

Establishing Native Habitats *for* Mississippi's Native Pollinators



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TABLE OF CONTENTS

Introduction.....	iii
Lesson 1: Mississippi’s Native Pollinators.....	1
Lesson 2: Native Plants for Native Habitats.....	15
Lesson 3: Planning and Designing a Pollinator Habitat.....	20
Lesson 4: Building a Native Pollinator Habitat.....	26
Lesson 5: Make a Mason Bee Box.....	29
Natural Heritage Program – Native Pollinator Survey.....	31

INTRODUCTION

This manual was created to provide basic information on the importance of Mississippi's native pollinators and their habitats. We hope this manual will enable its users to construct their own native pollinator habitats and promote Mississippi Native Pollinator Conservation. In addition, participants are encouraged to act as "citizen scientists" by learning to identify common pollinators and collect information on their presence in native habitats across the state. This extremely valuable information will be used to estimate the population status of many pollinator species. Currently, very little information is known about the population trends of Mississippi's native pollinators. However, recent national research findings suggest that some native pollinators are suffering huge declines across the U.S.

What are Pollinators? Long before human civilization, flowering plants developed complex relationships with animals that eventually resulted in the transfer of pollen from the male to female parts of flowering plants. This pollen transfer is now known as pollination, and today over 200,000 species of animals such as bees, butterflies, beetles, flies, ants, birds, wasps, and bats assist in this process. Pollination is a requirement in the sexual reproduction of flowering plants, and without it flowering plants would fail to reproduce fruit and seed.

What are Native Pollinators, & Why are they so Important?

Native pollinators naturally occur throughout North America and play a crucial role in ecosystem function because they have coexisted within these environments for thousands of years. While the European honey bee (*Apis* spp.) is considered an extremely important pollinator in agricultural food production in the U.S., it is a non-native species originally introduced by European settlers during the 1600s. In recent years, the honey bee has received widespread attention due to declining population numbers resulting from numerous disease outbreaks, habitat loss by increased urbanization, improper pesticide use, and bee keepers retiring or going out of business. The most recent dilemma facing the honey bee industry is a syndrome known as Colony Collapse Disorder (CCD). This disorder is not yet fully understood, but its symptoms are represented by foraging worker bees failing to return to their hives. Millions of dollars are currently being spent to study CCD and identify how to prevent further detriments to the beekeeping industry. While the honey bee is undoubtedly one of the most important pollinators to agricultural crops, most of us fail to consider the important role that native pollinators play in our lives. Within North America alone, there are around 4,000 bee species that play a huge role in pollination. Native pollinators are not only important in agricultural terms, but they also play a huge important role in the health of North American Ecosystems. For instance, without native pollinators 60 to 80 percent of flowering plants would not reproduce. This reproductive failure would eventually result in an ecosystem meltdown with detrimental consequences suffered by native habitats, wildlife, and mankind alike.

Lesson 1: Mississippi’s Native Pollinators

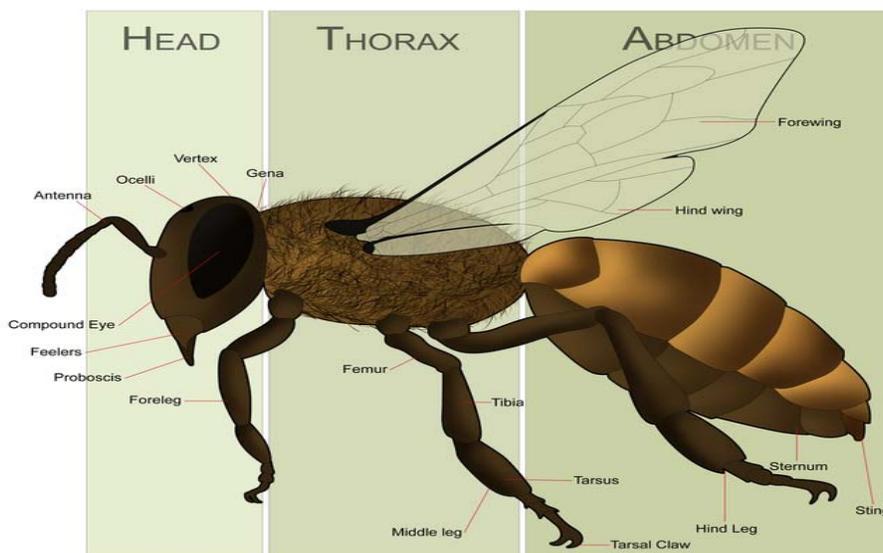
While there are literally thousands native pollinators to be found across Mississippi, this section primarily focuses on pollinators that are most commonly seen in gardens and/or natural habitats across our state. Special emphasis has also been placed on native pollinators that are likely to be declining across their native ranges. Our Top 15 Native Pollinators may not be yours, but understanding the need to establish habitat for all pollinating species is something that we all share.

We recommend that more experienced individuals use their own knowledge, experience, and creativity to develop more expansive Pollinator Habitats for pollinators of their own interest.

Bees (Order Hymenoptera)

Identification tips: Bees are insects that have 2 pairs of wings, with the front wings being larger than the back wings. Bees have a long tongue called a proboscis that they use to obtain nectar from flowers. Length of the proboscis varies among different bee species. For instance, bumble bees have longer proboscises than honey bees. Therefore, they can obtain nectar from certain types of flowers that honey bees cannot. Only female bees have the ability to sting.

Basic Bee Anatomy



1) **Bumble Bee (*Bombus* spp.) Length: ¾ inch to 1 ½ inches** – Approximately 12 different bumble bee species occur throughout Mississippi. These species live in small short-lived colonies (lasting only one year) and consist of 200 individuals or less. The queen bee is entirely responsible for the construction and reproduction that occurs within the nest. Nests are usually constructed under the ground in abandon mammal burrows, or in manmade materials such as cans or abandoned buildings. Bumble bee hives contain very little honey, just enough to feed their growing brood. Bumble bees are fairly easy to identify because they tend to fly around slowly. Their large bodies are covered entirely in hair (pile) that is yellow and black in color. They feed on nectar and collect pollen on their hind legs in “pollen pockets”. This pollen is then used to feed their young. Large queen bumblebees are usually only seen in the early spring before their hives become active. Bumble bees are used commercially to pollinate tomatoes grown in greenhouses because they perform buzz pollination. This pollination method enables them to be more effective at pollinating tomatoes compared to most other bee species. Recent research findings suggest that several southeastern Bumble bee species may be decreasing across their native ranges. Very little research has been conducted on native bees in Mississippi, so the current status of our state’s bumble bee populations is relatively unknown.



Bumble bee with full pollen pockets on hind legs



Group of bumble bees feeding on apple



Bumble bee feeding on native Carolina jasmine

- 2) **Carpenter Bee (*Xylocopa* spp.)** Length: $\frac{3}{4}$ to 1 $\frac{1}{2}$ inches - Carpenter bees are often confused with bumblebee because of their similar size and colorization. However, carpenter bees have abdomens that are hairless and shiny black in color. **Remember: Carpenter bees have shiny hinnies!!** Carpenter bees also do not have pollen pockets on their hind legs, but instead, thick black hairs. These bees also do not form colonies like bumblebees, but instead, are considered solitary. These bees get their name from the fact that the female bees create their brood nests by tunneling holes into wood by vibrating their bodies and moving their mouthparts (mandibles). The females do not eat the wood, but often use it to partition off sections within tunnels. These sections will contain the carpenter bee’s brood and will serve as overwintering sites for male and female adult bees during the winter. Carpenter bees are relatively non-aggressive; however, females will sting if threatened. Large (**non-stinging**) male carpenter bees can be seen in large numbers during the early spring in search of females. Males may hover around you when you come within their territory, but relax, they are **unable** to sting!



