Help for Farmers and Forests

Economist and geographer Rachael Garrett's goals: save Brazil's rainforest, ensure farmers and ranchers thrive / BY BARBARA MORAN

Rachael Garrett (left), with a cowhand in Brazil, has been interviewing people on the Brazilian frontier, gaining insight into their aspirations and motivations.

Two decades ago, the tiny town of Sorriso, deep in the heart of Brazil's tropical savanna, wasn't much to look at: three or four streets and a cluster of cheap multiunit buildings. "There were no cultural activities, there was nothing to do," recalls economist and geographer Rachael Garrett. "Just agribusiness and soy." It took 12 hours to get there by bus from the nearest airport.

LAST YEAR SHE FLEW IN TO THE local airport—no more 12-hour bus rides—and saw a Sorriso transformed. There was a yoga studio, a Crossfit, shoe shops, and luxury hotels with aquamarine swimming pools. The dusty outpost at the end of the world now looks like Tucson. Says Garrett, "It just sprawls and it sprawls and it sprawls."

The growth of Sorriso, though an extreme case, epitomizes the changes in Brazil over the last few decades, as farms, ranches, and cities have consumed vast areas of wetland, savanna, and rainforest. Those changes have helped expand the economy—Brazil's is eighth in the world—but at a cost. Since 1990, Brazil has lost about 150,000 square miles of rainforest, an area almost three times the size of New England.

Brazilians destroy native habitats for two major reasons: to grow soybeans, such as those that fed Sorriso's sprawl, and to raise cattle. In 2004, facing pressure from international organizations and internal protests, the country began to curb deforestation. The rate

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of forest destruction slowed until 2008, then rose until 2016. Between August 2016 and July 2017, about 2,500 square miles of rainforest were destroyed.

Garrett, a College of Arts & Sciences assistant professor of earth and environment and associate director of the University's Land Use and Livelihoods Initiative, has spent the last decade visiting towns like Sorriso, trying to understand what makes farmers and ranchers tick. Why do they ignore government incentives to make better use of the land? Why don't stricter laws keep them from clearing rainforest? Why do ranchers keep herding cattle, when they could make more money doing something else? Her goal is to help craft policies that will allow farmers and ranchers to thrive, while also curbing deforestation. It's a thorny problem, and Garrett is using a boots-on-the-ground approach to crack it.

ONLINE: *Watch a time-lapse video of forest destruction in Rondonia, Brazil, at bu.edu/bostonia.*

▸ In northern and northeastern Brazil, cattle ranching is a high-status profession. But payoffs can be poor, and damage to ecosystems can be devastating.

Money Can't Buy *Segurança*

Cattle ranching is a particularly vexing—and damaging—threat to Brazil's rainforest. Ranchers cut down forest to create pasture, which becomes less productive each year until they abandon it, then clear more rainforest to create new grazing space. And most ranchers, it turns out, aren't getting rich doing it. In the Brazilian state of Pará, they earn only about $250 per hectare (about 2.5 acres) by raising cattle. For a small rancher with fewer than 10 hectares, this translates into less than $2,500 a year. And that doesn't reflect the debt they often acquire when buying cattle and land, says Garrett.

Ranchers could make more money—and save land from further degradation—by growing oranges or açaí; fruit pays about $3,300 per hectare, 13 times as much as ranching, according to data Garrett published in the journal *Ecology and Society* in 2017. The Brazilian government has offered ranchers economic incentives to adopt agriculture, but they don't often work. To find out why, Garrett, whose work is supported by the National Science Foundation and the Gordon and Betty Moore Foundation, has taken a somewhat unique approach for an economist: rather than just scanning data and making assumptions, she has spent a decade interviewing hundreds of farmers and ranchers in northern and northeastern Brazil, trying to understand their motivations.

▾ This land was originally covered by native Amazonian rainforest, but was cleared for cattle ranching. Now it has a system that combines forestry and grazing. Farmers plant commercial trees to shade the cows, and can harvest the trees for profit.

Her research so far has uncovered two major reasons the ranchers stick with unprofitable cattle. The first is infrastructure: they don't have access to the good roads and refrigerated trucks that make fruit farming practical. The other reason is less tangible but perhaps more important. When Garrett interviewed ranchers and farmers, a term that kept coming up was *segurança*, which translates to "security," but implies a bit more: a quiet, safe, and contented life. Ranchers care about money, sure, but they care more about family traditions, local relationships, and a familiar way of living. There's also the status of owning cattle, and the sheer fun of being a cowboy. There are rodeos and cattle fairs and country singers—a culture that families are loathe to leave, or even change.

This finding shouldn't be a complete surprise, says Garrett. After all, many people prioritize family, location, and *segurança* over income when choosing a career. But programs to reduce deforestation in the Amazon generally ignore farmers' aspirations and lifestyle goals, and focus instead on economic incentives. Garrett wants to change that. She partners with the Brazilian Agricultural Research Corporation—a government agency akin to the US Department of Agriculture—coauthoring papers and leading a workshop for them in August 2017.

Her collaboration has made a difference, prompting the organization to incorporate

the perspectives of the ranchers and farmers when proposing new systems. "We think of farmers as firms," says Garrett. "But farmers are also consumers, they're households, they're us."

Cows and Trees

Garrett believes that a solution for Brazil—or at least part of it—lies in an approach called "integrated crop, livestock, and forestry": growing crops, cattle, and trees in rotation, or in unison, in a way that decreases the need for fertilizer and pesticides, and increases profit. "That's one potential solution for these ranchers," says Garrett. "We're not going to get rid of ranching. Being a cowboy is so well respected. Having cattle gives you social status. Even *eating* beef is associated with status. It's so socially embedded. So how do we make ranching better?"

Garrett saw some striking success stories when she visited Brazil last summer. One example was a beef cattle rancher who switched to more profitable dairy cows, planted eucalyptus trees to shade the animals, and rotated crops to renew the soil.

"The cattle graze in the shade. That makes the cattle more comfortable, makes them produce more milk," says Garrett. (She notes that some dairy products, such as powdered milk, don't require the same careful handling and refrigeration as fruits and vegetables for long-distance transport.) The cattle eat crop residues and their manure fertilizes crops and trees. The rancher eventually harvests the trees and sells the wood for fuel. It's easy to see the benefits: the rancher keeps ranching and makes more money, and the soils are improved.

Garrett thinks systems like this can become more widespread in Brazil when one high-status person buys in and others follow. "It's actually worked well among a small subset of the population that are leaders, and then it spreads out to other people," she says. According to the Brazilian Agricultural Research Corporation, farmers used integrated systems on about 5,800 square miles of land in 2010. That number rose more than sevenfold by 2016. "Status counts," she says. "Somebody needs to prove that it works."

PHOTOGRAPH BY JACKIE RICCIARDI

Sargent, ENG profs collaborate to prevent strokes that cause dementia / BY DAVID LEVIN

Delivering Drugs by Microbubbles

Memory loss in old age starts small, with misplaced keys or wallets. In some people dementia eventually sets in, robbing them of the memories of faces, names, and important events.