UC SANTA BARBARA

THE Current

May 20, 2021

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# Economics of Pollination

In a paper published today — World Bee Day — in the Annual Review of Resource Economics, a team of researchers at UC Santa Barbara, the University of North Texas (UNT) and the University of Maryland (UMD) take a look at pollinators, examining them from economic and ecological perspectives.

Kathy Baylis, a professor of geography at UC Santa Barbara, Elinor Lichtenberg, an assistant professor in the Department of Biological Sciences at UNT, and Erik Lichtenberg, a professor in Agricultural and Resource Economics at the University of UMD, are the article's coauthors.

A news release issued by UMD explains their findings in detail. The text follows:

**The Economics and Value of Pollination**

Pollinators are not only a critical component of a healthy ecosystem, but they are also necessary to produce certain foods and boost crop yields. While native and wild pollinators (whether they be certain bee species, other insects and animals, or just the wind) still play an important role, managed honey bee colonies are commercially trucked around the U.S. to meet the need for pollination services in agricultural products. Recent reports of parasites, disease and other concerns in colonies call into question the resilience of the managed honey bee rental markets, as well as how those managed bees are interacting with native pollinators. This recent collaboration with the University of California, Santa Barbara (UCSB), and the University of North Texas (UNT) highlights the importance of characterizing the

economic value of pollination services, including that of managed and wild pollinators, both for the sustainability of honey bee markets and the protection of overall ecosystem health.

“Many people don’t realize that honey bees are not native to the U.S., or that they are actually a form of agricultural livestock rented out largely for their pollination services,” says Erik Lichtenberg, professor in Agricultural and Resource Economics at UMD. “It used to be that you raised bees for honey, but today, pollination services account for the largest share of commercial beekeeper income, with honey as a secondary product. Agriculture is always integrated into an ecosystem, and we typically think about the managed parts without the ecosystem parts. But when we are thinking about resilience and things like climate change which is changing the ecosystem, then we have to reckon with the parts that we’ve tended to ignore. Getting a more holistic sense of the health of pollinators and the true resilience of the rental market is very important.”

Researchers have historically struggled to put a value on pollination services, largely because of the many complex inputs into the system like wind, native versus managed pollinator interactions, weather and even quality or health of the bees due to emerging diseases and invasive pests like varroa mites — in addition to inputs provided by farmers. With these complexities in mind, Lichtenberg teamed with Kathy Baylis, economist and professor in geography at UC Santa Barbara, and Elinor Lichtenberg, ecology professor at the University of North Texas, to take an interdisciplinary approach to reviewing the economics of pollination.

“As a pollination ecologist, it was exciting to collaborate with economists to write this review,” says Lichtenberg. “One of our goals was to help ecologists understand the economics, and economists understand the ecological considerations and constraints involved. This will help develop solutions that benefit both wildlife and farmers.”

Lichtenberg did her undergraduate work in biology at UMD, also spending a year working with Daniel Gruner and Dennis vanEngelsdorp in Entomology. Baylis also has collaborated with vanEngelsdorp and the Bee Informed Partnership (BIP), a nonprofit organization that conducts a nationwide annual Loss & Management Survey each year since 2006 to assess managed honey bee health and colony loss.

“Colony collapse disorder was big in the media in 2006 when beekeepers started seeing so many of their bees dying, so people wanted to know why,” explains Baylis. “With our increased reliance on managed honey bees for pollination, it really raised concerns about the resilience of the system we have in place, or the lack thereof. As it turns out, the pollination market and associated fees are quite responsive to colony health, and beekeepers have been able to meet that demand so far. The price signals are working, but there are many things that aren’t really priced in yet. So a big part of this paper is to highlight the linkages where we know things are being captured, and the values that aren’t being captured but should be.”

Erik Lichtenberg adds, “If we are thinking about the resilience of the system of migratory managed pollination services, a lot of that system is still hidden. We see the tip of the iceberg, but we don’t see what is underneath the waterline, so we’d like to take our analytical submarine and check out what’s down there.”

Currently, the system involves a migration route that is similar to that of farmed labor. Managed honey bee colonies start their year in central California pollinating almonds, plums, prunes, and other early blooming crops, and then are transported slowly up north to later blooming crops like apples, cucumbers, squash and even pumpkins. The route moves up to the Pacific Northwest and then ends with the bees “summering” in the Northern Plains region to forage and recharge. This system has become increasingly important as agriculture has become more specialized and mechanized, with less habitat for native pollinators and more consumer demand for insect-pollinated crops. But, as the researchers explain, there is so much about the system we just don’t understand.

“When problems like colony collapse disorder arise, to me, it feels like we are always trying to attach band aids to different parts of the dike wherever we see a crack without seeing the whole necessarily,” says Baylis. “And that’s a big purpose of the paper is trying to at least sketch out what the whole thing might look like.”

Some of the biggest unknowns identified are the protection of forage lands and habitat for native and managed honey bee colonies, how to manage the surrounding landscape to optimize pollination services and pollinator health, and especially understanding the interactions between wild and managed pollinators. Interactions may be positive, as with native pollinators reaching higher branches in high winds while honey bees stick to lower branches, or they can be negative, like the spread of disease from managed to wild pollinators. All these inputs are especially important

when considering the costs and benefits of conserving wild pollinator habitat.

“Economists and ecologists both recognize the importance of putting an economic value on inputs like clean water, clean air, biodiversity, and natural pollination, because these natural products that aren’t bought and sold in the market otherwise get a default value of zero placed on them,” says Baylis. “We know that is wrong, so hopefully this can draw attention to that issue. We’ve identified a lot of gaps here, and it is important not just for the space of bees, but more broadly for issues where part of the ecological system is managed and monetized, and other parts are not. This speaks to how we can develop a system that is responsive, resilient, and also sustainable.”

Erik Lichtenberg adds, “We are excited about the follow-on work that we’ve identified to do. There is a lot of fascinating work to be done in this area, and we hope this review inspires people to think creatively about some of the issues we’ve raised.”

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## About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.