THE NATIONAL ACADEMIES

REPORT IN BRIEF

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Status of Pollinators in North America

About three-quarters of the world's flowering plant species rely on pollinators—insects, birds, bats, and other animals—to carry pollen from the male to the female parts of flowers for reproduction. There is direct evidence for decline of some pollinator species in North America. For many species, there has not been enough monitoring over time to determine whether or not there has been a population decline.

Pollinators are vital to agriculture. Most fruit, vegetable, and seed crops and some crops that provide fiber, drugs and fuel are pollinated by animals. Bee-pollinated forage and hay crops, such as alfalfa and clover, also are used to feed the animals that supply meat and dairy products. Pollination by animals also is essential for maintaining the structure and function of a wide range of natural communities in North America. In view of that economic and ecological importance, this report assesses the status of pollinators in North America, identifies species for which there is evidence of decline, and analyzes the putative causes and potential consequences of those declines.

Sphinx moth (*Hyles lineata*)
Photo by W. May

Status of Managed Pollinators: Bees

Populations of the honey bee, *Apis mellifera*, North America's most important managed pollinator, are in decline in the United States. Many farmers depend on honey bees, which they lease for specific seasons to pollinate crops. Managed pollinator decline can adversely affect the availability, price, and quality of the many fruits, vegetables, and other products that depend on animal pollination.

Long-term honey bee population data have been gathered by U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) since 1947. However, the assessment of populations in North America has been complicated by NASS's historic focus on honey production rather than on the number of colonies, its exclusion of hobbyist beekeepers in its survey, the movement of colonies around the country, and inconsistent data collection methods among the United States, Canada, and Mexico. Population data are not available for other managed pollinators, such as alfalfa leafcutting bees and bumble bees.

Recommendation: Improved information gathering for the beekeeping industry is critical, and the National Agricultural Statistics Service (NASS) should modify its data collection methodologies. NASS should refine its assessment of honey bee abundance, collect commercial honey bee pollination data, and coordinate and reconcile data collection on honey bee colonies throughout North America.

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The honey bee, *Apis mellifera*, is North America's most important managed pollinator. Photo by S. Buchmann, University of Arizona, Tucson

Introduced parasites, in particular Varroa destructor (the varroa mite), have had a significant negative impact on honey bees in the United States. Importation of foreign bees into the United States, which was conducted in 2005 for the first time since 1922, carry the risk of pest and parasite introduction. Other factors affecting bee populations include antibiotic-resistant pathogens; pesticide-resistant mites; and the encroachment of Africanized honey bees, particularly in the southeastern United States.
Recommendation: The Animal and Plant Health Inspection Service (APHIS) should ensure that its regulations prohibit introduction of new pests and parasites along with imported bees, and Congress should expand the Honeybee Act of 1922 to include culturing of bumble bees and the fostering and breeding of other imported pollinator species.

Research in genetics and genomics has facilitated the development and maintenance of mite- and pathogen-resistant stocks of honey bees. However, these technologies have not been widely adopted, and there is a pressing need for translational research to develop commercially viable practices from the results of basic research.
Recommendation: Through research at the Agricultural Research Service (ARS) and competitive grant programs, USDA should expand its efforts to encourage innovative approaches to protecting honey bee health and improve genetic stocks of honey bees.

Despite the evidence of their efficacy as crop pollinators, wild species are not being effectively utilized in agriculture. The development of management protocols for wild species and the management of agricultural landscapes to better sustain wild pollinator populations can create alternatives to supplement honey bees as pollinator demands rise and shortages become likely.
Recommendation: USDA should establish discovery surveys for crop pollinators throughout the range of crops in North America to identify the contributions of wild species to agricultural pollination.

Status of Wild Pollinators

Long-term population trends for several wild bee species (notably bumble bees), and some butterflies, bats and hummingbirds are demonstrably downward. For most pollinator species, however, the paucity of long-term population data and the incomplete knowledge of even basic taxonomy and ecology make definitive assessment of status exceedingly difficult.

Improving Population Assessments

Most insect pollinators in natural and agricultural systems are not well characterized, taxonomically or ecologically, in part because of the lack of monitoring programs and in part because of a shortage of taxonomic resources. Although suggestive evidence of decline, extirpation, or extinction exists for some species, documentation of population changes is available for very few.
Recommendation: To address the taxonomic impediment to assessing pollinator status, the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS) should expand basic research on the systematics of pollinators and on the development of rapid identification tools.

Determining the Causes of Population Declines

The causes of decline among wild pollinators vary by species and are generally difficult to assign; definitive causes of decline could be assigned in only a few cases.

One possible cause of decline in native bumble bees appears to be introduced parasites carried by bumble bees imported from Europe for greenhouse pollination. These bees frequently harbor disease organisms and their escape from greenhouses can lead to pathogen spillover into native species. Disease, notably chalkbrood (caused by the fungal pathogen, *Ascosphaera aggregata*), also has harmed populations of the alfalfa leafcutting bee, *Megachile rotundata*, in the United States.

