



Establishing Pollinator and Beneficial Insect Habitat on Farms in Idaho

An Installation Guide



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The Xerces Society for
Invertebrate Conservation

xerces.org

Acknowledgements

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Cover: Monarch butterfly (*Danaus plexippus*) and other bees on showy milkweed (*Asclepias speciosa*), bee on false aster (*Boltonia asteroides*), dogbane leaf beetle (*Chrysochus auratus*)

(Top photograph by Jennifer Hopwood, The Xerces Society; bottom left photograph by John Anderson; bottom right photograph by Jade Florence, Northwest Center for Alternatives to Pesticides)

Below: The edge of a wildflower planting in Emmett (Christina Stucker-Gassi, Northwest Center for Alternatives to Pesticides)

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Pollinator and Beneficial Insect Habitat Installation Guide

Idaho

Purpose

These instructions provide in-depth guidance on how to install on-farm habitat for beneficial insects such as pollinators and natural enemies of crop pests on farms in Idaho. This guide focuses on how to incorporate native wildflowers and grasses in the form of hedgerows, beetle banks, and large seeded areas. To plan site preparation, planting method and maintenance for a specific project, use this guide with the Checklist found at the end of this document.

Key Site Characteristics

There are many opportunities to install habitat on farms, including fence lines, field borders, non-irrigated land, pivot corners and centers, farm roadsides, and more. Site selection for insectary habitat should take the following into consideration:

- **Pesticide Drift:** Habitat must be protected from pesticides (especially insecticides and bee-toxic fungicides and herbicides). This includes some pesticides approved for use on organic farms. Only sites with no or very low risk for pesticide drift should be established as new habitat.
- **Accessibility:** The site 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

Conservation Objectives

Depending on conservation objectives and project design, insectary habitat may also provide food and cover for other wildlife, reduce soil erosion, protect water quality, and sequester carbon.

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, or grass sod), use of pre-emergent herbicides or other chemicals, and soil compaction can affect plant establishment. It is important to find out if a proposed site 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:** Irrigation is required to establish plants from plugs, pots, or bare root. Irrigation may not be necessary when planting seed but is recommended if feasible, due to rainfall variability.
- **Other Functions:** The site may offer opportunities to serve other functions, such as run-off prevention, stream bank stabilization, wildlife habitat, or windbreaks. Additional desired functions can influence planting choice and/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 meadow planting (left) provides a variety of forage and nesting sites for native bees and beneficial insects (such as this parasitoid wasp on sulfur buckwheat, right).



(Photographs by Christina Stucker-Gassi, Northwest Center for Alternatives to Pesticides.)

Plant Selection

Native Plants: Plant species selection should emphasize native plants that provide pollen- and nectar-rich forage and/or nesting resources for pollinators and other flower-visiting insects. On-farm habitat may include flowering perennials and herbaceous plants as well as flowering shrubs or trees. Ideal habitat includes pollinator nesting materials such as bunch grasses and pithy-stemmed plants. Bunch grasses are also vital for beetles that prey on common crop pests. Important larval host food plants and nectar resources for butterflies should also be included. The Appendix provides a master list of recommended plants for various locations and environments in Idaho and includes the attractiveness of different plants to specific beneficial insect groups.

When designing a plant list, individual species should be chosen so that resources are present throughout each season. In order to achieve this goal, a minimum of three species from each blooming period (early, mid, and late season), are recommended. 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. When planting from seed, incorporating more than 10% grass into a seed mix is generally not recommended.

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 bottom of page 15 for a recommended list of non-native plants. Non-native cover crop species 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

Site Preparation

Site preparation is **one of the most important** and often inadequately addressed components for project success. It is a process that may require more than one season of effort to reduce competition from invasive, noxious, or undesirable plants prior to planting. This is especially true of areas to be planted from seed, which require very thorough weed management in order to establish successfully. In particular, site preparation should focus on the removal of perennial and aggressive annual weeds. 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.

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 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.

Site preparation methods are provided below.

