



Deforestation in the Brazilian Amazon

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Large-scale deforestation in the Brazilian Amazon began with the decision to relocate the capital and to construct the Belém-Brasília Highway (see figure 6.1). Brasília was built so that the capital would be in a more central location that would encourage Brazilians to look away from the coastline that they had been hugging for 350 years and begin to use the vast interior of the country. The highway, construction of which began in 1958, was the first of a series of highways to be built to “integrate” the northern and western states with the rest of the country. Shipping the products of the Amazon to Europe and the United States had been easier than shipping them to southern Brazil before these north-south roads were built (Mahar 1979).

Settling of land along the Belém-Brasília was slow at first, and the road cut through a broad array of vegetation, only a small part of which was tropical moist and rain forests. Most vegetation was savannas, scrub forests, and tropical deciduous forests. In the first twenty years more than two million people settled along this dirt road, which was paved only in 1973. As this essay will show, it was land along this road that first attracted attention to the destruction of forest, especially through low-quality cattle ranches (Hecht 1980). The cattle population increased from near zero to more than five million in the same twenty-year period (Mahar 1988:12). Even feeder roads near the Belém-Brasília Highway were quickly occupied and vast areas deforested. Along a 47,000-square-kilometer stretch of the PA-150 road, the amount of cleared area jumped from 300 square kilometers in 1972 to 1,700 in 1977 to 8,200 in 1985; the leading cause was conversion from forest to pasture (Mahar 1988:13, 14).

Road building became even more important with the announcement in



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is important because it has gold, uranium, and other strategic mineral deposits—and because it cuts through Yanomamo territory.

The oil crisis also affected the settlement and road building plans of the Transamazon and Cuiabá-Santarém highways. After 1973 the costs of transportation changed so radically that construction of the planned communities nearly halted, and only the main trunk of the highway was built, not the service roads to the farms. This left most farmers stranded on their landholdings, unable to get their rice, corn, and other produce to market (Moran 1976, 1981).

The changed costs of occupying the Amazon with small farmers and a change in presidents led to a policy shift in 1974, barely three years after the inception of PIN. President Ernesto Geisel announced that large-scale entrepreneurs would be more effective at developing the Amazon, and the government began to parcel out land in large units to individuals and corporations. Instead of the 100,000 families foreseen by the Transamazon Settlement Scheme in three years, only 6,000 had arrived; small farmers accounted for less than 4% of total deforestation in the 1970s (Browder 1988).

Giving priority to large-scale operators was not a new idea. In 1966 a plan to encourage Brazilians to occupy the Amazon created the Amazon Development Agency (SUDAM) and the Amazon Development Bank (BASA) through which individuals or companies could invest in projects within the Amazon region. It is important to note that in Brazil the "Amazon region" is not isomorphic with the drainage basin. Rather, it is legally defined for the purposes of development (i.e., the Legal Amazon, consisting of 5.4 million square kilometers versus 3.6 million of forests in the basin) and includes large areas of savannas and other kinds of vegetation and even areas outside the river drainage system. Individuals and companies that worked through SUDAM and BASA could invest in approved projects as much as 50% of their personal or corporate income tax liability. Participants thus paid no tax to the federal government and received three cruzeiros for every one they invested. Moreover they were able to keep all four dollars and the capital gain—tax free. Such incentives were too great to pass up. Most deforestation in the southeastern portion of the Amazon basin is traceable to this policy (Hecht 1980; Fearnside 1987a,b).

Most projects that SUDAM approved were extensive cattle ranches. Forest was converted to pasture at a rate of approximately 8,000 to 10,000 square kilometers per year in the 1970s (Mahar 1988:8), increasing to 35,000 square kilometers in the late 1980s (Fearnside 1989). By late 1985 SUDAM had approved about 950 projects, of which 631 were cattle ranches (García Vásquez and Yokomizo 1986:51 in Mahar 1988:15). Today cattle ranches cover at least 8.4 million hectares and average 24,000 hectares each (Mahar 1988:16); some are as large as 560,000 hectares. These ranches employ few people, averaging 1 cowboy (vaqueiro) for every 300 hectares.

A recent simulation of a typical 20,000-hectare ranch receiving a 75%

subsidy demonstrates that livestock activities are profitable only when they receive the full array of tax benefits. Without them they are not profitable and can achieve positive internal rates of return only through overgrazing. Although overgrazing destroys their long-term viability, the incentives to convert forest to pasture mean that ranchers clear new forested areas instead of investing in recovery of areas already cleared. Clearly, deforestation rates would have been much lower without the subsidies. In a study of a particular small farmer settlement project (Moran 1987) the correlation between bank subsidy and deforestation rate was 0.74 ($p = 0.0001$). It is probably higher still for cattle ranches.