Carpenter Bee

Typical tunnel structure of
carpenter bee within wood

Female Carpenter bees usually tunnel about 1 inch deep into wood, then they turn at a 90 degree angle and tunnel with the wood grain. These bees prefer to tunnel into wood that is at least 2 inches thick. Several females may live gregariously within separate tunnel sections. Each fertilized female will locate a section and begin depositing pollen and regurgitated nectar to make a provision of “bee bread”. She then deposits an egg into this food provision and seals this chamber off. Each female typically creates 6 to 8 separate chambers.

3) Mason Bee and Leafcutter bees – Family: Megachilidae, Length: ¼ to ½ inches – these common names refers to numerous pollinating bee species of the **Family Megachilidae** that occur throughout Mississippi (generally blue, black or green in color) and are considered solitary bees, but will live close together. The common names, mason or leafcutter, describe the way these bees build their nests using mud or plant materials to compartmentalize sections for their young to grow and mature. Nests are generally constructed within naturally hollow twigs or wooden holes previously constructed by wood boring bees. These bees are non-aggressive and are generally considered non-stinging (although they do have the ability to sting). Due to their docile nature, many nature lovers promote mason/leafcutter bee establishment by constructing bee boxes in their gardens. Mason bees (*Osmia* sp.) are often used commercially in the pollination of blueberries, cherries, apples, and almonds. They are excellent pollinators because their bodies are densely covered with hair that easily carries pollen from one flower to the next.



4) Sweat bee, Length 1/8 to ¼ inches – the name sweat bee is a common name used for a large group of bees that are attracted to the salts from human perspiration. These bees will sting if they are smashed between skin. Approximately 1,000 species occur in the United States, Canada and Central America, and are often difficult to identify. These bees can be metallic green, brown or yellow in color. Thousands of sweat bees can swarm flower gardens, and often do inconspicuously. These bees generally nest in the ground or in wood and their social structure varies widely from solitary to communal nesting.



5) **Digger bees, Length 1 ¼ to 2 inches** – digger bee is a common name used for a large group of bees that create their nests by digging in the ground. These bees are considered solitary, but will nest close to one another. Digger bees are usually extremely hairy and have fairly short wings. They are non-aggressive and generally do not sting, unless they are trapped between clothing or handled. They nest closely because they prefer certain environmental conditions relating to soil type, aspect and soil drainage. These bees can often be seen in open areas such as school yards. This nesting preference serves as an excellent pollinator educational opportunity. The female works extremely hard to dig out the nest cells and collect pollen for her young. Males do not assist in nest construction or food provisioning; instead they only fly around the nesting site looking to mate.



Digger bee nest



Digger bee



Students observing and learning about digger bees

Wasps (Order Hymenoptera)

- 6) Wasps: a common name for a group of insects closely related to bees. However, these insects are generally considered predacious and are not considered very effective pollinators. They tend to be seen in gardens while they are hunting other insects as prey (ex. flies, worms, spiders). They occasionally feed on nectar and pollen, which sometimes results in pollen transport, and thus pollination. Most wasps will sting if they feel threatened, so use extreme caution when they are in close proximity.



Mud dauber wasp



Paper wasp

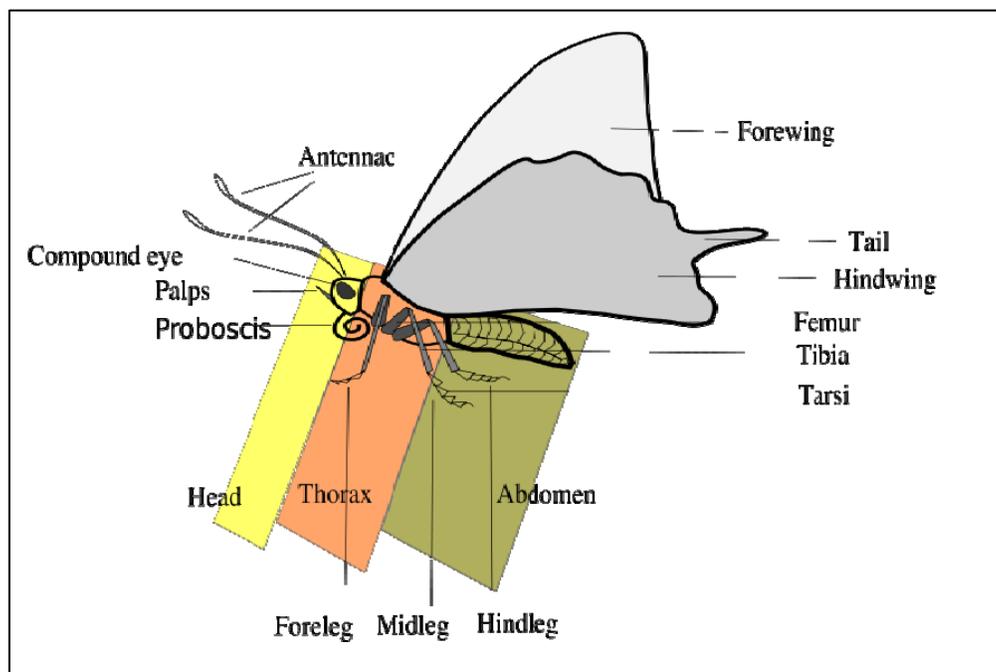


Cicada Killer

Butterflies & Moths (Order Lepidoptera)

Identification tips: Brightly colored to dull gray wings, have extremely long proboscises used for nectar feeding. Many butterflies have formed highly specialized relationships with certain plant species. Ex. Monarch butterflies and milkweed

Basic Butterfly and Moth Anatomy



- 7) **Monarch Butterfly (*Danaus plexippus*), Wingspan 3 ½ to 4 inches-** One of the best known butterflies in North America, the larvae feed entirely on milkweed (*Asclepias* spp.) which makes them toxic to predators (e.g., birds and other insects). The bright color contrasts of both larvae and adults are recognized as warning signs by predators which generally abstain from eating these foul tasting insects. These butterflies are often seen in open fields and along roadsides where milkweeds grow. Monarch butterflies have one of the longest migrations of any species (up to 3,000 miles). They can travel from Canada to central Mexico each year at around 50 miles per day. This migration begins in Sept.-October, with millions of butterflies traveling to approximately 12 roosting sites in the Sierra Madre Oriental Mountains of Mexico. They hang together in trees until March of the following year, then mate and begin their journey home. The females then lay eggs on milkweed plants along the way. Once these eggs hatch and the offspring mature, they then follow their parents' path north. This reproductive cycle continues, until Sept-Oct., with three to four generations having matured. Therefore, the butterflies that migrate in the fall are about 3 to 4 generations removed from the

original butterflies that made the previous year’s fall migration. It is nearly impossible for one monarch butterfly to make the entire migration cycle.



Monarch larvae feeding on milkweed



Adult Monarch

8) Gulf Fritillary (*Agraulis vanillae*), Wingspan 2 1/2 to 3 1/2 inches - A common butterfly found throughout Mississippi gardens, the larvae feed entirely on native passion flowers such as maypop (*Passiflora incarnata*) and yellow passionflower (*Passiflora lutea*). The larvae are toxic; this factor serves as great protection against predators. In addition, the larvae appear to be covered with stinging hairs, however this is mere mimicry, and they do not sting. Adult gulf fritillary butterflies are normally found along forest edges and open areas. The underwings of this brightly colored butterfly are pale with large silver spots. This butterfly species can be easily used to teach children about the life cycle of butterflies, and their often obligate relationships with plants.