Table 1 Site Preparation Methods

METHOD: MOWING, WEED-WHACKING, OR FLAMING	
Where to Use <ul style="list-style-type: none"> • Areas with low to moderate weed pressure • Areas to be planted with container plants (not seed) • Areas without perennial or aggressive annual weeds • Areas with a low risk of erosion • Areas accessible to equipment 	Timing <ul style="list-style-type: none"> • Total time: 6 -12 months before planting • Begin: Spring • Plant: Fall or spring
Basic Instructions: <ol style="list-style-type: none"> 1. Begin the process by smoothing and leveling, grading, or berming the area if needed. Clear the area of any debris or thick thatch. Do not cultivate unless necessary, as any disturbance can promote the germination of additional weed species. 2. Mow, weed-whack, or flame weed the area when weed growth occurs and repeat regularly as needed until planting. Do not allow weeds to set seed in the area. Do NOT till or cultivate the area once site preparation has begun. 	

METHOD: NON-PERSISTENT HERBICIDE	
Where to Use <ul style="list-style-type: none"> • Where weed pressure is low to high • Areas with a low risk of erosion 	Timing <ul style="list-style-type: none"> • Total time: 6 -12 months • Begin: Spring • Plant: Fall or spring
Basic Instructions: <ol style="list-style-type: none"> 1. Begin the process by leveling, grading, or berming the area if needed. Clear the area of any debris or thick thatch. Do not till or cultivate unless necessary, as any disturbance can promote the germination of additional weed species. 2. Apply a non-persistent herbicide as per label whenever weeds are actively growing. 3. Repeat regularly as needed until planting. Do not let weeds grow above 4". Do not let weeds go to seed. Do NOT till or cultivate the area once herbicide applications have begun. 4. Wait at least 72 hours after the last herbicide treatment before planting. <p><i>NOTE: Do not use herbicides that are highly bee-toxic (e.g. Paraquat and Gramoxone).</i></p>	
METHOD: SHEET MULCHING (FIGURE 2)	
Where to Use <ul style="list-style-type: none"> • Areas with a low risk of erosion • Areas accessible to equipment • Smaller acres (e.g. <1 acre) • Where mulching materials are available/ affordable 	Timing <ul style="list-style-type: none"> • Total time: 6 - 12 months • Begin: Spring • Plant: Fall or spring
Basic Instructions: <ol style="list-style-type: none"> 1. Begin the process by leveling, grading, or berming the area if needed. Clear the area of any debris or thick thatch. Do not till or cultivate unless necessary, as any disturbance can promote the germination of additional weed species. 2. Irrigate the site to moisten the soil. 3. Layer and overlap a weed-barrier of corrugated cardboard. Water this layer. 4. Layer nitrogen-based materials (e.g., composted plant materials) to a depth of 1-3 inches, depending on weed pressure (the more weeds, the greater the depth). Water this layer. 5. Spread a layer of carbon-based materials (e.g., natural wood bark, chips, straw, sawdust, or shavings) to a depth of 1-2 inches to retain moisture and prevent weed germination. Water this layer. 6. Repeat layers of nitrogen and carbon based materials at least once more, watering each layer as you go. Additional layers are recommended in areas with high weed pressure. 7. End with a layer of carbon based materials on the top. 8. In the fall, install transplants by planting directly into the cardboard/mulched area. If seeding into the area, scrape off the top layer and seed directly into the next layer. <p><i>NOTES: Do not till. Avoid any ground disturbance that may bring up additional weed seed.</i></p> <p><i>* Choice of materials (e.g., cardboard, straw, etc) must be acceptable to OMRI for organic operations or, if not, used outside of certified ground AND approved by an organic certifier. Using materials available as farm products or by-products, such as straw and leaf litter or wood chips, can help reduce the cost of sheet mulching a site.</i></p>	

Figure 2 After the layer of cardboard is moistened, a thick layer of carbon, in this case straw, was layered on top (left). The thick layer of straw will help to suppress existing weeds and prevent weed seeds from germinating (right).



