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NATIONAL PARTNERSHIP FOR REINVENTING GOVERNMENT
Vice President Al Gore

WANTED!

POLLINATORS:

Alarming Declines in Insect, Bird, and Mammal Populations Jeopardize Cash Crops, Forests, and Wild Plants. 22-23.

Pollinators, Plants, & Prosperity

Behind the peaceful façade of flowering meadows, lush gardens, and stately trees, an almost invisible battle for survival is raging across the nation. U.S. Geological Survey and other scientists are documenting alarming declines in populations of insects, birds, and mammals whose foraging is key to the spread of pollen from plant to plant.

Collectively referred to as pollinators, these diligent creatures are critical to the life cycle of seed-bearing plants. Without them, the ability of agricultural crops and wild plants to produce food products and seeds is jeopardized. Human intervention in the seed cycle may not provide an adequate substitute for natural pollinators simply because the specific pollination needs of most native plants are unknown.

Atala Butterfly photographed in the Florida Everglades

Scientists have determined that habitat loss, poisoning, diseases, and competition from non-native species are triggering the demise of pollinator populations. Two-thirds of all flowering plants depend on insects for pollination, and the rest depend on mammals and birds. USGS researchers are studying the ecology and population biology of insect, bird, and mammalian pollinators to better understand their crucial role in ecosystem processes.

Species, Habitat Alterations Affect Bee Pollinators in U.S. Northeast

Howard S. Ginsberg

Scientists have discovered that disturbances of natural habitats are having profound effects on bee communities and their pollinator relationship with plants. Two human activities in particular account for the major features of current bee and flower relationships: the introductions of alien species; and the clearing and later abandonment of land for farming.

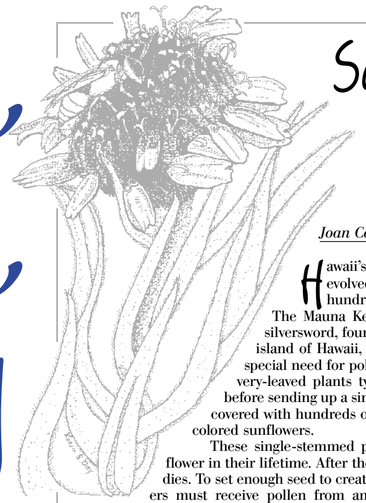
In an old field near Ithaca, New York, USGS biologists have found that the honeybee, an alien species introduced to North America by the early colonists, is the most common species found on native goldenrods, while native bees, mostly tiny sweat bees, are most abundant on introduced weeds. Open fields left untended by the abandonment of farms in the late 1800s and early 1900s provide ideal conditions for an historically rare abundance of goldenrods, which now blanket fields in late summer.

The highly social honeybees build large populations over the summer that easily exploit this abundant bloom. Foraging native bees, more solitary and less social, do not reach the high densities of honeybees and are far less common in late summer. Native bees peak earlier in the summer when they forage on the common flowers then in bloom, primarily introduced weeds.

How will changes in pollination patterns affect natural areas, how will these changes affect crop production, and what can be done about problems that might results from these changes? In May, scientists from the Department of the Interior and the Department of Agriculture held a joint workshop to discuss pollinator issues. Researchers shared their concerns and devised collaborative approaches to stemming a trend with potential for broad ecosystem effects.

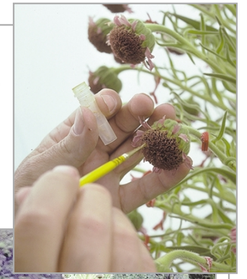
In recent years, honeybee colonies nationwide have faced additional threats to their survival. The Varroa mite and the tracheal mite are infesting bees and causing declines in bee populations. At the same time, many native bee species are declining due to pesticide use.

Bird and bat pollinators have been affected by similar factors. Habitat fragmentation, caused by human development in natural areas, is threatening populations of migratory species. Scientists have found that pollination patterns in natural areas are dramatically different now than they were before European settlement and little is known about their current status. Rare, threatened, and endangered plants are particularly vulnerable when their pollination requirements cannot be met.



Saving the Hawaiian Silversword

Joan Canfield



Hawaii's bird and insect pollinators evolved in tandem with the needs of hundreds of unique flowering plants. The Mauna Kea silversword and Mauna Loa silversword, found only on two volcanoes on the island of Hawaii, are endangered species with a special need for pollinators. These remarkable silvery-leaved plants typically grow for four decades before sending up a single, six-foot tall flowering stalk covered with hundreds of miniature, cream to maroon-colored sunflowers.

