Natural biodiversity protects rural farmers' incomes from tropical weather shocks

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The study found that farmers in areas with greater biodiversity took less of an income hit from droughts than their peers who farmed amid less biodiversity. Credit: Sandy Zebua

A big data study covering more than 7,500 households across 23 tropical

countries shows that natural biodiversity could be effective insurance for rural farmers against drought and other weather-related shocks.

Frederick Noack, assistant professor of food and resource economics in UBC's faculty of land and food systems, worked with colleagues from ETH Zurich and the University of Geneva to study whether natural biodiversity helps buffer farmers' incomes against weather shocks.

They found that farmers in areas with greater biodiversity took less of an income hit from droughts than their peers who farmed amid less biodiversity.

Their calculations also indicated that a loss of half the species within a region would double the impact of weather extremes on income.

"We should conserve biodiversity, not just because we like to see tigers and lions, but because it's also an important input for production," said Noack. "It's especially important for people who live in areas where it's hard to get insurance or loans to compensate for environmental shocks. A certain level of biodiversity conservation could be beneficial for people in agriculture, forestry and these sorts of industries."

Access to huge datasets allowed the researchers to compare farmers' actual incomes—using data gathered every three months—with geocoded data indicating the number of plant species in the local environment. They cross-referenced this with weather data through the growing, planting and harvesting seasons.

While the results clearly link natural biodiversity to income stabilization during adverse weather, the ways in which biodiversity accomplishes this were beyond the scope of the study. Noack pointed to a variety of processes occurring naturally within local ecosystems that could contribute. For example, an environment that supports several bee

species should allow pollination to happen at a broader range of temperatures. The same environment might also support the natural enemies of pests, which would reduce farmers' dependence on pesticides to stabilize their yield.

The research is the first to relate biodiversity directly to incomes at such a scale. Earlier studies have shown that biodiversity can stabilize the production of biomass such as leaves in a field or trees in a forest—but not how that translates into real income for farmers.

"The difference between studying biomass and studying income is that income assigns value to different types of biomass," said Noack. "Price signals our value for specific things, so looking at income converts something that happens in the ecosystem to something that we actually value."

The data came from tropical countries in Latin America, Asia and Africa, where weather extremes are expected to increase as the earth's atmosphere warms. The analysis shows that conservation of natural biodiversity could play an important role in alleviating poverty for rural households with little access to insurance or loans.

The findings also inform the ongoing debate about where conservation efforts should be directed. Conserving large swaths of parkland far from agricultural land may be less effective than conserving smaller pockets in close proximity to farms.

More information: Frederik Noack et al, Droughts, Biodiversity, and Rural Incomes in the Tropics, *Journal of the Association of Environmental and Resource Economists* (2019). DOI: 10.1086/703487