ASDM NEWS

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A newsletter for friends of the Arizona-Sonora Desert Museum

NATIVE BEES

Little insects playing a large role in our regional ecosystem

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leaf cutter bee (genus Megachile) by Michele Lamm

I've always been fascinated with insects, and have a true passion for these most underappreciated animals.

During my college sophomore year I interned at the American Museum of Natural History (AMNH) in New York City with Dr. Jerome Rozen, a world renowned expert on bees. I can still remember reading my acceptance letter, scarcely believing that I would spend a summer studying bees at one of the most prestigious natural history museums in the world.

Most of my time was spent learning to use dichotomous keys to identify the bees that I had collected in Central Park. While I was working on local bees, Dr. Rozen was studying bees from all over the world, from the deserts of Namibia to the tropical rainforests of Brazil. Dr. Rozen's special focus was on the immature forms of bees and, as a result, the AMNH holds the most complete collection of bee eggs, larvae, and pupae in the world.

Bees are holometabolous insects, they go through complete metamorphosis—just like butterflies and moths. Baby bees (larvae), look like grains of white rice. When fully grown, the larvae pupate, transforming into the more familiar adult forms that we see visiting flowers.

After two months with Dr. Rozen, we took a trip to the AMNH's Southwestern Research Station in Portal, Arizona, the eastern gateway to the Chiricahua Mountains. Dr. Rozen has likely spent more

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time collecting bees in southern Arizona than anywhere else in the world. Of the approximately 4,000 bee species in North America, 1,300 of them are found in Arizona, a true bee hotspot!

Sonoran Desert Bee Diversity

The Sonoran Desert is home to the smallest bee in North America, *Perdita minima*, a tiny mining bee less than two millimeters in length. Its common name reflects its habit of nesting in the ground. But mining bees are not the only bees that do this. Approximately 70% of all bee species nest in the ground.

A female digs a tunnel to a depth of a couple inches to well over one foot. She excavates cells in this tunnel and provisions each with a mixture of pollen, nectar, and saliva. She lays an egg on this pollen ball, seals the cell, and leaves her offspring to make the journey from egg to adult on their own.

Our desert is also home to some exceptionally large bees, such as the familiar shiny, black carpenter bees, *Xylocopa* spp., which nest aboveground. Carpenter bees excavate holes in the stems of desert plants such as dead agave stalks or tree branches.

Other bees that nest aboveground include leaf cutter and mason bees, which make use of abandoned holes made by wood-boring beetles. In urban environments, they will nest in a wide variety of man-made materials. In fact, cavity-nesting bees are often abundant in our cities due to an abundance of potential nest sites. The names 'leaf-cutter' and 'mason' refer to the fact that females construct individual cells within their nests with leaves or mud, respectively.

Some parasitic bees do not make any nest at all. These bees are called cuckoo bees because like cuckoos, they lay their eggs in the nest of other bees. When the parasitic larva hatches, it uses its giant jaws to kill the larva of its host and then devours the remaining pollen ball. These bees often look more like wasps than bees because they have lost the pollen-collecting hairs that give most bees their fuzzy look.

You may be surprised to know that the honey bee, *Apis mellifera*, is not native to North America. This species arrived with European colonists in the 17th century. The most striking difference between our native bees and honey bees is that our native bees are solitary (they build and provision a nest of their own) while honey bees are social they live in a hive with a queen bee and hundreds to thousands of worker bees.

Both native bees and honey bees excel as pollinators, playing a key role in sustaining wild plant communities and increasing agricultural yields. Furthermore, new research is demonstrating that many of our native North American bees are actually better pollinators of both native plants and many agricultural crops than the honey bee.

Bee Declines

Unfortunately, the number of managed honey bee colonies in the U.S. has been in slow decline since the 1940s. Scientists have been unable to pinpoint a single cause for this decline. Instead it appears that many factors are driving the loss of honey bee colonies.

A sharp decline in managed honey bee colonies was seen in the mid-1980s with the introduction of an ectoparasitic mite, *Varroa destructor*, that feeds on honey bee hemolymph (insect "blood"). These mites and many other novel parasites and pathogens continue to plague the bee keeping industry.

