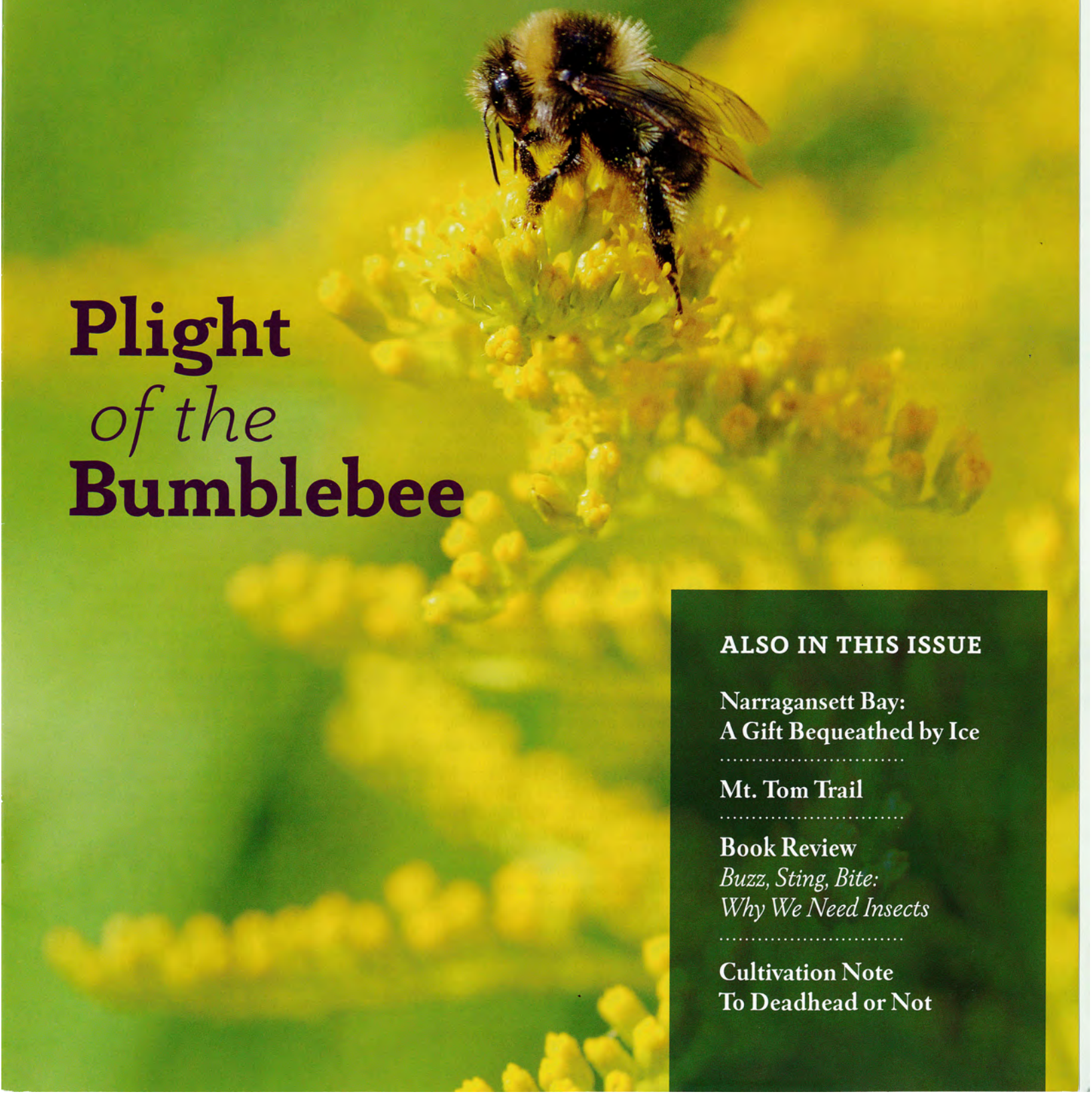
WINTER 2020

BULLETIN OF THE RHODE ISLAND WILD PLANT SOCIETY • VOL. 34 NO.2

WildfloraRI



Plight *of the* Bumblebee

ALSO IN THIS ISSUE

Plight of the Bumblebee

BY ANNE RAVER

Bombus vagans, the half-black bumblebee getting nectar from seaside goldenrod. *Photo by Robert Gegear.*

How many of us were out in the garden last fall, watching the bumblebees nuzzling the asters and goldenrod. "Other pollinators may be in trouble, we thought, but the bumblebees are doing just fine."

Well, they're not.

"Most of the bumblebees that you see right now are *Bombus impatiens*," the common eastern bumblebee, Dr. Robert J. Gegear, a biologist who has been studying bumblebees for decades, told a gathering at the University of Rhode Island in South Kingstown last October. "People see a lot of these bumblebees and it gives them a false sense of security."

What we are seeing is abundance—of a single species, not a diversity of species.

