

# PROTECTING THE WEB OF LIFE

## ESA Position Statement on Insects and Biodiversity

Approved on October 30, 2021  
Valid through October 30, 2025

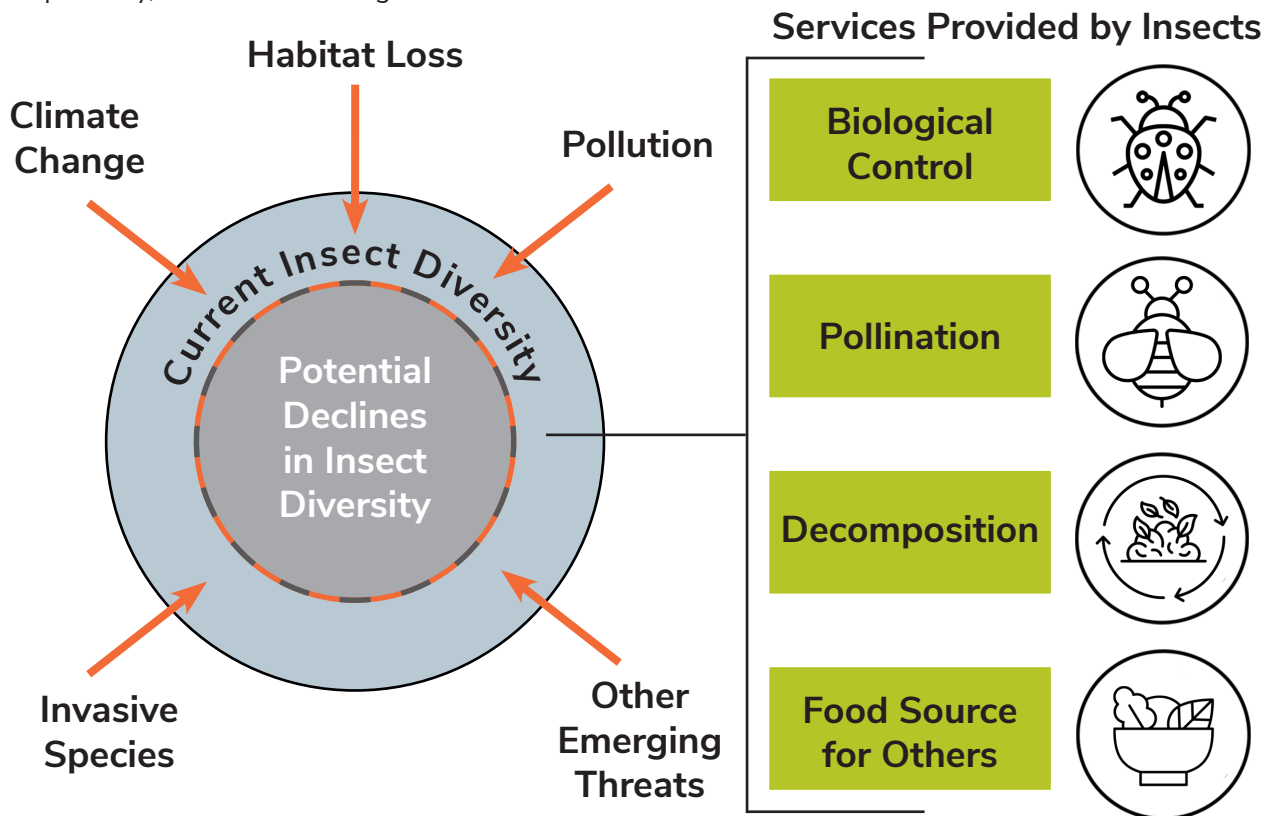
### SUMMARY

The benefits of healthy ecosystems—such as clean air, clean water, pollination of crops and native plants, and robust food webs—all depend on a diverse and thriving community of insects and arthropods, "the little things that run the world." ESA advocates for legislation and funding to support conservation of insect biodiversity and to deepen our understanding of insect ecology in natural and managed settings. The protection and exploration of Earth's biodiversity are essential for a sustainable future.

### OVERVIEW

The Entomological Society of America (ESA) advocates for increased study and protection of all forms of biodiversity, especially the millions of species of insects and their relatives — "the little things that run the world,"<sup>1</sup> as renowned entomologist and conservationist E.O. Wilson so aptly put it.

The extraordinary variety of living organisms with which we share the Earth, including animals, plants, and microorganisms, are deeply interconnected in countless ecological interactions that sustain life on this planet. Ecological services that ensure clean air, clean water, nutrient cycling, pollination of crops and native plants, natural pest management, and robust food webs all depend on a diverse and thriving community of insects and their relatives. Biodiversity, often measured by the number of different species and their relative population sizes in a given habitat, can have a significant impact on the resilience, flexibility, and sustainability of these services. Estimates of the worldwide economic benefit of biodiversity-based ecological services in 1996 and 1997 range from between \$26 and \$33 trillion respectively, without accounting for inflation<sup>2</sup>.




<sup>1</sup>Wilson, E.O. *Conservation Biology*, 1:4, 1987, 344–346.

<sup>2</sup>Pimentel, D, et al. *BioScience*, 1997, 47:11, 747-57.



**ENTOMOLOGICAL  
SOCIETY OF AMERICA**  
SHARING INSECT SCIENCE GLOBALLY



Alarming, recent studies in several parts of the world have revealed dramatic declines in insect populations over the past few decades. These reports have raised concerns among scientists and the public about a possible “insect apocalypse”<sup>3</sup>. Although a worldwide collapse of all insect populations is highly unlikely, this headline-grabbing phrase underscores the severe real-world effects of a loss of insect biodiversity on our managed and natural ecosystems.

