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## **ESA Position Statement on Pollinator Health**

*First Approved on July 29, 2015*

*Redrafted October 15, 2019*

*Valid through October 15, 2023*

Pollinators are vital components of natural and agricultural ecosystems, contributing to the reproduction of nearly 90 percent of flowering plant species,<sup>1</sup> including almost three-quarters of global agricultural crops, mainly fruit, vegetable and nut crops that provide key nutrients for human diets.<sup>2,3,4</sup> Pollinators, both managed (e.g., honey bees, bumble bees, and several solitary bee species) and wild (e.g., other bee species and many flies, butterflies, moths, beetles, and some birds and bats), collectively provide upwards of \$235 billion annually in economic value to global agriculture in pollination services, with billions more contributed to downstream industrial sectors.<sup>5,6,7</sup>

However, populations of many managed and wild pollinators are in decline in the U.S. and worldwide.<sup>8</sup> For managed U.S. honey bees, the annual survival rate of colonies is declining, though total colony numbers remain largely unchanged due to management practices that increase colony numbers in the spring.<sup>9,10,11</sup> Declines in pollinator populations are caused by multiple interacting factors<sup>12,13</sup>, similar to those associated with broader biodiversity declines: changes in land use (which reduce nesting habitat and nutritional resources provided by flowering plants); exposure to pesticides, pollutants, parasites, and pathogens, and climate change.

Tackling this multifaceted, complex issue requires a large, multidisciplinary, nationwide and international effort that encompasses fundamental research on pollinator ecology and biology, applied research on sustainable best practices for managing pollinators and landscapes, and active communication between the public, scientific community, stakeholders, and policymakers.<sup>14,15</sup> The Entomological Society of America (ESA) is in a unique position to inform this discussion because our society includes public and private-sector researchers and educators who work closely with a broad range of stakeholders that rely on healthy pollinator populations and sustainable food production. The priority areas below will provide the infrastructure to support research-informed and science-based policy to effectively and sustainably protect pollinator communities.

**(1) Develop accessible databases with long-term information on pollinator population trends.** To fully understand how environmental conditions and management practices affect pollinator populations, it is necessary to monitor long-term trends in pollinator abundance and diversity across large spatial scales.<sup>16</sup> ESA is in support of maintaining and expanding programs to monitor the health of managed bees (e.g., the U.S. Department of Agriculture (USDA) NASS

Annual Honey Bee Colonies Survey<sup>17</sup> and other public grant-funded academic and non-profit programs<sup>18</sup>). The ESA also supports programs targeted at wild pollinators (including the initiative from the USDA to establish a national monitoring program for wild bees). These large-scale efforts can be supported by monitoring schemes and programs to collect data from beekeepers, growers, land managers, and citizen scientists. Data generated from these efforts must be maintained in well-curated digital databases or museum collections accessible to the broader community.

**(2) Characterize the nutritional and habitat needs of pollinators and develop approaches to ensure that adequate resources are available to pollinators in agricultural, urban, and restored landscapes.** Pollinators are best supported by communities of diverse and abundant flowering plants and a variety of nesting habitats for wild species. Research is needed in the following areas: determining the nutritional needs of diverse pollinator species and the regionally appropriate flowering plants that meet these needs; understanding how nutrition interacts with other factors involved in pollinator decline; determining how nest-site availability for wild species influences population dynamics; and ascertaining how foraging and nesting habitat resources can be optimized through improved land-management practices. Research support should prioritize projects that address large geographic areas and management practices that are compatible with current land-use patterns.

**(3) Develop approaches for efficient and rapid characterization, modeling, and prediction of ecologically relevant effects of stressors.** Pollinators are exposed to multiple interacting, acute, and chronic biological and environmental stressors, the effects of which can vary among species, life stages, and environmental conditions. ESA members support science-based risk assessment and encourage further efforts to evaluate risk given the full spectrum of stress factors<sup>19</sup>. To fully characterize stressors' effects, it is necessary to develop efficient and accessible diagnostic methods to both monitor exposure and assess responses. Results must be rigorously and comprehensively analyzed across multiple studies, facilitating the development of predictive models. The data and results of these studies should be compiled into accessible databases (see Priority 1). This information will allow the development of decision support systems to improve the management of pollinators and landscapes, and can serve to inform regulatory processes, including improving and updating the 2014 framework for pollinator risk assessment developed by the EPA<sup>20</sup>. These efforts are best supported through collaborations which includes researchers with diverse expertise, stakeholders, and policymakers.

