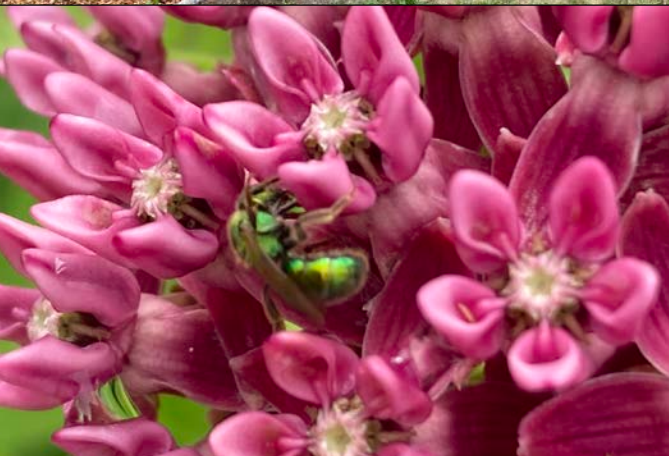


Creating Perennial Habitat for Pollinators and Beneficial Insects Using Plugs



High-quality pollinator and beneficial insect habitat is usually composed of native vegetation. Providing pollen and nectar resources, host plants, overwintering and nesting opportunities, and protection from pesticides are all critical to quality habitat. Native habitat plantings can be established from seed or with small live plants, also known as plugs. There are advantages and disadvantages for each approach (see Table 1 on page 2 for comparison), and selecting the right plant materials depends on the project goals and a variety of other site-specific factors. If you decide that establishing habitat with plugs is the method you want to use, this fact sheet will help you successfully complete your project.

Plugs, often sold in a few cubic inches of soil, are a great way to establish small-scale habitat in a variety of locations, such as city parks, street landscaping, urban and rural farms, residential gardens, natural areas, or acreages. While plugs are generally more expensive than seeds, they are much faster to establish, more reliably successful, often require less management in the long-term, and offer more opportunities for aesthetic and functional design of the habitat. Bloom densities, heights, colors, and vegetative textures can be specifically coordinated and staggered to provide diverse resources for pollinators and beneficial insects throughout the growing season.

This document focuses on how to design and create perennial pollinator and beneficial insect habitat by installing native plugs. The strategies outlined for plug planting are broad to cover multiple regions. For larger plantings (an acre or more in size), starting with seed is generally a more practical and economical approach, and Xerces Habitat Installation Guides (see “Further Reading” on page 6) should be referenced for that process.

TOP-DOWN—Native pollinator habitat installed by farm interns and apprentices at Michigan State University's Detroit Partnership for Food, Learning, & Innovation; green sweat bee on purple milkweed; parking lot pollinator garden in New Jersey. (Xerces Society Photos: Stefanie Steele [top, middle]; Kelly Gill [bottom].)

Seed or Plugs?

Table 1. Establishing Perennial Wildflower Habitat from Seed or Plugs

This table compares the planting of native perennial wildflower habitat from seed and from transplants (plugs). Use this table to help decide which option is best for the specific site.

STARTING FROM SEED	STARTING FROM TRANSPLANTS (PLUGS)
Typically lower cost (can vary by region/availability).	Higher cost (cost is reduced if you are able to grow some transplants yourself).
Very thorough pre-planting weed control is needed , since native seeds are slower to establish and can be outcompeted by weeds.	Less pre-planting weed control needed , since native transplants have more of a competitive advantage against weeds.
In some regions mowing is required for weed management during establishment. In drier areas (e.g., western US) hand-weeding or mowing are options for post-planting weed control.	Hand-weeding or weed-whacking is typically necessary during establishment.
Slower to bloom ; blooms are usually not abundant until years 2–4 of project (depending on site preparation and establishment mowing).	Quicker to bloom ; blooms abundant in year 1 or 2 of the project, depending on the timing of planting.
Can be low or high diversity . Seed mixes can be designed with very high diversity, but this is not always realized in the planting; some species are very difficult to establish from seed.	Can be low or high diversity . Some species are not available as plugs; others are nearly impossible to establish without using plugs.
Less control of planting layout ; design is mostly limited to seed mix.	More control & design opportunities ; select plants can be clustered, evenly distributed, arranged by height & bloom time, etc.
Lower installation time/labor.	Higher installation time/ labor.
Irrigation may not be needed or may be minimal , depending on location and climate.	Will likely require irrigation at the time of transplant or during dry periods.

