Discovering Native Bees

Why native pollinators matter and how children can learn about native bees in a classroom setting



By **Alison Pearce Stevens**

NATURAL SYSTEMS PROVIDE humans with a variety of services essential to our survival. Ecosystem services such as climate regulation, water purification, oxygen production, waste treatment and detoxification, flood prevention, and pollination are provided at no cost, yet their true value is immeasurable. In our economy-driven world, these systems are often taken for granted, and as a consequence many are in peril. Understanding their role is a critical first step towards ensuring that they endure.

Pollination, the process of moving pollen grains from one flower to another to stimulate fruit and seed production, is among the easiest of these services to understand. Pollination is important for successful reproduction of all flowering plant species, both wild and cultivated. It allows intact ecosystems to continue functioning efficiently, and it provides food and other products for human consumption. Despite its importance, pollinators have been declining in number over the past two decades.

Although some plants, including most major cereal crops (corn, rice, wheat, barley, and oats) rely on wind dispersal for pollination, 70 to 90 percent of flowering plants rely on animal pollinators. These plants include fruits and vegetables consumed by humans and other animals. Without pollinators to facilitate pollen transfer, these plants will cease to produce fruit altogether.

The best way to ensure that such ecosystem services remain intact and functional is to understand their value in economic terms. If we understand the costs associated with losing the services, we will be more likely to take steps to avoid paying those costs. Determining the economic value of ecosystem services presents a challenge, but the best estimates use traditional economic models to establish a ballpark value. Researchers have estimated the global value of all ecosystem services at US$33 trillion per year. The value of pollination alone is estimated between US$20 and 40 billion for the United States, and up to US$200 billion globally.

An economic perspective provides a useful framework for adults. An alternative approach—one that better illustrates the issue for children—is to examine the nutritional impact of a world that lacks animal pollinators. Approximately one-third of the food we eat comes from animal-pollinated plant crops. Pollinators affect not only the fruit and vegetable content of our diets (see the table below), but also availability of meat and dairy products (e.g., cattle are often fed alfalfa and clover, which are pollinated by bees).

The Role of Honey Bees

The best known animal pollinator is the honey bee (*Apis mellifera*). Honey bees are not native to North America; they were imported from Europe as early as the 1600s, to provide wax and honey. Their role in pollination went unrecognized for over 200 years, until native North American pollinators declined in the early 1900s and honey bees were used to replace them.

Honey bees are ideal from a management standpoint because they live in large, easy-to-manage colonies with thousands of foragers. In theory, such legions of pollinators would provide very efficient pollination of crops, particularly when a honey bee forager can spend 5-10 hours foraging in a day. In reality, although the honey bee can pollinate a wide variety of species, it is a sub-optimal pollinator for a number of plants. This is in contrast to native pollinators

that co-evolved with native plants and have adapted to collect and transfer pollen grains with each flower visit.

For example, honey bees visit alfalfa to collect nectar, but their bodies, which lack pollen-collection structures on the underside of the abdomen, fail to 'trip' the alfalfa flowers. As a consequence, the bees come away without pollen. Blueberries, cranberries, and tomatoes require buzz-pollination, in which the bee rapidly rotates its abdomen against the flowers' pollen-loaded anthers, transferring pollen to its body in the process. Bumble bees (*Bombus spp.*) buzz-pollinate, making them ideal pollinators for such crops. In contrast, honey bees fail to pollinate these plants. Similarly, the flowers found on apple trees are not well pollinated by honey bees. These trees are better served by the hornfaced bee (*Osmia cornifrons*). As an additional drawback, honey bees often make long-distance foraging trips, visiting flowers well outside the crop field or orchard they are intended to pollinate.

Perhaps the biggest issue concerning the use of honey bees to pollinate crops is colony collapse disorder (CCD), which was first documented with a decline of 30 to 90 percent of honey bee colonies in the winter of 2006-2007. CCD is characterized by a sudden loss of foragers and other adult bees from the colony, a low adult-to-brood ratio, and a lack of dead bees in the vicinity of the hive.[1]

The Need for Native Pollinators

In light of the extensive losses of managed honey bee colonies, recognition of, and efforts to encourage populations of, native pollinators are increasingly important. Globally, over 16,000 species of bee have been described — of which only seven are honey bees. Unlike honey bees, many of the remaining species are specialists, which co-evolved with native plant species and are best able to pollinate those plants. They have also evolved to emerge from their nests at the time of year when their host plants are in bloom. As a result, native bees are an essential component of plant-pollinator food webs throughout the world.

In addition, the sheer numbers of native pollinators boost pollination efforts when the availability of honey bees declines. Researchers have found that native bees account for over 50% of crop pollination in the United States, despite belief by farmers that their crops are entirely pollinated by managed honey bee colonies. Native bees are particularly abundant on small agricultural fields with nearby trees and a variety of flowering weedy species.

Such findings underscore the importance of habitat in promoting biodiversity. Loss of habitat is considered a major contributing factor to loss of native bee diversity in Europe. Suitable habitat may not be completely lost; however, researchers have found that 'partial' habitat loss—loss of either food resources or nesting sites—is sufficient to lead to a decline in the number of pollinators. All parts of the complete habitat must be present for individuals to complete their life cycles and perpetuate the species.

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VISIT www.greenteacher.com/contents93 for a list of common crop species and their animal pollinators (scroll down to the links for this article's supplements). Also online, you will find tables showing the nesting habits, timing and distribution of native bees, and common bee genera (scroll down to the links for this article's supplements); the following 5 activities for ages 9 and up: Pollination Exploration, Nest Search, Building a Nesting Block, Behavioral Observations and Busy Bees.

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Notes

1. Although researchers are still investigating the causes of CCD, bees in hives affected by the disorder have been shown to be infected with a higher number of pests and pathogens (tracheal mites, Varroa mites, hive beetles, and viruses). In addition, apiaries with at least one CCD-affected hive are more likely to have multiple CCD-affected hives, which suggests an element of transfer from one colony to another.