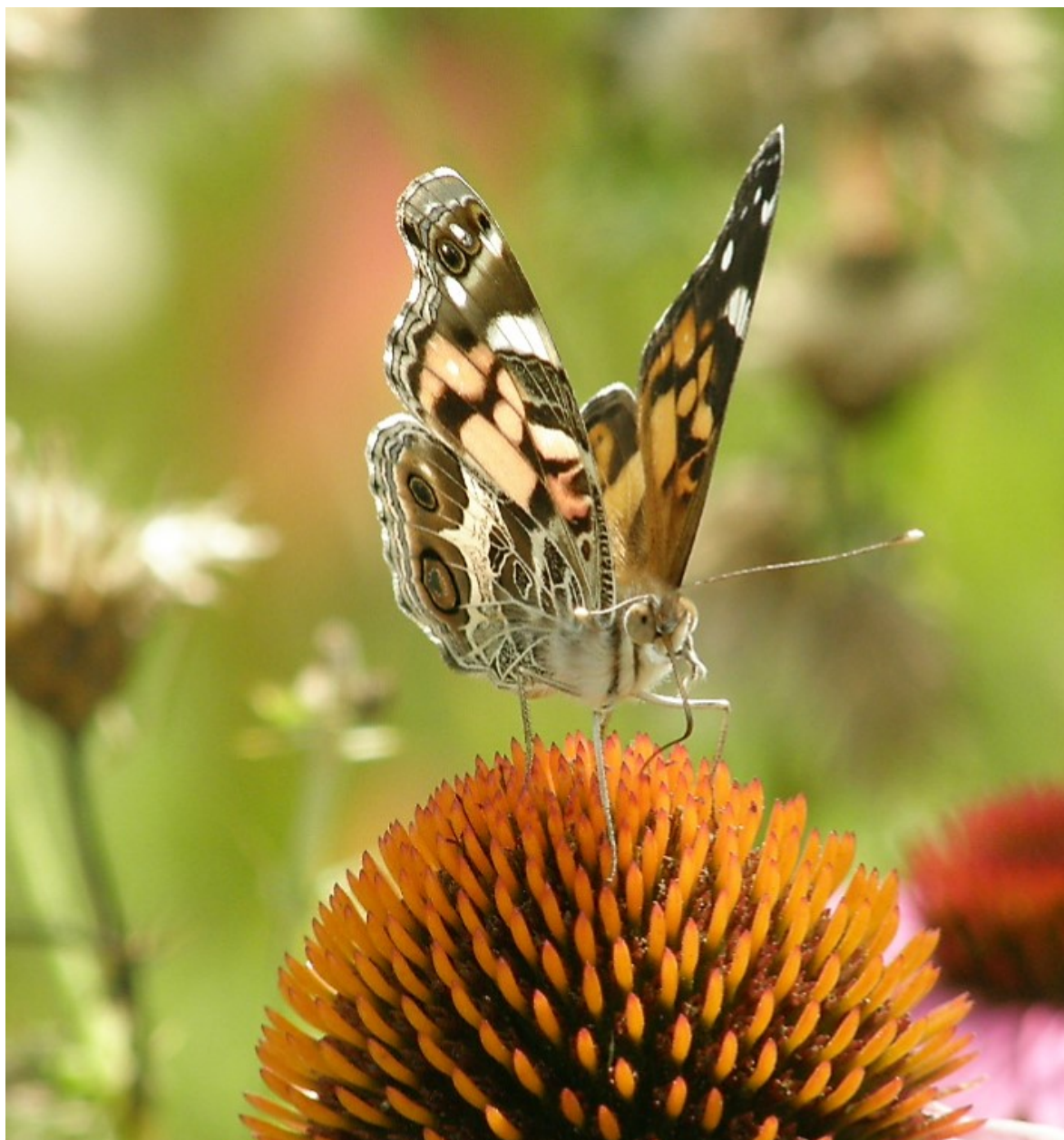

Planting for Pollinators and Beneficial Insects

New York

Wildflower Habitat Establishment Guide



January 2018

The Xerces Society for
Invertebrate Conservation

www.xerces.org

American lady butterfly (*Vanessa virginiensis*) on purple coneflower (*Echinacea purpurea*). Photo: Shawna Clark, USDA NRCS

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Authors

Core content for this guide was written by Mace Vaughan, Eric Mäder, Jessa Kay Cruz, Jolie Goldenetz-Dollar, Kelly Gill, and Brianna Borders of the Xerces Society for Invertebrate Conservation. Updated content adapted for New York was written by Kelly Gill (Xerces Society). Please contact Kelly Gill (kelly@xerces.org) to improve this publication. The authors would like to thank the following collaborators with NRCS NY for assisting with the development and review of this guide: Kim Farrell, Shawna Clark, Elizabeth Marks, and Shanna Shaw.

Photographs

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Black and gold bumble bee (*Bombus auricomus*) on butterfly milkweed (*Asclepias tuberosa*). Photo: The Xerces Society/Sarah Foltz Jordan

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628 NE Broadway Ste. 200, Portland, OR 97232

tel 503.232.6639 • fax 503.233.6794 • www.xerces.org

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WILDFLOWER HABITAT ESTABLISHMENT GUIDE: NEW YORK

PURPOSE

These instructions provide in-depth guidance on how to establish and maintain permanent vegetative cover, with a focus native wildflowers that provide pollen- and nectar-rich forage, to enhance habitat for pollinators. The requirements and considerations in this guide are in addition to NRCS NY criteria applicable all purposes for the planned conservation practice. To plan a specific project, use this guide along with NRCS NY Practice Standards. Consult with NRCS NY Biologists or State Specialists for site-specific guidance.

CONSERVATION OBJECTIVES

Depending on landowner objectives and project design, pollinator habitat may also enhance food and cover for other wildlife, reduce soil erosion, improve water quality, and attract beneficial organisms such as insect predators and parasitoids of crop pests.

KEY SITE CHARACTERISTICS

ASSESS THE FOLLOWING SITE CHARACTERISTICS WHEN SELECTING A LOCATION FOR WILDFLOWER HABITAT:

Pesticide Free Locations

Habitat must be protected from insecticides, fungicides, and herbicides. Including some pesticides approved for use on organic farms. Only sites with no to very low risk for pesticide drift will be established as new habitat.

Accessibility

Locate new habitat in areas accessible to equipment for site preparation, planting, and maintenance. Avoid sites with excessively wet conditions or seasonal or frequent flooding, as these conditions limit or prohibit accessibility.

Site History

Past land use, plant cover, application of pre-emergent herbicides or other chemicals, can affect plant establishment.

Weed Pressure

Establishing wildflowers from seed requires a well-prepared, weed-free seedbed. Prioritize areas with low weed pressure for wildflower seeding. Sites with high weed pressure take significantly more time and effort to prepare for seeding.

Slope

Do not disturb steep slopes or highly erodible lands. For the revegetation of erodible sites, use Critical Area Planting (342) or other suitable NRCS Practice Standards.

Sunlight

Most of the native wildflowers recommended in this guide grow best in full sun.

Soil Conditions

Many pollinator plants tolerate a range of soil types. Select species to match moisture, drainage, and other site conditions.

Irrigation

Establishing live plants from plugs or containerized stock will require irrigation. Irrigation is generally not needed for plantings established from seed.

Other Functions

Pollinator habitat may offer opportunities to serve other functions (e.g., erosion control or run-off prevention). These factors will influence plant choice or configuration.



FIGURE 1. Left: Monarch butterfly (*Danaus plexippus*) on wild bergamot (*Monarda fistulosa*). Right: In addition to pollinators, flower-rich habitat supports insect predators and parasitoids that attack crop pests, such as green lacewings. Photos: Xerces Society/Sarah Foltz Jordan.

SEED MIX REQUIREMENTS AND SPECIFICATIONS

PLANT SELECTION AND PLANTING STANDARDS:

Native Plants

Focus plant selection on native perennial plants that provide pollen- and nectar-rich forage for pollinators and beneficial insects and larval food plants for butterflies and moths. Include non-competitive native bunch grasses at a low rate; less than 25% of the mix based on a pure live seed (PLS) per square foot. See Appendix I.

Bloom Requirements

Select individual species that, in combination, provide consistent and adequate floral resources throughout the seasons. Seed or plant mixes must include a minimum of 3 species from each bloom period (early, mid, and late season). A more diverse mix is encouraged. See Appendix I.

Non-Native Plant

Non-native, non-invasive flowering plants beneficial to pollinators may be included in a native mix when cost or availability are limiting factors. Non-native plants will not exceed 10% of the mix per species and 20% of the mix in total based on PLS per square foot. Non-native plants are not recommended for natural areas or unique ecoregions.

Planting Size and Configuration

Bigger or connected habitat areas are ideal for supporting abundant and diverse populations of pollinators and beneficial insects, but habitat can be created in smaller patches or strips and still provide benefits. If planning for CRP, minimum size field is 0.5 acre and, if planted in strips, minimum width is 20 feet. Consider expanding or adding to existing habitat (Fig 2.).

