Researchers develop system for assessing how effective species are at pollinating crops

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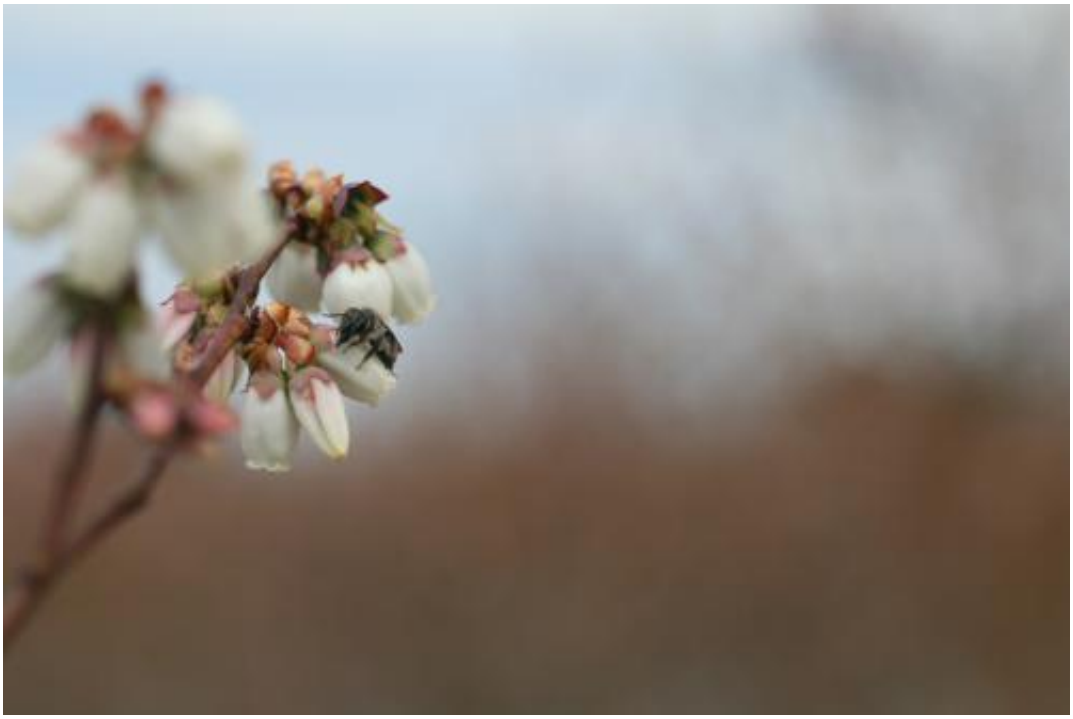


This is a photo of small native bee species *Andrena bradleyi* on a highbush blueberry flower. Credit: Hannah Burrack

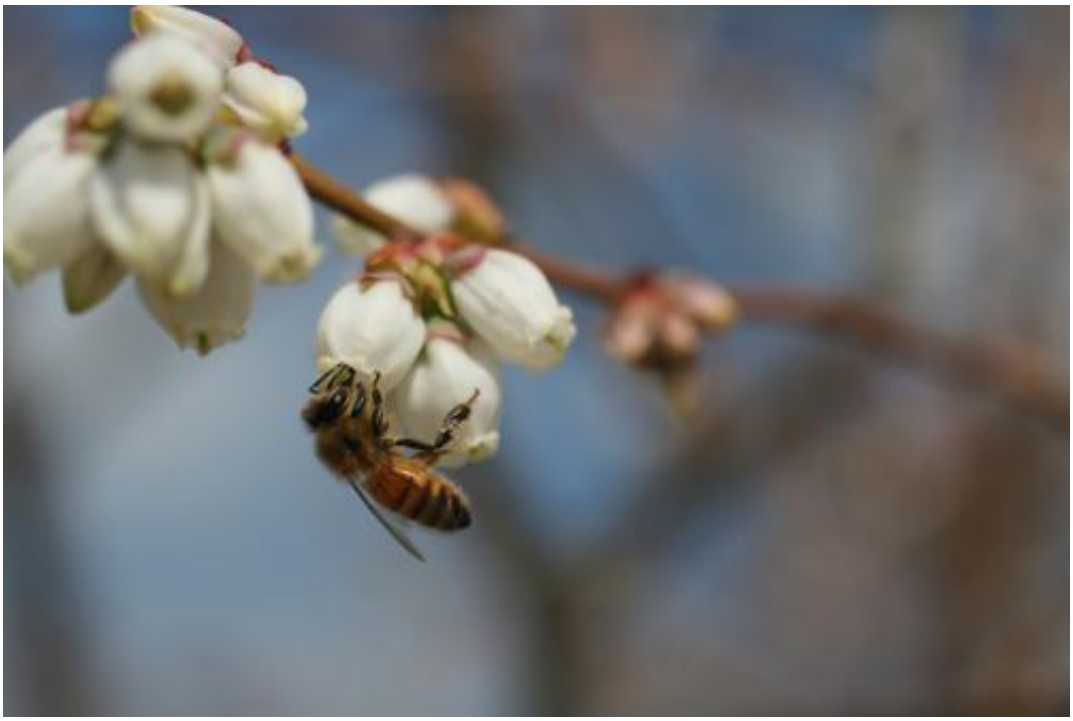
From tomatoes to pumpkins, most fruit and vegetable crops rely on pollination by bees and other insect species – and the future of many of those species is uncertain. Now researchers from North Carolina State University are proposing a set of guidelines for assessing the performance of pollinator species in order to determine which species

