

Honey Bees in North America

# Why Getting a Hive Won't "Save the Bees"



Lynn Friedman, Flickr (CC BY-NC-ND 2.0)



JP Goguen, Flickr (CC BY-SA 2.0)



John Flannery, Flickr (CC BY-NC 2.0)

Faced with news of bee declines, people have added honey bee hives to gardens, parks, and other places in towns and cities. Studies show that this can pose a risk to our native bee species, and the presence of hives may be harming the pollinators you seek to help.

Honey bees are amazing animals, with fascinating behaviors and interactions that provide people with a connection to the natural world in a way that few other insects can. They hold an unusual position for an insect in our society and culture: loved, cared for, kept close to where we live, represented in art and literature. From our earliest age we are exposed to honey bees in storybooks and pictures, household decorations and garden ornaments, movies and TV shows, and news stories. Honey bees are an important component of our farming system and directly provide us with a number of useful products, not the least of which is honey. They also have played a significant role in raising awareness of the essential role of pollinators.

In the face of ongoing reports of pollinator declines, honey bees are frequently the first bee that comes to mind. As a result, a tangible goal for some people has been to get a honey bee hive and hives have appeared in gardens and backyards, on rooftops, in parks, and in natural areas. This is well-intentioned and driven by a true desire to help pollinators, and on the surface, it makes sense—if bees are declining, it would seem that more bees in more places will help. Yet, these actions raise questions about the impact of

honey bees and beekeeping on native bees, and whether getting a hive will “save the bees.”

While the honey bee is ingrained in our culture and important for crop pollination, it is not native to North America—the first hives were brought from Europe by colonists in early seventeenth century—and despite facing many challenges, the honey bee is not at risk. In comparison, there are thousands of species of bees that are native to this continent, some of which are in trouble, with several truly facing the risk of extinction. Whether native or non-native, all bees are impacted by habitat loss, pesticide use, diseases, and other threats, including climate change. We must take action to counter these, but also need to ensure that the steps we take to help pollinators do not endanger the very animals we’re trying to protect. We know that in some situations honey bees are harmful to our native bees, through competition for nectar and pollen and disease transmission. There are reasons to become a beekeeper, such as a fascinating hobby or a desire to produce your own honey, but bee conservation is not one of them. If you are thinking of getting a hive, especially if conservation is a goal, we encourage you to carefully consider whether it is

the right step. Whether you are a beekeeper or not, there are alternative actions that will not only help honey bees, but also the thousands of native pollinators that call North America home.

## History of Honey Bees in North America

The honey bee that is widely found in North America is the European or western honey bee, *Apis mellifera*. It is native to Europe, Africa, and parts of Asia. Thanks to the value of honey, wax, and other hive products, western honey bees have been managed as domesticated livestock for millennia and introduced to many other parts of the world, including North America. They were brought over to North America in the 1620s by European colonists for honey (sugar) and wax production, with the first recorded arrivals at Jamestown in what is now Virginia (DeGrandi-Hoffman 2003), and had reached the West Coast by the 1850s (Carpenter & Harpur 2021). The introduction of the removable frame beehive in 1852 by L. L. Langstroth transformed hive management and made large-scale beekeeping possible, but it was the advent of the automobile and motorized trucks in the early twentieth century that sparked the widespread adoption of honey bees and migratory beekeeping in North American agriculture (Rucker & Thurman 2019).

There is evidence that at one time honey bees roamed at least a part of prehistoric North America—a single fossilized

bee discovered in paper shale from Nevada. It was named as *Apis nearctica* (Engel et al 2009), a different species from the western honey bee. The fossil is the only specimen of this species and there is no indication that it persisted beyond the era in which the shales were formed, ca. 14.5–14 million years ago.

## Honey Bees are Not Endangered

Honey bees are not endangered nor at risk of extinction. In addition to persisting in the wild in those regions where they are native with no significant indication of decline, there are millions of managed hives throughout the world, both within and beyond their native range. Globally, the number of hives is stable or increasing year over year (Phiri et al 2022).

