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Conservation Cover (327) for Pollinators

# Pennsylvania

## Installation Guide and Job Sheet



November 2014

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The Xerces Society for  
Invertebrate Conservation

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## Revised edition

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

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## Photographs

Cover: Eastern tiger swallowtail (*Papilio glaucus*) and bumble bee (*Bombus* spp.) on common milkweed (*Asclepias syriaca*). Photograph courtesy of Tom Potterfield, flickr.com. Below: bumble bee on wild bergamot (*Monarda fistulosa*). Photograph by Eric Lee-Mäder, The Xerces Society.

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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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# Conservation Cover (327) for Pollinators: Pennsylvania

## Installation Guide

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### Purpose

These instructions provide in-depth guidance on how to install nectar and pollen habitat for bees in the form of wildflower meadow plantings. 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 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.

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### Key Site Characteristics

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

- **Pesticide Drift:** Habitat must be protected from pesticides (especially insecticides and bee-toxic fungicides and herbicides). Only sites with no to very low risk for pesticide drift should be established as new habitat. This includes some pesticides approved for use on organic farms.
- **Accessibility:** New habitat should be accessible to equipment for planting and maintenance operations.
- **Sunlight:** Most wildflowers and native shrubs grow best in full sunlight.
- **Slope:** Steep or highly erodible sites should not be disturbed. For re-vegetating such sites, consider Critical Area Planting (342) or other suitable Practice Standards.
- **Weed Pressure:** Areas with high weed pressure will take more time and effort to prepare for planting. It is also important to note the primary weed composition. Knowing the most abundant weed species on site, their reproductive methods, and whether they are grass or broadleaf, perennial or annual, and woody or herbaceous, will help significantly in planning for site preparation and follow-up weed management during establishment.
- **Site History:** Factors such as past plant cover (e.g., weeds, crops, grass sod, and/ or native plants), use of pre-emergent herbicides or other chemicals, and soil compaction can affect plant establishment. It is also important to know if sites may have poor drainage or may flood, as such conditions make habitat establishment more difficult and require a plant mix adapted for 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:** Establishing plants from plugs, pots, or bare root will require irrigation. Irrigation is generally not needed for plantings established from seed.
- **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.

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**Figure 1** Pollinator plantings can serve other functions, such as habitat for wildlife or beneficial insects. This diverse pollinator meadow provides a variety of forage and nesting sites for native bees, beneficial insects, and more.



(Photograph by Kelly Gill, The Xerces Society.)

## Plant Selection

**Native Plants:** Plant species selection should be limited to plants providing pollen- and nectar-rich forage resources for bees. The inclusion of warm-season bunch grasses is appropriate at a low percentage of the mix by seed per square foot (e.g., 25% or less), but may limit options for use of grass-selective herbicides if grass weeds are a primary concern. The Appendix provides specific seed mixes for dry and wetland sites, and a master list of acceptable plants for 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 seasons. In order to achieve this goal, a minimum of three species from each blooming period (early, mid, and late season), should be included. Plant mix composition (i.e., percent of each species) can be designed to complement adjacent crop bloom time or other abundant species in the landscape, with more plants blooming immediately before and after adjacent crops.

**Non-Native Plants:** Plant selection should focus on pollen- and nectar-rich native plants, but non-invasive, non-native plants may be used when cost and/ or availability are limiting factors. Please see the Appendix for acceptable non-native plants. Non-native plants, such as buckwheat or clover, may be planted as part of a crop rotation or in a perennial crop understory using the Cover Crop Practice Standard (340), to increase the value of crop fields to pollinators.

**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 weedy borders 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 for 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. Site preparation methods are provided in **Table 1**.

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

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

Previously cropped lands—those that have been cultivated for several years—are generally lower in weed pressure.

**Figure 2** The site on top was prepared with a single glyphosate treatment, leaving a significant stubble layer and persisting weedy grasses. It is not ready for planting. The site on bottom was treated for an entire growing season with repeated glyphosate treatments (applied whenever new weeds appeared). The stubble has been removed with a flail mower and it is ready for planting. Neither site has been cultivated.



(Photographs by Brianna Borders, The Xerces Society.)

Table 1 **Site Preparation Methods**

| METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE   |   |
|--|---|
| <b>Where to Use</b> <ul style="list-style-type: none"> <li>• Conventional farms and organic farms*</li> <li>• Areas with a low risk of erosion</li> <li>• Areas accessible to sprayer</li> </ul>   | <b>Timing</b> <ul style="list-style-type: none"> <li>• Total time: 6+ months</li> <li>• Begin: Early spring after the first weed growth</li> <li>• Plant: Fall</li> </ul> |
| <b>Basic Instructions:</b> <ol style="list-style-type: none"> <li>1. Mow existing thatch as needed before beginning herbicide treatments to expose new weed growth to the herbicide spray.</li> <li>2. Apply a non-selective, non-persistent herbicide as per label as soon as weeds are actively growing in the early spring.</li> <li>3. Repeat herbicide applications throughout the spring, summer, and early fall as needed (whenever emerging weed seedlings reach 4–6”).</li> <li>4. For any herbicide-resistant weeds, mow the area to prevent flowering and seed development as necessary.</li> <li>5. Plant pollinator seed mix (and any transplants) in the fall after a hard frost, waiting at least 72 hours after the last herbicide treatment. Refer to the Planting Methods section of this document for specific recommendations.</li> </ol> <p><i>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).</i></p> <p><i>* Choice of herbicide must be acceptable to OMRI for organic operations; or, if not, used outside of certified ground <u>AND</u> approved by an organic certifier.</i></p> |   |
| METHOD: SOLARIZATION   |   |
| <b>Where to Use</b> <ul style="list-style-type: none"> <li>• Conventional farms and organic farms</li> <li>• Areas with a low risk of erosion</li> <li>• Areas accessible to mowing equipment</li> <li>• Locations with full sun</li> </ul>  | <b>Timing</b> <ul style="list-style-type: none"> <li>• Total time: 6+ months</li> <li>• Begin: Spring</li> <li>• Plant: Fall</li> </ul>                                   |
| <b>Basic Instructions:</b> <ol style="list-style-type: none"> <li>1. Mow, rake, or lightly harrow and smooth the site in the spring (raking off debris, if necessary).</li> <li>2. After smoothing the site, 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.</li> <li>3. Remove the plastic in early fall before the weather cools and the area beneath the plastic is recolonized by nearby rhizomatous weeds.</li> <li>4. Immediately plant the pollinator seed mix. Refer to Planting Methods section of this document for specific bed preparation recommendations.</li> </ol> <p><i>NOTE: Solarization may not be as effective in years when summer sun or high temperatures are 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.</i></p>   |   |



Sweat bee (*Agapostemon* spp.) on purple coneflower (*Echinacea purpurea*). Photograph by Nancy Lee Adamson, The Xerces Society.

