Objective(s)

Since 2006, many Americans have begun to take notice of the honeybee as a result of media coverage on the nationwide trend of disappearing bees, dubbed Colony Collapse Disorder (CCD). However, few understand the broad implications we now face as a result of the declining honeybee population. As industrial agriculture has developed over the past century, it has come to rely on the smallest of partners: the honeybee. Few Americans realize that approximately 80 percent of everything we put in our mouths was pollinated by the honeybee somewhere down the road, whether it was the alfalfa eaten by the cow that became your hamburger, or the almonds from the almond tree that became your afternoon snack, both plants rely on the honeybee for pollination.

In the pages that follow, I will demonstrate the central role the honeybee plays in the American food system. Next, I will examine the challenges currently facing the honeybee population in terms of Colony Collapse Disorder and other stresses. Finally, I will discuss the implications these factors have on the beekeeper, and possible solutions to the declining population problem.

Summary of Findings

The Smallest Migrant Farm Worker

For hundreds of millions of years, flowering plants have been reliant upon insects to reproduce. One insect in particular, the honeybee, made the business of pollination its specialty, taking advantage of two food sources flowers are happy to provide in exchange for the bees’ services: protein-rich pollen and energy-rich sugar water. As industrial agriculture has come to pervade the western world, its development has coincided with a reliance on the honeybee as pollinator. John Harvey Lovell’s 1919 book, *The Flower and the Bee*, describes why the honeybee is the ideal pollinator, “No other insect is so well adapted for this purpose. In numbers, diligence, perception and apparatus for carrying pollen it has no equal.” (Jacobsen, 15)

However, this development has been a catch twenty-two. As America’s cropland was converted into acres of monocrops the honeybee was forced off of the very land where it was
needed most. Rowan Jacobsen, author of *Fruitless Fall*, writes, “In many human communities, there aren’t enough locals left to work the crops. With insects, it’s the same. A vast monercrop of California almonds leaves no natural habitat where wild insects could live. If a New Jersey blueberry farm is hemmed by suburbs, it’s probably out of the three-mile range of any local, stationary honeybees.” (Jacobsen, 11) Instead, we have come to rely on beekeepers to transport hives to those crops in need of pollination. Jacobsen continues, “In fact, as industrial agriculture has come to dominate world production, and as exotic crops were grown on new continents, it has been forced to rely more and more heavily on middle-aged men with their wooden boxes of bees and tin smokers. This is an astonishing Achilles’ heel for industries increasingly devoted to high-tech solutions.” (Jacobsen, 10)

This system went unnoticed and underappreciated to much of the public until media coverage on Colony Collapse Disorder (CCD) began to shed light on the relationship in 2006. CCD is not the only challenge that American honeybees and their keepers are currently facing however; habitat degradation, diseases, pesticides, and poor nutrition are all likely factors contributing to the loss of approximately one third of American honeybee hives annually (Potter).

**Issues Facing the Honeybee Population**

As stated previously, habitat degradation, as a result of industrial agriculture practices and human development, has led to fewer naturally occurring bees, placing even more pressure on beekeepers to ensure the pollination system continues. Beekeeping was once a thriving industry: the number of honeybee hives in the U.S. was at 6 million during World War II, however this number fell throughout the 20th century reaching just 2.6 million in 2005. After the initial shock of CCD in 2006, the number of hives was below 2 million, while demand for pollination was at an all time high.

**Colony Collapse Disorder**

CCD, defined by the USDA as, “having no or a low number of adult honeybees present, but without a queen and no dead honeybees in the hive,” hit American beekeepers hard in 2006, with reported cases in 24 states (Thompson). By spring 2007, a quarter of the northern hemisphere’s honeybees were missing (Jacobsen, 5). While losses of 15 to 20 percent have come to be considered “normal” winter losses, some beekeepers experienced losses as large as 80 percent of their colonies at the onset of CCD. Such steep losses prompted scientists and beekeepers alike to assume that there was single culprit. Research and experiments explored such possibilities as genetically modified crops, pathogens, diseases, and pesticides. More than once, it was thought that the perpetrator had been identified, but soon after evidence would surface showing some kind of contradiction. Genetically modified crops for example, were discounted early on as signs of CCD were showing up in Europe as well, where GM crops are banned.
**Pesticides**

By 2008, the research community had virtually given up on finding a single criminal in the CCD mystery; instead, the relative contribution of a number of stressors has become the central debate. The beekeeping community for one, places the majority of the blame on a family of pesticides called neonicotinoid insecticides, which are among the most widely used pesticides in the world (Mickael). Neonicotinoid insecticides gained popularity because they kill insects by paralyzing nerves, but have a lower toxicity for other animals. Additionally, many are systemic pesticides; meaning seeds are soaked in the pesticide before planting and then diffuse throughout the tissues of the plant as it grows, eventually contaminating the nectar and pollen of the plant (Barrionuevo).

The ability of a honeybee colony to survive relies on the bees’ exceptional learning abilities, which is exactly where imidacloprid (the neonicotinoid most commonly tested) hits the bees hardest. A growing body of evidence is showing that sublethal doses have the potential to affect the honeybees’ olfactory memory, learning functions, and navigational skills. In effect, it looks as if continued exposure to imidacloprid could, overtime, damage the forager bees’ skills that allow them to navigate back to the hive, thus explaining the absence of dead bees either in the hive or surrounding the hive. One such study found that 10 to 30 percent of exposed honeybees failed to return to their colony after a foraging mission (Mickael). While these numbers may seem low, scientists explain that this additional mortality rate would be a heavy burden on the colony, leading to population decline during the spring and summer and possible collapse over the winter.