Alternate Pest or Disease Hosts

In most cases, native wildflowers used in pollinator habitat are not alternate hosts for crop pests or diseases. Check for host plant potential when specific pests or diseases are of concern.



FIGURE 2. A diverse wildflower mix planted along an existing forest edge provides high-quality forage and enhances vertical layering of habitats. Photo: Xerces Society/Kelly Gill

SEED MIX/PLANT STOCK REQUIREMENTS:

Seed Mix Specifications and Seeding Rates

NRCS Biologists or specialists will provide seed mix specifications and seeding rates that meet NRCS NY Practice Standards and Implementation Requirements. Species substitutions or modifications to seed mixes must be approved, including species or pre-packaged mixes recommended by seed suppliers.

Pure Live Seed (PLS)

Seed must meet certification standards for purity, germination, weed seed, and noxious weed seed. Most seed companies advertise and sell wildflower seed in bulk pounds per acre. NRCS recommendations are in pure live seed (PLS). Make sure to specify PLS when ordering seed. Important: this will increase the amount of bulk seed ordered and the total cost of the mix. Do not accept unlabeled seed. See References # 9, 16.

Order Seed Packaged Separately

Wildflower seeds range in size and texture (Fig. 3). Using equipment that can accommodate different seed types will result in better distribution across the planting area. Requesting seed be packaged separately by species (i.e., not pre-mixed) is also helpful, as similar seed can be sown in batches making it easier to calibrate seeders for consistent flow.

Locally Sourced Seed or Plants

Select plant materials from local or regional sources that are adapted to your ecoregion. If transplanting plugs or potted plants, focus on straight species and avoid cultivated varieties. See References # 5, 9

Species Substitutions

Obtain quotes based on PLS before purchasing the seed mix. Seed companies may adjust specifications or recommend species substitutions on your quote based on inventory. Modifications to the mix or recommended alternative species must be approved.



FIGURE 3. Wildflower seed varies in size, shape, and texture, as shown above. Ordering seed packaged separately makes it easier to calibrate seeders. Photo: Xerces Society/Kelly Gill

SITE PREPARATION

CONSIDER THE FOLLOWING WHEN SELECTING SITE PREPARATION METHODS AND TIMELINES:

Proper site preparation is *the most important* and often *inadequately addressed component of project success*.

It is a process that may require more than one season to reduce competition from invasive, noxious weeds or undesirable plants and to deplete the weed seed bank prior to planting. Prioritize areas with low weed pressure for wildflower habitat. Sites with high weed pressure take significantly more time and effort to eliminate competing vegetation (> 1 year) before establishing new habitat.

Assessing Current Plant Cover

Assess weed pressure and weed species on site when developing a site preparation plan. Identify the types of weeds present (e.g., annual or perennial, grass or broadleaf, dominant species) and how they reproduce (e.g., by seed or vegetative). Match weed control methods and timing that would be most effective against prevalent weeds on site. In particular, site preparation will prioritize removal of persistent, perennial weeds.

Sites with High Weed Pressure

Sites with year-round cover of persistent weeds that have been actively growing and producing seed, such as sites dominated by introduced sod-forming grasses and rhizomatous forbs (e.g., smooth brome grass, Canada thistle). These conditions are typically occur in fields that have been left in weedy condition following cropping, in low maintenance hayland, pasture, or idle. Sites with these conditions will require significantly more time and effort to eliminate competing vegetation (Fig. 4).

Sites with Low Weed Pressure

Previous cropped lands that have been cultivated for several years are generally lower in weed pressure. If possible, establish wildflowers on sites with a history of excellent weed control (Fig. 5-6).

Minimize Soil Disturbance

Non-tillage weed removal practices are less likely to release dormant weed seed and are preferred over tillage. If tillage is necessary, use shallow cultivation and avoid excessive and aggressive ground disturbance that may bring up additional weed seed. **Deep tillage is not recommended.**

Common Equipment Needed

Mower or brushhog, cultivation equipment with light implements (e.g., disk, drag/chain harrow, sweep cultivator), cultipacker or weighted barrel roller, raking implements, spray equipment, and if using cover/smother crops, seeding and termination equipment and access to irrigation if needed.

Additional Methods

For additional details on site preparation, including organic methods not included in this guide, refer to *Wildflower Establishment: Organic Site Preparation Methods*. See Reference #8.



FIGURE 4. Example of high weed pressure. Characterized by dense vegetation dominated by persistent and invasive weed species covering 50% or more of the proposed planting area year-round. Photo: Xerces Society/Kelly Gill



FIGURE 5. Example of moderate weed pressure. Characterized by persistent and invasive weed covering 10-50% of proposed planting area. Photo: Xerces Society/Kelly Gill



FIGURE 6. Example of low weed pressure. Characterized by weed species covering <5% of proposed planting area. Photo: Xerces Society/Kelly Gill

TABLE 1. SITE PREPARATION

METHOD: NON-SELECTIVE, NON-PERSISTENT HERBICIDE (FIG. 7)
<p>Where to Use: Conventional or organic sites with low risk of erosion or water pollution and are accessible to spray equipment.</p> <p>Regulations: All recommendations for chemical herbicide application must be made by a <i>Certified NYS Pesticide Applicator</i> and applied per label instructions as required by law. Choice of organic-approved herbicide must be acceptable to OMRI for organic operations or, if not, used outside of certified ground <i>and</i> approved by an organic certifier.</p> <p>Caution: Wet climatic conditions in NY may be prohibitive to site preparation and seeding. Cultivation and seeding should be timed appropriately to occur during dry conditions. Adjust the schedule of activities listed below to <i>avoid wet conditions</i>.</p> <p>Additional Information: For more information on organic herbicide and other organic site preparation techniques see the <i>Wildflower Establishment: Organic Site Preparation Methods</i> manual (Reference #8).</p>
<p>BASIC INSTRUCTIONS</p> <ol style="list-style-type: none">Spring: As soon as the planting area is accessible, mow existing vegetation as short as possible to clear the site. Rake off all clippings to expose new weed growth. Monitor regrowth. Apply non-selective, non-persistent herbicide to weeds at the recommended height per label instructions.Spring Through Late Summer: Repeat herbicide treatment throughout entire season when needed. It is important to continuously monitor weed growth heights for proper timing of herbicide application. Mow or string trim any herbicide resistant weeds to prevent flowering and weed seed dispersal or assess the need for a targeted herbicide for resistant plants (as recommended by a Certified NYS Pesticide Applicator and applied per label instructions). Shallow cultivation with light implements set no deeper than 2 inches can be used as an alternative to one or more herbicide treatments where erosion is not concern. Repeat shallow cultivation each time regrowth reaches 4-6 inches tall. Do not allow weeds to flower and disperse seed. Deep disking/plowing is not recommended.Late Summer (Aug.): Assess weed pressure.<ol style="list-style-type: none"><i>If adequate weed control is achieved</i> (Fig. 6, 7): Proceed to Table 2 for recommended pollinator mix seeding dates. Use <i>OPTION A</i> (fall dormant seeding dates) if there are <i>dry conditions at seeding</i>. Use <i>OPTION B</i> (spring seeding dates) if site is prone to <i>wet conditions in the fall</i>. If needed, follow step 4 below.<i>If weedy vegetation persists</i> (Fig. 4, 7): Repeat site preparation steps 1-3 for an additional season before seeding wildflowers. <i>If needed</i>, use oats as smother crop to suppress weeds and seed at the higher recommended seeding rate in step 4b. Lightly harrow oat residue the following spring, then resume herbicide treatments or other site preparation method to continue to control weeds before planting. Reassess site preparation. <i>If adequate weed control is achieved after the second season of site preparation</i>, follow Table 2 seeding date recommendations. If needed, follow Step 4.Optional Step: If needed, plant a nurse/cover crop of oats (<i>Avena sativa</i>) on sites where erosion is a concern and/or where additional weed suppression is needed. When using oats as a nurse crop, the wildflower seed mix is seeded into standing oat stems using fall dormant seeding dates. Most oats will completely winter-kill in NY. The mulch layer created, coupled with snow pack and the freeze-thaw action of soils, will ensure wildflower seeds receive seed-to-soil contact needed for proper germination in the spring. When using oats as a winter cover (smother) crop before spring seeding, use a higher seeding rate for a dense stand that will suppress weeds. Leave oat residue on soil surface in spring to continue to smother weeds until wildflower mix is seeded. See instructions below for using a nurse/cover crop.<ol style="list-style-type: none"><i>If using oats as a nurse crop before a fall dormant seeding</i>, seed oats at 30-50 lb/acre between 8/15 and 9/15 using higher rates for broadcast methods and/or later seeding dates (see Table 3 for seeding methods). Once oats are established, seed pollinator mix into standing oats. Follow Option A in Table 2 for fall dormant seeding dates.<i>If using oats as a winter cover crop preceding a spring seeding</i>, seed oats at 80-125 lb/acre between 8/15 and 9/15 using higher rates for broadcast methods and/or later seeding dates (see Table 3 for seeding methods). Lightly harrow in spring to remove oat residue before seeding the pollinator mix. Follow Option B in Table 2 for spring seeding dates.

