

Small family farms in tropics can feed the hungry and preserve biodiversity

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Conventional wisdom among many ecologists is that industrial-scale agriculture is the best way to produce lots of food while preserving biodiversity in the world's remaining tropical forests. But two University of Michigan researchers reject that idea and argue that small, family-owned farms may provide a better way to meet both goals.

In many tropical zones around the world, small family farms can match or exceed the productivity of industrial-scale operations, according to U-M researchers Ivette Perfecto and John Vandermeer. At the same time, smaller diversified farms are more likely to help preserve biodiversity in [tropical regions](#) undergoing massive amounts of deforestation, Perfecto and Vandermeer conclude in a paper to be published online Feb. 22 in the [Proceedings of the National Academy of Sciences](#) (*PNAS*).

"Most of the tropical forest that's left is fragmented, and what you have are patches of forest surrounded by agriculture," said Perfecto, a professor at the School of Natural Resources and Environment. "If you want to maintain biodiversity in those patches of forest, then the key is to allow organisms to migrate between the patches.

"And small-scale family farms that adopt sustainable agricultural technologies are more likely to favor migration of species than a huge, monocultural plantation of soybeans or sugar cane or some other crop."

Some ecologists have suggested that the history of eastern North American forests provides a preview of what's likely to happen in the

tropics. European colonization of eastern North America led to massive deforestation that accompanied the expansion of agriculture. Later, industrialization drew people to cities from the rural areas, and the forests recovered.

This scenario is known as the forest transition model. It has been argued that if a similar progression occurs in the tropics, then the decline in rural populations would make more land potentially available for conservation. A corollary of the forest transition model states that if you consolidate agriculture into large, high-tech farms, productivity increases and more land is freed up for conservation.

But after reviewing case studies from Costa Rica, El Salvador, Panama, Argentina, Brazil and Mexico, Perfecto and Vandermeer conclude "there is little to suggest that the forest transition model is useful for the tropics" and that it "projects an overly optimistic vision."

Instead, the U-M researchers propose an alternative model, which they call the matrix quality model. They say it provides a solid foundation for conservation planning in tropical regions.

If you think of the fragments of remaining tropical forest as islands in an ocean of agriculture, the ocean is what Perfecto and Vandermeer call the matrix---it's the area between the patches of undisturbed natural habitat.

A high-quality matrix is one that enables plants and animals to migrate between the remaining patches of forest, increasing the likelihood that a given species will be able to survive, helping to preserve biodiversity.

Small, family-owned farms that use agroecological techniques come closest to mimicking natural forest habitat, thereby creating corridors that allow plants and animals to migrate between forest fragments. Agroecological techniques can include the use of biological controls

instead of pesticides, the use of compost or other organic matter instead of chemical fertilizers, and the use of agroforestry methods, which involve growing crops beneath a canopy of trees or growing crops mixed with fruit trees such as mangoes or avocados.

"If you're really interested in conserving species, you should not just concentrate on preserving the fragments of natural habitat that remain, even though that's where many species are," said Vandermeer, a professor of ecology and evolutionary biology and a professor at the School of Natural Resources and Environment. "You also need to concentrate on the areas between the fragments, because those are the places that species have to migrate through."

Vandermeer said he advocates the break-up of large-scale farms in the tropics, as well as incentives to encourage "a large number of small-scale farmers, each managing the land to the best of his or her ability, using agroecological techniques."

Perfecto said these goals are in line with the findings of the 2009 International Assessment of Agricultural Knowledge, Science and Technology for Development synthesis report. The report concluded that small-scale, sustainable farms are the best way to alleviate world hunger while promoting sustainable development. Perfecto was one of the report's authors.

Provided by University of Michigan

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