gill, The Xerces Society.)

Figure 8 Many species of bees emerge in early spring, which is why it is essential to include plants that bloom early in the season—such as Chickasaw plum (*Prunus angustifolius*), left, eastern redbud (*Cercis canadensis*), middle, and New Jersey tea (*Ceanothus americanus*), right.

(Photograph courtesy of Jeff Wright, flickr.com.)

(Photograph courtesy of Martin LaBar, flickr.com.)



(Photograph courtesy of Peter Gorman, flickr.com.)

Appendix: Recommended Plants, Sources, and References

Recommended Native Woody Plants (Trees & Shrubs)

COMMON NAME	SCIENTIFIC NAME	MATURE HEIGHT	BLOOM PERIOD	WATER NEEDS[1]	PLANT COMMENTS
Early Spring Blooming Species					
Chickasaw plum[2, 3]	*Prunus angustifolia*	30′	Feb–May	L	Edible fruit
Common serviceberry[2, 3]	*Amelanchier arborea*	15–25′	Mar–May	L	Edible fruit
Eastern redbud	*Cercis canadensis*	30′	Mar–May	L–M	Henry's elfin and Io moth host plant; a source of nesting material for leafcutter bees
New Jersey tea	*Ceanothus americanus*	3–4′	Mar–Apr	L–M	Slow growing; attractive to deer
Possumhaw[3, 4]	*Ilex decidua*	15–30′	Mar–May	M	Dioecious; showy winter berries (bright red) on female plants
Prairie willow[4]	*Salix humilis*	12′	March	L–M	Dioecious—male plants most useful to pollinators; supports songbirds
Red buckeye[3]	*Aesculus pavia*	10–40′	Mar–May	M	Showy red flowers (var. *pavia*) attract hummingbirds and pollinators; rarer yellow var. *flavescens* available in central Texas
Stretchberry[3, 4]	*Forestiera pubescens*	5–10′	Feb–Mar	L–M	Dioecious; important early spring nectar source and host plant for butterflies; supports songbirds
Mid- to Late-Spring Blooming Species					
Black raspberry[2, 3]	*Rubus occidentalis*	3–5′	Apr–Jun	L–M	Pithy stems provide nesting sites for bees; edible fruit
Blackhaw	*Viburnum prunifolium*	15′	Apr–May	M	
Cockspur hawthorn[5]	*Crataegus crus-galli*	35′	May–Jun	L–M	Adaptable; host plant for 25+ species of moths; attracts pollinators and songbirds
Common elderberry[2, 3]	*Sambucus nigra* ssp. *canadensis*	4–12′	May–Jun	H	Pithy stems provide nesting sites for bees; edible fruit; **note:** new growth can be toxic to livestock
Common ninebark	*Physocarpus opulifolius*	12′	May–Jun	L–M	Adaptable; attracts pollinators, beneficial insects, and birds
Coralberry	*Symphoricarpos orbiculatus*	5′	Apr–Jun	L–M	
Downy arrowwood	*Viburnum rafinesquianum*	6′	May	L	
False indigo bush[6]	*Amorpha fruticosa*	10′	May–Jun	M	Legume; host plant for southern dogface, gray hairstreak, and silver-spotted skipper; considered weedy in some riparian areas
Fragrant sumac[3, 4]	*Rhus aromatica*	6–12′	Apr–Jun	L	Dioecious—only female plants produce flowers and berries; excellent nectar source for butterflies; beautiful fall color
Golden current[3]	*Ribes aureum*	6–12′	Apr–May	L	Very adaptive; alternate host for white pine blister rust
Hairy rosemallow	*Hibiscus lasiocarpos*	3–5′	Apr–Sep	H	Alt. "Woolly rosemallow"
Pasture rose[2, 3, 5]	*Rosa carolina*	3′	May–Jun	L	Rose hips high in vitamins (C, E, and K)
Prairie crabapple[3]	*Malus ioensis*	35′	Apr–Jun	M	Tolerates a variety of soil conditions, prefers moister soils and full sun
Roughleaf dogwood	*Cornus drummondii*	16′	Apr–Jun	L–M	
Rusty blackhaw	*Viburnum rufidulum*	25′	Apr–May	L	
Virginia sweetspire	*Itea virginica*	5′	May–Jun	M	Showy blooms; beautiful fall foliage
Yaupon[3, 4]	*Ilex vomitoria*	30′	Apr–May	L–M	Dioecious; evergreen