TABLE 1. SITE PREPARATION *continued*

METHOD: BUCKWHEAT SMOTHER CROP (FIG. 8)
<p>Where to Use: Conventional or organic sites with low risk of erosion and accessible to equipment and irrigation.</p> <p>Caution: Wet climatic conditions in NY may be prohibitive to site preparation and seeding. Cultivation and seeding should be timed appropriately to occur during dry conditions. Adjust the schedule of activities listed below to <u>avoid wet conditions.</u></p> <p>Additional Information: For more information on smother cropping, see the <i>Wildflower Establishment: Organic Site Preparation Methods</i> manual (Reference #8).</p>
<p>BASIC INSTRUCTIONS</p> <ol style="list-style-type: none">1. Spring: Mow vegetation and rake off clippings as needed to clear the site. Then, as soon as the planting area is accessible lightly till (disk and harrow or rototill). Time cultivation with dry soil conditions. Deep tillage is not recommended.2. Two Weeks Later: Lightly harrow to break clumps and kill emerging weed seedlings.3. Late May-Early June: Prepare for seeding buckwheat in late spring when soil temperatures are ~65°F. Create a smooth, firm seedbed and then <u>immediately</u> seed first crop of buckwheat. Monitor weather and delay planting to avoid extended periods of cool, wet weather.<ol style="list-style-type: none">a. <u>If drill seeding:</u> Use a seeding rate of 50-60 lb/acre and drill seed at 0.5-1 inch depth in 6-8 inch rows. Adjust seeding rates based on prior site conditions as necessary. If needed, irrigate to ensure buckwheat germination. Reseed any gaps in buckwheat cover crop to prevent weeds from invading.b. <u>If broadcast seeding:</u> Increase seeding rate to 70-80 lb/acre and lightly scratch seed into soil surface and cultipack with available equipment. Adjust seeding rates based on prior site conditions as necessary. If needed, irrigate to ensure buckwheat germination. Reseed any gaps in buckwheat cover crop to prevent weeds from invading.4. Early-Late July: Incorporate (disk) buckwheat 6 weeks after sowing (do not disk more than 1 inch deep) and <u>immediately</u> seed a second buckwheat crop. If needed, irrigate to ensure buckwheat germination.5. Early Fall (~ 6 weeks after second seeding): Terminate buckwheat crop before it goes to seed (mow and rake residue). Assess weed control. On sites where erosion is a concern, terminate buckwheat <u>before 9/15</u> and plant a cover crop using the appropriate option in step 6.<ol style="list-style-type: none">a. <u>If adequate weed control is achieved</u> (Fig. 6, 7): Proceed to Table 2 for recommended pollinator mix seeding dates. Use <u>OPTION A</u> (fall dormant seeding dates) if there are <u>dry conditions at seeding.</u> Use <u>OPTION B</u> (spring seeding dates) if site is prone to <u>wet conditions in the fall.</u> If needed, follow step 6 below.b. <u>If weedy vegetation persists</u> (Fig. 4, 7): Repeat site preparation steps 1-5 for an additional season before seeding wildflowers. If needed, seed a cover crop of oats after buckwheat termination using the higher recommended seeding rates in step 6b. Lightly harrow oat residue the following spring, then resume herbicide treatments or other site preparation method to continue to control weeds before planting. Reassess site preparation. <u>If adequate weed control is achieved after the second season of site preparation,</u> follow Table 2 seeding date recommendations. If needed, follow Step 6. <p>6. Optional Step: If needed, plant a nurse/cover crop of oats (<i>Avena sativa</i>) on sites where erosion is a concern and/or where additional weed suppression is needed. When using oats as a nurse crop, the wildflower seed mix is seeded into standing oat stems using fall dormant seeding dates. Most oats will completely winter-kill in NY. The mulch layer created, coupled with snow pack and the freeze-thaw action of soils, will ensure wildflower seeds receive seed-to-soil contact needed for proper germination in the spring. When using oats as a winter cover (smother) crop before spring seeding, use a higher seeding rate for a dense stand that will suppress weeds. Leave oat residue on soil surface in spring to continue to smother weeds until wildflower mix is seeded. See instructions below for using a nurse/cover crop.<ol style="list-style-type: none">a. <u>If using oats as a nurse crop before a fall dormant seeding,</u> seed oats at 30-50 lb/acre between 8/15 and 9/15 using higher rates for broadcast methods and/or later seeding dates (see Table 3 for seeding methods). Once oats are established, seed pollinator mix into standing oats. Follow Option A in Table 2 for fall dormant seeding dates.b. <u>If using oats as a winter cover crop preceding a spring seeding,</u> seed oats at 80-125 lb/acre between 8/15 and 9/15 using higher rates for broadcast methods and/or later seeding dates (see Table 3 for seeding methods). Lightly harrow in spring to remove oat residue before seeding the pollinator mix. Follow Option B in Table 2 for spring seeding dates.</p>



FIGURE 7. Left: This site was prepared with a single herbicide treatment, leaving significant stubble and persisting weedy grasses. It is *not ready* for planting. Right: This site was treated for an entire growing season whenever new weeds appeared. The stubble has been removed and it is ready for planting. Neither site has been cultivated. Photos: The Xerces Society/Brianna Borders



FIGURE 8. Left: A dense cover crop of buckwheat used to smother weeds can help reduce competing vegetation prior to wildflower seeding. Photo: The Xerces Society/Kelly Gill. Right: In addition to weed suppression benefits, buckwheat provides a temporary source of abundant flowers attractive to pollinators, such as the bumble bee pictured here, and a diversity of other beneficial insects. Photo: The Xerces Society/Nancy Lee Adamson

PLANT ESTABLISHMENT

CONSIDER THE FOLLOWING WHEN SELECTING PLANTING DATE AND TIMELINES:

Seeding Wildflowers

Planting dates and methods are site-specific. Seeding wildflowers can be a lower-cost way to establish pollinator habitat. Installing live plants (e.g., plugs) can be used as an alternative to seeding. Existing weed competition will affect planting success and must be addressed before planting. Table 2 outlines seeding dates and Table 3 outlines several planting methods.

TABLE 2. SEEDING DATES

POLLINATOR MIX SEEDING DATES	
<p>Fall Dormant Seeding</p> <p>Pro:</p> <ul style="list-style-type: none"> • Cold-moist stratification of seed enhances germination. <p>Con:</p> <ul style="list-style-type: none"> • Site conditions may not be favorable for preparing a seedbed or operating drills or other seeding equipment (e.g., sites prone to wet conditions in fall). 	<p>Spring Seeding</p> <p>Pro:</p> <ul style="list-style-type: none"> • Better field conditions for seeding, especially if site is prone to wet conditions in fall. <p>Con:</p> <ul style="list-style-type: none"> • Requires more maintenance in the first year to combat weed competition. • Reduced germination for some species (e.g. those that require or benefit from cold stratification).
<p>BASIC INSTRUCTIONS</p> <p>Option A. Fall Dormant Seeding: Late Oct.-Early Nov. These dates coincide with the first hard/killing frost dates (Fig. 9) and when daytime temperatures are consistently 45°F and below, but before the ground freezes. The exact date will vary by region and annual weather patterns. Caution: Wet field conditions can be prohibitive to fall dormant seeding. Proceed to Table 3. to select a planting method.</p> <p>Option B. Spring Seeding: Mid-April through end of May. These dates coincide with the last spring frost dates throughout NYS (Fig. 9). The exact date will vary by region and annual patterns. Seeding the pollinator after June 1 will increase weed competition and require additional effort for weed control during the first year of wildflower establishment. Caution: Avoid seeding during wet conditions. Proceed to Table 3. to select a planting method.</p> <p>Refer to options in Table 1. for using a nurse crop before fall dormant seeding or for using a winter cover crop preceding a spring seeding (recommended for sites where erosion control and/or additional weed suppression is needed until wildflowers are established).</p>	

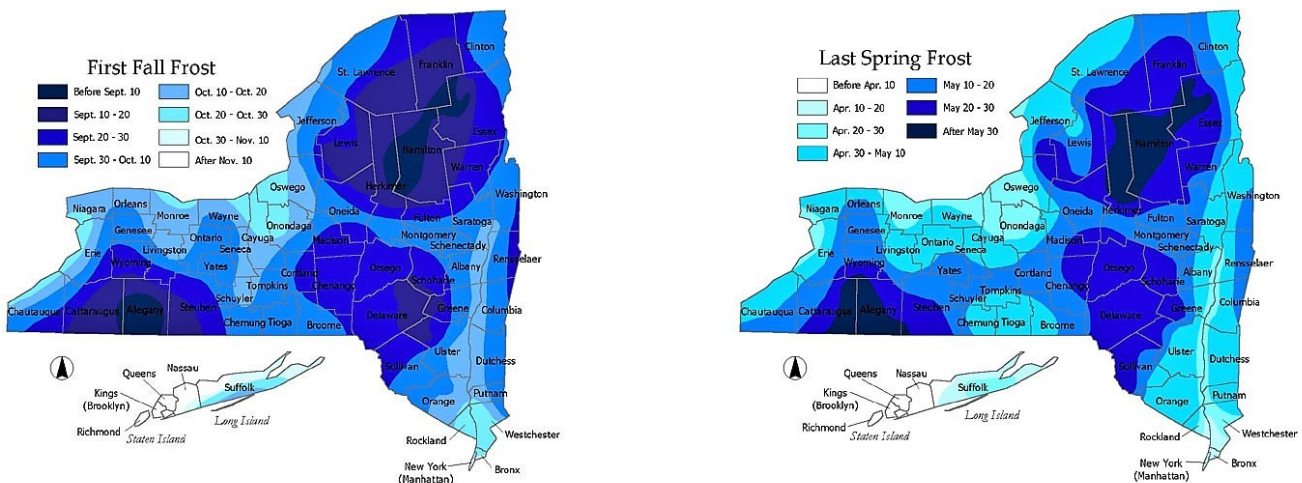


FIGURE 9. The map on the left shows the regions in NYS and their corresponding first fall frosts. The map on the right shows the last spring frost date. Please note these are approximate dates and actual seeding dates are to be planned accordingly. Source: Cornell University, available online at: <http://gardening.cals.cornell.edu/garden-guidance/weather-climate/>.

