



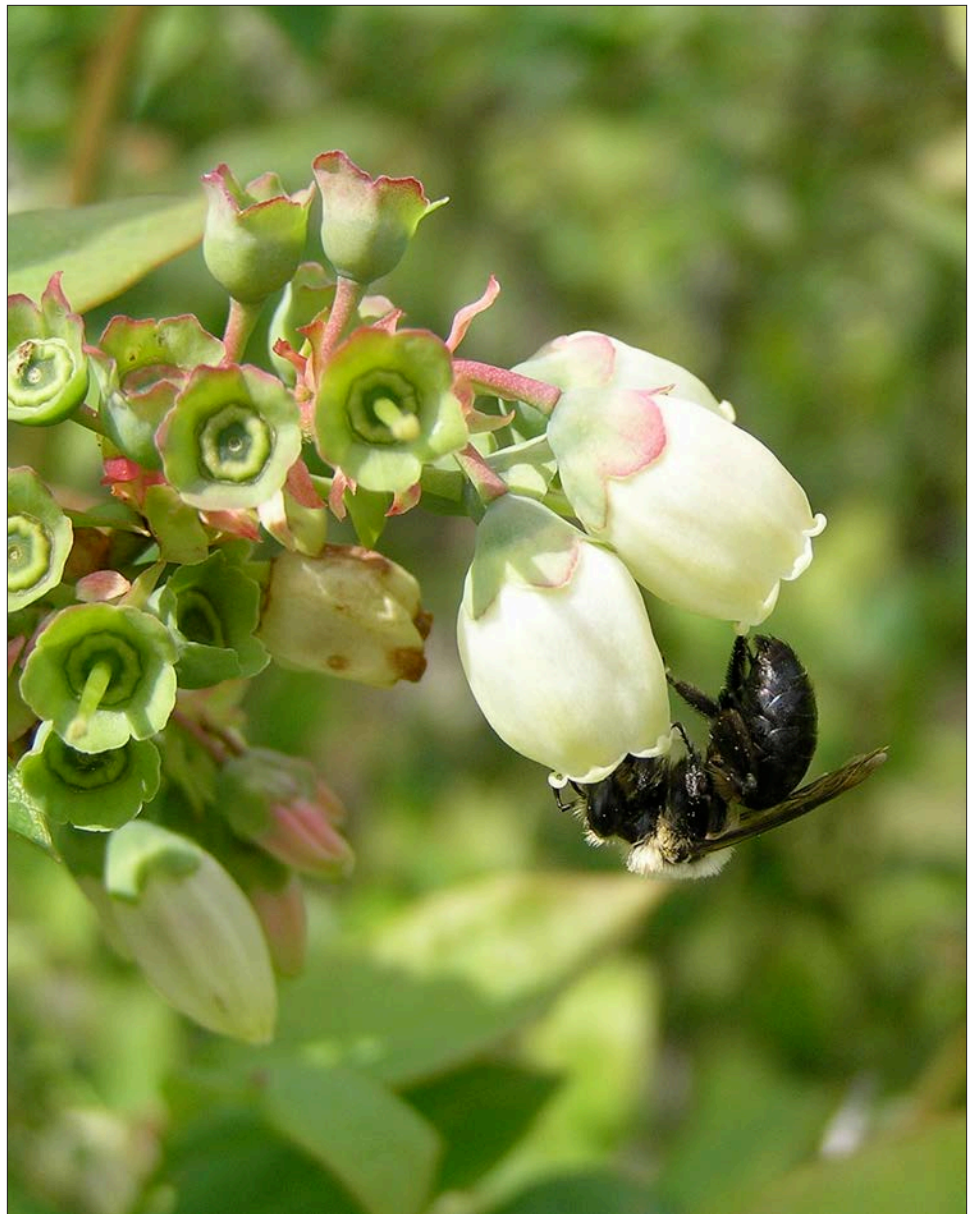
THE XERCES SOCIETY
FOR INVERTEBRATE CONSERVATION



Hedgerow Planting (422) for Pollinators

Pennsylvania

Installation Guide & Job Sheet



November 2014

The Xerces Society for
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Authors

This guide was written in November 2012 by Mace Vaughan, Eric Mäder, Jessa Kay Cruz, Jolie Goldenetz-Dollar, Kelly Gill, and Brianna Borders of the Xerces Society for Invertebrate Conservation. Please contact Mace Vaughan (mace@xerces.org) to improve this publication.