(continued on next page)

Recommended Native Woody Plants (Trees & Shrubs) *continued*

COMMON NAME	SCIENTIFIC NAME	MATURE HEIGHT	BLOOM PERIOD	WATER NEEDS[1]	PLANT COMMENTS
Summer Blooming Species					
Allegheny blackberry[2, 3, 5]	*Rubus allegheniensis*	6′	June	M	Pithy stems provide nesting sites for bees; edible fruit
American beautyberry[3]	*Callicarpa americana*	8′	May–Jul	M	Berries very showy
Apache plume[3]	*Fallugia paradoxa*	2–6′	May-Sep	L	Showy blossoms attract pollinators and birds; very adaptive; can become aggressive
Dwarf false indigo[6]	*Amorpha nana*	3′	May–July	L–M	Legume
Fourwing saltbush[3]	*Atriplex canescens*	10′	May–Jul	L	Berries very showy
Illinois bundleflower[3, 6]	*Desmanthus illinoensis*	1–3′	Jun–Aug	M	Legume; striking blooms and seedpods
Leadplant[6]	*Amorpha canescens*	3′	Jun–Jul	L	Legume; adaptable; attracts leafcutter bees, honey bees, and other beneficial insects
Prairie rose[2, 3]	*Rosa arkansana*	3′	May–Sep	L–M	Rose hips high in vitamins (C, E, and K)
Late Summer to Fall Blooming Species					
Blue mistflower	*Conoclinium coelestinum*	3′	Jul–Nov	M	Can be weedy
Buttonbush	*Cephalanthus occidentalis*	12′	Jun–Sep	M	Will survive periodic flooding; host plant for many butterflies and moths
Halberdleaf rosemallow	*Hibiscus laevis*	6′	Jun–Sep	M	Showy blossoms attract butterflies
Black prairie clover[6]	*Dalea frutescens*	3′	Jul–Oct	L	Legume
Rubber rabbitbrush	*Ericameria nauseosa*	8′	Jul–Sep	L	

Recommended Native Woody Plants (Trees & Shrubs) *Notes*:

1. Water Needs abbreviations: L = low, M = medium, H = high.
2. Edible—safe for human consumption.
3. Fruit-producing—supports birds and other wildlife.
4. Dioecious—pollen-producing (male) and nectar-producing (female) flowers found on separate shrubs. Male plants sometimes documented to provide more important resources for brood-rearing bees.
5. Alternate host for fire blight.
6. Legume—rich in nitrogen and attractive to a wide variety of wildlife.

Figure 9 Many species of native legumes are excellent pollinator plants that also attract a variety of beneficial insects and wildlife. Leadplant (*Amorpha canescens*), left, white prairie clover (*Dalea candida*), middle, and false indigo bush (*A. fruticosa*), right, are frequently used in restoration projects because they thrive in disturbed sites.

(Photograph courtesy of Aaron Carlson, flickr.com.)

(Photograph courtesy of Joshua Mayer, flickr.com.)

(Photograph courtesy of Jeff Wright, flickr.com.)

Recommended Native Wildflowers for Pollinators

If providing immediate resources for pollinators is a concern, wildflowers can be seeded or transplanted alongside newly-planted hedgerows to provide pollen and nectar resources while slower-growing shrubs become established. For more information on establishing wildflowers as pollinator habitat, see the ***References & Resources*** list on p. 13.

Planting from seed can be a lower-cost way to establish wildflowers, but it requires excellent site preparation to reduce weed pressure since weed control options are limited when the wildflowers start to germinate. Additionally, most native wildflowers are best planted in the late fall. ***Transplants*** are an effective way of providing mature nectar and pollen resources more quickly—and can be planted any time the ground can be worked, avoiding prolonged periods of hot, dry, or windy weather. Unlike seeds, transplants should be irrigated thoroughly immediately after planting, then irrigated with at least 1" of water per week (except during natural rain events), for the first two years after establishment.