## Planting Methods

Recommended planting methods are site-specific. Factors such as equipment availability should be taken into consideration. Installing and maintaining habitat should fit into general farm management practices as much as possible. Pre-project site conditions, especially weed competition, should be addressed prior to planting. **Table 2** (below) covers several planting options.

**Seeding Wildflowers:** Planting from seed can be a lower-cost way to establish wildflowers. Seeding requires **excellent site preparation** to reduce weed pressure since weed control options are limited when the wildflowers start to germinate. **Most native wildflowers are best planted in the late fall.**

Grain drills, unlike native seed drills, are usually not designed to handle wildflower seeds, many of which are very small. However, with simple modifications, most types of grass-seed planters or granulated fertilizer spreaders can be used with good results. **Table 2** outlines several possible seeding methods.

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

**Figure 3** Below, an established pollinator meadow in early summer. Dominant flowers in bloom are black-eyed Susans (*Rudbeckia hirta*), purple coneflower (*Echinacea purpurea*), and wild bergamot (*Monarda fistulosa*).



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

**Table 2** **Methods for Planting Wildflower Seed**

| METHOD: BROADCAST SEEDERS OR HAND-BROADCASTING (THROWING SEED)   |   |
|--|---|
| <p><b>Pros</b></p> <ul style="list-style-type: none"> <li>• Inexpensive</li> <li>• Easy to use</li> <li>• Can often accommodate poorly-cleaned seed</li> <li>• Many models and sizes of broadcasters are commonly available, including hand-held crank and larger tractor- or ATV-mounted models</li> </ul>  | <p><b>Cons</b></p> <ul style="list-style-type: none"> <li>• Requires a smooth seed bed</li> <li>• Seed should be pressed into the soil after planting</li> <li>• Difficult to calibrate</li> <li>• Some models of broadcast seeders cannot accommodate large seeds</li> </ul> |
| <p><b>Basic Instructions:</b></p> <ol style="list-style-type: none"> <li>1. Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seed bed. The soil surface can be <b>lightly</b> hand-raked or harrowed to break up crusted surfaces, but <b>do not cultivate the site (cultivation will bring up additional weed seed)</b>.</li> <li>2. Seeds of similar sizes can be mixed together and bulked up with an inert carrier ingredient such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or polenta (fine cornmeal). Use two to three parts bulking agent for each part seed by volume. These inert carriers ensure even seed distribution in the mix, provide visual feedback on where seed has been thrown, and make calibration easier.</li> <li>3. The broadcast-seeding equipment used should have a flow gate that closes down small enough to provide a slow, steady flow of your smallest wildflower seed. Models with an internal agitator are also preferred. Planting should begin with the flow gate set to the narrowest opening, to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed can be planted separately with the flow gate set to a wider opening.</li> <li>4. For small sites (e.g., less than one to two acres), seed can also be hand broadcast (similar to scattering poultry feed). When hand-broadcasting, divide the seed into at least two batches, bulk the seed mix with an inert carrier, and sow each batch separately (scatter the first batch evenly over the site while walking in parallel passes across the site, and then walk in passes perpendicular to the previous passes to scatter the second batch) to ensure seed is evenly distributed.</li> <li>5. Regardless of how it is broadcast, do not cover the seed with soil after planting. A water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker should be used to press the seed into the soil surface. Natural precipitation or light overhead irrigation can also help ensure good seed-soil contact. Floating row-cover can be used, if necessary, to protect seeds and small seedlings against predation.</li> </ol> |   |

**METHOD: DROP SEEDERS OR FERTILIZER SPREADERS (DROPPING SEED)**

|  |   |
|--|---|
| <p><b>Pros</b></p> <ul style="list-style-type: none"> <li>• Inexpensive</li> <li>• Easy to use</li> <li>• Even seed dispersal</li> <li>• Can accommodate both large and small seed</li> <li>• Many models and sizes are commonly available (hand-powered turf grass seeders are most common, but larger tractor-drawn “pasture-seeder” models also exist)</li> </ul> | <p><b>Cons</b></p> <ul style="list-style-type: none"> <li>• Requires a smooth, level seed bed</li> <li>• Seed should be pressed into the soil after planting</li> <li>• Hand-powered models are time consuming for large areas (over ½ acre)</li> <li>• Calibration requires trial and error</li> </ul> |
|--|---|

**Basic Instructions:**

1. Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seed bed. The soil surface can be **lightly** hand-raked or harrowed to break up crusted surfaces, but **do not cultivate the site (cultivation will bring up additional weed seed)**.
2. Seed of similar sizes can be mixed together and bulked up with an inert carrier ingredient such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or polenta (fine cornmeal). Use two to three parts bulking agent for each part seed by volume. These inert carriers ensure even seed distribution in the mix, provide visual feedback on where seed has been thrown, and make calibration easier. Planting should begin with the drop gate set to the narrowest opening, to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed can be planted separately with the drop gate set to a wider opening.
3. Do not cover the seed after planting. A water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker should be used to press the seed into the soil surface. Natural precipitation or light overhead irrigation can also help ensure good seed-soil contact. Floating row-cover can be used, if necessary, to protect seeds and small seedlings against predation.