Revised edition

Updated in November 2014 by Mace Vaughan, Kelly Gill, Eric Lee-Mäder, Emily Krafft, and Sara Morris of the Xerces Society.

Editing and layout

Sara Morris, The Xerces Society.

Photographs

Cover: Mining bee (*Andrena* spp.) foraging on highbush blueberry (*Vaccinium corymbosum*). Below: Carpenter bee on sumac (*Rhus* spp.). (Photographs by Nancy Lee Adamson, The Xerces Society.)

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628 NE Broadway Ste. 200 , Portland, OR 97232
tel 503.232.6639 • fax 503.233.6794 • www.xerces.org

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The Xerces Society for Invertebrate Conservation is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Established in 1971, the Society is at the forefront of invertebrate protection, harnessing the knowledge of scientists and enthusiasm of citizens to implement conservation programs worldwide. The Society uses advocacy, education, and applied research to promote invertebrate conservation.

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Hedgerow Planting (422) for Pollinators: Pennsylvania

Pennsylvania

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 Implementation Requirements/ 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 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 Hedgerow plantings for pollinators can serve other functions, such as habitat for wildlife or beneficial insects. The pollinator habitat featured below includes a diverse mix of native forbs, grasses, trees, and shrubs—providing a variety of forage and nesting sites for native bees and wildlife throughout the year.



(Photograph by Kelly Gill, The Xerces Society.)

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 Pennsylvania.

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, see *Conservation Cover (327) for Pollinators Installation Guide and Job Sheet: Pennsylvania*.

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 sides of the hedgerow).

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 hedgerow plants can become established with less competition for sunlight and water.



(Photograph by Ed Vaughn.)



(Photograph courtesy of the Oregon NRCS.)

Field stones are sometimes added to hedgerow berms as well, adding additional height and structure.

Table 1 **Site Preparation Methods**

METHOD: MOWING OR STRIP TILLAGE	
Where to Use <ul style="list-style-type: none"> • Where weed pressure is low • Areas with a low risk of erosion • Areas accessible to mowing or tilling equipment 	Timing <ul style="list-style-type: none"> • Total time: 1 month • Begin: Any time • Plant: Any time
Basic Instructions: <ol style="list-style-type: none"> 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 lightly harrow the strip to create a clean surface for installing transplants. 	
METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE	
Where to Use <ul style="list-style-type: none"> • Where weed pressure is high • 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: 1+ month(s) • Begin: Any time • Plant: Any time
Basic Instructions: <ol style="list-style-type: none"> 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. <p>NOTE: <i>Do not till.</i> 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 herbicides must be acceptable to OMRI for organic operations; or, if not, used outside of certified ground <u>AND</u> approved by an organic certifier.</p>	
METHOD: SOLARIZATION	
Where to Use <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Total time: 6+ months • Begin: Spring • Plant: Fall to winter
Basic Instructions: <ol style="list-style-type: none"> 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. <p>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.</p>	

Figure 3 Native bee foraging on white meadowsweet (*Spiraea alba*). A mid- to late-spring blooming shrub, white meadowsweet attracts a variety of pollinators and beneficial insects—particularly beetles and solitary wasps.



Photograph courtesy of rockerBOO, 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, 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. Approximately 70% of North American native bee species nest in the ground, making the undisturbed ground beneath hedgerows potential nest sites. As landscape fabric can deter bees from accessing the soil, hedgerows 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, 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 *Conservation Cover (327) for Pollinators Installation Guide and Job Sheet: Pennsylvania*.

