

Change and the Heartland

Big issues, bite-sized lessons

How Climate Change Will Affect the Midwest



Are Wild Bee Pollinator Populations Declining?



ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

National concern over honey bee colony collapse has generated interest in the status of the other 3,522 U.S. bee species, most of them wild pollinators. Because bees are the primary pollinators of many flowering plants and important crops, a national decline in overall wild bee populations would seriously affect the economy as well as natural plant communities. European countries have sampled bee populations for decades and have documented regional declines. Commercial and wild U.S. bee populations have not been systematically monitored, but there is evidence that the ranges and numbers of some species are shrinking.

Hundreds of Unique Illinois Bee Species Provide Different Pollination Services

Bumble bees are important wild pollinators, largely due to their robust size, long tongues, flight range, versatility, pollination efficacy, and the number of flowers they use for pollen and nectar. They also engage in “buzz pollination” (the buzz they make while on a flower vibrates the pollen receptacle at the frequency to expel the pollen), an important mechanism that honey bees do not exhibit. Bumble bees live in colonies initiated each spring by solitary queens that overwinter from the previous autumn. The colonies get bigger as the season progresses.

University of Illinois scientists are surveying bumble bees across the U.S. and comparing them with historical records from tens of thousands of museum specimens to track any significant changes in species richness and distribution over the last 20 years. The Illinois Natural History Survey insect collection has about 360,000 Hymenoptera specimens (ants, bees, and wasps) dating from the 1800s to the present. Sixteen of 49 U.S. bumblebee species were historically recorded in Illinois before 1949. A comparison of museum specimens with recent field collections shows that the richness of bumble bee species

Key Term

Citizen Scientist

Citizen scientists are members of the public who volunteer time and effort to gather data needed by scientists. At BeeSpotter, citizen scientists and amateur bee hunters partner online with scientists to gather images of bees around Illinois. Each spotting helps illuminate which bees live where. If you would like to help researchers understand and protect bee populations, snap some photos and visit beepotter.mste.uiuc.edu to contribute.

BeeSpotter
University of Illinois

in the state declined substantially in the past century, especially between 1940 and 1960. Four historically recorded species were not found during extensive collecting in 2006 and 2007, while four other bumble bees were found in fewer areas of the state.

Most bees are solitary and do not associate with their offspring or siblings. They emerge each year and mate, and nest in soil tunnels or in tunnels or cavities found or dug in wood, plant stems, or other material. The females provision cells with pollen and nectar for their young. Some species are active during most of the growing season, while others are active only for a few weeks. They typically die before their offspring emerge.

Carlinville, Illinois, is home to one of the oldest and most comprehensive studies of bees ever conducted. Between 1884 and 1916, Charles Robertson collected 296 species on over 400 plants. A re-collection in the area in the early 1970s concentrated on 24 selected plants. University researchers found 82 percent of the bee species originally present on those plants.

Native Pollinators Cope with Environmental Change

To survive, bees primarily require suitable nesting sites close to a continuous source of pollen and nectar when adults are active. Given their small size, bees can maintain themselves in much smaller areas than larger species like mammals. The bees at Carlinville are probably still present because some suitable habitat remains, although their overall numbers are likely greatly reduced. Likewise, the resources needed by a large bee or bumble bee colony to successfully reproduce far exceed those of a small solitary spring bee. The situation is further complicated by the fact that some bees, like honey bees, are generalists and use many plants, while others are adapted to obtain pollen and nectar from only a few specific plants.

Habitat Fragmentation, Pesticide Use, and Conventional Landscaping Stress Bee Populations

Bees are vulnerable to various modern practices as well as to introduced diseases. Land use and landscaping changes that occurred after World War II greatly impacted many species. The switch to row crops, removal of fencerows, conversion of mixed hay pastures to grasses or green alfalfa, and the advent of roadside herbicide spraying and mowing removed nesting habitat and eliminated useful flowering plants in rural areas. In and around urban areas, new subdivisions are begun by scraping away, piling, and often removing topsoil, together with its nesting bees. The new landscaping often lacks plants that provide pollen and nectar throughout the growing season. Extensive pesticide use in soil and on plants also kills countless bees. Bee habitat is becoming increasingly limited and fragmented, forcing bees to live in ever-smaller areas. This isolation, in turn, makes it more difficult for bees to maintain genetic diversity and to recolonize habitats.

Climate Change Could Force Bee Populations to Shift; Habitat Fragmentation Could Inhibit the Migration

If climate change causes shifts in temperature, rainfall, and ultimately the plants that can survive in an area, bee species that cannot adapt must emigrate to survive. However, bees have a relatively short flight range. Many species would probably be unable to bridge the distances between locations with suitable habitat in much of Illinois and would suffer dramatic declines. Habitat fragmentation would also make it difficult for species already adapted to new conditions to colonize the area. For example, species that currently range from Louisiana to Canada will likely adapt, while species found only in the Southwest may not be able to migrate to Illinois.

Planting a Variety of Native Plants Provides Pollinators Food Throughout Season

Plant	Season	Number of pollinator species that visit each plant		
		Long-tongued bees	Short-tongued bees	Butterflies and moths
Virginia Bluebell	early spring	16	2	6
Spring Beauty	early spring	21	37	9
foxglove beards-tongue	late Spring - summer	17	5	3
Swamp Milkweed	summer	12	6	15
Brown-eyed Susan	summer	23	25	7
Sawtooth sunflower	fall	29	9	13
Aster pilosus	fall	37	53	30

Landscaping with Native Plants and Habitat Corridors Would Help Feed Bees and Aid Migrations

Using native plants and carefully selected ornamentals in rural areas, along roadsides, and in neighborhoods, parks, and public landscaping would help mitigate the impacts of habitat fragmentation. Creating habitat islands and corridors would provide food for bees and other pollinators as well as many birds. Planting on or near suitable nesting sites would be even more helpful. The table above lists a few of the many plants that together could provide a continuous food resource throughout the growing season. Comprehensive lists of suitable plants and their availability could be developed for different parts of Illinois. Highways, rural roads, railroads, streams, and related land could form corridors for the migration and dispersal of native bees, butterflies, birds, and other animals.

About the Researchers

Dr. John Marlin is an associate director of the Illinois Sustainable Technology Center. Dr. Sydney Cameron is an associate professor in the Department of Entomology and the Program in Ecology, Evolution and Conservation Biology at the University of Illinois.