**METHOD: NATIVE SEED DRILLS (DRILLING SEED)**

|   |  |
|---|--|
| <p><b>Pros</b></p> <ul style="list-style-type: none"> <li>• Convenient for planting large areas</li> <li>• Seed box agitators and depth controls are designed specifically for planting small and fluffy native seeds at optimal rate and depth</li> <li>• Can plant into a light stubble layer</li> <li>• Seeds are planted in even rows, allowing for easier seedling recognition</li> <li>• Does not require seed to be pressed into soil surface after planting (e.g., cultipacking)</li> </ul> | <p><b>Cons</b></p> <ul style="list-style-type: none"> <li>• Expensive and not readily available in some areas</li> <li>• Difficult to calibrate for small areas (less than one acre)</li> <li>• Requires a tractor and an experienced operator to set planting controls</li> <li>• Seed with a lot of chaff can clog delivery tubes</li> </ul> |
|---|--|

**Basic Instructions:**

4. Plant only when the soil is dry enough to prevent sticking to the coulters. Under wet conditions, small seed is likely to stick to mud-caked parts of the drill, rather than the ground.
5. Keep seed separated by species until ready to plant. Prior to planting, seed should be organized into batches of large smooth seed, small smooth seed, and tufted seed that does not flow easily. Loosely fill seed boxes (do not compact seed into them) with the appropriate seed batch for each box. Seed quantities that do not cover the agitator should be planted using some other method, since the drill is difficult to calibrate for small volumes of seed.
6. As a general rule, the planting depth for a particular seed should be no more than 1.5x its diameter. To achieve this for most wildflower seed, set the depth controls to plant no deeper than ¼" (consult with the seed vendor for specific guidelines on very sandy soils). Small wildflower seed should be planted on the soil surface. Stop periodically to check planting depth.
7. Operate the drill at less than 5 mph, stopping periodically to check for any clogging of planting tubes (usually observed as a seedbox that is remaining full). Clogging is most common with fluffy seed, or seed with a lot of chaff. Avoid backing up the drill as it will likely cause clogging.

For information on native seed drill calibration, see NRCS publication: [www.plant-materials.nrcs.usda.gov/pubs/mipmctn10591.pdf](http://www.plant-materials.nrcs.usda.gov/pubs/mipmctn10591.pdf)



Bumble bee on sneezeweed (*Helenium autumnale*). (Photograph by Kelly Gill, The Xerces Society.)

## METHOD: TRANSPLANTING FORBS AND WOODY PLANTS

### Pros

- Provides mature nectar and pollen resources more quickly
- Does not require specialized planting equipment (except for large trees)
- Preferred for plants with limited seed availability, which are expensive or difficult to establish from seed
- Transplants can be established more easily in weedy sites with adequate mulching

### Cons

- Expensive and time consuming for large areas
- Transplants typically require irrigation during establishment

### Basic Instructions:

1. Regular shovels are adequate for transplanting most container stock. However, dibble sticks or mechanical transplanters are sometimes helpful for plug-planting. Power augers and mechanical tree spades can be helpful for larger plants.
2. 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.
3. Transplanting can occur any time the ground can be worked, but should be timed to avoid prolonged periods of hot, dry, or windy weather. Regardless of when planting occurs, however, the transplants should be irrigated thoroughly immediately after planting. Holes for plants can be dug and pre-irrigated prior to planting as well. Follow-up irrigation is dependent upon weather and specific site conditions, but generally even native and drought tolerant plants should be irrigated with at least 1" of water per week (except during natural rain events), for the first two years after establishment. Long, deep watering is best to encourage deep root system development and shallow irrigation should be avoided. Drip irrigation is useful, and other methods that allow for deep watering can be successful. It is advisable to irrigate at the base of plants and avoid overhead irrigation that would encourage weed growth. Once plants are established, irrigation should be removed or greatly decreased. Non-native plants may require more frequent irrigation, and may still require supplemental irrigation once established.
4. 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.
5. In cases where rodent damage may occur, below-ground wire cages are recommended. Similarly, plant guards may be needed to protect plants from above ground browsing or antler damage by deer. **Newly-planted areas should be clearly marked to protect them from herbicides or other disturbances.**
6. Mulching is recommended to reduce weed competition and to retain moisture during the establishment phase. Recommended materials include wood chips, bark dust, weed-free straw (e.g., rice straw), nut shells, grape-seed pumice, or other regionally appropriate mulch materials that contain **no** viable seeds.

**Figure 3** Transplanting forbs and shrubs may be preferred for plants that are difficult to establish from seed, have limited availability, or take longer to mature. Milkweed (*Asclepias* spp.)—the monarch butterfly's host plant—is a slow-growing perennial that usually blooms in its second year. As milkweed is an important resource for both monarch butterflies and native bees, mature milkweed transplants may be recommended for certain restoration projects. From left to right, swamp milkweed (*Asclepias incarnata*), butterfly milkweed (*A. tuberosa*), and common milkweed (*A. syriaca*).



(Photograph by Kelly Gill, The Xerces Society.)



(Photographs courtesy of Tom Potterfield, flickr.com.)





# Planting Method Photos

**Figure 4** For broadcast seeding, seed of **similar size** is mixed together (left). Sand or another inert carrier is added (at a ratio of at least 2:1) and then mixed (middle left), and the mix is divided into separate batches (middle right) for broadcasting in more than one pass (to ensure adequate coverage). When hand-broadcasting seed, walk in perpendicular passes over the entire planting area (right).



(Photographs by Brianna Borders, The Xerces Society.)

**Figure 5** Native wildflower seed should be planted directly on the soil surface (left). After broadcasting, roll the site with a turf roller (middle) or cultipacker (right).



(Photographs by Brianna Borders, The Xerces Society.)

(Photograph courtesy of Regina Hirsch, University of Wisconsin.)

**Figure 6** Hand-crank “belly grinder” type seeders (left) are inexpensive and can broadcast seed more evenly than hand-scattering on larger sites. Similarly, lawn fertilizer spreaders (right) are another commonly available tool for broadcasting seed. In both cases, models with internal agitators are preferred to prevent clogging. For best results, divide the seed into separate batches, grouping seed of similar sizes for planting together with the flow gate adjusted accordingly.



(Photographs courtesy of the New Hampshire NRCS.)

**Figure 7** Native seed drills are the ideal tool for large planting sites (5+ acres). Typical models can plant in a light stubble layer, have depth controls for optimal seed placement, and have separate seed boxes for different sizes of seed. Such drills need an experienced operator and careful calibration.



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

**Note:** It can be difficult to plant very large and very small seed together in a single seed mix using mechanical broadcasters. Use an inert carrier (such as sand) and walk in at least two perpendicular passes to ensure the most even seed distribution possible.

