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Paving to Save the Rain Forest

By DAVID GLENN

In his inaugural address on New Year's Day, Luiz Inacio Lula da Silva tried to gently dampen the expectations of the left-wing populist movements that carried him to the presidency of Brazil: "We must keep our many and legitimate social aspirations under control, so that they can be fulfilled at the right pace and at the right time ... for the simple reason that no one can harvest fruits without first planting the tree."

That metaphor may have struck an odd chord in the ears of Brazil's environmental activists, who are anxious to learn what policies Mr. da Silva's government will pursue in the rain forests of the Amazon River basin. The aspirations of many of the country's economic actors -- from landless farm laborers to multinational logging corporations -- entail the destruction, not the planting, of trees. A 2000 report by scientists at the Woods Hole Research Center predicted that as many as 104,248 square miles of the Brazilian Amazon, the world's largest surviving tropical forest, might be lost by 2025.

Mr. da Silva's Workers' Party has deep roots in certain environmentalist social movements. But the party is equally indebted to the Brazilian Landless Workers' Movement, which has fought for land redistribution within the populated farming belts of Brazil's south and northeast. In practice, however, the federal government has often responded to the movement's pressure not by dividing elite farmers' land but by helping landless farm workers migrate into remote areas of the Amazon basin. Mr. da Silva's government will surely face similar temptations.

Amid those competing pressures, the new administration must decide what to do with Avanca Brasil ("Forward Brazil"), the \$40-billion Amazon development program started by Fernando Henrique Cardoso, the nation's former president. Avanca Brasil, which is already well under way, is an ambitious -- and, its critics say, highly destructive -- package of road-paving, river-channeling, and dam-building projects.

Mr. da Silva's dilemma may not be so grave as most people believe, according to *The Dynamics of Deforestation and Economic Growth in the Brazilian Amazon* (Cambridge University Press), a new book written by five economists scattered across the globe. Using satellite imagery and data from the Brazilian agricultural census, which documents crops and livestock as well as farmers, the book's authors attempt to assess the relative importance of deforestation's many causes. Among their conclusions is a surprise: Certain elements of Avanca Brasil might actually slow the process of deforestation. Paving roads in parts of the Amazon that are already thickly settled, they suggest, will strengthen local economies and reduce the pressures that send farmers into virgin forest in search of new land to clear.

Many other scholars of the rain forest, however, are highly skeptical of any endorsement of road-building. Some also doubt the authors' underlying argument that "intensifying" Amazonian agriculture through better technology or crop selection will reduce the rate of deforestation.

Valuing the Amazon

The Dynamics of Deforestation first took seed 14 years ago, when Eustaquio J. Reis, who has served for many years on the staff of the Institute of Applied Economic Research in Brazil's Ministry of Planning, attended a Sao Paulo conference on deforestation and global warming. There he was approached by his former teacher Rudiger Dornbusch, a professor of economics at the Massachusetts Institute of Technology, who died in 2002. "[He] came up to me and said, 'You've got to do a study on this because you're the only economist in Brazil who takes the Amazon seriously.'"

It took Mr. Reis several years to find a satisfactory method for that study. "I started looking around, and finally found municipal-level satellite images that had been compiled by the statistical office of the Brazilian office of forestry. I realized that we could combine those images with data from the

agricultural census," which is also broken down by municipality.

Soon he realized that this data set was potentially very rich. The agricultural census, conducted every five years, is so detailed that scholars could, in theory, measure the interaction of a huge number of variables that are believed to affect deforestation rates: government subsidies, the paving of roads, land prices, population density, and a long list of others.

Mr. Reis worried, however, that building a valid model that weighed so many variables simultaneously would be extremely difficult. Then in 1994 came a stroke of luck. He was contacted by Diana Weinhold, a student of Clive W.J. Granger, an economist at the University of California at San Diego who is renowned for his sophisticated econometric techniques. Ms. Weinhold, who today is a lecturer in development studies at the London School of Economics and Political Science, wanted to work on environmental problems and had heard rumors of Mr. Reis's project. Eventually the team came to include Mr. Granger himself; another of his students, Lykke E. Andersen, who today is an economist at the Institute for Social Economic Research, in Bolivia; and Sven Wunder, a senior economist at the Center for International Forestry Research, in Indonesia. With Mr. Granger and his proteges on board, the group began to construct its econometric model.

