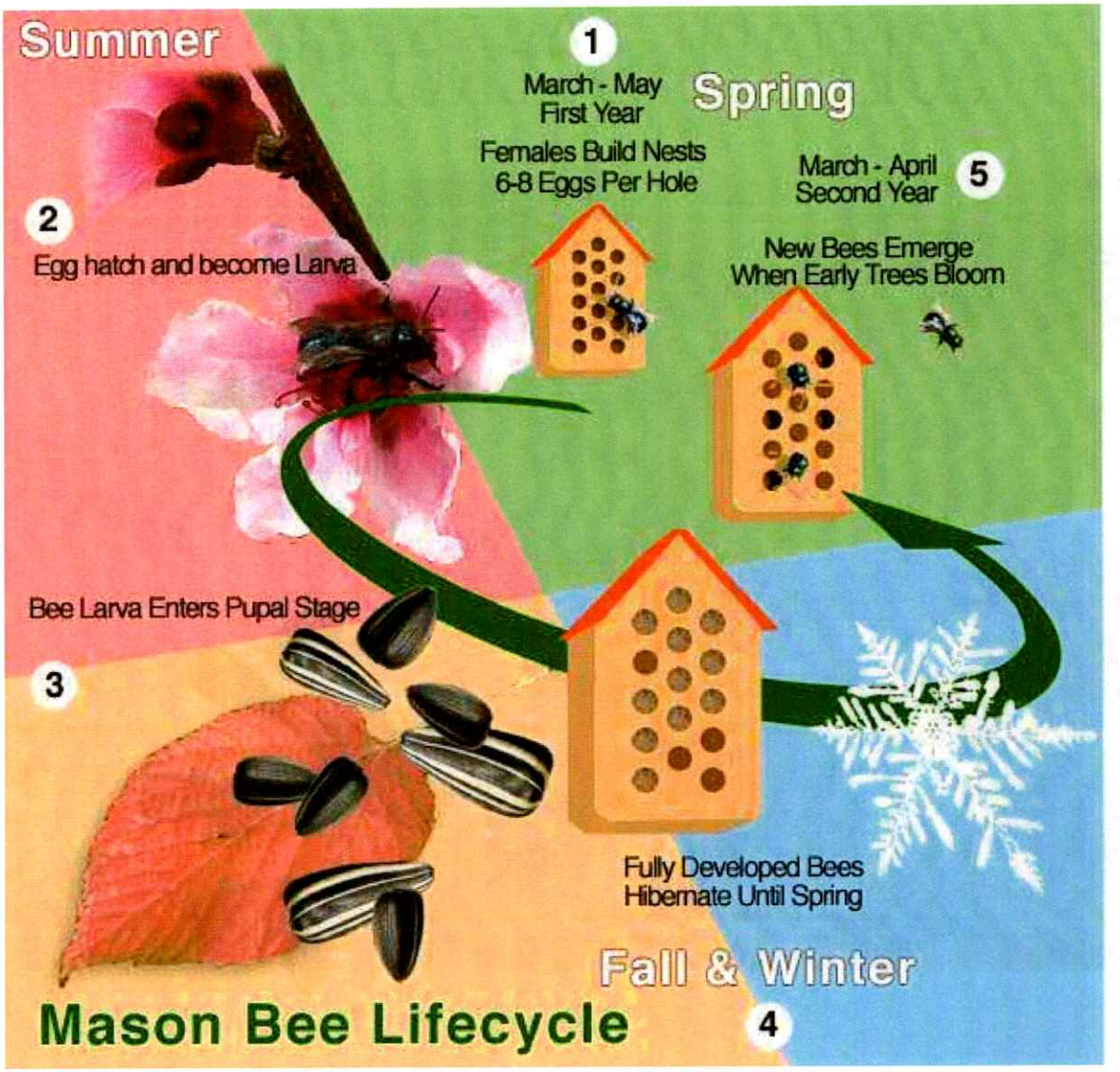
Solitary Beekeeping

Solitary bees are gentle non swarming bees, meaning they do not live in colonies like honeybees. Solitary bees can successfully pollinate 95% of the flowers and visit twice as many in a day as honeybees. Management does not require the time or equipment needed for honeybees. These bees are naturally attracted to holes in wood and that has become harder to find in gardens.



In solitary Bees females do the foraging, nest construction and egg- laying. Males only focus on finding a mate.