(Photographs by Susan Dill (left) Jennifer Miller (right))

METHOD: SOLARIZATION (FIGURE 3)	
<p>Where to Use</p> <ul style="list-style-type: none"> • Where weed pressure is moderate to high • Areas to be planted from seed • Flat or gently sloping areas with a low risk of erosion • Small sites (<1 acre) • Areas accessible to equipment • Locations with full sun and warmer summer temperatures • Locations not susceptible to traffic from wild or domesticated animals (e.g. dogs, deer) 	<p>Timing</p> <ul style="list-style-type: none"> • Total time: 6+ months • Begin: Spring • Plant: Fall
<p>Basic Instructions:</p> <ol style="list-style-type: none"> 1. Till, level and smooth the site in the spring. Remove all debris. Irrigate thoroughly and lay clear, UV-stabilized plastic (4 to 6 mil thick, such as high tunnel plastic), burying the edges to prevent airflow between the plastic and the ground. If joining two or more pieces of plastic, create a trench for the seams and bury the edges of both pieces, rather than overlapping the pieces of plastic. Weigh down the center with rocks or old tires, if necessary, to prevent the wind from lifting it. 2. 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. <i>Note: weeds under solarization plastic are not a concern, especially if they have not set seed.</i> 4. Immediately plant seed mix or transplants. <u>Do not till after solarizing site.</u> Avoid any ground disturbance that may bring up viable weed seed. 	

Figure 3 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 Susan Dill (left) and Sarah Foltz Jordan, The Xerces Society (center and right)).

Planting Methods

Recommended planting methods are site and project specific. Factors such as cost, availability and type of irrigation, equipment availability and site size should be taken into consideration. Pre-project site conditions, especially weed competition, must be addressed prior to planting.

Sites can be planted with either transplants or seeds. Transplants are generally easier to establish, but are also more expensive and require irrigation. Planting from seed is usually

more cost-effective and can be established with no or minimal irrigation, but requires very thorough site preparation. Organic growers should check with their certifiers regarding requirements for certified organic seed or plant materials for habitat projects.

Tables 2 and 3 present options for planting from seed and container, respectively.

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, SPREADERS (e.g. MODIFIED FERTILIZER OR ANT BAIT SPREADERS) OR HAND-BROADCASTING (THROWING SEED) (FIGURE 5)	
<p>Pros</p> <ul style="list-style-type: none"> • Inexpensive • Easy to use • Many models and sizes of broadcasters are commonly available, including hand-held crank and larger tractor- or ATV-mounted models 	<p>Cons</p> <ul style="list-style-type: none"> • Requires a smooth seed bed • Does not work well in narrow areas • Seed must be pressed firmly into the soil after planting
<p>Basic Instructions:</p> <ol style="list-style-type: none"> 1. Follow the instructions for one of the site preparation methods described in Table 1, above . Remove as much stubble as possible prior to seeding, creating a smooth, lightly-packed seed bed. The soil surface can be lightly raked to break up crusted surfaces, but <u>do not cultivate</u> 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, or polenta (fine cornmeal). Use one part 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 and seed deflectors 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. Grass-seed will also need to be planted separately from forb seed because of the differences in size, shape and weight. 4. For small sites (e.g., less than ½ acre), 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. 	

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.)

METHOD: DROP SEEDERS (FIGURE 6 AND 7)

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)
- Manual models are impractical for sites over ½ acre. Tractor-powered models are more efficient on larger sites
- Calibration requires trial and error

Basic Instructions:

1. Follow the instructions for one of the site preparation methods described in Table 1, above. 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 sawdust, gypsum, clean sand, or polenta (fine cornmeal). Use one part 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. Grass-seed will also need to be planted separately from forb seed because of the differences in size, shape and weight.
3. Use a turf-grass roller, ring-roller or cultipacker to press the seed into the soil surface after planting. Natural precipitation or light overhead irrigation can also help ensure good seed-soil contact. Do not cover the seed after planting. 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
- Seed box agitators and depth controls are designed specifically for planting small 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

- Can be expensive and not readily available in some areas
- Difficult to calibrate, **especially** for small areas (less than two acres)
- Can bury seed too deep
- Requires a tractor and an experienced operator to set planting controls
- Seed with a lot of chaff can clog delivery tubes

Basic Instructions:

1. Follow the instructions for one of the site preparation methods described in Table 1, above.
1. 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.
2. Seed types (eg. grass and forb seed, large and small seed) should be kept separate and organized into batches. 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.
3. 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.
4. 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: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_002267.pdf



Golden tickseed is an annual that will establish readily in areas of low precipitation. (Photograph by Jennifer Hopwood, The Xerces Society.)

