

Researchers show how coffee growers can optimize profits, sustainably

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On this farm in Antioquia, Colombia, coffee trees grow beneath a layer of canopy trees in a shade-grown coffee plantation. Credit: Guillermo Santos

Coffee has huge importance to many smallholder farmers around the world. The success of a year's coffee crop can mean the difference

between having enough cash in hand for buying food and watching your household go hungry. For many, it is the crucial component of their food security, even though coffee is not an edible crop.

As is true for many agricultural products, the process for growing coffee is complex. Increased use of fertilizer and pesticides will likely lead to higher crop yields, but at significant cost to wildlife populations and human health. Using fewer agrochemicals is more environmentally friendly, but requires farmers to face increased risks of losing crops to pests and disease. A forthcoming paper led by researcher Juan Nicolás Hernández-Aguilera, a postdoctoral scientist at the International Research Institute for Climate and Society, suggests this trade-off may not be as straightforward as previously thought, and that farmers could be better off financially if they used shade-growing practices for part of their production. The paper will be published in the May issue of the journal *Ecological Economics*.

No previous study has quantified the economic trade-offs a smallholder [farmer](#) would experience in shifting from conventional coffee-growing to shade-grown. Hernández-Aguilera and his colleagues developed a model to evaluate the financial costs and benefits for farmers. They examined a number of factors, including the cost of planting new trees, the price premiums that coffee consumers are willing to pay, and the potential yields farmers could see. The model suggests that farmers can optimize their coffee profits by converting a third to two-thirds of their acreage to shade-grown production.

Usually, coffee is grown in homogenous fields of trees in full sun. Hernández-Aguilera and his coauthors from Cornell University examined the merits of an alternative method of growing coffee, in the understory of shade-bearing trees. Shade-grown [production systems](#) mimic a forest structure and provide better habitats for birds than do full-sun systems. Both the birds and the shade trees provide ecosystem

services to the [coffee plantations](#), which can replace fertilizer and pesticides and save the farmer money. Birds prey on [insect pests](#); some estimates suggest that a single bird could help save as much as 65 pounds of coffee per hectare every year from pests. Additionally, shade trees in shade-grown coffee plantations, often the species *Inga edulis*, fix nitrogen in the soil, providing the coffee trees additional nutrients. Hernandez-Aguilera notes that other services provided by this system include a reduction in temperatures beneath the shade trees, a crucial adaptation strategy for climate change.

Hernandez-Aguilera points out that shade-grown coffee beans are often considered higher quality, and can provide a price premium to farmers that offsets the comparatively lower yields of the shade-grown system. "Our estimates can guide the design of market-based mechanisms that aim to promote sustainable practices in coffee," Hernandez-Aguilera says. "That said, the effective implementation of these instruments heavily relies on a better promotion and knowledge of the interactions between shade-grown coffee, environmental conservation and product quality among coffee consumers."

Coffee is also an important crop in many of the developing countries in which IRI is currently working. Hernandez-Aguilera's study paves the way for further research into how to make growing coffee a more secure and financially stable source of income for farmers who often operate on tight margins under highly variable climate conditions. Through IRI's work with Adapting Agriculture to Climate Today, for Tomorrow (ACToday), a part of Columbia World Projects, careful consideration is being given to [coffee](#) farmers in Vietnam, Guatemala, Colombia, and Ethiopia.

"This paper is a great example of the kind of work ACToday is already catalyzing in our pilot countries," says Ángel Muñoz, the country lead for Guatemala and Colombia on the ACToday project. "This kind of work

encourages our partners to ask key questions about how they can maximize income and promote [sustainable practices](#) in ways that are harmonious for the environment and that foster the conservation of biodiversity."

More information: J. Nicolas Hernandez-Aguilera et al, The Economics and Ecology of Shade-grown Coffee: A Model to Incentivize Shade and Bird Conservation, *Ecological Economics* (2019). [DOI: 10.1016/j.ecolecon.2019.01.015](#)

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