Late March when temperatures reach 50F/10C bees emerge from cocoons. Males emerge first, the process may last a couple of weeks. Once the females emerge, they mate.

1-2 days after mating, females are ready to lay eggs. During this period, she feeds on nectar and searches for empty holes that are the right size and shape for their nests.

During April/ May they will pollinate and build nests.

During the months of June/July, the female collects pollen and nectar, creating a pollen loaf for each egg's food supply. Once the pollen loaf is complete, the female places a single egg directly onto the loaf.

After laying the egg, the mother immediately begins gathering mud again to create a second wall that will completely enclose the developing egg. This process is repeated until the entire cavity is almost filled. Females will often leave an empty chamber at the end before sealing the cavity with a thicker layer of mud as extra protection against predators.

When the eggs hatch (after 1-2 weeks, depending on the temperature), the larva will consume the pollen loaf and develop into an adult bee. The process from egg to cocoon takes roughly one month.

In midsummer, the immature bee molts into a white pupa within the cocoon. These pupae resemble adult bees but are white. After another month, the pupa molts again inside the cocoon, shedding the white pupal skin.

The fully formed adult bee remains dormant throughout the winter inside the cocoon until the temperatures reach around 50F, and it is time to emerge and start the cycle over again.

Solitary Bee Habitat:

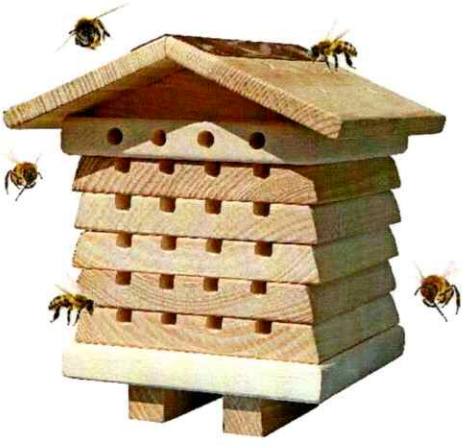
Inspection, education and cleaning
The solitary beehive can be dismantled to see the formation of small cells where the egg is laid or to check for predator action. This system allows easy cleaning, which is recommended annually, although solitary bees will remove debris themselves.

Siting
Site the box in a visible warm place ideally to catch the morning sun. It is helpful to have soil nearby and food sources such as flowers, fruit trees, etc. Although these bees do not swarm, they are gregarious and once the box is used, occupation will increase in the following years.

Timing
The solitary beehive can be sited at any time of the year. Solitary bees will use it from late February onwards, but other beneficial insects will use if for overwintering in. Because of the solid timber construction and insulation value, the beehive will normally not need to be taken inside in winter.

Houses:

The nesting material should be kept dry and sheltered from wind and rain. You can purchase nesting material at your local garden center or contact your local beekeeper. The nesting material should be able to absorb moisture from the pollen and not wrapped in plastic. Some examples of nesting material are easy tear tubes, reeds, or wood trays.



Your house should be placed on a sunny warm morning wall, under an overhang and 3-5 or more inches above the ground. The front of the house should have a south or southwest exposure where it will get the most sun in winter.

Nectar and pollen are both essential sources of energy and nutrients for these pollinators. Choose a variety of plants with overlapping and sequential bloom periods that prefer to receive full sun throughout most of the day.

Food sources (habitats) can include the following:

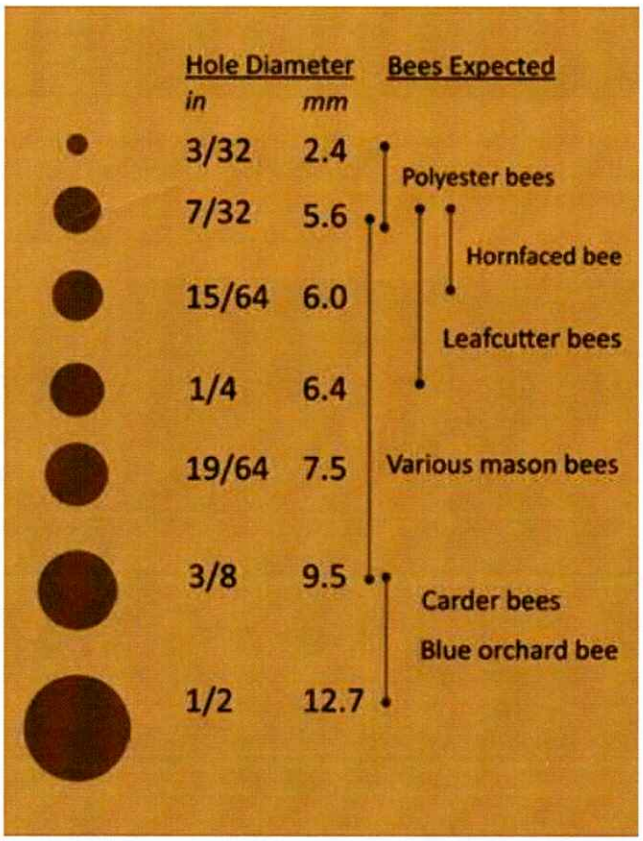
- Native plants and wildflowers – Catnip, Goldenrod, Penstemon, Phacelia, Salvia
- Flowers – Lavender, Rose, Sunflowers
- Crops – Almond, Apple, Cherry, Legumes, Thyme, Blueberry