**Diseases and Parasites**

While neonicotinoid insecticides are widely acknowledged to be a danger for bees, few experts believe they are the end of the CCD story. Other stressors are interacting with them and alongside them, perhaps the most notorious of which is the varroa mite. The varroa mite, which has long afflicted the Asian honeybee (the U.S. is full of European honeybees), was kept at bay by the Honeybee Act of 1922, which prevented Honeybee imports to the United States. The act was successful until 1987 when the mite arrived in Florida, despite the ban. Within a year, a quarter of the nation’s beekeepers were out of business (Jacobsen, 58). Since then, beekeepers have been at war with the mite, which feeds by sucking the blood of bees. The pesticides, which most beekeepers employ to protect their colonies from varroa infestations, are harmful to the bees as well; queens produce less and live about half as long when exposed to these pesticides. Few varroa-infested colonies survive the winter.

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1 For more information Sophie Daudon’s paper.
Varroa is just one of many parasites and diseases currently afflicting America’s honeybees. Research by honeybee expert, Jerry Bromenshenk, in 2007 tested both “healthy” hives and CCD afflicted hives. What they discovered was not that the CCD hives were suffering from one virus, but a total of fourteen (Jacobsen, 82). Even the “healthy” colonies were suffering from viruses; both the CCD hives and the control hives were full of sick bees. So how did this happen? What became of the honeybees’ immune system?

Sources of Stress

In order to begin to answer this question, we must look at how the beekeeper is making his or her profit. In recent years, high profit crops such as almonds have been expanding their acreage and thus their need for pollinators. This fact, combined with a flood of cheap imported honey into the U.S. market from countries like China and Argentina, has made pollination (as opposed to honey production) far more profitable for beekeepers. Indeed, some suggest that California’s almond crop is single handedly keeping America’s beekeepers alive. According to the USDA website, approximately half of all American honeybees are transported to California each February to pollinate the state’s enormous almond crop, where roughly 80 percent of the world’s almonds are grown (Potter). However, California almonds are not the only crop that needs pollinating; many beekeepers travel from one state to the next following the bloom. This travel schedule has several important implications for the honeybee.

The first of which is the schedule itself; without outside influence, the European honeybee would spend the winter months in semi-hibernation, reproducing very little. However, in order to have a hive at full strength at the beginning of February, beekeepers have to speed up the process by relocating to a warmer location and feeding the bees high-fructose corn syrup in order to trick them into thinking spring has arrived and food is abundant. This process has earned the name “feedlot beekeeping” and likely lowers the bees’ immunity to viruses (Barrionuevo).

The next issue trucking and “feedlot beekeeping” raises is that of nutrition. Jacobsen writes that, “much as vegans combine corn and beans to make complementary proteins, honey bees require an assortment of pollens …Under normal circumstances, nature takes care of this by providing a changing palette of flowers… But it’s a rare and fortunate colony that still gets to spend its life grazing natural areas. More often, bees are trucked to pollination jobs where they have exactly one type of flower to visit for weeks at a time.” (Jacobsen, 146) In the almond groves especially, not only are bees in danger of not getting enough protein, but they are in danger of not getting enough food at all, as the groves are oversaturated to ensure proper pollination. Low protein levels and lack of food combined with the stress of transportation and a shortened off-season, experts agree, are factors combining to weaken the immune system of bees throughout the hive. Not to mention, that once a colony arrives at a crop, viruses have a better opportunity to spread when millions of honeybees are concentrated in one area (Jacobsen, 134).
Conclusion

While I have argued that the honeybee is absolutely essential to plant life and the modern American food system, the importance of the beekeeper must be acknowledged as well. For, as I stated earlier, there are few naturally occurring bees left, and nowhere near enough to support the current industrial agriculture system. For many of the beekeepers interviewed in Jacobsen’s book, it wasn’t CCD that they considered to be the biggest challenge for American beekeepers, but instead Chinese honey imports.\(^2\) One interviewee even went so far as to say that, “the honey industry in the United States and Canada is as good as dead.” (Jacobsen, 121) The majority of beekeepers can no longer stay afloat through honey production; instead they must join the pollination business, and all the dangers that come with it.\(^3\)

It is imperative that action be taken to protect the honeybee. If serious steps are not taken soon, we will literally pay the price, as food prices will begin to soar (Potter). Fortunately, some efforts are being made. While the honeybee community has little revenue to spend on research, other industries and companies have begun to recognize their reliance on the honeybee and have contributed funding, namely the almond industry, and even the ice-cream maker Haagen-Dazs. In 2008, the company donated $250,000 to honey bee research and launched a new flavor, Vanilla Honey Bee, to promote the cause (Jacobsen, 17).

Finally, it is important to acknowledge that not all efforts are in the research stage; it is becoming widely accepted that the majority of commercial hives are not getting enough protein, and many beekeepers are taking steps to supplement their bees’ high-fructose corn syrup diet.

The honeybee is a vital link to a vast system that we have based much of our survival off of. Although the little honeybee may do the vast majority of its work behind the scenes, recent events have made it necessary for knowledge to be spread. Support for the honeybee may come in many forms: buying local, single-source honey to support American beekeepers and writing to legislators to ensure funding for CCD research are both ways that the general public can make a stand.

\(^2\) For more information see Sarah Robinson’s paper.

\(^3\) This is not to say that small, stationary producers are not safe from diseases and CCD.
Sources


