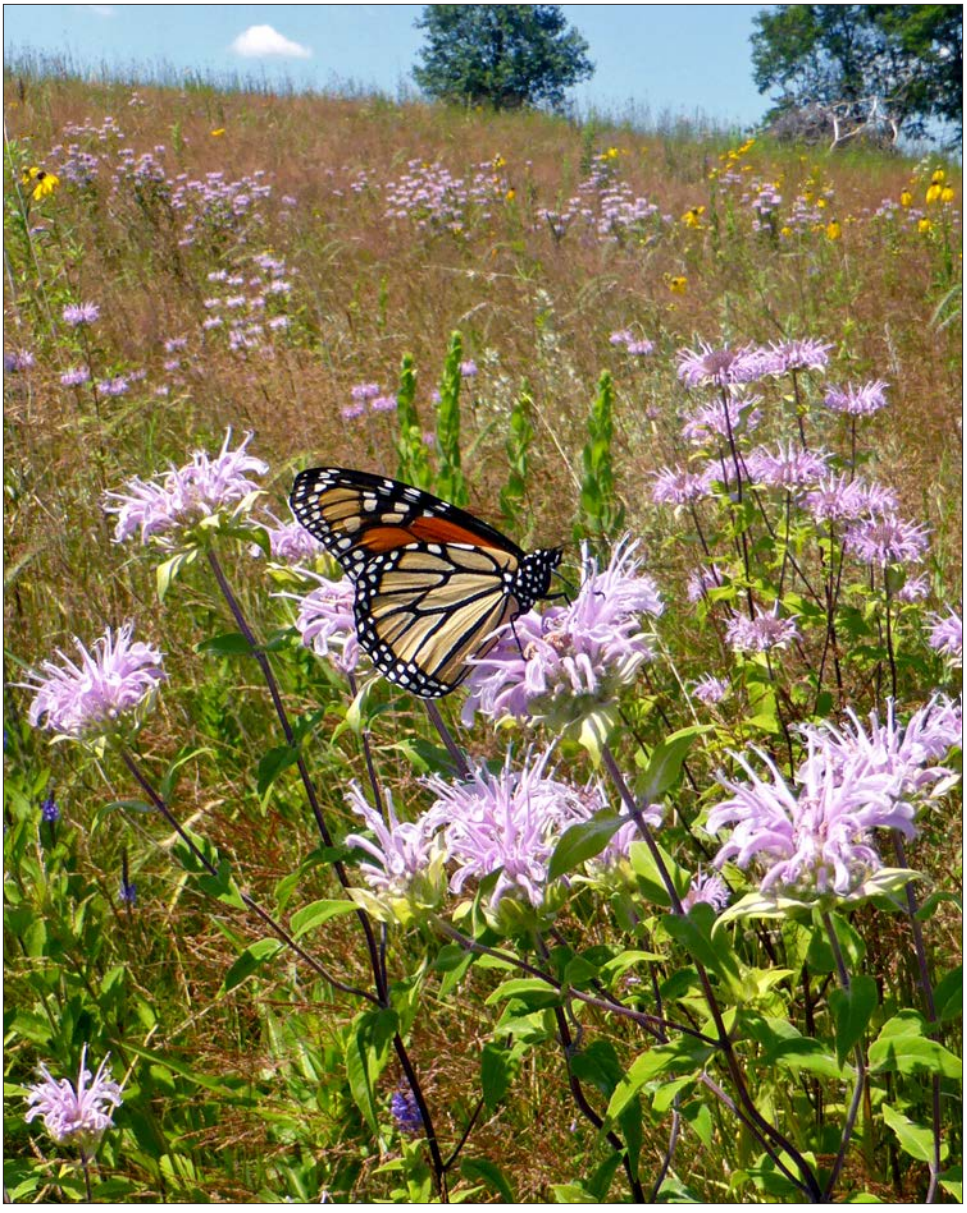
The Xerces Society
for Invertebrate Conservation

Center for Integrated Agricultural Systems (CIAS)

The University of Wisconsin Madison

Pollinator Meadow
Upper Midwest
Installation Guide & Checklist



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Revised edition

Updated in February 2015 by Mace Vaughan, Eric Lee-Mäder, Sarah Foltz Jordan, Emily Krafft, and Sara Morris of the Xerces Society. Additional revisions were made in October 2015. Please contact Mace Vaughan (mace@xerces.org) to improve this publication.