CONSIDER THE FOLLOWING WHEN SELECTING PLANTING METHODS AND EQUIPMENT:

Seeding Equipment

Consider availability of seeding equipment during project planning. All seeders require careful calibration to ensure proper rate and spread. Broadcast seeding is recommended for small sites. Native seed drills are more appropriate for larger sites. ***Most grain drills are not designed to handle wildflower seeds.***

TABLE 3. PLANTING METHODS

METHOD: NATIVE SEED DRILLS (FIG. 10)	
<p>Pros</p> <ul style="list-style-type: none"> • Convenient for planting large areas • Seed box agitators and depth controls designed for planting small and fluffy native seeds at optimal rate and depth • Seeds planted in even rows, for easier seedling recognition • Does not require seed to be rolled/cultipacking 	<p>Cons</p> <ul style="list-style-type: none"> • 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
<p>BASIC INSTRUCTIONS</p> <ol style="list-style-type: none"> 1. Plant only when the soil is dry enough to prevent seed from sticking to the coulters. Under wet conditions, small seed is likely to stick to mud-caked parts of the drill, rather than the ground. Seedbed should be level to ensure proper planting depth. 2. Keep seed separated by species until ready to plant. 3. Prior to planting, divide seed into batches of large smooth seed, small smooth seed, and tufted seed that does not flow easily. 4. Loosely fill seedboxes with the appropriate seed batch (based on size and texture per step 3). Do not compact seed into boxes). 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. 5. 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 <i>no deeper than ¼ inch</i> (consult with the seed vendor for specific guidelines on when planting in very sandy soils). Very small wildflower seed should be planted separately on the soil surface. 6. Operate drill at < 5 mph, stopping periodically to check planting tubes for clogs (usually observed as a seedbox remaining full). Clogging is most common with fluffy seed, or seed with a lot of chaff. Avoid backing up, as it can cause clogging. 7. Stop periodically to check planting depth. Some seed should be visible on soil surface. <p>See References # 9, 15, 16.</p>	



FIGURE 10. Native seed drills are ideal for large planting sites (5+ acres). Typical models have depth controls for optimal seed placement and separate seed boxes for different sizes of seed. Photo: Xerces Society/Kelly Gill

TABLE 3. PLANTING METHODS *continued*

METHOD: BROADCAST SEEDERS OR HAND BROADCASTING (FIG. 11 a-i)	
<p>Pros</p> <ul style="list-style-type: none"> • Inexpensive • Easy to use • Many models and sizes of broadcast seeders are commonly available (e.g., hand-held crank and larger tractor or ATV-mounted models) 	<p>Cons</p> <ul style="list-style-type: none"> • Requires a smooth, well prepared seed bed • Seed needs to be pressed into the soil after planting • Difficult to calibrate • Some models of broadcast seeders cannot accommodate large seeds
<p>BASIC INSTRUCTIONS</p> <ol style="list-style-type: none"> 1. Create a smooth, lightly packed seedbed. Remove all stubble and residue from seedbed prior to seeding. The soil surface can be lightly hand-raked or harrowed to break-up crusted surfaces, but do not cultivate the site after the site preparation phase (cultivation will bring up additional weed seed). 2. Mix seeds of similar sizes together in separate batches and bulk up seed with an inert carrier such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or pelletized lime. Use a 3:1 ratio of inert carrier to seed by volume. Using inert carriers ensures even seed distribution, provides visual feedback on where seed has been thrown, and makes equipment calibration easier (Fig. 11a-c) 3. Use broadcast seeding equipment that has a flow gate that closes down small enough to provide a slow, steady flow of the smallest wildflower seed. Models with an internal agitator are preferred. 4. Fill with flow gates closed. Begin seeding with flow gates set to narrowest opening to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed should be seeded separately with the flow gate set to a wider opening. 5. For small sites (e.g., less than 1 acres), seed can also be hand broadcast (similar to scattering poultry feed). When hand broadcasting, divide seed into at least two batches, bulk the seed mix with an inert carrier (as above), and sow each batch separately. Scatter the first batch evenly over the site, and scatter the second batch evenly over the site walking in the opposite direction (i.e., crosshatch pattern) to ensure seed is evenly distributed (Fig. 11d). 6. Do not cover the seed with soil after planting. Roll over seeded area with a water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker to press the seed into the soil surface (Fig. 11g-i). 	
METHOD: DROP SEEDERS OR FERTILIZER SPREADERS (FIG. 11 a-i)	
<p>Pros</p> <ul style="list-style-type: none"> • Inexpensive • Easy to use • Even seed dispersal • Can accommodate both large and small seed • Many models and sizes available (e.g., hand-powered turf grass seeders, larger tractor drawn “pasture-seeder”) 	<p>Cons</p> <ul style="list-style-type: none"> • Requires a smooth, level seed bed • Seed needs to be pressed into the soil after planting • Hand-powered models are time consuming for large areas (over ½ acre) • Calibration requires trial and error
<p>BASIC INSTRUCTIONS:</p> <ol style="list-style-type: none"> 1. Create a smooth, lightly packed seedbed. Remove all stubble and residue from planting area prior to seeding. The soil surface can be lightly hand-raked or harrowed to break-up crusted surfaces, but do not cultivate the site after the site preparation phase (cultivation will bring up additional weed seed). 2. Mix seeds of similar sizes together and bulk up with an inert carrier such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or pelletized lime. Use a 3:1 ratio of inert carrier to seed by volume. Using inert carriers ensures even seed distribution in the mix, provides visual feedback on where seed has been thrown, and makes equipment calibration easier (Fig. 11a-c). 3. Fill seeder with drop gates closed. Begin seeding with drop gate set to the narrowest opening to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed should be seeded separately with drop gate set to a wider opening. 4. Do not cover the seed after planting. Roll over seeded area with a water-filled turf grass roller (available for rent at most hardware stores) or a cultipacker to press the seed into the soil surface (Fig. 11g-i). 	



Fig. 11a



Fig. 11b



Fig. 11c



Fig. 11d



Fig. 11e



Fig. 11f



Fig. 11g

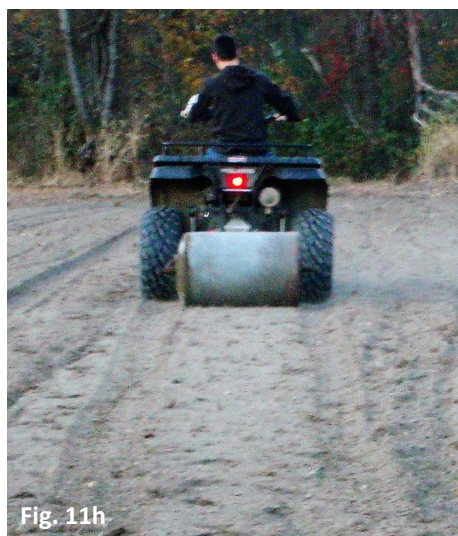


Fig. 11h



Fig. 11i

FIGURE 11 (a-i). Add inter carrier/bulking agent to seed, mix evenly, and divide mixture into several batches (a, b, c). Broadcast in multiple passes for even coverage. If hand-seeding (d) or using hand-crank seeders (e), walk in perpendicular passes or if using a tractor mounted broadcast seeder or PTO spinner/spreader (f), drive in overlapping passes. Broadcast seed directly onto soil surface and roll over with a turf roller (g, h) or cultipacker (i) to ensure seed-soil contact. Do not incorporate or bury seed. Planting too deep can inhibit germination. Photos: Xerces Society/Kelly Gill (a, h, i), Brianna Borders (b, d), Sara Foltz Jordan (c, f); Regina Hirsch, University of Wisconsin (g); New Hampshire NRCS (e).