Dr. Gegear spoke at the Lisa Lofland Gould Lecture last fall before an audience of URI master gardeners, members of the Rhode Island Natural History Survey, and RIWPS to help us understand pollinator decline—and to enlist our help both as citizen scientists and as gardeners.

We currently lack the critical ecological information needed to develop effective conservation and restoration strategies for threatened bumblebee species, says Dr. Gegear. To help gather this data, he started the Beecology Project (https://beecology.wpi.edu), a citizen science program, in 2016.

Pollinators are declining worldwide at ever-faster rates. As keystone species, native pollinators are essential to the survival of plants and wildlife at different levels in the food web: for example, the bird eats the larvae of the pollinator that fertilizes the plant, the seeds or berries of which are eaten by birds and other wildlife, which in turn become prey of the raptor that swoops down to capture its dinner, and on and on throughout a complex system of interdependencies. If you remove too many keystone species, the whole ecosystem collapses.

Dr. Gegear wants us to rethink our view of pollinator decline. "People tend to think about pollinators, particularly the honeybee, from the animal perspective only. But the term 'pollinator' is actually a plant-based term. Pollination is a very specific function that the animal is doing for the plant," Dr. Gegear explained. Consider a field of wildflowers. From the plant's perspective, the ideal pollinator is one that moves pollen between flowers of the same species. If it decides to move between flowers of different species then it reduces the reproductive success of both donor and recipient plants. So, plants want to prevent their pollinators from switching between species.

However, the pollinators do not care about plant reproduction. Rather, they are just looking to maximize their rate of energy intake. This "plant-pollinator conflict" has been a major driving factor in floral diversification.

To forage effectively, pollinators must learn and remember how different flowers look, smell, and taste. Remembering more than one combination of floral cues at a time is a daunting task for pollinators, so they restrict their visits to flowers of one species to maximize their rate of reward intake.

During his lecture, Dr. Gegear showed a photograph of a bumblebee's legs sticking out of an Andrew's bottle gentian (*Gentiana clausa*). The legs belonged to *B. vagans*, the half-black bumblebee, which has figured out how to pry open the flower's petals to get the nectar. As it does so, it gets

covered with pollen, and when it exits, it grooms this pollen off its head and thorax, carrying it back to its nest on its legs. "But the pollen it misses is going to pollinate another plant of this species," said Dr. Gegear.

Only about ten percent of bumblebees figure out where the nectar is hidden. "But for those that get inside, it's nectar heaven. It's so rewarding that bees remain faithful to these flowers. . . . That maximizes the pollen transfer efficiency."

"Think of it this way: every type of pollinator that you see—bees, butterflies, flies, beetles, hummingbirds—has co-evolved with a particular set of plants. Each side of the partnership needs the other to survive. As these native plant-pollinator systems continue to decline," he said, "so does the wildlife diversity that they support, ultimately leading to collapse of the entire ecosystem. To prevent this from happening, we really need to understand more about what makes the system function."

In part we need to differentiate between agricultural pollination and ecological pollination, Dr. Gegear says. "When most people hear the term 'pollinator decline' they immediately think of colony collapse disorder (CCD) in the honeybee, a single, nonnative species that plays a tremendously important role as a pollinator of crop plants." But our native ecosystem depends on native pollinators and pollination systems, and because so many of these are in trouble we need to shift our focus to them.

Bombus pensylvanicus on New York ironweed (*Vernonia noveboracensis*).

Bumblebees, for example, are one of our most important native pollinator groups. Historically, there were 11 or so species in Massachusetts. Now there are nine. Two of those—*B. affinis*, the rusty-patched bumblebee, and *B. pensylvanicus*, the American bumblebee—haven't been seen since 2015, despite extensive field surveys. Three other species—*B. terricola*, the yellow-banded bumblebee; *B. fervidus*, the golden northern bumblebee; and *B. vagans*, the half-black bumblebee—may disappear in the next decade unless we act now.

The loss of these keystone species, Dr. Gegear says, could have catastrophic consequences for native biodiversity. *B. affinis* was once so abundant that Dr. Gegear considered it a pest. As a young graduate student he was trying to find intact tubular flowers for an experiment. But every tubular flower he found had a perfect hole at the base. *B. affinis*, a "nectar-robbing" species, had stolen its nectar without pollinating it. "I couldn't find any intact flowers within a two-mile radius," he said. "Fast-forward five years, I could not find *B. affinis* within 100 miles of my study site."

The reasons for such declines are little known. "But so far our data points to habitat loss, the effects of exotics, and climate change," Dr. Gegear said. Pesticides might also be accelerating species decline in some areas. The response to pesticide exposure varies among pollinator species: *B. vagans*, for example, is highly sensitive to a pesticide dose that has no effect on honeybees or *B. impatiens*, the two species used to assess the risk of pesticides to pollinators.

Climate change also takes its toll on our native pollination systems. A plant might bloom before its pollinator shows up to fertilize its flowers. With warmer winters there is less snow cover to help insulate hibernation sites. Add to that the human propensity for tidying up the fall garden—blowing all the leaves off possible hibernation sites—and the bumblebee is more likely to freeze to death. "The snowpack and leaf litter help to protect them from freezing temperatures, but that's no longer there," says Dr. Gegear.

