

Georgia Landowners' Guide to Establishing and Managing Pollinator Meadows



State Botanical Garden
of Georgia
UNIVERSITY OF GEORGIA



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Georgia Landowners' Guide to Establishing and Managing Pollinator Meadows

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Heather Levy¹ and Heather Alley²
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The goal of this document is to provide a guide to landowners and managers who are interested in establishing pollinator meadows on a landscape-level scale. It will provide guidance on creating or augmenting existing meadows, choosing and ethically sourcing plants, and long-term management.

¹ Birds Georgia, Atlanta, Georgia | ² State Botanical Garden of Georgia, University of Georgia, Athens, Georgia



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1. INTRODUCTION

Populations of native insects and birds have been declining at alarming rates worldwide from habitat loss, pesticide use, and habitat degradation caused by mismanagement and invasive species. Some of the hardest hit species are grassland and open habitat specialists. Grasslands represent one of the most endangered ecosystems in the world, and in the southeast we have lost over 90% of our native grassland habitats to land conversion, urbanization, and the suppression of fire or other disturbances that prevent the invasion of trees and shrubs and keep the habitat open for sun-loving plants. For the purposes of this guide, we are referring to pollinator meadows as traditional lawn or old field spaces converted to grasslands containing a diversity of native plants, including wildflowers, grasses, and forbs, for the benefit of insects and wildlife.

Private landowners play a critical role in habitat and wildlife conservation as stewards of the land. Approximately 60% of the land in the United States is privately owned, and that number increases to 93% in Georgia. With the significant amount of land owned privately, landowners have the power to make a meaningful impact on local ecosystems. Each property can serve as a vital link in a larger network of landscape-level habitat connectivity and conservation.

This guide aims to provide landowners who are interested in establishing native pollinator meadows on a landscape-level scale with information on site preparation, recommended plants to establish, where to source ethically produced seeds and plants, planting methods, and long-term management. There are additional resources listed at the end of the guide, as well as organizations that offer conservation technical assistance.



Containerized wildflowers produce immediate results. Photo by Heather Alley



Pearl Crescent, Photo by Tom Garigan; Ruby-throated Hummingbird and bee, Photo by Berthelot; Pandorus Sphinx, Photo by Tom Garigan

2. SITE INVENTORY (light, moisture, soil, flora)

Which plants will persist and thrive on any given site is determined by the [USDA plant hardiness zone](#), sunlight exposure, soil type, and moisture. Paying attention to these characteristics will inform your site preparation and plant selection.

Light – Factors that affect light are aspect (the cardinal direction that slopes face) and shadows, which change significantly with season. North and northeast-facing slopes are shadier and cooler, while south and southwest slopes are sunnier and hotter. Additionally, observe shadows throughout the day and both in summer and winter.

Moisture – Factors besides climate that affect moisture are the shape of land and soil type. Low-lying, flat, or depressed areas hold more moisture than upland, sloped areas. Sandy or rocky soils drain faster and hold less moisture than clay soils.

Soil – For plants, the most important soil characteristics to consider are drainage and nutrient content. Drainage can be assessed by observing the proportion of clay, loam, and sand and by performing a percolation test as described in [UGA Extension's Tree Planting Guide](#). Nutrient content in soil is generally sufficient unless the site has been altered, but available nutrients can be affected by pH. A simple soil test can be obtained through county extension offices for a nominal fee, and its results will include recommendations for amendments if needed.

Flora – When possible, an excellent way to judge the light and moisture characteristics of a site is to observe the naturally occurring plants and consider their preferences. Determining if the existing species are mostly exotic invasives or native, sun or shade-loving, and wetland or upland obligates will tell you what grows well at a site.



Site preparation for a pollinator meadow in Cartersville, Georgia. Photo by Gabe Andrie;
A grassland restoration project at a private property in Georgia. Photo by Jesse Kamps

3. SITE PREPARATION

The biggest challenge to establishing a native meadow in the southeast is competition from undesirable species that dominate a site and inhibit the establishment of desired plants. Before planting, undesirable vegetation, weeds, and their debris will need to be removed. The end result of a well-prepared site will be a mostly bare soil surface that provides good soil contact for seeding and planting (unless augmenting an existing meadow).

For the typical case of weedy sites, a year or more is ideal for a combination of the following strategies to eliminate undesirable species and promote native species on the site.



Volunteer planting day in Southeast Georgia using plugs. Photo by Sarah Manning

Site Preparation is Key to Planting/Seeding Success

To prepare the ground to receive seeds and/or plugs, competing vegetation must be controlled. Bare soil space is necessary for seeds to make the soil contact required for germination and establishment. This may be achieved by: mechanical vegetation removal, herbicide applications, fire, haying, grazing, and/or tilling.

a. SITE PREPARATION TIMELINE

Develop a two to three-year plan that includes chosen methods and a timeline for implementation. The table below presents examples of activities and timing to plan for. Because each site is different, chosen methods will depend on personal preference, goals, and site conditions. Not all of the methods will or should be applied to the same situation.

Q1=Jan–Mar; Q2=Apr–Jun; Q3=Jul–Sep; Q4=Oct–Dec

Year, Quarter	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3	Y2 Q4	Y3 Q1	Y3 Q2	Y3 Q3	Y3 Q4
Manual vegetation removal	●	●										
Solarize		●	●	●	●							
Preparatory mowing	●											
Herbicide		●	●		●	●						
Preparatory prescribed fire				●	●							
Soil preparation					●							
Plant					●				●			
Seed					●	●						
Maintenance mow										●	●	
Spot herbicide						●	●	●		●	●	●
Prescribed fire (maintenance)									●			



b. MECHANICAL VEGETATION REMOVAL

Small trees and shrubs may be eliminated or thinned by the “cut and paint method,” which is relatively easy and uses a minimal amount of herbicide. With this method, cut or saw trunks as close to the ground as possible (about one inch). This is important for the herbicide to reach the roots and take effect. Paint the outer rim of the cut stump with 20% active ingredient glyphosate. Triclopyr amine may be more effective on some glyphosate-resistant species (for example, Mimosa,

Elaeagnus, Rubus, Rosa). Use concentrations as directed on the label. Apply the herbicide within 60 seconds of the cut to ensure uptake before the stem stops absorbing. Native woody species that typically become too aggressive for meadows include Box Elder, Loblolly Pine, Rubus, Sumac, and Sweet Gum. Loblolly Pines usually die when mowed or cut without requiring herbicide.

c. PREPARATORY MOWING

Mowing is an important tool for helping to control competing vegetation and reducing biomass prior to herbicide, but mowing alone will not control invasive or exotic grasses. Mowing also leaves behind dead stems and chaff that can pose challenges of their own. Mown debris should be removed by hay raking or burning prior to seeding. Mowing is not advisable in the spring before seeding because dead horizontal debris will inhibit seed contact. It is better to seed drill into standing vegetation.

d. SOLARIZATION

Solarization is a herbicide-free method for non-selective killing of all above-ground vegetation using clear plastic sheeting stretched over the ground during the peak growing season. It is applied during the heat of summer, trapping the sun’s heat to create lethal temperatures to kill plants and weed seeds. Allow six weeks to effectively sterilize the site. Drawbacks include limitations in scale and harm to beneficial soil organisms.

A contractor applying herbicide to a restoration site in Evans, Georgia. Photo by Heather Levy;
Cut and paint method of Chinese Privet eradication in the State Botanical Garden of Georgia’s floodplain.
Photo by Heather Alley

e. HERBICIDES

The year before seeding, treat warm-season weeds before seeds set—OR treat with Imazapic as a pre-emergent, but note that this may inhibit natives. First mow, burn, graze, hay, etc., then allow regrowth before treating with herbicides. Use Imazapyr in the summer or fall for resistant species, such as bermuda grass. For cool-season plants, spray imazapic or glyphosate in the fall and recheck in the spring.

The fall before seeding, mow, burn, graze or hay—then dethatch in the spring to facilitate soil-seed contact.

Evaluate the site after herbicide treatments and reapply as needed. Spray a final time with glyphosate 7–10 days before seeding and use imazapic to prevent germination of weed species for Imazapic-tolerant mixes.

Unless the site is already dominated by the desired plant species, herbicides may be necessary for eliminating undesirable plants in order to create a meadow bigger than what can be manually achieved by hand.