Design Considerations for Native Plug Plantings

Where to Plant

If the native perennial plantings are intended to be long term or permanent, placement is critical in the planning process. Consider the goals and objectives of the site and how long-term or permanent habitat will fit in. Creating and maintaining pollinator habitat is a commitment, and it should be planned to fit into the surrounding area and scaled to be manageable. Site specific considerations include sun exposure, soil type, protection from pesticides, access to irrigation, purpose (general planting, sensory garden, beetle bank, etc.), and more.

Additional considerations should be made when planting habitat on vacant or revitalized city lots or remediation lots. Have an understanding of the type of structures or businesses that previously occupied the site (i.e., residential or brownfield site), determine if obstructions have been buried (e.g., buried foundations or other debris from demolition), what soils were used to fill in the demolished area (sand and gravel are commonly used and will make planting difficult), and conduct soil tests to measure whether heavy metal contaminants are present. For more information on contaminated soils, review the Environmental Protection Agency’s guidance, “[What to Know Before You Grow](#).”

Size

The size of the planting will depend on the space available and other factors. The high cost of plants and labor is often a significant factor in the size. In some regions plugs are typically used for projects less than $\frac{1}{10}$ th of an acre in size and are usually only a few hundred square feet in size. In California and some other western regions, it is not uncommon for plug project areas to be up to an acre in size. In these areas, plug plantings can be more advantageous because native seed may not be readily available or affordable, may be difficult to establish, or have specific germination requirements to break dormancy. Plugs overcome all these concerns.

Site Preparation

Before planting, it is important to remove existing vegetation, particularly undesirable and invasive plants, to reduce competition with newly installed plants. Proper site preparation will decrease the need for extensive maintenance of the planting and should be conducted well in advance of planting. Examples of site preparation approaches include the use of herbicides or organic strategies such as smother cropping, silage tarping, sheet mulching, or solarization. See “Further Reading” below for sources of detailed guidance on site-preparation methods.

Plant Selection

A mixture of short- and tall-stature plants can be used, but remember taller plants have the potential to shade out smaller plants or flop into walkways and other areas. Match native species to the site’s sun exposure, soil, and drainage conditions. Select a variety of native wildflower species to ensure blooming begins early in the spring and lasts through the fall. Include species from a diversity of plant families and genera to support a wider range of insects. Consider adding host plants to benefit moths and butterflies, like native milkweed for monarch caterpillars or sunflowers and/or goldenrods for moth caterpillars. Native grasses and sedges are also an important part of pollinator and beneficial insect habitat; forage (as host plants), nesting, and overwintering opportunities are provided by our native grass species. Native grasses and sedges can also aid in the suppression of unwanted vegetation.



A native plug planting in process to support monarchs in California. (Photo © Nurtiz Katz.)

Initial Care of Plugs

Plants should be planted within a few days of delivery or pick-up, but if needed, they can be left in their trays for up to a few weeks until planting can take place. To care for plants prior to planting:

- Place plant trays in a lightly shaded area
- Protect from animal damage and monitor for potential damage, such as rabbit browse.
- Regularly water trays, ensuring the roots are thoroughly saturated, not just the top surface of the plug.
- Consider taking photos of young plants and their plant name tags for ease of identification later on.

Planting Design

We recommend the following practices:

- Plant the same species in groups of 3–6 plugs to improve garden aesthetics and create the larger bloom displays some pollinators prefer for more efficient foraging.
- Use grasses and sedges to create natural drifts between clusters of flowers.

