

Nesting & Overwintering Habitat for Pollinators & Other Beneficial Insects

STEPS TO CREATE NESTING & OVERWINTERING HABITAT:

- ✓ SAVE THE STEMS
- ✓ LEAVE THE LEAVES
- ✓ REDEFINE THE “PERFECT” LAWN
- ✓ RETHINK HOW YOU USE MULCH
- ✓ SAVE A SNAG AND “PLANT” A LOG
- ✓ BUILD A BRUSH PILE
- ✓ BUILD A ROCK PILE OR ROCK WALL
- ✓ PROVIDE A SAFE WATER SOURCE
- ✓ INSTALL A HABITAT SIGN



FIGURE 1: By selecting native plants and managing habitat purposefully, even small wildflower plots (left) can provide high-quality overwintering habitat for pollinators and beneficial insects, like these small carpenter bees hibernating in a pithy stem (right).

Moving Beyond Flowers

While flowering plants provide pollinators with food, insects also require suitable shelter for nesting and overwintering. Most bees and wasps create small nests beneath the soil or within dead plant stems or cavities in wood. Other beneficial insects such as butterflies, wasps, moths, fireflies, lady beetles, and ground beetles seek shelter in places that offer protection from predators and the elements, such as leaf litter and brush piles.

The More, The Better

The primary habitat features used by pollinators and other insects for shelter include stems and branches of trees, shrubs, and wildflowers; leaf litter; undisturbed ground; bare ground; dead wood; brush piles; and rock piles. Retaining and incorporating as many of these features as possible into your landscape (rather than “cleaning” them away) will help attract and support a diversity of bees and other beneficial insects.

Why Natural Is Best

The availability of nesting and overwintering habitat is one of the most important factors influencing populations of native bees and other beneficial insects. Yet, traditional landscaping

practices rarely leave enough natural resources to support pollinators and other wildlife. This guide focuses on a variety of natural nesting habitat features that can be readily incorporated into most landscapes. Compared to artificial nesting options such as bee blocks and bee hotels, natural nesting habitat features often better mimic the natural nest site density of insects, and also break down naturally with time, limiting disease and parasite issues. Moreover, natural nesting features often provide multiple conservation benefits. An appropriately managed wildflower planting, for example, can provide nesting sites, pollen, and nectar for bees; host plants and overwintering habitat for butterflies; and abundant food for songbirds.

Our Bring Back the Pollinators campaign is based on four principles:

1. Grow a variety of pollinator-friendly flowers;
2. Protect and provide bee nest sites and caterpillar host plants;
3. Avoid using pesticides, especially insecticides; and
4. Spread the word!

You can participate by taking the **Pollinator Protection Pledge** and registering your habitat on our nationwide map at: www.bringbackthepollinators.org.



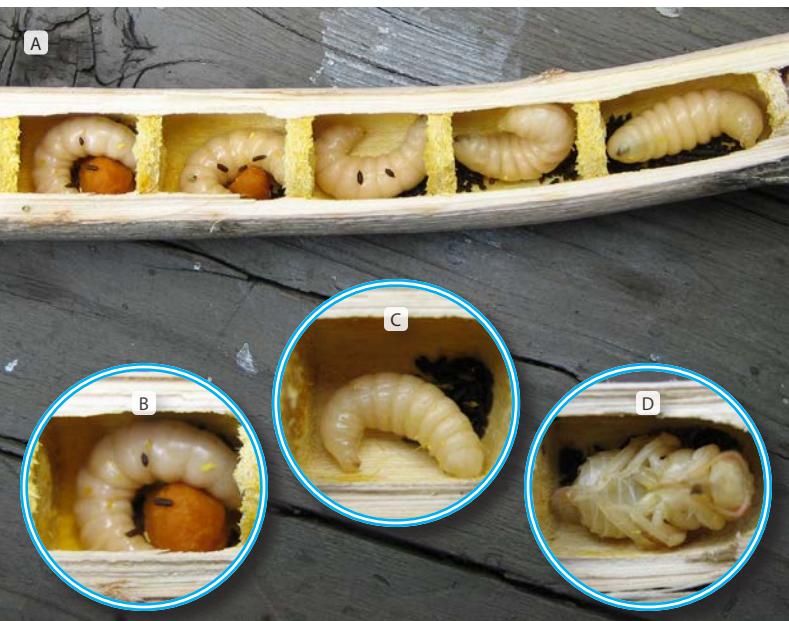


FIGURE 2: Located in a yucca stem (*Yucca* sp.), this opened large carpenter bee (*Xylocopa* sp.) nest shows multiple cells (A). In the cells closest to the nest entrance, larvae are still consuming pollen (B); while, further into the nest, larvae have consumed their provisions (C) and are preparing to pupate (D).

