Extractive Reserves in Brazilian Amazonia

An opportunity to maintain tropical rain forest under sustainable use

Philip M. Fearnside

In 1985 an opportunity arose for maintaining tracts of Amazonian forest under sustainable use. Brazil's National Council of Rubber Tappers and the Rural Worker's Union proposed the creation of a set of reserves of a new type, called extractive reserves. The first six are being established in one of the Brazilian states most threatened by deforestation.

The creation of extractive reserves grants legal protection to forest land traditionally used by rubber tappers, Brazil-nut gatherers, and other extractivists. The term *extrativismo* (extractivism) in Brazil refers to removing nontimber forest products, such as latex, resins, and nuts, without felling the trees. Approximately 30 products are collected for commercial sale (Table 1).[1] Many more types of forest materials are gathered, for example as food and medicines, for the extractivists' own use.

Extractivists, principally rubber tappers (Figure 1), have been living in the forest and collecting these products since the rubber boom in the late nineteenth century. Brazil counted 68,000 rubber-tapper families in its 1980 census (IBGE 1983). These families are estimated to occupy 4–7% of the legal Amazon at a typical density of one family per 300–500 ha. Rubber-tapper organizations claim that the number of tappers is much greater than that registered by the census.

The extractive reserves, as proposed, are to be communally run, with the government retaining land ownership in a manner similar to Amerindian reservations (Allegretti in press, Schwartzman and Allegretti 1987). But the system is not a form of resource collectivization. Although not issued separate deeds, individual families retain their rights to tap in their traditional collecting territories (*colocações*) within the reserves. The land cannot be sold or converted to nonforest uses, although small clearings for subsistence crops are permitted (usually not exceeding 5 ha per family, or approximately 1%–2% of a reserve).

The first two extractive reserves were decreed in Acre by the governor in February 1988. Four more have since been established there. However, opposition to extractive reserves has taken on a violent character in Acre, where leaders of the rubber tappers' organization live under threat of death by gunslingers hired by ranchers. The assassination of rubber tapper leader Francisco (Chico) Mendes Filho (Figure 1) on 22 December 1988 brought this violence to world attention.

Provisions for extractive reserves are included in Brazil's new constitution, which took effect 5 October 1988. Additional reserves are currently proposed in Acre, Rondônia, Amazonas, and Amapá (Figure 2, Table 2). Loans to Brazil that include funds for extractive reserves are under consideration by the Interamerican Development Bank and the World Bank.

Value to the rubber tappers

The reserve proposal is attractive for several reasons related to social problems. It allows the rubber tappers to continue their livelihood rather than be expelled by deforestation. However, it is unlikely that sufficient land will be set aside as extractive reserves to employ all the tappers. Displaced rubber tappers already swell the ranks of urban slum dwellers in Brazil's Amazonian cities, and they have become refugees to continue their profession in the forests of neighboring countries, such as Bolivia (de Almeida 1987, Weyrauch 1979).

The extractive reserve proposal should not be viewed as a means of supporting a dense population or of absorbing people migrating from other locations. Those new to extractivism lack the knowledge and attitudes necessary to make the system work sustainably. Even for experienced practitioners, only a sparse population is supported (currently 1.0–1.7 persons/km^2).[2] The government of Amazonas already has launched an "extractivist project" near Boca do Acre that will increase the number of families of rubber tap-

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[1] J. de Araújo, 1988, public statement. Conselho Nacional de Seringueiros, Manaus.

[2] S. Schwartzman and M. H. Allegretti, 1989, unpublished report (US-478) to the World Wildlife Fund–US, Washington, DC. Environmental Defense Fund, Washington, DC and Instituto de Estudos Amazônicos, Curitiba, respectively.