## Maintenance During Establishment (Short-Term)

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

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

Common weed-management strategies include:

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

**Figure 8** *Short Term:* In the first spring after seeding the previous fall, this planting site is dominated by annual and biennial weeds like wild radish (left). Mowing the site periodically during the first year (ideally as high as mower settings allow) will prevent these short-lived weeds from producing more seed, and allow sunlight to reach the slower-growing natives (middle), which are generally unharmed by the occasional mowing. *Long Term:* Flourishing wildflowers and pollinator habitat in the second year after planting (right).



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



(Photograph courtesy of Don Keirstead, New Hampshire NRCS.)

## 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-seeding or re-planting as necessary.

Wildflower plantings generally need to be managed over time to maintain open, early successional characteristics. The actual management will depend on the size and location of the habitat. Possible management tools/ techniques include

mowing or burning. If mowing is used, be sure all equipment is clean and free of weed seed. Do not mow or burn during critical wildlife nesting seasons (consult your state wildlife biologist for specific guidance). After establishment, no more than 30% of the habitat area should be mowed or burned in any one year to ensure sufficient undisturbed refuge areas for pollinators and other wildlife.

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

**Figure 9** Grow tubes or trunk protectors may help during establishment to reduce browsing by herbivores and trunk damage from mowers or weeding operations (left), but should be removed as soon as possible to avoid impeding plant growth. Most transplants will benefit from 1" of water per week during the first two years of establishment, either from natural rainfall or irrigation, such as drip-irrigation (right).



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



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

**Figure 10** Newly-planted areas should be clearly marked to protect them from herbicides or other disturbances (left). Using signs such as the one on the right can be a useful tool to designate protected pollinator habitat.



(Photograph by Kelly Gill, The Xerces Society.)



**Note:** Due to wildlife safety concerns, we recommend attaching habitat signs to the top hole of the fence post or plugging the top hole with a bolt and nut. Alternatively, posts which do not have holes—such as solid wood stakes—should be used.

# Appendix: Seed Mixes, Plant Lists and Sources, and References

## Sample Seed Mixes

The following sample seed mixes are formulated for a one-acre planting area. For larger areas, increase the rate accordingly. To create custom seed mixes, see recommended species master list on page 13 or the references section for vendors (for established or custom mixes). *Plants listed by first season of bloom, then alphabetically.*

These example seed mixes are formulated for areas with high weed pressure; which 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).

In areas where there is low weed pressure—such as previously cropped lands that have been cultivated for several years—decrease the seed mix by 1/3, for a total of **40 seeds per square foot**.

**Always consult your technical specialist before making adjustments to any seed mix.**

### Example Upland Dry Site Pollinator Seed Mix

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

| COMMON NAME            | SCIENTIFIC NAME                    | % OF MIX    | SEEDS/ FT <sup>2</sup> | LBS/ AC.    | BLOOM TIME |
|------------------------|------------------------------------|-------------|------------------------|-------------|------------|
| Golden Alexanders      | <i>Zizia aurea</i>                 | 1%          | 0.6                    | 0.15        | Early      |
| Wild blue indigo       | <i>Baptisia australis</i>          | 0.2%        | 0.12                   | 0.24        | Early      |
| Ohio spiderwort        | <i>Tradescantia ohioensis</i>      | 2%          | 1.2                    | 0.41        | Early–Mid  |
| Smooth penstemon       | <i>Penstemon digitalis</i>         | 9.8%        | 5.88                   | 0.14        | Early–Mid  |
| Black-eyed Susan       | <i>Rudbeckia hirta</i>             | 1%          | 0.6                    | 0.02        | Mid‡       |
| Butterfly milkweed     | <i>Asclepias tuberosa</i>          | 2%          | 1.2                    | 0.75        | Mid        |
| Common milkweed        | <i>Asclepias syriaca</i>           | 0.5%        | 0.3                    | 0.19        | Mid        |
| Dotted mint            | <i>Monarda punctata</i>            | 13.5%       | 8.1                    | 0.24        | Mid        |
| Partridge pea          | <i>Chamaecrista fasciculata</i>    | 1%          | 0.6                    | 0.4         | Mid (A)    |
| Purple coneflower      | <i>Echinacea purpurea</i>          | 9%          | 5.4                    | 2.03        | Mid        |
| Virginia mountain mint | <i>Pycnanthemum virginiana</i>     | 10%         | 6                      | 0.07        | Mid        |
| Wild bergamot          | <i>Monarda fistulosa</i>           | 15%         | 9                      | 0.31        | Mid        |
| Cup plant              | <i>Silphium perfoliatum</i>        | 0.5%        | 0.3                    | 0.52        | Mid–Late   |
| Marsh blazing star     | <i>Liatris spicata</i>             | 1%          | 0.6                    | 0.26        | Mid–Late   |
| Gray goldenrod         | <i>Solidago nemoralis</i>          | 3%          | 1.8                    | 0.08        | Late       |
| New England aster      | <i>Symphotrichum novae-angliae</i> | 4%          | 2.4                    | 0.1         | Late       |
| Wrinkleleaf goldenrod  | <i>Solidago rugosa</i>             | 3%          | 1.8                    | 0.08        | Late       |
| Big bluestem           | <i>Andropogon gerardii</i>         | 5.5%        | 3.3                    | 1.03        | —          |
| Indian grass           | <i>Sorghastrum nutans</i>          | 5.5%        | 3.3                    | 0.82        | —          |
| Little bluestem        | <i>Schizachyrium scoparium</i>     | 12.5%       | 7.5                    | 1.63        | —          |
| <b>TOTALS</b>          |                                    | <b>100%</b> | <b>60</b>              | <b>9.46</b> |            |