Table 3 **Methods for Transplanting**

METHOD: TRANSPLANTING FORBS AND WOODY PLANTS	
<p>Pros</p> <ul style="list-style-type: none"> • 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, slow establishment, or low seed germination rates. • Mulching can be used with transplants, making them easier to establish and outcompete weeds. 	<p>Cons</p> <ul style="list-style-type: none"> • Expensive and time consuming for large areas • Transplants typically require irrigation during establishment
<p>Basic Instructions:</p> <ol style="list-style-type: none"> 1. Regular shovels are adequate for transplanting most container stock. However, dibble sticks or mechanical transplanters are 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 6' - 12' centers (depending upon size at maturity), with most herbaceous plants spaced closer on 3' to 5' 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 is best done in the fall or spring, and should be timed to avoid prolonged periods of temperature or moisture extremes or high winds. 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 every 7 -10 days (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 (1-.5 gph emitters), 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. As plants become established starting in year two decrease irrigation frequency and typically terminate irrigation by end of year three. 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, compost can increase the likelihood of successful establishment and improve plant health and is recommended in most cases. 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 with a bio-degradable material 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 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 and use a bulking agent (right) 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 non-persistent 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 out-competing 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 is particularly worthwhile when it can eliminate small populations of especially competitive weeds before they are able to go to seed. 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 that herbicides do not drift or drip onto desirable plant species. Spot spraying is usually performed with backpack sprayers, or occasionally with rope-wick implements (when weed growth is substantially taller than newly established wildflowers). Dye can be added to herbicide mixes to assist the applicator in keeping the herbicide on target plants. To limit mortality events, do not spray herbicides when flowers are in full bloom or from mid-morning to mid-afternoon when pollinators are likely to be most active.
- **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 has some weed pressure 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.



(Photograph by Christina Stucker-Gassi, Northwest Center for Alternatives to Pesticides.)

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



(Photograph of woolly sunflower, *Eriophyllum lanatum*, by Arlie Sommer of Double Dutch Photography.)

Operations and Maintenance (Long-Term)

It may be necessary to protect transplants from herbivores during the establishment phase using grow tubes or tree guards. However, these should be removed as soon as possible after establishment to avoid impeding plant growth. 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. 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 insectary habitat 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.

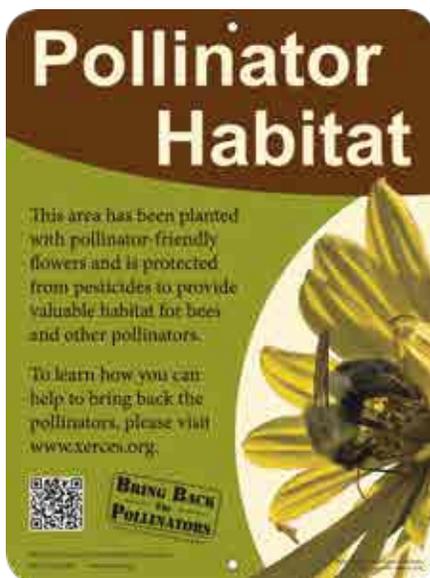


Figure 11 During establishment, grow tubes or trunk protectors may help to reduce browsing by herbivores and trunk damage from mowers or weeding operations (above), but should be removed as soon as possible to avoid impeding plant growth. Most transplants will benefit from 1" of water per week during 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: Plant Lists, Sources of Plant Materials, and References

Plant Lists

Recommended native woody shrubs, subshrubs, and trees for beneficial insects. Plants listed alphabetically by scientific name. Well documented attractiveness to listed insect group is listed in the notes section, along with resistance to fire and deer, and top performers for Conservation Biological Control (CBC).