Be sure to have a water and dirt source close by (clay). The bees will seal each nesting tube with mud or clay – therefore, mud is a vital nesting material. The mud they prefer is soft and damp with high clay content, so it can be molded and shaped without falling apart.

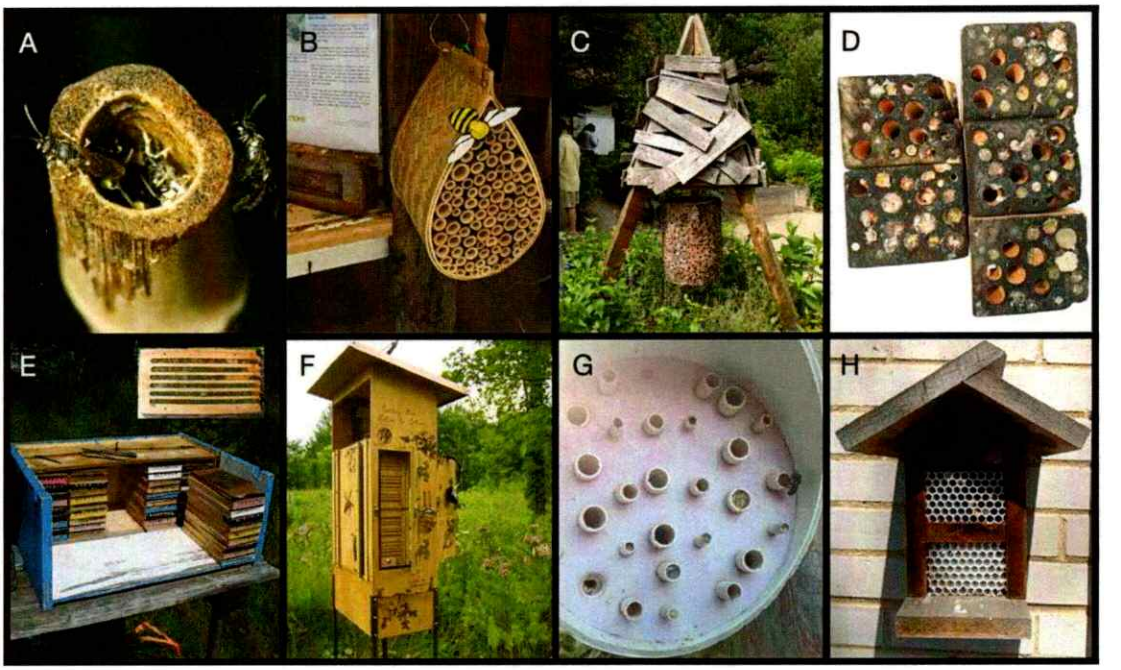
MASON BEE HOUSE CONSTRUCTION

The exterior of your bee hotel can be made from various materials such as untreated wood, cinder blocks, plastic buckets, or cut PVC pipe.

Tubes should be breathable, removable, thick-walled, and have one closed end. They can be made from various materials that are scavenged locally, purchased, or handmade. Consider the preferred nesting material of the bees you are trying to attract, and offer the same. Avoid using glass or plastic (including straws and PVC) for nesting tubes, as plastic holds moisture and encourages fungal growth which can cause bee mortality.



Wooden grooved boards or trays can be purchased or homemade and are recommended as they can be opened to inspect and sanitize and are reusable with annual maintenance.