#### Dry Site Pollinator Seed Mix Notes:

1. Bloom Time comments: ‡ = Short-lived biennial, (A) = Annual

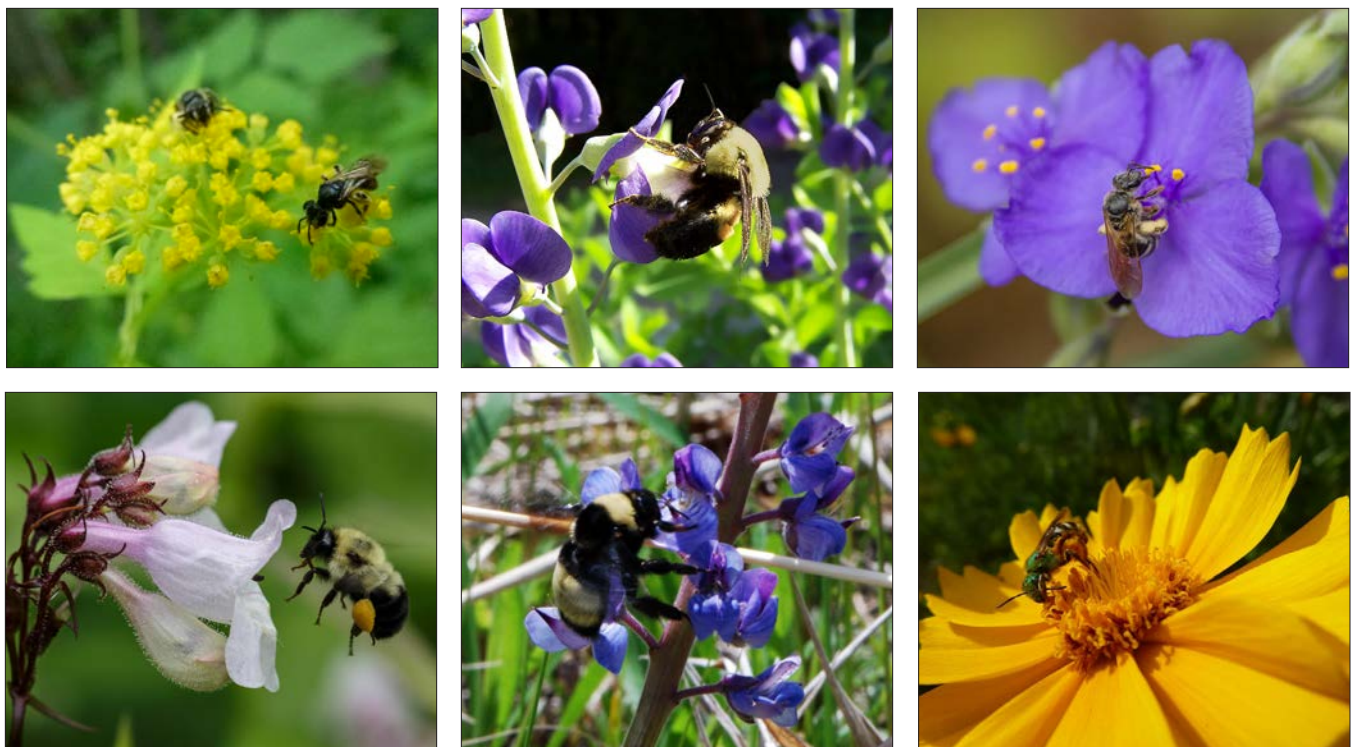
## Example Wetland Pollinator Seed Mix

| COMMON NAME         | SCIENTIFIC NAME                     | % OF MIX    | SEEDS/ FT <sup>2</sup> | LBS/ AC.    | BLOOM TIME |
|---------------------|-------------------------------------|-------------|------------------------|-------------|------------|
| Golden Alexanders   | <i>Zizia aurea</i>                  | 2%          | 1.2                    | 0.3         | Early      |
| Virginia spiderwort | <i>Tradescantia virginiana</i>      | 1%          | 0.6                    | 0.15        | Early–Mid  |
| Black-eyed Susan    | <i>Rudbeckia hirta</i>              | 1%          | 0.6                    | 0.02        | Mid‡       |
| Culver's root       | <i>Veronicastrum virginicum</i>     | 8%          | 4.8                    | 0.03        | Mid        |
| Great blue lobelia  | <i>Lobelia siphilitica</i>          | 8.5%        | 5.1                    | 0.03        | Mid        |
| Purple coneflower   | <i>Echinacea purpurea</i>           | 8%          | 4.8                    | 1.8         | Mid        |
| Swamp milkweed      | <i>Asclepias incarnata</i>          | 1%          | 0.6                    | 0.37        | Mid        |
| Wild bergamot       | <i>Monarda fistulosa</i>            | 8%          | 4.8                    | 0.16        | Mid        |
| Blue vervain        | <i>Verbena hastata</i>              | 8%          | 4.8                    | 0.14        | Mid–Late   |
| Boneset             | <i>Eupatorium perfoliatum</i>       | 8.5%        | 5.1                    | 0.11        | Mid–Late   |
| Cup plant           | <i>Silphium perfoliatum</i>         | 0.5%        | 0.3                    | 0.52        | Mid–Late   |
| Joe Pye weed        | <i>Eutrochium fistulosum</i>        | 6%          | 3.6                    | 0.23        | Mid–Late   |
| Sneezeweed          | <i>Helenium autumnale</i>           | 4%          | 2.4                    | 0.05        | Mid–Late   |
| Wingstem            | <i>Verbesina alternifolia</i>       | 2%          | 1.2                    | 0.36        | Mid–Late   |
| Grassleaf goldenrod | <i>Euthamia graminifolia</i>        | 5%          | 3                      | 0.02        | Late       |
| New England aster   | <i>Symphyotrichum novae-angliae</i> | 5%          | 3                      | 0.12        | Late       |
| New York ironweed   | <i>Vernonia noveboracensis</i>      | 3%          | 1.8                    | 0.26        | Late       |
| Big bluestem        | <i>Andropogon gerardii</i>          | 9%          | 5.4                    | 1.63        | —          |
| Fox sedge           | <i>Carex vulpinoidea</i>            | 6.5%        | 3.9                    | 0.13        | —          |
| Tussock sedge       | <i>Carex stricta</i>                | 5%          | 3                      | 0.07        | —          |
| <b>TOTALS</b>       |                                     | <b>100%</b> | <b>60</b>              | <b>6.52</b> |            |

### Wetland Site Pollinator Seed Mix Notes:

1. Bloom Time comments: ‡ = Short-lived biennial.

**Figure 11** Many species of native bees emerge in early spring, which is why it is essential to include plants that bloom early in the season. Clockwise from top left: golden Alexanders (*Zizia aurea*)<sup>1</sup>, wild blue indigo (*Baptisia australis*)<sup>2</sup>, spiderwort (*Tradescantia* spp.)<sup>3</sup>, lanceleaf coreopsis (*Coreopsis lanceolata*)<sup>4</sup>, wild lupine (*Lupinus perennis*)<sup>5</sup>, and smooth penstemon (*Penstemon digitalis*)<sup>6</sup>.



