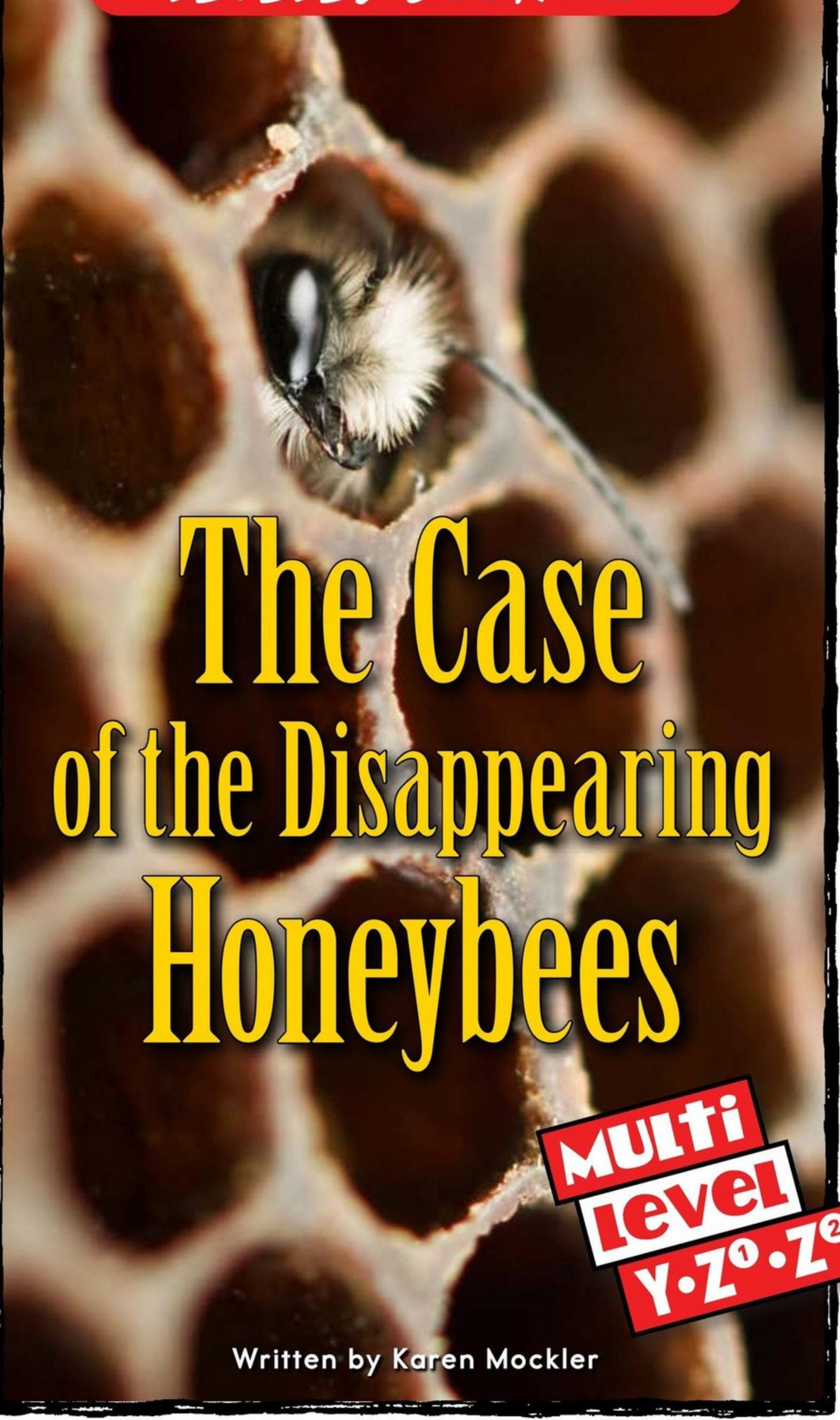


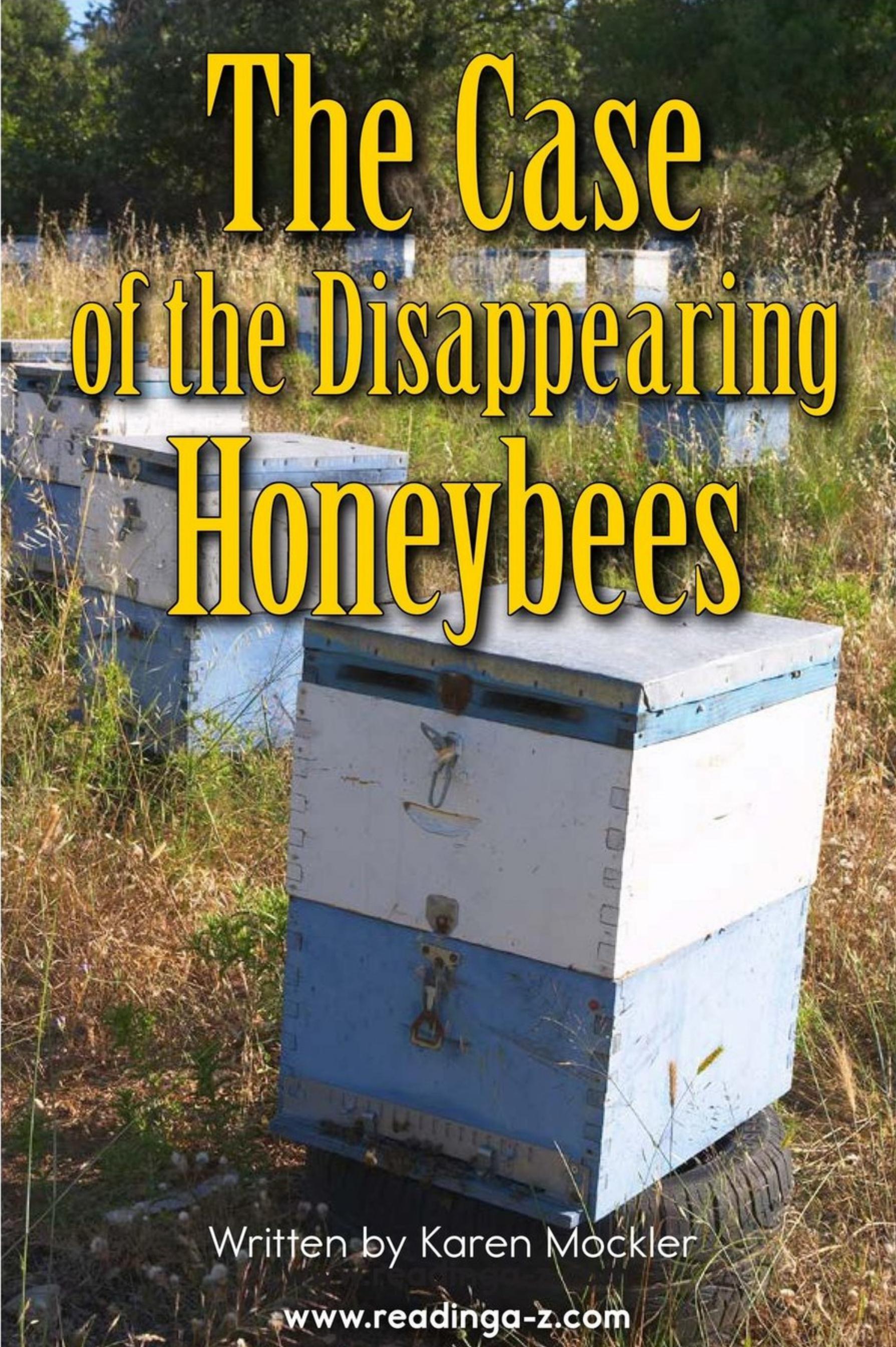
LEVELED BOOK • Z¹



The Case of the Disappearing Honeybees

MULTI
level
Y•Z¹•Z²

Written by Karen Mockler



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Focus Question

What are some factors contributing to the disappearance of honeybees?