Nonnative plants can disrupt ecosystems by crowding out native plants or by "stealing" their pollinators. They can also disrupt competition between different native pollinator species. For instance, *B. impatiens* loves the invasive purple loosestrife (*Lythrum salicaria*), which expands its population. "They get into the thousands," said Dr. Gegear. "But when loosestrife goes out of bloom, these bees move to native floral resources where their sheer numbers can outcompete other native flower visitors searching for food."

Even cultivars of native plants can disrupt pollination systems: their flowers may have no nectar, distasteful nectar, or a shape that no longer lets its pollinator get to the nectar.

As gardeners we can help the bees by choosing the straight species of native plants and avoiding nonnatives.

Dr. Gegear asks us to use a critical eye when selecting so-called "pollinator friendly" seed mixes online or at our local nursery. These seed mixes are often skewed toward composite flowers and so favor honeybees and short-tongued bees; they may lack seeds of tubular flowers needed by long-tongued species, which are the ones in decline.

Understanding the life cycle of threatened bumblebees can help you design a garden that supports their needs: The queens emerge from their overwintering sites in early spring when night temperatures climb above 35 degrees F., carrying fertilized eggs

CONTINUED ON P. 9

BUMBLE BEE *CONTINUED FROM P. 4*

and looking for a suitable nesting site. *B. affinis* and *B. terricola* are the first threatened species to emerge. While we know next to nothing about bumblebee hibernation and nesting sites, anecdotal observations from naturalists in the early 1900s suggest the underground nesters favor abandoned rodent nests, which might explain another reason for their decline—since people kill so many rodents.

Above-ground nesters need protected cavities, so Dr. Gegear suggests providing dry, protected cavities with straw, moss or dried grasses to help out the queens.

If you see a queen with pollen on her legs, he says, that's a sure sign she's found a nest. The queen lays her first batch of eggs in the ball of pollen in the nest, which feeds the hatched larvae of worker bees, which are all female. The workers collect and store nectar and pollen, while the queen lays more eggs, which hatch into workers, or later in the summer, male and virgin queen bees, which mate. The new fertilized queens search for suitable sites for winter hibernation. The old queen and her worker bees die as temperatures drop to freezing and food sources disappear. Throughout the cycle the colony needs a diversity of native plants to stay healthy and reproduce.

Dr. Gegear continues to expand and refine his own comprehensive, research-based plant list, matching each bumblebee species with its preferred food plants. With this data he can recommend plants that will support the threatened species from snow melt to snowfall. Jewelweed (*Impatiens capensis*), for example, supports many at-risk species. Willow (*Salix*) species provide a critical source of nectar and pollen at snow-melt, when bumblebees are just emerging from hibernation.

Bumblebees, of course, are not alone in the massive decline of pollinating insects. It's just that these big fuzzy bees with their colorful patterns are easier for amateur naturalists to recognize than some tiny fly or wasp.

Because we currently lack the critical ecological information needed to develop effective conservation and restoration strategies for threatened species, the Beecology project is recruiting volunteers to help by digitally collecting and submitting data on native bees. A work in progress, the Beecology website (https://beecology.wpi.edu) shows citizen scientists how to take a photo or short video of a bumblebee on a flower, then using the web app, answer a series of simple questions designed to identify the bee species. The site offers a number of videos of bee-plant interactions and tutorials on bee identification and bee photography.

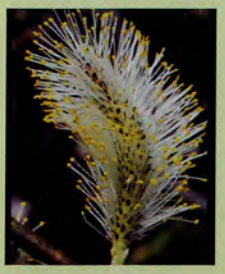
Meanwhile, amateur naturalists have already contributed to Dr. Gegear's research. "They are showing me the location of threatened species, so we can develop range maps and figure out why they are in decline," he said. At one of his first Beecology talks, he showed a picture of *B. terricola*, a species supposedly no longer in Massachusetts. At the end of his talk, someone showed him a photograph he had taken of the bumblebee.

"It's definitely still here, so we're trying to figure out how to get it back," he said.

About the speaker: Robert Gegear, Ph.D., a professor of biology at the University of Massachusetts Dartmouth, has focused his research on the neuroecology of plant-pollinator interactions and the conservation of native pollination systems. In 2016 he started the Beecology Project. Dr. Gegear works with scientists and engineers at Worcester Polytechnic Institute to improve Beecology's data collection and information systems.

(Dr. Gegear's Oct. 5 lecture and plant list may be accessed at www.riwps.org)

Sampler of Native Plants for Bumblebee Species at Risk



Willows
nectar/pollen

Blueberries
nectar

Native roses
pollen

Wild Yellow Indigo
nectar

Purple flowering Raspberry*pollen*

Selfheal
nectar

Meadowsweet
pollen

Jewelweed
nectar

Chart by Robert Gegear,