Different nest boxes and materials used to construct them. a , b Bamboo reeds (a photo credit: Stephen Humphreys). c , d Drilled holes in wood blocks. e , f Wood cartridges. g Cardboard paper tubes. h Extruded plastic tubes. CREDIT: Cavity-nest boxes for solitary bees: a century of design and research J. Scott Macivor.

"Texas Native Solitary Bees" Compiled and presented to the Bluebonnet Chapter of The Texas Master Gardeners. March, 19, 2024 by Tom Shaughnessy, New Ulm, TX

Types of Solitary Bees

Mining Bees

Mining bees, also known as Andrenidae, are ground-nesting solitary bees. They prefer sandy, loose, and well-drained soils for their nests. You might spot these bees in various colors, such as copper, green, or metallic red.

Mason Bees

Mason bees are great pollinators and often build their nests using mud. One common example is the red mason bee. These bees can come in bold colors like metallic green, blue, or black.

Carpenter Bees

Carpenter bees prefer to nest in wood. They can be identified by their robust body and shiny, black appearance. Carpenter bees play an essential role in pollinating plants.

Sweat Bees

Sweat bees, or Halictidae, are attracted to human sweat. They are usually small in size (around 0.5-0.75 inches) and come in various colors. They can be effective pollinators in your garden.

Leaf-Cutter Bees

Leaf-cutter bees use small pieces of leaves to create their nests. They are efficient pollinators and can be dark-colored or metallic green or blue. Their nests are typically found in soft wood or plant stems.

Wool Carder Bees

Wool carder bees collect plant fibers and use them to line their nests. These bees can be easily recognized by their vibrant yellow markings and unique behavior.

Andrenidae

Andrenidae is a family of solitary bees that includes the previously mentioned mining bees. These bees come in diverse colors, ranging from dark shades to metallic hues. They are found in various habitats and play a significant role in the ecosystem as pollinators.

Digger Bees

Digger bees, also known as digger wasps, create nests in the ground, just like mining bees. They can be quite large in size and vary in color from basic black to bright metallic green, blue, or red.

Solitary Bee Helpful Resources:

- https://www.youtube.com/watch?v=3Gp59zXFauk
- https://crownbees.com/pages/bee-knowledgeable
- https://cedarhollar.com/native-solitary-mason-bees/
- https://www.youtube.com/watch?v=qd-MIMvB_uQ
- https://www.youtube.com/watch?v=Ux9moi9DXoE
- https://www.whatsthatbug.com/solitary-bee-life-cycle/
- See the Austin County AG Guidelines for qualifications.

Texas Bee Identification Guide

Wizzie Brown[1], Dodie Stillman[2], Jose Madrigal[3], Reed Lievers[4]
1. Texas A&M Agrilife Extension Service
2. Texas Beekeepers Association
3. JMad Images
4. Pollinator Partnership

Bees are beneficial insects that pollinate flowering plants by transferring pollen from one flower to another. This is important for plant reproduction and food production. In fact, one-third of the nation's food supply depends on pollinators. While the honey bee gets most of the credit for providing pollination, there are actually about 800 bee species in Texas!

Using this guide: This card provides key features needed to identify 12 types of bees found in home landscapes. The approximate size of each bee is listed in millimeters. The following symbols will help along the way:

Common nesting locations.

Identifying aspects or features to watch for.

Additional random facts that help discern differences between bee species.

How to Identify Bees

All bees have three body segments, a **head**, **thorax**, and **abdomen.** The **head** is where large multi-faceted eyes, long slender antennae, and chewing mouthparts are found. The **thorax** is the middle segment where wings and legs attach. Last is the **abdomen**, which for female bees has a stinger.

Special **pollen-carrying hairs** unique to female bees resemble dense broom bristles, and are commonly found on the rear legs or the underside of the abdomen. Some carry pollen in an almost hairless, flattened pollen basket on the rear legs.

Jose Madrigal

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Bumble bees (*Bombus* spp.)

Family: Apidae, 10-23 mm

Nest: Social; in the ground (abandoned rodent nests), piles of wood, or leaf litter

Description: Medium to large size, very hairy bodies, yellow & black in color, pollen basket on hind legs

Random fact: Able to be active in colder weather than other bees; 9 species of bumble bees in Texas

Jose Madrigal

Jose Madrigal

Sweat Bees:

- Furrow Bees (*Halictus* spp.)
- Metallic Sweat Bees (*Augochloropsis* spp.)
- Striped Sweat Bees (*Agapostemon* spp.)

