

Facts from the NAS National Research Council Study: *Status of Pollinators in North America*

Importance of Pollinators

About three-quarters of the more than 240,000 of the world's flowering plants rely on pollinators – insects, birds, bats, and other animals – to various degrees to carry pollen from the male to the female parts of flowers for reproduction. (p. 1)

Vital to our food:

- Pollinators are vital to agriculture because most fruit, vegetable, seed crops and other crops that provide fiber, drugs, and fuel are pollinated by animals. (p. 1)
- Globally, pollinators are fundamentally important for the production of roughly 30 percent of the human diet and most fibers (cotton and flax), edible oils, alcoholic beverages, nutraceuticals and medicines created from plants. (p. 21)
- Bee-pollinated forage and hay crops, such as alfalfa and clover, are also used to feed the animals that supply meat and dairy products. (p. 1)
- Honey bees enable the production of no fewer than 90 commercially grown crops...(p. 2)
- ...Fruits and vegetables, which add diversity to the human diet and provide essential nutrients, tend to depend heavily on pollinators. Seven of the nine crops that provide at least 50 percent of the vitamin C available to the human diet depend partially or entirely on animal pollination for the production of fruits or seeds (oranges, cabbages, green peppers, tomatoes, melons, tangerines, watermelon). (p. 94)
- Five major fruit crops are 100 percent reliant on insect pollination: almond, apple, avocado, blueberry and cranberry. (p. 103)

Vital to our ecosystem:

- ...Pollinator-plant relationships encompass almost 400,000 species... (p. 14)
- In general, pollination is a mutually beneficial interaction; pollinating animals receive some sort of nutritional “reward” for visitation and pollination delivery...As an example of a closely dependent association is the relationship between plants in the genus *Yucca* and their pollinators, the aptly-named yucca moths...this mutualism [is] estimated to be more than 40 million years old... (p. 14)
- Estimating the value of pollinators and pollination in natural ecosystems and predicting the consequences of their losses are considerably more challenging than estimating their economic value in agriculture...[Animal-pollinated] plants...contribute to many ecosystem services of value to humans, such as water filtration, carbon sequestration, and flood and erosion control. (p. 21)

Vital to our economy:

- The annual value of honey bee pollination to U.S. agriculture has been...estimated at [as much as] \$18.9 billion...The annual benefit of honey bee pollination in Canada has been estimated at \$443 million... (p. 18)

Vital to the diversity of our planet:

- Insects comprise the most diverse assemblage of terrestrial animals...(p. 32)
- ...More than 750,000 insect species have been described, possibly as many as 30 million more await discovery and formal description (p. 32)
- Insects account for more than half of the estimated 1,586,800 species that have been formally described by scientists. (p. 32)

Did you know?

Pollinators aren't limited to honey bees; they include other insects such as beetles, flies, butterflies, and thrips. Vertebrates such as birds and bats are also important pollinators for many plant species.

- Tropical tree...species used for timber, silk cotton, balsa wood, and other products, rely primarily on bats for pollination (p. 21)
- Most bat-pollinated flowers have intense scents...Sulphur-based compounds are more common in bat-pollinated species than they are in other pollination systems. Given that the scents are produced in many phylogenetically unrelated species of plants, they are likely the result of long coevolutionary associations. (p. 57)
- Species of pollinators, such as bees and ants, exhibit "eusociality," which is "the most extreme form of social organization in the animal kingdom" (p. 33)
- Forager [bees] communicate the location of particularly rewarding food sources by means of the famous "dance language"... the only non-primate symbolic language (p. 34)
- Beetles are often ignored as pollinators because both the larvae and the adults of many species destroy the reproductive organs of wild and domesticated seed plants. However, beetle pollination is believed to have contributed to the pollination of different lineages of flowering plants for over 120 million years. (p. 47)
- "...Flies may have been the first pollinators... and fly pollination is regarded as second only to bee pollination in evolution of flowering plant diversity." And cacao, the main ingredient in chocolate, is pollinated by flies! (p. 50)
- Some moth species have specialized morphological features, such as long proboscides, and behavior that make them excellent pollinators of some plants (p. 55)
- Thrips are slender, small insects...[that live] largely in the tropics and temperate regions.... They are so numerous on flowers that they can be effective pollinators of a wide variety of plants in nature and agriculture (p. 56)
- Although hummingbirds might be minor pollinators of agricultural crops, many species of wildflowers have coevolved with hummingbirds and exhibit morphological, phonological, or other traits that facilitate interaction. (p. 61)

Causes of Decline in Pollinator Populations

Many explanations have been invoked to account for declines in pollinator populations in North America, including, among others, exposure to pathogens, parasites, and pesticides; habitat fragmentation and loss; climate change; market forces; intra- and inter-specific competition with native and invasive species, and genetic alterations. (p. 69)