* SCIENTIFIC NAME	COMMON NAME	SOIL ¹	LIFE CYCLE ²	SUN ³	WATER NEEDS ⁴	NOTES	
Early	<i>Berberis aquifolium</i>	Oregon grape	F - C	P		L	Butterfly, deer resistant, fire resistant
	<i>Prunus pumila var. besseyi</i>	Western sand cherry	F - C	P		M	Butterfly, birds, native/bumble bees
	<i>Prunus virginiana</i>	Chokecherry	F - C	P		L	Butterfly, CBC, fire resistant
	<i>Rhus trilobata</i>	Oakleaf sumac	M	P		M	CBC, butterfly, monarch, deer resistant, fire resistant, native/bumble bees,
	<i>Ribes aureum</i>	Golden currant	M	P		M	CBC, butterfly, monarch, native/ bumble bees, deer resistant
	<i>Shepherdia argentea</i>	Silver buffaloberry	F - C	P		L	Butterfly, native/bumble bees
	<i>Spiraea douglasii</i>	Douglas' spirea	M - C	P		L / H	Butterfly, CBC
Early - Mid	<i>Crataegus douglasii</i>	Black hawthorn	M - F	P		M / H	Butterfly
	<i>Purshia tridentata</i>	Bitterbrush	M, C	P		L	Butterfly, native/bumble bees, CBC
	<i>Rosa nutkana</i>	Nootka rose	F - C	P		M / H	Butterfly, bumble bee, nesting, fire resistant
	<i>Rosa woodsii</i>	Wood's rose	M	P		M / H	Butterfly, nesting, native/bumble bees, deer resistant
	<i>Symphoricarpos albus</i>	Snowberry	F - C	P		L / H	Butterfly, native/bumble bees, deer resistant, fire resistant
Mid	<i>Agastache cusickii</i>	Cusick's giant hyssop	F - C	P		L / M	Butterfly, native/bumble bees
	<i>Amelanchier alnifolia</i>	Serviceberry	C - F	P		M	CBC, Butterfly
	<i>Chamaebatiaria millefolium</i>	Fernbush	M	P		L	Butterfly, native/bumble bees, deer resistant
	<i>Dasiphora fruticosa</i>	Shrubby cinquefoil	M	P		H	CBC, monarch, native/bumble bees
	<i>Holodiscus discolor</i>	Oceanspray	C - F	P		H	CBC, butterfly, deer resistant, fire resistant
	<i>Sambucus cerulea</i>	Elderberry	M - C	P		L / M	CBC, butterfly, nesting, deer resistant
	<i>Yucca glauca</i>	Soapweed yucca	F - C	P		L	Honey bees, butterflies, birds
Mid - Late	<i>Eriogonum heracleodes</i>	Whorled buckwheat	M - C	P		L	CBC, butterfly
	<i>Eriogonum umbellatum</i>	Sulfur buckwheat	C - F	P		L	CBC, butterfly, monarch
Late	<i>Atriplex canescens</i>	Fourwing saltbush	C - F	P		L	CBC, Butterfly
	<i>Erigeron corymbosum</i>	Lacy buckwheat	F - C	P		L / M	Butterfly, birds, native/bumble bees, honey bees, CBC
	<i>Ericameria nauseosa</i>	Rubber rabbitbrush	M	P		L	CBC, butterfly, monarch, native/ bumble bees

Key for Plant Lists

- Soil:** C = coarse texture, M = medium, F = fine
 - Life Cycle:** P = perennial, A = annual, B = biennial
 - Sun:** = sun, = part shade, = sun/part shade
 - Water Needs:** L(ow) = 7"-12" annual precipitation, M(oderate) = 12"-18", H(igh) = 18"-25"
- ***Bloom Time:** Early = March - May, Mid = June - Aug, Late = Sept - Nov
- ****Legume:** rich in nitrogen and attractive to a wide variety of wildlife