- If a manicured look is desired, mix groups of plants with different bloom periods or flower colors and/or add a border (e.g., mowed borders, bricks, dead wood, etc.)
- Do not overwhelm shorter species with tall species, consider planting taller species in the interior of the planting and shorter species along the habitat perimeter edge.

A planting map may be helpful to plan or document the configuration and location of plants. This could be as rough or as detailed as you'd like, from broadly noting the species in each flower cluster and grass or sedge "drift" to describing exactly how many plants of each species and where they should be placed in a given location.

Plant Spacing

Plugs of wildflowers or grasses should be planted anywhere from 12–36" apart (center-to-center). Denser plantings will fill in more quickly and be more resistant to weed invasion. Planting on a grid can help ensure even distribution.

When to Plant and Irrigation

The local climatic conditions will determine when planting can take place, how much watering is necessary to establish plants, and for how long. Once planted, plugs will need to be watered thoroughly and immediately. In most cases, plug plantings will need to be watered regularly for ease of establishment. Watering can be done by hand (e.g., hose) or through an irrigation system. See Table 2 on page 5 for installation and irrigation timing.

Common Tools for Planting and Weeding

There are several tools that can aid in the planting of plugs such as soil knives, trowels, dibblers, or shovels. Weeding can be done by hand using hoes (collinear, swan-neck, stirrup, diamond, etc.) or flame weeders, or by machine with walk-behind tractors or mowers.

Mulch

Spread a layer of weed and disease-free straw, bark, or wood chip mulch around the plants to reduce weed competition and to hold in moisture. Following the first year or two of growth, additional applications of mulch may be unnecessary and may even prevent plants from spreading or seeding out into the surrounding space. As the mulch decomposes, native plants should naturally reseed or spread via roots into the exposed soil space.



A newly planted habitat garden created with plugs. The plants are laid out so the species form blocks and spaced so that they will fill the planted area over the next year. (Photo: Xerces Society.)



Native plants emerge in spring for their second growing season on a urban farm in Iowa. (Photo: Zack D'Amico.)



Three-year-old beetle bank planted with native plugs on urban farm in Iowa. (Photo: Xerces Society / Sarah Nizzi.)

Table 2. Timing Windows for Installing and Irrigating Plugs by Region

REGION	INSTALLATION	IRRIGATION
Alaska	Apr–May <u>or</u> Sep–Oct	May require irrigation <u>if</u> rainfall is sparse and in dry regions
California	Oct–Dec	Apr–Oct for the first 2–3 years during normal rainfall; may need more during drought years, and may require winter irrigation in times of severe drought
Florida	Spring	May require irrigation
Great Basin	Apr–May <u>or</u> Sep	Jun–Sep
Great Lakes	Early fall <u>or</u> spring	May require irrigation <u>if</u> soils are dry or rainfall does not follow planting event
Hawaii	Early wet season (Nov–Mar)	Leeward-facing shore areas may require irrigation during dry periods; windward-facing shore areas may or may not need irrigation depending on rainfall
Inland Northeast	Mar–Apr <u>or</u> Oct–Nov	Apr–Oct in the first season during dry periods
Maritime Northwest	mid-Sep–mid-Oct	Spring, usually require irrigation the first season
Mid-Atlantic	mid-Oct–mid-Dec <u>or</u> spring	Plugs usually require irrigation the first season
Midwest	Early fall <u>or</u> spring	May require irrigation <u>if</u> soils are dry or rainfall does not follow planting event
Northeast	May–Jun	May require irrigation the first season, especially during dry years
Northern Plains	Sep	<u>If</u> dry, or drought year, irrigate recent plug plantings
Rocky Mountains	Apr–May <u>or</u> Sep	Required for the first 2–3 years
Southeast	Spring	May require irrigation
Southern Plains	mid-Oct–Jan	<u>If</u> dry or drought year, irrigate recent plug plantings
Southwest	Sep–Dec	Required for the first 2–3 years, may need more during drought years