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



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



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

Planting Method Photos

Figure 5 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.



(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 hedgerows 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 *Conservation Cover (327) for Pollinators Installation Guide and Job Sheet: Pennsylvania*. 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 hedgerow 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 or 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. 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.

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. 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 thicker hedgerow structure and fills in gaps where other shrubs may have died. 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 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 native bees—such as bumble bees—emerge very early in the spring, which is why it is essential to include plants that bloom early in the season. From left to right: eastern redbud (*Cercis canadensis*)¹, American holly (*Ilex opaca*)², and pussy willow (*Salix discolor*)³ bloom in early to mid-spring.



(Photographs courtesy of Martin LaBar¹, Phillip Pendley², and Kristin Shoemaker³—via flickr.com.)

Appendix: Recommended Plants, Sources, and References

Recommended Native Hedgerow Plants

COMMON NAME	SCIENTIFIC NAME	MATURE HEIGHT	WATER NEEDS ¹	PLANT COMMENTS
Early Spring Blooming Species				
Allegheny serviceberry ^{2,3,4}	<i>Amelanchier laevis</i>	15–25'	M	Edible fruit—rich in iron and copper
Black willow ^{5,6}	<i>Salix nigra</i>	30–60'	H	Dioecious; highly variable depending on conditions
Eastern redbud ^{5,7}	<i>Cercis canadensis</i>	15–30'	L–M	Henry's elfin and lo moth host plant; a source of nesting material for leafcutter bees
Fragrant sumac ^{4,6}	<i>Rhus aromatica</i>	6–12'	L	Dioecious; excellent nectar source for butterflies
Pussy willow ⁶	<i>Salix discolor</i>	15'	M–H	Dioecious
Red maple ⁵	<i>Acer rubrum</i>	40–60'	H	Excellent early resource; foliage may be toxic to cattle
Mid to Late Spring Blooming Species				
Allegheny blackberry ^{2,3,4}	<i>Rubus allegheniensis</i>	3–6'	M	Pithy stems provide nesting sites for bees; edible fruit
American holly ^{5,6,8}	<i>Ilex opaca</i>	15–30'	L–M	Dioecious; good honey bee forage; fruit toxic; slow growing
American plum ^{2,3,4}	<i>Prunus americana</i>	15–30'	M	Edible fruit
Beach plum ^{2,3,4}	<i>Prunus maritima</i> var. <i>maritima</i>	6–18'	M	Edible fruit—foliage and seeds can be toxic to livestock and children
Black cherry ^{2,3,4,7}	<i>Prunus serotina</i> var. <i>serotina</i>	25–110'	M	Edible fruit—foliage and seeds can be toxic to livestock and children; fast growing
Black chokeberry ^{3,4}	<i>Aronia melanocarpa</i>	3–12'	M	Edible fruit; tolerates flooding
Black huckleberry ^{3,4}	<i>Gaylussacia baccata</i>	1–2'	L	Edible fruit; valuable resource to wildlife
Black locust ^{4,5,6,7,9}	<i>Robinia pseudoacacia</i>	30–60'	L–M	Dioecious; legume; potentially weedy; excellent for erosion control
Blackgum ^{4,5,6}	<i>Nyssa sylvatica</i>	60–80'	H	Primarily dioecious; good honey bee forage
Blue huckleberry ^{3,4}	<i>Gaylussacia frondosa</i>	6'	M–H	Edible fruit; spreads via rhizome
Canadian serviceberry ^{2,3,4}	<i>Amelanchier canadensis</i>	6–20'+	M	Edible fruit
Chinquapin ^{3,4}	<i>Castanea pumila</i>	20'	L	Edible fruit; excellent for disturbed sites; susceptible to chestnut blight
Chokecherry ^{2,3,4,7}	<i>Prunus virginiana</i>	20–30'	M	Edible fruit—foliage and seeds can be toxic to livestock and children; tolerates shade
Cockspur hawthorn ^{2,4}	<i>Crataegus crus-galli</i>	20–30'	L	Adaptable; host plant for 25+ species of moths; attracts pollinators and songbirds
Common ninebark ⁴	<i>Physocarpus opulifolius</i>	3–10'	L	Adaptable; host plant for 25+ species of moths; drought tolerant; disease resistant
Common persimmon ^{3,4,6}	<i>Diospyros virginiana</i>	15–75'	M	Dioecious; edible fruit; highly variable depending on conditions
Common winterberry ^{4,5,6,8}	<i>Ilex verticillata</i>	5–15'	H	Dioecious; good honey bee forage; fruit toxic
Cucumber-tree ⁴	<i>Magnolia acuminata</i>	50–75'	H	Highly variable depending on conditions
Downy hawthorn ^{2,4}	<i>Crataegus mollis</i>	20–40'	H	Extremely variable; susceptible to leaf diseases
False indigo bush ⁹	<i>Amorpha fruticosa</i>	3–10'	L–M	Legume; host plant for southern dogface, gray hairstreak, and silver-spotted skipper; considered weedy in some riparian areas; highly variable
Grayleaf red raspberry ^{2,3,4}	<i>Rubus idaeus</i> ssp. <i>strigosus</i>	3–6'	L	Edible fruit
Highbush blueberry ^{3,4,5}	<i>Vaccinium corymbosum</i>	6–12'	M–H	Edible fruit; showy flowers and foliage
Inkberry ^{4,5,6,8}	<i>Ilex glabra</i>	5–10'	H	Dioecious; good honey bee forage; tolerates flooding; toxic if ingested
Lowbush blueberry ^{3,4}	<i>Vaccinium angustifolium</i>	0.5–2'	M	Edible fruit