**(4) Improve best-practice guidelines for raising, managing, and transporting honey bees.** Honey bee colonies often are transported great distances to provide pollination services in agricultural landscapes. However, they may experience limited diets and increased exposure to parasites, diseases, agrochemicals, and other stressors. Maintaining healthy bees under these conditions can be difficult. Best management practices can assist beekeepers<sup>21</sup>, but these should be continuously improved with new information. Improved monitoring, treatment thresholds, treatment options, and the breeding of resilient genetic stocks (resulting from Priorities 1-3) can further increase success rates in maintaining the large numbers of vigorous honey bee colonies needed for crop production and honey production. Improvements in honey bee colony management can also reduce risks – such as spillover of parasites and pathogens – to other managed and wild pollinator populations. The development and expansion of tools and platforms

for facilitating rapid communication between beekeepers, growers, and land managers are critical. Improving and disseminating best management and communications practices requires a coordinated effort by University and Cooperative Extension apiculturists and other personnel, the USDA-Agricultural Research Service (ARS), and industry experts.

**(5) Develop best-practice guidelines for "Integrated Pollinator and Pest Management" (IPPM) in diverse landscapes.** Integrated pest management (IPM) is a sustainable strategy that can improve profitability while reducing risks associated with pesticide use, but the economic value of pollination services at the ecosystem level should be assessed even more broadly and be included in the IPM decision-making process.<sup>22,23,24</sup> Therefore, integrated pollinator and pest management (IPPM) guidelines should be developed through research and incorporated into crop- and region-specific programs that recommend appropriate pest-management solutions and land-management strategies that reduce risks to pollinators and enhance pollinator ecosystem services while maintaining profitable crop and honey production<sup>24,25,26</sup>. Increased support for research on IPPM practices and for Cooperative Extension are needed to develop and implement programs that are compatible with pollination ecosystem services.

**(6) Facilitate coordinated efforts among stakeholders, universities, industry, and government agencies.** There has been substantial progress in understanding the factors leading to population decline in managed and wild pollinator species. However, the majority of efforts to address pollinator decline have been fragmented across research groups and confined to primarily short-term and small-scale studies, due to low levels of federal funding for agricultural research and limited communication among researchers, stakeholders, and policymakers. Therefore, strong partnerships are needed among universities (with their associated Cooperative Extension services), USDA-ARS laboratories, state and federal regulatory agencies, agricultural industry, non-governmental organizations, and other stakeholders. These partnerships can effectively leverage existing national and international resources, leading to innovative approaches for pollinator conservation.

**(7) Develop professional training programs and public-outreach campaigns for pollinator research, management, and conservation.** Educational programs are essential for providing broad integrative training in research, extension, and outreach to academics at all levels, including undergraduates, graduate students, and postdoctoral scholars—the next generation of scientists, educators, and policymakers who will tackle future challenges. Similarly, expanded training and outreach programs should be provided to non-research communities, including pesticide applicators, crop consultants, homeowners, landowners, beekeepers, and policymakers. These programs should be accessible to individuals from different socioeconomic and other backgrounds.

Pollinators are critical to the function of healthy landscapes and are key contributors to food security. They serve as outstanding exemplars of the role that healthy ecosystems play in supporting a sustainable future. ESA strongly supports expanded research and educational efforts in the area of pollinator health to improve management, understanding, and appreciation of our complex and dynamic natural, urban, and agricultural ecosystems.

ESA is the largest organization in the world serving the professional and scientific needs of entomologists and people in related disciplines. ESA today has more than 7,000 members affiliated with educational institutions, health agencies, private industry, and government. Headquartered in Annapolis, Maryland, the Society stands ready as a non-partisan scientific and educational resource for all arthropod-related topics. For more information, visit [www.entsoc.org](http://www.entsoc.org).

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