Family: Halictidae, 3-12mm

Nest: Solitary to social, usually nest in the ground, with a few nesting in rotten wood

Description: Tiny to medium sized, two color forms- metallic OR blackish-brown with pale bands of hair on abdomen, slim bodies, hairs for carrying pollen on hind legs

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Jose Madrigal

Jose Madrigal

Large Carpenter Bees (*Xylocopa* spp.) and Small Carpenter Bees (*Ceratina* spp.)

Family: Apidae, *Xylocopa*: 13-30mm
Ceratina: 2-15mm

Nest: Solitary to communal; in wood or plant stems

Description: *Xylocopa* – Medium to large size, dark wings, abdomen lacks hair
Ceratina: Tiny to medium sized, nearly hairless and shiny, metallic blue or green

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Leafcutter Bees (*Megachile* spp.)

Family: Halictidae, 10-20mm

Nest: Solitary; in wood & preexisting cavities, some nest in the ground

Description: Small to large size, dark colored with whitish-yellow hairs and striping on abdomen, fuzzy hairs under abdomen to carry pollen, large mandibles

Random fact: Typically line nursery area with plant material

Mason/ Orchard bees (*Osmia* spp.)

Family: Megachilidae, 5-20mm

Nest: Solitary but aggregate; build nursery area from mud in preexisting cavities

Description: Small bodies with metallic sheen, various colors, carry pollen on underside of abdomen

Longhorn Bees (*Melissodes* spp.)

Family: Apidae, 7-20mm

Nest: Solitary to communal; in ground, like sandy soil

Description: Medium sized, hairy, green or blue eyes, pollen carried on hind legs, males have very long antennae


Honey Bees (*Apis* spp.)

Family: Apidae, 15-20mm

Nest: Social, man-made hives or natural cavities

Description: Medium size, brown body with banding on abdomen, lightly fuzzy, pollen carried in pollen basket on hind legs

Random Fact: Not native to the United States; brought to North America by European colonists

Digger Bees (*Anthophora, Centris* spp.)

Nest: Solitary but may aggregate, in the ground, some in wood

Family: Apidae, *Anthophora:* 12-16mm

Description: Medium to large, hairy and fast flying, gray to orangish-yellow in color

Random Fact: Called digger bees because they burrow into the ground with their front legs and loosen soil with mandibles

Family: Apidae, *Centris:* 12-20mm

Description: Large, densely hairy, often with brightly colored eyes, carry pollen on legs

Random Fact: Fast flying, often during hot times of the day; some collect oil in addition to pollen

Mining Bees (*Andrena, Perdita* spp.)

Family: Andrenidae, *Andrena*: 6-15mm

Nest: Solitary; in ground, like sandy soil

Description: Small to medium size, slightly fuzzy, color from gray to brown to reddish

Random Fact: Can fly at cooler temperatures than other bees, so often first bees seen in the spring

Family: Andrenidae, *Perdita*: 2-10mm

Nest: Solitary but may aggregate, bare ground

Description: Very small to small, yellow to orange in color

Random Fact: Only found in North America; especially common in the Southwestern US and many are specialists and collect pollen from specific blooming plants

A Bee or Not a Bee?

There are two kinds of insects that are often confused with bees -- flies and wasps. Many flower-visiting flies (e.g. Syrphidae) are bee and wasp mimics in color, form and actions. By mimicking bees and wasps, they gain protection from predators. So, how do you tell these pollinators apart?

Fly Identification: Flies have only one pair of wings, while bees have two pair wings. Flies usually have short, stubby antennae with single hairs, or feathery antennae. They have piercing-sucking or sponging mouthparts. Many flies have large eyes that meet at the top of their heads.

Wasp Identification: Wasps have four wings, chewing mouthparts, a stinger in females, and filamentous antennae. Wasps have simple, straight hair on their bodies whereas bees have branched hairs and tend to have hairier bodies. Wasps do not have specialized pollen carrying hairs (although Masarid wasps feed on pollen). Adult wasps feed on nectar while immature wasps (larva) feed on scavenged insects and other arthropods provided by adult wasps.

Now that you know how to tell the difference between bees, wasps and flies, try identifying the insects in the photos below. Answers are at the bottom.