TABLE 3. PLANTING METHODS *continued*

METHOD: TRANSPLANTING FORBS AND WOODY PLANTS (FIG. 12)	
Pros <ul style="list-style-type: none">• Provides nectar and pollen resources more quickly• 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 <ul style="list-style-type: none">• Expensive and time consuming for large areas• Transplants typically require irrigation during establishment
BASIC INSTRUCTIONS <ol style="list-style-type: none">1. Regular shovels are adequate for transplanting most container stock. Dibble sticks or mechanical transplanters are helpful for plug-planting. Power augers and mechanical tree spades can be used to install larger plants. Transplanting can occur any time the ground can be worked outside of frost dates or prolonged periods of hot, dry, or windy weather.2. Measure the planting to determine how many plants will be needed for the recommended spacing. <i>For woody shrubs:</i> Space plants on 4'–10' centers (depending upon size at maturity). <i>For herbaceous plants:</i> Space plants closer on 2'– 3' centers.3. Stage the transplants in position with proper spacing prior to installing plants in the ground (Fig. 12).4. Pre-dig and pre-irrigate holes. If soil is compacted, degraded, or depleted, add compost to each hole before installing plant materials. Compost must be free from weed seeds, aged properly, and mixed thoroughly with soil in the holes. Other soil amendments are typically not needed.5. Install plants by placing them in holes and backfilling with soil as needed (Fig. 12). Lightly tamp soil around the plant to increase soil-root contact and minimize potential for frost heaving. Ensure plants are at proper depth with the root collar flare (woody plants) or soil at the top of plugs flush with soil (ground) level.6. Follow-up irrigation is dependent upon weather and specific site conditions. Irrigate with at least 1 inch of water per week (except during natural rain events), for the first two years after establishment. Use long, deep watering to encourage deep root system development. Avoid shallow irrigation. Irrigate at the base of plants (or use drip irrigation). Avoid overhead irrigation that would encourage weed growth. Once plants are established, irrigation should be removed or greatly decreased.7. In cases where rodent damage may occur, below ground wire cages are recommended. Similarly, plant guards (fencing, tree tubes, etc.) may be needed to protect plants from above ground browsing or antler damage by deer (Fig. 15)8. Mulching is recommended to reduce weed competition and to retain moisture during the establishment phase. Recommended materials include untreated wood chips, bark dust, weed-free straw, nut shells, or other regionally appropriate mulch materials that contain <i>no</i> viable weed seeds. To prevent rodent damage, do not mulch within one foot of seedling.	



FIGURE 12. Measuring the planting area and staging plants before transplanting (left) to achieve proper spacing and plant density. Install transplants into proper sized holes (right) and irrigate immediately after transplanting. Photos: Tim Dunne, USDA NRCS.

HABITAT MANAGEMENT REQUIREMENTS AND PROCEDURES

WHAT TO EXPECT DURING THE ESTABLISHMENT PERIOD—YEAR 1 AND 2 AFTER PLANTING

Wildflower mixes planted from seed are slow to establish. In the first growing season, perennial wildflowers devote most of their energy to root growth and do not grow much aboveground. Many species will not bloom until year 2 or 3. Newly planted sites, often look patchy or weedy and the presence of annual or biennial weeds is common in year 1 (e.g., foxtail, crabgrass, wild mustards, Fig. 13). During this time, weeds will grow faster and taller than the slow-growing wildflowers. If left unmanaged, weeds can choke— or shade— out wildflower seedlings resulting in poor wildflower establishment.

To ensure good establishment, controlling weeds is the biggest priority in year 1-2 after seeding a perennial wildflower mix. Use frequent high-mowing in year 1 and 2 to prevent weeds from producing and dispersing seed in the wildflower planting (Table 4). Control weeds in adjacent areas to eliminate sources from which weeds can spread. Repeated high-mowing can also help control perennial weeds as it removes leaves, which reduces photosynthesis, and causes the plant to use stored resources to regrow, which depletes the energy available for production of reproductive plant parts. Additional methods of weed control are listed in Table 5. As wildflowers mature, plants become more vigorous and are able to outcompete weeds. Once the plant community is well established, and weed pressure is low, transition to a rotational management plan (Table 5).

TABLE 4. WEED CONTROL DURING ESTABLISHMENT

METHOD: HIGH-MOWING (FIG. 13 AND 14)

Where to Use: In perennial wildflower plantings established from seed and in adjacent areas that have weedy vegetation.

Equipment Needed: Mower that can be adjusted to at least 8 inches height (e.g. rotary brush mower, flail mower). A lawn mower/finishing mower will not be effective. Clean equipment to ensure it is free of weed seed before entering planting area.

BASIC INSTRUCTIONS

Monitor growth and begin follow-up weed management immediately. Perennial wildflowers are slow to establish and are usually not harmed by incidental mowing, but since young wildflower and weed seedlings may look alike care should be taken to properly identify weeds before removal (especially in year 2 and after). Use other weed control strategies along with high-mowing to remove problem weeds (see Table 5).

1. **In year 1 after planting:** Each time plant cover reaches a height of 10-12 inches, trim vegetation back to a height of 6-8 inches. Do not let weeds growing in the planting area and in adjacent areas produce and disperse seed. Mowing should cease by mid-September, unless additional late-season mowing is needed to prevent weed seed production and dispersal.
2. **In year two after planting:** Monitor weed pressure. Each time plant cover reaches a height of 12-18 inches, trim vegetation back to a height of 8 inches. Adjust management schedule to reduce mowing if weed pressure is low and wildflowers are dominant cover, but do not allow weeds to go to seed. Mowing should cease by August, unless additional late-season mowing is needed to prevent weed seed production and dispersal.



FIGURE 13. Annual weeds, such as foxtail, are common invaders of newly seeded wildflower plantings (left). In year 1, frequent high-mowing was used to prevent weeds from reseeding and to cut back weedy vegetation to expose slow-growing wildflowers emerging beneath weeds to sunlight (right). Photo: Xerces Society/Kelly Gill

WEED MANAGEMENT DURING ESTABLISHMENT (YEAR 1 AND 2 AFTER PLANTING)

Use weed management methods in Table 5. in combination with high-mowing (or as an alternative, where appropriate) to control noxious and invasive species. An integrated approach to weed management is often more effective than mowing alone, as some weeds may not respond to mowing and require more effective methods. These methods can also be used on a targeted, or spot-treatment basis beyond the establishment period as part of a long-term plan (see Table 6). Follow restrictions during wildlife nesting periods (consult with NRCS Biologists). Clean equipment to ensure it is free of weed seed before entering planting area.

TABLE 5. OTHER COMMON WEED MANAGEMENT STRATEGIES

METHOD	DESCRIPTION
<p>String-Trimming</p>	<p>Use string-trimming to keep weedy species from shading out wildflower seedlings and to prevent annual and biennial weeds from flowering and producing seed (similar to high-mowing). Like, high-mowing, raise string-trimmer so that vegetation is clipped no shorter than 6 inches to avoid seedling damage (establishment period). Adjust to appropriate height if using to control weeds in mature plantings.</p> <p>Where to Use: Smaller plantings, areas not accessible to mowers, to remove small weed patches within a larger planting (i.e., alternative to spot-mowing), and to manage weeds around woody transplants or plugs.</p>
<p>Hand-Weeding</p>	<p>Use hand-pulling or hand tools to eliminate weeds from the planting area.</p> <p>Where to use: Hand-weeding is effective in small areas to remove individual plants before they produce seed or spread, or for weedy species that do not respond to mowing or whose growth is encouraged by mowing. When pulling or digging out perennial weeds, it is important to remove the entire root (for some plants even the smallest piece of root may be capable of producing a new plant). Hand-weeding is easiest when the soil is damp (e.g., after a rain event). Remove weedy plant material from the site. If weeds being pulled have set seed, carefully remove the plant and put it in a bag to prevent seed dispersal and properly dispose of or destroy seed heads.</p>
<p>Spot-Spraying*</p>	<p>For weed control after planting, herbicide is to be applied on a spot-treatment basis to protect desirable plants, pollinators, and other wildlife. Do not allow herbicide to drift or drip onto wildflowers or grasses planted in the mix. Targeted herbicides can be spot-sprayed to treat herbicide resistant weeds. Grass-selective herbicides can be especially helpful to control weedy grasses, which are common invaders wildflower plantings. If large areas need to be sprayed, reseed or replant any resulting bare patches.</p> <p>Where to use: Spot-spraying is usually performed with backpack spraying, or with rope-wick implements (when weed growth is substantially taller than newly established wildflowers). <i>*All recommendations for chemical herbicide application must be made by a Certified NYS Pesticide Applicator and applied per label instructions as required by law.</i></p>

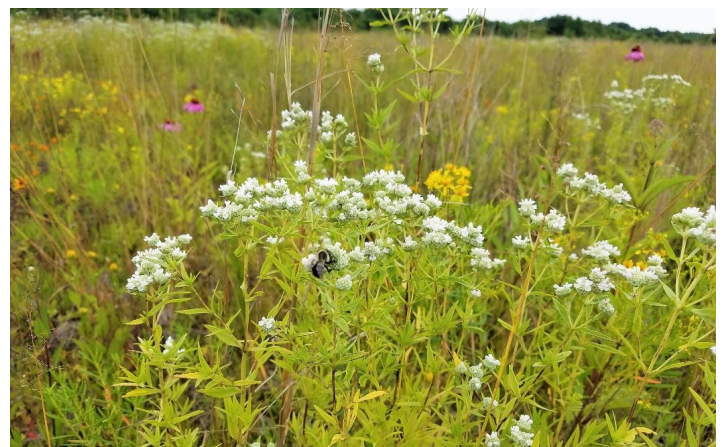


FIGURE 14. Left: This photo shows a site in the first year after seeding that is dominated by weeds (nut-sedge). Weeds were managed with high-mowing and herbicide spot-treatment (rope-wick application). Right: By year 3, a diverse community wildflowers was established. Photo: Xerces Society/Kelly Gill.