After it changed its policy toward small-scale owners, the government diverted migrant flows to Rondônia. Construction in 1968 of the Cuiabá-Pôrto Velho Road, which happened to be cut through some of the better soils in the region—made it easier to settle this area. Rondônia is today the state with the most deforested land (24%). The average area deforested each year in the 1980s equaled the total area deforested before 1980 (Mahar 1988:34). Deforestation in Rondônia is more clearly related to the increased pace of in-migration, which averaged 160,000 people per year for the period 1984 to 1988, as compared with 65,000 in the period of 1980 to 1983, and 28,500 from 1968 to 1978 (the total population was 70,000 before 1968). Efforts to promote tree crops as a more environmentally sound way to sustain land use have faltered. Favorable treatment of cattle ranching by banks and SUDAM has led to an increase in the total amount of land in pasture—25.6% of the 1985 total—whereas land in perennial crops has remained stagnant at about 3.5% of the total (see table 6.1).

Table 6.1
Agricultural Land Use in Rondônia, 1970–85 (in km²)

Year	Crops				Total ³
	Annual ¹	Perennial	Pasture	Forest ²	
1970	323.7	127.2	410.1	15,031.1	15,892.1
1975	1,503.9	457.6	1,645.2	26,681.4	30,288.1
1980	2,425.8	1,701.8	5,101.8	41,461.1	50,690.5
1985	3,153.3	2,238.0	15,611.5 ⁴	39,903.7	60,906.6

1. Includes fallow land
2. Includes natural pastures
3. Area under farms at time of census; includes land unsuitable for agricultural use
4. Estimated

Source: Estimates made by Mahar (1988:35)

ern Amazonia, an area with less forest cover than most of the Amazon. However, since 1975 the pace of deforestation has steadily accelerated. Table 6.2 shows that the deforested area increased fourfold, to 125,000 square kilometers by 1980, and twentyfold, to 600,000 square kilometers by 1988. This last figure is equivalent to approximately 12% of the Amazon and is an area the size of France. David Skole and Compton Tucker (1993) recently revised these figures; according to them, Amazonian deforestation increased from 78,000 square kilometers in 1978 to 230,000 square kilometers in 1988, an area equivalent to 6% of the closed canopy forest. These authors are quick to point out, however, that if the calculations include the effects of habitat isolation and edge effects (changes in vegetation from exposure to a different light and temperature regime), the area affected biologically by deforestation is actually 15% of the Brazilian Amazon, or 588,000 square kilometers (Skole and Tucker 1993). There was considerable controversy in Brazil during 1989 over the exact percentage and whether the estimates included areas that are not properly "tropical forests." One thing is not subject to dispute: deforestation has been concentrated in areas within easy access to roads and feeder roads, suggesting the importance of access in accelerating deforestation.

Table 6.2
Landsat Surveys of Forest Clearing in Legal Amazonia

State or Territory	Area (in km ²)	Area Cleared			
		By 1975 (in km ²)	By 1978 (in km ²)	By 1980 (in km ²)	By 1988 (in km ²)
Acre	152,589	1,165.5	2,464.5	4,626.8	19,500.0
Amapá	140,276	152.5	170.5	183.7	571.5
Amazonas	1,567,125	779.5	1,785.8	3,102.2	105,790.0
Goiás	285,793	3,507.3	10,288.5	11,458.5	33,120.0
Maranhão	257,451	2,940.8	7,334.0	10,671.1	50,670.0
Mato Grosso	881,001	10,124.3	28,355.0	53,299.3	208,000.0
Pará	1,248	8,654.0	22,445.3	33,913.8	120,000.0
Rondônia	243,044	1,216.5	4,184.5	7,579.3	58,000.0
Roraima	230,104	55.0	143.8	273.1	3,270.0
Totals	3,758,631	28,595.4	77,171.9	125,107.8	598,921.5

Source: Adapted from Mahar (1988:6)

How Deforestation in the Brazilian Amazon Became a Problem

Ecological Aspects of Development in the Humid Tropics, an important book published by the National Research Council in the United States in 1982, showed absolutely no sign of deep concern over Brazilian deforestation. The book recommends protective action to permit both conservation and development of the humid tropics but sounded no alarms. This is not surprising—until 1975 the deforested area was small and on the periphery of the Amazon basin. Nor had some political alliances been forged that would begin to give this issue prominence.

Concern about deforestation began in the late 1970s and focused primarily on deforestation in the Asian and African tropics, which started soon after World War II. In those areas much of the forest cover was gone by the 1970s, and in the few remaining countries with significant areas of forest the rates of deforestation were alarming. In most Asian and African countries only 2% to 15% of their forests stand today.

