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SUSTAINABILITY

Colony Collapse Disorder: The Economics of Decline

by Amelia Sadler

For the first time in history, bees have been placed on the endangered species list. The bee population has declined by more than 40 percent, which could signal a crisis not only in the health of our ecosystems, but also in the viability of our country's agricultural industry.

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Though Charles Darwin is best known for his theory of evolution by natural selection, he may have unknowingly offered prescient political commentary as far back as 1859. In his first edition of "On the Origin of Species" he opines, "humble-bees...plants and animals, most remote in the scale of nature, are bound together by a web of complex relations." Having observed the pollination behavior and hive-construction of bumblebees in Kent,

England, Darwin concluded bees were indispensable to the fertilization of numerous plant species, whose very existence would be threatened by the decline or extinction of this insect. On September 22nd 2016, federal wildlife officials submitted a recommendation to include the rusty-patched bumblebee on the perennially lengthening list of endangered species. On September 30th, these officials at the U.S Fish and Wildlife Service granted endangered status to seven different species of yellow-faced bees endemic to Hawaii. These decisions signal a new era of alarm for the protection and wellbeing of North America's bee population, and an increasing cognizance of the environmental and economic impacts associated with its decline.

Population Crisis

Bees made national headlines in 2006 at the peak of an epidemic of colony collapse disorder culminating in a 40 percent decline in the U.S bee population over the course of five decades. Colony collapse disorder (CCD) is a phenomenon characterized by worker bees' abandonment of otherwise healthy hives, leaving a helpless queen, nurse bees, and baby bees to die without access to nectar and pollen. Between April 2014 and April 2015, 42 percent of U.S honeybee colonies disappeared, and for the first time in history there were more bee deaths during the summer than the winter of 2015. This epidemic, which has brought the total U.S. bee population from 5 million to 2.5 million individuals (its lowest level since the mid 1940s) is attributed to a combination of insecticide and pesticide use, changing climates, parasites, and urban development. The widespread use of agricultural chemicals if of greatest concern. Neonicitoids, commonly found in pesticides used to treat pollinated plants, are thought to be the main culprit; bees collect pollen from crops treated with pesticides and carry these chemical compounds back to their hive where they weaken the insects' immune systems, increasing susceptibility to disease and parasites. Recent research confirms that these pesticides represent a severe threat to the health of bees. Ahead of an upcoming review by the European Union, a team of British scientists found a significant correlation between the use of neonicitoids and bee deaths, concluding these chemicals could be responsible for as much as half of the decline in bee populations within the last year.

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The Economics of Decline

The economic cost of these vanishing bees is immense. In addition to being a keystone species (meaning they have a disproportionately large role in the ecosystem), bees contribute an estimated 15-30 billion dollars in annual agricultural productivity alone. In North America, pollination is integral to the production of at least 90 commercial crops, which account to 15-30 percent of the typical American's diet. The cost here arises in the agricultural market for beekeeping. Commercial farmers often hire beekeepers to pollinate their land. And in the case of certain crops, such as tomatoes, bees are the only available pollinator. The California almond industry, for example, requires the annual services of roughly 1.4 million beehives, and is responsible for 80% of global almond production, amounting to a total value in excess of 4.8 billion dollars — and that's just one crop.

The agricultural industry's overreliance on this vanishing resource means that the full impact of this pandemic will be realized not only by industry participants such as beekeepers, farmers, and members of secondary markets such as honey and wax, but also by final product consumers. California beekeepers charged almond farmers $51.99 per hive in 2003. By 2009 that price had more than tripled. As costs for domestically produced nuts, fruits and vegetables inevitably rise, they will ultimately be reflected in the grocery store, and not only in the produce section. Both the beef and dairy industries are heavily reliant on feedstocks such as clover, hay, and forage crops that require apian pollination. The increased cost of livestock feed, a critical input in determining market prices, will also undoubtedly be reflected in the price paid by consumers.

The costs don't end with more expensive fruit salads or a mark-up on trail-mix. The economic benefits bees provide also extend into consumer products such as hair, skin and other beauty products, as well as honey production. As mentioned above, the estimated service value of bees to the agricultural industry does not account for the value of secondary markets in honey and wax. These externalities of pollination have generated

multi-billion dollar markets all their own; Burt's Bees alone, a company specialized in the manufacture of lip balms derived exclusively from beeswax, was acquired by Clorox in 2007 for $925 million. Beeswax is also an important component of countless moisturizers, creams, cosmetics, and salves. Of course, an analysis of the economic contributions of North America's honeybee would be incomplete without taking note of its eponymous product. The domestic market for honey is valued at almost half a billion dollars and is, by its nature, impossible to diversify or produce via modified inputs.

Implications

The magnitude of the threat posed by colony collapse disorder and the unprecedented decline in bee populations should not be understated. In addition to playing a critical role in North American ecosystems, bees have a major impact on our country's economy, providing primary inputs to multiple industries and contributing indirectly to countless others. Many reports of bees' service value are conservative underestimates. After accounting for peripheral markets such as dairy and beef, secondary markets, and other industries that could suffer disruptions, it is reasonable to anticipate that the economic cost of bees' soaring mortality rates could near one percent of the country's GDP.

It is important to contemplate the magnitude of these numbers. The recent announcements from the U.S Fish and Wildlife Association are sobering. A quarter of North American bees are facing extinction. This is the first time in modern history that bees have been classified as an endangered species, news that should not be taken lightly. Agribusiness firms and the EPA must lead the way in mitigating the effect of pesticides on pollinating populations, as the misuse of industrial chemicals has broad and far-reaching effects. It was more than 150 years ago that Darwin warned of the dangers of a world without bees. It is about time we all took heed.

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