To develop an herbicide plan, it is important to identify the current undesired species onsite as well as what weed species emerge from the seed bank following initial herbicide treatments. Use herbicides and application methods that target undesirable plants and minimize chemical drift, the unintended movement of mist or droplets away from the target site.

The most common herbicide is glyphosate, which is post-emergent and broad-spectrum (kills all types of plants—grasses, forbs and many trees and shrubs). **Glyphosate** is considered to be one of the safer herbicides on the market and is among the lowest in cost. While it is broad-spectrum in nature, glyphosate resistance occurs in some plants, so alternatives may be needed.

Herbicides containing **triclopyr** are a good alternative for glyphosate-resistant species (i.e. Chinese Lespedeza, Horsetweed, Morning Glory, Blackberry Bramble, Mimosa, Amaranth, Pigweed and Nutsedge). Triclopyr is also extremely useful in established stands of desirable native grasses because it generally doesn't seriously affect grasses (native and non-native) or other monocot species. There are two formulations of triclopyr: triclopyr amine (aka triclopyr 3) and triclopyr ester (aka triclopyr 4). Triclopyr amine is usually sufficient and less severe. Triclopyr ester is generally only needed for basal bark applications for killing large shrubs or small trees. **Caution should be used as triclopyr ester volatilizes at temperatures above 80 degrees F and can damage untreated plants in the vicinity.**

Two herbicides that are particularly useful for establishing meadows that are too large for manual vegetation control are enzyme disruptors in the imidazolinone class, **imazapic** and **imazapyr**. Because they affect different plant species and ages of plants differently, they can be used to selectively control the composition of your plant community. However, for the same reason, research and trial and error are needed to determine how best to utilize them. Further, they remain active in the soil for a considerable time. **Therefore, it is best to consult an herbicide or restoration professional before using them.** While these soil-active herbicides may seem a heavy-handed approach, the costs may be worth the benefits in the long run, especially when tackling resistant species, like bermuda turf grass. They may be used to prevent reinfestation of some weeds when used in concert with a seed mix that is tolerant of the selective herbicide.

Please note that when using herbicides, it is highly recommended to seek professional help from a licensed habitat restoration specialist. A license is required for herbicide application near bodies of water. Herbicide application rates must adhere to product labels.

Name	Imazapic	Imazapyr
Type	pre- and post-emergent	pre- and post-emergent
Target	certain grasses, some broadleaf	non-selective/non selective, broader range
Mode of action	localized	systemic
Duration	shorter, soil half-life 120 days	longer, soil half-life 150 days or longer
Species tolerance	variable, depends on environmental factors, Bermuda and Bahia tolerate	variable, depends on environmental factors, Blackberry tolerates

Imazapic is safe for:

- Native warm-season grasses: For example, Bluestem, Indiangrass, and Switchgrass.
- Many native forbs/wildflowers: It generally doesn't harm a wide variety of native wildflowers.
- Certain broadleaf weeds and grasses: It can selectively kill some non-native weeds like Fescue, Bahiagrass, Johnson-grass, and others while leaving native species unharmed.

f. PRESCRIBED FIRE FOR THATCH REMOVAL

When feasible, prescribed fire during the fall or winter prior to seeding is the best tool for removing dead vegetation and thatch **when seeding by broadcast spreader or hand**. Creating bare soil allows for good seed-to-soil contact, which is critical for germination and seedling establishment. The Georgia Forestry Commission and Georgia Department of Natural Resources provide prescribed fire resources to private landowners. Private contractors also provide prescribed fire services. More information on prescribed fire is in the management section.

If using a no-till drill, burning first is not necessary because the seed drill will deposit seeds into the ground. Standing, unmowed vegetation helps reduce erosion and hold soil moisture when seed drilling.



A contractor applying a prescribed fire in winter to remove thatch post-herbicide at a restoration site in Evans, Georgia. Photo by Heather Levy

g. SOIL PREPARATION

There are conflicting opinions regarding soil tillage or cultivation. The decision of whether or not to till depends on the soil type and condition. Tilling is most beneficial for compacted clay soil, but less so for sandy soil. Consider the potential drawbacks before automatically tilling.

Tilling is not recommended except in cases of severe compaction (due to building construction or heavy vehicular activity) to incorporate amendments such as composted pine bark or to control competing vegetation. Tilling can cause erosion, awaken weed seeds, and disrupt the soil structure, chemistry and microfaunal composition. However, tilling may be an option for controlling unwanted vegetation instead of herbicides. In this case, disk-harrow the site every two weeks for 2 months to exhaust perennials and some of the weed seed bank. While tilling eliminates some annual weeds, some seeds will remain in the seed bank for many years and need to be dealt with otherwise (by mowing, pulling, or herbicide application).

In general, do not add compost, manure or other nitrogen-rich amendments; native grassland species do best with low nutrients, and heavy nutrients favor weeds. Only incorporate compost (2 inches or so) into clay soils that have been compacted and stripped of topsoil to improve its texture. Breaking up and amending brick-hard soil allows seeds to germinate and rain to infiltrate instead of running off. If the soil has been loosened mechanically, it is beneficial to smooth and firm the seedbed with a **cultipacker**. This can prevent the soil from settling on top of seeds, thereby burying them too deep.

Weigh the costs and benefits and choose the method that is best suited to your situation and ability to mitigate the consequences.



The prescribed fire removed thatch for better seed to soil contact for future planting at a restoration site in Evans, Georgia. Photo by Heather Levy

4. PLANTING

The two options for establishing new plants are planting container-grown plants and sowing seeds. They each have merits and challenges related to cost and success rates. When possible, a combination of both methods allows a balance between cost, time, and satisfactory outcomes. Generally, planting container-grown plants is the best option for faster results and higher plant survival rates, though it is the most expensive. It is ideal for smaller-scale projects and/or supplementing already established meadows to increase diversity and select species. Use container-grown plants for trees, shrubs, and plants that are harder to establish from seed.

Fall is the best time to plant most trees, shrubs, vines and perennials. An exception is warm-season grasses, which can be rot-prone if planted when dormant. **Warm-season grasses should ideally be planted in early fall (September) or spring (mid-March-early April), although drought is a risk at this time.** Landscape plugs are 4-inch deep and 1 to 1.5-inch wide young plants that come in tray flats of 32 or 50. Such plugs are the most economical option for planting large numbers of plants for restoration purposes. Plants are generally planted 12 to 24 inches apart on a grid, depending on the species' width at maturity.



Jekyll Garden Club at Altama Plantation Volunteer Workday, Photo by Susan Rodgers and Stephanie Hooks; Planting a pollinator garden at a site in North Georgia. Photo by Sebastian Hagan; A volunteer planting day using plugs at a restoration site in Stockbridge, Georgia. Photo by Sebastian Hagan

5. SEEDING

For larger projects or when funding is limited, seeding is a good option. It does require careful timing and preparation. Practitioners must consider season, seeding rates and carriers, seed quality, methodology, and equipment.

a. SEASON

Seeds may be sown during the winter or early spring, with benefits and disadvantages to each. Traditionally, it has been the practice to sow seeds in early spring (mid-March in Georgia) in order to prevent seeds washing away, rotting, being eaten by wildlife, or becoming buried too deep (over $\frac{1}{4}$ th inch) in the soil. Nurse crops, such as cereal rye or crimson clover, can reduce erosion, seed loss, and weed eruption. Seeding in the spring also allows for the elimination of early spring weeds with herbicide prior to seeding. The primary advantage of

spring seeding is the ability to reduce competition. However, with strategic use of herbicides in the year prior to seeding, dormant season (soil temperature less than 55 degrees F) seeding can be successful. Seeding in the dormant season has the benefit of favoring the vernalization of wildflower seeds, increasing their presence in the first year. The seeding rate should be increased by 25% when sowing during the dormant season to compensate for seed losses.

b. SEEDING RATES AND CARRIERS

For conservation purposes, the standard seeding rate is 20–60 live seeds per square foot. For species with particularly large or small seeds, the recommendation changes accordingly. Determining pounds per acre for a given seed lot depends on the purity and viability of the seed. Reputable seed companies provide recommendations for seeding rates according to their calculated percentages of pure live seed (PLS). Law requires seed companies to provide a seed analysis report for each seed lot. When comparing options for purchasing seeds, be sure you are comparing prices for PLS totals, not only raw seed weight, because seed mixes can vary widely in purity and germination rates.