1. Fly 2. Wasp 3. Fly 4. Wasp 5. Bee

1mm 25mm

Acknowledgements: Thank you to Jose Madrigal for the exceptional photos.

Pests!

They are bad and must be controlled

Pollen mites

A pollen mite exists to eat pollen. They piggyback on your mason bees and are scraped off with the gathered pollen. Pollen mites eat the pollen before bee larva can, which starves the larva. In spring, emerging bees exit throughout these pollen mites spreading them through the hole to damage even more egg chambers the following year. Many mason bees are so loaded with the mites that they can't fly.

What to do

Provide clean nesting material each year. Don't use drilled blocks of wood, as you won't be able to prevent the spreading of pollen mites. Harvest your cocoons in the fall!

Monodontemerous (Parasitic wasp)

Parasitic wasps arrive in late May and begin inserting their eggs into mason bee egg chambers. If the wall of the nesting material isn't thick enough, the mono will lay their eggs throughout the tube. A month or so later, you'll find holes their larva left when exiting the tube. At this point, it is too late for many of your mason bee larvae.

What to do

Remove your nesting material in early June to prevent "mono-intrusion". Harvest your nesting material in the fall and feel for "squishy" cocoons. A healthy mason bee is a more firm cocoon. Open the squishy cocoon and observe numerous mono-larva. Dispose of them!

Birds/squirrels/rodents

Your mason bees throughout the summer, or winter if they're left outside, are tasty treats to most foraging animals. You can't stop them from grabbing a mason bee in flight, but you can make your mason bee house harder to penetrate.

What to do

Place ½-¾" hardware cloth over the front of your nesting house. Try to leave a 3" space between the front of the nesting material and hardware cloth/chicken wire.

Books & Accessories

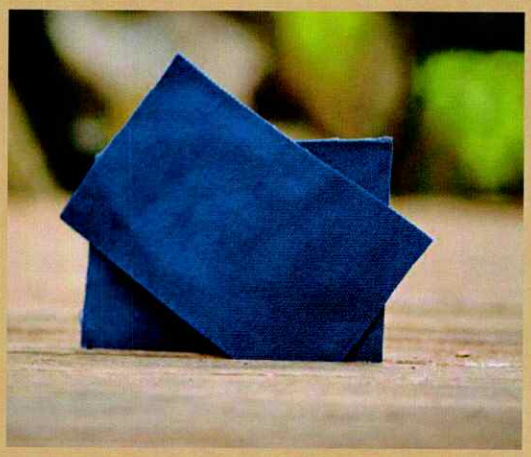
Mason Bee Attractant – Recent research conducted by commercial mason bee pollinators has concluded that spring nesting females are attracted to specific nesting scents. The commercial mason bee industry is now using this attractant.

Through collaboration and experimenting, Crown Bees has developed an innovative method to capture these natural nesting smells and preserve them for you.

With the use of the Mason Bee Attractant, your mason bees will have a higher probability of nesting in your tubes/reeds/trays. Downwind wild mason bees of the same species will look to nest in these holes as well.

Two scent-laden cloths are included in a cellophane pouch to preserve the freshness of the attractant. It is recommended that one bee attractant cloth be placed inside the Mason Bee House at the onset of the mason bee season, and the second cloth be added about two weeks later.

The cloth is 100% cotton, and blue (a color preferred by spring mason bees).



Crown Bees™

Your complete Mason Bee Resource

For more information on raising mason bees, frequently asked questions, basic mason bee requirements, or to sign up for Bee-Mail, a monthly newsletter designed to inform you when to do what activity, please visit

www.crownbees.com

Crown Bees contact information:
info@crownbees.com
(425) 949-7954
Woodinville, WA 98072

Photos by Crown Bees and TNC photography
Layout by CC design

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DEVELOPING LANDSCAPE PLANTINGS THAT PROVIDE POLLINATOR HABITAT

WHETHER YOU ARE A FARMER of many acres, land manager of a large tract of land, or a gardener with a small lot, you can increase the number of pollinators in your area by making conscious choices to include plants that provide essential habitat for bees, butterflies, moths, beetles, hummingbirds and other pollinators.

FOOD:

Flowers provide nectar (high in sugar and necessary amino acids) and pollen (high in protein) to pollinators.

Fermenting fallen fruits also provide food for bees, beetles and butterflies.

Specific plants, known as host plants, are eaten by the larvae of pollinators such as butterflies.