Words to Know

apiaries	forage	pollinate
compromised	migratory	prone
disorder	parasites	sanctuaries
dissected	pathogen	specialized
fertilization	pesticides	systemic

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Level Z1 Leveled Book

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Correlation

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Table of Contents

Who Took My Strawberries?	4
Busy Bees	5
Missing in Action	7
On the Case	8
Just One Crop.....	10
Keep On Trucking.....	13
Help the Bees	16
Glossary	19



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—or many other fruits, nuts, vegetables, or flowers—is extremely rare.

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

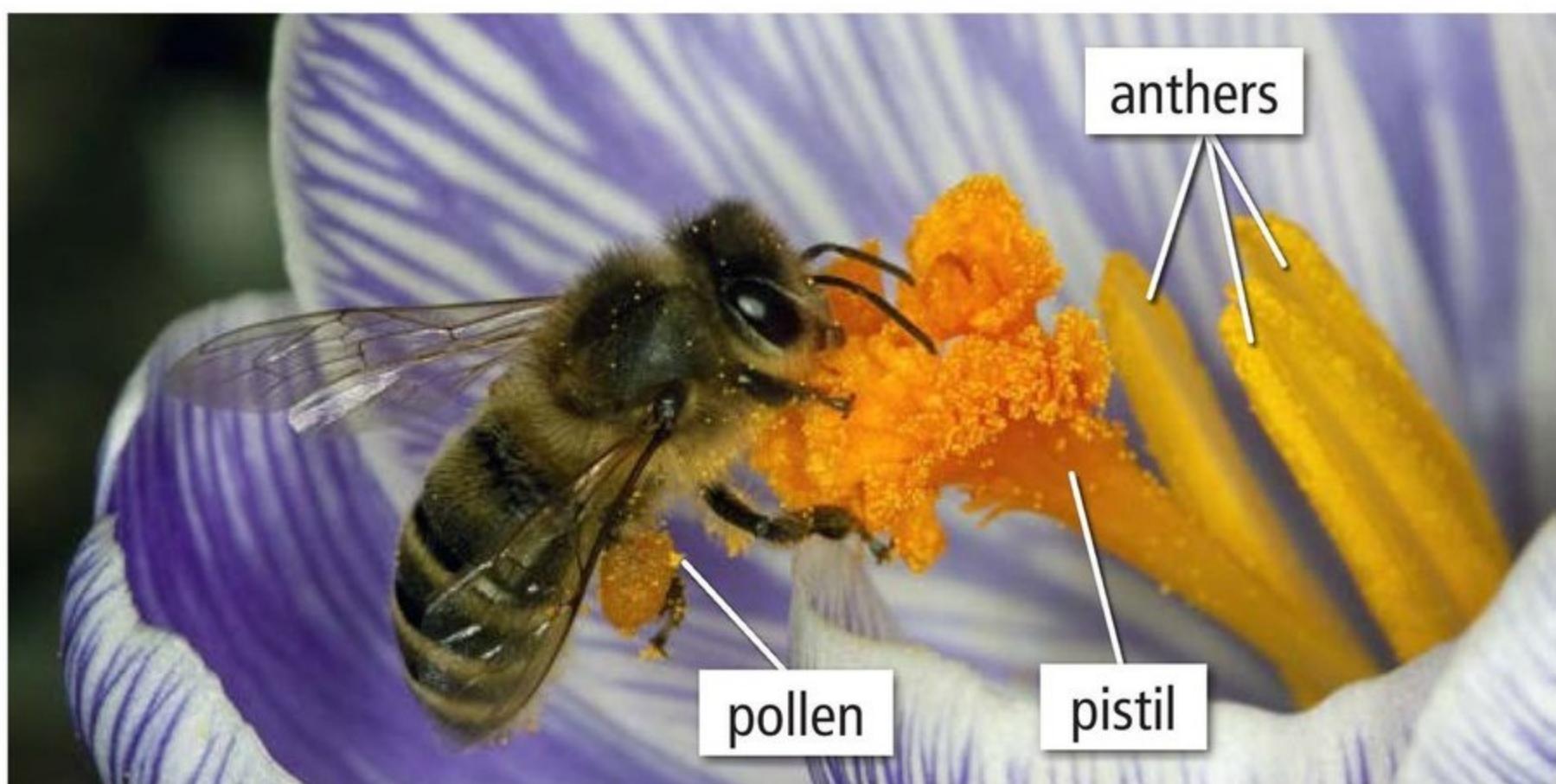
Yet honeybees are vanishing around the world, and the reason has puzzled scientists for years. Researchers have uncovered evidence, however, suggesting that the bees' disappearance might have everything to do with humans.