(continued on next page)

Recommended Native Hedgerow Plants *continued*

COMMON NAME	SCIENTIFIC NAME	MATURE HEIGHT	WATER NEEDS ¹	PLANT COMMENTS
Mid to Late Spring Blooming Species <i>continued</i>				
Pasture rose ^{2,3,4}	<i>Rosa carolina</i>	5'	L	Edible fruit—rose hips high in vitamins (C, E, and K)
Purple-flowering raspberry ^{4,7}	<i>Rubus odoratus</i>	3–6'	M	Thornless
Red chokeberry ^{3,4}	<i>Photinia pyrifolia</i>	6–12'	H	Edible fruit; showy foliage and fruit
Running serviceberry ^{2,3,4}	<i>Amelanchier stolonifera</i>	3–6'	M	Edible fruit; drought tolerant
Sand cherry ^{3,4,7}	<i>Prunus pumila</i>	6'	L	Edible fruit; numerous varieties available
Silky willow ⁶	<i>Salix sericea</i>	12'	H	Dioecious—male plants most useful to pollinators; host plant to the Acadian hairstreak
Sugar maple ^{2,4,5}	<i>Acer saccharum</i>	80–120'	M	Good honey bee forage; alternative host for apple maggot
Sweet crab apple ^{3,4}	<i>Malus coronaria</i>	20–30'	M	Edible fruit; susceptible to rust
Tulip tree ^{4,5}	<i>Liriodendron tulipifera</i>	80–120'	H	Abundant nectar and pollen
Umbrella-tree ^{4,5}	<i>Magnolia tripetala</i>	15–45'	M	Good honey bee forage; showy flowers and fruit
Washington hawthorn ^{2,3,4}	<i>Crataegus phaenopyrum</i>	30'	M	Edible fruit; showy foliage and fruit
White meadowsweet ⁴	<i>Spiraea alba</i>	3–6'	H	Produces small, pod-like fruit
Winged sumac ^{3,4,5,6}	<i>Rhus copallinum</i>	20–35'	L	Dioecious; edible fruit— used for lemonade-like drink; drought and pest resistant; late winter resource for wildlife; thrives in disturbed sites
Early to Mid Summer Blooming Species				
American basswood ^{4,5}	<i>Tilia americana</i>	60–80'	M	Good honey bee forage; disease and pest susceptible
American mountain ash ^{2,4}	<i>Sorbus americana</i>	15–30'	H	Variable depending on conditions; showy berries
Buttonbush ^{4,5}	<i>Cephalanthus occidentalis</i>	6–12'	H	Excellent mid-summer nectar and pollen source; will survive periodic flooding; foliage may be toxic if ingested
Devil's walkingstick ^{3,4,5}	<i>Aralia spinosa</i>	12–20'	H	Good honey bee forage; make sure to use <u>native</u> species, can become aggressive; edible fruit
New Jersey tea ^{4,5}	<i>Ceanothus americanus</i>	4'	M	Extremely adaptable; nitrogen-fixing; attractive to deer; slow growing
Northern catalpa ^{5,7}	<i>Catalpa speciosa</i>	75–85'	L	Good honey bee forage; considered weedy in some areas
Staghorn sumac ^{4,6}	<i>Rhus typhina</i>	15–30'	L	Dioecious
Steeplebush	<i>Spiraea tomentosa</i>	3–6'	M	Very attractive to butterflies
Swamp rose ^{3,4,5}	<i>Rosa palustris</i>	6–8'	H	Edible fruit—rose hips high in vitamins (C, E, and K)
Sweetbay ^{4,5,8}	<i>Magnolia virginiana</i>	12–20'	H	Eastern tiger swallowtail host plant