In terms of scale, however, the Amazon basin accounts for a much greater proportion of the total area of tropical forests in the world. One percent of the Brazilian Amazon equals 40,000 square kilometers. When the rate of deforestation increased in the 1980s, environmental organizations, individuals in the scientific community, and agencies within national governments began to speak simultaneously of the devastation of tropical forests. Organizations like the National Council of Rubber Tappers, organized in 1985, sought to form alliances with national and international conservation organizations. Chico Mendes's activity within this organization brought him to the World Bank to talk to staff there, and he used that opportunity to start a dialogue with U.S. senators. The denunciation of violations of agreements led the World Bank to temporarily cancel the paving of the road in Rondônia. After Mendes was killed, more conservation groups joined the cause and achieved some modest victories. Now it is common for local people, working through organizations like the rubber tappers' council, to consult on strategy with nongovernmental organizations (NGOs), multilateral development banks, and Brazilian conservation organizations when they are planning protests, and conservation efforts have received favorable media coverage. This loosely organized coalition began to call attention to the numerous global consequences of deforestation:

- A German scientist described the Amazon forests as the "lungs of the world," contributing large net amounts of oxygen and removing carbon dioxide. The statement, made in 1980, was incorrect, but it was highly effective in mobilizing public concern.

What Policy Interventions Might Be Effective?

Brazil is more likely to take corrective action if its critics recognize that territorial rights in the Amazon are a raw nerve. Recent economic analyses of deforestation have suggested that several corrective steps are available:

1. Eliminate tax benefits outright. They constitute an income transfer to the wealthy and have promoted wasteful deforestation of vast areas. Politically, this could be popular with the masses but difficult to implement, given the power of the beneficiaries.
2. Eliminate fiscal incentives for cattle ranching. Cattle ranching is an Iberian cultural tradition that already enjoys considerable cultural preference. To give it further encouragement distorts the economic behavior of individuals. Ranching incentives should be limited to transfers of technical expertise and more intensive production methods.
3. Collect the 25% capital gains tax on land sales. This can pay for increasing the staff needed to collect it. Collecting the tax is likely to have the most direct effect on the current wave of land speculation.
4. Institute and collect an annual progressive property tax on landholdings. In areas zoned for conservation—especially where soils are poor or where biodiversity is high—those who keep the forested land intact could be exempted from this tax. This would reverse current trends that see deforestation as an improvement.
5. Institute favorable tax rates for those who buy and reclaim degraded areas for farming, ranching, or forestry activities. This would not require tax breaks but simply a lower rate than would be assessed of those clearing still-forested areas.
6. Extend the terms for timber licenses and tie them to regular monitoring of reforestation (Repetto and Gillis 1988:386). Violators should be assessed stiff penalties, and logging companies and mills should be charged for the costs of road maintenance and regrading. Today logging trucks make the largely dirt roads impassable almost as soon as they have been regraded. This cost should be charged to those responsible for causing most of the transportation problem.
7. Stop constructing roads that fail to present a clear environmental and social impact statement. Some observers call for stopping all road construction (cf. Fearnside 1989), but this seems impractical. Road plans that guarantee adequate policing of resource use in the area cut by the road should be given favorable consideration. Roads should not be initiated until indigenous land

rights and biological reserves have been demarcated; this would decrease the number of roads that cut through protected areas, thereby opening them to illegal entry and devastation by outsiders. Road building in already opened areas that have productive agriculture may in fact lead to greater stewardship by farmers. This would need to be tied to zoning of the Brazilian Amazon, so that large areas remain off-limits to development. Farmers would welcome this because it would probably would increase the value of their open land.

8. Beef up research on intensive agriculture with low input approaches (crops that require little in the way of fertilizer, insecticides, water, and capital) so that population growth becomes less of a factor in deforestation. Brazil's population, and that of Amazonia in particular, will continue to grow at a fast rate. Even if many of these actions are taken, population pressure alone will continue to affect the forests unless researchers find economical ways to increase food production on less land (Nicholaides et al. 1983; Moran 1989; Fearnside 1989; Sánchez et al. 1982; Serro and Homma 1993).
9. Expand Indian reservations: indigenous peoples have often proved to be sophisticated stewards of the forest (Balée and Gély 1989; Balée 1994). Moreover they have an inherent right to land on both historical and humanistic grounds. These rights extend to intellectual property rights over the resources they have husbanded. Further, the Brazilian constitution protects these rights. Indigenous territories need more forceful demarcation and more effective protection, which should not be tied to criteria for stewardship imposed by outsiders. Indigenous people, like ourselves, are looking to develop viable ecological and economic systems that meet their needs. Many important biological areas are probably important biotically because of the actions of indigenous people. Their removal could mean a loss of biodiversity. The most conservative strategy is probably to allocate to indigenous peoples land they already are managing, even if that land is biotically precious. A parks model might protect some areas that are too far away for indigenous people to protect.

Brazilian government policies clearly have encouraged the deforestation activities of both ranchers and farmers in the Amazon. Some policies could be changed at the stroke of a pen, but their implementation is less than likely. The government does not have the institutional capacity to monitor and police compliance with conservation. In areas like Peru, where an antigovernment guerrilla effectively terrorized the population, it is difficult to imagine how the government could even enter some areas safely,

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