Busy Bees

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

Honeybees outside the hive have one job—finding flowers 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 blossoms in a day. As they do, they perform 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



A bee pollinates a flower.

rounds from blossom to blossom. The transfer of pollen from anthers to pistils is pollination, which leads to **fertilization**. Seeds are the product of fertilization.

Who's Who in the Hive

Each colony has one queen bee, whose primary job is to lay eggs in the spring and early summer. Queen bees are easy to distinguish from other bees in the hive because they are much longer and have shorter wings. The life span of a queen bee is usually two to three years.

Drones are the male bees of the colony. Their job is to mate with the queen in spring and summer. Drones have large eyes, no stingers, and enormous appetites. They rely on worker bees for food.

The most numerous bees are worker bees. They are similar to young girls—they are female, but they do not reproduce. They do sting, though! Worker bees perform many essential duties for the hive. They guard, clean, and stock the hive with food. Worker bees live from six weeks to six months, depending on the season.



queen



drone



worker

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

Missing in Action

The problem of disappearing honeybees became clear in October 2006, when an American beekeeper arrived at one of his **apiaries** in Florida to pick up 400 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 searched for piles of dead insects on the ground, yet there was no sign of the 20 million bees that had disappeared. This beekeeper's experience was not unique. Reports of other losses began to surface across the United States, Europe, China, and other regions. The numbers were shocking.

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,



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

U.S. beekeepers lost 38 percent of their colonies. The largest known disappearance occurred during 2008 in the almond tree groves of California, where 2 billion bees vanished. Farmers and beekeepers were desperate for science to shed some light on the mystery.

On the Case

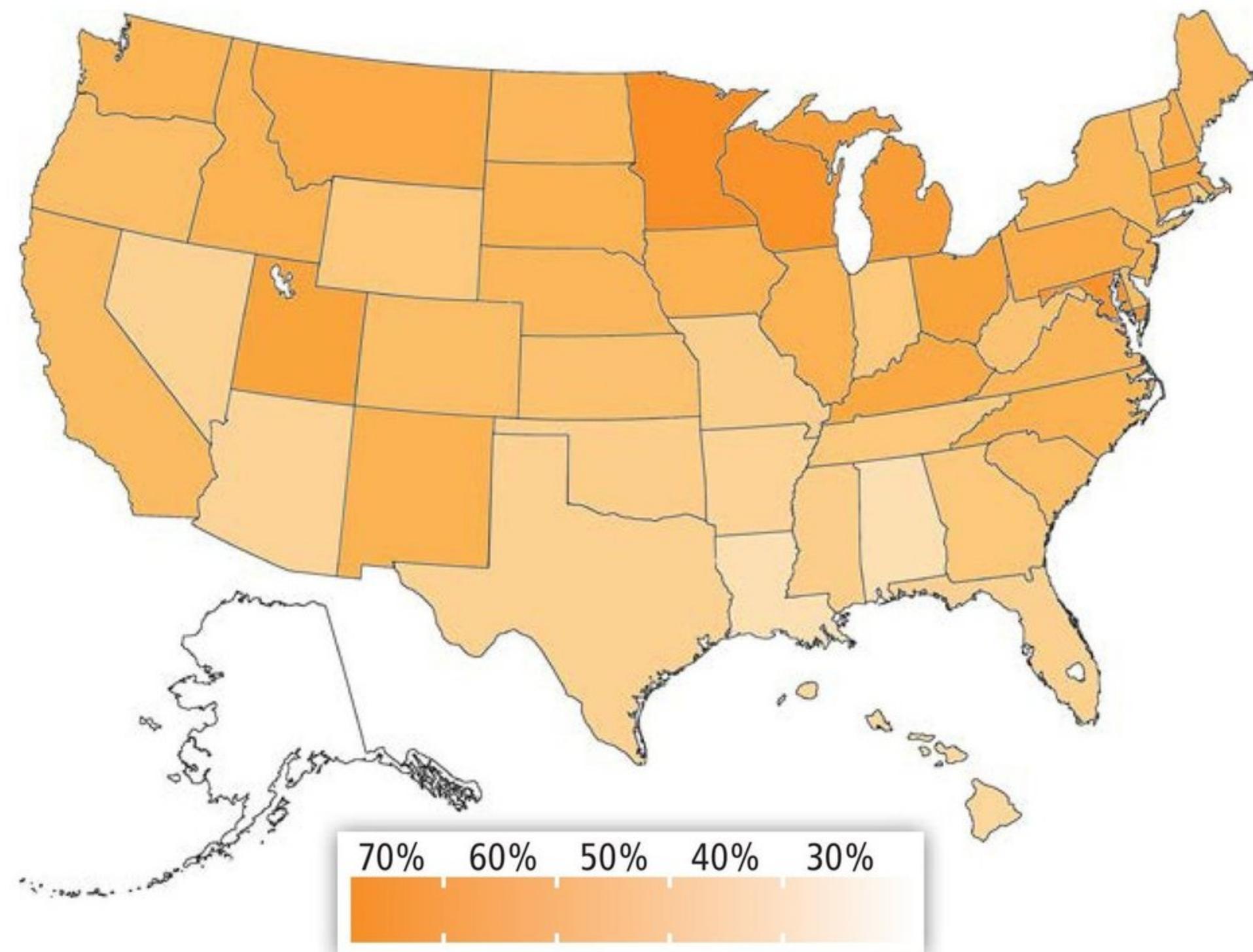
Scientists named the problem *colony collapse disorder* (CCD) and quickly determined its symptoms. CCD happens in a matter of weeks when most members of what seems to be a healthy hive disappear. Few, if any, dead bees from the colony can be found. The only bees remaining are the very young and the queen—members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