FIGURE 3: Stem "stubble" created from the previous year's wildflowers (A, stiff goldenrod plant [*Solidago rigida*]) provides excellent nesting opportunities for stem-nesting bees, such as small carpenter bees (B).



Many hollow or pithy plant stems and branches provide excellent places for cavity-nesting insects to call home. Small carpenter bees (*Ceratina* spp.) frequently carve out their nests in last year's dead raspberry (*Rubus* spp.) canes or wildflower stems, often only a few inches away from the blossoms that provide pollen to feed their young. Still tinier yellow-faced bees (*Hylaeus* spp.) use the hollow center of smaller stems, like bee balm (*Monarda* spp.) or roses (*Rosa* spp.), and larger leaf-cutter bees (*Megachile* spp.) prefer the larger stems of plants like native thistles (*Cirsium* spp.), cup plant (*Silphium perfoliatum*), or desert willow (*Chilopsis linearis*). The biggest stem-nesting bees in North America, large carpenter bees (*Xylocopa* spp.), sometimes use the pithy stems of large plants like yucca (*Yucca* spp.) and agave (*Agave* spp.) in regions where wood is uncommon or unavailable. Other common occupants of dead stems and twigs include cavity-nesting wasps, stem-boring moths, and even some spiders. In addition, some beneficial insects insert their eggs into the stems of wildflowers and grasses for safe keeping over the winter.

ACTIONS:

- ✓ First, ensure your landscape supports a diversity of native shrubs such as elderberry (*Sambucus* spp.), sumac (*Rhus* spp.), and raspberries (*Rubus* spp.), as well as a diversity of wildflowers. For regional lists of plant species that are known to provide sites for nesting, visit <https://xerces.org/providing-nest-sites-for-pollinators/>.
- ✓ In a wildflower garden, leave flower stalks (and seed heads) intact over the winter. Many birds and other wildlife feed on the seeds of plants, including sunflowers (*Helianthus* spp.), asters (*Sympyotrichum* spp.), goldenrod (*Solidago* spp.), purple coneflowers (*Echinacea* spp.), blazingstars (*Liatris* spp.) and Joe Pye weed (*Eupatorium* spp.). Begin pruning dead flower stalks in the early spring, to create nest sites shortly before the first bees start flying.
- ✓ When pruning dead wildflowers, make your cuts at a variety of heights from about 8–24" above the ground. This creates vertical nesting opportunities in a variety of diameters, suitable for insects of different body sizes. The tops of the plants can go into a mulch or compost pile, or be bundled together and left in a sheltered place (either vertically or horizontally) to create additional nesting opportunities.
- ✓ Shrub pruning can occur any time that is compatible with the plant at hand, but typically occurs in late spring before the plant breaks dormancy. Create cut ends in a variety of diameters across the plant, which will simulate the nesting sites created by deer browsing.

When pruning to expose cut ends, be sure that the nest sites you are leaving are at least 4–6" from a branch or stem node. Plants with pith-filled or hollow centers should be prioritized for nest-site pruning, since these will be more attractive than shrubs that have solid centers.

As the weather warms, watch your new nesting sites for insect activity. It is not uncommon to see bees checking out multiple stems for suitability, and eventually settling on the perfect stem to call home. Stems that have been blocked at the cut end with natural materials such as leaves, mud, pebbles, grass, or resin indicate that there is a nest inside. Stems with unblocked cut ends may also be occupied by overwintering adults. Use your observations to guide future plantings and pruning decisions (e.g., stubble height) in your garden.

Remember to leave cut stems in place during spring clean-up the following year, as they may be housing insect larvae, pupae, or overwintering adults.

FIGURE 4: Prune shrubs to create cut ends that serve as nest entrances for stem nesting bees (A). When pruning, the tops that you cut off can be bundled to create additional habitat. After being cut to 6" lengths and bundled, these stems were occupied by yellow-faced bees (*Hylaeus* spp.) and aphid hunting wasps (B, *Pemphredon* sp.).



How to Create Habitat for Stem-Nesting Bees



WINTER

Leave dead flower stalks intact over the winter

SPRING

Cut back dead flower stalks leaving stem stubble of varying height, 8 to 24 inches, to provide nest cavities.



