

METABOLIC RIFT

Insect Apocalypse in the Anthropocene, Part 1

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The rapid decline of Earth's most numerous animals is a major threat to the biosphere



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"The question is whether any civilization can wage relentless war on life without destroying itself, and without losing the right to be called civilized."[1]

It is six decades since Rachel Carson wrote her brilliant book Silent Spring, often described as the foundational work of the modern environmental movement. Carson's aim was to stop the killing of insects, and many people thought her cause had succeeded when widespread use of DDT ended.

The victory was short-lived.

When Silent Spring was published, my family had recently moved to a rural area of eastern Ontario. As a teenager, I wasn't happy about losing urban social life, but I was enthralled by visions I never saw in the city. In particular, in summer a field near our house was filled by day with monarch butterflies, and by night with fireflies. I spent many hours just watching the insect displays.

Lis and I still live in that house, and that field is still there, growing wild, but we haven't seen a monarch or a firefly for decades. The continuing slaughter of six-legged animals is greater, and more damaging, than anything Rachel Carson could have imagined.

On February 3, a comprehensive report showed that 80% of butterfly species in the UK have decreased in abundance or distribution since the 1970s, and half of them are now listed as threatened or near-threatened.[2] Since butterflies are by far the most consistently monitored wild insects, their decline is like the proverbial canary whose collapse warned coal miners that deadly gas was accumulating. If there are fewer butterflies, there are probably fewer insects of all kinds.

On the same day, scientists from China's Academy of Agricultural Sciences reported that since 2005 there has been a steady decline in the 98 species of flying insects that migrate every year over Bohai Bay between China and Korea. The number of plant-eating insects has declined 8 percent, and the predator insects that eat them have dropped nearly 20 percent. The authors say the data identifies "a critical decline in (insect) functional diversity and a steady loss in ecological resilience across East Asia." [3]

These studies, conducted on opposite sides of the globe, add to the growing evidence of a rapid worldwide decline of insect life. While most conservation groups illustrate their fund-raising pitches with pictures of pandas and tigers and rare birds, the pervasive decline of insects poses the greatest threat to all life in the Anthropocene. Scott Black, Executive Director of the Xerces Society, a non-profit that emphasizes protecting insects and other invertebrates, concisely sums up the danger :

"No matter how roughly we treat the planet, we are going to vanish before the insects will. But what we will see is fewer or no birds in the sky. If you want birds, you need insects. If you want fruits and vegetables, you need insects. If you want healthy soils, you need insects. If you want diverse plant communities, you need insects." [4]

Insects are central to what Karl Marx called the universal metabolism of nature, the constant recycling of energy and matter that makes life possible. Arthropods — mostly insects but including spiders, mites, centipedes and millipedes — pollinate 80 percent of all plants, recycle life's essential nutrients, create healthy and fertile soils, purify water, and are the primary food of many birds and animals. If they were to disappear entirely, the biosphere would collapse and humans would not last long.

"Most of the fishes, amphibians, birds, and mammals would crash to extinction about the same time. Next would go the bulk of the flowering plants and with them the physical structure of the majority of the forests and other terrestrial habitats of the world. The earth would rot. As dead vegetation piled up and dried out, narrowing and closing the channels of the nutrient cycles, other complex forms of vegetation would die off, and with them the last remnants of the vertebrates. The remaining fungi, after enjoying a population explosion of stupendous proportions, would also perish. Within a few decades the world would return to the state of a billion years ago, composed primarily of bacteria, algae, and a few other very simple multicellular plants." [5]

To be clear, the disappearance of *all* insects is not likely in the foreseeable future : indeed, some insects are likely to outlive humanity. What the evidence shows is a combination of outright extinctions and radical population declines that some scientists call *defaunation*. "If unchecked, defaunation will become not only a characteristic of the planet's sixth mass extinction, but also a driver of fundamental global transformations in ecosystem functioning." [6]

Most accounts of life on earth focus on mammals, birds, fish and reptiles, but in fact the vast majority of animals are insects. Nobody knows exactly how many there are, but a good estimate is ten quintillion — 10 followed by eighteen zeros, well over a billion insects for every human being. Together they weigh substantially more than all other types of animals (including humans) combined. They are immensely varied : in the U.S. alone, there are about 23,700 species of beetles, 19,600 species of flies, 17,500 species of ants, bees, and wasps, and 11,500 species of moths and butterflies. Worldwide, a million insect species have been catalogued, and it's thought that another four million haven't yet been identified or named. At present rates, many will disappear before humans even know they exist.