Adult Gulf Fritillary Butterfly



Gulf fritillary larvae feeding on Passion-vine

9) **Spicebush Swallowtail (*Papilio Troilus*)** Wingspan 3 to 4 inches – Mississippi’s Official State Butterfly, and found only in the eastern United States. This species is commonly found in deciduous forests and shaded swamps. Larvae feed on sassafras and spicebush (*Lindera* spp.). One particular spicebush species (*Lindera melissifolia*) is currently listed as endangered in Mississippi. This plant species has declined due to the drainage of wetlands and habitat conversion to other uses.



Spicebush Swallowtail Larva



Adult Spicebush Swallowtail

Several other swallowtail species occur across Mississippi such as: **Eastern Tiger Swallowtail, Zebra Swallowtail, and the Pipevine Swallowtail.** The Pipevine Swallowtail and Female (Black form) Eastern Tiger Swallowtail can be easily confused with the Spicebush Swallowtail. For further description, see the suggested butterfly references on page 14.

10) Skippers: a common name used to describe numerous species of small dull orange to brown butterflies that resemble moths. Numerous species are found across Mississippi and are often difficult to identify from one another. These butterflies get their name “skipper” because they tend to skip from flower to flower while they feed on nectar. The natural habitat of skippers is forest edges, open grassy areas.



Adult Skippers

11) Sulphurs (*Phoebis sp.*) Wingspan 1.5 to 2.5 inches: Common yellow butterflies that are often seen in gardens or grassy fields. Several different species occur throughout Mississippi. These butterflies remain active until late fall, by feeding on fall flowering plants. The larvae feed on numerous clovers, marigolds and sneezeweeds.



Clouded Sulphur

12) Sphinx Moth (or hawk moths, hornworms): There are several sphinx moth species that occur in MS. One common sphinx moth, known as the Hummingbird moth, feeds on nectar during the day and is sometimes mistaken for a hummingbird. Other sphinx moth species may only be seen during dawn or dusk, and others are only seen at night. The larvae of some Sphinx moths are considered pests because they feed on tomatoes and tobacco. These larval pests are better known as tomato hornworms and are green with a black horn located on their rear.



Hummingbird moth



Sweetpotato hornworm

Special Note:

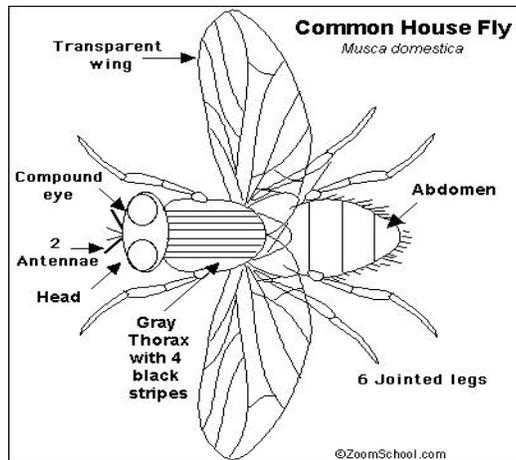
Mitchell’s satyr butterfly (*Neonympha mitchelli mitchelli*) Wingspan 1 ½ inches to 1 ¾ inches – an endangered butterfly species recently identified in northeast Mississippi near Tishomingo State Park in wetlands associated with beaver ponds. This species is one of the rarest in the world and is generally associated with rare calcareous wetlands called prairie fens. Many of these areas have been drained, thus resulting in this species decline.



Flies (Order Diperta)

Identification tips: True flies have a single pair of wings which with distinguishes them from other insects. Some common fly species that are considered pollinators are: mosquitoes, love bugs, crane flies, hover flies, or blow flies. Many pollinating flies are attracted to foul smelling flowers that tend to smell like carrion (ex. Skunk cabbage, stinking trillium).

Basic Fly Anatomy



13) Hover fly, Bee Fly, Tachinid Fly, Flower Fly – these common names describe numerous fly species that mimic bees. Some are confused with sweat bees because they occasionally land on the exposed skin of humans and sip on perspiration droplets. However, unlike sweat bees, hover flies can “hover” motionless in mid air, have one pair of wings, and do not sting. The abdomen color of many of these flies is yellow and black striped.



Tachinid fly

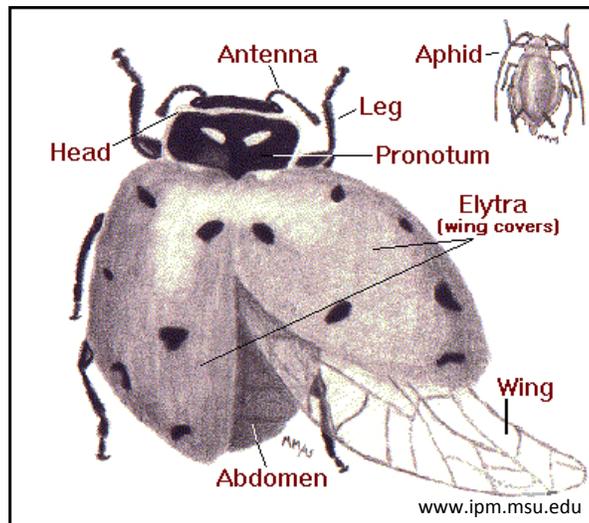


Syrphid fly

Beetles (Order Coleoptera)

Identification tips: Pollinating beetles are usually seen walking around on open-faced flowers (ex. Black-eyed susans). Beetles have a single pair of wings that are located under hard exoskeleton wing covers. The hind wings are usually only seen while beetles are in flight.

Beetle Anatomy



14) Pollinating beetles: beetles make up the largest set of pollinating insects. They evolved long before bees and were some of the first insects to assist in pollination. For example, magnolias are some of the most ancient of all flowering plants and beetles have long been associated with magnolia pollination. These insects are considered “mess and soil” pollinators because they pollinate flowers while they messily consume nectar, pollen and various flower parts. They can easily be found feeding on open faced flowers in gardens.



Leaf beetle



Cucumber beetle



False potato beetle

Birds (Class Aves)

15) Ruby-throat Hummingbird (*Archilochus colubris*) – is the only hummingbird species that commonly occurs east of the Mississippi River. This species is quite common in Mississippi and feeds primarily nectar from red tubular flowers such as cardinal flower (*Lobelia cardinalis*), Red buckeye (*Aesculus pavia*), and coral honeysuckle (*Lonicera sempervirens*). This species is also known to feed on small insects and tree sap. During feeding, hummingbirds may transport pollen from one flower to the next. Hummingbirds are considered the only true pollinating birds in MS.



References:

Stokes, Donald, Lillian Stokes, and Ernest Williams. 1991. Stokes Butterfly Book, The Complete Guide To Butterfly Gardening and Behavior. 1st edition. Little, Brown, and Company, New York, NY.

Mather, Bryant and Eve Dingus. (Revised by John Davis). 2008 Butterflies of Mississippi Checklist. Mississippi Museum of Natural Science, Jackson MS.

Butterflies and Moths of North America
<http://www.butterfliesandmoths.org/>

Insect Photographs: www.bugwood.org

Lesson 2: Native Plants For Pollinator Habitats



Cardinal Flower



Flame Azalea



Maypop passion flower

It doesn't take much room to establish habitat for native pollinators. As long as you have a small spot to set out a few flowering plant containers and an area that receives around six hours of sunlight a day, you have all that is needed for native pollinators to thrive. Using native plants in your garden is the best way to provide habitat that will be the most beneficial to native pollinators. While numerous non-native plant species have showy flowers that would appear to attract pollinators, these varieties have often been genetically altered to produce less or no pollen/nectar. Many non-native plant species can also become invasive and out-compete native plant species. This pollinator habitat guide was written to promote the use of native plants in pollinator gardens/habitats. Native pollinators have co-existed with native plants in North America for thousands of years and many of these species require native plants for their continued survival.