A scientist takes samples from a hive with CCD.

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

Average Annual Hive Loss by State, 2012–2013



Source: Bee Informed Partnership

collected samples of wax, pollen, and live and dead bees (when they could find them). When scientists **dissected** the bees, they discovered that the bees had many diseases. The bees' immune systems appeared to be **compromised**.

Next, scientists investigated the usual suspects 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 well-known deadly **pathogen** in a large number of CCD hives. Yet efforts to name a single germ as the root cause

of hive collapse were unsuccessful. Everything they had looked at seemed to be a result of CCD rather than its cause.

The scientists next turned their attention to several **parasites**. One, a mite called *Varroa destructor*, is also known as the “vampire mite.” It clings to adult bees, sucking their blood and leaving the bees with open wounds that are **prone** to infection. Another parasite, called *Nosema apis*, produces spores that infect the bees’ intestines and eat the bee from the inside out. These parasites, however, had been observed in hives before. Whatever was causing CCD seemed to be coming from another source.

Researchers decided to look beyond the bees and their hives. They began looking at how farming practices had changed.

Just One Crop

Years ago, most farms were small, family-run operations that grew and harvested a variety of crops. Today, many farms are massive businesses 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 “bee friendly.” A single crop means a single blooming season,



A truck sprays pesticide over young plants.

which leaves bees in that area with no source of pollen or nectar once those flowers fade. Bees must also deal with chemical **pesticides** used to rid fields of insect pests. Pesticides spell trouble for bees, which use their bodies to filter out toxins from the honey.

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 to keep bees safe. 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 **systemic** pesticides has some scientists particularly concerned. Plant seeds are treated with chemicals that then spread to every part of a plant as it grows. A single treatment is long-lasting and kills various crop pests, as it should, but researchers discovered what appeared to be an unintended result of using these treatments—a rapid rise in CCD.

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,

Do You Know?

Despite the fact that systemic pesticides are widely used in Australia, the honeybees there haven't seen the same problems as others around the world. It could be because Australian winters are short and mild. Perhaps it's because Australia doesn't move its bees from one monoculture to the next. So far, the mite that feeds on honeybees hasn't made it to Australia, either.



remember, and navigate. This could explain the bees' failure to return to the hive after foraging.