Recommendation: To prevent pathogen spillover to wild populations, APHIS should require that any commercially produced bumble bee colony shipped within the United States be certified as disease-free.

For some wild species, competition with exotic pollinators (including the honey bee, *A. mellifera*, which is not native to North America) has led to population declines.

Declines in many pollinator groups are associated with habitat loss, fragmentation, and deterioration, although data are often inadequate to demonstrate causation unambiguously.

Changes in the temporal patterns and spatial relationships of pollinators and plants (as their ranges and distributions change) that result from global climate change can lead to a decline in interactions between flowers and pollinators. Disruption of migratory routes is evident in hummingbirds, nectar-feeding bats, and some butterflies.

Identifying the Consequences of Pollinator Population Declines

One consequence of pollinator decline may be an increased vulnerability of some plant species to extinction, although consequences are difficult to define in nonagricultural systems. In the event of declining pollinator populations, some plant populations that are dependent on affected pollinators for reproduction could become more vulnerable to an extinction vortex—the interacting factors that serve to progressively reduce small populations—because of the demographic and genetic consequences of small population size. The effects of pollinator decline on rare plant species or on those with small populations should be given special attention.

Recommendation: The U.S. Geological Survey, the Fish and Wildlife Service, and other agencies responsible for natural resource protection should establish discovery surveys for pollinators of rare, threatened, and endangered plant species.

Long-term, systematic monitoring is necessary for unambiguous documentation of trends in species abundance and richness. Such monitoring allows detection of relationships between changes in pollinator communities and the putative causes of change. Those relationships must be understood to assist development of plans to mitigate harm or to manage species sustainably. Pollinator-monitoring programs in Europe (for example, the Survey of Wild Bees in Belgium and France and the European Union's project, Assessing Large-Scale Risks for Biodiversity with Tested Methods, ALARM) have effectively documented declines in pollinator abundance, but there is no comparable U.S. program. The lack of historical baselines with which contemporary survey data can be compared makes it difficult to assess pollinator status or to determine the causes of documented declines. However, the ALARM project showed that such baselines could be established by mining museum specimens for historical data.

Recommendation: The federal government should establish a network of long-term pollinator-monitoring projects that use standardized protocols and joint data-gathering interpretation in collaboration with Canada and Mexico. A rapid, one-time assessment of the current status of wild pollinators in North America to establish a baseline for long-term monitoring is a laudable initial goal.

Steps Toward Conservation of Pollinator Species

Effective conservation or restoration of pollinator populations requires comprehensive knowledge of their biology. Current knowledge is insufficient to inform conservation and management programs.

Recommendation: The National Science Foundation and USDA should recognize pollination as a cross-cutting theme in their competitive grant programs and work together to integrate research that ranges from the genomics of honey bees and the systematics and ecology of wild pollinators to the effects of global climate change on pollinator-plant interactions.

Hummingbird, a wild avian pollinator
Photo by W. May

Many simple and relatively low-cost practices that would promote pollinator conservation are known and available. Land managers and landowners, including farmers and homeowners, should be encouraged to adopt "pollinator-friendly" practices, many of

which incur little expense. Farmers and ranchers can be offered economic incentives to adopt such practices. Landowners such as homeowners and businesses could contribute to the conservation of pollinators by planting wildflowers to provide floral resources for resident and migratory adult pollinators and by providing nesting sites for females. Public outreach is key to pollinator protection, conservation, and restoration.

Recommendation: Economic incentives should be expanded for pollinator conservation.

Recommendation: As part of their outreach, federal granting agencies should make an effort to enhance pollinator awareness in the broader community through citizen-scientist monitoring programs, teacher education, and K-12 and general public education efforts that center on pollination.

Recommendation: Professional societies (Ecological Society of America, Entomological Society of America, American Association of Professional Apiculturists, Botanical Society of America) and nongovernmental organizations (North American Pollinator Protection Campaign, Xerces Society for Invertebrate Conservation) should collaborate with landowners and the public to increase awareness of the importance of pollinators and to publicize simple activities the public can use to promote and sustain pollinator abundance and diversity.

Although the object of the Endangered Species Act of 1973 (ESA) is to protect endangered species and their habitats, many endangered pollinators are not recognized as candidate species for two reasons. First, Congress directed that listing of species required a scientific determination of its continued existence as threatened or endangered, but data on many pollinators are inadequate for such a determination. Second, a 1981 congressional revision of the ESA specifically exempts any "species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man." Some caterpillars and carpenter bees, for example, can cause or have the potential to cause damage. This means that some pollinating species are not likely to receive protection.

Recommendation: Congress should not consider any Endangered Species Act amendment that would create additional barriers to listing pollinator species as endangered.

Lesser long-nosed bat (*Leptonycteris nivalis*), a wild mammalian pollinator; Photo © Merlin D. Tuttle, Bat Conservation International, reprinted with permission.

COMMITTEE ON STATUS OF POLLINATORS IN NORTH AMERICA

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This report brief was prepared by the National Research Council based on the committee's report. For more information, contact the Board on Life Sciences at bls@nas.edu or visit http://nationalacademies.org/bls. *Status of Pollinators in North America* is available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.