

Conservation Cover for Pollinators in Pennsylvania



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 *Conservation Cover for Pollinators Job Sheet* (included later in 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.

KEY SITE CHARACTERISTICS

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

- **Pesticide Drift:** Habitat must be protected from pesticides (especially from bee toxic insecticides and fungicides). Only sites with no to very low risk for insecticide drift should be established as new habitat.
- **Accessibility:** New habitat should be accessible to equipment for planting and maintenance operations.
- **Sunlight:** Most wildflowers and native shrubs grow best in full sunlight.
- **Slope:** Steep or highly erodible sites should not be disturbed. To revegetate such sites, consider Critical Area Planting (342) or other suitable Practice Standards.
- **Weed Pressure:** Areas with high weed pressure will take more time and effort to prepare for planting. It is also important to note the primary weed composition. Knowing the most abundant weed species on site and whether they are grass or broadleaf, perennial or annual, and woody or herbaceous will help significantly in planning for site preparation and follow up weed management during establishment.
- **Site History:** Factors such as past plant cover (e.g. weeds, crops, 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 different mixture of plant species.

- **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 usually requires 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. These factors can influence plant choice and/or design.

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. 20% or less), but may limit options for use of grass selective herbicides if grass weeds are a primary concern. The Appendix provides seed mixes for dry and wet sites, and a master list of acceptable plants for various locations and/or environments 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 mix composition (i.e. percent of each species) can be designed to complement adjacent crop bloom time or other abundant species in the landscape.

Non-Native Plants: Plant selection should focus on pollen and nectar rich native plants, but 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, also may be planted as part of a crop rotation or in a perennial crop understory using the Cover Crop Practice Standard (340), to increase value of crop fields to pollinators.

Alternate Pest or Disease Hosts: It is rare for native pollinator plants to serve as alternate hosts for crop pests or diseases, but selected plants should be cross-referenced for specific crop pest or disease associations.

SITE PREPARATION

Site preparation is **one of the most important** and often inadequately addressed components of project success. It is also a process that may require more than one season of effort to reduce competition from invasive, noxious or undesirable non-native plants prior to planting. *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 the table below.

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:

1. Persistent year-round cover of undesirable plants (covering the entire surface of the site);
2. Sites where weeds have been actively growing (and producing seed) for multiple years;
3. 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.

Photos: The site on the left was prepared with a single glyphosate treatment, leaving a significant stubble layer and un-killed weedy grasses. It is not ready for planting. The site on the right was treated for an entire growing season with repeated glyphosate treatments (applied whenever new weeds appeared). The stubble has been removed with a flail mower and it is ready for planting. Neither site has been cultivated. (Photos by Brianna Borders, Xerces Society).



TABLE 1: SITE PREPARATION METHODS

METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE	
Where to Use: <ul style="list-style-type: none"> • Conventional farms • Areas with a low risk of erosion • Areas accessible to sprayer 	Timing: <ul style="list-style-type: none"> • Total time: 6+ months • Begin: Early Spring after the first weed growth • Plant: Fall
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 soon as weeds are actively growing in early Spring. 3. Repeat herbicide applications throughout the Spring, Summer, and early Fall, as needed (whenever emerging weed seedlings reach 4 – 6 inches). 4. For any herbicide-resistant weeds, mow the area to prevent flowering and seed development as necessary. 5. Plant pollinator seed mix (and any transplants) in the fall, waiting at least 72 hours after the last herbicide treatment. Refer to the Planting Methods section of this document for specific recommendations. <p>NOTE: <i>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>	

METHOD: SOLARIZATION	
Where to Use: <ul style="list-style-type: none"> • Organic and conventional farms • Areas with a low risk of erosion • Areas accessible to mowing equipment • Locations with full sun 	Timing: <ul style="list-style-type: none"> • Total time: 6+ months • Begin: Spring • Plant: Fall
Basic Instructions: <ol style="list-style-type: none"> 1. Mow, rake or harrow and smooth the site in the Spring (raking off debris, if necessary). 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. 3. Remove the plastic in late-Fall and immediately plant the pollinator seed mix. Refer to Planting Methods section of this document for specific bed preparation recommendations. <p>NOTE: Solarization may not be as effective in years when summer sun or high temperatures are limited. Do not till. Avoid any major ground disturbance that may bring up additional weed seed. An additional year of site preparation is recommended if weed pressure is particularly high.</p>	

PLANTING METHODS

Recommended planting methods are site-specific. 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. Below are 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. The table below outlines several possible seeding methods.