- Over past quarter century, declines in wild pollinator populations of various descriptions have been reported in Europe, Asia, Central and South America, Africa, and Australia. By contrast, few pollinator species are monitored in N.A. (p. 26)
- Declines in bat populations have been so dramatic that two of the tree U.S. species...are now listed as endangered under the terms of the U.S. Endangered Species Act. (p. 26)
- Around the world, almost half of the insect extinctions documented have involved flower-visiting species (p. 26)
- ...More than 750,000 insect species have been described [and] possibly more than 30 million more await discovery and formal description...In some communities, insects pollinate as many as 93% of the flowering plants. (p. 32)
- *The rate at which insects are becoming extinct appears to exceed the rate at which new species are being described. [The current rate of extinction has been called] the greatest extinction crisis in roughly 60 million years.* (p. 32)
- The complex nature of many plant-pollinator relationships, which can involve many links among many species, could mean that the loss of component species would eventually elicit a sequence of plant-pollinator extinctions...[For example] plants with long, curved corollas, which might have depended on pollinators with matching mouthparts, have had unusually high extinction rates on Pacific Islands; these losses have been accompanied (or preceded) by extinctions of their pollinating birds. (p. 109-110)
- The loss of bat populations is mostly the result of habitat destruction; especially of roosting sites in caves...The most common causes for the destruction of cave-dwelling bats cave populations involve misguided attempts to control the vampire bat... (p. 88)

Loss of Pollinators Means Loss of Cultural Traditions

Stingless bees...comprise about 400 species found in neotropical and paleotropical forests...For millennia, ancient and modern Maya peoples of southernmost Mexico and neighboring countries have kept the meliponine bees of their tropical forest environments in hollow log hives (“jobones”) in or near villages. Stingless bees have supplied the Maya honey for food and medicine and with beeswax as a sealant and art material. (p. 41)

- In the past, bee houses with traditional log hives contained dozens or hundreds of colonies...It is now uncommon to find a beekeeping operation with more than five colonies of [stingless bees] in villages... (p. 41)
- Ancient Maya beekeeping is disappearing because of habitat fragmentation and intensive apiculture. (p. 41)
- ...93% of the managed...stingless bee colonies in the Yucatan Peninsula have been lost during the past quarter-century. (p. 41)
- [Researchers] predict that there will be no managed colonies of [stingless bees] in Yucatecan Mayan lands by 2008 unless action is taken to maintain the bee colonies. (p. 41)

What you can do to Help

Citizen Scientist Programs

A cost-effective approach to addressing the two kinds of obstacles to monitoring insect pollinators might be to involve both professional and citizen scientists in the effort. The professional science component provides the scientific rigor and detail needed for robust

assessments of biodiversity response to changes in management practices. The citizen science component may then increase the temporal and spatial breadth of studies that can be conducted at minimal cost... (p. 134)

- A proposed citizen-scientist program could use simple measures of pollinator abundance (such as the number of bees observed at flowers) and pollination function (such as seeds set within fruits or flower to fruit ratios on target plants) that could be correctly implemented by non-scientists with minimal training. (136)
- Many examples of successful citizen-scientist monitoring programs provide models (for example, Frogwatch, Monarch Watch, Tucson Bird Count, Illinois Butterfly Monitoring Network, <http://www.bfly.org/>, Canada's Ecological Monitoring and Assessment Network, and others). (p. 137)

Creating Appropriate Habitat for Pollinators

Maintaining diverse groups of wild pollinators therefore requires an understanding of various habitat needs and of managing habitats and landscapes to provide necessary resources.

Populations of pollinators can be supported if habitats are managed to provide food and areas for nesting, overwintering, and breeding... Adequate resources must be available within foraging and dispersal areas and along migratory routes. (p. 154)

- Providing sequences of blooming plants that encompass the entire flight period of the pollinator is one important component of maintaining pollinator populations... (p. 156)
- Native plants are generally preferable to introduced species because they help maintain North American biodiversity of plants and pollinators. Ideally, plants are not just native to the continent but they are native to and genetically adapted to the region and site conditions... Plants must provide a complete phenological suite of resources for key pollinator species. (p. 156)
- Developing an optimal plant list requires research on the network of interactions between plants and pollinators and on which critical "bridging" plants might be needed to provide resources during periods of dearth. (p. 157)
- ...Conserving existing original habitats generally should take priority over restoration, because restored habitats might not replicate every component that is functionally significant to pollinator species, and goals for restoration can be difficult to establish. (p. 157)
- ...Retaining dead branches or trees is an essential part of habitat management for healthy bee populations and communities. Removing large amounts of dead wood for fire wood (mesquite, palo verde, and ironwood in the United States) results in the rapid elimination of many native bees. (p. 160)
- Bee-nesting habitats can also be created by attaching drilled-board trap nests to fence posts, dead trees, or buildings. Detailed instructions for drilled-board trap nests are...online (<http://snohomish.wsu.edu/mg/omblock/omblock.htm>; <http://www.nwf.org/backyardwildlifehabitat/beehouse.cfm>). (p. 160)
- Nest boxes made of wood or Styrofoam with plastic or rubber hose entrance tunnels can be provided for bumble bee species that nest underground. The boxes can be buried or nestled into bank or ditch sides to attract founding bumble bee queens in the spring. Add upholsterer's cotton, abandoned mouse nests, or other nesting materials can improve the nest's attractiveness. (p. 161)