The fact that honey bees are domesticated and managed negates the possibility of being endangered. This does not mean that they do not face challenges, or that hives are completely healthy. The annual hive loss figures in the U.S. that jumped from roughly 10% in the mid-90s to 30–45% starting in 2006 is evidence of the problems facing honey bees and beekeepers. The fact that the number of hives is replenished every year (through a practice known as hive splitting) is testament to the dedication and hard work of beekeepers. Figures from the U.S. Department of Agriculture (NASS 2022) show that in April 2022 there were more than 2.9 million hives in this country.

Like our native bees, there are several threats impacting honey bee health, most notably pesticides, diseases, and a lack of diverse forage. We need to target efforts at ensuring the agricultural landscape can sustain the pollinating animals farming relies on (see Shanahan 2022). We must change how land is managed to create more habitat and alter how pesticides are used to reduce or remove exposure to bees. As with other work focused on habitat, this will benefit both honey bees and native bees.

## Native Bees have Different Needs than Honey Bees

Asked to think of bees, many people picture a hive with a single queen and thousands of workers that tend the honeycomb and dance to tell each other where to find the best forage. However, the honey bee is a really unusual bee and this image of hive life is quite different from the reality of how most bees live. A more accurate generalization is that of a single mom working as hard as she can to build her small nest and make sure that her offspring will be healthy and successful.

There are more than 3,600 species of bees in the United States and Canada (a total which rises to around 4,500 species if we include Mexico). Honey bees, bumble bees, stingless bees, and other highly social species make up fewer than 5% of bees. The rest are mostly solitary, with a single female working to create a nest, typically, a narrow tunnel

Honey bees—and beekeepers—play an essential role in large-scale agriculture and the production of food crops. Honey bees are most effective with mass-flowering crops, and their benefit as pollinators decreases away from farm fields. (Photo: Ian Sane, Flickr [CC BY 2.0].)







A metallic sweat bee forages beside a bumble bee on a thistle, illustrating the diversity of color, size, and hairiness of native bees. Behind is a third bee, probably a small carpenter bee. (Photo: © Bryan E. Reynolds.)



How a bee carries pollen influences how effective it is as a pollinator. The majority of native bees, like this mining bee, carry pollen as dry grains, which can brush off as it continues foraging. (Photo: © Bryan E. Reynolds.)

dug in the ground with brood cells off the tunnel or a hollow twig divided into brood cells. The female supplies the brood cells with nectar and pollen and lays a single egg in each. She lays only two to three dozen eggs in her short adult life and dies before her offspring emerge the following year. With so many different species, there are some that have two or three females tending a nest or a few that do have an overlap between generations, but this annual cycle with the adults active for only a few weeks is the overwhelming norm.

### The Value of Honey Bees as Pollinators

There is no question that honey bees are excellent pollinators of many crops, but they are not the optimum pollinators in all situations. They're at their best with a single mass-flowering resource such as an almond orchard or canola field. In such systems, they can mobilize the colony to exploit the abundant pollen and nectar, and their sheer numbers make up for their relative inefficiency per visit. Consequently, honey bees play an essential role in modern agriculture (aided by the fact that hives can be moved in and out of fields on demand and trucked around between regions to service a variety of crops). Native bees also significantly contribute to crop pollination, and are better pollinators of some crops (Artz & Nault 2011; Garibaldi et al 2013) and can even make honey bees become better pollinators (Greenleaf & Kremen 2006). Nevertheless, our current agricultural system could not exist without the pollination services of honey bees and the hard work of beekeepers.

In North America, the benefits of honey bees as pollinators decrease beyond farm fields, especially in natural areas, where honey bees are often incompatible with the management goals. Such areas are made up of diverse vegetation with flowers of all shapes, sizes, and quantities of resources supporting a diversity of pollinators that also come in all different shapes and sizes. Some native flowers require specific native bees for pollination. For example, some flowers are too small for honey bees to access or don't

have much pollen, so honey bees ignore them. But, there are native bees that will forage for that pollen, even specialize in collecting it. In addition to not pollinating such flowers, honey bees can disrupt pollination networks, and even increase seed set in invasive, or non-native plants, reducing plant diversity.