COMMON NAME	SCIENTIFIC NAME	LIFE CYCLE[1]	MAX HT.	WATER NEEDS[2]	PLANT COMMENTS
Early Season Blooming Species					
Antelope horns milkweed[4, 5]	*Asclepias asperula* ssp. *capricornu*	P	2′	M	Monarch butterfly host plant
Cream wild indigo[3]	*Baptisia bracteata*	P	2′	L	Legume; host plant for numerous butterflies and skippers
Prairie penstemon	*Penstemon cobaea*	P	2′	L	Tolerates a variety of soil conditions
Prairie spiderwort[4]	*Tradescantia occidentalis*	P	2′	L	Drought tolerant; will grow in partial shade
Scarlet globemallow	*Sphaeralcea coccinea*	P	1′	L	*Sphaeralcea* spp. are drought tolerant
Mid Season Blooming Species					
Narrowleaf coneflower	*Echinacea angustifolia*	P	3′	L	A key nectar source for skippers
Blanketflower[4]	*Gaillardia pulchella*	A, B, P	2′	L	Establishes easily from seed
Lemon beebalm	*Monarda citriodora*	A, B, P	2′	L	Hawk moths, hummingbirds, and long-tongued bees (e.g., bumble bees) are common visitors
Mexican hat[4]	*Ratibida columnifera*	P	2′	L	Deer-repellent; long bloom period
Narrowleaf mountain mint[4]	*Pycnanthemum tenuifolium*	P	2′	M	Fragrant foliage
Purple poppy mallow[4]	*Callirhoe involucrata*	P	1′	L	Drought tolerant; long bloom period
White prairie clover[3, 4]	*Dalea candida*	P	2′	L	Legume
Mid–Late Season Blooming Species					
Baldwin's ironweed	*Vernonia baldwinii*	P	5′	L	Tolerates a variety of soil conditions; *Vernonia* spp. attract late summer butterflies and bees
Dotted blazing star[5]	*Liatris punctata*	P	4′	M	*Liatris* spp. support bees and many butterflies—including monarchs, swallowtails, and skippers
Leavenworth's eryngo	*Eryngium leavenworthii*	A	3′	L	Prefers dry, rocky sites; resistant to deer browsing
Wholeleaf rosinweed[4]	*Silphium integrifolium*	P	5′	L	Tolerates a variety of soil conditions; host plant for the Silphium moth
Late Season Blooming Species					
Aromatic aster[4]	*Symphyotrichum oblongifolium*	P	2′	L	Fragrant foliage; host plant for many moths
Azure blue sage	*Salvia azurea*	P	5′	L	Tolerates a variety of soil conditions; fragrant foliage; a host plant for sphinx moths
Giant goldenrod[4, 5]	*Solidago gigantea*	P	6′	M	Very adaptive, can spread via rhizomes; *Solidago* spp. are host plants for 12+ moth species
Maximilian sunflower	*Helianthus maximiliani*	P	8′	L	Spreads easily
Showy goldenrod[4, 5]	*Solidago speciosa*	P	5′	M	*Solidago* spp. are vital for fall-migrating monarchs and pre-hibernation bumble bee queens

Recommended Native Wildflowers for Pollinators *Notes*:

1. Life Cycle abbreviations: P = perennial, A = annual, B = biennial.
2. Water Needs abbreviations: L = low, M = medium, H = high.
3. Legume—rich in nitrogen and attractive to a wide variety of wildlife.
4. Also attracts and supports beneficial insects (e.g., syrphid flies, soldier beetles, and solitary wasps).
5. Important resource for monarchs and other 'milkweed' butterflies (*Danaus* spp.).

Native Grasses and Sedges for Pollinator Seed Mixes

Note: Grasses and sedges should ideally comprise no more than 25% of seed mixes on pollinator sites.

COMMON NAME	SCIENTIFIC NAME	MAX HT.	WATER NEEDS[1]	PLANT COMMENTS[2]
Beaked panicgrass	*Panicum anceps*	2–4′	M	Prefers moist to wet soil; good for grazing
Big bluestem	*Andropogon gerardii*	8′	M	Can be aggressive at high seeding rates
Broomsedge bluestem	*Andropogon virginicus*	3–5′	L	Tolerates a variety of soil conditions
Fox sedge	*Carex vulpinoidea*	3′	H	Tolerates occasional flooding
Indian grass	*Sorghastrum nutans*	7′	M	Can be aggressive at high seeding rates
Little bluestem	*Schizachyrium scoparium*	3′	L	Drought tolerant; can be aggressive at high seeding rates
Prairie dropseed	*Sporobolus heterolepis*	3′	L	Long-lived but slow to establish from seed
Prairie junegrass	*Koeleria macrantha*	2′	L	Cool-season bunch grass