Recommended Native Hedgerow Plants for Pollinators Notes:

1. Water Needs abbreviations: L = low, M = medium, H = high.
2. Alternative host for fire blight.
3. Edible—fruit safe for human consumption.
4. Support birds and other wildlife with fruit and nesting materials/ sites.
5. Abundant nectar and/ or pollen—an excellent resource for bees and other pollinators.
6. Dioecious—pollen-producing (male) and nectar-producing (female) flowers found on separate plants. Male plants sometimes documented to provide more important resources for brood-rearing bees. Only female plants produce fruit.
7. Potential host for BMSB—*Host Plants of the Brown Marmorated Stink Bug in the U.S.* A publication of the Brown Marmorated Stink Bug IPM Working Group in conjunction with the Northeastern IPM Center: www.stopbmsb.org/where-is-bmsb/host-plants/
8. Evergreen.
9. Legume-rich in nitrogen and attractive to a wide variety of wildlife.

Recommended Plants for a Hedgerow Near an Orchard**

COMMON NAME	SCIENTIFIC NAME	MATURE HEIGHT	WATER NEEDS ¹	BLOOM TIME ²
Fragrant sumac	<i>Rhus aromatica</i>	6–12'	L	Early–mid spring
Pussy willow	<i>Salix discolor</i>	15'	M–H	Early–mid spring
Red maple	<i>Acer rubrum</i>	40–60'	H	Early–mid spring
American holly	<i>Ilex opaca</i>	15–30'	L–M	Mid–late spring
Common ninebark	<i>Physocarpus opulifolius</i>	3–10'	L	Mid–late spring
Red chokeberry	<i>Photinia pyrifolia</i>	6–12'	H	Mid–late spring
White meadowsweet	<i>Spiraea alba</i>	3–6'	H	Mid–late spring
False indigo bush	<i>Amorpha fruticosa</i>	3–10'	L–M	Late spring
Buttonbush	<i>Cephalanthus occidentalis</i>	6–12'	H	Early–mid summer
New Jersey tea	<i>Ceanothus americanus</i>	4'	M	Early–mid summer

Recommended Plants for a Hedgerow Near an Orchard** Notes:

1. Water Needs abbreviations: L = low, M = medium, H = high.
2. See *Recommended Native Hedgerow Plants* on p. 9–10 for additional information.

** These plants are not alternate hosts for fire blight, BMSB, or other orchard pests. Table 2 is adapted from *Managing Northeast Apple Orchards for Pollinators and Other Beneficial Insects through Integrated Pest Management*.