Editing and layout

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Photographs

Cover: Monarch butterfly (*Danaus plexippus*) nectaring on wild bergamot (*Monarda fistulosa*) in a pollinator planting in Central Minnesota. *Below*: green sweat bee (*Augochlora pura*) on a butterfly milkweed (*Asclepias tuberosa*).
Photographs by Sarah Foltz Jordan, 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.

Pollinator Meadow Installation Guide

Upper Midwest

Purpose

These instructions provide in-depth guidance on how to install nectar and pollen habitat for bees in the form of native wildflower meadows in Illinois, Indiana, Iowa, Michigan, Minnesota, and Wisconsin. To plan a specific project, use this guide with the Checklist found at the end of this document.

Conservation Objectives

Depending on conservation 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 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.
- **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, 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:** To establish plants from plugs, pots, or bare root will likely 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 or design.

Figure 1 Pollinator plantings can serve other functions, such as habitat for wildlife or beneficial insects. The diverse mix of native wildflowers, shrubs, and grasses in this native prairie planting in Minnesota (left) provides a variety of forage and nesting sites for native bees, beneficial insects (such as green lacewings, right), and more.

(Photograph by Sarah Foltz Jordan, The Xerces Society.)

Plant Selection

Native Plants: Flower species selection should emphasize plants that provide pollen- and nectar-rich forage resources for bees and other flower-visiting insects. Important larval food plants for butterflies and moth should also be included. Warm-season bunch grasses should be included at a low percentage of the mix (e.g., 50% or less). The Appendix provides specific seed mixes for dry and wetland sites, and a master list of acceptable plants for various locations and environments in the Upper Midwest.

If you are designing a custom plant list, individual species should be chosen to provide **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 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, 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 diverse native plantings harbor fewer pests than unmanaged weedy borders.

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 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 below.

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 (e.g., burdock);
- Sites dominated by introduced sod-forming grasses and rhizomatous forbs (e.g., Canada thistle).

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

Table 1 Site Preparation Methods

METHOD: NON-SELECTIVE (NON-PERSISTENT) HERBICIDE (FIGURE 2)	
Where to Use • Conventional farms and organic farms* • Areas with a low risk of erosion • Areas accessible to sprayer	**Timing** • Total time: 6+ months • Begin: Early spring after the first weed growth • Plant: Late fall after hard frost
Basic Instructions: 1. Mow existing thatch as needed before beginning herbicide treatments to expose new weed growth to the herbicide spray. 2. Apply a non-selective, non-persistent herbicide as per label as soon as weeds are actively growing in the early spring. 3. Repeat herbicide applications throughout the spring, summer, and early fall as needed (whenever emerging weed seedlings reach 4–6″). 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 late 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. ***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 (e.g., herbicide is applied more than five times during preparation season but new growth covering more than 30% of area is still present in the fall, or stands of white or red clover covering more than 30% of site remain). Avoid use of herbicides that are bee-toxic (e.g., Paraquat and Gramoxone).*** **** Choice of herbicide must be acceptable to OMRI for organic operations or, if not, used outside of certified ground AND approved by an organic certifier.***	

METHOD: SOLARIZATION (FIGURE 3)

Where to Use

- Conventional and organic farms
- Areas with a low risk of erosion
- Areas accessible to mowing equipment
- Locations with full sun

Timing

- Total time: 5+ months
- Begin: Spring
- Plant: Late fall after hard frost

Basic Instructions:

1. Mow or cultivate the site in the spring (raking or burning off debris, if necessary, to avoid puncturing the plastic). After smoothing the site, create a trench around the perimeter in order to more easily bury the edges of the plastic (see below).
2. 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 with rocks or old tires, if necessary, to prevent the wind from lifting it. Repair any rips that occur during the season with greenhouse repair tape.
3. Remove the plastic in early fall before the weather cools and the area beneath the plastic is recolonized by nearby rhizomatous weeds. *Note: weeds under solarization plastic are not a concern, especially if they have not set seed.*
4. Immediately plant the pollinator seed mix. ***Do not till after solarizing site. Avoid any ground disturbance that may bring up viable weed seed.*** Refer to Planting Methods section of this document for specific seed bed preparation recommendations.

NOTE: Solarization may not be as effective in years when summer sun or high temperatures are limited. An additional year of site preparation is recommended if weed pressure is particularly high.

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.)