Native Grasses and Sedges for Pollinator Seed Mixes *Notes*:

1. Water Needs abbreviations: L = low, M = medium, H = high.
2. All species are perennials.

Figure 10 When installing pollinator habitat, individual plant species should be chosen so that there are consistent and adequate floral resources throughout the seasons—a minimum of three species from each blooming period (early, mid, and late season) should be included. Late season floral resources are particularly important to pre-hibernation bumble bee queens and migrating monarch butterflies. Clockwise from top left: blue mistflower (*Conoclinium coelestinum*)[1], Maximilian sunflower (*Helianthus maximiliani*)[2], showy goldenrod (*Solidago speciosa*)[3], aromatic aster (*Symphyotrichum oblongifolium*)[4], wholeleaf rosinweed (*Silphium integrifolium*)[5], and buttonbush (*Cephalanthus occidentalis*)[6], are late blooming plants that support a variety of pollinators from late summer into fall.

(Photographs courtesy of Ken Slade (TexasEagle)[1], Matthew Lee High[2], JanetandPhil[3], Josh*m[4], Peter Gorman[5], and Doug Wertman[6]—via flickr.com.)

Regional Native Seed Vendors and Native Plant Nurseries

Inclusion on this list does not constitute an endorsement. 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.**

Almost Eden (*T*) • Merryville, LA
337-375-2114 • https://almostedenplants.com

Bustani Plant Farm (*T*) • Stillwater, OK
405-372-3379 • www.bustaniplantfarm.com

Far South Nursery (*T*) • Austin TX
512-291-4648 • https://farsouthnursery.com

Grogg's Green Barn (*T*) • Tulsa, OK
918-994-4222 • www.groggsgreenbarn.com

Johnston Seed Company (*S*) • Enid, OK
800-375-4613 • www.jeinc.com

Kaw River Restoration Nurseries (*S&T*) • Baldwin City, KS
608-897-8641 • www.restorationnurseries.com

Lorenz's OK Seeds (*S*) • Okeene, OK
580-822-3655 • www.lorenzsokseedsllc.com

Missouri Wildflowers Nursery (*S&T*) • Jefferson City, MO
573-496-3492 • www.mowildflowers.net

Pine Ridge Gardens (*T*) • London, AR
479-293-4359 • www.pineridgegardens.com

Prairie Pride Plants (*T*) • Wichita, KS
316-258-8237 • http://prairieprideplants.com

Pure Air Natives (*S&T*) • Wentzville, MO
636-357-6433 • www.pureairnatives.com

Vinland Valley Nursery (*T*) • Baldwin City, KS
785-594-2966 • www.vinlandvalleynursery.com

Wright's Nursery (*T*) • Killeen, TX
512-489-2239 • http://wrightstexasnursery.com

Notes: Seeds Only (*S*), Transplants Only (*T*), Seeds & Transplants (*S&T*)

References & Resources

Seed Mix Calculator & Plant Information

Xerces Society Seed Mix Calculator
Develop your own custom pollinator conservation seed mix using this seed rate calculator.
www.xerces.org/pollinators-northeast-region/xerces-seed-mix-calculator

Pollinator Conservation Resource Center
For additional information on pollinator plant lists, conservation guides, pesticide protection, and more.
www.xerces.org/pollinator-resource-center

USDA-NRCS Central Region Seedling Identification Guide for Native Prairie Plants
Many of the plant species recommended in this guide are featured in a series of seedling photos in this downloadable resource.
www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mopmcpu6313.pdf

Site Preparation & Planting Guidelines

Establishing Pollinator Meadows From Seed
These guidelines provide step-by-step instructions for establishing pollinator meadows from seed in areas that range in size from a small backyard garden up to areas around an acre.
www.xerces.org/establishing-pollinator-meadows-from-seed

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.
http://nac.unl.edu/documents/insideagroforestry/vol20issue1.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.
http://vric.ucdavis.edu/pdf/soil_solarization.pdf

Comprehensive Guides

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

Farming with Native Beneficial Insects: Ecological Pest Control Solutions
The newest book from the Xerces Society provides clear, effective, science-based conservation strategies that increase beneficial insect populations on farms through conservation systems.
www.xerces.org/farming-with-native-beneficial-insects

Figure 11 Including native warm-season bunch grasses in pollinator habitat is important—bumble bees often nest among tall grasses. Big bluestem (*Andropogon gerardii*), left, and prairie junegrass (*Koeleria macrantha*), right, are often used in restoration projects.

