Learning A–Z	level Z2	Multi-level	Y Z1 Z2
Grade	5+	Word Count	1,999
Lexile	1110L	Nonfiction • Informational	

Refer to the Focus Question on page 2 of this title to guide discussion and support additional learning connected to the text.

We depend on honeybees to pollinate the plants that produce our food. Beekeepers, farmers, and scientists want to know why honeybees started vanishing this century. **The Case of the Disappearing Honeybees** explores the mystery of colony collapse disorder (CCD), a worldwide problem that results in millions of honeybees disappearing without a trace every year. The book can also be used to teach students how to compare and contrast information and the proper use of commas in a series. The book is also available for levels Y and Z1.

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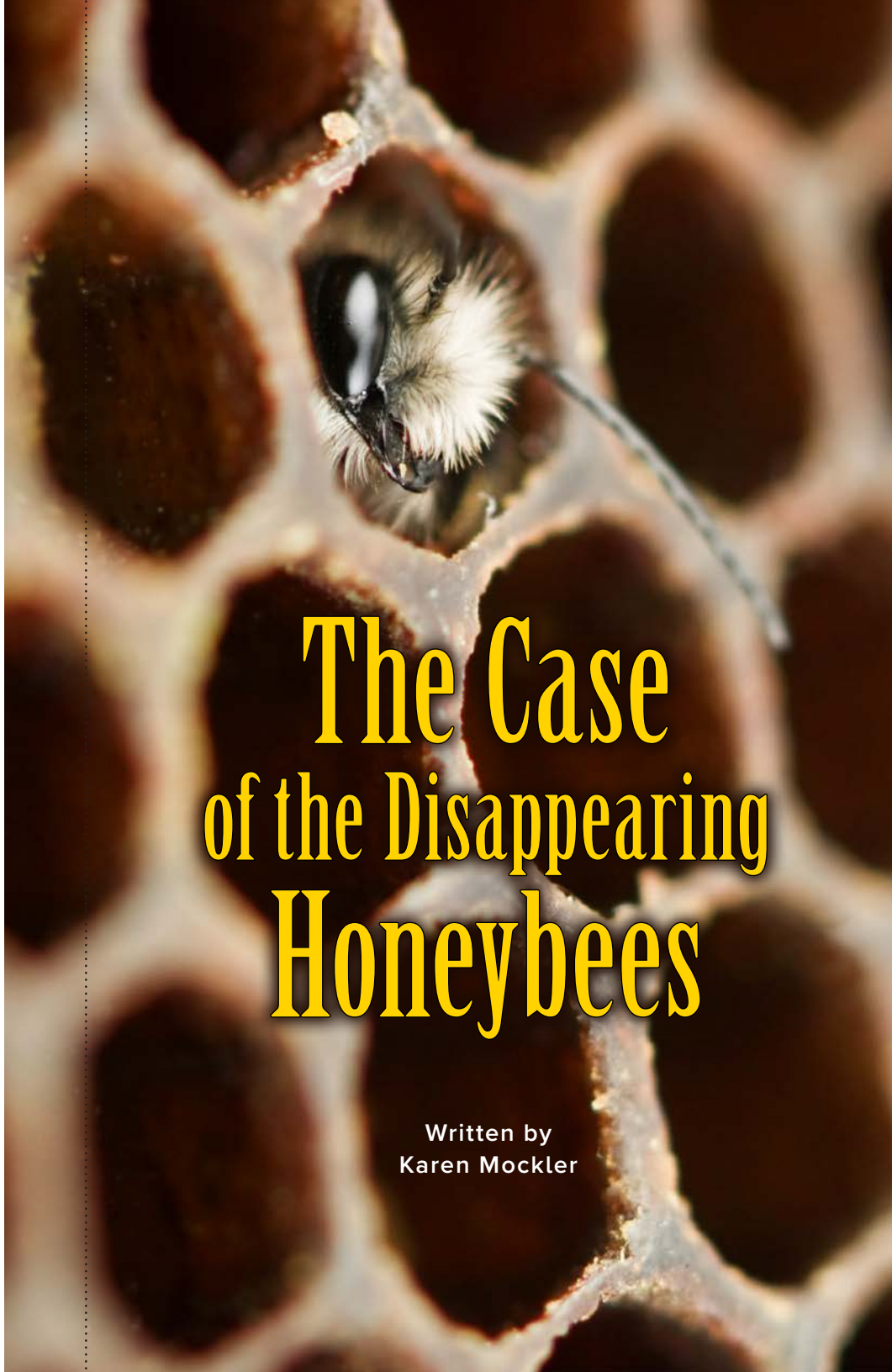