Figure 3 Solarization is an effective method to prepare a site for future planting. For optimal results, the site should get full sun and be accessible to equipment. Begin by cultivating and smoothing the site in early spring. Equipment, such as a trencher on a tractor, can be used to dig a trench around the perimeter (left). Next, lay UV-stabilized plastic (middle) and bury the edges (right), weighing down the center with rocks if necessary to prevent airflow between the plastic and the ground. Throughout the season, repair any holes in the plastic with high-tunnel repair tape, to keep the temperature high. Remove the plastic in early fall and immediately plant the pollinator seed mix **without** tilling the site (see **Table 2 Methods for Planting Wildflower Seed** for instructions).

(Photographs by Sarah Foltz Jordan, The Xerces Society.)

Planting Methods

Recommended planting methods are site-specific. Factors such as equipment availability and site size 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.**

Hand-broadcasting is an excellent method for small sites. Drop-seeders or fertilizer spreaders, with simple modifications, can be used for larger sites. Native seed drills can also be used for larger sites, although they are often more challenging to operate effectively. **Table 2** outlines several possible seeding methods.

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

Figure 4 Many wildflower seeds are available as a lower-cost alternative to transplants or plugs, but establishing wildflowers from seed requires excellent site preparation to prevent weed encroachment.

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

Table 2 **Methods for Planting Wildflower Seed**

METHOD: BROADCAST SEEDERS OR HAND-BROADCASTING (THROWING SEED) (FIGURE 5)	
Pros • 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** • Requires a smooth seed bed • Seed should be pressed firmly into the soil after planting (unless fall planting, in which case this step can be skipped) • Difficult to calibrate • Some models of broadcast seeders cannot accommodate large seeds
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. Seeds of similar sizes can be mixed together and bulked up with an inert carrier ingredient such as peat moss, sawdust, gypsum, clean sand, pelletized lime, 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. 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. 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. 5. Regardless of how it is broadcast, do not cover the seed with soil after planting. Unless fall 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. A very light covering of weed free straw may be necessary on sites where water flows through and there is the potential for rains to wash the seeds away.	

METHOD: DROP SEEDERS OR FERTILIZER SPREADERS (DROPPING SEED) (FIGURE 6)

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 (unless fall planting)
- Hand-powered models are time consuming for large areas (over ½ acre), tractor-powered models are more efficient on larger sites
- Calibration requires trial and error

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 peat moss, sawdust, gypsum, clean sand, pelletized lime, 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. Unless fall 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) (FIGURE 8)

Pros

- Convenient for planting large areas (note: do not use grain drills, which are not equipped to handle small seed)
- 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, **especially** for small areas (less than one acre)
- Requires a tractor and an experienced operator to set planting controls
- Abrupt turns or bumps can spill large quantities of seed
- Seed with a lot of chaff can clog delivery tubes

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

Small carpenter bee (*Ceratina* sp.) on golden Alexanders (*Zizia aurea*). (Photograph by Sarah Foltz Jordan, The Xerces Society.)

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

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, 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., oat straw), or other regionally appropriate mulch materials that do not contain viable weed seeds.

Figure 5 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 (more for larger sites) and then mixed (middle). The mix is divided into separate batches 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 Sarah Foltz Jordan, The Xerces Society.)

Figure 6 Hand-crank "belly grinder" type seeders (left) are inexpensive and can broadcast seed more evenly than hand-scattering on larger sites. ***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. Similarly, lawn fertilizer spreaders (middle) 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 (right) for planting together with the flow gate adjusted accordingly.

(Photograph courtesy of the New Hampshire NRCS.)

(Photographs courtesy of Terry Best, North Carolina NRCS.)

Figure 7 When planting native wildflowers by hand-broadcasting or with a drop seeder, the seed should be planted directly on the soil surface (left). After broadcasting, roll the site with a turf roller (middle) or cultipacker (right)–unless planting in fall when the freeze-thaw cycle will adequately work seed into the ground.

(Photograph by Kelly Gill, The Xerces Society.)

(Photograph by Sarah Foltz Jordan, The Xerces Society.)

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

Figure 8 Tractor-powered spreaders (left) and native seed drills (middle) are ideal for large planting sites (5+ acres). Tractor-powered spreaders can broadcast over larger areas, have motorized agitators to prevent clogging, and only require a tractor to operate. For best results, seed should be divided into batches by size and mixed with an inert carrier. Alternately, typical native seed drills can plant in a light stubble layer (middle), have depth controls for optimal seed placement, and have separate seed boxes for different sizes of seed (right). Such drills need an experienced operator and careful calibration.