The introduction of these new pesticides coincides with the appearance of CCD. The overlap in timing, however, is not enough to suggest that the pesticides actually cause CCD. In fact, recent research suggests otherwise. Researchers are becoming even more convinced that 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, their relationship with humans transformed. Humans went from being hunters of wild honey to being beekeepers. People can now control where and when bees work.

Since honeybees are excellent pollinators, moving them into a field while crops are blooming is a great 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.

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.

The thought of trucking a million bees down the highway may seem strange, but it makes sense 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. 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 busy and beautiful sight.

The call for pollination services has continued to increase through the years. At the same time, managed honeybee colonies are declining—from five million in the 1940s to half that number today.

The result: fewer honeybees must do more work. 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.

When bees arrive at their next pollination job, they come in contact with millions of other trucked-in bees. By one estimate, two-thirds of all bees in the United States mix on these huge farms. Bringing in bees from different parts of the country (or world) also spreads parasites and disease at a rapid rate.

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.

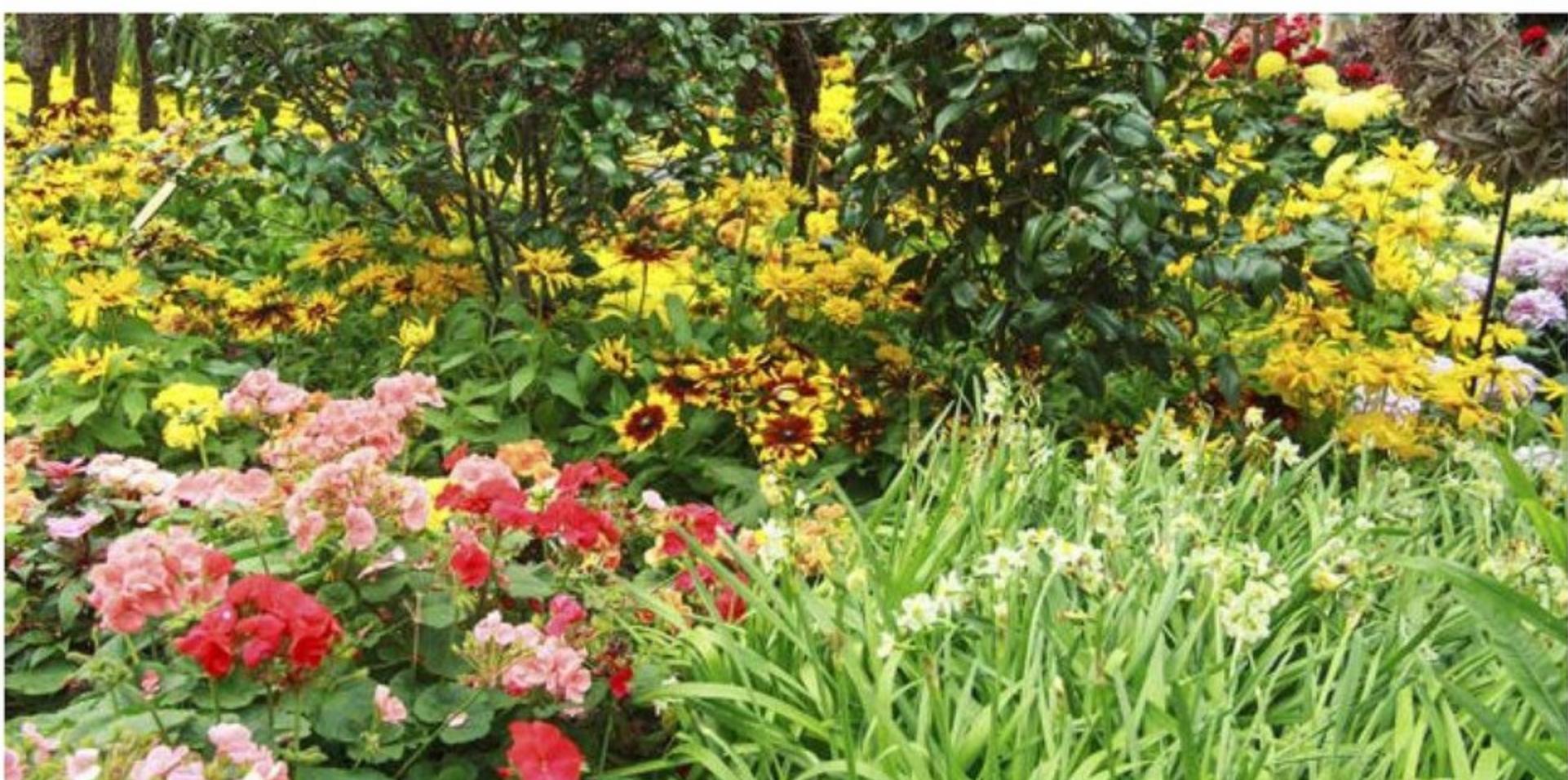
People were horrified. Africanized bees are more aggressive than European honeybees, and rumors spread that they didn't make honey or pollinate plants. In fact, they do both those things. The bees are more aggressive, but they are also healthier. Some beekeepers have begun to welcome them as nature's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