With populations that large, it is difficult to imagine that all or even a significant proportion of them could be at risk. Apart from butterflies, which are pretty, and honeybees, which are profitable, until

recently threats to insect life were rarely mentioned in accounts of biodiversity loss.[7] Elizabeth Kolbert's prize-winning 2014 book [*The Sixth Extinction*](#), for example, refers to insect declines only briefly, as a difficult-to-measure consequence of Amazon deforestation. Anthony Barnosky's [*Dodging Extinction*](#), also published in 2014, mentions insects just twice in passing. Similarly, David Wallace-Wells' 2019 bestseller [*The Uninhabitable Earth*](#), contains just three paragraphs about insects.

These authors were not arbitrarily ignoring our six-legged relatives : their omissions reflected a longstanding gap in the scientific literature. While entomologists had published many reports on the biology and behavior of specific species, few had examined or measured trends in insect populations over time. Even among bees, one of the most studied insect groups, the U.S. National Academy of Sciences lamented in 2007 that "long-term population data are lacking and knowledge of their basic ecology is incomplete." [9]

A major turning point came in October 2017, when twelve European scientists published a groundbreaking report on the decline of flying insects in nature protection areas in Germany. For nearly three decades, members of the volunteer-run Entomological Society Krefeld had been trapping and counting insects in sixty-three nature reserves, using tent-like traps. An analysis of their records, published in the journal *PLOS One*, revealed a shocking trend that affected bees, wasps, butterflies, flies, beetles and more.

"Our results document a dramatic decline in average airborne insect biomass of 76% (up to 82% in midsummer) in just 27 years for protected nature areas in Germany. ...

"The widespread insect biomass decline is alarming, ever more so as all traps were placed in protected areas that are meant to preserve ecosystem functions and biodiversity. While the gradual decline of rare insect species has been known for quite some time (e.g. specialized butterflies), our results illustrate an ongoing and rapid decline in total amount of airborne insects active in space and time." [10]

In 2018, another group of scientists showed that between 2008 and 2017 there had been substantial declines in insect diversity, biomass, and abundance in German grasslands and forest areas, and a study published in the *Proceedings of the National Academy of Sciences* found that insect populations in Puerto Rican rain forests had plummeted up to 98% since the 1970s. [11] Although there were debates about precise figures and methodology, there was now, as noted British ecologist William Kunin wrote in the prestigious journal *Nature*, "robust evidence of insect declines." [12]

Those findings prompted ecologists and entomologists around the world to look into past studies and records, looking for data that could be used to measure changes in insect populations. In 2019, the journal *Biological Conservation* featured a detailed review of 73 published studies of insect declines.

"From our compilation of published scientific reports, we estimate the current proportion of insect species in decline (41%) to be twice as high as that of vertebrates, and the pace of local species extinction (10%) eight times higher, confirming previous findings. At present, about a third of all insect species are threatened with extinction in the countries studied. Moreover, every year about 1% of all insect species are added to the list, with such biodiversity declines resulting in an annual 2.5% loss of biomass worldwide." [13]

Since then, as the studies cited at the beginning of this article illustrate, research on insect populations has exploded. In February 2023, Google found over 30,600 entries for "endangered insects," and Google Scholar found over 1,000 academic papers. For accessible accounts of the latest research, I strongly recommend two recent books, [*Silent Earth*](#) by Dave Goulman and [*The Insect Crisis*](#) by Oliver Milman. Both are by serious authors who eschew sensationalism, and yet one

refers to an “insect apocalypse,” and the other describes the decline of insect populations as “a dire situation [that] can barely be comprehended.”[14]

In [*The Cosmic Oasis*](#), a history of the biosphere published in 2022, leading Anthropocene scientists Mark Williams and Jan Zalasiewicz warn that it is impossible to overstate the threat posed by the decline of insect life that recent research has confirmed.