(Photographs by Kelly Gill, The Xerces Society.)

(Photographs by Sarah Foltz Jordan, The Xerces Society.)

Maintenance During Establishment (Short-Term)

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

- **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 should 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.
- **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.

Figure 9 ***Short Term:*** In the first spring after seeding the previous fall, this site is dominated by annual and biennial weeds. 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 (right), which are generally unharmed by the occasional mowing.

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

Figure 10 ***Long Term:*** Flourishing wildflowers and pollinator habitat in the second year after planting.

(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 pollinator meadow is outside of the sprayed area or protected from application and drift.

Note: *using signs such as the one below can be a useful tool to designate protected pollinator habitat. 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.*

Figure 11 Grow tubes or trunk protectors may help during establishment to reduce browsing by herbivores and trunk damage from mowers or weeding operations (above), 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 (below).

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

Figure 12 Newly-planted areas should be clearly marked to protect them from herbicides or other disturbances.

(Photograph by Kelly Gill, The Xerces Society.)

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 14 or the references section for vendors (for established or custom mixes). *Plants listed by first season of bloom, then alphabetically.* ***Note:*** *"% of mix" is by seed count, not seed weight.*

Mesic Site Pollinator Seed Mix (Orchards, Vegetables, and Berry Farms)

The mix is designed to provide season-long pollen and nectar resources on any sunny mesic to slightly dry upland site.

✳	COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS/ FT²	LBS/ AC.
Early	Golden Alexanders	*Zizia aurea*	6%	3.6	0.82
	White wild indigo	*Baptisia alba*	0.2%	0.12	0.2
	Wild lupine	*Lupinus perennis*	0.3%	0.18	0.49
Early–Mid	Ohio spiderwort	*Tradescantia ohiensis*	5.5%	3.3	1.12
	Smooth penstemon	*Penstemon digitalis*	5.5%	3.3	0.08
Mid	Butterfly milkweed	*Asclepias tuberosa*	0.4%	0.24	0.19
	Common milkweed	*Asclepias syriaca*	1%	0.6	0.41
	Compassplant	*Silphium laciniatum*	0.1%	0.06	0.25
	Dotted mint	*Monarda punctata*	7%	4.2	0.12
	Lavender hyssop	*Agastache foeniculum*	7%	4.2	0.18
	Purple coneflower	*Echinacea purpurea*	2%	1.2	0.5
	Purple prairie clover	*Dalea purpurea*	5%	3	0.41
	Virginia mountain mint	*Pycnanthemum virginianum*	5%	3	0.02
	Wild bergamot	*Monarda fistulosa*	12%	7.2	0.25
	Yellow coneflower	*Ratibida pinnata*	4%	2.4	0.26
Mid–Late	Maximilian sunflower	*Helianthus maximiliani*	4%	2.4	0.57
	Meadow blazing star	*Liatris ligulistylis*	2%	1.2	0.33
Late	New England aster	*Symphyotrichum novae-angliae*	3%	1.8	0.07
	Rattlesnake master	*Eryngium yuccifolium*	1%	0.6	0.2
	Showy goldenrod	*Solidago speciosa*	7%	4.2	0.11
	Smooth blue aster	*Symphyotrichum laeve*	3%	1.8	0.09
—	Big bluestem	*Andropogon gerardii*	5%	3	1
	Little bluestem	*Schizachyrium scoparium*	10%	6	1.86
	Prairie dropseed	*Sporobolus heterolepis*	1%	0.6	0.12
	Prairie junegrass	*Koeleria macrantha*	3%	1.8	0.03
	TOTALS		**100%**	**60**	**9.68**

✳ Bloom Time

Figure 13 *From top to bottom:* wild white indigo, meadow blazing star, rattlesnake master, and a native wildflower prairie—dominant wildflowers in bloom include sunflowers, blazing stars, wild bergamot, and leadplant.

(Above: photographs courtesy of Peter Gorman, flickr.com.)

(Below: photograph by courtesy of Justin Meissen, flickr.com.)

Wetland Pollinator Seed Mix

The mix is designed to provide season-long pollen and nectar resources in a wetland or semi-reparian site, including along irrigation ditches, streams, flood-prone areas, etc.