OPERATIONS AND MAINTENANCE

Once wildflowers are successfully established (e.g., wildflower cover > weed cover, most species in the mix planted are present, at least 3 species blooming in each bloom period), long-term management is required to maintain early successional habitat and wildflower diversity. Maintenance practices include managing weeds and woody vegetation, protecting habitat from pesticide risk, and preventing plant damage. Management activities will occur on an annual, patch-rotation basis. Maintenance practices shall not disturb cover during the reproductive period for the desired species (exceptions should be considered for periodic mowing or burning if necessary to maintain the health of the plant community. Table 6. lists some common maintenance activities.

TABLE 6. OPERATIONS AND MAINTENANCE

PRACTICE	DESCRIPTION
<p>Early Successional Habitat Management</p>	<p>Control invasive, noxious weeds in the wildflower planting and in adjacent areas. Once wildflowers are successfully established mowing, burning, or other disturbance will be planned and implemented on an annual patch-rotation. Schedule of operations is site specific. Do not mow or burn during critical wildlife nesting seasons (consult with NRCS biologists for guidance).</p> <p>BASIC INSTRUCTIONS:</p> <ol style="list-style-type: none"> 1. Mow or burn only 1/3 of the total area in any one year to ensure sufficient and undisturbed cover for pollinators and other wildlife remains standing. Mow at 6 inch height in late-fall after wildflowers are done blooming for the season. Adjust timing (e.g., late summer/early fall when <i>most</i> wildflowers are done blooming) if site is prone to wet fall conditions that prohibit management activities. 2. The remaining patches are mowed, burned, etc. in subsequent years per annual rotation schedule with no patch being disturbed in consecutive years unless there is a specified need to control weeds or woody encroachment at greater frequency or over a larger portion of the planting. If burning, consult with a Certified Prescribed Burn Manager/Specialist on permitting and proper implementation of controlled burns. 3. Hand-weeding may be necessary to control noxious weeds. Use targeted herbicide application only when necessary on a spot-treatment basis to control noxious weeds that do not respond to other methods. Do not allow herbicide drift onto desirable plants. <i>*All recommendations for chemical herbicide application must be made by a Certified NYS Pesticide Applicator and applied per label instructions as required by law.</i> 4. Occasional thatch removal (using a chain or tine harrow) after mowing can be beneficial to facilitate regeneration/reseeding of wildflowers and reduce build-up of thatch that can inhibit seedling growth or movement of wildlife (e.g., dense thatch layers can inhibit movement of birds foraging for insects). 5. Maintain diversity and consistent bloom by re-seeding or re-planting as necessary.
<p>Pesticide Protection</p>	<p>Insecticides, including some insecticides approved for organic farms, can kill or have sub-lethal effects on pollinators and beneficial insects. Some fungicides and herbicides also show toxicity against insects, and herbicide drift or over-spray will damage or degrade the plant community.</p> <p>BASIC INSTRUCTIONS:</p> <ol style="list-style-type: none"> 1. Habitat must be protected at all times from pesticide application, drift, or other routes exposure. See References # 17-20 for detailed guidance. 2. Do not spray near habitat. 3. Use pesticide set-backs and prevent drift from all pesticide applications occurring on or adjacent to the site. 4. Clearly flag or mark the planting with a sign (Fig. 16) to designate the area as protected wildlife habitat.
<p>Prevent Plant Damage</p>	<p>Controlling herbivore damage is especially important where habitat is established from transplants, as young plants are more susceptible to animal damage. Control herbivore damage with grow tubes, cages, or other exclusion. Remove materials that could impede plant growth as soon as possible after establishment (Fig. 15). Prevent other disturbances that can damage plants (e.g., farm equipment/vehicle traffic, herbicide drift).</p>



FIGURE 15. Grow tubes, trunk protectors, plant cages, temporary exclusion, or fencing is used during establishment to reduce browsing by herbivores and damage from mowers or weeding operations, but should be removed as soon as possible to avoid impeding plant growth. Photos: Xerces Society/Kelly Gill.



FIGURE 16. Newly planted areas should be clearly marked to protect from harmful disturbance. ***Note:** Due to wildlife safety concerns, attaching habitat signs like the one above to the top hole of the fence post, plugging the top hold with a bolt and nut, or using posts that do not have holes, such as wood stakes, is recommended. Photos: Xerces Society/Kelly Gill

REFERENCES AND RESOURCES

1. **USDA Natural Resources Conservation Service (NRCS):** For information on NRCS conservation programs, contact your local NRCS or conservation district office. <https://offices.sc.egov.usda.gov/locator/app>
2. **USDA NRCS New York Pollinator Webpage:** Information on Farm Bill programs for pollinators and additional resources. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ny/plantsanimals/?cid=nrcs144p2_027389
3. **Biology Technical Note No. 78: Using 2014 Farm Bill Programs for Pollinator Conservation (2nd Ed):** This technical note outlines opportunities within current Farm Bill programs that benefit pollinators and summarizes existing pollinator conservation guidance developed by and for most NRCS State offices <http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=37370.wba>
4. **NRCS Documents for Pollinator Conservation and Enhancement:** Database of plant lists, fact sheets, and other technical guidance documents that provide information to improve planning and implementation of conservation practices or broaden understanding of a practice's value. <https://plants.usda.gov/pollinators/NRCSdocuments.html>
5. **Xerces Society's Pollinator Conservation Resource Center:** Comprehensive library of pollinator conservation resources including regional plant lists, habitat installation and conservation guides, pesticide protection guidelines, habitat monitoring, and more. www.xerces.org/pollinator-resource-center. Search (click on map) for regional lists of native plant nurseries and seed companies. Note: The list of seed/plant vendors is not all inclusive.

REFERENCES AND RESOURCES

6. **Pollinator and Beneficial Insect Habitat Assessment Guides:** A tool used in conservation planning to assess current habitat conditions, identify and prioritize conservation actions, and quantify habitat or land management improvements for pollinators or beneficial insects on a single site. <http://xerces.org/pollinator-conservation/habitat-assessment-guides/>. New version including fillable form capabilities coming soon, check website for current version.
7. **Pollinator Habitat Installation Guides:** Regional and state-specific guidelines provide in-depth instructions on how to install and maintain nectar- and pollen-rich habitat for pollinators in the form of wildflower plantings/conservation cover (NRCS Practice 327) or native flowering shrubs/ hedgerow plantings (NRCS Practice 422) <https://xerces.org/pollinator-conservation/agriculture/pollinator-habitat-installation-guides/>. Updated frequently, check for latest version.
8. **Wildflower Establishment: Organic Site Preparation Methods:** In-depth guide on organic wildflower establishment and site preparation methods and techniques including smother cropping, solarization, mechanical weed control, sheet mulching, and more http://www.xerces.org/wp-content/uploads/2016/10/Organic-Wildflower-Establishment_Oct2016_FINAL-web.pdf
9. **A Guide to Conservation Planting on Critical Areas for the Northeast:** A comprehensive guide on vegetative conservation practices for a variety of purposes in the Northeast including plant profiles, planting methods, and much more. https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/nypmspu11417.pdf
10. **Farming for Bees:** This publication contains a wealth of information about common groups of native bees, their habitat requirements, conservation strategies, extensive pesticide risk reduction guidance, and case studies from across the U. S. http://www.xerces.org/wp-content/uploads/2008/11/farming_for_bees_guidelines_xerces_society.pdf.
11. **Habitat Planning for Beneficial Insects:** This publication outlines the ecology of many native beneficial insect groups and highlights strategies for conservation biological control—the practice of providing habitat for insects that attack crop pests, including case studies from across the U.S. <https://xerces.org/habitat-planning-for-beneficial-insects/>
12. **Pollinator-Friendly Plants of the Northeast:** A 60 page guide detailing high-value plants for pollinators, their characteristics preferred conditions, and more (Clark, S. 2012. 60p., ID# 11164). https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_027028.pdf
13. **Monarch Conservation Plants:** Resources for monarch conservation including Xerces' Milkweed Seed Finder tool, regional monarch nectar plant lists, and other conservation guides <https://xerces.org/monarchs/>
14. **100 Plants to Feed the Bees: Provide a Healthy Habitat to Help Pollinators Thrive:** User-friendly, illustrated field guide offers browsable profiles of 100 common flowers, herbs, shrubs, and trees that attract bees, butterflies, moths, and hummingbirds. <https://xerces.org/100-plants-to-feed-the-bees/>
15. **Seed Quality, Seed Technology, and Drill Calibration:** This NRCS Plant Materials Technical Note features information on calibrating native seed drills and the use of inert carriers www.plant-materials.nrcs.usda.gov/pubs/wapmctn6331.pdf
16. **Calibration of Truax No-Till Grain Drill:** Instruction on calibration and operation of the Truax no-till drill, using Model FLX 1188RD as an example. https://wmc.ar.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mipmctn11123.pdf
17. **Agronomy Technical Note No. 9: Preventing or Mitigating Potential Negative Impacts of Pesticides on Pollinators Using Integrated Pest Management and Other Conservation Practice:** This manual provides guidance on conservation strategies that can reduce the risk of pesticides to bees in farmland (e.g., pesticide buffer systems) and gives the readers a deeper understanding of pesticide risk assessment (toxicity and exposure) to inform decisions on pesticide selection <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=34828.wba>
18. **Guidance to Protect Habitat from Pesticide Contamination:** This document is designed to help growers, land managers, and others safeguard pollinator habitat from harmful pesticide contamination and includes information on selecting habitat sites and ways to maintain clean habitat by limiting and carefully managing pesticide use. <https://xerces.org/guidance-to-protect-habitat-from-pesticide-contamination/>
19. **Impacts of Pesticide on Invertebrates (IPI) Online Database:** The IPI database contains summaries of research articles on pesticides, their effects on invertebrates, and pesticide movement in the environment. Articles have been reviewed and summarized to highlight key findings by Xerces Society staff. <https://pesticideimpacts.org/>
20. **How to Reduce Bee Poisoning from Pesticides:** An overview of how a variety of wild and managed bees and their pollination activities are affected by pesticide application. Provides guidelines for how beekeepers, growers, and pesticide applicators can work together to prevent bee poisoning. <https://catalog.extension.oregonstate.edu/pnw591>