What Is Needed to Create Good Pollinator Habitat?

Before you begin to create your own pollinator habitat, you need to first consider that pollinators are living animals and require food, shelter and water to survive.

Food – Pollinators need food such as nectar, pollen and plant matter for energy and growth. Before planting native plants for pollinators, you should first consider what types of pollinators you want to attract to your area. Some pollinator species depend entirely on specific plant species for survival. For example, numerous butterfly species have formed obligate relationships with specific plant species. The Monarch butterfly has formed an obligate relationship with milkweed plant species. Monarch butterflies lay their eggs on milkweed plants, and when larvae hatch, they feed on milkweed plant tissue and then ingest chemical substances that make them poisonous to predators. **For a detailed list of plants which attract specific pollinators see Tables 1 and 2.**

Water- Having a small pool near your planting will serve as an excellent place for butterflies to gather and obtain water and minerals. Also, bees and wasps will often use these areas to gather mud for nest building.

Shelter- Dead plant material remaining from the prior summer season can often be used as shelter for pollinators. For instance, wood stumps can be used by drilling carpenter bees to make nests. Also, hollow twigs placed in piles could provide nest sites for numerous mason bee species. Turning over flower pots and leaving drainage holes open will often provide a nice site for bumble bees to establish their nests.

Table 1. Pollinator Flower Color and Shape Preference

Pollinator Type	Flower Preference
Bees	Yellow, blue, or purple flowers
Butterflies	Red, orange, yellow, pink, blue flowers
Moths	Light colored flowers opening at dusk (evening primrose)
Pollinating Beetles	Wide open flowers (sunflowers, roses)
Flies	Green, white or cream flowers (often with foul odor)
Hummingbirds	Red, orange, or purple/red tubular flowers containing lots of nectar (jewelweed, cardinal flower, red buckeye)
Bats	Large, light colored, night blooming flowers with a strong fruity odor (mainly occurring in southwest U.S.)

Table 2. Pollinator Butterfly - Host and Nectar Plant Relationships

Common Butterflies	Larval Host Trees	Larval Wildflower Host Plants	Adult Wildflower Nectar Plants
Spicebush Swallowtail	Spicebush, Red bay, Sweet bay, Tulip-tree		<i>Verbena</i> sp. nectar only
Red-Spotted Purple	Black Cherry, Eastern Cottonwood, Hop hornbeam, Willow	Cardinal Flower (<i>Lobelia cardinalis</i>)	
Tiger Swallowtail	Black Cherry, Catalpa, Eastern Cottonwood, Sassafras, Spicebush, Sweet bay, Tulip-tree	Butterfly milkweed (<i>Asclepias tuberosa</i>)	
Viceroy	Black Cherry, Eastern Cottonwood, Willow		
Painted Lady	American Elm	<i>Aster</i> sp., Sunflower (<i>Helianthus</i> sp.), Thistle (<i>Cirsium</i> sp.)	Bee balm (<i>Monarda</i> sp.), Golden rod (<i>Solidago</i> sp.), Joe-pye weed (<i>Eupatorium</i> sp.)
Monarch		Butterfly milkweed (<i>Asclepias tuberosa</i>)	Goldenrod (<i>Solidago</i> sp.), Joe-pye-weed (<i>Eupatorium</i> sp.), Milkweed (<i>Asclepias</i> spp.), Purple coneflower (<i>Echinacea purpurea</i>), <i>Verbena</i> sp.
Buckeye		<i>Aster</i> sp.	<i>Coreopsis</i> sp.
Gulf fritillary		Passion flower (<i>Passiflora incarnata</i>)	
Silver-spotted skipper	Black locust, Honey locust,	<i>Wisteria</i> sp.	
Sulphur		<i>Aster</i> sp., Sickle-pod (<i>Cassia</i> sp.)	Phlox sp., Golden rod (<i>Solidago</i> sp.), Joe-pye weed (<i>Eupatorium</i> sp.)

Where can you easily obtain Native Plants?

While there are literally hundreds (if not thousands) of native plants that can be used to create native pollinator habitat, some are often difficult to obtain by the average gardener. The following plant species recommendations were created with the intent of choosing native plant species that can easily be obtained from local nurseries. In recent year, plant nurseries have started to carry more native plants due to increased demand by gardeners. As more people become aware of the importance of using native plants in their gardens, nurseries will surely

begin carrying even more natives to meet customer demand. So always request native plants at your local nurseries! (The Pollinators will thank you!) You may find it difficult to find native species at commercial garden centers, but many private and locally owned nurseries carry these plants. Also, numerous native plants and seeds can be obtained from online dealers. Please see **Tables 3 through 5** below for a list of common native plants that can be used to create pollinator habitat in your yard.

Should you collect native plants from the wild?

No, generally native plants should never be collected from the wild. Collecting wild plant populations could lead to the decline or extinction of plants species overtime. For example, lady slipper orchids are extremely beautiful plants that have been over collected in Mississippi and have now become a rare site to see.

If you absolutely must collect plants from the wild, never collect all the plants that you find in a single location. By doing this, you could be destroying important pollinator habitat in that area! Consider this, the average foraging distance for native pollinators ranges between 50 feet to ½ mile.

Table 3: Common Tree/Shrub Species Used in Pollinator Habitats

Trees/Shrubs:	Soil	Light	Blooms
Elm (<i>Ulmus</i> sp.)	Dry-normal	Sun	Spring
Black Cherry (<i>Prunus serotina</i>)	Dry-normal	Sun-partial shade	
Catalpa (<i>Catalpa bignonioides</i>)	Normal	Sun	Spring
Eastern Cottonwood (<i>Populus deltoides</i>)	Normal-moist	Sun	Spring
Sweet bay (<i>Magnolia virginiana</i>)	Normal-moist	Shade	Summer
Tulip-tree (<i>Liriodendron tulipifera</i>)	Normal-moist	Partial shade	Spring
Willow (<i>Salix</i> sp.)	Normal-moist	Sun	Spring
Sassafras (<i>Sassafras albidum</i>)	Dry-normal	Sun	Spring
* Spicebush (<i>Lindera benzoin</i>)	Normal-moist	Partial shade-shade	Spring
Redbud (<i>Cercis canadensis</i>)	Any	Partial shade	Spring
Pine (<i>Pinus</i> sp.)	Dry-normal	Sun	Spring
Oak (<i>Quercus</i> sp.)	Any	Sun-Partial Shade	Spring
Flowering Dogwood (<i>Cornus florida</i>)	Dry-normal	Shade	Spring

* Plants that may be somewhat difficult to find at nurseries, but are excellent pollinator plants that should still be mentioned!

