Plight of the Bumblebee

The phrase "plight of the bumblebee" yields thousands of hits on the web. For example, a 2009 *Earth Island Journal* article (www.earthisland.org/journal/index.php/eij/article/plight_of_the_bumblebee) describes how the greenhouse tomato industry contributed to bumblebee declines. A Belgium-based company, Biobest, pioneered commercial production of bumblebees for pollination of greenhouse vegetables in the late 1980s. It imported North American bumblebees, reared them in Europe, and exported them to the U.S. Some bees apparently became infected with a virulent European strain of the fungal pathogen *Nosema bombi.* After the bees were shipped back to the U.S. the fungus quickly spread to wild bumblebees.

Scientists began to see dramatic population declines in North American species in the mid-1990s. Two formerly common species, Franklin's bumblebee and the western bumblebee, may already be extinct.

Wild bumblebees are also impacted by agricultural practices in the field. Herbicide spraying eliminates flowering plants on field margins, depriving bumblebees of food and habitat when crop plants aren't in bloom. While there are thousands of native bee species in North America, including roughly 50 species of bumblebees, the domesticated honeybee (*Apis mellifera*) is a European import brought over by colonists in the 1600s. Although honeybees tend to be the main focus of concern about pollinator declines, wild bees can be more plentiful and better pollinators than honeybees, according to a 2011 study (http://news.cornell.edu/stories/2011/10/native-bees-are-better-pollinators-honeybees). Unfortunately, neonicotinoid insecticides, widely used as seed coatings, harm wild bees as much, if not more, than honeybees.

An extensive Swedish field study published in *Nature* earlier this year (http://www.nature.com/nature/journal/v521/n7550/full/nature14420.html), found that planting neonicotinoid-coated oilseed rape (similar to canola) seeds significantly reduced wild bee density, solitary bee nesting, and bumblebee colony growth and reproduction. Researchers concluded that such insecticidal use "can pose a substantial risk to wild bees in agricultural landscapes, and the contribution of pesticides to the global decline of wild bees may have been underestimated."

Bumblebees are important pollinators of many of our most nutritious food crops: not just tomatoes, but squash, beans, melons, apples and blueberries, to name only a few. In reducing pollination, an ecosystem service worth billions of dollars to food producers, chemical-based agriculture is sowing seeds of its own destruction while creating major risks to food security.

Now a new study in *Science* (http://www.sciencemag.org/content/349/6244/177.abstract), led by University of Ottawa researcher Jeremy Kerr, indicates that climate change is another major driver of bumblebee declines. Furthermore, this study suggests that global warming is already contributing significantly to the planet's current mass extinction, acting in surprising and complex ways.

By examining records dating back more than 100 years, researchers found that areas occupied by individual bumblebee species in both North America and Europe have been rapidly contracting. Bees are vanishing from southern parts of their ranges as they grow unsuitably warm, while their northern range limits remain unchanged. In contrast, other insect groups such as butterflies are expanding northward as the climate warms, and are still persisting at their southern range limits.

The study's authors suggest that this difference in tolerance to global warming may reflect the evolutionary origins of these different insect groups. Whereas butterflies "originated and diversified in tropical climates and retain ancestral tolerances to warmer conditions," bumblebees evolved in cooler climates at higher latitudes.

It has been known for some time that bumblebees are essentially "warm-blooded" animals. Bernd Heinrich, professor emeritus at the University of Vermont and author of *Bumblebee Economics,* conducted an elegant series of studies starting in the mid-1970s in which he compared body temperatures of bumblebees to surrounding air temperatures. His research revealed that a well-fed bumblebee can raise the temperature of its thorax when brooding eggs or preparing to fly. Their tolerance of cool temperatures adds to the importance of bumblebees in crop pollination.

Why bumblebees are not migrating northward remains a mystery. And, what to do about this is already stirring up controversy. Dr. Kerr and his co-authors propose "experimental relocation of bumblebee colonies into new areas" to offset range losses. But Rich Hatfield, a conservation biologist with the Xerces Society (a non-profit group devoted to insect conservation), urges a cautious approach to any such "assisted migration" efforts. In a recently-published blog (http://www.xerces.org/blog/climate-change-and-bumble-bee-conservation/) he says, "Before we even consider experimental relocation, we suggest that a concerted and focused effort -- at a continental scale -- should be made to conserve, protect, restore, and create a landscape that more closely resembles the world in which bumble bees evolved." An on-line report published by his group, *Conserving Bumble Bees, Guidelines for Creating and Managing Habitat for America's Declining Pollinators* (http://www.xerces.org/wp-content/uploads/2012/06/conserving_bb.pdf), suggests how this could be done.

Kerr and Hatfield agree on the need for better data on where different bumblebee species are currently found. Both their institutions are participating in bumblebeewatch.org, a new project to track North America's bumblebee species. This website allows a "citizen scientist" -- essentially, anybody concerned about the fate of bumblebees -- to upload a photo, identify the species in the photo, and have the identification verified by an expert.

The new and unexpected findings in the *Science* paper indicate that the global community must address climate change and biodiversity loss as inseparably-linked challenges. Virtually all nations of the world are members of separate U.N. treaties covering these two topics that emerged from the 1992 Rio Earth Summit. Both treaties rely on member nations to maintain authoritative databases through ongoing monitoring activities, and to manage and share the resulting information. But government officials who attend meetings of the United Nations Framework Convention on Climate Change, in particular, have resisted cooperation with the Convention on Biological Diversity. This wastes resources (prospective participants at the Paris climate meeting this coming December, please take note).

Many of the bumblebee species records used in the *Science* study came from Canada's contributions to the Global Biodiversity Information Facility (GBIF), an international organization dedicated to making biodiversity data universally and freely accessible on-line. GBIF member countries acknowledge the scientific importance of biodiversity data sharing. Older records are mostly associated with specimens in natural history collections, such as Canada's national insect collection in Ottawa. Specimens must be painstakingly re-examined, and data on specimen record cards entered into computer programs.

Unfortunately, climate and biodiversity monitoring and data management have suffered under Canada's current government. Funding has been cut -- for example, Canada no longer pays its annual GBIF dues.

University researchers and citizens are stepping up to the plate to tackle biodiversity and climate change issues, through scientific research and monitoring programs. Governments must also act. Failure to do so could have tragic, even fatal consequences for bumblebees and others, including humans.