From earlier studies, it was broadly known that most deforested Amazonian land quickly goes fallow because soils there are weak. Mr. Reis and his colleagues confirmed this. Fifty-nine percent of the newly cleared plots in their study were fallow five years later. And many scholars had argued that the local benefits of deforestation are outweighed by the global costs -- the loss of carbon storage, biodiversity, and "existence value," the price people worldwide might pay simply for the comfort of knowing that a unique landscape has been preserved.

Mr. Reis's team attempted to quantify those costs. They estimated that a hectare of pristine Amazonian forest can be valued to humanity at large at \$540. They suggested that a new international institution, a "global parks agreement," might pay Brazil's government to preserve forests.

Paved Roads, Costlier Acres

To the outside world, the book's most eyebrow-raising assertion will surely be that new paved roads are not historically correlated, in the aggregate, with greater deforestation. The economists' model predicts that new unpaved roads will increase land-clearing, but new paved roads will not.

"The likely mechanism for this relationship," they write, "... is that unpaved roads open up access to new forest land, which suppresses the price of agricultural land and encourages wasteful land use. The construction of paved roads works in exactly the opposite way." Paved roads increase land values, they say, by making it easier and more reliable to bring agricultural products to market. That adds to the region's productivity without causing additional clearing.

On that basis the authors cautiously endorse elements of *Avanca Brasil*. They concede that certain new paved highways through pristine regions will accelerate deforestation. "No one wants this book to be considered a free ticket to build roads all over the Amazon," says Ms. Weinhold. Nonetheless, their econometric model predicts that the net effect of *Avanca Brasil*'s road improvements will be to reduce accumulated clearing by 6,015 square miles over a 10-year period.

"My one-word response to that conclusion would be, Unbelievable," says William F. Laurance, a staff research scientist at the Smithsonian Tropical Research Institute, in Panama, who has written widely on the Brazilian Amazon. "There's an enormous body of evidence that would support a completely contrary conclusion. Many of the road-building projects that are embodied in *Avanca Brasil* are in fact going to be penetrating into the heart of the Amazon -- into large tracts of pristine forest."

Mr. Laurance says that the authors' finding may be a "misleading statistical artifact" because few new paved highways were constructed during the period from which their data are drawn. "In the past," he says, "most paved roads were constructed in areas that had already been deforested." With *Avanca Brasil*, the proportions are different: Some roads will be built in populated areas, but other major roads are being constructed that move deep into the frontier, irreparably fragmenting the forest. "You tend to put a highway in, and then what you see is a halo of unpaved roads surrounding that highway ... If you look along the BR-163 [highway]," he says, "you already see big increases in soybean development and in

land speculation and in settlement patterns. ... The Avanca Brasil program dwarfs any kind of development program that has ever existed in the Amazon."

Ms. Andersen replies that her team is well aware of the new networks of dirt roads that quickly surround paved highways. She says that their statistical model accurately describes the effects of highways built during the 1980s, and should do the same for roads currently being paved. In an e-mail message, she adds: "Whereas Laurance et al. only estimate the costs ... of road-building, we also estimate the benefits (in terms of increased economic activity, job creation, and poverty reduction) and those benefits appear to be large in the long run." Infant mortality, for example, fell from 124 deaths per 1000 live births in 1970 to 54 in 1991; during the same period life expectancy rose from 50 to 61 years.

Soybean Wars

Another skeptic is Susanna B. Hecht, a professor of urban planning at the University of California at Los Angeles and the author, with the journalist Alexander Cockburn, of *The Fate of the Forest: Developers, Destroyers, and Defenders of the Amazon* (Verso, 1989). "Economists on the loose again," she says. "Oh, dear." Like Mr. Laurance, she doubts that the authors have taken appropriate stock of the effects of Avanca Brasil's major new highways. But she is also critical of the economists' argument that the smaller, more localized paved roads will necessarily have positive effects. "There's a very common fallacy that if you intensify agricultural production and technology, you'll reduce land-clearing. The experience along the soybean frontier just completely argues against that idea."