are most important and should be prioritized for protection.

"Widespread concerns over the fate of honey bees and other pollinators have led to increased efforts to understand which species are the most effective pollinators, since this has huge ramifications for the agriculture industry," says Dr. Hannah Burrack, an associate professor of entomology at NC State and co-author of a paper on the new guidelines and related research. "However, various research efforts have taken a wide variety of approaches, making it difficult to compare results in a meaningful way.

"We've developed a set of metrics that we think offers a comprehensive overview of pollination efficiency, which would allow researchers to compare data from different crops and regions."

The new comprehensive approach looks at four specific metrics. First is single-visit efficiency, which measures the number of seeds produced when one bee visits one flower. Second is abundance, which measures the number of each type of bee observed in a study area. Third is inclement weather behavior, which tracks how active a bee species is during cool, cloudy and/or windy weather. Fourth is visitation rate, or the number of flowers that a bee visits while foraging, and the amount of time it spends at each flower.



This is a photo of a honey bee (*Apis mellifera*) on a highbush blueberry flower. Credit: Hannah Burrack

"The perfect bee would produce a lot of seeds and visit a lot of flowers, even in poor weather – and there would be a lot of them," Burrack says. "But as far as we know, the perfect bee doesn't exist."

The researchers conducted a pilot study using their comprehensive approach to assess the pollination performance of various bee species on economically important highbush blueberry crops in North Carolina. They found that small native bees had extremely high single-visit efficiency rates and were active during inclement weather. However, small native bees did not have high abundance nor appear to have high visitation rates.

"This highlights the importance of incorporating multiple metrics," says Dr. David Tarpy, an associate professor of entomology at NC State and

co-author of the paper. "Because researchers looking only at visitation rates or abundance may think the small native species are unimportant, when they actually appear to be important pollinators for blueberry growers."

More information: The paper, "Multiple Criteria for Evaluating Pollinator Performance in Highbush Blueberry (Ericales: Ericaceae) Agroecosystems," was published online Nov. 25 in the journal *Environmental Entomology*. DOI: 10.1603/EN12303

Abstract

Numerous bee species provide pollination services in agricultural ecosystems. Evaluating a pollinator's performance with regard to a crop is an important step in attributing pollination services and predicting how changes in a bee community or foraging environment will affect those services. We used multiple criteria to evaluate pollinators of North Carolina highbush blueberry, Vaccinium corymbosum L., agroecosystems. For five groups of bees (Apis mellifera L., Bombus spp., Habropoda laboriosa F., small native bees, and Xylocopa virginica L.), we measured forager abundance through transect observations, quantified per-visit efficiency as viable seed set resulting from a single visit, and analyzed bee presence in different weather conditions. We also considered two other criteria affecting pollinator performance—visitation rate and interspecific influence. A. mellifera was the most abundant bee in the majority of our survey sites, yet had low per-visit efficiency and reduced foraging activity in inclement weather. Small native bees were highly efficient pollinators. Their visits resulted in nearly twice as many seeds as A. mellifera or H. laboriosa. Bombus spp., H. laboriosa, and small native bees were more resilient to fluctuations in temperature, wind speed, and solar radiation than A. mellifera. Although nectar-robbing X. virginica contributed to little pollination through direct flower visits, their presence within the crop impacts the behavior and performance of other individuals.

Underscoring the importance of evaluating pollinator performance via multiple criteria, our results show that bee groups contribute to pollination in different ways. These differences may provide functional complementarity and stability of pollination services to agricultural systems.

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