Table 4: Common Native Herbaceous Plants Used in Pollinator Habitats

Plant Name	Soil	Light	Blooms
Perennials:			
Bee Balm (<i>Monarda</i> sp.)	Dry-Moist	Sun	Summer-Fall
Black-eyed Susan (<i>Rudbeckia</i> sp.)	Dry-normal	Sun	Summer-Fall
Milkweed (<i>Asclepias</i> sp.)	Dry-normal	Sun	Summer
Cardinal Flower (<i>Lobelia cardinalis</i>)	Moist	Sun-partial shade	Fall
<i>Coreopsis</i> sp. (State Wildflower!!)	Dry-moist	Sun	Spring-Fall
Goldenrod (<i>Solidago</i> sp.)	Any	Sun	Fall
Indian blanket (<i>Gaillardia pulchella</i>)	Dry-normal	Sun	Spring-Fall
Purple coneflower (<i>Echinacea purpurea</i>)	Dry-normal	Sun	Summer
Blazing star (<i>Liatris</i> sp.)	Dry-Moist	Sun	Summer
*Joe-pye weed (<i>Eupatorium fistulosum</i>)	Moist	Sun-Partial shade	Fall
Verbena (<i>Verbena</i> sp.)	Dry-normal	Sun	Summer
Bee Blossom (<i>Gaura</i> sp.)	Dry-normal	Sun	Spring-Fall
Annuals:			
Common sunflower (<i>Helianthus</i> sp.)	Dry-normal	Sun	Fall
*Partridge pea (<i>Chamaecrista fasciculata</i>)	Dry-normal	Sun	Summer
*Thistle (<i>Cirsium</i> sp.)	Normal	Sun	Sun-Fall
Vines:			
*Passion Flower (<i>Passiflora incarnata</i>)	Dry-normal	Sun	Summer
Coral Honeysuckle (<i>Lonicera sempervirens</i>)	Normal-Moist	Sun-partial shade	Spring-Fall
Carolina Jasmine (<i>Gelsemium sempervirens</i>)	Dry - Moist	Sun-partial shade	Spring
Perennial Grasses:			
*Indian Grass (<i>Sorghastrum nutans</i>)	Dry-normal	Sun	Summer
*Switchgrass (<i>Panicum virgatum</i>)	Dry-moist	Sun	Summer
*Little Bluestem (<i>Schizachyrium scorparium</i>)	Dry-normal	Sun	Summer
*Eastern gamagrass (<i>Tripsacum dactyloides</i>)	Dry-moist	Sun	Summer
<i>Iris</i> sp.	Normal-moist	Sun	Spring

* Plants that may be somewhat difficult to find at nurseries, but are excellent pollinator plants that should still be mentioned!

Pollinator Habitat for Clay Soils and Full Sun

Pollinator Habitats that will be on clay soils or wet spots in the landscape can be designed to function also as Rainwater Gardens. These multipurpose habitats will benefit pollinators and will also provide stormwater benefits.

See <http://clean-water.uwex.edu/pubs/pdf/home.rgmanual.pdf> for specific information on

physical design parameters for Rain Gardens. Do not follow the plant recommendations as they may not be compatible with Mississippi and Pollinator Habitat goals.

The plants listed in **Table 5** below have been selected specifically for Mississippi to benefit pollinators while being able to tolerate the wetness of the rain garden function.

Table 5: Moisture Tolerate Pollinator Plants

Plant Name	Habit	Bloom	Height
Meadow-beauty (<i>Rhexia virginica</i>)	Perennial	Summer-Fall	Up to 18"
Wild petunia (<i>Ruellia humillis</i>)	Perennial	Summer-Fall	Less than 6"
Skullcap (<i>Scutellaria integrifolia</i>)	Perennial	Summer	Up to 2 ½'
Thistle (<i>Cirsium sp.</i>)	Annual	Spring-Fall	Up to 4'
Rattlesnake master (<i>Eryngium yuccifolium</i>)	Perennial	Summer	Up to 6'
Swamp Rosemallow (<i>Hibiscus moscheutos</i>)	Perennial	Summer	Up to 7'
Touch-me-not (<i>Impatiens capensis</i>)	Annual	Summer-Fall	Up to 6'
Blazing Star (<i>Liatris sp.</i>)	Perennial	Summer-Fall	Up to 5'
Goldenrod (<i>Solidago fistulosa</i>)	Perennial	Summer-Fall	Up to 7'
Blue-eyed grass (<i>Sisyrinchium atlanticum</i>)	Perennial	Spring-Summer	Up to 2'
Indian grass (<i>Sorghastrum nutans</i>)	Perennial	Summer	Up to 8'
Blue Flag Iris (<i>Iris virginica</i>)	Perennial	Spring	Up to 3'
Bee Balm (<i>Monarda sp.</i>)	Perennial	Spring-Summer	Up to 5'

Links to Vendors of Seed and Plant Sources - There are many sources of seeds and plants. It is critical to get adapted varieties of the desired native plants.

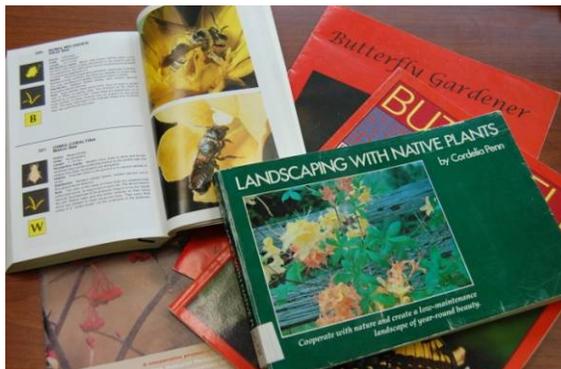
- 1) Mississippi Wildflower Program – Mississippi Soil and Water Commission sales wildflower seed that is locally grown at the USDA-NRCS Jamie L. Whitten Plant Materials Center, Coffeerville, MS These seeds serve as a source for select Native Mississippi Wildflowers.

<http://www.mswcc.state.ms.us/Wildflowers/wildflowers.html>

- 2) Seed & Plant Vendors of Conservation Plants for the Mid & Southeast U.S. This publication identifies potential vendors by plant species.

<http://www.plant-materials.nrcs.usda.gov/pubs/mspmcmt6589.pdf>

Lesson 3: Planning and Designing a Pollinator Habitat



What are Pollinator Habitats?

Homeowners in many parts of the country are catching on to **Pollinator Habitats** – landscaped areas planted to native wildflowers, grasses, trees and shrubs that provide food, water and shelter for pollinators. The pollinator habitat provides as many needs as possible for pollinators typically found in your area. Pollinator habitats can also serve as: rain habitats, wildflower habitats, native grass habitats, backyard habitats, etc. What distinguishes the **Pollinator Habitat** is that its primary purpose and design is based upon the needs of pollinators.

Why are pollinator habitats Important?

As cities and suburbs grow and replace forests and agricultural land, important pollinator habitats are lost to development.

Working together to re-create these lost pollinator habitats, can be a valuable part of changing these trends. While an individual pollinator habitat may seem like a small thing, collectively they produce substantial neighborhood and community environmental benefits. Pollinator habitats work for us in several ways:

- Increasing the amount of habitat available for pollinators
- Providing habitat for numerous other wildlife that depend on native plants for food and cover
- Helping to insure our food supply by supporting pollinators that are required for pollinating **70%** of our food supply
- Enhancing the beauty of yards and neighborhoods

Do pollinator habitats require a lot of maintenance?

No, after plants become established, these habitats can actually be maintained with little effort. Some weeding and watering will be needed in the first two years and perhaps some thinning in later years as the plants mature.

Is a Pollinator Habitat expensive to create?

No, it doesn't have to be. A family and a few friends can provide the labor. The main cost will be purchasing the plants, and even this cost can be minimized by using some native plants that might already exist in your yard or in a neighbor's yard. Seeds can also be collected from desired plants.

Note: Never remove plants from public areas (parks, forests, road rights-of-way, etc.) or from private land where you do not have the landowners permission. If you are granted permission to collect, you should always leave some plants behind. Do not collect the entire plant population in a given area. If you do, you could be destroying valuable habitat that local pollinators depend on! The average foraging distance of native pollinator is between 50 feet to ½ mile.