The way that honey bees interact with flowers means that they sometimes contribute little or nothing to pollination—in a bee-to-bee comparison our native bees tend to be more efficient pollinators. One reason for this is that honey bees groom their pollen and carry it in neat pollen cakes, moistened with nectar and safely tucked into the baskets on their hind legs. By contrast, many of our native bees tend to be messier, carrying pollen as dry grains, often all over their bodies. This messiness means that the pollen they carry is more likely to contact the stigma of another flower and pollinate the plant. In addition, honey bees are known “nectar robbers” of many plants, accessing their nectar in a way that means they don't touch the pollen, often by biting a hole in the base of the flower. Page & Williams (2022) studied the impact of honey bee introductions in meadows in the Sierra Nevada of California. They found that honey bees were ineffective as pollinators of camas lilies and that native bee visitation was reduced in areas with honey bees, resulting in reduced pollination of the lilies.

### Native Bees also Pollinate Crops

Honey bees are profoundly important for large-scale agriculture. However, many species of native bee are much more effective than honey bees at pollinating flowers on a bee-per-bee basis. For example, as few as 250 female orchard mason bees (genus *Osmia*, also called blue orchard bees) can effectively pollinate an acre of apples, a task that would require one or more hives, each with thousands of honey bees. There are many reasons for this increased efficiency. Mason bees are active in cooler and wetter conditions than honey bees, and how they actually handle each flower when

## Native Bees at Risk

Several species of our native bees are in danger of extinction, and some may be at or beyond the brink. One species, Franklin's bumble bee, native to Oregon and California, has not been detected since 2006, despite significant efforts to find it. Eight other native bees join Franklin's bumble bee on the list of species protected by the U.S. Endangered Species Act—the rusty patched bumble bee is the best known—and others have been petitioned and are currently under review by the U.S. Fish and Wildlife Service.

Extinct?: Franklin's bumble bee (Brendan White, USFWS).



Endangered: Rusty patched bumble bee (Xerces Society / Rich Hatfield).



At-risk: Western bumble bee (Xerces Society / Rich Hatfield).



foraging leads to more pollen movement than from honey bees alone.

In other cases, honey bees are simply not well adapted to certain crops. Alfalfa flowers have a very active pollen-release structure that hits bees. Honey bees try to avoid being hit, while the alkali bee (*Nomia melanderi*) is happy to forage on these flowers. Other native bees specialize in one type of flower. Squash bees (in the genera *Peponapis* and *Xenoglossa*), for example, primarily visit flowers from the squash plant family (the cucurbits). The females, which often nest in the ground below the plants, may start foraging before dawn.

Further, bumble bees and many other native bees perform buzz pollination, highly beneficial for the cross-pollination of tomatoes, blueberries, cranberries, tomatoes, and peppers, among other plants. During buzz pollination, the bee grabs onto the flower and vibrates her flight muscles, releasing a burst of pollen otherwise inaccessible within the flower. Honey bees don't have this behavior, and thus cannot contribute to the pollination of these crops.

## A Diversity of Bees is Essential for a Healthy Environment

There are more than 3,600 species of native bees in the United States, which have coevolved with our native plants. As efficient as honey bees are at gathering and transporting pollen to the hive, they are not adapted to forage on all flowers. Buzz-pollination is one behavior that honey bees lack, so the many flowers that benefit from being vibrated (e.g., shooting stars, flax lilies, and manzanita) don't benefit from honey bee visits. There are also many specialist bees that forage for pollen on one or a small range of flower species. The spring beauty mining bee is one example. The female bees collect pollen from only two species of spring beauty, a woodland wildflower that blooms during the brief period from winter ending to the forest canopy leafing out. The leg hairs between which the bees carry pollen are just the right size and shape to hold the flower's pollen.

There are numerous other examples of specialist bees that live in all habitats from the cool conditions of New England's broadleaf forests to the heat of the Southwest deserts, and which play an essential role for the plants they visit. Beyond individual bee-plant interactions, there is also evidence that a diversity of bees is necessary to support plant communities and ecosystems. By looking at which bees visited which flowers, Simpson et al (2022) were able to identify the bees that were important for pollinating the flowers in plant communities in New Jersey. The sites had between 22 and 86 species of bees, and the researchers showed that on average 25 percent of the bee species that were important for sustaining a plant community were rare. Clearly, a diversity of bees is necessary to maintain our environment.