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

TABLE 2. METHODS FOR PLANTING WILDFLOWER SEED

METHOD: BROADCAST SEEDERS OR HAND BROADCASTING (THROWING SEED)	
Pros: <ul style="list-style-type: none"> • Inexpensive • Easy to use • Can often accommodate poorly cleaned seed • Many models and sizes of broadcasters are commonly available, including hand-held crank and larger tractor or ATV-mounted models 	Cons: <ul style="list-style-type: none"> • Requires a smooth seed bed • Seed should be pressed into the soil after planting • Difficult to calibrate • Some models of broadcast seeders cannot accommodate large seeds
Basic Instructions: Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seedbed. 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)**.

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 or polenta (fine cornmeal). These inert carriers ensure even seed distribution in the mix, visual feedback on where seed has been thrown, and make calibration easier.

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.

For small sites, 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 (walking in perpendicular passes) to ensure that seed is evenly distributed.

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.

METHOD: DROP SEEDERS OR FERTILIZER SPREADERS (DROPPING SEED)

Pros:

- Inexpensive
- Easy to use
- Even seed dispersal
- Can accommodate both large and small seed
- Many models and sizes are commonly available (Hand-powered turf grass seeders are most common, but larger tractor-drawn “pasture-seeder” models also exist)

Cons:

- Requires a smooth, level seed bed
- Seed should be pressed into the soil after planting
- Hand-powered models are time consuming for large areas (over ½ acre)
- Calibration requires trial and error

Basic Instructions:

Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seedbed. 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)**.

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, or polenta (fine cornmeal) for even seed distribution and ease of calibration. Planting should begin with the drop gate set to the narrowest opening, to allow multiple perpendicular passes over the seed bed for even distribution. Very large seed can be planted separately with the drop gate set to a wider opening.

Do not cover the seed after planting. A water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker should be used to press the seed into the soil surface. Natural precipitation or light overhead irrigation can also help ensure good seed-soil contact. Floating row-cover can be used if necessary to protect seeds and small seedlings against predation.

METHOD: NATIVE SEED DRILLS (DRILLING SEED)

Pros:

- Convenient for planting large areas
- Seed box agitators and depth controls are designed specifically for planting small and fluffy native seeds at optimal rate and depth
- Can plant into a light stubble layer
- Seeds are planted in even rows, allowing for easier seedling recognition
- Does not require seed to be pressed into soil surface after planting (e.g. cultipacking)

Cons:

- Expensive and not readily available in some areas
- Difficult to calibrate for small areas (less than 1 acre)
- Requires a tractor and **an experienced operator** to set planting controls
- Seed with a lot of chaff can clog delivery tubes

Basic Instructions:

Plant only when the soil is dry enough to prevent sticking to the coulters. Under wet conditions, small seed is likely to stick to mud-caked parts of the drill, rather than the ground.

Loosely fill seed boxes, but do not compact seed into them. 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.

For most wildflower species, set depth controls to plant ¼" deep (consult with the seed vendor for specific guidelines on very sandy soils). Stop periodically to check planting depth. Some seed should be observable on or just below the soil surface. As a general rule, planting depth should be equal to 1.5x the diameter of the seed.

Operate the drill at less than 5 mph, stopping to check periodically to 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:
<http://www.plant-materials.nrcs.usda.gov/pubs/mipmctn10591.pdf>.

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, or which are expensive or difficult to establish from seed
- Transplants can be established in weedy sites with adequate mulching

Cons:

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

Basic Instructions:

Regular shovels are adequate for transplanting most container stock. However, dibble sticks are sometimes helpful for plug-planting. Power augurs and mechanical tree spades can be helpful for larger plants.