APPENDIX 1. RECOMMENDED PLANTS FOR POLLINATORS

COMMON NAME ¹ <i>Scientific name</i>	FLOWER TIME ²	WETLAND INDICATOR ³	DRAINAGE CLASS ⁴	HEIGHT (FT) ⁵	PLANT CHARACTERISTICS & GROWING CONDITIONS ⁶
Early Bloom Period					
EASTERN COLUMBINE <i>Aquilegia Canadensis</i>	April-June	FACU	W	1-2	One of the earliest wildflowers to bloom, striking red flowers with yellow centers; grows best in full-partial sun and moist soils
GOLDEN ALEXANDERS <i>Zizia aurea</i>	Late April-June	FAC	W-SP	1-3	Yellow compound umbel flowers; grows best in full-partial sun and moist conditions; will tolerate light shade; can be slow to germinate
TALL WHITE BEARDTONGUE ⁷ <i>Penstemon digitalis</i>	Late May-June	FAC	W-MW	2-5	Robust early bloomer, showy white trumpet-shaped flowers; tolerates poor soils; grows best in full-partial sun and average moisture; benefits from stratification
BLUE WILD INDIGO ⁸ <i>Baptisia australis</i>	Late May-July	FACU	W-MW	3-5	Legume; violet pea-shaped flowers on spikes; bushy habit; can be slow to establish; grows best in full sun and dry-medium soils; hard seed
OHIO SPIDERWORT <i>Tradescantia ohiensis</i>	Late May-July	FACU	W-SP	2-3	Graceful, grass-like foliage; flowers open during morning hours and close in response to warm temps; may not flower until year 2-3, grows best in full-partial sun and dry-medium moisture
LANCELEAF COREOPSIS <i>Coreopsis lanceolata</i>	June-July	FACU	W-MW	1-3	Easy to establish, adaptable wildflower; grows best in full sun and dry-medium soils; tolerates poor soils with sandy, gravelly, rocky material
HAIRY BEARDTONGUE <i>Penstemon hirsutus</i>	Mid June-July	FACU	W-MW	2-4	Showy lavender trumpet-shaped flowers; grows best in full-partial sun and dry-average moisture; benefits from stratification
BUTTERFLY MILKWEED <i>Asclepias tuberosa</i>	Late June-Aug	FACU	W-MW	1-2	Large showy clusters of small, bright orange flowers; grows best in full sun and dry-mesic soils; develops slowly forming a long taproot; very drought tolerant
PLAINS COREOPSIS <i>Coreopsis tinctoria</i>	June-Aug	FACU	W-MW	1-2	Reseeding annual; grows best in full sun and moderate moisture; may compete during establishment, include in mix at low rate
CARDINAL FLOWER <i>Lobelia cardinalis</i>	June-Aug	OBL	SP-P	1-4	Brilliant scarlet winged flowers on slender spikes against dark green and purple foliage; grows best in part shade and wet-moderate moisture
BLACKEYED SUSAN <i>Rudbeckia hirta</i>	June-Aug	FACU	W-SP	2-3	Widely adapted, easy to grow; biennial/short-lived perennial (self-seeds); grows best in full-partial sun and dry-medium moisture
BLUE VERVAIN <i>Verbena hastata</i>	June-Aug	FACW	SP-P	2-5	Wetland-adapted; light purple flowers on showy candelabra-like spikes; easy to establish; small colonies often produced from rhizomes; grows best in full-partial sun and medium-wet moisture
BLANKETFLOWER ⁷ <i>Gaillardia aristata</i>	June-Sept	NI	W	1-2	Native to mid-west, but widely planted; easy to establish; long-bloom, showy flowers; grows best in full sun and dry-average moisture; drought tolerant; use for added diversity in native plantings
BROWNEYED SUSAN <i>Rudbeckia triloba</i>	June-Sept	FACU	W-SP	1-3	Biennial/short-lived perennial, readily self-seeds; long bloom; grows best in full-partial sun and dry-medium moisture

APPENDIX 1. RECOMMENDED PLANTS FOR POLLINATORS

COMMON NAME ¹ <i>Scientific name</i>	FLOWER TIME ²	WETLAND INDICATOR ³	DRAINAGE CLASS ⁴	HEIGHT (FT) ⁵	PLANT CHARACTERISTICS & GROWING CONDITIONS ⁶
Mid Bloom Period					
WILD BERGAMOT <i>Monarda fistulosa</i>	July	FACU	W-MW	2-5	Persistent; showy clusters of pink to lavender flowers; grows best in full-partial sun and medium soils (but adaptable to all but extremely wet soils); drought tolerant
PURPLE BERGAMOT <i>Monarda media</i>	July-Aug	FACW	W-SP	2-3	Persistent; showy clusters of reddish-purple flowers; grows best in full-partial sun and medium moisture
SPOTTED BEEBALM <i>Monarda punctata</i>	July-Aug	UPL	W	1-3	Dense whorls of flowers along stem; flowers in first year short-lived, but can reseed; grows best in full sun and dry conditions; avoid wet soils
GRAY CONEFLOWER <i>Ratibida pinnata</i>	July-Aug	FAC	W-MW	3-5	Robust, adaptable plant; prefers full sun and mesic conditions; will tolerate partial sun and dry sites
WILD SENNA ⁸ <i>Senna hebecarpa</i>	July-Aug	FACW	W-SP	4-6	Perennial legume, large clusters of yellow, pea-like flowers; grows best in full sun and medium moisture; hard seed
HOARY VERVAIN <i>Verbena stricta</i>	July-Aug	FACU	W	4-6	Stems terminate in flower spikes with dense light pink flowers; grows best in full sun and dry-medium moisture; does not compete well with vigorous grasses
PARTRIDGE PEA ⁸ <i>Chamaecrista fasciculata</i>	July-Aug	FACU	W-MW	1-3	Reseeding annual legume; easy to grow; grows best in full-partial sun and average to dry soils; avoid 'Lark' accession which is too aggressive for mixes; hard seed
SWAMP MILKWEED <i>Asclepias incarnata</i>	July-Aug	OBL	SP-P	3-6	Clusters of erect deep pink-purple umbel flowers, branching habit; grows best in full-partial sun and moderate to wet conditions; tolerates occasional flooding; larval host plant of monarch butterfly
COMMON MILKWEED <i>Asclepias syriaca</i>	July-Aug	UPL	W-MW	3-4	Fragrant, large domes of dusty rose-deep pink flowers; grows best in full sun and moist soils, but will tolerate a variety of situations; larval host plant of monarch butterfly
SPOTTED JOE PYE WEED <i>Eutrochium maculatum</i>	July-Aug	OBL	SP-P	2-7	Tall plant with large leaves and enormous pink-purple flower heads; adaptable species; grows best in full sun-partial shade and medium-wet soils; tolerates irregular or seasonal inundation
OXEYE SUNFLOWER <i>Heliopsis helianthoides</i>	July-Aug	FACU	E-MW	2-5	Upper stems terminate in erect flowerheads with yellow composite flowers; branching form, can become bushy in open habitats; grows best in full-partial sun and average-dry conditions
VIRGINIA MOUNTAINMINT <i>Pycnanthemum virginianum</i>	July-Aug	FAC	W-MW	1-3	Numerous heads of small, silvery-white flowers with purple dots; branching stems create bush-like form; grows best in full-partial sun and moist to average conditions; adaptable to a range of soil textures.
NARROWLEAF MOUNTAINMINT <i>Pycnanthemum tenuifolium</i>	July-Sept	FAC	W-MW	2-4	Easy to establish; stems terminate in small, flat abundant white flowers; grows best in full sun and average-moist conditions

