

Our Dying Earth: How Pollinators Struggle to Survive

The earth is grow more and more hostile to wildlife species--so much so that scientists across the world are documenting "alarming declines" in the diversity and populations of pollinators, such as butterflies, wasps, bees, beetles, moths, birds and bats, as well as many other species.



Photo courtesy of Wikipedia

For instance, one California study showed a 40 percent decline

in species diversity of butterflies over the past 29 years, said Dr. May R.

Berenbaum in a speech to the U.S. Congress. Dr. Berenbaum chaired a National

Research Council Committee on the status of pollinators in North America.¹ In

Britain, 75 percent of butterfly species have declined in the past 30 years,

according to the nonprofit organization Butterfly Conservation and three UK

universities.²

Wild and managed pollinators are disappearing at alarming rates.

The decline in pollinators threatens the foundation of every ecosystem in the world. It could be a contributing factor in causing 20,000 species of plants to go extinct in the next few decades, according to the World Conservation Union.³

This could cause a chain reaction that spirals out of control. Dr. Peter Raven, who is with the National Academy of Sciences and director of the Missouri Botanical Gardens, said when a plant species is lost, an average of 10-30 other species are also lost, since some species have "specialized feeding habits." Therefore, according to him, "The diversity of plants is the underlying factor controlling the diversity of other organisms and thus the stability of the world ecosystem."⁴

In the Great Britain, much of the decline in butterfly species can be blamed on habitat loss -- a 70 percent reduction in flower-rich grasslands, ancient woodlands and heaths due to an expansion of intensive agriculture. But across the world, intensive agriculture--and habitat loss-- will be expanding much much more as corn and sugar cane is grown to make ethanol to fuel automobiles.

Furthermore, habitat loss is just one of many stresses pollinators face; they suffer death by a thousand cuts. For instance, they are also being killed by pesticides as they gather tainted nectar or pollen or when they drink or touch contaminated water on foliage or flowers.

In Maoxian County in China, the heavy use of pesticides has so decimated the populations of pollinators, such as butterflies, moths and wild bees, that human beings are having to pollinate crops, such as apples and pears, by hand, according to said Dr. Uma Partap, a research officer with the International Centre for Integrated Mountain Development (ICIMOD) Beekeeping Project in Kathmandu, Nepal.⁶

"Every family member-- men, women and children--are engaged in pollination of apple flowers, making it a community effort," she said.

"Beekeepers do not rent their honeybee colonies for pollination of these crops because farmers make excessive use of pesticides, even during the flowering season."

A crisis is also occurring in India. In a Reith Lecture on the BBC Radio, Dr. Vandana Shiva said in the Punjab of India, "an old farmer pointed out that even the trees have stopped bearing fruit because heavy use of pesticides have killed the pollinators - the bees and butterflies."⁷



Researchers at the University of Oxford found in 1997 that organic fields have significantly more butterflies than fields sprayed with pesticides.⁵

Pesticides have also taken a toll in California. The National Academy of Sciences reported that "in California, between 1966 and 1979, before the emergency of the varroa mite, insecticides caused the death of more than one million colonies [of bees]."⁸

Pesticides and Bees

Scientists say if pesticides and herbicides don't kill bees outright, they may kill them indirectly by weakening their immunity so that they are vulnerable to disease or impacting their ability to learn or make memories so that they lose their sense of direction⁹ and can not remember their way back to their nest or hive. In addition, bees that survive exposure to pesticides may lose their ability to fly, may become aggressive or agitated, may have jerky or wobbly movements, may perform abnormal communication dances, or may experience paralysis--all of which make nest building and/or foraging for nectar and pollen difficult.



Butterflies Have Legal Rights

Many butterflies are threatened species, thus, the Endangered Species Act requires that their critical habitat be identified and protected.

This can mean that the spraying of pesticides is illegal. For instance, the U.S. Fish and Wildlife Service, the agency that lists endangered species and designates their critical habitats, said the threatened Bay checkerspot butterfly's critical habitat may be affected by the application or drift of pesticides.