Plant size at maturity should be considered when planting. Most woody shrubs can be spaced on 4' – 10' centers (depending upon size at maturity), with most herbaceous plants spaced closer on 2' – 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. 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. The timing of follow-up irrigation depends 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 and shallow irrigation should be avoided to encourage deep root system development. Drip irrigation is useful, but other methods that allow for deep watering can be successful. 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.

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 during planting.

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.

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.



Photos: For broadcast seeding, seed of similar size is mixed together (left). Sand or another inert carrier is added (middle), and the mix is divided into separate batches (right) for broadcasting in perpendicular passes over the planting site. (Photos by Brianna Borders, Xerces Society).



Photos: When hand-broadcasting seed, walk in perpendicular passes over the entire planting area (left). Native wildflower seed should be planted directly on the soil surface (middle). After broadcasting, roll the site (right) with a cultipacker or turf roller. (Photos by Brianna Borders, Xerces Society).



Photos: Hand-crank “belly grinder” type seeders (left) are low cost and can broadcast seed more evenly than hand-scattering on larger sites. Similarly, lawn fertilizer spreaders (right) are another commonly available tool for broadcasting seed. (Photos: New Hampshire NRCS).

In both cases, models with internal agitators are preferred to prevent clogging. For best results divide the seed into separate batches, grouping seed of similar sizes for planting together with the flow gate adjusted accordingly. It can be difficult to plant very large and very small seed together in a single seed mix using mechanical broadcasters. Use an inert carrier (such as sand) and walk in at least two perpendicular paths to ensure the most even seed distribution possible.



Photo: (above) 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. (Photo: Jessa Guisse, 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, 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 after planting to help ensure long-term success. Familiarity with the life cycle of weeds will facilitate appropriate timing of management activities. Since young wildflower and weed seedlings may look alike, care should be taken to properly identify weeds before removal.

Common weed-management strategies include:

- **Spot Spraying:** Spot spraying with herbicides can be effective, relatively inexpensive, and require minimal labor, even on larger project areas. Care should be taken that herbicides do not drift or drip onto desirable plant species. Spot spraying is usually performed with a backpack sprayer, 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 when possible (through drip irrigation, for example) to avoid watering nearby weeds.
- **Mowing / String Trimming:** Mowing or string trimming can be utilized to keep weedy species from shading out other plants, and to prevent them from going to seed. Mowing is especially useful when establishing wildflower plots of perennial species. When planted with perennial seed mixes, sites can be mowed regularly (ideally at 6 inches or higher) during the first year after planting to prevent annual and biennial weeds from flowering and producing seed. Perennial wildflowers are slow to establish from seed, and are usually not harmed by incidental mowing in the first year after planting. Mowing can also be used on plots of re-seeding annuals at the end of the growing season to help shatter wildflower seedpods, and to reduce woody plant encroachment. Mowing and string trimming can also be useful around woody transplants to manage nearby weeds.
- **Hand Weeding:** Hand-weeding (including hoeing) can be effective in small areas with moderate weed pressure. Hand-weeding will likely be necessary in forb plots to eliminate broadleaf weeds during the first few seasons.
- **Mechanical Weed Control:** Mechanical cultivation (e.g. rototilling) can be used to control weeds between linear rows of transplants during the establishment phase. Long-term cultivation however may increase disturbance-favoring weed species.



Photos: In the first Spring after seeding the previous Fall, this planting site is dominated by annual and biennial weeds like wild radish (far left). Mowing the site periodically during the first year (ideally at a height greater than 6 inches) will prevent these short-lived weeds from producing more seed, and allow sunlight to reach the slower-growing natives (left), which are generally unharmed by the occasional mowing.

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, transplants can be removed from irrigation by the end of the second year after planting. Continue to protect habitat from pesticides and herbicides except when necessary to control noxious or invasive plants. On-going herbicide use (spot-treatment), mechanical weed management 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 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.

APPENDIX – SEED MIXES, PLANT LISTS AND SOURCES, AND REFERENCES

SEED MIXES

The following sample seed mixes are formulated for a 1-acre planting area. For larger areas, increase the rate accordingly. To create custom seed mixes, download a seed mix calculator (see link in references).