Female bees find cut or naturally occurring open stems, start a nest, then lay an egg on the pollen balls. Larvae eat the pollen.



SUMMER

New growth of the perennial hides the stem stubble.



Bee larvae develop in cut dead stems during the growing season.



FALL



WINTER

Bees hibernate in stems during the winter



SPRING

Cut back dead flower stalks. Old stem stubble will naturally decompose.



Adult bees emerge and start nests in newly cut dead stems or in naturally occurring open stems.



Protect plants and build better soil with nature's free mulch! Just...



FIGURE 5: Fallen leaves (A) have all the properties and benefits of wood mulch (moisture retention and weed control) *and* are vital resources for overwintering pollinators and beneficial insects, like red-banded hairstreak (B, *Calycopis cecrops*) larvae and bumble bee (C, *Bombus* sp.) queens.

2

Leave the Leaves

In cold climates, the vast majority of butterflies and moths use leaf litter for winter protection of eggs, caterpillars, chrysalises, or adults. For example, great spangled fritillary (*Speyeria cybele*) and wooly bear (Arctiini) caterpillars tuck themselves into a pile of leaves for protection from cold weather and predators. Red-banded hairstreaks (*Calycopis cecrops*) lay their eggs on fallen oak (*Quercus* spp.) leaves, which become the first food of the caterpillars when they emerge. Luna moths (*Actias luna*) encase their cocoons in leaves and the chrysalises of swallowtail butterflies (*Papilio* spp.) resemble dried leaves, blending in with the real leaves. Some overwintering queen bumble bees (*Bombus* spp.) also rely on leaf litter for protection. At the end of summer, the mated queens burrow an inch or two into the earth to hibernate; an extra thick layer of leaves is welcome additional protection from the elements. In addition to these pollinators, there are many, many other animals that live or overwinter in leaves: lace bugs, snails, worms, beetles, millipedes, mites, spiders, and more—which in turn support the chipmunks, turtles, birds, and amphibians that rely on these invertebrates for food. Leaves also help plants weather spring freeze-thaw cycles by providing additional insulation to their root systems.

ACTIONS:

- Leave a thin layer of leaves on any lawn areas. While a couple of inches or more could smother the turf, research has shown that a thin layer of leaves actually benefits lawns, since decomposing leaves provide organic matter and nutrients to help lawns grow.
- If leaving leaves on your lawn isn't an option, rake them up and spread them over vegetable or flower beds, where they will help to build soil and provide habitat.
- Pile leaves around ornamental trees, shrubs, and perennials for mulch. Fallen leaves have the same weed suppression and moisture retention properties of shredded wood mulch—and they're free!
- Consider reducing your overall lawn footprint, replacing it instead with wildlife supporting plantings that can be future repositories for fall leaves. Leaves, along with cardboard and other compostable materials, can also be used to smother existing grass when converting lawn areas to habitat.
- When moving leaves, opt for raking or using a leaf vacuum to capture whole leaves, rather than shredding them with a mower.
- While the idea is to "leave the leaves" permanently—if you do decide to remove some of the leaves in spring, make sure you wait until late spring to increase the chances of successful emergence by butterflies, queen bumble bees, and other overwintering animals.



FIGURE 6: Join the Xerces Society's social media campaign to "leave the leaves" by using the hashtag #leavetheleaves.



FIGURE 7: Many common native bee species—such as mining bees (A, *Andrena* sp.), cellophane bees (B, *Colletes* sp.), and sweat bees (C, *Agapostemon* sp.)—are often found nesting in areas with bare soil or patchy vegetation in residential lawns or parks.

3

Redefine the “Perfect” Lawn

Roughly 70% of our native bee species nest in the ground, where they are often found in loose, undisturbed soil, and patches of bare soil without a lot of dense vegetation or sod. Ground-nesting bees are often confused with aggressive ground-nesting social wasps. Here are a few key differences: social wasps are active all summer long and tend to actively defend their nest, with a large number of workers protecting their underground larval brood. In contrast, solitary bees are not aggressive, their nests very small (just one foraging adult mother and a handful of underground larvae), and they are active for only a very short period (a few days to weeks while the mother is filling the nest with food). As a result, solitary bee nests often go unnoticed, though there can be many nests in the same area, making them easier to locate. Ground-nesting behavior is found in the vast majority of our native bees, including long-horned bees (*Melissodes* spp.), squash bees (*Peponapis* spp.), mining bees (*Andrena* spp.), polyester bees (*Colletes* spp.), and many sweat bees (*Halictus* spp.). Many of these bees are among the earliest pollinators to emerge in spring, and are essential pollinators of early-blooming fruit tree crops, as well as spring ephemeral wildflowers and native trees and shrubs.