How Pesticides and herbicides Contaminate the Whole Environment

"There is not one single insect or other living species whether it is an albatross, a polar bear, a penguin--or even a human--that does not have detectable levels of many pesticides in its tissues," said Dr. Louis Guillette, a professor and associate dean of research in the Zoology Department at the University of Florida at Gainesville.¹⁰ This is because pesticides and herbicides don't stay put when they are sprayed on farmers fields or on people's yards. They blanket the whole environment as they volatilize into the air, mix with other chemicals and get carried as gases or particulates in the fog, wind, clouds, dust, snow and rain.

To illustrate how agrochemicals move with the air currents, fish in the Great Lakes were once being killed by an acutely toxic pesticide called toxaphene, but farmers in the area were not using this substance.

Researchers tested the wind currents for the pesticide by drawing air through polyurethane foam. "Places where we found high concentrations in the air correlated with prevailing winds from the South," said Dr. Clifford Rice, an environmental chemist with the Agricultural Research Center in Beltsville, Maryland. They set up testing stations in those places and were able to track the movement of the chemical all the way across the country to cotton fields in the South where it was being sprayed.¹¹

While toxaphene is now banned in the United States, it is still in use in some countries and thus, still moving on global air currents--contaminating the earth.

Another team of scientists detected 16 types of pesticides in fog, with some of the chemicals enriched "several thousandfold."¹²

"These numbers go down in areas where pesticides are not being used," said one of the researchers, Dr. J.N. Seiber, who is director of the Agricultural Research Service in Albany, California.¹³

In addition to pesticides and herbicides, Dr. Rice said fog contains "quite a wide variety of other chemicals." To illustrate the urgency of the problem, he said scientists doing research in the

Central Valley of California, which is mostly agricultural, found that red-tailed hawks exposed to fog had organophosphate pesticides in their feces, as well as on their feathers and feet during the period when pesticides are sprayed. How could small insects survive such contamination?



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You can help pollinators survive by planting bright fragrant flowers, such as foxgloves, shown here, to provide nectar.

Other nectar-producing flowers include bee balm, red clover and joe-pye weed.

How Genetically Modified Crops Can Hurt Butterflies

Scientists seeking to reduce pesticide use on corn created a genetically modified species of corn by splicing genes from a bacterial into it. When the corn is attacked by pests, such as the European corn borer, the toxic tissues of the corn kills the pest.

However, researchers at Cornell University found that when pollen from this genetically modified corn is dispersed by wind, it often lands on other plants, such as milkweed, the exclusive food of monarch butterfly caterpillars. Milkweed is often found near cornfields. Caterpillars ingesting this pollen ate less, grew more slowly and had a higher rate of mortality. Nearly half of them died.

However, Mr. Richard Hellmich with the Agricultural Research Service said without the genetically modified corn, more pesticides would be used, which also can kill butterflies. Moreover, he said corn pollen is too heavy to blow far and rain easily washes it off the milkweed leaves.

How Monocropping Hurts Pollinators

Most largescale farms are pesticide intensive because they rely on specialized equipment that is used with one crop, but when there is a monocrop rather than a diversity of crops, insects often run riot across an entire field.

Moreover, these farms are not rotating crops, which would break up the life cycle of pests.

And because monocropped fields have only one crop, the diets of pollinators are impoverished. In contrast, small farms often have a wide diversity of crops with blooming times that differ, which means there are sources of nectar and pollen throughout the growing season.

Furthermore, small farms are also more likely to have natural habitat nearby that attracts pollinators such as forest patches, wetlands and hedgerows laden with berries and seeds and places they can make a nest and mate.

In contrast, a row of crops in a huge monocropped field may be long distances from natural vegetation. Also, since farmers who

do monocropping need to maneuver a big combine through a wide open field, they must remove their hedgerows. Thus, farms that do monocropping must often rely on



Migratory Corridors

Since many species of hummingbirds, butterflies and bats migrate long distances they need pesticide-free corridors that connect natural habitats--a mosaic of stepping stones with each stone a stopover that allows refueling on fragrant nectar and pollen-bearing flowers. Restoring such habitats will require the participation of local governments, farmers and homeowners.

commercially managed honeybees that are trucked in. But how long can this be sustained?

Honey Bees and Colony Collapse Disorder

One mouthful in three benefits from honeybee pollination, but a mysterious mass die-offs of commercially managed honeybee's may soon lead to a shortage of food and an increase in the prices of many food crops in the United States.