The Case of the Disappearing Honeybees

Written by
Karen Mockler

migratory *(adj.)* page 15
of or relating to the regular movement from one habitat or region to another at certain times of the year

onset *(n.)* page 12
the start of something

parasites *(n.)* page 8
plants or animals that grow on or feed off others

pathogen *(n.)* page 8
a microorganism, such as a virus or a bacterium, that causes disease

pesticides *(n.)* page 10
chemical or biological substances that kill harmful animals or plants

pollinate *(v.)* page 4
to put pollen in a flower in order to fertilize it

sanctuaries *(n.)* page 17
safe places

susceptible *(adj.)* page 8
easily affected or influenced; vulnerable

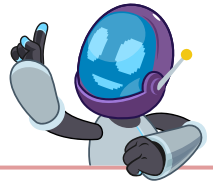
systemic *(adj.)* page 11
of, relating to, or affecting an entire system or body

The Case of the Disappearing Honeybees

Written by Karen Mockler

Focus Question

What are some factors contributing to the disappearance of honeybees?



Words to Know

apiaries
bustling
compromised
contagion
demise
disorder
fertilization
forage
gruesome
migratory
onset
parasites
pathogen
pesticides
pollinate
sanctuaries
susceptible
systemic

Connections

Writing

Write a letter to the editor persuading readers to help save honeybees. Use the information from this book and outside resources to explain the importance of honeybees and what people can do to help them.

Science

Research two different species of bees and write a report comparing and contrasting them.

Glossary

apiaries *(n.)* page 6
places where collections of hives are kept for raising bees

bustling *(adj.)* page 14
moving in a rushed, noisy manner

compromised *(adj.)* page 8
damaged or impaired in some way

contagion *(n.)* page 15
an illness spread through direct or indirect contact, or the process by which it is spread

demise *(n.)* page 8
the end or failure of something; death

disorder *(n.)* page 7
a physical or mental condition that is unhealthy or not normal

fertilization *(n.)* page 5
the process of combining male and female cells to create a new animal or plant

forage *(v.)* page 8
to search for or gather food or other supplies

gruesome *(adj.)* page 9
causing fear, shock, or disgust

Anyone with a bit of outdoor space to spare can help local bees by keeping the kinds of plants the bees need.

Even commercial monoculture farmers can find small ways to help bees without sacrificing a productive harvest. Setting aside a small portion of their land for native plants that would sustain bees all year long instead of just for a couple of weeks each year would help create a population of homegrown pollinators. Farmers could even investigate more organic means of pest control that would let them avoid using toxic chemicals to deal with pests.

Bees are small but important contributors to the health and well-being of many other species, including humans. Taking action to protect them helps not only the bees but us as well.

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A healthy honeybee colony moves into a new hive.

Who Took My Strawberries?

Think of your favorite fruit.

Now imagine a world in which that fruit—and many other fruits, nuts, vegetables, and flowers—is extremely rare, perhaps even nonexistent.

Such would be the world without honeybees. Honeybees don't just make honey. They **pollinate** the blossoms of plants. One in three bites of the food people enjoy is the product of honeybees' hard labor.

Yet, in 2007, honeybee populations began to decline rapidly. The reason has puzzled scientists for years. Although the problem slowed over time, the mystery of what caused it in the first place remains. Researchers are still working today to help save the honeybees.

Honeybees benefit from access to a diversity of plant life; having a variety of native wildflowers gives honeybees a longer foraging season. People can create honeybee **sanctuaries** in their yards—places full of blooming native plants where bees can reduce their contact with pesticides and thrive in a natural environment.

Rooftop and backyard pollinator gardens are gaining popularity in many rural and urban neighborhoods. The bees visit parks and gardens, producing honey and pollinating native fruit trees and plants.

What Lawns Lack

While colony collapse disease is in decline, another bee crisis is on the rise. Many species of native bees are endangered and at risk of extinction. Manicured lawns have contributed to wild bee decline. Certain types of bees rely on certain plants to survive. Because there are fewer native plants and more honeybees—which farmers bring in to pollinate crops—wild bees are having trouble finding food and shelter.

Help the Bees

Because of the complexity of CCD, scientists have yet to pinpoint an exact cause or a complete cure. However, they have improved prevention measures and discovered some promising treatments. As a result, the rates of CCD have dropped over time—though not as much as scientists would like.