Planning the Pollinator Habitat

This section covers pollinator habitat basics such as – where to put the pollinator habitat, how big to make it, and what kind of soils and sunlight are best. Following the instructions in this section is the best way to ensure a successful pollinator habitat project.

If you already know the size you want your pollinator habitat to be, then skip ahead to the section about building the pollinator habitat. However, take time to read the pointers about location, and make sure to find the right sunlight conditions. If the location has a sun condition of shade, it's best to pick a different location because of the lack of suitable plant material to create a pollinator habitat.

Where should the pollinator habitat go?

The pollinator habitat can go virtually anywhere in the landscape you desire, so long as the proper plants are selected for the targeted pollinators.

To help decide where to put a pollinator habitat, consider these points:

- The pollinator habitat should typically capture at least 6 hours of sunlight.
- Do not place the pollinator habitat in an area where you do not want to attract pollinators (e.g. directly next to walkways of public buildings).

- Consider putting the pollinator habitat in a part of the yard where water pools. Many pollinator plants can handle wet feet and this will make use of a yards “problem spot”. These areas can also function as rain gardens!
- It is better to build the pollinator habitat in full or partial sun, not directly under a big tree. Too much shade will prevent your plants from blooming and will fail to attract pollinators. **South and southwest exposures are best.**

When considering placement of your pollinator habitat, design with the end in mind. Carefully consider how the pollinator habitat can be integrated into existing and future landscaping. Also, pay attention to views from inside the house as well as those throughout the landscape. Determine how far or how close you want your pollinator habitat to be from outdoor gathering spaces or other play areas.

Shape

Pick a pleasing shape for the pollinator habitat. Shapes may be: crescent, kidney, or teardrop. Very few things in nature are straight, so keep the pollinator habitat border curvilinear and consider your overall landscape. Consider placing walkways through the pollinator habitat to better enjoy it, assist with upkeep, and open the canopy for even more sun. ***See Figures 1 and 2 for examples.***

How big should the pollinator habitat be?

The surface area of the pollinator habitat can be almost any size, but time and cost will always be important considerations in sizing decisions. Any reasonably sized pollinator habitat will provide some habitat. A typical residential pollinator habitat may range from 100 to 300 square feet. Pollinator habitats can be smaller than 100 square feet, but very small habitats have little plant variety. If a pollinator habitat is larger than 300 square feet it takes a lot more time to prepare and maintain, and could be hard on your budget. Pollinator habitats can be expanded to reduce lawn maintenance (mowing) by converting grass spaces with little habitat value to pollinator habitats with higher habitat value and overall lower maintenance requirements.

The size of the pollinator habitat will depend on?

- will you grow plants from seed or plants (start small with plants or seed, harvest your seed, and replant into larger areas)
- how much sun and the direction of sun on the proposed habitat site
- How much diversity you want in your pollinator habitat

Guidelines are not rules...

The sizing guidelines described in this manual are based on a variety of plant materials to meet needs throughout the seasons.

If you follow the guidelines in the manual and decide the calculated surface area is just too large for your goals, it is perfectly acceptable to make the pollinator habitat smaller. On the other hand, it is fine to make the pollinator habitat larger too!

Soils

The soils will determine the types of plant materials that can reasonably be expected to perform well. The goal is to produce a pollinator habitat that will thrive on its own.

Soil information can be found at the NRCS Web Soil Survey at:

<http://websoilsurvey.nrcs.usda.gov/app/>

Simple soil tests

Soil tests can determine the characteristics of the soil. Since many areas are highly disturbed (development, agriculture, lawn, etc.), a beginning reference point is a good idea. You may not be planting your native plants in soil that is original to the site (potting soil, mulch).

Soil testing information can be found at the Mississippi State University Extension Service county office or internet site at:

<http://msucares.com/crops/soils/testing.html>

Choose a size that is best for your yard

Remember that these are only guidelines. The size of the pollinator habitat also depends on how much money you want to spend, how much room you have in your yard, and how much plant/pollinator diversity you want to provide.

Tips for designing an attractive pollinator habitat

While pollinator habitats are a highly functional way to help promote pollinators, they are also a type of habitat and should be an attractive part of your yard, community and neighborhood. Think of the pollinator habitat in the context of the site’s overall landscape design.

Here are a few tips:

- When choosing native plants for the habitat, it is important to consider the height of each plant, bloom time and color, and its overall texture. **Use plants that bloom at different times to create a long flowering season.** Mix heights, shapes, and textures to

give the habitat depth and dimension. This will keep the pollinator habitat looking interesting even when few wildflowers are in bloom.

- When laying plants out, randomly clump individual species in **groups of 3 to 7 plants** to provide a bolder statement of color. Make sure to repeat these individual groupings to create repetition and cohesion in a planting. This will provide a more traditional look to the planting.
- Try incorporating a **diverse mixture of trees, shrubs, and grasses** with your flowering species. Once the pollinator habitat has matured and your plants have established a deep, thick root system, there will be less change in species location from year to year, and weeds will naturally decline.
- Finally, consider enhancing the pollinator habitat by **using local or existing stone, ornamental fences, trails, habitat benches, or water features**. This will help give the new pollinator habitat an intentional and cohesive look and provide a feeling of neatness that the neighbors will appreciate.
- **Always maintain a defined border** around the pollinator habitat, it will provide definition and the look of a maintained system.

Figure 1. Excellent native plants for a Pollinator Habitat in a corner area. (Shorter plants are usually planted in the front, for the most appealing habitat views.)