Seed companies recommend burying seeds no more than $\frac{1}{4}$ inch, and some seed may be visible on the soil surface. Burying seed too deep is a common mistake that causes poor germination. The only exception is for soft sandy soil, where burying seeds about $\frac{1}{2}$ inch can help keep young seedlings from drying out. Rolling out sandy or furrowed soil with a cultipacker prior to seeding is very helpful in preventing seed from becoming buried too deep.

Seed carriers are typically inert materials that aid in the distribution of seed, help with visibility of seed, prevent seed drill blockages, prevent fluffy seeds from blowing away, and may help with moisture retention. The best choice of seed carrier depends on your site, type of seeds (fluffy vs. slick) and distribution method. Your seed company should provide advice on the best carrier for the seed mix you purchase according to your seed distribution method.



Using donated sawdust as a seed carrier at a restoration site in Evans, Georgia. Photo by Heather Levy

Overview of common seed carriers and their attributes

Carrier	Benefits	Limitations
Rice hulls	lightweight, biodegradable, inexpensive, often comes in custom mixes, best for seed drills—helps feed seed evenly through seed box	does not aid in moisture retention, does not weigh down light or fluffy seeds
Vermiculite	lightweight, highly visible, ideal for broadcasting and hand seeding of light seeds, helps with moisture retention	dusty, does not weigh down light or fluffy seeds
Sand (washed builders' sand/crushed granite; NOT playground sand)	inexpensive, highly visible, easily sourced, weighs down light or fluffy seeds, good for broadcasting	heavy, best for small scale
Pelletized lime	improves seed flow through seed drills, can help pH in highly acidic soil (test soil first!), helps with drill calibration, also good for broadcasting	dusty, can alter pH and micronutrient levels too much so test soil and dose accordingly
Seed coatings	improve flow through seed drills, eliminating the need for a carrier, purchased seeds are ready to sow	often more expensive, but may be worthwhile

c. SEED QUALITY

No amount of planning and preparation can compensate for poor seed quality, so make sure you are getting what you pay for when it comes to purchasing seeds. Seeds that have too much inert dried plant material (chaff) can cause problems with seeding equipment, germination and establishment.

Pay attention to seed source location and seed zones. The closer the climate and soil conditions of the seed source are to your planting area, the better adapted the plants will be to your area (and less likely to become invasive). Ecotype seeds refer to seeds that are from and genetically adapted to a place that may be fine or broad in geographic scale, according to EPA ecoregion maps. More companies are developing the capacity to offer seeds sourced from the southeast.

Roundstone Seed Company and Ernst Seeds have a limited selection of southeastern ecotype seeds.

Consider the percentage of pure live seed (PLS) when shopping for seeds and comparing prices. Ensure seeds have been stored in controlled humidity and temperature conditions, and continue to do so once you receive them. Debearded seeds are ideal when possible because they are less likely to clog seed drills and make better soil contact necessary for germination success.

You can protect your investment by having seeds tested through the Georgia Department of Agriculture Seed Lab. Save a sample of seeds for documentation in the event issues arise to determine if the seeds were a factor.



A thriving pollinator meadow

d. SEEDING METHODS

The type of seeding method has a big impact on results and how you should prepare the site and seeding rates. Your seeding method will mostly depend on the scale of your project, your access to equipment, and your budget. The three most common methods for seeding are no-till seed drill (no-till seeding), broadcast, and hand seeding.

No-till Drill

A no-till drill is a machine pulled behind a tractor that plants seeds directly into unplowed or untilled soil. It uses vertical cutting blades to slice into the earth at a calibrated depth. A seed tube then deposits measured seeds into the narrow trench, followed by a roller to press soil back into place. It is advantageous for planting non-debearded and chaffy seeds. This method is best for sites with standing vegetation or heavy chaff as the no-till drill cuts through to the soil for good contact. Drills can also be used in sites prepared via herbicides only. They minimize the awakening of weed seed by soil disturbance. Seeds can be no-tilled directly through the thatch. On firm cultivated soil, roll with a roller, or drive across it with truck/tractor tires to firm the seed. The best seed carrier for no-till drills depends on the type of seeds and therefore seed box being used. For native warm-season grasses, a native grass box with an agitator is crucial, and you can add vermiculite or rice hulls as a filler to improve flow.

Broadcast Spreader

Broadcast spreaders are tools for dispersing large quantities of seeds and their carriers over a large area using a spinning mechanism to distribute the materials in an arc-like pattern. They are available in various sizes and with several mounting options. Broadcast seeding requires the soil surface to be cleared of vegetation and chaff. If the soil has been tilled due to compaction, it should be culti-packed or rolled with tires before and after seeding. This ensures the seeds do not become buried too deeply and make good contact. Do not roll wet soil, as it will become too compacted. For even seed coverage, it is recommended to make two passes with the seed spreader, each at half-seeding rates, in opposite right-angle rows. Use a damp seed carrier such as rice hulls, vermiculite or sand to weigh down seeds, improve visibility, and evenly distribute seeds. The more the seed is diluted, the better it will be distributed.

Hand Seeding

Hand seeding is the least expensive and requires the least skill and equipment; however, it is the least effective for larger projects. It is best for small sites or filling in gaps in already established grasslands. It allows control over where seeds land and finesse in species distribution. Seed carriers for hand seeding should be the options lighter in weight since they will be carried manually (e.g., not sand).



Seed spreader attachment for a tractor used in planting a large pollinator meadow at a private property near Waynesboro. Photo by Jesse Kamps

Variables for the three most common methods for seeding a warm-season meadow.

	No-till drill	Broadcast spreader	Hand
Scale	3+ acres	1-10 acres	<10 acres
Equipment need	no-till drill and tractor	tractor or ATV	none or hand tools
Site prep need	moderate	high	high
Soil-seed contact	excellent	fair	fair to poor (site dependent)
Cost	high (unless renting)	medium	low
Skill	high	moderate	low
Weed disturbance	lower	high (if tilled)	high (if tilled)

e. EQUIPMENT

To rent no-till drills or other equipment, look for landscaping contractors in your area. Some contractors will do the seeding for you. You can also contact your local Soil and Water Conservation District (SWCD) or Natural Resources Conservation Service (NRCS) office. The SWCD has a [list of equipment items](#) available at each of the districts.

f. SOURCING SEEDS AND PLANTS

Birds Georgia, with help from the Georgia Native Plant Society and the Department of Natural Resources, has developed a list of recognized plant providers that offer mostly native species. This list is housed on an ArcGIS Story Map, '[Native Plants for Georgia Birds](#)'. The State Botanical Garden of Georgia also maintains a list of ethical sources on its [website](#). These sources include retail, wholesale, and non-profit organizations offering seasonal plant sales.

The following producers offer the largest selection of local ecotype seeds. Each company offers individual seeds or seed mixes tailored to different habitat types and project needs. To make sure plants you purchase naturally occur in Georgia, consult the [Flora of the Southeast](#). Note that some species offered by these seed producers are not native to Georgia and could become invasive in our area (*Asclepias syriaca*, for example).

[Roundstone Native Seed](#) (Kentucky)

- Offers regionally grown native seeds adapted to your area
- Over 300 species and 125 standard mixes

[Ernst Seed](#) (Pennsylvania)

- Largest native seed producer and supplier in the Eastern US, and offers regional options
- Over 540 individual seeds and 244 mixes

[Hamilton Native Outpost](#) (Missouri)

- Offers individual seeds, pre-made mixes, or customizable blends

Additionally, local organizations such as the Georgia Native Plant Society, which has chapters throughout the state, and the State Botanical Garden of Georgia, host seasonal native plant sales.



Wildflower plugs provide immediate results at an affordable price. Pictured here is *Salvia lyrata*, a low-growing wildflower for early spring bees. Photo by Heather Alley; Container grown pollinator plants get straight to work holding soil and supporting wildlife. Photo by Heather Alley

6. MANAGEMENT

First year of Planting

In the first year, most native meadow plants will focus energy on roots, growing very slowly above ground. During this time, strategic mowing can be used to begin to reduce any **annual weeds** that pop up. Examples of such annual weeds include Mulberry Weed, Nodding Thistle, Perilla Mint, Sicklepod, and Virginia Copperleaf. When annual weeds reach 12–18" tall, mow to no less than 6" high. This allows light to reach the slower-growing perennials, helps reduce annual weed seed development, and avoids smothering the desirable species. Mowing 6–8" high will not hurt the native perennials growing in the site. Mow several times as needed over the growing season if competition continues to be a problem. Mow before any undesirable species flower or set seed.

