



Factors Affecting Bee Decline

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Bees contribute to the pollination of agricultural and wild plant species, which is a crucial ecosystem service. For pollination services to continue throughout time, bee diversity (i.e., the variety of species and their quantity) is essential, but unfortunately, a number of species and populations have been under decline. Bee population decreases have been linked to a variety of reasons, such as habitat loss, poor apiary management, pesticide use, climate change, pests and infections, competition between native and introduced bee species, poor nutrition, and others. Landscapes can be optimized for bees by providing shelter and nesting sites, an abundance of spring-through-fall pollinator-friendly flowers, and protection from pesticides.

Habitat Loss: Urbanization and other human activities that destroy or remove native areas can have a severe influence on bees and other pollinators, and these habitat losses can affect both social and solitary bee species. Some bumble bee species, as well as ground-nesting bees, can suffer from the loss of nesting habitat caused by landscape weed fabrics. Native bee diversity, abundance, and pollination services are reduced in conventional crop fields that are cut off from natural habitats. For instance, honey bees were necessary for pollination in a conventional crop of watermelons (a crop heavily dependent on pollinators) grown away from natural habitats.

Improper Apiary Management: Poor management of honey bee hives can negatively affect not only colony health and longevity, but it can also affect native bees when pathogen spill overs occur. For instance, the Varroa mite (*Varroa destructor*), which is known as specialist honey bee parasite, has been found to vector deformed wing virus (DWV) to wild bumble bees. Practicing good management techniques such as prompt diagnosis and control of pests and diseases, proper nutrition, obtaining local queens that are better adapted to the local environment, separating healthy colonies from those showing signs of collapsing, routine cleaning and replacement of older frames, and minimizing risk from pesticides.

Climate Change: Climate change can have a significant impact on bee dispersal, phenology, pollination, abundance, and danger of illnesses and pests. Increased temperatures are most likely responsible for some bee species emerging from overwintering habitats sooner than usual. This change in spring emergence might cause disruptions in plant-pollinator interactions. For instance, the yellow avalanche lily (*Erythronium grandiflorum*), which is also found in Utah, has suffered from poor pollination rates and decreased fruit set in a subalpine region of western Colorado. This is assumed to be brought on by an incongruity between the timing of blooms and the emergence of pollinators.

Pesticides: If chemical pest control is necessary, less harmful alternatives like insecticidal soap should be chosen and applications shouldn't be performed when bees are foraging actively or when plants are blooming, releasing pollen, or making nectar. Early spring

pesticide applications before bee emergence could particularly harm solitary bees and bumble bee colonies, which are fully dependent on their overwintering solitary queen.

Pathogens and Pests: By sharing floral resources, diseases can spread both within and between pollinator species. Diseases like parasitic mite syndrome, *Nosema bombi*, and American foulbrood*, viruses like deformed wing, black queen cell, Lake Sinai virus 2, and Israeli acute paralysis virus, interactions with pests like the small hive beetle and the newly introduced Africanized honey bee (*Apis mellifera scutellata*), and parasites like the Varroa mite can all contribute to bee population declines (*V. destructor*) an invasive external parasite that is thought to play a large role in colony collapse disorder.

Poor Nutrition: The majority of the food consumed by bees comes from pollen, which gives them the proteins, amino acids, lipids, vitamins, and minerals required for growth and development. Poor nutrition may result from other issues such habitat loss, increasing agricultural productivity, and decreased pollen and nectar production due to more frequent drought and heat events. Our country's agriculture is dominated by monoculture, which limits the options available to bees when choosing plants to pollinate.

Competition: Although honey bees are an essential component of agriculture, their coexistence with native bees has a number of detrimental effects, such as increased competition for resources like pollen, nectar, and nesting habitat, the spread of pathogens, and the alteration of plant communities by pollinating exotic weeds and facilitating their spread.

Colony Collapse Disorder: In honey bee hives, colony collapse disorder (CCD) was first noted in the years 2006–2007. Worker bees vanish as a result of CCD, but the queen, young, and food are still present. Because there are not enough bees in the collapsing colonies to maintain brood, the remaining bees are hesitant to eat the beekeeper's supplied food. Although the exact cause of CCD is unknown, it is believed that a number of variables, such as pests and infections, secondary chemical poisoning, and inadequate nutrition are to blame.

Options for promoting Pollinators

- Make sure the hives are hydrated and healthy. Feed and maintain each hive properly, and to keep hives cooler in the summer, paint supers a light color.
- Include native plants in your landscaping that produce blossoms all through the growing season. Concentrate on developing a variety of floral habitats in urban locations.
- Plant flowers that bloom early. Early blooms are a crucial source of food for overwintering bees, and plant clusters are more efficient food sources than a single plant.
- Avoid using chemical fertilizers and pesticides altogether in your landscape, especially in the early spring, to allow all bees a healthy start to the year.
- Provide bees with cool, shaded locations to rest in addition to a clean water source with floating objects to give drowning bees a way to escape.
- By avoiding tilling or disturbing the ground where nests are located, you can increase the nesting and overwintering habitat for ground-nesting bees.
- To attract local cavity-nesting bees, include plants with hollow or pithy stems year-round in your landscape, and keep your nesting structures in good condition.