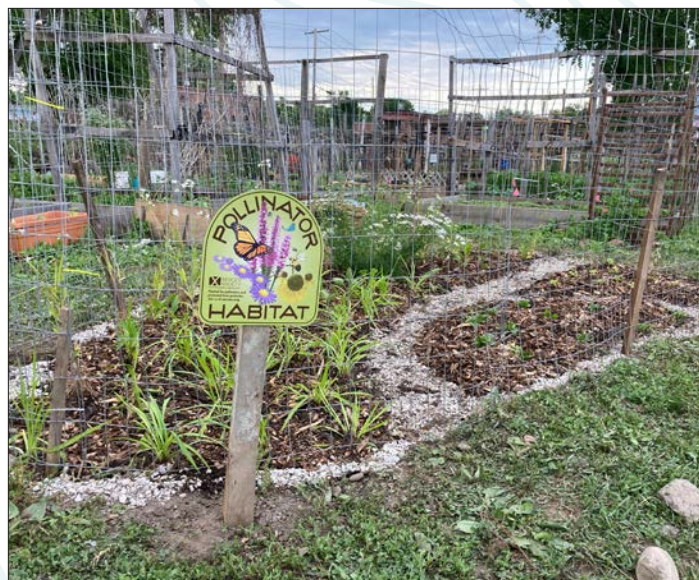
We do not recommend using dyed wood chips, black walnut wood chips, or wood chips whose origins may be from chemically treated wood.

Protection During Establishment

Install temporary fence, netting, or other plant or root guards where needed to protect transplants from browsing animals that can cause significant damage.

Weed Management

During the first growing season, plan to control weeds throughout the habitat area—something that is especially important if a mulch weed barrier is not applied. Focus efforts on fully removing any problematic perennial weeds, and clipping the seed heads of annual weeds. After a few years of regular weed control, the prolific growth and dominant cover of native plants should prevent most weeds from establishing.



An example of animal protection in a urban setting in New York. (Photo: Anna Victoria.)

Soil Amendments

In most cases, native plants do not require any fertilizers, composts, or other amendments. However, it may be useful to add a bit of compost to each plant hole to reduce compaction issues or add a beneficial nutrient boost. If soils have been significantly altered, we recommend consulting your county's Extension or USDA office on appropriate soil-restoration and remediation practices. Soil tests are recommended to determine the level of heavy metals on site and if soil remediation is required. Heavy metals, such as lead, pose health risks to the people who steward and interact with the land, as well as wildlife.

Long-Term Management

Management will be ongoing throughout the lifespan of the planting. Monitor plantings on a regular basis and pull or spot-spray woody or herbaceous weeds at first detection. Larger plantings can be maintained through mowing, haying, or burning every 4–6 years once the habitat is established. (Establishment may be achieved in years 3 or 4 of the project, so burning, etc., is unlikely to be considered earlier than year 6 or 7.) Timing may depend on the presence and type of weed pressure. Leave refugia areas by only disturbing one-third of the habitat each year and rotating where the disturbance happens from year to year. See “Further Reading” section below for resources on management recommendations.

Further Reading

- [Habitat Installation Guides \(Xerces Society\)](#)
- [Maintaining Diverse Stands of Wildflowers Planted for Pollinators \(Xerces Society\)](#)
- [Nesting and Overwintering Habitat for Pollinators and Beneficial Insects \(Xerces Society\)](#)
- [Organic Site Preparation for Wildflower Establishment \(Xerces Society\)](#)
- [Pollinator Conservation Resource Center \(Xerces Society\)](#)
- [Turning Brownfields into Community-Supported and Urban Agriculture \(Environmental Protection Agency\)](#)



Monarch habitat kit recipients ready to plant native plugs in California. (Photo: Xerces Society / Jessa Kay Cruz.)



A completed native plug planting in California. (Photo: Xerces Society / Jessa Kay Cruz.)

Acknowledgments

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