ACTIONS:

- ☛ Reduce lawn size where possible, replacing lawn with native flowering plants as well as native bunchgrasses and clump-forming native sedges. These grasses and sedges are useful in supporting ground nesting bees, since they grow with a space around the plant where bees can access bare soil, even in densely vegetated areas. Limit turf grass to select areas, such as accents or as garden paths.
- ☛ Retain a variety of “microhabitats” in your yard or lawn, including patches of bare ground where possible. Although unsightly to some, bare spots in turf grass provide ground nesting bees and other insects with access to a very important resource: soil.
- ☛ Plant a bee lawn, composed of short-statured grasses and wildflowers that tolerate some foot traffic and need less water, mowing, and fertilizer than typical turfgrass. These plants are naturally patchy, leaving room for nest sites.
- ☛ Set mower blades to the highest setting, and reduce mowing frequency. Lawns mown every two to three weeks have more flowers like dandelions and clover. These flowers, though non-native, provide food for a surprising diversity of bees. Ground-nesting bees often nest in close proximity to the plants from which they forage.
- ☛ Leave some areas of your lawn unmown. Tall grass can provide shelter for butterflies, moths, fireflies, and lacewings, as well as nesting habitat for small mammals, which in turn supports the nesting needs of many bumble bees.
- ☛ Avoid chemical fertilizers, herbicides, and insecticides in your lawn, many of which have unknown or negative consequences to bees and other soil-dwelling insects.

FIGURE 8: Mining bee (*Andrena* sp.) nest entrance (circled) in an area of patchy lawn.





FIGURE 9: Many solitary bee species can be found nesting in soil with pebbles on the surface, like this small sweat bee (A, *Lasioglossum* sp.) poking her head out of ground nest among pebbles; and this striped sweat bee (B, *Halictus* sp.) observed exiting her nest.

Different types of mulch can influence how easily ground nesting bees can reach the soil to create their nests. Some mulch can also support beneficial insects and spiders by providing shelter.

ACTIONS:

- Avoid landscaping with plastic mulch, landscape fabric, and heavy wood chips, especially chemically treated or colored wood chips. Not surprisingly, these impenetrable layers can limit nesting sites for ground nesting bees.
- Use a shallow layer of pebbles as rock mulch. Bees can still reach small patches of soil, and some even prefer to nest among pebbles over bare ground (e.g., the widely-distributed orange-legged furrow bee [*Halictus rubicundus*]).
- Use compost, leaf litter, and plant debris from your wildflower gardens, rather than wood mulch. Compared to wood mulch, a layer of leaf litter or other loose mulch allows ground-nesting bees easier access to their nest entrances.
- If using bark or wood mulch, create a light layer rather than a thick layer. Mulch only the first foot or so into the garden from your path, leaving the rest of your garden with bare soil under the plants.
- Consider "reversing" the mulch in your yard. Instead of using mulch around plants, use leaves in gardens and reserve heavy mulch for walking paths.

FIGURE 10: When mulching a potential nesting site, a little goes a long way. Make sure to spread any mulch (A), leaf litter (B), or gravel (C) shallowly enough that bees can still reach the soil underneath to dig their nests (circled).



Dead standing trees (snags) are often quickly removed from our managed landscapes due to aesthetics or safety concerns. However, in many cases a snag poses no real danger, and if left in place, the dead woody material provides an abundance of habitat for a wide diversity of wildlife, including woodpeckers, owls, and of course insects. Long-horned beetles (Cerambycidae), jewel beetles (Buprestidae), and bark beetles (Scolytinae) are just a few of the insects that can be found burrowing through recently dead wood, activities which create perfect chambers in which cavity-nesting bees such as mason bees (*Osmia* spp.) and leaf cutter bees (*Megachile* spp.) can lay their eggs.

Similarly, fallen logs also provide a plethora of resources for insects. The moist spaces under logs and behind peeling bark are attractive to spiders, ground beetles (Carabidae), and other insect predators, while bees and butterflies are more likely to nest and overwinter in dryer parts of logs. Many larger animals will also appreciate log habitat additions: chipmunks use logs as “runways” through a landscape; tree frogs are attracted to the moisture provided by well-decomposed logs; and skinks and lizards enjoy the surface of logs for basking in the sun.