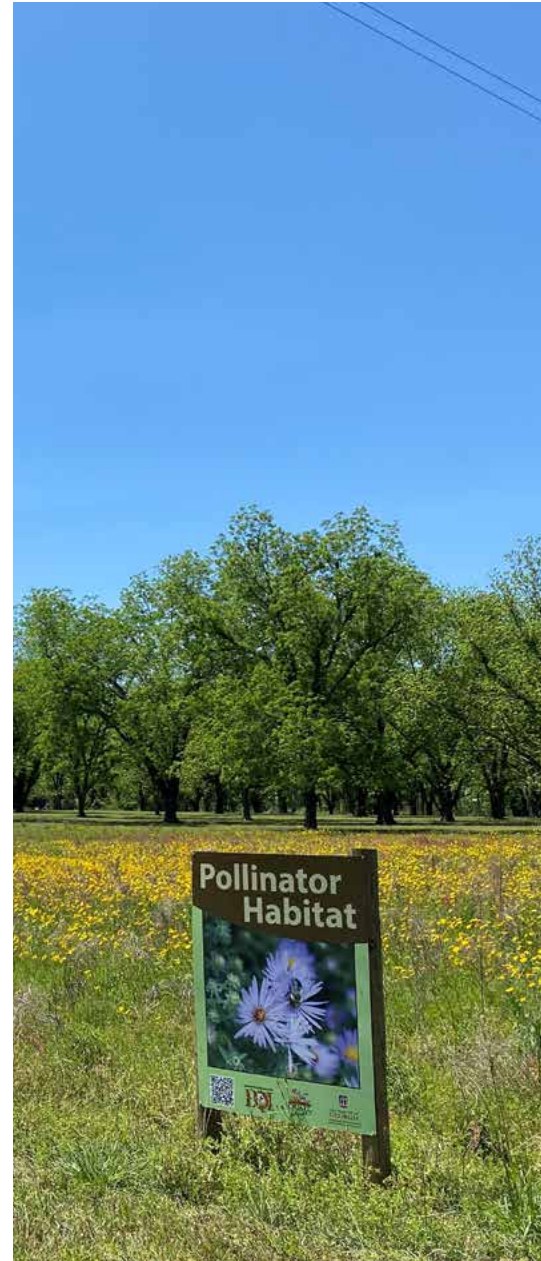
Perennial weeds present more of a challenge. Examples include Highway Lespedeza, Johnsongrass, and Vasey Grass. They will need to be spot-sprayed or dug out. Mowing is also helpful to reduce biomass before spot spraying and hand pulling, which can be very effective for small areas or limited invasions of weeds.

Second Year After Planting

Mow once close to the ground in early spring. Postponing mowing until early spring provides winter cover for wildlife, while avoiding disturbing ground-nesting birds who nest from March through September. If weeds remain a problem in the second year, mow again in late spring or early summer, being mindful to go around nesting birds. However, in the long-term, high-quality nesting habitat will outweigh losses of individual nests. Ground-nesting birds are adapted to have a long breeding season and will re-nest if they lose a nest early in the season. If you mow too late in the fall, you may destroy the seed heads of natives that feed birds in winter. However, if annual weeds are still predominant, it is better to prevent them from going to seed during the initial establishment.

Established Stand

Pollinator meadows require ongoing management to prevent succession and maintain plant diversity, function, and longevity. Annual prescribed fire and mowing should be implemented in a mosaic manner such that the entirety of the field is not mowed/burned every single year. Early intervention is the best way to handle weeds and invasive species; therefore, fields should be monitored routinely throughout the growing season. Areas where weeds or invasive species come up should be treated immediately to prevent further development.



A pollinator meadow in its third year of establishment

a. PRESCRIBED FIRE

Prescribed fire is a tool that managers use to mimic a natural environmental process. Historically, many habitats of the southeast, including meadows and grasslands, were burned every 1–3 years by low-intensity fires caused by lightning strikes and Native Americans. Fires help to:

- Reduce woody encroachment from shrubs and trees
- Promote growth of grasses and wildflowers
- Control invasive species, which are often not fire-adapted
- Improve soil health by breaking down old vegetation, returning nutrients to the soil
- Reduce the risk of harmful wildfires

The timing of pollinator meadow burning is dependent on landowner capacity and logistics. Historically, there would have been a mix of growing season (spring to early fall) and dormant season burning (late fall to early spring), with the majority of fires occurring in the growing season. However, most prescribed burns today are conducted during the dormant season because the weather makes burning safer. Fall and early winter burns typically promote growth of forbs the following season, whereas late winter and early spring burns lead to higher production of warm-season grasses. However, if there is presence of invasive cool-season grasses, burning too early can promote its spread. Burns later in the spring can reduce the abundance of forbs and promote the growth of warm-season grasses. While growing season burns are encouraged to more closely mimic natural timing, burning at different times of the year can promote diversity, depending on what species you have planted and what weeds you are controlling.

For planted grassland/meadow sites, burning a one-third to half of the site every year is recommended and will ultimately mimic a 2–3 year burn rotation among portions of the meadow. Burning the entire site every year may not produce standing fuel loads to carry a fire, but every 2–3 years should produce a fuel load that is enough to carry a low-intensity fire without the risk of a more catastrophic fire. Burning only portions also ensures higher survival of aboveground pollinating insects and other animals.

The ability to apply a prescribed fire is dependent on landowner capacity, smoke management concerns, your location, weather, and the presence of potential county-wide burn bans. Smoke management is a necessary consideration if you are near a major road, town/city, school, or hospital.

To conduct a prescribed burn, a burn permit must be obtained from the Georgia Forestry Commission (GFC). If a landowner is interested in leading their own burns, they can become trained and certified as a Certified Prescribed Fire Manager, which reduces liability. If they are not interested in leading their own burns or being highly involved, they can hire staff from GFC or a licensed prescribed fire contractor to conduct the burn. GFC and other organizations are available to make a site visit prior to the burn and can write burn plans. If the landowner is interested in receiving training for certification, there are events year-round and state wide to learn more about fire behaviors, weather, and get hands-on training.



Assisting with a prescribed fire at a meadow restoration site in Stockbridge, Georgia. Photo by Owen Smith

b. MOWING

Depending on your location, prescribed fire may not be a feasible option. Mowing or bush hogging meadows can help to control annual and biennial weeds (particularly in the first two years after seeding), control cool-season grasses, and prevent woody encroachment by trees and shrubs. To mow, you can use a wheeled brush mower, a heavy-duty riding mower, a weed whacker, or a tractor-mounted mower at an ideal mowing height of 6–8" high for controlling annual weeds or 12–18" for reducing competition from woody encroachment and larger natives. Lower is better than nothing not mowing at all if you cannot get equipment that will allow for that height.

To improve habitat for birds, March is the optimal month to mow, though mowing can start as soon as late February or into early April if you are only mowing once per year. This allows vegetative cover, seed, and insect resources to hold with standing vegetation until early spring when birds are beginning to breed and new vegetation is starting to grow. Mowing once a year is recommended, but if you must mow twice a year for aesthetic reasons, late July, August, and early September are ideal in addition to the late winter/early spring mow. Mowing during the growing season can also help expose smaller invasive species that may be lurking beneath taller desired species, like *Microstegium* and *Highway Lespedeza*. Mowing late summer also allows birds to complete their

breeding season and is early enough in the year to allow for some growth for winter cover.