Plant Lists

Recommended Native Wildflowers for Pollinators

* SCIENTIFIC NAME	COMMON NAME	SOIL ¹	LIFE CYCLE ²	SUN ³	WATER NEEDS ⁴	NOTES	
Early	<i>Erigonum compositum</i>	Arrowlead buckwheat	M - C	P		L	Native/bumble bees, natural enemies, butterfly
	<i>Hedysarum boreale</i>	Northern sweetvetch	F - C	P		L	Butterfly, native/bumble bees
	<i>Lupinus argenteus</i>	Mountain lupine**	F - C	P		L	Butterfly, bumble bees, fire resistant
	<i>Wyethia amplexicaulis</i>	Mule's ears	M - F	P		M	
Early - Mid	<i>Balsamorhiza sagittata</i>	Arrowleaf balsamroot	M - F	P		L	CBC, butterfly, bumble bee
	<i>Geranium viscosissimum</i>	Sticky geranium	M	P		M	Butterfly, fire resistant
	<i>Lomatium triternatum</i>	Biscuitroot	M - C	P		M	Butterfly
	<i>Penstemon palmeri</i>	Palmer's penstemon	M - C	P		L	Butterfly, bumble bee, deer resistant, fire resistant
	<i>Penstemon strictus</i>	Rocky Mountain penstemon	M - C	P		L	Butterfly, bumble bee, deer resistant, fire resistant
	<i>Sphaeralcea coccinea</i>	Scarlet globemallow	M - C	P		L	Butterfly, CBC
	<i>Sphaeralcea grossulariifolia</i>	Gooseberry globemallow	M - C	P		L	Butterfly, CBC
Mid	<i>Achillea millefolium</i>	Yarrow	C - F	P		L	CBC, butterfly, nesting, deer resistant, fire resistant
	<i>Allium cernuum</i>	Nodding onion	M - C	P		L	Deer resistant, butterflies, birds
	<i>Asclepias speciosa</i>	Showy milkweed	C - F	P		M	CBC, butterfly, bumble bee, monarch, deer resistant
	<i>Astragalus filipes</i>	Basalt milkvetch**	M - C	P		L	Butterfly
	<i>Cleome serrulata</i>	Rocky Mountain bee plant	M	A		L	Butterfly
	<i>Coreopsis tinctoria</i>	Golden tickseed	M - F	A		M	CBC, fire resistant
	<i>Dalea ornata</i>	Blue mountain prairie clover	M	P		M	Butterfly, native/bumble bees, honey bees
	<i>Gaillardia aristata</i>	Blanketflower	M - C	P		L	CBC, monarchs, fire resistant
	<i>Liatris pycnostachya</i>	Prairie blazingstar	F - C	P		H	Butterfly, monarch
	<i>Linum lewisii</i>	Lewis flax	M - C	P		L	Butterfly, deer resistant, fire resistant
	<i>Mondarda fistulos</i>	Beebalm/wild bergamont	F - C	P		L / M	Native/bumble bees, butterfly
	<i>Penstemon eatonii</i>	Firecracker penstemon	F - C	P		L	Butterfly, bumble bee, deer resistant, fire resistant
	<i>Ratibida columnifera</i>	Prairie coneflower	F - C	P		M	Butterfly
	<i>Rudbeckia hirta</i>	Black-eyed susan	M - F	P		L	Butterfly, deer resistant
Mid - Late	<i>Eriophyllum lanatum</i>	Woolly sunflower	C - F	P		L	CBC, butterfly, deer resistant
	<i>Heterotheca villosa</i>	False goldenaster	M - C	P		L	CBC, butterfly
	<i>Symphotrichum laeve</i>	Smooth blue aster	M	P		M	CBC, butterfly, bumble bee, fire resistant
Late	<i>Boltonia asteroides</i>	False aster	M - C	P		M	CBC, butterfly, natural enemies, native/bumble bees
	<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush	M - F	P		L	Butterfly, monarch
	<i>Erigonum strictum</i>	Strict buckwheat	M	P		L	Native/bumble bees, natural enemies, butterfly
	<i>Helianthus maximiliani</i>	Maximilian sunflower	F - C	P		L	Butterfly, monarch, nesting
	<i>Heliomeris multiflora</i>	Showy goldeneye	M	P		L	Native/bumble bees
	<i>Machaeranthera canescens</i>	Hoary tansyaster	M	P		L	Butterfly



(Photograph by Christina Stucker-Gassi, Northwest Center for Alternatives to Pesticides)

Native Grasses for Pollinator Seed Mixes

Note: Grasses and sedges should ideally comprise no more than 25% of seed mixes on pollinator sites, but no more than 50%.