ACTIONS:

- Retain any dead standing trees in place as long as they do not pose safety concerns. If safety is an issue, fell the tree and leave the log in place, or move it to another part of the yard or landscape.
- If logs or snags are lacking in your yard, consider “planting” a log that is destined for disposal from a neighboring yard or park. Note that moving dead wood across longer distances is not allowed in some areas; check your local natural resource authorities for details. Also, do not relocate any fallen wood that was removed due to insect pests or diseases.
- When “planting” a log, give preference to hardwood logs with the bark still attached. This will result in longer-lasting woody habitat. Lay the log horizontally on the ground, burying one end of the log a few inches into the soil to maintain some moisture, and surrounding parts of the log with a few smaller branches or rocks to provide extra cover and improved habitat.



FIGURE 11: Beetle exit holes in dead cottonwood tree; these abandoned tunnels make nice homes for cavity-nesting bees.

FIGURE 12: In addition to supporting wildlife, snags attract solitary species that nest in cavities under bark (A, bumblehead mason bee [*Osmia bucephala*]), or in old beetle holes (B, aphid hunting wasps [*Pemphredon* sp.]). To identify occupied nests, look for entrances “capped” with mud or plant matter (C, circled).



Constructing a brush pile is an effective way to provide habitat for a diversity of beneficial insects and other wildlife. Brush piles provide hibernation sites for mourning cloaks (*Nymphalis antiopa*) and other butterflies, soil access for ground nesting bees, daytime shelter for fireflies (Lampyridae), and food for a diversity of wood-eating beetles and other organisms that eventually break the piles down into valuable organic matter for your yard. Larger animals also benefit from brush piles. Chickadees, warblers, and other songbirds enjoy the hiding spaces provided by the branches, and small mammals create warm burrows in the pile that later provide protected spaces for bumble bees (*Bombus* spp.) to nest.

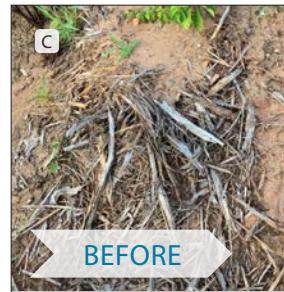
In most municipalities, local waste management authorities will collect curbside brush and either chip and compost it or haul it off to a landfill. If everyone retained just a small amount of their clippings and prunings, we could reduce the burden on our waste management system. In rural areas, brush is often burned on site, a practice which not only adds carbon dioxide to the atmosphere, contributing to climate change, but also wastes valuable organic material that could be retained on site.

ACTIONS:

- >Select an out-of-the-way location for your brush pile, such as a fence corner, woodland edge, or around a large tree.
- Begin the brush pile by placing larger branches or logs on the bottom, along with any stones, so that your pile has a sturdy base.
- Continue to stack branches and logs, layering them crosswise with small limbs and brush on the top, or pile the branches in a conical shape around a large central log or stump.
- Aim for 2–8' high, and 3–10' in diameter (depending on the space and resources available).
- Structure the pile to have plenty of air spaces on the sides and in the interior of the pile. While insects can find space in almost any pile, birds and small mammals will benefit from holes at least 6" wide along the sides and throughout the pile.
- As the brush pile settles, you can add to it, or create a new pile.
- Retired brush piles are excellent places to plant raspberries (*Rubus* spp.) or other shrubs, since the decomposing brush provides abundant organic matter and weed control.
- Your brush pile can also be the base of a raised hugelkultur garden. Start with a 3-foot-high brush pile, water the pile, fill in spaces with leaf litter or compost, top with a few inches of top soil and a thin layer of mulch, and plant seeds or transplants.
- If you are worried about your pile being an eyesore, consider hiding the pile behind a hedge or wildflowers, building a “brush fence”, or simply installing a Pollinator Habitat sign to advertise your good intentions to your neighbors.

FIGURE 13: In rural areas, larger brush piles should be left to decompose naturally (A), rather than burned. In yards or parks, a “woven” wildlife habitat feature (B) or raised hugelkultur (C) garden built on top of a brush pile filled in with leaves, compost, and mulch, could create attractive habitat, once established.

A



Build a Rock Pile or Rock Wall

Rock piles, rocky embankments, rock walls, and similar structures provide important habitat for a diversity of beneficial insects and other wildlife. Leafcutter bees (*Megachile* spp.) make nests in the cracks or crevices present in some types of rock. Other tunnel-nesting bees, such as some digger bees (*Anthophora* spp.), use water to soften sandstone and excavate into it. Bumble bees (*Bombus* spp.) make homes in protected cavities inside rock piles and walls, while ground beetles (Carabidae) and numerous other beneficial insects find shelter at the interface between soil and stone.