“Something of the order of two-fifths of the world’s insect species may be threatened with extinction within a few decades ; they are being widely exterminated across both urban and agricultural landscapes, and are decimated by pollution in aquatic settings. ... Because insects are deeply embedded in the functioning of Earth’s ecosystems, a major loss to their numbers and diversity would have incalculable effects ; indeed, would likely cause wholesale collapse to ecosystems, including those that sustain us.”[15]

[Part 2](#) will discuss how capitalism is driving and accelerating the insect apocalypse.

Ian Angus

Notes

[1] Rachel Carson, *Silent Spring* (Mariner Books , 2002), 99.

[2] R. Fox et al., *The State of the UK’s Butterflies 2022* (Butterfly Conservation, 2023).

[3] Yan Zhou et al., “Long-Term Insect Censuses Capture Progressive Loss of Ecosystem Functioning in East Asia,” *Science Advances* 9, no. 5 (February 3, 2023).

[4] Quoted in Oliver Milman, *The Insect Crisis : The Fall of the Tiny Empires That Run the World* (W.W. Norton, 2022), 61.

[5] E. O. Wilson, “The Little Things That Run the World* (the Importance and Conservation of Invertebrates),” *Conservation Biology* 1, no. 4 (1987), 345.

[6] Rodolfo Dirzo et al., “Defaunation in the Anthropocene,” *Science* 345, no. 6195 (July 25, 2014) : 406.

[7] An obvious exception was Rachel Carson, but her primary concern was not the insects themselves, but the effect of DDT on the birds that ate insects.

[8] Simon Leather, “Taxonomic Chauvinism Threatens the Future of Entomology ,” *Biology* 56, no. 1 (February 2009) : pp. 10-13.

[9] May Berenbaum et al., *Status of Pollinators in North America* (National Academic Press, 2007), 1.

[10] Caspar A. Hallmann et al., “More than 75 Percent Decline over 27 Years in Total Flying Insect Biomass in Protected Areas,” *PLOS ONE* 12, no. 10 (October 18, 2017), 14, 15-16.

[11] Sebastian Seibold et al., “Arthropod Decline in Grasslands and Forests is Associated with Landscape-Level Drivers,” *Nature* 574, no. 7780 (October 30, 2019) : pp. 671-674 ; Bradford C. Lister and Andres Garcia, “Climate-Driven Declines in Arthropod Abundance Restructure a

Rainforest Food Web," *Proceedings of the National Academy of Sciences* 115, no. 44 (October 15, 2018).

[12] William E. Kunin, "Robust Evidence of Declines in Insect Abundance and Biodiversity," *Nature* 574, no. 7780 (October 30, 2019) : 641.

[13] Francisco Sánchez-Bayo and Kris A. G. Wyckhuys, "Worldwide Decline of the Entomofauna : A Review of Its Drivers," *Biological Conservation* 232 (2019) : 16, 22.

[14] Oliver Milman, *The Insect Crisis : The Fall of the Tiny Empires That Run the World* (W.W. Norton, 2022), 5 ; Dave Goulson, *Silent Earth : Averting the Insect Apocalypse* (HarperCollins, 2021).

[15] Mark Williams and J. A. Zalasiewicz, *The Cosmic Oasis : The Remarkable Story of Earth's Biosphere* (Oxford University Press, 2022), 130-131.

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- [L'apocalypse des insectes dans l'anthropocène - Partie 1](#)
 - [L'apocalypse des insectes dans l'anthropocène - Partie 2](#)
 - [Insect Apocalypse in the Anthropocene - Part 3](#)
 - [Insect Apocalypse in the Anthropocene, Part 4](#)
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P.-S.

- CLIMATE & CAPITALISM. February 16, 2023 :
<https://climateandcapitalism.com/2023/02/16/insect-apocalypse-in-the-anthropocene-i/>