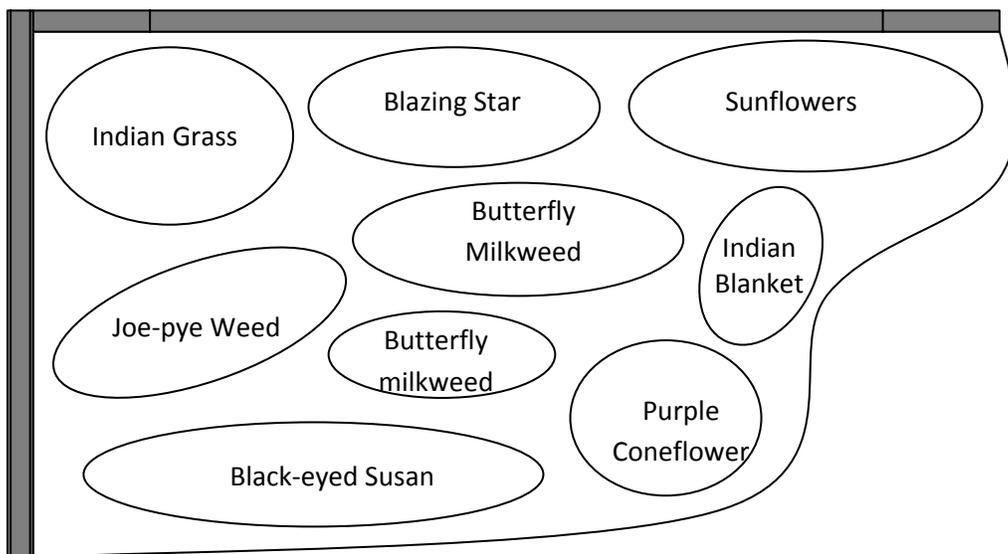
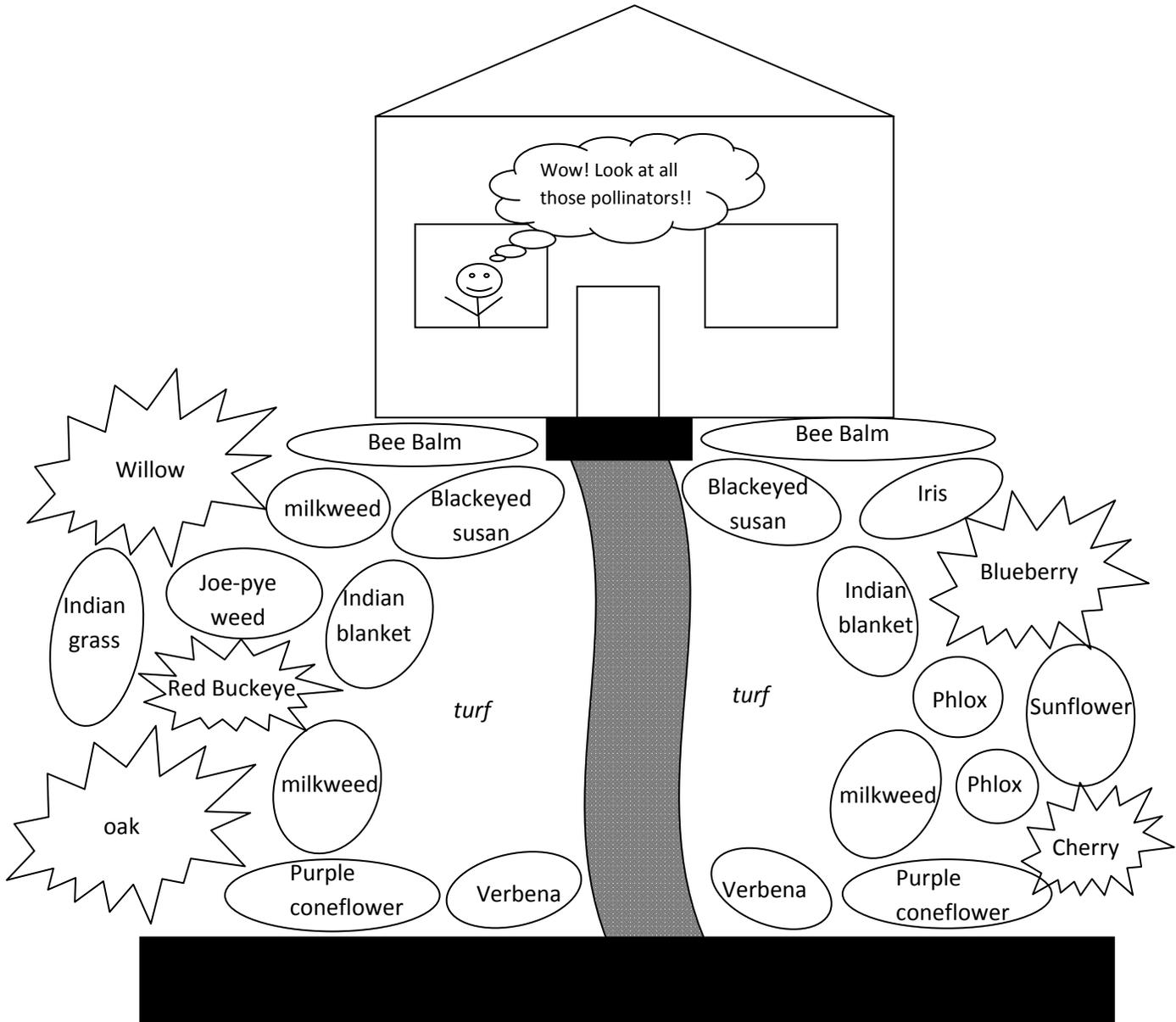


Figure 2. Native Pollinator Habitats reduce the amount of mowing and watering that is needed. Native perennial plant species need little water and come back every year!



Lesson 4: Building a Native Pollinator Habitat



Now that the size and place for the pollinator habitat are set, it's time to get a shovel and start digging!! Working alone, it will take about six hours to dig an average-size pollinator habitat. If friends help, it will go much faster, possibly only an hour or two.

Step 1: Preparing the Pollinator Habitat Area

If you are building the pollinator habitat into an existing lawn, digging time can be reduced by killing the grass first. A chemical such as Round-Up can be used, but a more environmentally friendly approach is to place black plastic over the lawn until the grass dies.

Also, the best time to build the pollinator habitat is in the spring. It will be easier to dig, and the plants are more likely to thrive later in the hot summer months.

Before you start digging, call Mississippi One-Call Hotline at 1-800-242-8511 to identify buried utilities if using any equipment other than hand tools.

- Start by laying hose/string around the perimeter of your pollinator habitat to help you get the best idea of how your habitat is going to look.
- Next, use shovels (or a tiller) to break up the ground and loosen the soil for easy planting.
- If a soil test has previously been performed, and the soil is nutrient deficient, you may want to consider adding an organic fertilizer (e.g. manure or compost material).

Planting the Pollinator habitat

Planting the pollinator habitat is the fun part! A number of planting designs and lists of suggested plants are included in this publication. Use these for ideas, but don’t be afraid to be creative – there’s no single best way to plant a pollinator habitat. Anyone who has ever done any habitating will have no problem planting a pollinator habitat, but a few basic reminders are listed below.

- Select plants that have a well established root system. Usually one or two-year-old plants will have root systems that are beginning to circle or get matted. (Note: use only nursery-propagated plants; do not collect plants from the wild).
- Make sure to have at least a rough plan for which plants will be planted where. Lay out the plants as planned one foot apart in a grid pattern, keeping them in containers if possible until they are actually planted to prevent drying out before they get in the ground.
- Dig each hole twice as wide as the plant plug and deep enough to keep the crown of the young plant level with the existing grade (just as it was growing in the cell pack or container). Make sure the crown is level and then fill the hole and firmly tamp around the roots to avoid air pockets.
- Apply double-shredded mulch evenly over the bed approximately two inches thick, but avoid burying the crowns of the new transplants. Mulching is usually not necessary after the second growing season unless the “mulched look” is desired.
- Stick plant labels next to each individual grouping. This will help identify the young native plants from non-desirable species (weeds) as you weed the habitat.
- As a general rule, plants need one inch of water per week. Water immediately after planting and continue to water twice a week (unless rain does the job) until the plugs are established. You should not have to water your pollinator habitat once the plants are established. Plugs can be planted anytime during the growing season as long as they get adequate water.

Maintaining the Pollinator Habitat

Weeding (weed – a plant out of place)

Weeding will be needed the first couple of years. Remove by hand only those plants you are certain are weeds. Try to get out all the roots of the weedy plants. Weeds may not be a problem in the second season, depending on the variety and tenacity of weeds present. In the third year and beyond, the native grasses, trees, shrubs, and wildflowers will begin to mature and will out-compete the weeds. Weeding isolated patches might still be needed on occasion.

After each growing season, the stems and seedheads can be left for winter interest, wildlife cover and bird food. Once spring arrives and new growth is 4-6-inches tall, cut all tattered plants back. If the growth is really thick, hand-cut the largest plants and then use a string

trimmer to mow the planting back to a height of six to eight inches. Dead plant material can also be removed with a string trimmer or weed whacker (scythe) and composted or disposed of as appropriate.

The best way to knock back weeds and stimulate native plant growth is to burn off the dead plant material in the pollinator habitat. However, burning is banned in most municipalities. Another option is to mow the dead plant material. If the mowing deck of your lawn mower can be raised to a height of six inches or so, go ahead and simply mow your pollinator habitat. Then, rake up and compost or properly dispose of the dead plant material.