Solving the case of the disappearing honeybees once and for all will require additional research. In the meantime, we can use the available knowledge and resources to foster bee-friendly environments that will benefit plants, bees, and people.

Africanized Survivors

In some places, bee species seem to be breeding and evolving into stronger strains. For instance, the Africanized honeybee is a hybrid of the European honeybee and the African honeybee. Some of these bees escaped from a Brazilian lab in 1957 and spread north, reaching the United States in 1990.

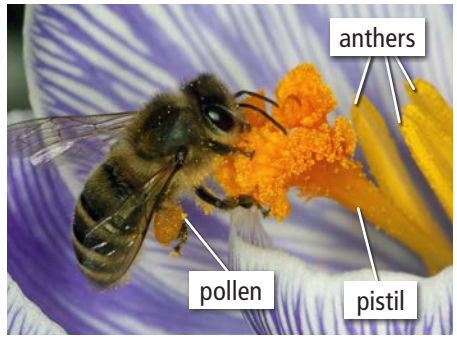
People were horrified. Africanized bees are more aggressive than European honeybees, and rumors spread that they didn't make honey or pollinate plants. In fact, they do both those things. The bees are more defensive, but they are also healthier. Some beekeepers began to welcome them as nature's answer to CCD.

Busy Bees

Honeybees live in colonies, busy places where each bee performs a specialized task. All the bees in a colony depend on one another and must work together to keep the hive humming. Outside the colony, a lone honeybee isn't likely to survive for more than twenty-four hours.

Honeybee activity outside the hive is dedicated to a single purpose—finding flowers in bloom and collecting pollen from them for food as well as nectar to make honey. Honeybees from a single, healthy hive can visit more than 100,000 flowers in a day while performing one of the most critical processes in nature: pollination.

When a bee brushes against the anthers on the inside of a flower, the bee's body picks up pollen grains from that flower. The pollen is transferred to the pistils of other flowers as the bee makes its rounds from blossom to blossom. The ongoing transfer of pollen from anthers to pistils is pollination, leading to **fertilization**, a process that will eventually result in seed formation.



A bee pollinates a flower.

Without pollination, plants don't reproduce. They eventually die off without being replaced, which presents a serious problem for animals that rely on those plants as a food source.

Missing in Action

The problem of disappearing honeybees became evident in October 2006, when an American commercial beekeeper arrived at one of his **apiaries** in Florida to retrieve four hundred hives. Three weeks before, the hives had appeared active and healthy, but now they were empty except for food, baby bees, and a few queens. The beekeeper surveyed his surroundings, expecting to see piles of dead insects littering the ground, but there was no sign of the twenty million bees that had disappeared.

A frame from a honeybee colony before and after the bees vanished.

This beekeeper's experience, it turns out, was not unique. Reports of other losses began to surface across the United States, Europe, China, and other regions. The numbers were shocking.

Migrant bees face another problem—**contagion**. When bees arrive at their next pollination job, they come in contact with millions of other migrant-worker bees. By one estimate, two-thirds of all bees in the United States interact on these huge farms. Bringing in bees from different parts of the country (or world) also spreads parasites and disease at a rapid rate, as they travel cross-country along with the honeybees.

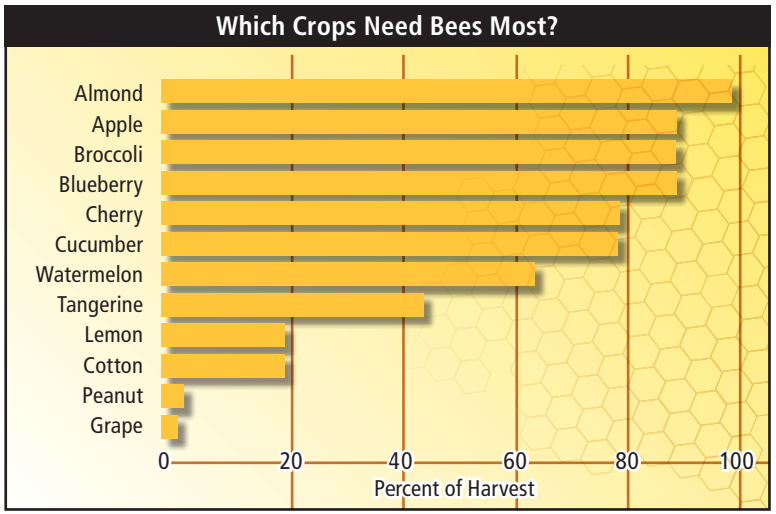
In the United States, beekeepers have attempted to fend off disease by adding antibiotics to the sugar water that the bees feed on as they travel. Using antibiotics as a preventive measure, however, creates a problem of its own. Overuse of antibiotics may have weakened the honeybees' ability to fight other diseases and resist the effects of pesticides. The drugs also kill off beneficial bacteria that help the honeybees process food. An additional concern is that, over time, bacteria can build up resistance to antibiotics, which renders the drugs ineffective.