Some beekeepers have lost 30 to 90 percent of their bee colonies during the winter and spring of 2006 and 2007 in what is called Colony Collapse Disorder.

Adult bees mysteriously vanish; no dead bees are found in or around the colonies. All that is left in the hives is honey, a live queen bee and a few newly emerged bees. Also mysterious, the honey in the colonies remains untouched by wildlife and other bees that would ordinarily raid it when the colony is deserted.

In all, about one-fourth of beekeepers in 35 states have reported losses. Albert Einstein once said that if the bees disappeared, "man would have only four years of life left."

It is not proven, but scientists suspect that a bee disease called Israeli acute paralysis virus (IAPV) is partly responsible for the die-off.

"We do not believe IAPV is acting alone," said Dr. Jeffrey S. Pettis, an entomologist and research leader with the U.S. Dept. of Agriculture's Bee Research Laboratory. "Other stressors are likely to be involved."

Other contributing factors being investigated include additional pathogens; parasites, such as varroa mites, which are about the size of a pin head and feed off honeybees like ticks, weakening their immune systems; contaminants used to control mites; pesticides used on crops; poor nutrition; and the stress of overcrowding and being trucked around the country to pollinate crops.



Photo courtesy of ARS

The brownish-orange bumps on the backs of these bees are varroa mites. In China, bees remove these mites as they groom themselves.

In the last 50 years, honeybee colonies have declined by 50 percent, according to Senator Barbara Boxer, chair of the U.S. Senate Environment Committee.

Human Bees

Pollinators are among the hardest working creatures in the universe, but if we let them die, we'll be the hardest working creatures as we attempt to pollinate the natural world by hand.

End Notes:

¹ "The Birds and the Bees'—How Pollinators Help Maintain Healthy Ecosystems," testimony by May R. Berenbaum, PhD. Before the 110th Congress, June 26, 2007, on the WWW at:

http://www7.nationalacademies.org/ocqa/testimony/How_Pollinators_Help_Maintain_Healthy_Ecosystems.asp .

² "British Butterflies in Decline," October 31, 2001, available on the BBC website at:

<http://news.bbc.co.uk/2/hi/science/nature/1630193.stm> .

³ "Science Summary: Pollinators in Decline--Causes," on the Ecological Society of America website, available at <http://www.esa.org/ecoservices/poll/body.poll.scie.decl.html> .

⁴ "Ethics and Attitudes," in J.B. Simmons et al., *Conservation of Threatened Plants*, New York City: Plenum, 1978. Cited in Ehrlich, Paul and Ehrlich, Anne, *Extinction: The Causes and Consequences of the*

Disappearance of Species, New York City: Random House, 1981, p. 139.

⁵ Feber, R.E; Johnson, P.J.; Firbank, L.G; Hopkins, A.; MacDonald, D.W., "A Comparison of Butterfly Populations on Organically and Conventional Managed Farmland," *Journal of Zoology*, Vol. 271, No. 1, Pp. 30-39.

⁶ Partap, Uma, "Declining Apple Production and Worried Himalayan Farmers: Promotion of Honeybees for Pollination," *Issues in Mountain Development*, available on the WWW at:

<http://www.icimod.org/archive/icimod/publications/imd/imd2001/imd01-1.htm> .

⁷ Lecture 5, "The Reith Lectures 2000: Respect for the Earth," on the BBC website at:

<http://www.bbc.co.uk/radio4/reith2000/lecture5.shtml> .

⁸ NRCC (Natural Resource Council Canada). 1981. Pesticide-Pollinator Interactions. NRCC Report No. 18471. Associate Committee on Scientific Criteria for Environmental Quality. Ottawa: National Research Council of Canada. Table 6, Page 83.

⁹ Bonmatin, J.M., P.A. Marchand, R. Charvet, M.E. Colin, (1994): Fate of systemic insecticides in fields (Imidacloprid and Fipronil) and risks

for pollinators, in First European Conference of Apidology, Udine 19-23 September 2004.

¹⁰ Telephone interview with Dr. Louis Guillette

¹¹ Telephone interview with Dr. Clifford Rice.

¹² Glotfelty, D.E.; Seiber, J.N; Liljedahl, A; "Pesticides in Fog," *Nature* Vol. 325, Feb. 18, 1987, pp. 602-605.

¹³ Telephone interview with Dr. J.N. Seiber