

The Birdies and The Bees

Native pollinators on your golf course.

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NOTHING causes more excitement on a golf course than accomplishing the golfer's dream, a hole-in-one. But to other organisms, small and unobtrusive, scoring a hole-in-one is all in a day's work. We refer to bees, those uncommonly beneficial insects that collect food from flowers and deliver it, unerringly, to a hole in the ground or in wood, where it succors their offspring. We should welcome them to our golf courses, but not because we expect their hole-finding proficiency to rub off on us. No, we should do it to be good neighbors.

When you think of bees, chances are you think of those that live in hives or colonies like honeybees, or bumblebees, or of picnics disturbed by yellow jackets (which are wasps, not bees). Most people are surprised to discover that most of the more than four thousand species of native bees in the United States don't fit that description. Indeed, most bees are easily overlooked because they are solitary, not social, and most people never come into contact with them. Out of sight and out of mind, these bees play a vital role in renewing our environment by pollinating the majority of flowering plants; we can be good neighbors simply by providing them with habitat.

Pollination is one of the most important ecological services that animals perform for plants. It is a process that holds together the very fabric of our environment, those rich and diverse plant communities that clothe the soil and provide food for us and habitat for wildlife. Many different animals help with this: hummingbirds, bats, moths,



PHOTO BY EDWARD S. ROSS

Sweat bees, like this Augochorella sp. halictid bee, are generalists, able to exploit a wide range of flowers and survive in degraded or weedy plant communities.



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The load of golden-yellow pollen collected by this leafcutter bee (Megachile sp.) can be clearly seen in its "pollen brush" on the underside of its abdomen.

beetles, flies, wasps, and butterflies, but it is bees — especially native bees — that play a dominant role in plant reproduction.

For a process that is so important to us, pollination is sadly ignored, as are the creatures that provide this service. Research indicates that our native bees

are in decline, and in places suffering local extinction. The primary reason for this is the destruction, modification, and fragmentation of habitat. Urban growth and intensified agriculture and forestry have been significant causes of this. The habitat areas that remain are often isolated patches that have been



Encouraging pollinators on the golf course does not pose a risk to golfers, so nesting sites and plant materials can be placed close to the playing areas. Bee nesting blocks can be mounted on fences, placed in trees, or fixed to stakes in suitable areas (Wildhorse Golf Course, Mission, Oregon).

degraded by invasive plant species, pesticide use, and changes in land management. Fortunately, populations of many native bee species are quite resilient and even compatible with light or moderate human activity if supplied with a few necessary resources. We hope to illustrate here how some simple changes to out-of-play areas will benefit pollinators, help to beautify and naturalize your golf course, and make you a good neighbor to the surrounding community.

Life Cycle and Habitat of Native Bees

The native bees of North America range in length from less than an eighth of an inch to more than an inch. Their colors vary from nondescript brown or black to metallic green or blue, their markings from unmarked to bright red, white, or yellow stripes, and their hairiness from nearly bald (though most are quite hirsute) to profuse “punky” orange. Often their names reflect the way they build nests: plasterer bees,

leafcutter bees, mason bees, carder bees, digger bees, and carpenter bees. Others are named after particular habits, such as cuckoo bees that lay eggs in the nests of other bee species, or sweat bees that drink sweat from mammals.

Despite such diversity, they share two important characteristics: all are strict vegetarians that draw their sustenance from nectar and pollen, and they are quite placid, faster to flee than to sting. The solitary life led by most means they don’t have a colony to defend, and neither solitary nor social species are aggressive when visiting flowers. No special equipment or protective clothing is needed when working with native bees — unlike honeybees — and encouraging native bees on your course will not create any threat to golfers. You’ll have more problems from yellow jackets attracted to trash cans than you’ll ever have from these gentle pollinators.

Solitary bee females perform a multitude of duties and do so unassisted by

workers or drones. Females mate soon after emerging as adults and then spend the rest of their brief, three- to four-week lives searching for, selecting, and sometimes excavating their own burrows, preparing their nesting tunnels to receive the pollen and nectar they will collect, and laying eggs. A few bee species excavate their nests within the soft central pith of stems and twigs, but many more use abandoned beetle burrows in dead snags. Others dig a nest in bare or sparsely vegetated soil. The nests of some species will have only one cell, but most will have many. These cells are often in a line filling the hole or burrow, but some are in complex, multi-chambered tunnels.