ACTIONS:

- To build a rock pile, include a diversity of rock types and sizes, and assemble with a "messy" configuration. This helps ensure that there are air spaces in the pile, and that access to ground is available under some parts of the pile.
- Consider incorporating native bunchgrasses around the pile, to help support nesting by bumble bees and overwintering by ground beetles and other insects.
- Wildflowers around the pile will make it more attractive to pollinators and beneficial insects that feed on nectar/pollen during part of their life cycle, and will also provide seeds for birds and small mammals.
- If building a rock wall, choose a dry wall construction method, since this provides more crevices in which insects can find shelter.

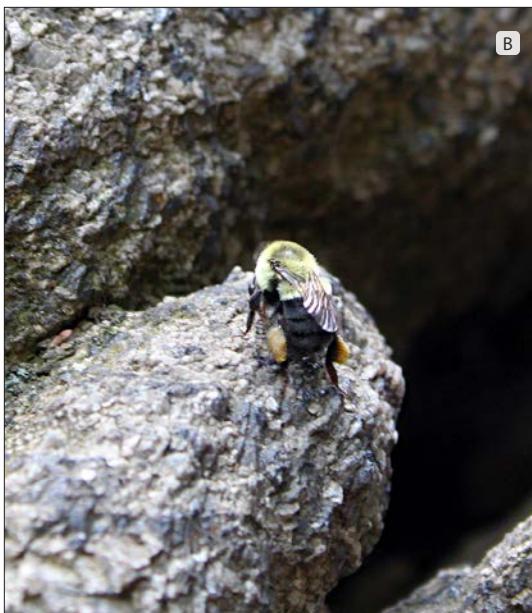
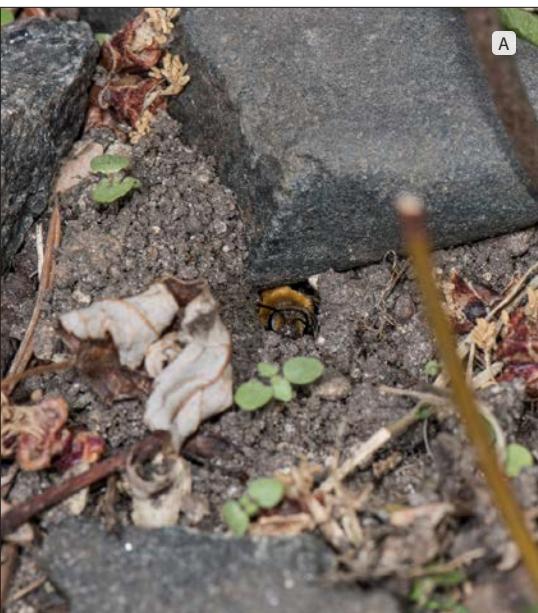


FIGURE 14: Rock walls at the University of Wisconsin Arboretum provide nesting habitat for mud dauber wasps and bumble bees, including the endangered rusty-patched bumble bee (*B. affinis*).

BUMBLE BEE NESTING

Bumble bees are social insects that nest in a variety of pre-existing cavities (hollow logs, spaces in rock walls, under bunchgrasses, in bird nest boxes, etc.). Their nests are often found in abandoned rodent burrows, where the soft, fuzzy lining helps protect and insulate the nest. Bumble bee nests can be hard to find, unless you happen to notice bees going in and out of the nest. As long as the immediate area around the nest is avoided, there is very little risk of getting stung by bumble bees nesting in your yard.

FIGURE 15: If space is an issue, unmortared natural rock retaining walls or raised flower beds can provide nesting places for habitat for mining bees (*Andrena* sp., A), bumble bees (*Bombus* sp., B), and leafcutter bees (*Megachile* sp., C).



Honey bees (*Apis mellifera*) and bumble bees (*Bombus* spp.) are familiar visitors to bird baths during warm weather, but they're not the only species that require access to a safe water source. Paper wasps (*Polistes* spp.) are social nesters that also collect water to make paper and to cool their colonies in hot weather. In addition to these social groups, some solitary bees, like mason bees (*Osmia* spp.) and solitary wasps (e.g., potter wasps, *Eumeninae*) need mud to create their nests. In drier weather (when mud is not available), they will frequently collect water in their crops and then carry it to dirt in order to make their own mud. Other ground-nesting species, like digger bees (*Anthrophora* spp.) and the blue mud-dauber wasp (*Chalybion californicus*) also collect water in their crops, but they use it to soften the ground where they dig their nests. Some digger bee species make up to 80 water-collecting trips a day when excavating their nests. Since many native bees and wasps will resort to collecting water from puddles and ditches when other sources are unavailable, they can run the risk of exposure to harmful pollutants and pesticides. Providing a shallow source of unpolluted water for bees and wasps can improve their overall chances of nesting successfully by reducing the time needed to forage, as well as the risk of exposure to pesticides.