(Photographs by Nancy Lee Adamson, The Xerces Society<sup>1,4</sup>; and courtesy of Mike<sup>2</sup>, Brett Whaley<sup>3</sup>, Joshua Mayer<sup>5</sup>, and Tom Potterfield<sup>6</sup>—via flickr.com.)

# Master Plant Lists

## Recommended Native Wildflowers for Pollinators

| COMMON NAME                              | SCIENTIFIC NAME                    | LIFE CYCLE <sup>1</sup> | MAX HT. | WATER NEEDS <sup>2</sup> | PLANT COMMENTS                                       |
|--|------------------------------------|-------------------------|---------|--------------------------|--|
| <b>Early Season Blooming Species</b>     |                                    |                         |         |                          |  |
| Golden Alexanders                        | <i>Zizia aurea</i>                 | P                       | 3'      | H                        | Adapted to disturbance; spreads by rhizomes          |
| Wild blue indigo <sup>3</sup>            | <i>Baptisia australis</i>          | P                       | 5'      | M                        | Legume; slow to establish                            |
| Wild lupine <sup>3</sup>                 | <i>Lupinus perennis</i>            | P                       | 2'      | L                        | Legume; prefers sandy soil; Karner blue host plant   |
| <b>Early–Mid Season Blooming Species</b> |                                    |                         |         |                          |  |
| Lanceleaf coreopsis                      | <i>Coreopsis lanceolata</i>        | P                       | 2'      | L                        | Low-cost seed  |
| Smooth penstemon                         | <i>Penstemon digitalis</i>         | P                       | 2'      | M                        | Establishes quickly                                  |
| Spiderwort                               | <i>Tradescantia</i> spp.           | P                       | 2'      | M                        | Multiple species available                           |
| Wild beardtongue                         | <i>Penstemon hirsutus</i>          | P                       | 2'      | L                        |  |
| <b>Mid Season Blooming Species</b>       |                                    |                         |         |                          |  |
| Black-eyed Susan                         | <i>Rudbeckia hirta</i>             | B, P                    | 2–3'    | L                        | Short-lived  |
| Butterfly milkweed <sup>4</sup>          | <i>Asclepias tuberosa</i>          | P                       | 3'      | L                        | Monarch butterfly host plant; prefers sandy soil     |
| Common milkweed <sup>4</sup>             | <i>Asclepias syriaca</i>           | P                       | 6'      | M                        | Monarch butterfly host plant                         |
| Culver's root                            | <i>Veronicastrum virginicum</i>    | P                       | 5'      | H                        |  |
| Dotted mint                              | <i>Monarda punctata</i>            | A, B, P                 | 3'      | L                        | Prefers sandy soil; establishes quickly              |
| Great blue lobelia                       | <i>Lobelia siphilitica</i>         | P                       | 3'      | H                        | Prefers part-shade and fertile soil                  |
| Lavender hyssop                          | <i>Agastache foeniculum</i>        | P                       | 5'      | M                        | Establishes quickly                                  |
| Partridge pea <sup>3</sup>               | <i>Chamaecrista fasciculata</i>    | A                       | 2'      | L                        | Legume; favors disturbed sites, butterfly host plant |
| Purple coneflower                        | <i>Echinacea purpurea</i>          | P                       | 4'      | M                        | Establishes quickly                                  |
| Swamp milkweed <sup>4</sup>              | <i>Asclepias incarnata</i>         | P                       | 5'      | M–H                      | Monarch butterfly host plant                         |
| Virginia mountain mint                   | <i>Pycnanthemum virginianum</i>    | P                       | 3'      | M                        |  |
| Wild bergamot                            | <i>Monarda fistulosa</i>           | P                       | 4'      | M                        | Establishes quickly                                  |
| <b>Mid–Late Season Blooming Species</b>  |                                    |                         |         |                          |  |
| Blue mistflower                          | <i>Conoclinium coelestinum</i>     | P                       | 2'      | M                        | Can be weedy   |
| Blue vervain                             | <i>Verbena hastata</i>             | P                       | 5'      | H                        |  |
| Boneset                                  | <i>Eupatorium perfoliatum</i>      | P                       | 5'      | H                        | Prefers fertile soil                                 |
| Cup plant                                | <i>Silphium perfoliatum</i>        | P                       | 8'      | M                        | Occasionally aggressive; stems provide nest sites    |
| Field thistle                            | <i>Cirsium discolor</i>            | B, P                    | 6'      | M                        | Short-lived; not aggressive ( <u>native</u> species) |
| Joe Pye weed                             | <i>Eutrochium fistulosum</i>       | P                       | 7'      | H                        | Prefers part-shade and fertile soil                  |
| Marsh blazing star                       | <i>Liatris spicata</i>             | P                       | 4'      | M                        | Prefers sandy soils                                  |
| Purple giant hyssop                      | <i>Agastache scrophulariifolia</i> | P                       | 5'      | M                        |  |
| Sneezeweed                               | <i>Helenium autumnale</i>          | P                       | 2–5'    | H                        | Prefers moist, fertile soil; toxic to livestock      |
| Wild golden glow                         | <i>Rudbeckia laciniata</i>         | P                       | 7'      | H                        | Spreads by rhizomes; tolerates occasional flooding   |
| Wingstem                                 | <i>Verbesina alternifolia</i>      | P                       | 6'      | M–H                      | Prefers moist soils                                  |
| Yarrow                                   | <i>Achillea millefolium</i>        | P                       | 2'      | L                        | Very aggressive; spreads by rhizomes                 |



Sweat bee on partridge pea (*Chamaecrista fasciculata*). (Photograph courtesy of Tom Potterfield, flickr.com.)