Fire safety

Make sure burning is allowed in your area. If so, be sure to notify the local fire department and obtain a burn permit if needed. It’s also wise – not to mention neighborly – to make sure the neighbors know that you’re burning and that all safety precautions are being taken. Basic fire precautions include:

- Make sure there is a fire-break (non-burnable area, such as turf-grass) at least 10-feet wide surrounding the area to be burned.
- Never burn on windy days.
- Never leave an actively burning fire unattended.
- Keep a water hose handy in case fire strays where it is not wanted.

Also have a metal leaf rake in hand to beat out flames that creep beyond the burn zone.

What does a pollinator habitat cost?

The cost of a pollinator habitat will vary depending on who does the work and where the plants come from. If you grow your own plants or borrow plants from neighbors, there can be very little or no cost at all. If you do all the work but use purchased prairie plants, a pollinator habitat will cost approximately \$3 to \$5 per square foot.

It might seem easiest to sow native wildflower seed over the habitat, but experience shows that seeding a pollinator habitat has its problems. Protecting the seeds from wind, flooding, weeds, and habitat pests is very difficult, and the pollinator habitat will be mostly weeds for the first two years. Growing plugs from seed indoors or dividing a friend’s plants is much better. If you grow plugs, start them about four months before moving them to the pollinator habitat. When the roots have filled the pot and the plants are healthy, they may be planted in the pollinator habitat

Lesson 5: Build A Bee Box



Mason bees and numerous other native bee species naturally build their nests in the hollow wooden stems and/or dead wood. Making a “Bee Box” for these solitary nesting bees is quite easy and will benefit pollinators by providing them with shelter from predators and enable them to more successfully rear their young. (Note: Ready made bee boxes can be purchased commercially from several online dealers, just search mason bee box.)

Materials Needed for a Wooden Block Bee Box:

- 1) A 4”x6” or 6”x6” post of untreated wood.
- 2) A Drill and drill bits ranging in size from ¼ inch to 3/8 inch
- 3) An warm area that is protected from rain and predators
- 4) (optional) Paper straws (not plastic) – can be used to line the inside of each nest hole, makes bee box clean up much easier in the spring.

Building the Bee Box!

- 1) Cut wooden post into 1 ft sections
- 2) Drive holes in wood blocks ranging in size from ¼ inch to 3/8 inch, they should be 3 to 5 inches deep and spaces ¾ inch apart.
- 3) Attach the bee box to the side of a building or post. Make sure to place box in a warm, dry location with southern exposure such as the eaves of a shed or garage.

On a Tight Budget?

- 1) Hollow twigs (e.g. switchcane or elderberry stems) can be bundled together and secured in warm, dry location with southern exposure. Be sure to plug one end of each hollow twig!!
- 2) Downed trees or branches can be made into bee nesting habitat simply by drilling holes in the ends.



POLLINATOR SURVEYS

JOIN THE POLLINATOR PATROL



What is the Mississippi Pollinator Survey?

The Mississippi Pollinator Survey is a citizen-science project created by the Mississippi Natural Heritage Program, aimed at determining base-line information on the status of Mississippi’s native pollinators. Very little information is known about the status of our state’s native pollinators. We hope that citizens will participate by conducting pollinator surveys in their on gardens or natural areas. We also hope this survey will educate the public about the importance of conserving and protecting native pollinators and their habitats; and additionally enable our program to estimate the current population distributions of common native pollinators across our state and where more pollinator habitat conservation work is needed.

How to conduct a Pollinator Survey

The Pollinator Survey should take place in any garden (such as, native wildflower, vegetable, or combination of both). If native flowers are not available, non-natives will still do. You can also use flower gardens found in parks or other public spaces.

- 1) The Pollinator Survey should be conducted between May 1 – July 1 on warm, sunny days (above 60 degrees) between the 10 am to 6 pm. Do not conduct surveys on windy or rainy days. Be sure to record weather conditions on pollinator survey data sheets. Fill out your data sheets as completely as possible in order to ensure usefulness.
- 2) Estimate the size of your garden by pacing out the width and length. Each step you take will be the estimate for 1 foot. Then multiply them (width x length) together to estimate the size of your garden in square feet. Record the garden size on your data sheet.
- 3) Between May 1 and July 1 make at least 3 observations of pollinators in your garden. If you want to survey more than three times, please do so. You can also conduct surveys at multiple sites if you like. The more data received the better. Just be sure to use separate data sheets for each individual survey.

- 4) For each survey, spend 10 minutes watching pollinators that visit your garden. Please spend the same exact amount of time per survey so your results will be standardized with the rest of the survey participants.
- 5) Maintain a safe distance from the pollinators that visit your garden. Some of these pollinators do sting, and others will not come to your garden if they feel you are intruding on their space.
- 6) As the pollinators forage on your flowers, use the Native Pollinator Guide to identify the different species or types. Record this information on your datasheet(s). Don’t worry if you miss some, pollinators often move fast, we don’t expect you to identify every pollinator that you see.
- 7) After the 10 minute observation is complete, identify the plants that are blooming in your garden that day and note the ones that were most preferred by the pollinators. Record this info. on the datasheet(s).
- 8) When you are finished with your pollinator surveys, mail or email your completed forms to:

Mississippi Natural Heritage Program
Mississippi Pollinator Survey
2148 Riverside Drive
Jackson, MS 39202
Sherry.surette@mmns.state.ms.us

Mississippi Pollinator Survey



POLLINATOR PATROL

Name of Observer: _____ Date: _____ Time of Survey: _____

Location of Garden/Site: (be as descriptive as possible)

Plants in Bloom During Survey: _____

Pollinator Data

Pollinator Types Observed	Number Observed	Species (if known)	Additional Notes
Swallowtails			
Sulphurs			
Skippers			
Other Butterflies			
Moths			
Beetles			
Bumble bees			
Honeybees (non-native)			
Carpenter bees			
Green Metallic Bees			
Brown Sweat Bees			
Other Bees			
Flies			
Ruby Throat Hummingbird			

Flower Preferences: _____

More Notes: _____

Disclaimer: Some pollinating insects are capable of delivering a venomous sting. Caution should be exercised in the presence of any stinging insect. Participation in this survey is voluntary. The Mississippi Natural Heritage Program – Mississippi Museum of Natural Science assumes no responsibility or liability for any injuries sustained by individuals participating in the survey.

REFERENCES:

North American Pollinator Protection Campaign

www.nappc.org

Southeastern Flora – Southeastern Plant Identification Resource

www.southeasternflora.com

The Xerces Society for Invertebrate Conservation

www.xerces.org/

USDA-NRCS May 2008. South Dakota Fact Sheet-Pollinators SD-FS-55

USGS-National Biological Information Infrastructure January 2008. Pollinators-What kind of Bee Is That? Online Identification of Native Bees

www.discoverlife.org/20/q?search=Apoidea

Winfree Rachael, Williams Neal M., Dushoff Jonathan, and Claire Kremen. 2007. Native bees provide insurance against ongoing honey bee losses. *Ecology Letters* 10: 1105-1113.

The Jamie L. Whitten Plant Materials Center (MSPMC), located near Coffeeville, Mississippi, is operated by the USDA Natural Resources Conservation Service (NRCS). This PMC is one of a national network of plant centers dedicated to providing vegetative solutions for conservation problems.

Working with a broad range of plant species, including grasses, forbs, trees, and shrubs, our mission is to address priority needs of NRCS field offices and land managers in both public and private sectors. Our service area includes Mississippi, the delta areas of Arkansas, the blackland prairie of Alabama, and parts of Louisiana, Tennessee, Missouri, and Kentucky.



MSPMC Service Area

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