FIGURE 16: Provide bees and wasps with water to create their nests with a shallow bird bath or bowl and a safe place to perch.

ACTIONS:

► Provide a shallow source of water—such as a bird bath or bowl with stones on which bees and wasps can perch safely without slipping—in a sunny place near potential nesting sites.

► Clean the water source regularly to prevent mosquitoes from proliferating, but don't worry about dirt or organic matter in the water—there are minerals not present in nectar and pollen that bees obtain from "dirty" water.

Consider installing a Pollinator Habitat sign to advertise your new landscape features. Not only does a sign help to explain your objectives, it's also an opportunity to inspire neighbors to think about their own role in making landscapes more sustainable for pollinators.

FIGURE 17: Your garden can support a bounty of beneficial insects all year long. Let your neighbors know the "mess" is intentional by posting a pollinator or wildlife habitat sign.

AUGUST

Pollinator
Habitat

NOVEMBER

Pollinator
Habitat

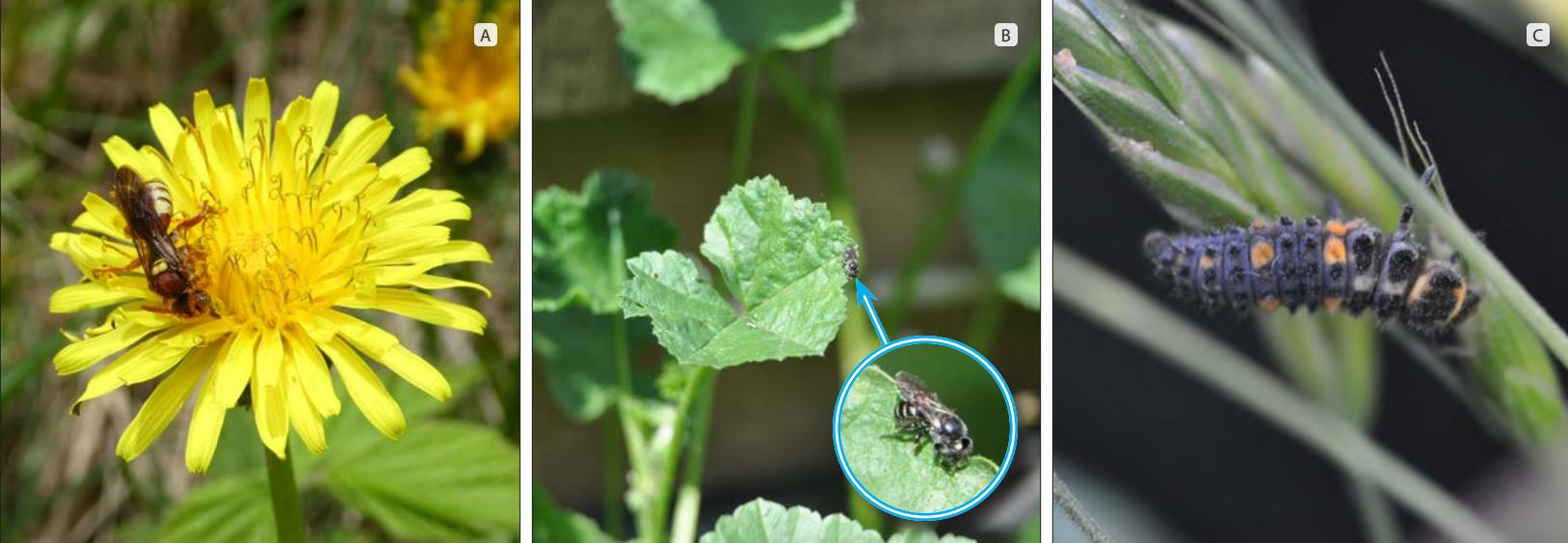


FIGURE 18: While they may be unwanted additions to a lawn or garden, some weedy species provide critical resources for pollinators and beneficial insects looking for places to forage or collect nesting materials. From left to right: A, cuckoo bee (*Nomada* sp.) foraging on dandelion (*Taraxacum* sp.); B, a small mason bee (*Hoplitis* sp.) collecting pieces of mallow leaves (*Malva* sp.) for lining the cells of its nest; C, convergent lady beetle (*Hippodamia convergens*) larva seeking smaller insect prey in tall grass.