These single-stemmed plants have just one chance to flower in their lifetime. After the seeds mature, the silversword dies. To set enough seed to create the next generation, the flowers must receive pollen from another silversword plant. With fewer than 50 wild Mauna Kea silverswords in existence, and under 1,000 Mauna Loa silverswords (compared to 65,000 Haleakala silverswords on Maui), this puts incredible pressure on the act of cross-pollination.

Yellow-faced bees and moths of the *Noctuidae* family are important native pollinators of Hawaiian silverswords. They are far less common today, because they are forced to compete with introduced honeybees for pollen and nectar, and are preyed on by other introduced species such as Argentine ants and yellow-jacket wasps. The likelihood that insects will carry pollen between two silverswords flowering simultaneously is very low. In many years, only one silversword—or sometimes none—will flower.

To make up for missing pollinators and non-overlapping flowering, a partnership of biologists is serving as a silversword surrogate pollinator team. USGS researchers are joined by the Hawaii Division of Forestry and Wildlife, U.S. Fish and Wildlife Service, National Park Service, and the University of Arizona in this effort. Each summer, the team locates budding silverswords, returns when they flower to collect the pollen in vials, and then hikes to other flowering silverswords and gently brushes pollen from the vial onto the flowers. Mating choices are selected to maximize genetic diversity.

Returning in late summer, the team collects seed for propagation in a rare plant greenhouse operated by the University of Hawaii. Beginning in 1999, the young plants will be returned to the volcano's slopes, in order to build up the wild population to a self-sustaining level, where yellow-faced bees can easily move from silversword to silversword, regaining their rightful role as cross-pollinators.

Argentine Ant Threatens Island Pollinators

Lloyd Loope

Two native yellow-faced bees visit a silversword flower. Photo by Pete Oboyski.

Hawaii's native animals, including its pollinators, evolved in isolation, 2,000 miles from the nearest continent, without ants. As a result, insect pollinators in Hawaii are extremely vulnerable to predation by aggressive, immigrant, alien ant species. Immigrant ants have reduced or eliminated native insect pollinators in most low elevation areas of Hawaii; higher elevation ecosystems remain more intact.

However, the Argentine ant, a species capable of invading alpine elevations, is spreading throughout Haleakala National Park, one of the state's most intact ecosystems. The species has also proven itself a pest in California and other parts of the world.

Over the past 15 years, research has shown that the Argentine ant at Haleakala National Park is expanding its range at a rate of over 50 yards per year. Because queens are unable to fly, the spread of this species is relatively slow. Wherever this tiny, voracious predator spreads, however, it reduces and can even halt reproduction of pollinators such as native bees and moths. The ant now occupies about five percent of the park and has the potential to occupy up to half of the area.

Argentine ant encroachment is ominous for all insect-pollinated native plants. The most alarming threat involves the famous Haleakala silversword, a federally-listed threatened species that grows only within the ant's potential range. This giant, silvery subalpine plant grows for 30 to 50 years, then sends up a six-foot tall flowering stalk, sets seed, and dies. Cross-pollination is essential for seed set, but for this plant it is critical for its survival. Silversword-pollinator relationships are currently being studied. Strategies for containment or local eradication of the Argentine ant are also being explored with preliminary success. Careful chemical control may prove successful in containing the ants and saving the yellow-faced bees that the threatened silverswords depend on for pollination.

Crested Honeycreeper Depends on Endangered Plants

Thane Pratt

Photo of crested honeycreeper, also known by its Hawaiian name, Akohekohe, by Eric Nishibayashi.

The crested honeycreeper, or Akohekohe, is one of Hawaii's unique and endangered nectar-feeding birds. Its curled crest feathers collect pollen as it sips nectar from flowers in Maui's lush rainforests, making this bird an important pollinator of native plants.

The federal endangered species list includes 263 Hawaiian plant species, in part because their pollinators are rare or extinct. In the case of Hawaiian honeycreepers, 25 of the 45 species are extinct, seven are probably extinct, and eight are highly endangered. To help prevent more extinctions of Hawaiian birds and the plants they pollinate, USGS scientists are studying the feeding habits of honeycreepers, including the Akohekohe.

The Akohekohe's main source of food is nectar from the crimson flowers of the Ohia-lehua, a common native tree. Akohekohe breed around January, when Ohia flowers are most abundant. When Ohia flowering is lowest in mid-summer, Akohekohe do not join other honeycreeper species in moving to lower-elevation areas where Ohia are in bloom.

Instead, the Akohekohe stay in its high-elevation territory switching its diet to nectar from other less common tree and shrub species. Because wild pigs root up and destroy these flowering plants, conservation of the endangered Akohekohe and the plants it pollinates depends on protecting the rainforest habitat from introduced pigs.