## Honey Bees Can Harm Native Bees

It is absolutely true that honey bees don't always harm native bees: when resources are plentiful, honey bees are present at low densities, and hives are well-tended, the risks are reduced. Yet, with a changing climate and a growing human population, such places are increasingly rare and becoming progressively more valuable. Research shows that honey bees compete with native bees for pollen and nectar (Mallinger et al 2017; Hatfield et al 2018 and citations within; Iwasaki & Hogendoorn 2022), potentially putting our natural ecosystems at risk. Cane and Tepedino (2017) calculated that over a period of three months, a hive collects as much pollen as could support the development of 100,000 native solitary bees.

Moreover, in recent years evidence has emerged that through competition for resources, honey bees can change a pollination network, disrupting both plant and bee populations. Other evidence shows that honey bees can pass diseases to our native bees (for example, Deformed Wing Virus transferred from honey bees to bumble bees), as well as amplify and distribute diseases within a bee community. Because disease is a leading hypothesis for the decline of our endangered bumble bees (see sidebar opposite), these are real, relevant threats that could have lasting impacts on the survival of species.

## Why a Backyard Hive Won't "Save the Bees"

If you are thinking of getting a hive, we encourage you to consider carefully why you want to do so. Adding a hive to your backyard, on your office or hotel roof, or in a local park or community garden will not help native species; indeed, their very presence has the potential to harm them. Introducing more bees to forage in the landscape does nothing to improve the landscapes' ability to support bees, and only increases competition and other stressors for the bees currently there.

Bee conservation should focus on creating adequate habitat to support the entire life cycle of bees. This includes appropriate nesting sites. The great majority of native bees are solitary, making their nests in the ground or hollow twigs. (Photos: [l] Matthew Shepherd; [c, r] Sara Morris.)

## Problems with Diseases

Disease spread and amplified from commercial bumble bee pollinators is currently implicated as a major factor in the dramatic decline of two species of bumble bees that have received protection under the Endangered Species Act. While current evidence does NOT suggest honey bees contributed to those declines, it does show that disease can be a major threat to native bee populations, and we need to do a better job of protecting them from harm.

Further, honey bees forage over a large area—typically up to a mile from the hive, but sometimes much further—so the impact of a hive extends far beyond your garden (even your neighborhood). Evidence that honey bees compete directly with native bees for the available pollen and nectar (see Hatfield et al 2018 and citations within) continues to be reinforced by studies demonstrating changes in native bee activity in the presence of honey bees (e.g., Ropars et al 2019; Prendergast & Ollerton 2021; MacInnis et al 2023). These effects are exacerbated in certain landscapes, and at certain times of year, but the fact remains that honey bees can negatively impact bee communities by increasing competition and shifting resource use among native bees.

Even in Europe, where honey bees are native, there is growing concern about the density of hives in urban areas. Researchers in Switzerland looked at the sustainability of beekeeping in several cities (Casanelles-Abelia & Moretti 2022). They assessed the forage plant availability in the urban landscape and compared that to the known number of hives, and concluded that there was not enough forage to support the hives. Their recommendations included regulating hive numbers and expanding habitat. In Britain, the London Beekeepers Association found that some parts



of London had four-times as many hives as the landscape could support (LBKA 2020), noting that honey bees “are not in decline – not globally, nor in the UK” and that “this misunderstanding can lead to inappropriate actions and unintended consequences.” The Association encouraged residents to plant flowers to expand habitat and work to prevent further habitat loss. Also in Britain, the nonprofit Buglife suggests that a beekeeper should add 5 acres (2 hectares) of flowering habitat for each hive (Buglife 2021).