Numerous global trends harm insect biodiversity and most are caused by people. Some of the most critical include:

- *Habitat loss*: To meet the needs of growing populations, people cause direct habitat destruction and damage through deforestation, agricultural and urban development, and environmental pollution and contamination.
- *Climate change*: Although biological systems can evolve and adapt to changing environments, the current pace of change in temperatures, seasonal length, rainfall, and fire frequency exceeds the capacity of most species to respond. Insects are falling out of sync with critical host plants, pollen providers, and microbial partners. Attempts to adapt result in changing distributions of insect populations to new habitats, altered emergence times (when individual species are active) and reproductive rates, and feeding on new hosts that the species has not fed on previously. But many species will also fail to adapt and will suffer local or global extinctions.
- *Pollution and pesticide use*: Pesticides, fertilizers, and other chemical compounds are important in crop production, managing pests in various settings, and managing invasive species. However, use of these chemicals in agricultural, forest, and urban settings may have spillover effects that harm non-target insects, including native and managed pollinators, and hinder natural pest management in managed systems. Similarly, other pollutants, such as heavy metals from industrial processes, can also harm insect populations.
- *Invasive species*: Expanding global trade has increased the rate of introduction of exotic species, leading to direct competition with and potential extinction of native species. Invasive species can decimate plant species that are vital to local insect communities (e.g., ash trees killed by the emerald ash borer), threaten food security, or dramatically alter ecosystems through predation, competition, and other mechanisms.
- *Emerging threats*: Decreased spring runoff in aquatic systems, light pollution disrupting nocturnal life cycles, excessive nitrification of soil and water causing pH and nutrient changes, and co-extinction of species dependent on each other are all increasing as threats to biodiversity.

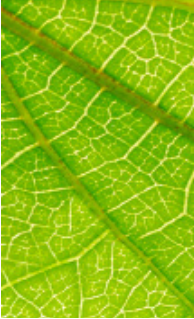
We must achieve a better understanding of how these stressors interact to challenge ecosystem stability and the tradeoffs that various competing needs (e.g., food security) place on those ecosystems. An expanded research enterprise involving professional and community scientists is necessary to document the overall diversity of insects, their critical ecological roles, and their long-term population trends. Without such documentation, we can neither predict nor prepare for the effects of changing insect diversity and abundance on essential ecological processes. Focused research can help identify preemptive actions and mitigate potential negative impacts on biodiversity.

## A BRIEF OVERVIEW OF INSECT BIODIVERSITY

More than half of all species on Earth are insects and their relatives, with more than 1.5 million species described (known to science and assigned a scientific name) and at least that many more awaiting discovery or description. As the largest and most diverse lineage of living organisms, insects play dominant and vital roles in every non-marine ecosystem, sustaining populations of birds, fish, and, in turn, most other vertebrate species.

<sup>3</sup>Wagner, DL, et al. PNAS, 2021, 118:2, e2023989118.





A conservative estimate of the annual value of ecological services, adjusted for inflation, provided by insects in the United States is at least \$88 billion<sup>4,5</sup>. Insects also play critical roles as research model systems (much of what we know about genetics was learned first in *Drosophila* fruit flies), agents of biological control in agriculture and across landscapes, and inspiration for design, engineering, materials, art, medicine, textiles, and stories. Insect species and populations are also valuable indicators of biodiversity and ecosystem health and stability. Monitoring key insect groups can assist with early detection of ecological shifts that might adversely affect human welfare.

## RECOMMENDATIONS TO PREVENT FURTHER LOSS

The protection and exploration of the Earth's biodiversity, particularly with regard to insects and other arthropods, are essential for a sustainable future. ESA advocates for legislation and funding aimed at conservation of insect biodiversity in the wild and a more comprehensive understanding of insect ecology and biology in natural and managed settings. Emphasis is placed in the following areas:

- **Increase discovery and exploration of biodiversity** within our country and world, fully documenting species richness and ecosystem processes.
- **Increase long-term monitoring of insects and related species** across a diversity of landscapes—by leveraging advances in remote sensing, machine learning, and artificial intelligence—to develop critical baseline data and understand drivers of change in insect populations.
- **Expand research on insects** and their relatives—by harnessing cross-disciplinary data sets, scientific collections, and innovative analytics—to address all aspects of their biology including behavior, genomics, physiology, ecology, population dynamics, systematics and taxonomy, and potential values to humanity.
- **Protect and restore habitat**, ensuring and maintaining a complete range of intact natural ecosystems and their dynamics.
- **Facilitate domestic and international collaboration** and cooperation between entomologists, other scientists in the public and private sectors, policymakers, and citizens to work together to prevent the loss of native species and populations and to prevent the introduction of damaging exotic species.
- **Promote improved pest management techniques** that apply integrative, science-based management

<sup>4</sup>Losey JE, Vaughan M. *BioScience*, 56:4, 2006, 311–323.

<sup>5</sup>Jordan A, et al. *Environ. Sci. Technol.* 2021, 55, 4, 2243–2253

The Entomological Society of America is the largest organization in the world serving the needs of entomologists and other insect scientists. ESA stands as a resource for policymakers and the general public who seek to understand the importance and diversity of earth's most diverse life form—insects. Learn more at [www.entsoc.org](http://www.entsoc.org).

3 Park Place, Suite 307  
Annapolis, MD 21401-3722 USA  
Phone: 1-301-731-4535  
Fax: 1-301-731-4538  
[esa@entsoc.org](mailto:esa@entsoc.org)  
[www.entsoc.org](http://www.entsoc.org)



**ENTOMOLOGICAL  
SOCIETY OF AMERICA**  
SHARING INSECT SCIENCE GLOBALLY