| COMMON NAME                         | SCIENTIFIC NAME                     | LIFE CYCLE <sup>1</sup> | MAX HT. | WATER NEEDS <sup>2</sup> | PLANT COMMENTS  |
|-------------------------------------|-------------------------------------|-------------------------|---------|--------------------------|---|
| <b>Late Season Blooming Species</b> |                                     |                         |         |                          |   |
| Bottle gentian                      | <i>Gentiana andrewsii</i>           | P                       | 2'      | M                        | Not drought tolerant; difficult to establish from seed, establish from transplants                  |
| Calico aster                        | <i>Symphyotrichum lateriflorum</i>  | P                       | 3'      | M                        | Prefers part-shade  |
| Grassleaf goldenrod                 | <i>Euthamia graminifolia</i>        | P                       | 3'      | H                        | Drought tolerant  |
| Gray goldenrod <sup>5</sup>         | <i>Solidago nemoralis</i>           | P                       | 2'      | L                        | Tolerates a variety of soil conditions; smaller and less aggressive than other <i>Solidago</i> spp. |
| New England aster                   | <i>Symphyotrichum novae-angliae</i> | P                       | 6'      | M                        | Can be aggressive   |
| New York ironweed                   | <i>Vernonia noveboracensis</i>      | P                       | 7'      | H                        | Tolerates a variety of soil conditions; prefers moist soils but will tolerate regular to dry sites  |
| Showy goldenrod <sup>5</sup>        | <i>Solidago speciosa</i>            | P                       | 5'      | M                        | Prefers part-shade; can be aggressive in moist soils  |
| Wrinkleleaf goldenrod <sup>5</sup>  | <i>Solidago rugosa</i>              | P                       | 4'      | M                        | Highly variable in appearance   |

**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. Milkweed (*Asclepias* spp.) attract and support an incredible range of pollinators and beneficial insects; most species tolerate clay soils and wet or dry conditions.
5. Goldenrods (*Solidago* spp.), shown below, are vital for fall-migrating monarchs and pre-hibernation bumble bee queens; host plants for 12+ moth species.

**Figure 12** When designing a custom plant list, individual 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, in addition to many other pollinators. Clockwise, from top left: cup plant (*Silphium perfoliatum*)<sup>1</sup>, New England aster (*Symphyotrichum novae-angliae*)<sup>2</sup>, wild golden glow (*Rudbeckia laciniata*)<sup>3</sup>, New York ironweed (*Vernonia noveboracensis*)<sup>4</sup>, goldenrod (*Solidago* spp.)<sup>5</sup>, and marsh blazing star (*Liatris spicata*)<sup>6</sup>, are late blooming plants that support pollinators from late summer into fall.



(Photographs courtesy of Tom Potterfield<sup>1,3</sup>, Peter Gorman<sup>2</sup>, Chesapeake Conservation Landscaping Council<sup>3</sup>, Henry T. McLin<sup>5</sup>, and Ken Slade (TexasEagle)<sup>6</sup>—via flickr.com.)

## 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 <sup>1</sup> | PLANT COMMENTS <sup>2</sup>             |
|--------------------|--------------------------------|---------|--------------------------|---|
| Big bluestem       | <i>Andropogon gerardii</i>     | 8'      | M                        | Can be aggressive at high seeding rates |
| Fox sedge          | <i>Carex vulpinoidea</i>       | 3'      | H                        | Tolerates occasional flooding           |
| Indian grass       | <i>Sorghastrum nutans</i>      | 7'      | M                        | Can be aggressive at high seeding rates |
| Little bluestem    | <i>Schizachyrium scoparium</i> | 3'      | L                        | Considered a weed in cranberry bogs     |
| Pennsylvania sedge | <i>Carex pensylvanica</i>      | 1.5'    | M                        | Prefers part-shade                      |
| Tussock sedge      | <i>Carex stricta</i>           | 4'      | H                        | Tolerates occasional flooding           |

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

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

## Non-Native Annual Plants for Insectary Meadows and Cover Crops

| COMMON NAME                              | SCIENTIFIC NAME               | LIFE CYCLE <sup>1</sup> | MAX HT. | WATER NEEDS <sup>2</sup> | PLANT COMMENTS  |
|--|-------------------------------|-------------------------|---------|--------------------------|---|
| <b>Early Season Blooming Species</b>     |                               |                         |         |                          |   |
| Alsike clover <sup>3</sup>               | <i>Trifolium hybridum</i>     | A                       | 2'      | H                        | Legume  |
| Crimson clover <sup>3</sup>              | <i>Trifolium incarnatum</i>   | A                       | 1.5'    | M                        | Legume; not freeze-tolerant, spring-seeded in cold climates |
| Hairy vetch <sup>3</sup>                 | <i>Vicia villosa</i>          | A                       | 1.5'    | M                        | Legume ; fall-seeded; aggressive at high seeding rates      |
| Lacy phacelia                            | <i>Phacelia tanacetifolia</i> | A                       | 2'      | L                        | Not freeze-tolerant, spring-seeded in cold climates         |
| <b>Early–Mid Season Blooming Species</b> |                               |                         |         |                          |   |
| Blue flax                                | <i>Linum perenne</i>          | P                       | 2'      | Med                      |   |
| Red clover <sup>3</sup>                  | <i>Trifolium pratense</i>     | P                       | 1'      | M                        | Legume; aggressive at high seeding rates                    |
| <b>Mid Season Blooming Species</b>       |                               |                         |         |                          |   |
| Alfalfa                                  | <i>Medicago sativa</i>        | P                       | 2'      | M                        | Susceptible to frost heaving                                |
| Blanketflower                            | <i>Gaillardia aristata</i>    | P                       | 2'      | L                        | Low cost seed; thrives in disturbed sites                   |
| Borage                                   | <i>Borago officinalis</i>     | A                       | 1.5'    | M                        | Not freeze-tolerant, spring-seeded in cold climates         |
| Buckwheat                                | <i>Fagopyrum esculentum</i>   | A                       | 2'      | M                        |   |
| Mexican hat                              | <i>Ratibida columnifera</i>   | P                       | 3'      | M                        |   |
| Yellow sweet clover <sup>3</sup>         | <i>Melilotus officinalis</i>  | B                       | 5'      | M                        | Legume  |
| <b>Mid–Late Season Blooming Species</b>  |                               |                         |         |                          |   |
| Common sunflower                         | <i>Helianthus annuus</i>      | A                       | 9'      | M                        |   |
| Cosmos                                   | <i>Cosmos bipinnatus</i>      | A                       | 5'      | M                        | Select single-petal varieties for pollinators               |

### Non-Native Annual Plants for Insectary Meadows and Cover Crops 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.