For established meadows or those that do not have issues with invasive species, it is recommended to mow sections of the meadow in a mosaic over the course of a few years, as opposed to mowing the entirety of the meadow at a single time. Cut approximately one-third of the meadow each year so that the uncut part can still provide wintering habitat. Butterflies overwinter as chrysalis or eggs attached to grass or flower stalks, and bees lay eggs in hollow stalks of last year's dead plant stems. Leaving part of the meadow uncut also benefits songbirds and other small mammals, as unmowed parts provide seed heads as a source of food and cover from predators. After mowing, rake away the dead material to expose the soil to sunlight. The following spring, after mowing, the uncut areas will provide thick cover in which to hide or raise young, and the uncut areas will provide new growth. Mowing or bush hogging part of the meadow creates a more complex and multi-aged habitat that benefits both wildlife and pollinators while still preventing woody encroachment. If you are dealing with invasive species, mowing in sections can allow them to get a foothold and spread; therefore, you may want to consider mowing the entire meadow for the first year and monitor the species composition afterwards.

c. TARGETED WEED AND INVASIVE TREATMENT AFTER ESTABLISHMENT

While burning and/or mowing are going to be your first line of defense against weeds, controlling weeds can still be a constant battle. Weed seeds may be viable, but dormant in the seed beds for long periods of time. Early intervention is important, so make sure you are carefully scouting to ensure weeds and/or invasive species haven't started to invade.

Hand-weeding: If your meadow is on the smaller side, the best strategy for weeds is to hand-pull them as soon as they pop up. This will help prevent them from becoming established or producing seeds. Weed the meadow as often as possible during the growing season.

Spot-spraying: It is best to avoid broadcast spraying of herbicides over large areas (unless those areas have become dominated by weeds or invasive species) as most herbicides are not selective enough and will kill non-target species. Instead, spot treatment is recommended with a postemergent herbicide, selecting the best product for the target. Apply the herbicide when broadleaf weeds are small in the spring, and woody plants can be treated from spring through summer. Herbicide wands can help prevent herbicide from unintentionally slopping onto native plants. Cool-season weeds can be sprayed in the early spring before warm-season plants emerge.



Hand removing Chinese Privet at a habitat restoration site in Atlanta. Photo by Sebastian Hagan

7. RECOMMENDED PLANTS FOR POLLINATOR MEADOWS

The plants in the following table are selected based on their occurrence in Georgia, availability for purchase, and **dependability without aggressive tendencies**. Use as close to the local ecotype when possible. Avoid using larger varieties of species that are selected for forage or biofuels as they outcompete other species and form a monoculture. Similarly, avoid using aggressive heavy seeding species in the early stages of establishing a meadow, as they will reduce species diversity. Examples of aggressive seeders to avoid or use sparingly or after establishment (large Switchgrass cultivars, Indian Grass, Plume Grass, Broomsedge, Canada Goldenrod, Partridge Pea, Wingstem) as they can tend towards monocultures.

Habitats are grouped into four categories:

- **Shaded Wetland:** characterized by a low amount of sunlight and consistently high moisture levels
- **Sunny Xeric:** receive ample sunlight but little water
- **Sunny Mesic:** receive ample sunlight and is consistently more moist
- **Edge:** ecological transition zone between two different habitat types (e.g., where a meadow meets a forest)

Plant **types** are categorized into graminoids (herbaceous plant with a grass-like morphology), groundcover, shrubs, trees, vines, and wildflowers. Meadows will primarily be composed of graminoids and wildflowers with some scattered shrubs or trees. We have included edge species in our list, as it is important to consider your land in a holistic picture and select species surrounding the meadow that are native. Edge habitat should have a diverse canopy structure and be open enough to allow sunlight to penetrate the ground and encourage groundcover diversity.

Diversifying your meadow with plants that have different **bloom times** and **life cycles** helps to provide habitat and forage for bees and butterflies throughout the year. Annual plants complete their life span in one year. Biennials will grow leaves in their first year and bloom in their second. Perennials are slower to establish, but bloom dependably year after year. Planting a combination of annuals, biennials, and perennials ensures extended blooming time and ensures greater overall resiliency and soil health.







The National Wetland Plant List (NWPL), developed by the U.S. Army Corp of Engineers, provides **wetland status** ratings for plant species. This indicates a plant species' estimated frequency of occurrence in wetlands or non-wetlands. This table, in conjunction with the habitat types listed, should provide good general guidelines for planting based on your site conditions.

Propagule options are based on the most widely available options at stores, which are the most efficient planting methods for each species. Plugs are small, young plants that have been grown in cell trays. Containerized plants are mature plants grown in their own pot, barrel, or other container. A live stake is a living cutting from a plant that can be directly planted into the ground. Seeds can be bought in various quantities and can be single species or mixed species in a desired ratio. Refer to sections 4 and 5 for more information on planting and seeding.







National Wetland Plant List (NWPL)

Wetland Indicator Status Rating	Definition
OBL (Obligate)	Almost always occurs in wetlands
FACW (Facultative Wetland)	Usually occur in wetlands, but may occur in non-wetlands
FAC (Facultative)	Occur in wetlands and non-wetlands
FACU (Facultative Upland)	Usually occur in non-wetlands, but may occur in wetlands
UPL (Upland)	Almost never occur in wetlands

PLANTS BY HABITAT







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Edge	Groundcover	Wild Ginger	<i>Asarum canadense</i>		Perennial	Flies, beetles. Larval host for Pipevine Swallowtail Butterfly.	4-8 in.	Apr.-Jun.	FACU	Plugs, containerized
Edge	Groundcover	Green and Gold	<i>Chrysogonum virginianum</i>		Perennial	Birds, bees, butterflies	0.5-1 ft.	Apr.-Oct.	UPL	plugs, containerized
Edge	Groundcover	Little Brown Jug	<i>Hexastylis arifolia</i>		Perennial	Beetles	6 in.	Mar.-May	FAC	Containerized
Edge	Groundcover	Dward Crested Iris	<i>Iris cristata</i>		Perennial	Hummingbirds, bees	1 ft.	Mar.-Apr.	UPL	Containerized
Edge	Groundcover	Partridgeberry	<i>Mitchella repens</i>		Perennial	Bees, birds	1-4 in.	May-Jul.	FACU	Containerized
Edge	Groundcover	Wood Phlox	<i>Phlox divaricata</i>		Perennial	Swallowtail butterflies, Sphinx moths, hummingbirds	1-1.5 ft.	Apr.-May	FACU	Containerized







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Edge	Groundcover	Violet	<i>Viola</i> spp.		Perennial	Small bees, ants. Larval host for fritillary butterflies and many moths.	4-8 in.	Mar.-May	UPL	Containerized
Edge	Shrubs	Pawpaw	<i>Asimina triloba</i>		Perennial	Beetles, flies, birds, mammals. Larval host for Zebra Swallowtail.	15-30 ft.	Apr.-May	FAC	Containerized
Edge	Shrubs	American Beautyberry	<i>Callicarpa americana</i>		Perennial	Butterflies, bees. Berries for songbirds and mammals.	3-8 ft.	Jun.-Jul.	FACU	Seed
Edge	Shrubs	Buttonbush	<i>Cephalanthus occidentalis</i>		Perennial	Hummingbirds, bees, butterflies. Seed for birds.	6-12 ft.	Jun.-Sept.	OBL	Containerized, live stake
Edge	Shrubs	Winterberry	<i>Ilex verticillata</i>		Perennial	Small bees, flies	6-12 ft.	Jun.-Jul.	FACW	Containerized
Edge	Shrubs	Native Azaleas	<i>Rhododendron</i> spp.		Perennial	Bees, butterflies, moths	3-8 ft.	Mar.-Apr.	UPL	Containerized







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Edge	Shrubs	Elliot's Blueberry	<i>Vaccinium elliotii</i>		Perennial	Native bees, butterflies. Larval host for several Hairstreak butterflies and numerous moths.	6-8 ft.	Mar.-Jun.	FACW	Containerized
Edge	Shrubs	Sparkleberry	<i>Vaccinium arboreum</i>		Perennial	Native bees, butterflies. Larval host for several Hairstreak butterflies and numerous moths.	6-20 ft.	Apr.-May	UPL	Containerized
Edge	Shrubs	Mapleleaf Viburnum	<i>Viburnum acerifolium</i>		Perennial	Small native bees, flies, beetles. Larval host for numerous moths and butterflies, such as the Hummingbird Clearwing Moth.	3-6 ft.	May-Jun.	UPL	Containerized
Edge	Trees	Silky Dogwood	<i>Cornus amomum</i>		Perennial	Specialized bees, songbirds. Larval host for Spring Azure Butterfly.	15 ft.	Mar.-Apr.	FACW	Containerized, live stake
Edge	Trees	Eastern Redbud	<i>Cercis canadensis</i>		Perennial	Bees, songbirds, small mammals. Larval host for many butterflies, such as Henry's Elfin.	20-30 ft.	Mar.-May	FACU	Containerized
Edge	Trees	American Beech	<i>Fagus grandifolia</i>		Perennial	Over 100 species of butterflies and moths. Mammals and birds eat the nuts.	50-80 ft.	Apr.-May	FACU	Containerized

Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Edge	Trees	Tulip Poplar	<i>Liriodendron tulipifera</i>		Perennial	Songbirds, hummingbirds	60-90 ft.	May-Jun.	FACU	Containerized
Edge	Trees	Chickasaw Plum	<i>Prunus angustifolia</i>		Perennial	Fruit and cover for songbirds and mammals. Larval host for many butterflies, such as the Coral Hairstreak.	4-15 ft.	Mar.-Apr.	FACW	Containerized
Edge	Trees	Black Cherry	<i>Prunus serotina</i>		Perennial	Larval host for over 450 species of butterflies and moths, including the Eastern Tiger Swallowtail, Cherry Gall Azure, Viceroy, & Cecropia moth.	60-80 ft.	Apr.-May	FACU	Containerized
Edge	Vines	Crossvine	<i>Bignonia capreolata</i>		Perennial	Nectar for hummingbirds, bees, other pollinators. Larval host for the Rustic Sphinx moth and the Gray Hairstreak Butterfly.	up to 50 ft.	Apr.-May	FAC	Containerized
Edge	Vines	Coral Honeysuckle	<i>Lonicera sempervirens</i>		Perennial	Hummingbirds. Larval host for the Spring Azure butterfly and Clearwing Moth.	4-20 ft.	Mar.-Jun.	FACU	Containerized
Edge	Vines	Muscadine	<i>Vitex rotundifolium</i>		Perennial	Birds. Larval host for Spinx Moths.	up to 90 ft.	Apr.-May	UPL	Containerized







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Shaded Wetland	Graminoids	Lurid Sedge	<i>Carex lurida</i>		Perennial	Skipper butterflies and moths. Food and nesting cover for birds and other wildlife. Larval host for the Appalachian Brown Butterfly and the Dun Skipper.	3.5 ft.	Mar.-May	OBL	Seed
Shaded Wetland	Graminoids	Fox Sedge	<i>Carex vulpinoidea</i>		Perennial	Food for birds and mammals, such as ducks and geese. Larval host for several species of Skipper butterflies and other lepidoptera.	3.5 ft.	Jul.-Aug.	OBL	Seed
Sunny Mesic	Graminoids	Lurid Sedge	<i>Carex lurida</i>		Perennial	Skipper butterflies and moths. Food and nesting cover for birds and other wildlife. Larval host for the Appalachian Brown butterfly and the Dun Skipper.	3.5 ft.	Mar.-May	OBL	Seed
Sunny Mesic	Graminoids	Fox Sedge	<i>Carex vulpinoidea</i>		Perennial	Food for birds and mammals, such as ducks and geese. Larval host for several species of Skipper butterflies and other lepidoptera.	3.5 ft.	Jul.-Aug.	OBL	Seed
Sunny Mesic	Graminoids	Riveroats	<i>Chasmanthium latifolium</i>		Perennial	Butterflies, moths. Larval host for Northern Pearly Butterfly.	2-3 ft.	Aug.-Sep.	FACW	Seed
Sunny Mesic	Graminoids	Redtop Panic Grass	<i>Coleataenia (Panicum) rigidula</i>		Perennial	Skippers	1.5-5 ft.	Jul.-Oct.	FACU	Seed







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Mesic	Graminoids	Virginia Wild Rye	<i>Elymus virginicus</i>		Annual	Seed for birds. Shelter for small mammals and insects.	2-4 ft.	Mar.-May	FACW	Seed
Sunny Mesic	Shrubs	Elderberry	<i>Sambucus canadensis</i>		Perennial	Bees. Larval host for at least 42 species of caterpillars, such as the Polyphemus, Cecropia, and White-lined Sphinx Moths.	12 ft.	May-Jul.	FACW	Containerized
Sunny Mesic	Wildflower	Swamp Milkweed	<i>Asclepias incarnata</i>		Perennial	Bees, butterflies, other insects. Larval host for many butterflies, such as the Monarch & Milkweed Tussock.	3-5 ft.	Jun.-Aug.	OBL	Seed or plugs
Sunny Mesic	Wildflower	Bearded Beggar Ticks	<i>Bidens aristosa</i>		Annual	Specialist bees, butterflies. Seed for birds.	5 ft.	Jul.-Nov.	FACW	Seed
Sunny Mesic	Wildflower	Devil's Beggar Ticks	<i>Bidens frondosa</i>		Annual	Bees, flies, butterflies. Larval host for several moth and butterfly species, such as the Goldenrod Stowaway and the Bidens Borer Moth.	6 ft.	Jun.-Oct.	FACW	Seed
Sunny Mesic	Wildflower	Lance-leaved Coreopsis	<i>Coreopsis lanceolata</i>		Perennial	Butterflies, specialist bees	1-2 ft.	Apr.-Jun.	FACU	Seed



Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Mesic	Wildflower	Common Boneset	<i>Eupatorium perfoliatum</i>		Perennial	Butterflies, birds	3-6 ft.	Jun.-Oct.	FACW	Seed or plugs
Sunny Mesic	Wildflower	Joe-pye Weed	<i>Eutrochium (Eupatorium) fistulosum</i>		Perennial	Butterflies, bees, beneficial insects	2-7 ft.	Jul.-Sep.	FACW	Seed or plugs
Sunny Mesic	Wildflower	Swamp Sunflower	<i>Helianthus angustifolius</i>		Perennial	Specialist bees, butterflies, songbirds. Larval host for the Silvery Checkerspot Butterfly	5-8 ft.	Oct.	FACW	Seed or plugs
Sunny Mesic	Wildflower	Smooth Oxeye	<i>Heliopsis helianthoides</i>		Perennial	Butterflies, moths, birds, specialist bees	5 ft.	Jun.-Sep.	FACU	Seed or plugs
Sunny Mesic	Wildflower	Dense Blazing Star	<i>Liatris spicata</i>		Perennial	Songbirds, hummingbirds, butterflies	5 ft.	Aug.-Sep.	FAC	Seed or plugs
Sunny Mesic	Wildflower	Cardinal Flower	<i>Lobelia cardinalis</i>		Perennial	Hummingbirds, butterflies, moths, and other insects	3-6 ft.	May-Oct.	FACW	Seed or plugs







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Mesic	Wildflower	Great Blue Lobelia	<i>Lobelia siphilitica</i>		Perennial	Hummingbirds, butterflies, moths, and other insects	1-3 ft.	Jul.-Oct.	FACW	Seed or plugs
Sunny Mesic	Wildflower	Monkey Flower	<i>Mimulus ringens</i>		Perennial	Bees, butterflies. Larval host for Baltimore and Common Buckeye butterflies.	3-20 ft.	Jun.-Sep.	OBL	Seed
Sunny Mesic	Wildflower	Maryland Meadow Beauty	<i>Rhexia mariana</i>		Perennial	Bees, moths	2.5 ft.	Jun.-Aug.	OBL	Seed or plugs
Sunny Mesic	Wildflower	White Goldenrod	<i>Solidago bicolor</i>		Perennial	Bees, butterflies, specialist bees. Larval host for the Wavy-lined Emerald Moth.	2-3 ft.	Jul.-Oct.	FACU	Seed or plugs
Sunny Mesic	Wildflower	Giant Ironweed	<i>Vernonia gigantea</i>		Perennial	Serves 12 species of specialist bees. Larval host for ~20 species of butterflies and moths, such as the American Lady Butterfly.	10 ft.	Aug.-Oct.	FACW	Seed or plugs
Sunny Mesic	Wildflower	New York Ironweed	<i>Vernonia noveboracensis</i>		Perennial	Serves 12 species of specialist bees. Larval host for ~20 species of butterflies and moths, such as the American Lady Butterfly.	7 ft.	Aug.-Sep.	FACW	Seed or plugs







Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Graminoids	Big Bluestem	<i>Andropogon gerardii</i>		Perennial	Butterflies, moths. Larval host for the Northern Pearly Butterfly.	4-8 ft.	Aug.-Nov.	UPL	Seed
Sunny Xeric	Graminoids	Splitbeard Bluestem	<i>Andropogon ternarius</i>		Perennial	Birds, butterflies, particularly skippers.	4 ft.	Aug.-Nov.	FACU	Seed or plugs
Sunny Xeric	Graminoids	Virginia Wild Rye	<i>Elymus virginicus</i>		Annual	Seed for birds. Shelter for small mammals and insects.	2-4 ft.	Mar.-May	FACW	Seed
Sunny Xeric	Graminoids	Purple Lovegrass	<i>Eragrostis spectabilis</i>		Perennial	Leafhoppers. Seed and nesting material for songbirds. Larval host for the Paradoxical Grass Moth.	2 ft.	Aug.-Oct.	UPL	Seed or plugs
Sunny Xeric	Graminoids	Switchgrass (avoid large cultivars, which can become aggressive)	<i>Panicum virgatum</i>		Perennial	Larval host for various butterflies and moths, such as the Common Wood Nymph Butterfly.	3-7 ft.	Aug.-Nov.	FAC	Seed
Sunny Xeric	Graminoids	Little Bluestem	<i>Schizachyrium scoparium</i>		Perennial	Birds, butterflies	2-3 ft.	Sep.	UPL	Seed or plugs






Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Graminoids	Eastern gamagrass	<i>Tripsacum dactyloides</i>		Perennial	Birds, butterflies, moths	4-8 ft.	May-Sept.	FACW	Seed
Sunny Xeric	Graminoids	Indiangrass	<i>Sorghastrum nutans</i>		Perennial	Birds, butterflies, moths	3-7 ft.	Oct.-Nov.	FACU	Seed
Sunny Xeric	Wildflower	Wild Columbine	<i>Aquilegia canadensis</i>		Perennial	Hummingbirds. Larval host for several butterflies, such as the Columbine & Wild Indigo Duskwings.	1-3 ft.	Feb.-Jul.	FAC	Seed or plugs
Sunny Xeric	Wildflower	Butterfly Weed	<i>Asclepias tuberosa</i>		Perennial	Bees, butterflies, other insects. Larval host for many butterflies, like the Monarch & Milkweed Tussock.	2 ft.	May-Sep.	UPL	Seed or plugs
Sunny Xeric	Wildflower	White Wild Indigo	<i>Baptisia alba</i>		Perennial	Butterflies, bees	4 ft.	Apr.-Jul.	FACU	Seed or plugs
Sunny Xeric	Wildflower	Partridge Pea	<i>Chamaecrista fasciculata</i>		Annual	Butterflies, bees. Larval host for the Cloudless Giant Sulphur, Orange Sulphur, & Sleepy Orange butterflies.	1-3 ft.	Jun.-Sep.	FACU	Seed

Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Wildflower	Maryland Goldenaster	<i>Chrysopsis mariana</i>		Perennial	Specialist bees, butterflies	1-2.5 ft.	Jun.-Oct.	UPL	Seed
Sunny Xeric	Wildflower	Lance-leaved Coreopsis	<i>Coreopsis lanceolata</i>		Perennial	Specialist bees, butterflies	1-2 ft.	Apr.-Jun.	FACU	Seed
Sunny Xeric	Wildflower	Whorled Coreopsis	<i>Coreopsis major</i>		Perennial	Butterflies, bees, songbirds	3-4 ft.	Jul.-Oct.	FACU	Seed
Sunny Xeric	Wildflower	Flat-topped White Aster	<i>Doellingeria umbellata</i>		Perennial	Bees, other insects. Larval host for several butterflies, such as the Pearly Crescent and Silvery Checkerspot.	3-6 ft.	Aug.-Sep.	FACW	Seed or plugs
Sunny Xeric	Wildflower	Robin's Flea Bane	<i>Erigeron pulchellus</i>		Perennial	Butterflies, bees	1-1.5 ft.	Apr.	FACU	Seed or plugs
Sunny Xeric	Wildflower	Rattlesnake Master	<i>Eryngium yuccifolium</i>		Perennial	Bees, beetles, flies, butterflies. Larval host for Rattlesnake Master Stem Borer moth.	4-6 ft.	Jun.-Aug.	FAC	Seed or plugs

Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Wildflower	Purplehead Sneezeweed	<i>Helenium flexuosum</i>		Perennial	Butterflies. Deer and rabbit resistant.	1.5-3 ft.	May-August	FAC	Seed or plugs
Sunny Xeric	Wildflower	Smooth Oxeye	<i>Heliopsis helianthoides</i>		Perennial	Butterflies, moths, birds, specialist bees	5 ft.	Jun.-Sep.	FACU	Seed or plugs
Sunny Xeric	Wildflower	Roundhead Lespedeza	<i>Lespedeza capitata</i>		Perennial	Larval host for several butterfly and moth species, such as the Southern Cloudywing, Northern Cloudywing, Hoary Edge, Eastern Tailed-Blue, and Bella Moth.	2-4 ft.	Jul.-Sep.	FACU	Seed
Sunny Xeric	Wildflower	Shrubby Bushclover	<i>Lespedeza frutescens</i>		Perennial	Larval host for several butterfly and moth species, such as the Southern Cloudywing, Northern Cloudywing, Hoary Edge, Eastern Tailed-Blue, and Bella Moth.	2-5 ft.	Jul.-Sep.	UPL	Seed
Sunny Xeric	Wildflower	Slender Lespedeza	<i>Lespedeza virginica</i>		Perennial	Larval host for several butterfly and moth species, such as the Southern Cloudywing, Northern Cloudywing, Hoary Edge, Eastern Tailed-Blue, and Bella Moth.	2-4 ft.	Jul.-Sep.	FACU	Seed
Sunny Xeric	Wildflower	Dense Blazing Star	<i>Liatris spicata</i>		Perennial	Songbirds, hummingbirds, butterflies	5 ft.	Aug.-Sep.	FAC	Seed or plugs

Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Wildflower	Wild Bergamot	<i>Monarda fistulosa</i>		Perennial	Hummingbirds, bees, butterflies	3-4 ft.	Jun.-Jul.	UPL	Seed or plugs
Sunny Xeric	Wildflower	Sundrops	<i>Oenothera fruticosa</i> var. <i>fruticosa</i>		Perennial	Butterflies, hummingbirds. Larval host plant for several moths, such as the Primrose and Momphid moths.	1-3 ft.	May	FAC	Seed or plugs
Sunny Xeric	Wildflower	Wild Passion Flower	<i>Passiflora incarnata</i>		Perennial	Bees, butterflies, fruit for small mammals and birds. Larval host for the Fritillary and Zebra Longwing butterflies.	Vine	Apr.-Sep.	FACU	Containerized
Sunny Xeric	Wildflower	Southern Beardtongue	<i>Penstemon australis</i>		Perennial	Bees, butterflies, hummingbirds	1-3 ft.	May-Jul.	FACU	Seed
Sunny Xeric	Wildflower	Smooth Beardtongue	<i>Penstemon laevigatus</i>		Perennial	Bees, butterflies, hummingbirds. Larval host for the Common Buckeye butterfly.	1-3 ft.	May-Jul.	FACU	Seed
Sunny Xeric	Wildflower	Carolina Phlox	<i>Phlox carolina</i>		Perennial	Bees, hummingbirds, butterflies. Larval host for several moth species.	2-3 ft.	May-Jun.	FACU	Containerized

Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Wildflower	Hoary Mountain Mint	<i>Pycnanthemum incanum</i>		Perennial	Bees, butterflies, other insects. Larval host for the Wavy-lined Emerald Moth.	1-3 ft.	May-Jul.	FAC	Seed or plugs
Sunny Xeric	Wildflower	Narrowleaf Mountain Mint	<i>Pycnanthemum tenuifolium</i>		Perennial	Bees, butterflies, other insects. Larval host for several moths, such as the Wavy-lined Emerald and Hermit Sphinx.	1-3 ft.	Jul.-Sep.	FACW	Seed or plugs
Sunny Xeric	Wildflower	Grayheaded Coneflower	<i>Ratibida pinnata</i>		Perennial	Bees, butterflies. Seeds for songbirds. Larval host for several butterflies and moths, such as the Silvery Checkerspot.	5 ft.	May-Sep.	UPL	Seed or plugs
Sunny Xeric	Wildflower	Black-eyed Susan	<i>Rudbeckia hirta</i>		Biennial	Bees, seeds for songbirds. Larval host to the Wavy-lined Emerald moth and Silvery Checkerspot Butterfly.	2-3 ft.	Aug.-Oct.	FACU	Seed or plugs
Sunny Xeric	Wildflower	Starry Rosinweed	<i>Silphium asteriscus</i>		Perennial	Butterflies, bees. Seeds for songbirds.	3-6 ft.	May-Sep.	UPL	Seed or plugs
Sunny Xeric	Wildflower	Gray Goldenrod	<i>Solidago nemoralis</i>		Perennial	Supports many specialized bees. Seeds eaten by birds. Larval host for Wavy-lined Emerald Moth.	0.5-2 ft.	Aug.-Nov.	UPL	Seed or plugs