A source of nectar and pollen is essential for bees. Adults of both sexes feed on nectar and sometimes pollen, commonly visiting hundreds of flowers on a foraging trip. Females also collect both nectar and pollen as food for their offspring. This pollen is taken to the nest securely carried in either a “pollen brush” on the underside of the

abdomen or in "pollen baskets" on the hind legs, depending on species. During foraging, other pollen grains get caught in the bee's body hairs and are deposited on the stigmas of subsequently visited flowers. Thus, almost by accident, bees perform one of the fundamental relationships that keep ecosystems healthy.

During their active life, bees will not collect pollen and nectar from all the plant species that are in bloom, but different bee species will differ greatly in the number of plants they are attracted to and can exploit. Some bee species can be defined as generalists, i.e., they are visitors to a large proportion of the flower species available, and others as specialists, because they visit only a narrow, usually closely related, range of plant species.

A Conservation Partnership

In the summer of 1997, the Xerces Society (Portland, Oregon), with the help of the USDA Bee Biology and Systematics Lab (Logan, Utah), initiated a project to explore methods to enrich out-of-play areas of golf courses with native plants for pollinator insects. The project was funded by a grant from the Wildlife Links Program of the USGA and the National Fish and Wildlife Foundation. Project staff worked with the superintendents at three golf courses in the Columbia Basin of eastern Oregon and Washington. The three courses were Wildhorse in Mission, Oregon; Veterans Memorial in Walla Walla, Washington; and Horn Rapids in Richland, Washington. For each golf course, a reference site was also established in a nearby area of natural vegetation so that pollinator populations could be compared.

The project had four main components. These were to:

1. Survey and compare pollinating insects among golf courses, and between golf courses and their respective "natural" areas.

2. Enrich out-of-play and rough areas of golf courses with flowering plants native to the locality.

3. Create pollinator nesting sites.

4. Educate people about the importance of pollinators and their management.

Surveys trapped over 10,000 individual bees and showed that 78 bee species, representing 25 genera, used the courses, perhaps mostly as flyways. This is an important finding because it demonstrates that large numbers of pollinators are associated with some

golf courses, and that golf courses can serve as refuges if we can supply the necessary resources. At the same time, it is equally important to recognize that, though abundant, the existing golf course pollinator fauna is impoverished in that it is dominated by only three genera of sweat bees (*Agapostemon*, *Halictus*, and *Dialictus*). In 1997, these three genera accounted for 92 percent of specimens captured.

This pattern of species abundance causes concern. The three dominant genera are generalist sweat bees that are frequently associated with disturbed and degraded plant communities composed of weedy species. Sweat bees are

managing habitat areas for vertebrates, for some plant communities, and for wetlands, including the Landscape Restoration Handbook produced by the USGA. Recommendations for pollinator conservation management, however, are not readily available. In this section we describe methods for attracting a variety of native bees to golf courses, and for supplying them with the pollen and nectar they need to survive and reproduce once they get there.

Introducing or restoring local species of native flowering plants is the first step to converting a portion of your golf course to a pollinator refuge. There are



Matthew Shepherd checks one of the bee nesting boxes at Wildhorse Golf Course (Mission, Oregon). The holes with plugs have been filled with egg cells and sealed with mud.

able to visit and exploit the flowers of a wide variety of plants. However, because of their very diverse tastes in flowers and their habit of moving almost randomly among several plant species on a single foraging trip, they are usually regarded as inferior pollinators when compared to other, more specialized species. In contrast to these generalists, specialist species restricted to foraging on a few species of flowers are more vulnerable to changes in numbers of their preferred species of nectar and pollen plants. Unfortunately, specialist pollinator populations appear to be quite low or non-existent on golf courses in this part of the Northwest.

Enhancing Foraging Areas

There are many good sources of information on planning, creating, and

several reasons for this. As already noted, native species are adapted to the area's climate, and once established, should require minimum attention. In contrast, horticultural varieties and hybrids of many plants are not necessarily well adapted to local climates. In addition, they have been artificially bred to produce showy blooms at the expense of pollen and nectar production. Unlike such ornamentals, native plants have supplied native bees with pollen and nectar for ages and are well adapted to do so.