Figure 9 When installing pollinator habitat, it's important to include floral resources that will bloom later in the season, after the peak bloom period for many other pollinator plants and crops. Clockwise from top left: buttonbush (*Cephalanthus occidentalis*), white meadowsweet (*Spiraea alba*), staghorn sumac (*Rhus typhina*), purple-flowering raspberry (*Rubus odoratus*), New Jersey tea (*Ceanothus americanus*), and swamp rose (*Rosa palustris*).



(Photographs courtesy of Doug Wertman¹, Jon Hayes², rockerBOO^{3,4}, and Peter Gorman⁵—via flickr.com; and by Nancy Lee Adamson, The Xerces Society⁶.)

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.

Arch(E)Wild • Quakertown, PA
855-752-6862 • <http://archewild.com>

Edge of the Woods Native Plant Nursery • Orefield, PA
610-395-2570 • www.edgeofthewoodsnursery.com

Ernst Conservation Seed • Meadville, PA
800-873-3321 • www.ernstseed.com

Heartwood Nursery • Felton, PA
717-993-5230 • www.heartwoodnurseryinc.com

Mid Atlantic Natives • New Freedom, PA
717-227-0924 • www.midatlanticnatives.com

Natural Landscapes • West Grove, PA
610-869-3788 • www.naturallandscapesnursery.com

North Creek Nurseries • Landenberg, PA
610-255-0100 • www.northcreeknurseries.com

Northeast Natives & Perennials • Quakertown, PA
215-901-5552 • www.nenativesandperennials.com

Octoraro Native Plant Nursery • Kirkwood, PA
717-529-3160 • www.octoraro.com

Pinelands Nursery • Columbus, NJ
609-291-9486 • www.pinelandsnursery.com

Redbud Native Plant Nursery • Glen Mills, PA
610-358-4330 • www.redbudnativeplantnursery.com

Sugarbush Nursery • Mohnton, PA
610-856-0998 • www.sugarbushnursery.com

Sylva Native Nursery and Seed • Glen Rock, PA
717-227-0486 • www.sylvanative.com

Wetland Supply Company • Apollo, PA
724-727-3772 • www.wetlandsupply.com

Yellow Springs Farm Native Plant Nursery • Chester Springs, PA
610-827-2014 • www.yellowspringsfarm.com

Notes: *Wholesale only

References & Resources

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

Xerces Society Seed Mix Calculator

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

www.xerces.org/pollinators-northeast-region/xerces-seed-mix-calculator/

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/

Figure 10 Many fruit-bearing species of trees and shrubs are excellent pollinator plants that can also provide fruit for wildlife—or harvest—later in the season. Highbush blueberry (*Vaccinium corymbosum*), left, and lowbush blueberry (*Vaccinium angustifolium*), right, can hum with pollinators—such as bumble bees (*Bombus* spp.)—in the spring.



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



(Photograph courtesy of Rob Routledge, Sault College, Bugwood.org.)

Hedgerow Planting (422) for Pollinators: Pennsylvania

Implementation Requirements/ Job Sheet

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

Purpose

These Implementation Requirements/ 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 *Hedgerow Planting (422) for Pollinators Installation Guide: Pennsylvania*.

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 Shrubs and Subshrubs

See the Appendix in the Installation Guide for recommended species

Early Spring Blooming Species	Mid to Late Spring Blooming Species	Early to Mid Summer 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 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 *Conservation Cover (327) for Pollinators Installation Guide: Pennsylvania*.

Note herbaceous species being established here:

Site Preparation Method

Choose an option and note any adjustments.

Mowing

Herbicide

Solarization

Adjustments:

Planting Method

See *Hedgerow Planting (422) for Pollinators Installation Guide and Job Sheet: Pennsylvania*

Adjustments:

Maintenance During Establishment

Choose all options that apply and note any adjustments.

Spot-spraying weeds with herbicide

Mowing/ string-trimming

Grass-specific or other selective herbicide

Hand-weeding and/ or hoeing

Managing irrigation

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 422. 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