There are reasons for getting into beekeeping—you like honey, you want an intimate relationship with a fascinating insect, it’s a fun hobby—but getting a hive to save bees has been likened to keeping chickens to save songbirds. Both honey bees and chickens are domesticated livestock and their care and husbandry won’t directly help wild-living native species, nor improve the habitat that is needed to support them. Beekeeping is different from bee conservation, which focuses on providing the conditions that bees need—flowers, nest sites, protection from pesticides.

### **What Can I do Instead of Getting a Honey Bee Hive?**

There are many steps you can take to help bees. The primary focus should be on creating the conditions necessary to provide bees with the food and shelter they need to complete their entire life cycle. The core components of bee conservation are providing flower-rich habitat for foraging, places where bees can nest and overwinter, and an environment free of pesticides.

#### **Grow flowers**

To be of greatest benefit to the widest diversity of pollinators, foraging habitat should contain a variety of plants that provide a succession of flowers in a range of shapes and colors throughout the growing season. Depending on where you live in the U.S. or Canada, adult bees can usually be seen anytime between February and November (even all

year in subtropical climates). A sequence of plants—from willows in the spring to goldenrod in the fall—that provide a diversity of flowers throughout the growing season is needed to support bee species with different flight periods. Native plants are frequently the best choice because native bees tend to prefer them over introduced species or horticultural varieties. Native plants are also adapted to grow in the local climate and soils and, once established, they require less water and maintenance. However, non-invasive, non-native plants can be beneficial and may be used when cost and/or availability are limiting factors. It is important to source your plants from nurseries and providers that do not pre-treat plants with systemic insecticides.

#### **Provide nest sites**

The majority of our native bees need bare ground (or at least, access to the soil) in order to dig nest tunnels. Most of the other species need existing tunnels in hollow stems or dead trees in which to create brood cells for their offspring. In addition to ensuring your landscape includes these kinds of features, it is important to retain them for the entire year. Although solitary bee adults may only be active for a few weeks, bees live for a year, spending most of that time dormant in the nest. Bumble bees build their nest in a small cavity, such as an abandoned chipmunk nest, and then overwinter in loose bare soil, pine duff, or leaf litter.

#### **Avoid pesticides**

Given the damage insecticides inflict upon pollinators, use of these chemicals should be eliminated or reduced whenever possible. Consider using integrated pest management (IPM), a system that enables you to assess need and use the least hazardous options for bees, when action is necessary against a pest. Of course, healthy, diverse pollinator habitat will also support other beneficial insects, such as the predators or parasites of pest insects. In time, your habitat will reach an ecological balance that negates the need for pesticides.

## **Bring Back the Pollinators Campaign and Pollinator Protection Pledge**

The Xerces Society’s Bring Back the Pollinators campaign is based on four principles:

- ⇒ Grow pollinator-friendly plants
- ⇒ Provide nesting or egg-laying sites
- ⇒ Avoid pesticides
- ⇒ Share the word

Find information about how you can adapt these to your location and sign the Pollinator Protection Pledge at:

**[BringBackThePollinators.org](http://BringBackThePollinators.org)**





# Recommendations for Honey Bees

For some people, the first thought for how to save the bees or help pollinators is to get a honey bee hive. On the surface, it makes sense—if bees are declining, more bees will help. However, a hive in your backyard, on your office or hotel roof, or in a local park or community garden may not help bees, and has the potential to do the opposite. Honey bees are fascinating insects and there are reasons to keep them, whether as a business or hobby. Although they are important

for agriculture, the benefit that honey bees bring to gardens, parks, and in particular, natural areas is mixed. Yes, they raise awareness and offer educational opportunities, but they can pose a risk to our native bee species and the presence of hives may be harming the pollinators you seek to help. In all situations, first and foremost, we encourage you to focus on creating habitat that is rich in flowers, provides nesting sites, and is protected from pesticides.