✳	COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS/ FT²	LBS/ AC.
Early	Golden Alexanders	*Zizia aurea*	2%	1.2	0.27
Early–Mid	Ohio spiderwort	*Tradescantia ohiensis*	0.5%	0.3	0.1
Mid	Cup plant	*Silphium perfoliatum*	1%	0.3	0.39
	Great blue lobelia	*Lobelia siphilitica*	20%	12	0.06
	Sweet Joe Pye weed	*Eutrochium purpureum*	5%	3	0.17
	Purple coneflower	*Echinacea purpurea*	10%	6	2.48
	Swamp milkweed	*Asclepias incarnata*	0.5%	0.3	0.18
	Wild bergamot	*Monarda fistulosa*	10%	6	0.21
Mid–Late	Boneset	*Eupatorium perfoliatum*	11%	6.3	0.14
Late	New England aster	*Symphyotrichum novae-angliae*	5%	3	0.12
	Rattlesnake master	*Eryngium yuccifolium*	1%	0.6	0.2
	Showy goldenrod	*Solidago speciosa*	5%	3	0.08
	Sneezeweed	*Helenium autumnale*	10%	6	0.12
—	Big bluestem	*Andropogon gerardii*	10%	6	1.99
	Fox sedge	*Carex vulpinoidea*	5%	3	0.07
	Tussock sedge	*Carex stricta*	5%	3	0.04
	TOTALS		**100%**	**60**	**6.62**

Dry Pollinator Seed Mix

The mix is designed to provide season-long pollen and nectar resources in a sunny dry site with drought-tolerant native prairie plants.

✳	COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS/ FT²	LBS/ AC.
Early	Golden Alexanders	*Zizia aurea*	2%	1.2	0.27
	Wild lupine	*Lupinus perennis*	3%	1.8	4.9
Early–Mid	Lanceleaf coreopsis	*Coreopsis lanceolata*	11%	6.6	1.44
	Ohio spiderwort	*Tradescantia ohiensis*	1%	0.6	0.2
Mid	Butterfly milkweed	*Asclepias tuberosa*	1%	0.6	0.47
	Dotted mint	*Monarda punctata*	10%	6	0.17
	Hoary vervain	*Verbena stricta*	9%	5.4	0.46
	Purple prairie clover	*Dalea purpurea*	10%	6	0.82
	Virginia mountain mint	*Pycnanthemum virginianum*	10%	6	0.05
	Wild bergamot	*Monarda fistulosa*	10%	6	0.21
Mid–Late	Meadow blazing star	*Liatris ligulistylis*	1%	0.6	0.16
Late	Skyblue aster	*Symphyotrichum oolentangiense*	3%	1.8	0.06
	Smooth blue aster	*Symphyotrichum laeve*	5%	3	0.15
	Stiff goldenrod	*Oligoneuron rigidum*	5%	3	0.2
—	Indian grass	*Sorghastrum nutans*	5%	3	0.96
	Little bluestem	*Schizachyrium scoparium*	10%	6	1.86
	Prairie dropseed	*Sporobolus heterolepis*	1%	0.6	0.12
	Prairie junegrass	*Koeleria macrantha*	3%	1.8	0.03
	TOTALS		**100%**	**60**	**12.53**

✳ by seed count, not seed weight

Figure 14 *From top to bottom:* golden Alexanders, butterfly milkweed, wild bergamot, purple prairie clover, Virginia mountain mint, and stiff goldenrod.

(Photographs by Sarah Foltz Jordan, The Xerces Society.)

Low Cost Pollinator Seed Mix

This low cost mix provides fewer season-long pollen and nectar benefits, and may be less resistant to weed encroachment. For extremely large sites, however—especially where financial resources are limited—it may be a preferred option.