(Photographs courtesy of Scott Seigfreid, left, and Dave Powell, USDA Forest Service, Bugwood.org, right.)

Aerial Sketch or Map of Farm Conservation Plan:

Notes:

Tree/ Shrub Establishment (612) & Hedgerow Planting (422) for Pollinators: Oklahoma

Practice Installation Job Sheet

Client:	Farm #:	Date:
Field(s):	Tract #:	Planned by:
Client Conservation Objectives:		

Purpose

This Practice Installation Job Sheet documents the process of establishing nectar and pollen habitat for bees in the form of linear plantings of flowering trees and shrubs. Other natural resources may also benefit, depending on your conservation objectives and the integration of this habitat with other conservation practices. Installation shall be in accordance with these requirements and any attached drawings. **No changes are to be made without prior approval from the technical specialist who approved the installation plan.** For detailed instructions on each step in this Job Sheet, please see the *Tree/ Shrub Establishment (612) & Hedgerow Planting (422) for Pollinators Installation Guide: Oklahoma.*

Key Site Characteristics

Risk of pesticide drift on site? ☐ **Low to high** ☐ **Very low to none**

Weeds: weed pressure, and primary weed species of concern:

_____

Site history: historic and current plant cover, past use of land, pre-emergent herbicide use, compaction, etc.:

_____

Soils and habitat: soil texture (coarse to fine), drainage, and moisture level:

_____

Irrigation: availability and method (necessary if transplants are to be used):

_____

Other concerns or conservation goals that may affect plant choice or site preparation and planting:

_____

Plant Selection: Native Flowering Trees and Shrubs

See the Appendix in the Installation Guide for recommended species

Early Spring Blooming Species	Mid to Late Spring Blooming Species	Summer and Fall Blooming Species
(No.____) _____	(No.____) _____	(No.____) _____
(No.____) _____	(No.____) _____	(No.____) _____
(No.____) _____	(No.____) _____	(No.____) _____
(No.____) _____	(No.____) _____	(No.____) _____
(No.____) _____	(No.____) _____	(No.____) _____

Note any woody or herbaceous species established from transplants here:

_____

Note: Hedgerows and windbreaks can also include herbaceous wildflowers as an understory feature, or as linear strip plantings running alongside the row of shrubs. For suggested wildflowers, see the Appendix in the *Tree/ Shrub Establishment (612) & Hedgerow Planting (422) for Pollinators Installation Guide: Oklahoma*.

Note herbaceous species being established here:

Site Preparation Method

Choose an option and note any adjustments.

☐ Mowing ☐ Herbicide ☐ Solarization

Adjustments:

Planting Method

See Tree/ Shrub Establishment (612) & Hedgerow Planting (422) for Pollinators Installation Guide: Oklahoma

Adjustments:

Maintenance During Establishment

Choose all options that apply and note any adjustments.

☐ Spot-spraying weeds with herbicide
☐ Grass-specific or other selective herbicide
☐ Managing irrigation
☐ Mowing/ string-trimming
☐ Hand-weeding and/ or hoeing
☐ Other:_____

Adjustments:

Long Term Site Operations and Maintenance

Control herbivores as needed, but remove plant guards or other materials that could impede plant growth as soon as possible after establishment. In most cases, irrigation of transplants is no longer required by the end of the second growing season after planting. Maintain the long-term plant diversity of pollinator habitat by re-planting or re-seeding as necessary.

Finally, after establishment, no more than 30% of the habitat area should be mowed, grazed, or burned in any one year to ensure sufficient undisturbed refuge areas for pollinators and other wildlife. Continue to protect habitat from pesticide applications and drift (especially insecticides and bee-toxic fungicides). Herbicide spot-treatments and hand-weeding may be used to control noxious or invasive plants.

Check Out and Certification Requirements

I certify that the above Design and Installation requirements (circle one) *have* / *have not* been met in accordance with the criteria of the Conservation Practice(s) 422 / 612. The _____ acres of this practice installed on the locations covered by this job sheet were installed on the date(s) of _____.

Signature of Designated Conservationist or Technical Service Provider *Date*