- Plant in groups to increase pollination efficiency. If a pollinator can visit the same type of flower over and over, it doesn't have to relearn how to enter the flower and can transfer pollen to the same species, instead of squandering the pollen on unreceptive flowers.
- Plant with bloom season in mind, providing food from early spring to late fall. (see Bloom Periods pp.16-17)
- Plant a diversity of plants to support a variety of pollinators. Flowers of different color, fragrance, and season of bloom on plants of different heights will attract different pollinator species and provide pollen and nectar throughout the seasons.
- Many herbs and annuals, although not native, are very good for pollinators. Mint, oregano, garlic, chives, parsley and lavender are just a few herbs that can be planted. Old fashioned zinnias, cosmos, and single sunflowers support bees and butterflies.
- Recognize weeds that might be a good source of food. For example, dandelions provide nectar in the early spring before other flowers open. Plantain is alternate host for the Baltimore Checkerspot.
- Learn and utilize Integrated Pest Management (IPM) practices to address pest concerns. Minimize or eliminate the use of pesticides.

SHELTER:

Pollinators need protection from severe weather and from predators as well as sites for nesting and roosting.

- Incorporate different canopy layers in the landscape by planting trees, shrubs, and different-sized perennial plants.
- Leave dead snags for nesting sites of bees, and other dead plants and leaf litter for shelter.
- Build bee boxes to encourage solitary, non-aggressive bees to nest on your property.
- Leave some areas of soil uncovered to provide ground nesting insects easy access to underground tunnels.
- Group plantings so that pollinators can move safely through the landscape protected from predators.
- Include plants that are needed by butterflies during their larval development.

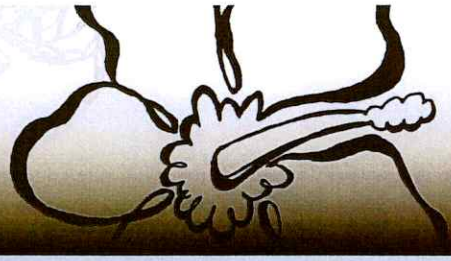
WATER:

A clean, reliable source of water is essential to pollinators.

- Natural and human-made water features such as running water, pools, ponds, and small containers of water provide drinking and bathing opportunities for pollinators.
- Ensure the water sources have a shallow or sloping side so the pollinators can easily approach the water without drowning.

Your current landscape probably includes many of these elements. Observe wildlife activity in your farm fields, woodlands, and gardens to determine what actions you can take to encourage other pollinators to feed and nest. Evaluate the placement of individual plants and water sources and use your knowledge of specific pollinator needs to guide your choice and placement of additional plants and other habitat elements. Minor changes by many individuals can positively impact the pollinator populations in your area. Watch for - and enjoy - the changes in your landscape!

- CAUTION: Remember that pesticides are largely toxic to pollinators. Extreme caution is warranted if you choose to use any pesticide. Strategically apply pesticides only for problematic target species.



FARMS

Cucumbers, figs, blackberries and blueberries are a few of the food crops in the Prairie Parkland (Subtropical) Province that will benefit from strong native bee populations that boost pollination efficiency. Incorporate different plants throughout the farm that provide food for native populations when targeted crops are not in flower.

Farmers have many opportunities to incorporate pollinator-friendly land management practices on their land which will benefit the farmer in achieving his or her production goals:

- Manage the use of pesticides to reduce the impact on native pollinators. Spray when bees aren't active (just after dawn) and choose targeted ingredients.
- Carefully consider the use of herbicides. Perhaps the targeted weeds can provide needed food for pollinators.
- Minimize tillage to protect ground nesting pollinators.
- Ensure water sources are scattered throughout the landscape.
- Choose a variety of native plants to act as windbreaks, riparian buffers, and field borders throughout the farm.
- Plant unused areas of the farm with temporary cover crops that can provide food or with a variety of trees, shrubs, and flowers that provide both food and shelter for pollinators.
- Check with your local Natural Resources Conservation Service (NRCS) office to see what technical and financial support might be available to assist you in your effort to provide nectar, pollen, and larval food sources for pollinators on your farm.

Illustrations by Carolyn Vibbert

"FOOD SUPPLIES FOR BEES ARE CRITICAL TO MAINTAINING STRONG HIVES FOR ALMOND POLLINATION THE FOLLOWING WINTER."

-- DAN CUMMINGS, CHICO, CALIFORNIA ALMOND GROWER.