✳	COMMON NAME	SCIENTIFIC NAME	% OF MIX	SEEDS/ FT²	LBS/ AC.
Early–Mid	Lanceleaf coreopsis	*Coreopsis lanceolata*	8%	4.8	1.05
	Smooth penstemon	*Penstemon digitalis*	10%	6	0.14
Mid	Alfalfa	*Medicago sativa*	5%	3	0.58
	Blanketflower	*Gaillardia aristata*	6%	3.6	0.71
	Dotted mint	*Monarda punctata*	8%	4.8	0.14
	Partridge pea	*Chamaecrista fasciculata*	2%	1.2	0.86
	Purple coneflower	*Echinacea purpurea*	4%	2.4	1
	Purple prairie clover	*Dalea purpurea*	7%	4.2	0.57
	Yarrow	*Achillea millefolium*	8%	4.8	0.05
	Yellow coneflower	*Ratibida pinnata*	7%	4.2	0.45
Mid–Late	Maximilian sunflower	*Helianthus maximiliani*	8%	4.8	1.15
—	Big bluestem	*Andropogon gerardii*	8%	4.8	1.6
	Indian grass	*Sorghastrum nutans*	8%	4.8	1.53
	Little bluestem	*Schizachyrium scoparium*	8%	4.8	1.49
	Prairie junegrass	*Koeleria macrantha*	3%	1.8	0.03
	TOTALS		**100%**	**60**	**11.35**

✳ Bloom Time

Figure 15 *From top to bottom:* smooth penstemon, dotted mint, and a pollinator meadow featuring various native plants—including yarrow and little bluestem.

(Above and below photographs courtesy of Tom Potterfield, flickr.com.)

Figure 16 Plant selection should focus on pollen- and nectar-rich native plants as much as possible, with a mix of plants to ensure consistent and adequate floral resources through the seasons, as demonstrated by this pollinator planting adjacent to a farm in Minnesota.

(Photographs by Sarah Foltz Jordan, The Xerces Society.)

Master Plant Lists

Recommended Native Wildflowers for Pollinators

✳	COMMON NAME	SCIENTIFIC NAME	LIFE CYCLE[1]	MAX HT.	WATER NEEDS[2]	NOTES
Early	Golden Alexanders	*Zizia aurea*	P	3′	H	Adapted to disturbance; spreads by rhizomes
	White wild indigo[3]	*Baptisia alba*	P	4′	L	Slow to establish[3]
	Wild lupine[3]	*Lupinus perennis*	P	2′	L	Prefers sandy soil; Karner blue host plant[3]
Early–Mid	Lanceleaf coreopsis	*Coreopsis lanceolata*	P	2′	L	Establishes quickly
	Ohio spiderwort	*Tradescantia ohiensis*	P	3′	M	Can tolerate partial shade
	Smooth penstemon	*Penstemon digitalis*	P	2′	M	Establishes quickly
Mid	Butterfly milkweed	*Asclepias tuberosa*	P	3′	L	Monarch butterfly host plant; prefers sandy soil
	Common milkweed	*Asclepias syriaca*	P	6′	M	Monarch butterfly host plant
	Compass plant	*Silphium laciniatum*	P	12′	M	Large-statured plant
	Cup plant	*Silphium perfoliatum*	P	8′	M	Occasionally aggressive; stems provide nest sites
	Dotted mint	*Monarda punctata*	A, B, P	3′	M	Prefers sandy soil; establishes quickly
	Great blue lobelia	*Lobelia siphilitica*	P	3′	H	Prefers part-shade and fertile soil
	Hoary vervain	*Verbena stricta*	P	3′	L–M	
	Sweet Joe Pye weed	*Eutrochium purpureum*	P	7′	H	Prefers part-shade and fertile soil
	Lavender hyssop	*Agastache foeniculum*	P	5′	M	Establishes quickly
	Partridge pea[3]	*Chamaecrista fasciculata*	A	2′	L	Favors disturbed sites[3]
	Purple coneflower	*Echinacea purpurea*	P	4′	M	Establishes quickly
	Purple prairie clover[3]	*Dalea purpurea*	P	2′	L	Does not tolerate grazing well[3]
	Swamp milkweed	*Asclepias incarnata*	P	5′	M–H	Monarch butterfly host plant
	Virginia mountain mint	*Pycnanthemum virginianum*	P	3′	M	Very attractive to numerous beneficial insects
	Wild bergamot	*Monarda fistulosa*	P	4′	M	Establishes quickly
	Yarrow	*Achillea millefolium*	P	2′	L	Very aggressive
	Yellow coneflower	*Ratibida pinnata*	P	4′	M	Tends to grow tall and spindly on fertile sites
Mid–Late	Boneset	*Eupatorium perfoliatum*	P	5′	H	Prefers fertile soil
	Maximilian sunflower	*Helianthus maximiliani*	P	7′	L	Tends to grow tall and spindly on fertile sites
	Meadow blazing star	*Liatris ligulistylis*	P	5′	L	*L. aspera* also recommended
	Prairie blazing star	*Liatris pycnostachya*	P	5′	M	*Liatris* spp. excellent nectar plant for monarchs
	Prairie ironweed	*Vernonia fasciculata*	P	5′	H	
Late	Bottle gentian	*Gentiana andrewsii*	P	2′	M	Not drought tolerant; difficult to establish from seed, establish from transplants
	Calico aster	*Symphyotrichum lateriflorum*	P	3′	M	Prefers part-shade
	Field thistle	*Cirsium discolor*	A, B, P	6′	M	Short-lived; not aggressive (native species)
	New England aster	*Symphyotrichum novae-angliae*	P	6′	M	
	Rattlesnake master	*Eryngium yuccifolium*	P	6′	M	Attractive to wasps and other beneficial insects
	Showy goldenrod	*Solidago speciosa*	P	5′	M	
	Skyblue aster	*Symphyotrichum oolentangiense*	P	3′	L	
	Smooth blue aster	*Symphyotrichum laeve*	P	3′	L	
	Sneezeweed	*Helenium autumnale*	P	2′	H	Prefers fertile soil; toxic to livestock
	Stiff goldenrod	*Oligoneuron rigidum*	P	5′	L	Will grow in acidic, poor soil

