

Study finds market forces influence the value of bat-provided services

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This photo shows bats returning to Frio Cave near Conan, Texas, in the early morning. Credit: Amy Russell of Grand Valley State University

Services provided by Mother Nature, such as pest control from insect-eating bats, are affected by market forces like most anything else in the

economy, a University of Tennessee, Knoxville, study finds.

The study's results have implications for biodiversity conservation efforts.

Researchers from UT and the University of Arizona, Tucson, studied how forces such as volatile market conditions and technological substitutes affect the value of pest control services provided by Mexican free-tailed bats on [cotton production](#) in the U.S. They found the services are impacted by the forces to the tune of millions of dollars.

The study, conducted by Gary McCracken, professor in the Department of Ecology and Evolutionary Biology, and led by UA's Laura López-Hoffman, is the first to examine how bat ecosystem services change over time. It is published in this week's edition of the journal *PLOS ONE*.

There are more than 1,200 bat species and two-thirds of them are insectivorous, which means they help farmers by preying on pests and reducing the need for insecticides. The researchers calculated the value of the bat pest control service each year from 1990 through 2008 by estimating the value of avoided crop damage and the reduced social and private costs of insecticide use in the presence of bats.

Taking into account a drop in cotton commodity price, the resulting decrease in cotton production and the adoption of transgenic Bt (*Bacillus thuringiensis*) cotton, which is modified to express its own pesticide, the researchers found that the value of the pest control services dropped 79 percent, from a high of \$23.96 million in 1990 to a low of \$4.88 million in 2008.

"The results of this study document that volatile market conditions and technological substitutes such as Bt cotton can affect the value of an ecosystem service even when ecosystem function, in this case bat

population numbers, may remain constant," said McCracken.

The findings fuel a discussion as to whether or not it is economically worthwhile to conserve biodiversity.

"There is a worry that technological substitutes such as cloning and pesticides that replace nature's services such as pollination and natural pest control diminish the importance of protecting ecosystems," said López-Hoffman. "While our research shows a diminished value of pest control due to fluctuations in market conditions, our larger analyses show that conservation is still economically beneficial."

The researchers point to mounting evidence of the evolution of pest resistance to Bt cotton, suggesting that the value of bat pest control services may increase again.

"This evidence of resistance evolution suggests that Bt [cotton](#) may not be a long-term solution to pest-related losses," said McCracken. "In fact, by preying on the individual insects that survive the Bt toxin, bats may provide the additional service of slowing the evolution of resistance to Bt and other insecticides. Bats are also free of charge and, as generalist predators, are providing a broad spectrum of [pest control](#)."

More information: To view the article, visit <http://dx.plos.org/10.1371/journal.pone.0087912>.

Provided by University of Tennessee at Knoxville

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