SCIENTIFIC NAME	COMMON NAME	SOIL ¹	LIFE CYCLE ²	SUN ³	WATER NEEDS ⁴	NOTES
<i>Achnatherum hymenoides</i>	Indian ricegrass	M	P	☀️	L	Cool-season bunch grass, nesting, beetles
<i>Elymus trachycaulus</i>	Slender wheatgrass	M	P	☀️	L	Warm-season grass, CBC, nesting, beetles
<i>Festuca idahoensis</i>	Idaho fescue	C - F	P	☀️	M	Cool-season grass, CBC, butterfly, nesting, beetles
<i>Leymus cinereus</i>	Basin wildrye	F - C	P	☀️ ☀️	L	Warm-season grass, CBC, butterfly, nesting, beetles
<i>Poa secunda</i>	Sandberg bluegrass	M - C	P	☀️	L	Warm-season grass, CBC, butterfly, nesting, beetles

Non-Native Plants for Insectary Meadows and Cover Crops

*	SCIENTIFIC NAME	COMMON NAME	SOIL ¹	LIFE CYCLE ²	SUN ³	WATER NEEDS ⁴	NOTES
Early	<i>Vicia villosa</i>	Hairy vetch	F - C	A	☀️ ☀️	M	CBC, butterfly
	<i>Phacelia tanacetifolia</i>	Lacy phacelia	F - C	A	☀️ ☀️	L	CBC, butterfly, bumble bee, deer resistant
Early - Mid	<i>Trifolium incarnatum</i>	Crimson clover	F - C	A	☀️ ☀️	M	CBC, butterfly, bumble bees
	<i>Trifolium repens</i>	White clover**	F - C	P	☀️	L / M	CBC, butterfly
Mid	<i>Fagopyrum esculentum</i>	Buckwheat	M	A	☀️	M	
	<i>Medicago sativa</i>	Alfalfa**	M	P	☀️ ☀️	M	Butterfly
	<i>Onobrychis viciifolia</i>	Sainfoin**	M - F	P	☀️ ☀️	L	



Hunt's bumble bee (*Bombus huntii*) on lacy phacelia (*Phacelia tanacetifolia*) in a pollinator planting. (Photo by Jennifer Hopwood, The Xerces Society)

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 (i.e., neonicotinoids).

Buffalo Berry Farm (S,T) • McCall, ID
208-634-3062 • buffaloberryfarm.com

Cadera Seeds Inc (S) • Swan Valley, ID
208-483-3683 • growseedsswanvalley.com/flower-seeds

Cedar Mountain Perennials (T) • Athol, ID
208-683-2387 • cedarmountainperennials.com

Center for Forestry, Nursery and Seeding Research
University of Idaho (T) • Moscow, ID
208-885-3888 • uidaho.edu/cnr/cfnr

Clifty View Nursery (T) • Bonners Ferry, ID
208-267-7129 • cliftyview.com

Draggin' Wing Farm (T) • Boise, ID
208-345-4199 • waterthriftyplants.com/

Idaho Grimm Growers Native Seed Foundation (S)
Blackfoot, ID • 208-785-0830 • idahogrimmgrowers.com/

Native and Xeric Plants, Inc. (T) • Emmett, ID
208.365.4331

North Fork Native Plants (T) • Rexburg, ID
208-354-3691 • northforknativeplants.com

Pineview Horticulture Services (S) • Hayden, ID
208-772-7294 • pineviewhorticulturalservices.com/

Plantasia Cactus Gardens (T) • Twin Falls, ID
208-734-7959 • plantasiacactusgardens.com

Sun Mountain Natives (S) • Moscow, ID
208-883-7611 • sunmountainnatives.com

Thorn Creek Native Seed Farm (S) • Genesee, ID
208-596-9122 • nativeseedfarm.com

Wildlife Habitat Nursery (T) • Princeton, ID
208-875-2500 • whn-online.com

Notes: Seeds Only (S), Transplants Only (T), Seeds & Transplants (S, T)

References and Resources

SEED MIX CALCULATOR & PLANT LISTS

Xerces Society Seed Mix Calculator

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

www.xerces.org/xerces-seed-mix-calculator

Plants for Pollinators in the Inland Northwest

A technical note with information about plants that support pollinators in parts of Idaho, Oregon, and Washington.