Recommended Native Wildflowers for Pollinators Notes:

✳ Bloom Time

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.

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[1]	MAX HT.	WATER NEEDS[2]	NOTES
Big bluestem	*Andropogon gerardii*	P	8′	M	Can be aggressive at high seeding rates
Fox sedge	*Carex vulpinoidea*	P	3′	H	Tolerates occasional flooding
Indian grass	*Sorghastrum nutans*	P	7′	M	Can be aggressive at high seeding rates
Little bluestem	*Schizachyrium scoparium*	P	3′	L	Considered a weed in cranberry bogs
Pennsylvania sedge	*Carex pensylvanica*	P	1.5′	M	Prefers part-shade
Prairie dropseed	*Sporobolus heterolepis*	P	3′	L	Long-lived but slow to establish from seed
Prairie junegrass	*Koeleria macrantha*	P	2′	L	Cool-season bunch grass
Tussock sedge	*Carex stricta*	P	4′	H	Tolerates occasional flooding

Native Grasses and Sedges for Pollinator Seed Mixes Notes:

1. Life Cycle abbreviations: P = perennial, A = annual, B = biennial
2. Water Needs abbreviations: L = low, M = medium, H = high

Non-Native Annual Plants for Insectary Meadows and Cover Crops

✳	COMMON NAME	SCIENTIFIC NAME	LIFE CYCLE[1]	MAX HT.	WATER NEEDS[2]	NOTES
Early	Crimson clover[3]	*Trifolium incarnatum*	A	1.5′	M	Not freeze-tolerant, spring-seeded in cold climates[3]
	Hairy vetch[3]	*Vicia villosa*	A	1.5′	M	Fall-seeded; aggressive at high seeding rates[3]
	Lacy phacelia	*Phacelia tanacetifolia*	A	2′	L	Not freeze-tolerant, spring-seeded in cold climates
Early–Mid	White clover[3]	*Trifolium repens*	P	1′	M	Aggressive at high seeding rates[3]
Mid	Alfalfa[3]	*Medicago sativa*	P	2′	M	Susceptible to frost heaving[3]
	Blanketflower	*Gaillardia aristata*	P	2′	L	
	Borage	*Borago officinalis*	A	1.5′	M	Not freeze-tolerant, spring-seeded in cold climates
	Buckwheat	*Fagopyrum esculentum*	A	2′	M	
Mid–Late	Common sunflower	*Helianthus annuus*	A	9′	M	
	Cosmos	*Cosmos bipinnatus*	A	5′	M	Select single-petal varieties for pollinators

Non-Native Annual Plants for Insectary Meadows and Cover Crops Notes:

✳ Bloom Time

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.

Figure 17 Certain pollen- and nectar-rich non-native plants, such as blanketflower (below), can be included in pollinator plantings when native plants are unavailable or cost-prohibitive. Always check your state's list of invasive plant species before including any non-native plants in pollinator habitat (see next page).