Resources & References

Providing Nest Sites for Native Pollinators

The Xerces Society

Includes plant lists for species that provide nesting material and resources for maintaining artificial nests.

xerces.org/providing-nest-sites-for-pollinators

Bee Nesting Plants Survey

The Xerces Society

You can help! Use this link to let us know about your observations of plants used by bees for nesting.

<https://bit.ly/2YdWg3n>

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

The Xerces Society

Evaluate pollinator habitat at a given urban, suburban, or rural site and identify areas for improvement.

www.xerces.org/publications/habitat-assessment-guides/habitat-assessment-guide-for-pollinators-in-yards-gardens

Regional Pollinator Plant Lists

The Xerces Society

Recommended native plants that are highly attractive to pollinators.

xerces.org/pollinator-conservation/plant-lists

Attracting Native Pollinators: Protecting North America's Bees and Butterflies

The Xerces Society

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

Farming with Native Beneficial Insects: Ecological Pest Control Solutions

The Xerces Society

xerces.org/farming-with-native-beneficial-insects

Bees In Your Backyard: A Guide to North America's Bees

Princeton University Press

<https://press.princeton.edu/titles/10593.html>

Habitat Network website

Cornell University and The Nature Conservancy

Information on how to provide fallen log habitat, remove lawn, and more.

<http://content.yardmap.org>

Gardening and Landscaping Practices for Nesting Native Bees

Utah State University Extension

https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1723&context=extension_curall

Managing Bee Lawns

University of Minnesota Bee Lab

www.beelab.umn.edu/bees/beelawn

How to Create Habitat for Stem-nesting Bees

University of Minnesota Bee Lab

<https://z.umn.edu/stemnestingbees>

Bees: An Identification and Native Plant Forage Guide

Pollination Press, LLC

Includes extensive nesting information for each bee genus, along with foraging and other details.

www.pollinationpress.com/books.html

Ground Nesting and Cavity Nesting Bee Posters:

Pollination Press, LLC

www.pollinatorsnativeplants.com/plant-lists--posters.html



FIGURE 19: Incorporating natural habitat features—such as pithy-stemmed plants (A), logs (B, C), patches of undisturbed soil (D), and leaf litter (E, F)—into a garden or urban space can provide important nesting and overwintering sites for pollinators and beneficial insects.

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Photographs & Artwork

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- ⇒ **Jenn Forman Orth** [flickr.com/urtica]: Figure 19B.
- ⇒ **Brian Henderson** [flickr.com/stinkenroboter]: Figure 13B.
- ⇒ **Heather Holm** [www.pollinatorsnativeplants.com]: Figures 3B; 7A–B; 10A; 12C; 15A; 19A & C.
- ⇒ **Ilona Loser** [flickr.com/woolcarderbee]: Figure 12A.
- ⇒ **Sean McCann** [flickr.com/deadmike]: Figures 9B; 16 (top).
- ⇒ **Steven Severinghaus** [flickr.com/horsepunchkid]: Figure 5C.
- ⇒ **Vicky Somma** [flickr.com/tgaw]: Figure 15B.
- ⇒ **Robin Williams, via Nigel Jones** [flickr.com/insectman]: 12B.

- ⇒ **The Xerces Society / Kitty Bolte**: Figure 19F.
- ⇒ **The Xerces Society / Candace Fallon**: Figure 10B.
- ⇒ **The Xerces Society / Sarah Foltz Jordan**: Figures 1; 3A; 4A; 8; 11; 13A; 18A; 19 (main), 19E.
- ⇒ **The Xerces Society / Jennifer Hopwood**: Figures 9A; 14.
- ⇒ **The Xerces Society / Ray Moranz**: Figure 13C.
- ⇒ **The Xerces Society / Sara Morris**: Figures 1A, C, E; 4B; 7C; 16 (bottom); 18B–C.
- ⇒ **The Xerces Society / Matthew Shepherd**: Figures 10C; 17; 19D.
- ⇒ **The Xerces Society / Katharina Ullmann**: Figure 2.
- ⇒ **The Xerces Society / Justin Wheeler**: Figures 5A (photograph & artwork); 5B (artwork); 6 (artwork).