APPENDIX 1. RECOMMENDED PLANTS FOR POLLINATORS

COMMON NAME ¹ <i>Scientific name</i>	FLOWER TIME ²	WETLAND INDICATOR ³	DRAINAGE CLASS ⁴	HEIGHT (FT) ⁵	PLANT CHARACTERISTICS & GROWING CONDITIONS ⁶
Mid Bloom Period (continued)					
GREAT BLUE LOBELIA <i>Lobelia siphilitica</i>	July-Sept	FACW	SP-P	2-5	Wetland-adapted plant with brilliant blue flowers on tall, sturdy spikes; grows best in partial sun-filtered shade and moist soils, but can adapt to drier conditions with more shade
DENSE BLAZINGSTAR <i>Liatris spicata</i>	July-Sept	FAC	W-SP	2-4	Interesting form, long spikes with purple tassel-like flowers that bloom from the top downward; can be slow to establish; grows best in full-partial sun and medium-wet soils; drought tolerant
ANISE HYSSOP ⁷ <i>Agastache foeniculum</i>	July-Sept	NI	W-MW	3-5	Establishes quickly; fragrant showy spikes of flowers on upper stems; grows best in full-partial sun and dry to medium moisture
PURPLE CONEFLOWER <i>Echinacea purpurea</i>	July-Sept	FAC	W-MW	2-4	Common, widely grown; daisy-like prominent flowerheads and pink-purple reflexed petals; easy to establish; grows best in full sun and dry to moderate moisture; very drought tolerant
BONSET <i>Eupatorium perfoliatum</i>	July-Sept	FACW	SP-P	3-5	Upper stems terminate in clusters of white flowers; forms vegetative colonies; grows best in full-partial sun and medium to wet conditions
ZIGZAG ASTER <i>Symphotrichum prenanthoides</i>	July-Sept	FAC	W-SP	2-4	Tolerates a range of conditions; grows best in full sun-partial shade and dry to moist conditions; spreads easily, include in a mix at low rate
Late Bloom Period					
FLAT TOP WHITE ASTER <i>Doellingeria umbellata</i>	Aug-Sept	FACW	W-P	3-4	Central stem terminates in a flat-headed panicle flowerheads with white florets; grows best in full-partial sun and slightly wet to moist conditions
CALICO ASTER <i>Symphotrichum lateriflorum</i>	Aug-Sept	FAC	W-P	1-5	Upper stems produce elongated panicles of flowerheads with light pinkish-white florets; grows best in light shade-partial sun and medium moisture.
NEW YORK IRONWEEED <i>Vernonia noveboracensis</i>	Aug-Sept	FACW	MW-SP	5-8	Robust wildflower; clusters of deep purple flowers at the apex; grows best in full sun-filtered shade and medium to wet conditions, but tolerates periods of dry conditions
PURPLEHEADED SNEEZEWEED ⁷ <i>Helenium flexuosum</i>	Aug-Oct	FAC	W-SP	1-3	Abundant, cone-shaped flowerheads with 3-lobed yellow petals and purple centers; grows best in full sun-partial shade and average to moist conditions
NARROWLEAF SUNFLOWER <i>Helianthus angustifolius</i>	Aug-Oct	FACW	SP-P	5-7	Upright clumping form with late-blooming bright yellow flowers; grows best in full sun and medium to wet moisture
NEW YORK ASTER <i>Symphotrichum novi-belgii</i>	Aug-Oct	FACW	MW-P	4-5	Robust native aster, abundant purple flowers; grows best full sun and medium to wet soils
SHOWY GOLDENROD <i>Solidago speciosa</i>	Aug-Nov	UPL	W-MW	4-6	Stout stem; abundant yellow flowers; important late season nectar plant for fall-migrating monarchs
GRASSLEAF GOLDENROD <i>Euthamia graminifolia</i>	Late Aug-Sept	FAC	SP-MW	3-4	Yellow flowers bloom gradually; important late season nectar plant for fall-migrating monarchs

APPENDIX 1. RECOMMENDED PLANTS FOR POLLINATORS

COMMON NAME ¹ <i>Scientific name</i>	FLOWER TIME ²	WETLAND INDICATOR ³	DRAINAGE CLASS ⁴	HEIGHT (FT) ⁵	PLANT CHARACTERISTICS & GROWING CONDITIONS ⁶
Late Bloom Period (continued)					
COMMON SNEEZEWEED <i>Helenium autumnale</i>	Late Aug-Sept	FACW	W-SP	2-5	Abundant, cone-shaped flowerheads with 3-lobed yellow petals; grows best in full sun and medium-wet moisture
BIGLEAF ASTER <i>Eurybia macrophylla</i>	Late Aug-Oct	UPL	W-MW	2-3	Central stems terminate in panicle flowerheads with abundant lavender/white florets; grows best in full sun-moderate shade and average to dry conditions; moderate spreading habit
ROUGH GOLDENROD <i>Solidago patula</i>	Sept-Oct	OBL	SP-P	4-5	Stem terminates in an open panicle of flowerheads; grows best in partial sun-light shade in consistently moist soils; will spread; include in mix at a low rate
SMOOTH BLUE ASTER <i>Symphyotrichum laeve</i>	Sept-Oct	FACU	W-MW	2-5	Adaptable to a range of soil conditions; important late season food source; moderate spread
NEW ENGLAND ASTER <i>Symphyotrichum novae-angliae</i>	Sept-Oct	FACW	W-MW	2-6	Robust native aster; abundant deep purple flowers; grows best in full sun-shade and medium to wet conditions, establishes quickly
AROMATIC ASTER <i>Symphyotrichum oblongifolium</i>	Sept-Oct	NI	W	2-3	One of the longest blooming native asters; grows best in full sun and dry-average moisture
CANADA WILDRYE <i>Elymus canadensis</i>	Grass	FACU+	W-MW	3-4	Performs better on dry soils
VIRGINIA WILDRYE <i>Elymus virginicus</i>	Grass	FACW-	MW-P	3-4	Performs better on moist soils
DEERTONGUE <i>Dichanthelium clandestinum</i>	Grass	FACW	E-SP	2	Adds structure; cover for wildlife; provides erosion control

PLANT LIST NOTES

- Most species are native New York, but introduced to some counties and/or naturalized. To determine county-level distribution of individual species visit The Biota of North America Program Maps by States and Provinces: <http://bonap.net/fieldmaps>.
- Seed mixes shall contain a minimum of 9 species of pollinator-friendly flowering plants with at least 3 species from each bloom period: Early (April-Mid June), Mid (Late June-July), Late (August-October). A more diverse mix is encouraged. For several species, the duration of flowering will overlap several bloom periods. Flower time and duration of bloom can vary depending on ecotype, location, and environmental conditions. Bloom times listed for each species are approximate. NRCS can provide seed mix specifications that meet NRCS NY Conservation Practice Standards and Implementation Requirements. Custom mixes can be designed for unique ecoregions or site conditions.
- Wetland indicator values from 2016 Army Corps of Engineers, National Wetlands Plant List.
- Drainage class indicates site adaptability of species. E = excessively drained, W = well drained, MW = moderately well drained, SP = somewhat poorly drained, P = poorly drained. Some species will tolerate moisture conditions outside of this range.
- Height differences are based on site conditions. Optimal site conditions will produce larger, more vigorous plants.
- Many native wildflowers are adapted to a wide range of environmental conditions, but establish best when matched with most favorable conditions. Wildflowers tolerate poor soil nutrients and typically do not require soil amendments. Nitrogen applications are not needed, and not recommended, as it will promote weed growth. If soil pH is extremely low, lime can be applied to bring pH to optimal range of 5.5 to 6.5.
- Species are listed as native to NY, but not in every county, or species are naturalized.
- Legume species listed will have a percentage of hard seed in each lot. If fall planting, it is not necessary to scarify seed before planting. If spring seeding, scarify seed before planting for increased germination. Do not store scarified seeds longer than a few days. Use sandpaper to nick the seed coat or soak the seeds in boiling water until water cools. If soaking the seeds, spread them out to dry before seeding. Note that all native perennial wildflowers benefit from a period of cold stratification to improve germination and vigor.

For more information on pollinator-friendly plants, see the NY Wildflower Establishment Guide References and Resources section (See References # 4, 5, 9, 12-14)