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

Help the Bees

Because of the complexity of CCD, scientists have yet to pinpoint the cause and recommend a cure. Solving the case of the disappearing honeybees will likely require additional research. In the meantime, we can use what we do know to create bee-friendly environments that will benefit plants, bees, and people.

Honeybees benefit from having a variety of native wildflowers. Variety means ample forage



A garden of plants and shrubs that provide a continuous cycle of blossoms is honeybee heaven.



More and more people in cities are keeping bees, such as this woman in London, England.

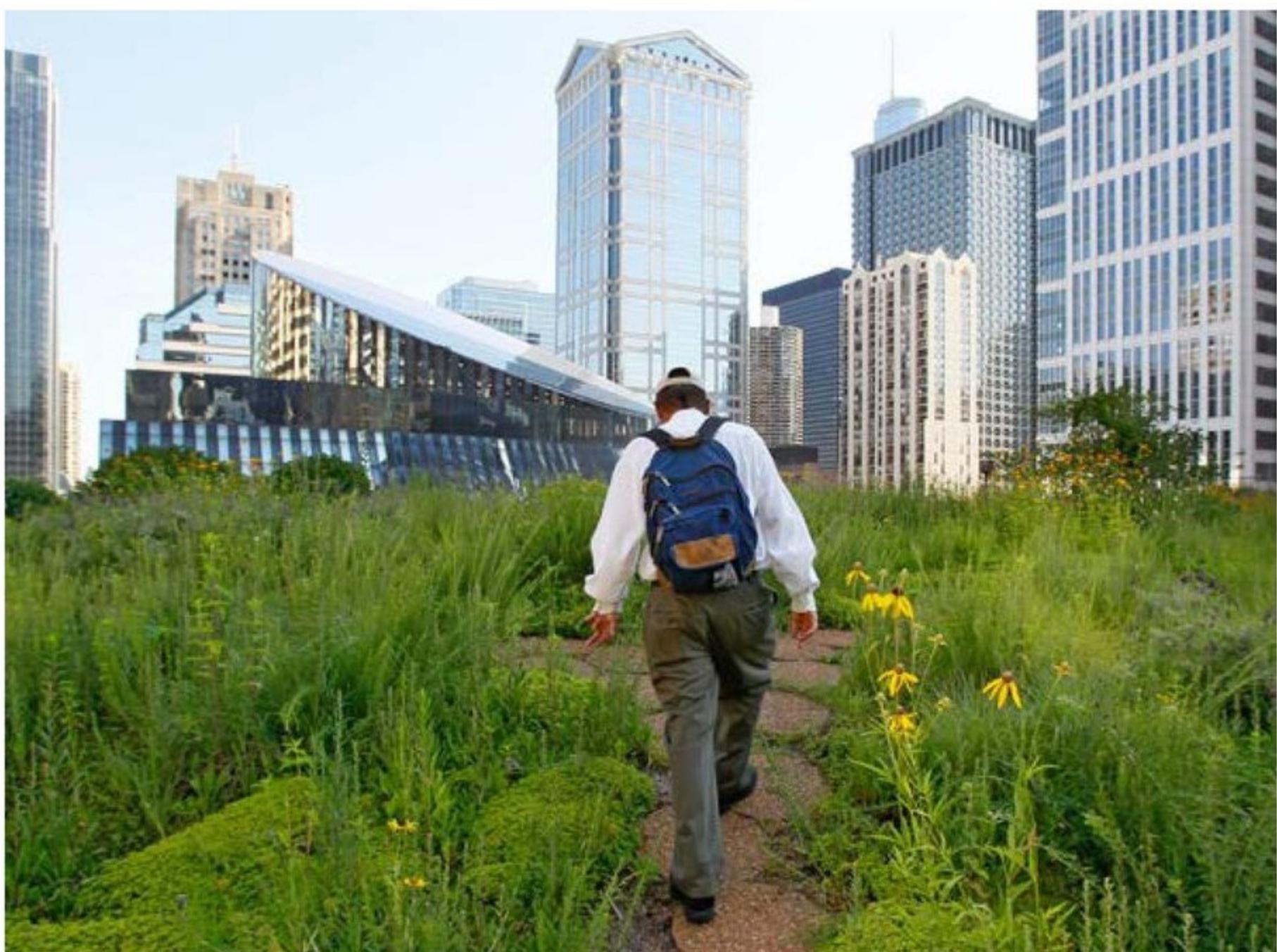
and longer foraging seasons. People can create honeybee **sanctuaries**, places full of blooming plants where bees can avoid pesticides and thrive in a natural environment.