The hazards of **migratory** beekeeping are just one more piece of the complex puzzle of CCD. As with any puzzle, every piece matters. It looked more and more as though CCD was a complicated mix of biological, chemical, and physical stresses.

Around Valentine's Day, bees are trucked to the California groves, and they go to work when the almond trees start to bloom. For two weeks, those 600,000 acres (242,811 ha) of blooming trees are a **bustling** and beautiful sight.

The call for pollination services continued to increase, and managed honeybee colonies declined rapidly to very low numbers.

Once the blossoms are gone, the bees are packed up and shipped to a new location. Transport is tough on the bees since they are shut inside trucks with no way to obtain flower nectar. The sugar water that beekeepers feed them instead is comparable to junk food. Millions of bees die from the stress of commuting from job to job.



During the winter of 2006–2007, roughly 750,000 of the estimated 2.4 million bee colonies in the United States had vanished. On average, U.S. beekeepers lost 38 percent of their colonies. The largest known disappearance occurred during 2008 in the almond tree groves of California, where two billion bees vanished. Faced with an emerging crisis, farmers and beekeepers were desperate for science to shed some light on the mystery.

On the Case

Scientists named the problem *colony collapse* ***disorder*** (CCD) and began documenting its symptoms. CCD happens in a matter of weeks when most of the occupants of what seems to be a healthy hive suddenly vanish. Few, if any, dead bees from the colony can be found. The only bees remaining are the very young and the queen—members of the colony that normally would never be left alone by the rest of the bees.

Once the symptoms of CCD were identified, the real detective work began. Scientists from around the country set out to determine the cause of the disorder and propose a solution. CCD scientists surveyed beekeepers and collected samples of wax, pollen, and live and dead bees (when they could be found). When scientists

dissected the bees, they discovered that the bees were afflicted with multiple diseases, which suggested the bees had **compromised** immune systems.

Next, scientists considered germs known to damage bees' immune systems. Scientists found fungal bacteria that made it difficult for bees to eat and left them too weak to **forage**. They also detected a variation of a well-known fatal **pathogen** called *acute bee paralysis virus* (ABPV) in a large number of CCD hives. Yet efforts to pinpoint a single germ as the root cause of the bees' **demise** led nowhere. Everything they had looked at seemed to be the result of CCD rather than its cause.

The scientists next turned their attention to several **parasites**. One, an ominously named mite called *Varroa destructor,* is also known as the "vampire mite." It clings to adult bees, sucking their blood and leaving them with open wounds that make them **susceptible** to infection.

A scientist takes samples from a hive with CCD.

Do You Know?

Ancient Egyptians floated beehives on rafts down the Nile River to follow the bloom.

Today, trucks like this one transport hives all over the country.

Since honeybees are excellent pollinators, moving them into a field while crops are blooming is a way for farmers to ensure a plentiful harvest. Today in the United States, semi-trailer trucks transport hives from one farm to another all over the country. The honeybees they haul pollinate $15 billion worth of food annually in the United States alone.