MESIC (DRY) SITE SEED MIX

Common Name	Scientific Name	% of Mix	Seeds/ Ft ²	Lbs / Acre	Price / Lb	Total Price	Bloom Time
Wild Blue Indigo	<i>Baptisia australis</i>	0.2%	0.12	0.24	\$140	\$33.26	Early Bloom
Golden Alexanders	<i>Zizia aurea</i>	1.0%	0.60	0.17	\$150	\$26.14	Early Bloom
Spiderwort (multiple spp)	<i>Tradescantia spp</i>	2.0%	1.20	0.30	\$280	\$83.64	Early Bloom
Smooth Penstemon	<i>Penstemon digitalis</i>	9.8%	5.88	0.64	\$100	\$64.03	Early Bloom
Common Milkweed	<i>Asclepias syriaca</i>	0.5%	0.30	0.19	\$160	\$29.87	Mid Bloom
Butterfly Milkweed	<i>Asclepias tuberosa</i>	0.5%	0.30	0.19	\$300	\$56.01	Mid Bloom
Purple Coneflower	<i>Echinacea purpurea</i>	9.0%	5.40	2.03	\$30	\$60.83	Mid Bloom
Wild Bergamot	<i>Monarda fistulosa</i>	15.0%	9.00	0.31	\$220	\$69.00	Mid Bloom
Black-Eyed Susan	<i>Rudbeckia hirta</i>	1.0%	0.60	0.02	\$24	\$0.40	Mid Bloom (short-lived)
Partridge Pea	<i>Chamaecrista fasciculata</i>	1.0%	0.60	0.44	\$10	\$4.36	Mid Bloom (annual)
Cupplant	<i>Silphium perfoliatum</i>	3.0%	1.80	0.78	\$50	\$39.20	Mid Bloom
Virginia Mountain Mint (or other Mountain Mint spp.)	<i>Pycnanthemum spp</i>	10.0%	6.00	0.07	\$480	\$32.59	Mid Bloom
Dotted Mint	<i>Monarda punctata</i>	15.0%	9.00	0.27	\$180	\$48.67	Mid Bloom
Rough Blazingstar	<i>Liatris spicata</i>	1.0%	0.60	0.26	\$220	\$57.50	Mid-Late Bloom
Grey Goldenrod	<i>Solidago nemoralis</i>	3.0%	1.80	0.08	\$260	\$20.39	Late Bloom
Wrinkleleaf Goldenrod	<i>Solidago rugosa</i>	3.0%	1.80	0.08	\$260	\$23.39	Late Bloom
New England Aster	<i>Symphotrichum novae-angliae</i>	4.0%	2.40	0.10	\$250	\$23.76	Late Bloom
Little Bluestem	<i>Schizachyrium scoparium</i>	10.0%	6.00	1.31	\$20	\$26.14	*
Big Bluestem	<i>Andropogon gerardii</i>	5.5%	3.30	1.03	\$20	\$20.54	*
Indian Grass	<i>Sorghastrum nutans</i>	5.5%	3.30	0.82	\$20	\$16.43	*
TOTALS		100%	60	9.31		\$733.12	