Little bluestem (*Schizachyrium scoparium*) intermixed with native wildflowers in a Pennsylvania pollinator meadow. (Photograph courtesy of Tom Potterfield, 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.

**Aquascapes Unlimited Inc.** (T) • Pipersville, PA  
215-766-8986 • [www.aquascapesunlimited.com](http://www.aquascapesunlimited.com)

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

**Bowman's Hill Wildflower Preserve** (S&T) • New Hope, PA  
215-862-1846 • [www.bhwp.org](http://www.bhwp.org)

**Edge of the Woods Native Plant Nursery** (T) • Orefield, PA  
610-395-2570 • [www.edgeofthewoodsnursery.com](http://www.edgeofthewoodsnursery.com)

**Ernst Conservation Seed** (S&T) • Meadville, PA  
800-873-3321 • [www.ernstseed.com](http://www.ernstseed.com)

**Green Light Plants, Organic Nursery** (T) • Landenberg, PA  
610-633-7637 • [www.greenlightplants.com](http://www.greenlightplants.com)

**Mid Atlantic Natives** (T) • New Freedom, PA  
717-227-0924 • [www.midatlanticnatives.com](http://www.midatlanticnatives.com)

**North Creek Nurseries** (T) • Landenberg, PA  
610-255-0100 • [www.northcreeknurseries.com](http://www.northcreeknurseries.com)

**Northeast Natives & Perennials** (T) • Quakertown, PA  
215-901-5552 • [www.nenativesandperennials.com](http://www.nenativesandperennials.com)

**Octoraro Native Plant Nursery** (T) • Kirkwood, PA  
717-529-3160 • [www.octoraro.com](http://www.octoraro.com)

**Pinelands Nursery** (S&T)\* • Columbus, NJ  
609-291-9486 • [www.pinelandsnursery.com](http://www.pinelandsnursery.com)

**Redbud Native Plant Nursery** (T) • Glen Mills, PA  
610-358-4300 • [www.redbudnativeplantnursery.com](http://www.redbudnativeplantnursery.com)

**Sugarbush Nursery** (T) • Mohnton, PA  
610-856-0998 • [www.sugarbushnursery.com](http://www.sugarbushnursery.com)

**Sylva Native Nursery and Seed** (S&T) • Glen Rock, PA  
717-227-0486 • [www.sylvanative.com](http://www.sylvanative.com)

**Wetland Supply Company** (S&T) • Apollo, PA  
724-727-3772 • <http://wetlandssupply.com>

**Yellow Springs Farm Native Plant Nursery** (T) • Chester Springs, PA  
610-827-2014 • [www.yellowspringsfarm.com](http://www.yellowspringsfarm.com)

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

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## References & Resources

### SEED MIX CALCULATOR & ADDITIONAL RESOURCES

#### 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/](http://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](http://www.xerces.org/pollinator-resource-center)

#### *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/](http://www.xerces.org/announcing-the-publication-of-attracting-native-pollinators/)

### SEEDLING IDENTIFICATION

#### 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](http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mopmcpu6313.pdf)

#### Bonestroo Prairie Seedling and Seeding Evaluation Guide

Many of the plant species recommended in this guide are featured in a series of seedling photos in this resource. The publication also includes guidelines for assessing establishment success of seeded native grass and wildflower plots.

[www.prairiemoon.com/books/identification-guides/prairie-seedling-and-seeding-evaluation-guide.html](http://www.prairiemoon.com/books/identification-guides/prairie-seedling-and-seeding-evaluation-guide.html)

### WEED IDENTIFICATION & CONTROL

#### Weeds of the Northeast

This PLANTS database collection highlights key weeds of the Northeast with species-level PLANTS profiles. Inclusion on the list is based upon references in multiple weed science publications.

[www.plants.usda.gov/java/invasiveOne?pubID=NEAST](http://www.plants.usda.gov/java/invasiveOne?pubID=NEAST)

#### Directory for Invasive Weeds of the Northeast

This database is an ongoing project at the Penn State Department of Plant Science to compile a comprehensive list of web-based information related to invasive weeds for the northeastern United States.

<http://extension.psu.edu/pests/weeds/invasive-plants>

### SITE PREPARATION & PLANTING GUIDELINES

#### 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](http://vric.ucdavis.edu/pdf/soil_solarization.pdf)

#### Seed Quality, Seed Technology, and Drill Calibration

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

[www.plant-materials.nrcs.usda.gov/pubs/wapmctn6331.pdf](http://www.plant-materials.nrcs.usda.gov/pubs/wapmctn6331.pdf)



# Conservation Cover (327) 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 wildflower meadow plantings. 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 *Conservation Cover (327) 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:  High weed pressure  Low weed pressure

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: Wildflower Seed Mix

See the Appendix in the Installation Guide

Dry Site Pollinator Seed Mix  Wetland Pollinator Seed Mix  Custom Seed Mix

Note any species substitutions here or attach copy of custom seed mix:

Recommended seeding rate (weed pressure):  60 seeds per square foot (high)  40 seeds per square foot (low)

Transplants may be preferred when seed is not available, weed pressure is high, or when a particular species is difficult to establish by seed. Transplanting can be most cost-effective when using plug plants. Conservation Cover can also include woody plants. See *Hedgerow Planting (422) for Pollinators Installation Guide and Job Sheet: Pennsylvania* for suggested woody plants.

Note any woody or herbaceous species established from transplants here:

## Site Preparation Method

Choose an option and note any adjustments.

- Herbicide  Solarization
- Severe weed pressure? (If so, an additional year of site prep or the use of transplants should be considered. See the *Installation Guide* for information on assessing weed pressure.)

Adjustments:

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## Planting Method

Choose all options that apply and note any adjustments.

- Broadcasting: by machine or hand  Native seed drill
- Drop-seeding  Transplants

Adjustments:

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## 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:

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## 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-seeding or re-planting 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 areas for pollinators and other wildlife. Do not mow or burn during critical wildlife nesting seasons (consult your state wildlife biologist for specific guidance). 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 327. The \_\_\_\_\_ acres of this practice installed on the locations covered by this job sheet were installed on the date(s) of \_\_\_\_\_.

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Signature of Designated Conservationist or Technical Service Provider

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Date