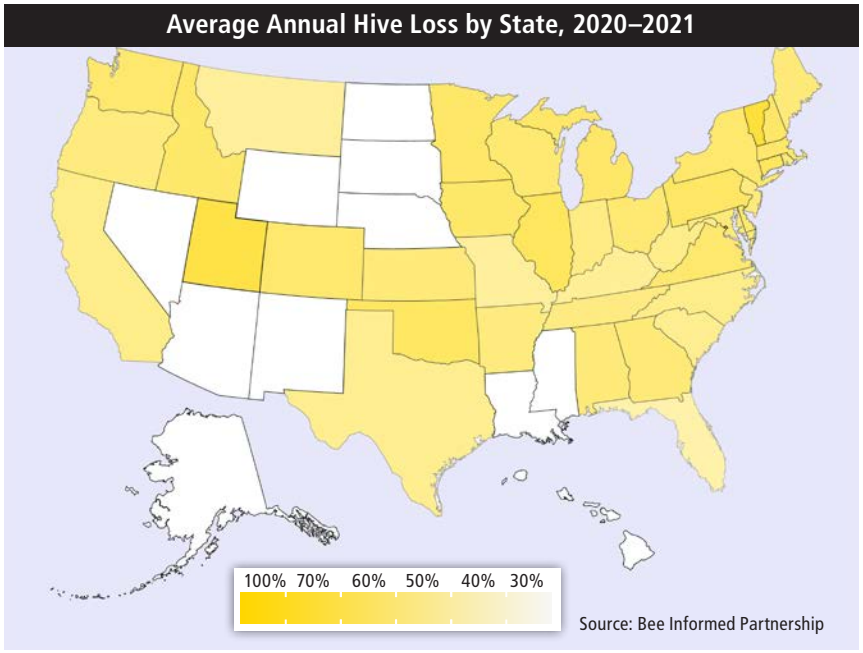
The thought of trucking a million bees down the highway may seem strange, but it helps production with modern monoculture farming. Farmers might need bees to pollinate one crop in February and another one in a different part of the country in April. Almond trees, for example, are completely dependent on honeybees for pollination.

Scientists wonder if systemic pesticides might weaken the bees' immune systems, allowing pathogens like the paralysis virus to take hold. It's also possible that, since the pesticides affect the nervous system, they might interfere with the bees' ability to learn, remember, and navigate. This could explain the bees' failure to return to the hive after foraging.

It seems logical to draw these conclusions since the introduction of these new pesticides coincides with the appearance of CCD, but the overlap in timing is not enough to suggest that the pesticides actually cause CCD. In fact, recent research says otherwise. Researchers are now becoming even more convinced that the **onset** of CCD does not have a single cause but may instead result from a combination of factors.

Keep On Trucking

Scientists continued to explore other factors that could contribute to CCD, including a form of job stress. Bees have been buzzing around the world for 150 million years, but in the last 10,000 years the relationship between bees and humans has transformed. Humans went from being foragers of naturally pollinated food to using bees for monoculture farming. People can control where and when honeybees work.



Another parasite, called *Nosema apis,* has an equally **gruesome** effect on honeybee health. This parasite produces spores that infect the bees' intestines and essentially eat the bee from the inside out. These parasites, however, had been observed in hives before. Whatever was triggering CCD seemed to be coming from another source.

Just One Crop

Researchers decided to look beyond the bees and their hives. They began looking at how farming practices had changed. Years ago, most farms were small, family-run operations that grew and harvested a variety of crops.

Today, many farms are massive corporate operations engaged in monoculture—farming that specializes in a single crop, such as wheat, corn, or soybeans.

Monoculture farming is simple and efficient for farmers, but it certainly isn't good for bees. Cultivating a single crop results in a single blooming season, which leaves bees in that area with no source of pollen or nectar once those flowers fade. Bees must also contend with exposure to chemical **pesticides** intended to rid fields of other insects that might destroy an entire harvest. While pesticides used correctly can save crops, they can also spell trouble for bees, which use their bodies to filter out toxins from the honey they produce.

It's challenging for farmers to find chemical pesticides that kill harmful insects but leave the beneficial ones alone. In the United States, farmers try to spray crops at times when plants aren't blooming in an effort to keep bees safe. Yet even with these precautions, scientists still found pesticides in the samples they'd collected from hives with CCD.

According to the Environmental Protection Agency, more than a billion pounds of chemicals are used on our crops annually. Scientists have long known how toxic many pesticides are to bees. A new class of pesticides called *neonicotinoids* or *neonics* has some scientists particularly concerned. These pesticides are **systemic**. Plant seeds are treated with chemicals that then spread to every part of a plant as it grows. A single neonics treatment is long-lasting and kills various crop pests, as it should, but researchers discovered what appeared to be an unintended consequence of using these treatments—a rapid rise in CCD.

Life Without the Birds and the Bees—The Great Sparrow Campaign

In 1958, Mao Zedong, the founding father of the People's Republic of China, kicked off the Great Sparrow Campaign. Hundreds of millions of sparrows were killed throughout China because the sparrows ate grain that Zedong thought could feed Chinese people instead.

However, the birds also ate insects. Without the sparrows, locusts consumed human crops. As many as 45 million people starved.

This led China to use more pesticides. Parts of China now use so many chemicals that bees have all disappeared. Farm workers must do the bees' job for them. They use cotton swabs to hand-pollinate fruit trees, bloom by bloom.