POLLINATORS, PLANTS & PROSPERITY

Declining Bat Populations Imperil Crops and Forests

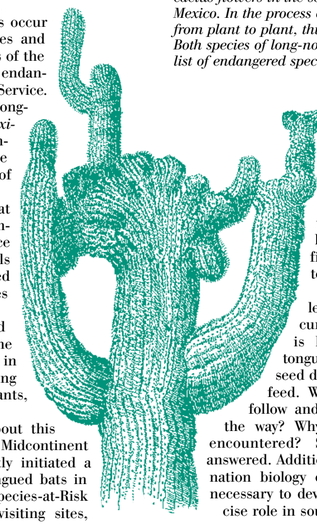
Paul M. Cryan, Michael A. Bogan, and Thomas J. O'Shea

This Mexican long-nosed bat, Leptonycteris nivalis, *hovers above the flowers of a blooming agave. Two species of long-nosed bats feed on the nectar and pollen of agave and cactus flowers in the southwestern United States and Mexico. In the process of feeding, the bats transfer pollen from plant to plant, thus serving as important pollinators. Both species of long-nosed bats are currently on the federal list of endangered species.*

Bat populations are widely believed to be declining. This decline is of concern because bats are consumers of vast numbers of insect pests that cost farmers and foresters billions of dollars. In addition, bats pollinate flowers and disperse seeds, including those of agricultural plants such as bananas, breadfruit, mangoes, cashews, dates, and figs.

In North America, bats pollinate century (agave) plants as well as giant columnar cacti, including the organ pipe and saguaro of Arizona. In addition, bats play important roles as seed dispersers and pollinators on U.S.-affiliated islands, including flying foxes in the Pacific and New World fruit bats in the Caribbean.

Three species of bat pollinators occur in the southwestern United States and two of these, both long-nosed bats of the genus *Leptonycteris*, are listed as endangered by the Fish and Wildlife Service. The third species is the Mexican long-tongued bat, *Choeronycteris mexicana*, now termed a species of concern. Very little is known of the population status and biology of this species.



The Mexican long-tongued bat ranges from Honduras into southern Arizona and New Mexico. Since 1906, fewer than 500 individuals have been found in the United States; nearly all have been females and young. They migrate from the South each spring and spend the warmer months feeding on the nectar of agave and cactus flowers in the desert Southwest. While feeding the bats transfer pollen among plants, serving as pollinators.

In hopes of learning more about this species, scientists at the USGS Midcontinent Ecological Science Center recently initiated a field survey for Mexican long-tongued bats in the Southwest under the USGS Species-at-Risk program. The study involves revisiting sites, such as mines and caves, where long-tongued bats were found in the past. The USGS hopes to assess current distribution and numbers of this species, gather information about behavior and habitat requirements, and assess threats to their existence. So far, long-tongued bats have been verified in many of the areas of historic occurrence.

However, much remains to be learned about the biology of these curious creatures. For instance, little is known about how crucial long-tongued bats are to the pollination and seed dispersal of the plants on which they feed. What migratory routes do the bats follow and are there ample resources along the way? Why are these bats so infrequently encountered? Such questions remain to be answered. Additional in-depth studies into the pollination biology of Mexican long-tongued bats are necessary to develop a clearer picture of their precise role in southwestern desert ecosystems.

Butterfly Pollinators & Exotic Plants in Rocky Mountain National Park

Geneva Chong, Thomas J. Stohlgren and Sara Simonson

This native swallowtail butterfly is nectaring on an introduced musk thistle.

In Rocky Mountain National Park, Colorado, **Dr. Tom Stohlgren** and his research team have found that the most diverse native plant communities contain more invasive exotic plants than do less diverse areas. This is alarming to some scientists, who thought that diverse native plant communities would be better able to resist exotic plants invasion.

Even more surprising was **Sara Simonson's** discovery that the most diverse butterfly communities overlap with plant communities that have been heavily invaded by exotic plants. Researchers are concerned that a destructive cycle could develop between butterfly pollinators and invasive exotic plants.

Most adult butterflies can feed on nectar from a variety of flowering plants, yet they must lay their eggs on a limited number of native plant species because caterpillars typically feed on very specific host plants. As exotic plant species invade a site, they displace native plant species, which may include butterfly host plants. However, several exotic invaders, such as musk thistle and Canada thistle, are good nectar providers and attract adult butterflies. When adult butterflies drink this nectar they may also pollinate the exotic plants, contributing to their invasion success. Native plants that depend on butterflies as pollinators are impacted twice: by exotic plants crowding them out and by exotic plants 'stealing' their limited pollinators. Meanwhile, butterfly populations may decline through this process: adults could find sufficient nectar from exotic plants but be unable to locate their specific host plants to lay eggs to produce next season's adult butterflies.