Green sweat bee (*Agapostemon virescens*) on blanketflower (*Gaillardia aristata*). (Photograph by courtesy of sankax, 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.**

Agrecol (*S,T*) • Madison, WI
608-223-3571 • www.agrecol.com

Allendan Seed (*S*) • Winterset, IA
515-462-1241 • www.allendanseed.com

Cardno JFNew (*S, T*) • Walkerton, IN
574-586-2412 • www.cardnojfnew.com

Hidden Savanna Nursery (*T*) • Kalamazoo, MI
269-352-3876 • www.hiddensavanna.com

Hoksey Native Seeds (*S*) • Lynnville, IA
641-780-1539 • www.hokseynativeseeds.com

Ion Exchange Native Seed Nursery (*S, T*) • Harpers Ferry, IA
800-291-2143 • www.ionxchange.com

Michigan Wildflower Farm (*S*) • Portland, MI
517-647-6010 • www.michiganwildflowerfarm.com

Minnesota Native Landscapes (*S, T*) • Otsego, MN
763-295-0010 • www.mnnativelandscapes.com

Native Connections (*S*) • Three Rivers, MI
269-580-4765 • www.nativeconnections.net

Osenbaugh's Prairie Seed Farm (*S*) • Lucas, IA
800-582-2788 • www.prairieseedfarms.com

Prairie Nursery (*S, T*) • Westfield, WI
800-476-9453 • www.prairienursery.com

Prairie Moon Nursery (*S, T*) • Winona, MN
866-417-8156 • www.prairiemoon.com

Prairie Restorations, Inc. (*S, T*) • Princeton, MN
800-837-5986 • www.prairieresto.com

Shooting Star Native Seeds (*S, T*) • Spring Grove, MN
507-498-3944 • www.shootingstarnativeseed.com

Taylor Creek Restoration Nurseries (*S, T*) • Brodhead, WI
608-897-8641 • www.restorationnurseries.com

The Prairie Flower (*S, T*) • Spencer, IA
712-262-5864 • www.theprairieflower.com

Wildtype (*S*,T*) • Mason, MI
517-244-1140 • www.wildtypeplants.com

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

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/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

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

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

Weed Identification & Control

Midwest Invasive Plant Network
A comprehensive list of resources to identify and control common weeds of the Upper Midwest. Extensive links to other resources.
http://mipn.org/control.html

University of Wisconsin Extension - Weed Science
The UW Extension Weed Science website provide identification resources and management fact sheets for common weeds of the Upper Midwest.
http://fyi.uwex.edu/weedsci

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

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

Seeding Pollinator Plots (NRCS Technical Note)
This NRCS Plant Materials Center guide includes detailed information about the use of various types of seeders, and how seed size influences planting method, and planting success.
https://prod.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_023218.pdf

Comprehensive Guides

Attracting Native Pollinators: Protecting North America's Bees and Butterflies
This comprehensive book on pollinator conservation includes information about pollinator ecology, guides for identifying common bees, and habitat designs for multiple landscapes.
www.xerces.org/announcing-the-publication-of-attracting-native-pollinators

Wisconsin Pollinator Biology and Habitat (NRCS Technical Note)
The NRCS Tech Note No. 8 provides an in-depth guide to native bee ecology and conservation for natural areas and farms in Wisconsin. An extensive and detailed list of plant species is included on pages 18–24. Also included are color photos of common regional bees and sample seeding mixes for habitat restoration efforts.
ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/biology-tn8.pdf

Aerial Sketch or Map of Farm Conservation Plan:

Notes:

Pollinator Meadow Installation Checklist

Upper Midwest

Landowner/ manager:	Location:
Planned by:	Date:
Conservation Objectives:	

Purpose

This Pollinator Meadow Installation Checklist 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. For detailed instructions on each step in this Installation Checklist, please see the *Pollinator Meadow Installation Guide: Upper Midwest*.

Key Site Characteristics

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

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

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

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

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

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

Plant Selection: Wildflower Seed Mix

See the Appendix in the Installation Guide

☐ Mesic Site Pollinator Seed Mix ☐ Wetland Pollinator Seed Mix ☐ Dry Site Pollinator Seed Mix

☐ Low Cost Pollinator Seed Mix ☐ Custom Seed Mix

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

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. Pollinator meadows can also include woody plants. See *Wisconsin Pollinator Biology and Habitat (NRCS Technical Note No. 8)* 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.*)

Adjustments:

Planting Method

Choose all options that apply and note any adjustments.

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

Adjustments:

Maintenance During Establishment

Choose all options that apply and note any adjustments.

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

Adjustments:

Long Term Site Operations and Maintenance

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