WETLAND SITE SEED MIX

Common Name	Scientific Name	% of Mix	Seeds/ Ft ²	Lbs / Acre	Price / Lb	Total Price	Bloom Time
Golden Alexanders	<i>Zizia aurea</i>	2.0%	1.20	0.35	\$150	\$52.27	Early Bloom
Virginia Spiderwort (or other Spiderwort spp.)	<i>Tradescantia spp</i>	1.0%	0.60	0.15	\$280	\$41.82	Early-Mid Bloom
Swamp Milkweed	<i>Asclepias incarnata</i>	1.0%	0.60	0.36	\$280	\$101.64	Mid Bloom
Purple Coneflower	<i>Echinacea purpurea</i>	8.0%	4.80	1.80	\$30	\$54.07	Mid Bloom
Blue Lobelia	<i>Lobelia siphilitica</i>	8.5%	5.10	0.03	\$260	\$6.94	Mid Bloom
Wild Bergamot	<i>Monarda fistulosa</i>	8.0%	4.80	0.17	\$220	\$36.80	Mid Bloom
Culver's Root	<i>Veronicastrum virginicum</i>	8.0%	4.80	0.03	\$600	\$16.17	Mid Bloom
Joe Pye Weed	<i>Eupatorium purpureum</i>	6.0%	3.60	0.21	\$220	\$45.39	Mid Bloom
Black-Eyed Susan	<i>Rudbeckia hirta</i>	1.0%	0.60	0.02	\$24	\$0.04	Mid Bloom (short-lived)
Boneset	<i>Eupatorium perfoliatum</i>	8.5%	5.10	0.11	\$200	\$22.22	Mid Bloom
Cupplant	<i>Silphium perfoliatum</i>	2.0%	1.20	0.52	\$50	\$26.14	Mid Bloom
Wingstem	<i>Verbesina alternifolia</i>	2.0%	1.20	0.37	\$65	\$24.27	Mid Bloom
Blue Vervain	<i>Verbena hastata</i>	8.0%	4.80	0.14	\$90	\$12.71	Mid Bloom
New York Ironweed	<i>Helenium autumnale</i>	3.0%	1.80	0.26	\$240	\$62.73	Mid-Late Bloom
Sneezeweed	<i>Helenium autumnale</i>	4.0%	2.40	0.05	\$80	\$3.70	Late Bloom
Grassleaf Goldenrod	<i>Euthamia graminifolia</i>	5.0%	3.00	0.02	\$120	\$2.80	Late Bloom
New England Aster	<i>Symphotrichum novae-angliae</i>	5.0%	3.00	0.12	\$250	\$29.70	Late Bloom
Big Bluestem	<i>Anropogon gerardii</i>	9.0%	5.40	1.68	\$20	\$33.60	*
Tussock Sedge	<i>Carex stricta</i>	5.0%	3.00	0.04	\$640	\$27.88	*
Fox Sedge	<i>Carex vulpinoidea</i>	5.0%	3.00	0.07	\$16	\$1.50	*
TOTALS		100%	60	6.49		\$602.30	