Reducing the need for bee transport is another way to reduce stress on honeybee populations. One way to do so is to establish permanent local apiaries. Rooftop and backyard beekeeping is becoming popular in many communities. Cities such as Seattle, Chicago, San Francisco, and even New York have made it legal to raise bees. The bees visit parks and gardens, producing honey and pollinating native fruit trees and plants.

Even monoculture farmers can find small ways to help bees without sacrificing their harvest. Setting aside a small area to grow plants that

would sustain bees all year long instead of just for a couple of weeks each year would support a population of homegrown pollinators. Farmers could even investigate more organic means of pest control that would let them avoid using toxic chemicals.

There is much we can do to help honeybees while scientists work to solve the mystery of colony collapse disorder. Honeybees 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.



A beekeeper is on his way to check on the more than 100,000 honeybees that live in hives around the garden on top of City Hall in downtown Chicago, Illinois.

Glossary

apiaries (<i>n.</i>)	places where collections of hives are kept for raising bees (p. 7)
compromised (<i>adj.</i>)	damaged or impaired in some way (p. 9)
disorder (<i>n.</i>)	a physical or mental condition that is unhealthy or not normal (p. 8)
dissected (<i>v.</i>)	cut open or separated something into parts in order to study it (p. 9)
fertilization (<i>n.</i>)	the process of combining male and female cells to create a new animal or plant (p. 6)
forage (<i>v.</i>)	to search for or gather food or other supplies (p. 9)
migratory (<i>adj.</i>)	of or relating to the regular movement from one habitat or region to another at certain times of the year (p. 16)
parasites (<i>n.</i>)	plants or animals that grow on or feed off others (p. 10)

pathogen (<i>n.</i>)	a microorganism, such as a virus or a bacterium, that causes disease (p. 9)
pesticides (<i>n.</i>)	chemical or biological substances that kill harmful animals or plants (p. 11)
pollinate (<i>v.</i>)	to put pollen in a flower in order to fertilize it (p. 4)
prone (<i>adj.</i>)	likely to suffer from, experience, or do something, especially something negative (p. 10)
sanctuaries (<i>n.</i>)	safe places (p. 17)
specialized (<i>adj.</i>)	created, designed, and made to perform a certain task (p. 5)
systemic (<i>adj.</i>)	of, relating to, or affecting an entire system or body (p. 12)

The Case of the Disappearing Honeybees

A Reading A-Z Level Z1 Leveled Book

Word Count: 1,801

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.

The logo for Reading A-Z features the word "Reading" in a large, bold, red sans-serif font. The letter "R" has a small sun-like icon with rays above it. To the right of "Reading" is a large, stylized red letter "A-Z".

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