Plants should be chosen with diversity of both shape and color and of blooming periods in mind. Diversity is important because, as noted earlier, many bee species either prefer, or are obligately dependent on, particular kinds of flowers for food. In general, the more kinds of flowers planted on

the course, the more kinds of bees that will be supported. Color and scent are significant to attract bees; they are particularly attracted to blues, violets, yellows, and whites. Equally important is selecting species in a range of flower sizes and shapes, as there is a rough association between the depth of the flower tube and the length of the mouthparts of the bees that use them. Thus, the more different depths represented, the more species of bees attracted. Variety of flower shape and symmetry (radial vs. bilateral) will also help to favor a variety of bees.

Another consideration when choosing plants is the blooming time and duration. The flowering time of many plants is restricted, sensitive to the

amount of daylight, and thus predictable. It is easy to select a range of species that will, together, fill in the growing season with a diversity of flowers through spring, summer, and fall. Such a planting strategy will support a diversity of bee species, catering to species that fly only in spring, summer, or fall and those that are active for longer. A variety of flowers through the year will make the habitat more attractive to golfers as well.

In an article of this length it is not possible to list specific species of plants for every region. Table 1 lists plant genera that are good nectar or pollen sources for the semi-arid Columbia Basin. They are listed here only as examples because all planting decisions

must be made with the local flora in mind. Talk to native plant nurseries, your local native plant society chapter, other wildlife organizations, or consultants in your local area to refine this list with suggestions for equivalent local species of these or other plants, information on flowering times, and advice on what is best adapted to local conditions. The Lady Bird Johnson Wildflower Center in Austin, Texas, offers lists of species suitable for many local areas.

For most situations pot-grown transplants are preferable to seed for establishing the plants. Transplants are more likely to survive when introduced to existing grassy areas. Ideally, the plants you use should be from a local supply of seed or cuttings. Local plants are likely to be better adapted to growing conditions and climate and should be easier to establish and grow. They are also more likely to be attractive to local native bees.

There are several things to consider then locating habitat. Bees are unusual among insects because of their high level of parental behavior. Their need to supply food for their offspring makes them density-sensitive foragers. Thus, while any flowering habitat is good, bigger patches can hold more plants and will be more attractive to bees. Try to avoid long, narrow patches, as the centers of these will be disturbed more by activity on the edges (like mowing or maintenance work) than larger, blocky areas. Where possible, link new areas or add onto existing habitat as this will generate greater benefit for the same amount of effort.

Bee Nesting Sites

The second major requirement of native bees that pollinator conservationists must supply is suitable nesting habitat. As with flowering plants, the more kinds of nesting places that are made available, the more types of bees one can expect to attract. Many, though not all, easily creatable types of nesting sites will be suitable for your course. For example, unsheltered adobe blocks may not last long in a rainy climate, and sand pits and piles may be superfluous on sandy sites.

Outlined below are eight ways to make nesting sites, four each for ground-nesting and snag-nesting bees. In all cases, location of the nesting sites is important. Wet soil is usually bad for ground-nesting bees and should be avoided. Choose sunny, dry, well-drained areas for the bare-ground and

Table 1
Native Plants for Nectar and Pollen

These plants were chosen for the sites in the semi-arid Columbia Basin where the Wildlife Links project worked. They are listed as guidance. Talk to native plant nurseries in your local area to identify equivalent species for your region.

Family	Genus	English name
Salicaceae	<i>Salix</i>	willow
Polygonaceae	<i>Eriogonum</i>	buckwheat
Berberidaceae	<i>Berberis</i>	Oregon grape
Crassulaceae	<i>Sedum</i>	stonecrop
Grossulariaceae	<i>Ribes</i>	current, gooseberry
Rosaceae	<i>Geum</i> <i>Rosa</i>	avens wild rose
Leguminosae	<i>Lupinus</i>	lupine
Geraniaceae	<i>Geranium</i>	geranium
Linaceae	<i>Linum</i>	flax
Malvaceae	<i>Sphaeralcea</i>	globe-mallow
Cactaceae	<i>Opuntia</i>	cholla, prickly pear
Onagraceae	<i>Clarkia</i> <i>Oenothera</i>	clarkia evening primrose
Umbelliferae	<i>Lomatium</i>	lomatium
Primulaceae	<i>Dodecatheon</i>	shooting star
Polemoniaceae	<i>Gilia</i>	gilia
Hydrophyllaceae	<i>Phacelia</i>	phacelia
Labiatae	<i>Agastache</i> <i>Scutellaria</i>	giant hyssop skullcap
Scrophulariaceae	<i>Penstemon</i> <i>Verbascum</i>	penstemon mullein
Caprifoliaceae	<i>Symphoricarpos</i>	snowberry
Compositae	<i>Achillea</i> <i>Aster</i> <i>Chrysothamnus</i> <i>Gaillardia</i> <i>Helianthus</i> <i>Senecio</i> <i>Solidago</i>	yarrow aster rabbit brush blanket flower sunflower groundsel goldenrod
Liliaceae	<i>Alium</i> <i>Brodiaea</i>	wild onion brodiaea