NATIVE WILDFLOWERS FOR POLLINATORS – MASTER LIST

COMMON NAME	SCIENTIFIC NAME	LIFE CYCLE*	MATURE HEIGHT	WATER NEEDS	NOTES
Early Season Blooming Species					
Golden Alexanders	<i>Zizia aurea</i>	P	3 ft	High	Adapted to disturbance; spreads by rhizomes
Wild Blue Indigo	<i>Baptisia australis</i>	P	5 ft	Medium	Slow to establish
Wild Lupine	<i>Lupinus perennis</i>	P	2 ft	Low	Prefers sandy soil; host for Karner blue butterfly
Early to Mid Season Blooming Species					
Virginia Spiderwort	<i>Tradescantia virginiana</i>	P	4 ft	Medium	
Bluejacket	<i>Tradescantia ohioensis</i>	P	4 ft	Medium	
Golden Tickseed	<i>Coreopsis tinctoria</i>	P	3 ft	High	
Smooth Penstemon	<i>Penstemon digitalis</i>	P	2 ft	Medium	Establishes quickly
Virginia Spiderwort	<i>Tradescantia virginiana</i>	P	2 ft	Medium	
Wild Beardtongue	<i>Penstemon hirsutus</i>	P	2 ft	Low	
Mid Season Blooming Species					
Blue Lobelia	<i>Lobelia siphilitica</i>	P	3 ft	High	Prefers part shade and fertile soil
Butterfly Milkweed	<i>Asclepias tuberosa</i>	P	3 ft	Low	Prefers sandy soil; host plant for monarch butterfly
Common Milkweed	<i>Asclepias syriaca</i>	P	6 ft	Medium	Host plant for monarch butterfly
Dotted Mint	<i>Monarda punctata</i>	P	3 ft	Medium	Prefers sandy soil; establishes quickly
Lavender Hyssop	<i>Agastache foeniculum</i>	P	5 ft	Medium	Establishes quickly
Gloriosa Daisy	<i>Rudbeckia gloriosa</i>	P	3 ft	Medium	
Joe Pye Weed	<i>Eupatorium purpureum</i>	P	6 ft	High	Prefers part shade and fertile soil
Marsh Blazingstar	<i>Liatris spicata</i>	P	5 ft	Medium	
Mexican Hat	<i>Ratibida columnifera</i>	P	3 ft	Medium	
Purple Coneflower	<i>Echinacea purpurea</i>	P	3 ft	Medium	Establishes quickly
Smooth Oxeye	<i>Heliopsis helianthoides</i>	P	5 ft	Low	
Swamp Milkweed	<i>Asclepias incarnate</i>	P	5 ft	High	Host plant for monarch butterfly
Virginia Mountain Mint	<i>Pycnanthemum virginianum</i>	P	3 ft	Medium	
Wild Bergamot	<i>Monarda fistulosa</i>	P	4 ft	Medium	Establishes quickly
Mid to Late Season Blooming Species					
Boneset	<i>Eupatorium perfoliatum</i>	P	5 ft	High	Prefers fertile soil
Bottle Gentian	<i>Gentiana andrewsii</i>	P	2 ft	Medium	Not drought tolerant; difficult to establish from seed, establish from transplants
Purple Giant Hyssop	<i>Agastache scrophulariifolia</i>	P	5 ft	Low	
Field Thistle	<i>Cirsium discolor</i>	P	6 ft	Medium	Short-lived; not aggressive
Mistflower	<i>Conoclinium coelostinium</i>	P	2 ft	Medium	
Yarrow	<i>Achillea millefolium</i>	P	2 ft	Low	Very aggressive
Late Season Blooming Species					
Calico Aster	<i>Symphyotrichum lateriflorum</i>	P	4 ft	Medium	Prefers part-shade
Gray Goldenrod	<i>Solidago nemoralis</i>	P	2 ft	Medium	
New England Aster	<i>Symphyotrichum novae-angliae</i>	P	4 ft	Medium	
Showy Goldenrod	<i>Solidago speciosa</i>	P	4 ft	Medium	
Sneezeweed	<i>Helenium autumnale</i>	P	3 ft	High	Prefers fertile soil; toxic to livestock

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

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	LIFE CYCLE*	MATURE HEIGHT	WATER NEEDS	NOTES
Big Bluestem	<i>Andropogon gerardii</i>	P	8 ft	Medium	Can be aggressive at high seeding rates
Fox Sedge	<i>Carex vulpinoidea</i>	P	3 ft	High	Tolerates occasional flooding
Indian Grass	<i>Sorghastrum nutans</i>	P	7 ft	Medium	Can be aggressive at high seeding rates
Little Bluestem	<i>Schizachyrium scoparium</i>	P	3 ft	Low	Considered a weed in cranberry bogs
Pennsylvania Sedge	<i>Carex pennsylvanica</i>	P	1.5 ft	Medium	Prefers part shade
Tussock Sedge	<i>Carex stricta</i>	P	4 ft	High	Tolerates occasional flooding

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

NON-NATIVE PLANTS FOR INSECTARY MEADOWS AND COVER CROPS

COMMON NAME	SCIENTIFIC NAME	LIFE CYCLE*	MATURE HEIGHT	WATER NEEDS	NOTES
Early Season Blooming Species					
Alsike Clover	<i>Trifolium hybridum</i>	A	2 ft	High	
Crimson Clover	<i>Trifolium incarnata</i>	A	1.5 ft	Medium	Not freeze tolerant, spring seeded in cold climates
Hairy Vetch	<i>Vicia villosa</i>	A	1.5 ft	Medium	Fall seeded, aggressive at high seeding rates
Lacy Phacelia	<i>Phacelia tanacetifolia</i>	A	2 ft	Low	Not freeze tolerant, spring seeded in cold climates
Early to Mid Season Blooming Species					
Blue Flax	<i>Linum perenne</i>	P	2 ft	Medium	Blue Flax
Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	P	2 ft	Medium	
Red Clover	<i>Trifolium repens</i>	P	1 ft	Medium	Aggressive at high seeding rates
Mid Season Blooming Species					
Alfalfa	<i>Medicago sativa</i>	P	2 ft	Medium	Susceptible to frost heaving
Blanketflower	<i>Gaillardia aristata</i>	P	2 ft	Low	
Borage	<i>Borage officinalis</i>	A	1.5 ft	Medium	Not freeze tolerant, spring seeded in cold climates
Buckwheat	<i>Fagopyrum esculentum</i>	A	2 ft	Medium	
Partridge Pea	<i>Chamaecrista fasciculata</i>	A	2 ft	Low	Favors disturbed sites
Yellow Sweet Clover	<i>Melilotus officinalis</i>	B	5 ft	Medium	
Mid to Late Season Blooming Species					
Common sunflower	<i>Helianthus annuus</i>	A	9 ft	Medium	
Cosmos	<i>Cosmos bipinnatus</i>	A	5 ft	Medium	