http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/idpmstn10799.pdf

Plants for Pollinators in the Intermountain West

A technical note with information about plants that support pollinators in parts of Idaho, Oregon, Nevada, and Utah.

http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/idpmstn10798.pdf

SEEDLING IDENTIFICATION

USDA-NRCS Forb Seedling Identification Guide for the Inland Northwest

Many of the plant species recommended in this guide are featured in a series of seedling photos in this downloadable resource.

http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/wapmcpu11331.pdf

WEED IDENTIFICATION & CONTROL

Idaho's Noxious Weeds

University of Idaho's Extension guide to identify common weeds of Idaho.

http://www.cals.uidaho.edu/weeds2/IWR/iwr-v6_website/files/Download/BUL816.pdf

Invasive Species of Idaho

From the Idaho State Department of Agriculture, this website has resources and guides for weed management

<http://invasivespecies.idaho.gov/control-strategies>

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

Soil Solarization for Gardens and Landscapes

A short illustrated guide for installing solarization plastic to control soilborne pests.

ipm.ucanr.edu/PDF/PESTNOTES/pnsoilsolarization.pdf



This hedgerow includes native shrubs as well as perennial wildflowers. (Photo by Arlie Sommer of Double Duch Photography.)

PESTICIDE MITIGATION

Bee Precaution

A searchable tool with information about how different pesticides may impact bees.

www2.ipm.ucanr.edu/bee precaution/

NRCS Pesticide Screening Tool WIN-PST

<http://go.usa.gov/Kok>

Habitat Assessment Guide for Pollinators in Yards, Gardens, and Parks

https://xerces.org/sites/default/files/publications/19-038_01_HAG_Yard-Park-Garden_web.pdf

Guidance for Protecting Habitat from Pesticides

<https://xerces.org/publications/fact-sheets/guidance-to-protect-habitat-from-pesticide-contamination>

COMPREHENSIVE GUIDES

Idaho Pollinator Habitat Assessment Form and Guide: Farms and Agricultural Landscapes

This pollinator habitat assessment guide is designed for a single site on a farm or agricultural landscape in Idaho.

<https://xerces.org/publications/hags/idaho-farms-and-agricultural-landscapes>

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.

xerces.org/announcing-the-publication-of-attracting-native-pollinators

Pollinator Conservation Resource Center

For additional information on pollinator plant lists, conservation guides, pesticide protection and more.

xerces.org/pollinator-resource-center

Pollinator Habitat Assessment Form and Guide: Orchard & Field Crops

This NRCS evaluation guide provides a before and after assessment for pollinator habitat projects in farmland.

https://efotg.sc.egov.usda.gov/references/public/CA/CA_PollHabAssessment_Orchard_FieldCrops_8-18.pdf

Pollinator Habitat Assessment Form and Guide: Rangeland & Pastureland

This NRCS evaluation guide provides a before and after assessment for pollinator habitat projects in rangeland.

https://efotg.sc.egov.usda.gov/references/public/CA/CA_PollHabAssessment_Range_Pasture_8-18.pdf

Pollinator Habitat Installation Checklist

Idaho

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

Purpose

This Pollinator and Beneficial Habitat Installation Checklist documents the process of establishing on-farm habitat for beneficial insects such as pollinators and natural enemies of crop pests on farms in Idaho. Other natural resources may also benefit, depending on your conservation objectives and the integration of this habitat with other conservation practices.

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

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.

Note any woody or herbaceous species established from transplants here:

Site Preparation Method

Choose an option and note any adjustments.

- Sheet mulch 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 non-persistent herbicide Hand-weeding and/ or hoeing
 Mowing/string-trimming Plant guards/grow tubes
 Managing irrigation Other: _____

Adjustments:

Long Term Site Operations and Maintenance

It may be necessary to protect transplants from herbivores during the establishment phase using grow tubes or tree guards. However, these should be removed as soon as possible after establishment to avoid impeding plant growth. 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). Organic herbicide spot-treatments and hand-weeding may be used to control noxious or invasive plants.