Bee nesting boxes can be made from blocks of water-resistant lumber, drilled with various sized holes. These boxes provide a suitable nesting habitat for solitary nesting bees (Veterans Memorial Golf Course, Walla Walla, Washington).

sand-pit techniques. The techniques to create wood substrate nests can be more widely used as they are less affected by ground conditions. Try to place these nests so that they are sheltered from the worst of the weather yet receive direct sunshine early in the day. Facing the entrance of such nests east or southeast is best because bees like warm conditions, especially in the morning so they can become active earlier.

- **Bare ground.** Simply clear the vegetation from a small level or gently sloping area (about 6' by 6') and compact the soil. A few rocks placed in the cleared area will improve it by adding basking places and help to warm the soil. Bare areas on precipitous, south-facing slopes or banks will draw other species.

- **Adobe blocks.** Use adobe blocks to construct a wall about 4'-5' high and 5'-6' long. Use wood and/or metal backing and supports to prevent toppling. Drill holes ($\frac{3}{32}$ " to $\frac{3}{8}$ " in diameter) into the blocks at least 4" deep.

- **Sand pits.** Dig a pit about 12' square and 4' deep, and fill it with fine-grained, pale-colored sand.

- **Sand piles.** Create a sand pile of a similar size and materials as the sand pit.

- **Logs and snags.** Get some logs or old stumps and place them in the

habitat patches. Plant a few upright like dead trees to ensure some deadwood habitat stays dry. Drill holes as in the adobe blocks.

- **Elderberry bundles.** Cut elderberry stems into lengths of 8" to 12". Drill out the central pith to form a hole $\frac{3}{32}$ " to $\frac{3}{8}$ " in diameter to a depth of 6" (do not drill completely through the stem), and then tie the stems in bundles of 15 to 20. Fix the bundle to a stake or tree with the stems horizontal to the ground. (Other stems with soft pith can be substituted, such as blackberry, raspberry, or sumac.)

- **Elderberry stakes.** Cut stakes from elderberry stems about 24" to 30" long. Drill out the pith from one end as you did the stems for the bundles, and then about 12" from the end, drill a "side hole" of similar diameter through the bark just into the pith. Drive them about 6" into the ground.

- **Nesting blocks.** Bee nesting blocks can be made from blocks of water-resistant lumber at least 4" by 4" and 8" long. (Redwood or cedar are good choices, but any treated wood, preferably aged, will do.) In one side of the block, drill lots of holes $\frac{3}{32}$ " to $\frac{3}{8}$ " in diameter and almost all the way through the block. When drilling, make the interior of the holes as smooth as possible. Bees are not partial to rough-

ened holes and may avoid them. Ideally, the top of the block should slope slightly towards the entrance and be capped with a plywood roof (like a bird nesting house). The roof should extend beyond the front of the block to afford the nesting holes some protection from precipitation. This block can be fixed to a stake or tree in a sunny, preferably eastward-facing spot.

Helping the Forgotten Pollinators

Golf courses have a huge potential to contribute to the well-being and education of the public, and to greatly benefit local wildlife by providing safe refuge as the landscapes around them come under increasing pressure. Conservation of native bees and plants is a valuable way in which golf courses can contribute to a healthier environment and is a comparatively simple task to integrate into the management of a golf course. The simple actions that can be taken to conserve native bees targets two key aspects of their habitat: foraging areas and nesting sites. Habitat diversification inevitably benefits other wildlife as well — a more diverse environment results in a more diverse range of inhabitants — and, since the habitat will support populations of helpful predators, can assist in pest management.

Every superintendent who can find space on his or her course has the potential to improve both the pollinator populations in the local area as well as the image of the course itself, both aesthetically and to the local community. Golf courses can be good neighbors to the flower and vegetable gardeners of their immediate areas, to the school systems who will use them for education, to the golfers who can appreciate the native vegetation, and, of course, to the creatures who will find a home there. Golf courses can make a difference across the nation, forming a network of enhanced pollinator habitat to support the vital work of native bees in the health of both farmland and wildlands.

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