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

REGIONAL NATIVE SEED VENDORS AND NATIVE PLANT NURSERIES.

Inclusion on this list does not constitute an endorsement or a recommendation. Other vendors not listed below may also have suitable plant materials. Ensure that all plants or seeds purchased for pollinator habitat are **NOT** treated with systemic insecticides.

Pennsylvania:

- Ernst Conservation Seed • Meadville, PA • 1-800-873-3321 • <http://www.ernstseed.com/>
- Sylva Native Nursery and Seed • Glen Rock, PA • 717-227-0486 • <http://www.sylvanative.com/>
- Wetland Supply Company • Apollo, PA • 724-7273772 • <http://wetlandsupply.com/>
- Redbud Native Plant Nursery • Glen Mills, PA • 610-358-330 • <http://www.redbudnativeplantnursery.com/>
- Aquascapes Unlimited Inc. • Pipersville, PA • 215-766-8986 • <http://www.aquascapesunlimited.com/>
- North Creek Nurseries • Landenberg, PA • 610-255-0100 • <http://www.northcreeknurseries.com/>
- Bowman's Hill Wildflower Preserve • New Hope, PA • 215-862-1846 • <http://www.bhwp.org/>
- Edge of the Woods Native Plant Nursery • Orefield, PA • 610-395-2570 • <http://www.edgeofthewoodsnursery.com/>
- Meadowood Nursery • Hummelstown, PA • 717-566-9875 • <http://www.meadowoodnursery.com/>
- Mid Atlantic Natives • New Freedom, PA • 717-227-0924 • <http://www.midatlanticnatives.com/>
- Northeast Natives & Perennials • Quakertown, PA • 215-901-5552 • <http://www.nenativesandperennials.com>
- Octoraro Native Plant Nursery • Kirkwood, PA • 717-529-3160 • <http://www.octoraro.com/>
- Sugarbush Nursery • Mohnton, PA • 610-856-0998 • <http://www.sugarbushnursery.com/>
- Yellow Springs Farm Native Plant Nursery • Chester Springs, PA • 610-827-2014 • <http://www.yellowspringsfarm.com/>

New Jersey:

- Pinelands Nursery • Columbus, NJ • 609-291-9486 • <http://www.pinelandsnursery.com/>
- Toadshade Wildflower Farm • Frenchtown, NJ • 908-996-7500 • <http://www.toadshade.com/>

Maryland:

- Chief Mountain Farms • Port Deposit, MD • 866-530-8902 • <http://www.chiefmountainfarms.com/>

REFERENCES

Xerces Society Seed Mix Calculator

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

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

USDA-NRCS Seedling ID 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.plant-materials.nrcs.usda.gov/pubs/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 downloadable resource from the Midwest. The publication also includes guidelines for assessing establishment success of seeded native grass and wildflower plots.

www.bonestroo.com/asset/mj6r2i/Prairie-Seedling-Guide.pdf

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

Directory for Invasive Weeds of the Northeast

This database, compiled by the Penn State Department of Crops and Soil Sciences features links to multi-agency fact sheets and management guidelines for major region weed species.

<http://extension.psu.edu/weeds/extension-info/invasive-plants#misc-dicots>

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

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

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

Seed Quality, Seed Technology, and Drill Calibration

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

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

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THE XERCES SOCIETY
POLLINATOR CONSERVATION PROGRAM



United States Department of Agriculture
Natural Resources Conservation Service