

Pest-eating birds mean money for coffee growers, biologists find

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To quantify the benefit birds provide to coffee plantations, the researchers calculated bean yield of infected plants that were housed in bird-proof cages versus yield from infected plants open to beetle-eating birds. Credit: Daniel Karp

In recent years, Stanford biologists have found that coffee growers in Costa Rica bolster bird biodiversity by leaving patches of their plantations as untouched rainforest.

The latest finding from these researchers suggests that the [birds](#) are

returning the favor to farmers by eating an aggressive [coffee](#) bean pest, the borer beetle, thereby improving coffee bean yields by hundreds of dollars per hectare.

The study is the first to put a [monetary value](#) on the pest-control benefits rainforest can provide to agriculture, which the researchers hope can inform both farmers and conservationists.

"The benefits that we might get are huge," said Daniel Karp, a graduate student in biology and lead author of the study. "There's lots of unrealized value in these small patches of rainforest. This looks like a sustainable, win-win opportunity for [pest management](#)."

The researchers hope that the work will improve [conservation efforts](#) in heavily farmed areas by illustrating to farmers the financial benefits of leaving some land in its natural state, while also guiding governments toward the best conservation methods.

Worldwide scourge

By some accounts, coffee is the world's most economically profitable crop, and its harvest supports the livelihoods of some 100 million people globally. Coffee beans around the world, however, are threatened by the pervasive beetle.



The coffee berry borer beetle (*Hypothenemus hampei*) is coffee's primary insect pest and is consumed by native birds. Credit: Daniel Karp

The insect burrows into the beans and eats its way out, ruining the beans. It originated in Africa and has made its way into nearly every major coffee-producing country. It arrived in Hawaii two years ago, and [coffee plantations](#) there are already experiencing 50 to 75 percent less yield.

"It's the only insect that competes with us for [coffee beans](#)," Karp said. "It's the most damaging [insect pest](#) by far, causing some \$500 million in damage per year."

Stanford [biologists](#) have been studying the intersection of nature and agriculture in Costa Rica since the 1990s, in part because of the vast amounts of land in that country dedicated to coffee production. The borer beetle arrived in the past few years, and Karp's group began to investigate whether farms with protected forests, and thus a greater

biodiversity of insect-eating birds, fared better under attack from the insects.

A 'not-so-glamorous' experiment

To quantify the benefit birds provide to plantations, the researchers first calculated coffee bean yield – the amount of healthy, beetle-free beans that could be harvested – of infected plants that were housed in bird-proof cages versus yield from infected plants in the open, where birds were eating the beetles.

Next, they needed to confirm which species of birds were eating the beetles, and whether the birds required forest to survive. This required a more unorthodox approach.

"We had the not-so-glamorous task of collecting the birds' poop, and then taking it back to Stanford and looking through the DNA within it to learn which birds were the pest preventers," Karp said.



The yellow warbler (*Setophaga petechia*) is a pest-eating bird that frequents coffee plantations. Credit: Daniel Karp

Five species of birds contributed to cutting infestation rates in half, and these birds were more abundant on farms featuring more forests.

"Depending on the season, the birds provide \$75 to \$310 increases in yield per hectare of farmland," Karp said. The birds' activity could become even more valuable if the beetle infestation worsens.

The scientists found that the closer the forests were to the farms, the greater benefit the birds provided. Specifically, smaller stands of trees – roughly the size of a few football fields – situated throughout crop fields provided better levels of beetle protection than the much larger forest preserves set on the outskirts of farms.

By differentiating the financial gains of different conservation strategies

– large but distant preserves versus small, local stands of trees – Karp thinks the study could provide a framework for introducing similar efforts in agricultural zones around the world.

"This work suggests that it might be economically advantageous to not farm in certain areas of a plantation," Karp said. "We're going to start trying to generalize these results so that farmers, [conservationists](#), land managers and governments can use them anywhere to make simple estimates of what they might gain in pest protection by protecting certain patches of the landscape."

The study was published in the online edition of the peer-reviewed journal *Ecology Letters*.

More information: 'Forest bolsters bird abundance, pest control and coffee yield,' *Ecology Letters*. ([DOI: 10.1111/ele.12173](https://doi.org/10.1111/ele.12173))
[onlinelibrary.wiley.com/doi/10 ... 1/ele.12173/abstract](https://onlinelibrary.wiley.com/doi/10.1111/ele.12173/abstract)

Provided by Stanford University

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