---

## Towns and Cities

- ⇒ Think carefully about why you want honey bees and the potential impacts before getting a hive, especially in nature parks, natural areas, or other places dedicated to wildlife protection.
- ⇒ If you choose to keep honey bees:
  - ⇒ Do all you can to manage bee mites and to help ensure the bees are healthy to avoid spreading disease to bumble bees and other native bees.
  - ⇒ Create a significant amount of habitat to help them thrive and to protect our native bees.
  - ⇒ Support habitat creation policies and projects in your community.
- ⇒ If you have a garden or other space:
  - ⇒ Grow pollinator-friendly flowers, provide nest sites, and avoid pesticides
  - ⇒ Leave fallen leaves under trees and shrubs to create potential overwintering refuge for bumble bee queens.
  - ⇒ Post signs letting neighbors know your garden is pollinator habitat.
- ⇒ Take the Pollinator Protection Pledge.
- ⇒ Advocate within your community to engage more people in pollinator habitat conservation efforts.
  - ⇒ Work with your city council and other community members to join Bee City USA.
  - ⇒ College campuses can join Bee Campus USA.
- ⇒ Participate in community science projects such as Bumble Bee Watch.

## Wildlands and Natural Areas

- ⇒ Our natural areas are the last refuge for our native bees, and in these landscapes they should be protected from unnecessary competition and disease as much as possible.
- ⇒ Public land managers should conduct an assessment to determine the likely impact on native bees—especially imperiled species—and other pollinators, if asked to host apiaries of honey bees.
- ⇒ Do not place hives within two miles of areas where at-risk species of bees or flowers are known to occur.

## Farming and Food

- ⇒ Growers can adopt bee-safe farming techniques, such as planting or protecting high-quality permanent pollinator habitat (hedgerows, flower strips, etc.), include flowering cover crops in rotations, and use integrated pest and pollinator management (IPPM) or other pest management programs designed to reduce risks to bees, pollinators, and other beneficial insects.
- ⇒ Consumers can support farmers who practice bee-safe farming techniques or prioritize buying organic products.
- ⇒ Consumers and food companies can look for farms or food products that have been independently certified as meeting Xerces' Bee Better™ standard.

---

**We make the commitment to you that we will work every day to protect pollinators and their habitat. Will you support our work? Make a tax-deductible donation to the Xerces Society today!**

Visit [xerces.org/donate](https://xerces.org/donate) to learn more.