Habitat	Type	Common Name	Scientific Name	Photo	Life Cycle	Wildlife Characteristics	Size	Bloom Time	Wetland status	Propagule Best Option(s)
Sunny Xeric	Wildflower	Rough-leaved Goldenrod	<i>Solidago rugosa</i>		Perennial	Bees, moths, butterflies. Seed for birds.	1-3 ft.	Sep.-Nov.	FAC	Seed or plugs
Sunny Xeric	Wildflower	Smooth Aster	<i>Symphotrichum laeve</i>		Perennial	Many specialist bees, butterflies. Seed for songbird. Larval host for Pearl Crescent butterfly.	2-4 ft.	Sep.-Nov.	FACU	Seed or plugs
Sunny Xeric	Wildflower	Calico Aster (Starved Aster)	<i>Symphotrichum lateriflorum</i>		Perennial	Many specialist bees, butterflies. Seed for songbird. Larval host for Pearl Crescent butterfly.	2-3 ft	Aug.-Oct.	FACW	Seed or plugs
Sunny Xeric	Wildflower	Frost Aster	<i>Symphotrichum pilosum</i>		Perennial	Many specialist bees, butterflies. Seed for songbird. Larval host for Pearl Crescent butterfly.	2-5 ft.	Sep.-Nov.	FAC	Seed or plugs
Sunny Xeric	Wildflower	Golden Alexander	<i>Zizia aurea</i>		Perennial	Butterflies, bees. Larval host for several species of Swallowtail butterflies.	1-2 ft.	Apr.-May	FAC	Seed or plugs

8. SELECT RESOURCES RELEVANT TO MEADOW RESTORATION IN THE SOUTHEAST

Comprehensive Guides

- [PDF] [Restoring Your Invasive Perennial-Dominated Grassland to Conservation Meadow](#) - The Nature Conservancy
- [PDF] [Establishing Pollinator Meadows from Seed](#) - Xerces Society
- [PDF] [NRCS Georgia Wildlife Habitat Planting: Native Warm Season Grasses for Wildlife Implementation Requirements](#)
- [PDF] [NRCS Georgia Technical Guide - Pollinator Habitat](#)
- [PDF] [NRCS Georgia Technical Guide - Monarch Habitat](#)
- [PDF] [Conservation Cover for Pollinators: Florida Installation Guide](#) - NRCS and the Xerces Society
- [PDF] [Pollinator Habitat Establishment & Management Guide](#) - The Bee & Butterfly Habitat Fund

Determining Site Characteristics

- [Webpage] [Web Soil Survey](#)
- [Webpage] [Ecological Site Descriptions](#) - USDA. Contains tools, resources, and information on site characteristics
- [Webpage] [How Much Sun do I Get? Guide to Sunlight Assessment in the Garden](#) - Alabama and Auburn Extension

Site Preparation

Invasive Species

- [PDF] [A Management Guide to Invasive Plants in Southern Forests](#) - USDA Forest Service Southern Research Station

Mechanical Vegetation Removal

- [PDF] [Manual, Mechanical, and Cultural Control Methods and Tools](#)
- [Webpage] [Cut Stump Herbicide Treatments for Woody Plant Control](#)

Planting

- [Video] [Native Seeds: Supplying Restoration](#) - Full movie
- [PDF] [Native Warm-Season Grasses: Identification, Establishment, and Management for Wildlife and Forage Production in the Mid-South](#) - University of Tennessee Extension

Management

Covers Multiple Methods

- [Management of Prairie Meadows](#) - Prairie Nursery

Prescribed Fire

- [PDF] [Guidebook for Prescribed Burning in the Southern Region](#) (UGA Cooperative Extension)
- [PDF] [Introduction to Prescribed Fire in Southern Ecosystems](#) (USDA)
- [Paper] Season of prescribed fire determines grassland restoration outcomes after fire exclusion and overgrazing (Novak et al 2021)

Targeted Weed and Invasive Treatment

- [PDF of a Powerpoint] [Weeds of Meadows and Their Control](#) - Ernst Seeds
- [Webpage] [Commonly Used Herbicides for Directed Spot Foliage Applications](#)

9. CONSERVATION TECHNICAL ASSISTANCE PROGRAMS

There are several organizations in Georgia that offer conservation technical assistance to help landowners prepare the site and select specific seed mixes for the region and soil type. Information for the listed organizations is provided by their website, as well as the website link. More information on additional organizations, programs, and cost-share opportunities is also available in the [Georgia Landowners Guide to Conservation Resources](#).

[Natural Resources Conservation Service \(NRCS\)](#): The Conservation Technical Assistance Program assists landowners in planning and implementing conservation systems that reduce erosion and upstream flooding, improve and conserve wetlands, enhance fish and wildlife habitat, and improve air quality, pasture and range condition, soil and water quality, and woodlands. A customized conservation plan can be written that identifies the appropriate conservation practices most applicable to a landowners property. NRCS also provides opportunities for financial assistance through various programs to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, and related resources on agricultural lands and non-industrial private forest land.

[Georgia Department of Natural Resources \(GA DNR\) Private Lands Program \(PLP\)](#): The PLP assists private landowners who are interested in integrating wildlife within their land management objectives. Biologists provide free technical assistance to all Georgia landowners for game and nongame species and habitat objectives in order to promote healthy ecosystems throughout the state. Through science-based conservation planning, landowners can more effectively achieve their wildlife and natural resource goals and make sure these resources are in good condition for Georgia's future generations. Biologists are available to offer free general technical and onsite consultations to provide management recommendations and guidance on financial assistance programs.

[Quail Forever \(QF\)](#): With funding from USDA's Natural Resources Conservation Service, Georgia Department of Natural Resources, Georgia Quail Forever Chapters, and other conservation partners, QF biologists work to implement the conservation provisions of the Federal Farm Bill and other related wildlife conservation programs, such as the Bobwhite Quail Initiative. In addition to assisting with Farm Bill implementation, QF biologists advocate for good stewardship of the land through outreach and education, hosting field days, seminars, and workshops for landowners, natural resources agencies, conservation organizations, and local community members. Many conservation practices that benefit wildlife are compatible with working lands, which include agriculture, forestry, and grazing. As partner biologists working closely with federal and state governmental agencies on the implementation of USDA conservation programs, QF biologists also serve as a liaison between program applicants and agencies, assisting with conservation planning and the application process.

[Georgia Wildlife Federation \(GWF\) Private Lands Stewardship Program](#): The primary objective of this program is to provide, at no cost, land management technical assistance to help landowners in Georgia achieve wildlife habitat enhancement and forest management objectives. Due to the ecological and wildlife habitat benefits associated with longleaf pine restoration, they emphasize assistance for properties that are within the historic range of longleaf pine in Georgia. Given the importance of active management in developing and maintaining quality wildlife habitat, the GWF Biologist will perform one-on-one site visits with landowners to assess land condition and landowner objectives and then develop a detailed management plan.

[Birds Georgia](#): The Birds Georgia Habitat Stewardship Program is a new conservation program geared toward both public and private land holdings and the people who own and manage them. Properties in any state of conservation are eligible, whether you are in the beginning stages of restoration or already manage healthy habitats. The program rubric offers flexibility to allow stewards to tailor management needs to their property. The program is designed to enable property stewards to make improvements to their land for the benefit of native wildlife while also connecting them to educational resources, technical assistance programs, cost-sharing and revenue-generating programs, engagement and research opportunities, perks associated with Birds Georgia membership such as early access and program discounts, recognition as an official "Habitat Steward" in our program, and more.



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