Another sudden decline was observed in 2006 with the advent of Colony Collapse Disorder (CCD)—a set of symptoms that results in the loss of the colony without any obvious cause. CCD is characterized by a rapid loss of adult worker bees, which leave behind their queen

Native sweat bee *(tribe Augochlorini)* foraging in Santa Rita prickly pear

Honey bee, *Apis mellifera*, visiting a cactus flower

You can attract a wide diversity of bees to even a small urban backyard with a small diversity of plants. You don't have to start big, just pick a few flowering plants and slowly increase that number over time.

and an excess of brood. In essence, the adult workers seem to just disappear.

In addition to pests and pathogens, honey bees are exposed to a wide range of pesticides, including neonicotinoids, which target the insect nervous system. These common pesticides are absorbed by the plant and distributed systemically finding their way into pollen and nectar, as well as honey. Scientists are currently working to better understand the toxicity of these pesticides to bees and other pollinating insects.

And what about our native bees? Nearly all research has focused on honey bees, but it's likely that pests, pathogens, and pesticides are affecting at least some of our native bees. For example, fungal and viral pathogens that attack honey bees have also been linked to dramatic declines in native bumble bees.

Without a doubt another problem contributing to global pollinator declines is habitat loss and degradation, resulting in the loss of floral resources, which translates to a depauperate diet and poor nutrition. Just as we require a diverse diet, so do bees!

Habitat loss and degradation have different effects on different bee species. For example, honey bees are generalists, (they aren't picky when it comes to plants). In contrast, many native bees are specialists to varying degrees, collecting pollen from only one or several closely related plant genera or families. Specialists are more vulnerable to changes in plant community composition and diversity.

Research in the U.K. and the Netherlands has shown that since 1980 specialist bees have declined whereas generalist bees have tended to thrive. In some parts of these countries, declines in bees have been accompanied by a decline in bee-pollinated plants but whether the decline in bees is driving the decline in plants, or vice versa, is not clear. It's possible that both groups are declining independently of each other with the declines being driven by other environmental changes.

Unfortunately for the overwhelming majority of bee species, we have little to no data on current or long-term population trends. As recognition grows for the important role they play in pollinating our food crops and wild plants, concern for the health of our native bees is growing. To address the lack of understanding about native bees the Desert Museum is refocusing its conservation program on pollinators.

The fishhook barrel cactus is primarily pollinated by native cactus bees, which can often be seen swimming through the pollen-laden anthers of its vibrant yellow, orange, and red flowers. In addition to seed counts, we are developing another branch to this citizen science program that will add value to our growing database of seed count data, but will require a greater commitment on the part of our citizen scientists. We will be asking for your help in conducting a variety of pollination experiments on fishhook barrel cactus across the Tucson Basin. If you are interested being a part of this effort, check out the class listings in this newsletter and online.

You can support bees in your backyard by providing them with a place to nest. For ground-nesting bees this means leaving a bit of dirt in your yard free of gravel or other ground cover, so that the bees can dig into the soil. Cavity-nesting bees often need no help finding nest sites within urban environments, but bee blocks are a fun way to encourage leaf-cutter and mason bees to nest where you will be able to watch them. These are simply blocks of wood drilled with holes ranging in diameter from a quarter to half an inch, and two to three inches in depth. Watching bees construct their nests in these "bee hotels" can be as exciting as watching hummingbirds coming to your backyard feeder.

In addition to a place to live, bees need food. You can attract a wide diversity of bees to even a small urban backyard with a small diversity of plants. You don't have to start big. Just pick a few flowering plants and slowly increase that number over time. As part of its monarch conservation efforts, the Desert Museum is ramping up production of a wide variety of pollinator plants, most of which you will find at this fall's plant sale.*

Two years ago the Museum launched a Pollinator Hotspots, citizen science program. The program's first project involved gathered data on native bees through seed counts, specifically counts of seeds from the fruit of the fishhook barrel cactus, *Ferocactus wislizeni*. Why count seeds? Because seed development is dependent on the deposition of pollen, and the deposition of pollen is dependent on pollinators.