## References

- Artz, D. R., and B. A. Nault. 2011. Performance of *Apis mellifera*, *Bombus impatiens*, and *Peponapis pruinosa* (Hymenoptera: Apidae) as pollinators of pumpkin. *Journal of Economic Entomology* **104**:1153–1161. DOI:10.1603/ec10431
- Buglife. 2021. “Save the bees! (but which ones?)” by Andrew Whitehouse, posted May 6, 2021. Available at [www.buglife.org.uk/blog/save-the-bees-but-which-ones/](http://www.buglife.org.uk/blog/save-the-bees-but-which-ones/) [accessed 5/22/23].
- Cane, J. H., and V. J. Tepedino. 2017. Gauging the effect of honey bee pollen collection on native bee communities: *Apis* pollen depletion and native bees. *Conservation Letters* **10**:205–210. DOI:10.1111/conl.12263
- Carpenter, M. H., and B. A. Harpur. 2021. Genetic past, present, and future of the honey bee (*Apis mellifera*) in the United States of America. *Apidologie* **52**:63–79. DOI:10.1007/s13592-020-00836-4
- Casanelles-Abelia, J., and M. Moretti. 2022. Challenging the sustainability of urban beekeeping using evidence from Swiss cities. *npj Urban Sustainability* **2**:3 DOI:10.1038/s42949-021-00046-6
- DeGrandi-Hoffman, G. 2003. Honey Bees in U.S. Agriculture: Past, Present, and Future. In *For Nonnative Crops, Whence Pollinators of the Future?*, edited by K. Strickler and J. H. Cane, 11–20. Annapolis, MD: Entomological Society of America.
- Engel, M. S., I. A. Hinojosa-Días, and A. P. Rasnitsyn. 2009. A honey bee from the Miocene of Nevada and the biogeography of *Apis* (Hymenoptera: Apidae; Apini). *Proceedings of the California Academy of Sciences* **60**:23–38.
- Garibaldi, L. A., I. Steffan-Dewenter, R. Winfree, M. A. Aizen, R. Bommarco, S. A. Cunningham, C. Kremen et al. 2013. Wild bees enhance fruit set regardless of honey bee abundance. *Science* **339**:1608–1611. DOI:10.1126/science.1230200
- Greenleaf, S. S., and C. Kremen. 2006. Wild bees enhance honey bees’ pollination of hybrid sunflower. *Proceedings of the National Academy of Sciences* **103**:13890–13895. DOI:10.1073/pnas.0600929103
- Hatfield, R. G., S. Jepsen, M. Vaughan, S. Black, and E. Lee-Mäder. 2018. *An Overview of the Potential Impacts of Honey Bees to Native Bees, Plant Communities, and Ecosystems in Wild Landscapes: Recommendations for Land Managers*. 12 pp. Portland, OR: The Xerces Society for Invertebrate Conservation. Available at <https://xerces.org/publications/guidelines/overview-of-potential-impacts-of-honey-bees-to-native-bees-plant> [accessed 5/22/23].
- Iwasaki, J. M., and K. Hogendoorn. 2022. Mounting evidence that managed and introduced bees have negative impacts on wild bees: an updated review. *Current Research in Insect Science* **2**:100043 DOI:10.1016/j.cris.2022.100043
- LBKA [London Beekeepers Association]. 2020. The London Bee Situation. An LBKA Outline Report. Available at [www.lbka.org.uk/london.html](http://www.lbka.org.uk/london.html) [accessed 5/22/23].
- MacInnis, G., E. Normandin, and C. D. Ziter. 2023. Decline in wild bee species richness associated with honey bee (*Apis mellifera* L.) abundance in an urban ecosystem. *PeerJ* **11**:e14699 DOI:10.7717/peerj.14699
- Mallinger, R. E., H. R. Gaines-Day, and C. Gratton. 2017. Do managed bees have negative effects on wild bees?: A systematic review of the literature. *PLoS ONE* **12**(12):e0189268. DOI:10.1371/journal.pone.0189268
- NASS [National Agricultural Statistics Service]. 2022. “Honey Bee Colonies.” 18 pp. Washington, D.C.: USDA-NASS.
- Page, M. L., and N. M. Williams. 2023. Honey bee introductions displace native bees and decrease pollination of a native wildflower. *Ecology* **104**:e3939. DOI:10.1002/ecy.3939
- Phiri, B. J., D. Fèvre, and A. Hidano. 2022. Uptrend in global managed honey bee colonies and production based on a six-decade viewpoint, 1961–2017. *Science Reports* **12**:21298. DOI:10.1038/s41598-022-25290-3
- Prendergast, K., and J. Ollerton. 2021. Impacts of the introduced European honeybee on Australian bee-flower network properties in urban bushland remnants and residential gardens. *Australian Ecology* **47**(1):35–53. DOI:10.1111/aec.13040
- Ropars, L., I. Dajoz, C. Fontaine, A. Muratet, and B. Geslin. 2019. Wild pollinator activity negatively related to honey bee colony densities in urban context. *PLoS ONE* **14**(9):e0222316. DOI:10.1371/journal.pone.0222316
- Rucker, R. R., and W. N. Thurman. 2019. “Combing the Landscape: An Economic History of Migratory Beekeeping in the United States.” 42 pp. Orange, CA: Chapman University Economic Science Institute
- Shanahan, M. 2022. Honey bees and industrial agriculture: What researchers are missing, and why it’s a problem. *Journal of Insect Science*, **22**(1):14. DOI:10.1093/jisesa/ieab090
- Simpson, D. T., L. R. Weinman, M. A. Genung, M. Roswell, M. MacLeod, and R. Winfree. 2022. Many bee species, including rare species, are important for function of entire plant–pollinator networks. *Proceedings of the Royal Society B: Biological Sciences* **289**:20212689 DOI:10.1098/rspb.2021.2689

---

## Acknowledgments

Written by Rich Hatfield and Matthew Shepherd, and reviewed by Scott Black, Mace Vaughan, and Eric Lee-Mader (all Xerces Society staff). A special thank you to Scott McArt of Cornell University for his review. Editing and design by Matthew Shepherd.

This publication was made possible by the generosity of Xerces Society members and individual donors.