The "soybean frontier" that worries Ms. Hecht has evolved during the past decade in the savannah areas on the southern and eastern borders of the Amazonian rain forest. Like many other scholars, Mr. Reis and his colleagues are enthusiastic about this development. They write: "The identification of [other] suitable and profitable crops and crop combinations would tend to reduce wasteful land uses like extensive cattle-ranching. It will not necessarily reduce deforestation, but at least it will make deforestation more justifiable." (They note, however, a costly side effect of the present arrangement: The growth of soybeans along the edges of the Amazon has raised local land prices and therefore pushed cattle-ranching deeper toward the heart of the forest.)

Precisely because Brazilian soybeans have been so profitable on world markets, Ms. Hecht and others argue that the crop has been especially destructive to the country's forests. In a 2001 article in the journal *Environmental Conservation*, Philip M. Fearnside, a research professor at the National Institute for Research in the Amazon, in Manaus, Brazil, wrote: "Soybeans are much more damaging than other crops because they justify massive transportation infrastructure projects that unleash a chain of events leading to destruction of natural habitats over wide areas."

And in his contribution to a new book, *Deforestation and Land Use in the Amazon* (University Press of Florida), Mr. Fearnside further argues that intensifying cattle pasture lands is also unlikely to slow deforestation. The "full stomach" hypothesis posits that small farmers will stop clearing new lands if their existing pastures become more productive. Mr. Fearnside says, however, that there are many motivations for pasture-clearing other than beef production. Some farmers clear in order to strengthen their claims to the land (in Brazil's often ambiguous system of property rights, it is important to demonstrate that you're making "productive use" of any land you hold). Other farms are conduits for drug-money laundering, and aren't intended to be profitable at all, so their owners care little about pasture efficiency.

Even if agricultural intensification were desirable, Mr. Fearnside says, he has little faith that the Brazilian government could make the appropriate investments to carry it off. "There just isn't the money around to intensify the areas that have already been cleared," he says. "Much less any new areas."

Charles H. Wood, the book's co-editor and a professor of sociology at the University of Florida, has mixed feelings about proposals for agricultural intensification. "The argument was that if you could provide the right incentives for land managers to intensify the use of pastures, that it would slow the deforestation rate," he says. "But unless you assume that there's a finite economic ceiling, then people are going to expand even further. And hence the debate."

So what steps might Mr. da Silva's government take? Mr. Wood says he is encouraged by the recent track record of a Workers' Party government in the western state of Acre. That government has taken seriously Brazil's rarely enforced law that requires

at least 80 percent of individuals' land plots in the Amazon to be maintained as forest.

Even Acre's government is investing heavily in road-building, according to David Cleary, the Amazon program manager of the Nature Conservancy and the author of *Anatomy of the Amazon Gold Rush* (University of Iowa Press, 1990). "The difference is that they're working intensively with all the municipal governments along the new road corridors. The idea is that with appropriate regulation it will be possible to break the cycles of destruction." Mr. Cleary is sympathetic to the economists' notion of beneficial local road-paving, which he calls "a reasonable argument." But he says the crucial ingredient will be effective law enforcement like Acre's. "What we've learned is that it's much easier to deal with capitalism than to deal with anarchy."

Mr. Reis, however, cautions against placing too much faith in government regulation. One of his team's findings is that Brazilian deforestation is increasingly self-perpetuating and immune to external stimuli of any sort. "It's a process that in some ways is inexorable," he says. "It's very difficult to deny to local populations and local communities what they are asking for in terms of connection to the rest of the country and to international markets."

ROADS TO RUIN?

Deforestation in the Brazilian Amazon has tended to cluster along paved highways. Areas colored gold on the map represent zones of deforestation -- the darker the gold, the more thorough the land-clearing. Notice the deforested areas that hug the existing paved highways BR-364 and BR-158.

The Brazilian government's modernization program, *Avanca Brasil*, involves the construction of a few new paved roads and the paving of many existing roads. Scholars worry especially that the paving of BR-319 and BR-163 will open up new corridors of logging, mining, and cattle-ranching. The economist Eustaquio Reis and his colleagues suggest, however, that the net long-term effect of *Avanca Brasil* might actually be positive. They argue that paving existing minor roads in the already-settled areas in the southern and eastern Amazon might strengthen local economies, raise land prices, and reduce the pressure felt by small-scale farmers to move into new areas.

SOURCE: Chronicle reporting; adapted by Dave Allen from maps
created by Charles H. Wood and William F. Laurance

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