Figure 1. Rubber tappers (*seringueiros*) have drawn latex from naturally occurring rubber trees for more than a century without damaging the sustainability of the productive system. *Seringueiro* leader Francisco (Chico) Mendes Filho is shown tapping a tree in Brazil's first extractive reserve at Seringal São Luis do Remanço, Acre. Chico Mendes was assassinated on 22 December 1988. Photo: P. M. Fearnside.

pers in the area from 500 to 5000 (*A Critica* 1988). Great care must be taken that the terms *extractivist projects* or *extractivist reserves* do not become mere euphemisms for the type of settlement that has already become discredited on the Transamazon Highway and in Rondônia (Fearnside 1986a), thus indirectly discrediting legitimate extractivism:

Acre and Rondônia, states that are undergoing rapid deforestation, have the greatest proportion of free, or autonomous, rubber tappers and the strongest rubber-tapper organizations, which see a need to defend the forest for the tappers' survival. Most tappers elsewhere are still under the *aviamento*, or debt peonage, system. Whitesell (1988) says that support for the reserves can help rubber tappers outside Acre and Rondônia escape from *aviamento*. Rubber tappers under *aviamento* sell their products to, and buy their provisions from, a rubber baron or *seringalista*. The tappers are "held captive" by the ever-increasing debts they owe the *seringalista*.

Unlike almost all other Amazonian developments, the extractive reserve proposal originated at the grass-roots level. Amazonian development projects are usually decreed by government decision makers or come from the private initiative of outside investors. The local origin of the extractive reserve proposal greatly increases the likelihood that the facilities and the system will be maintained as planned. In settlement projects and other developments planned and delivered from outside, the recipients often lapse into complaining rather than organizing as a community to solve problems and maintain the roads, schools, and other facilities.

Economic self-sufficiency is an important goal of the extractivists. Self-sufficiency will require maximizing the variety and value of the products sold, limiting the drain of money to intermediaries, and minimizing the cost of establishing and maintaining the reserves. Although improving living conditions for the extractivists is a motivation of the proposal's originators, the government is unlikely to be persuaded to create extractive reserves primarily to provide health and education facilities to rubber tappers, because larger, more accessible populations also lack minimal services.

Therefore, the first priority for use of any funds received for extractive reserves must be to demarcate quickly as many reserves as possible. Development of infrastructure to improve living conditions in the reserves should come later and be kept as modest and locally supported as possible. The cost to install health centers and schools in remote areas through the government bureaucracy and its contracted construction firms can be astronomical. Expensive facilities might make the extractive reserve system unsuccessful as an economic venture. Requirements of constant government input would be gleefully seized upon by those waiting for the first sign that the extractive system has failed. They would then insist the forest be cut to give rapid profit to outside investors.

Sustainable harvest versus deforestation

Finding effective ways to block the process of forest loss is an obvious priority. The benefits of deforestation are marginal; cattle pasture, the land use that sooner or later takes over almost all deforested land in Brazilian Amazonia, is unsustainable (Fearnside 1979a, 1980, Hecht 1981, 1983, 1985). Timber management projects and extractive reserves should be promoted as alternatives to deforestation. The forest remaining in the region is ample for both. Where conflicts of interest occur between these options, extractive reserves are preferable.

If the Brazilian government promotes forestry management for timber production, those in power will

Table 1. Some products currently collected by Amazonian extractivists*

Scientific name	Common names: Portugeuse	Common names: English	Plant part	Use	States where collected†	Value in 1981 (in US$1000‡)
Hevea brasiliensis	Seringa	Rubber	Latex	Rubber	AC, AM, AP, PA, RO	27,400.9§
Castilloa ulei	Coucho		Latex	Rubber	RO	1496.4
Manilkara bidentada	Balata		Latex	Nonelastic gum	AM, PA	229.9
Manilkara elata	Maçaranduba		Latex	Nonelastic gum	AM, AP	212.6
Couma utilis; C. macrocarpa	Sorva		Latex	Nonelastic gum	AM, PA, RR	1635.2
Mauritia flexuosa	Buriti	Miriti palm	Petiole	Fiber	PA	34.0
Philodendron bipinnatifidum	Cipó-Imbé		Stem	Fiber	PA	12.3
Urena lobata	Guaxima	Bastard cedar	Stem	Fiber	PA	2.1
Sida rhombifolia	Malva		Stem	Fiber	PA	0.7
Leopoldinia piassaba	Piaçava		Petiole	Fiber	AM	277.2
Astrocaryum aculeatum	Tucum	Star-nut palm	Petiole	Fiber	AC	0.5
Stryphnodendron barbadetiman	Barbatimão		Bark	Tannin	PA	0.4
Rhizophora mangle	Mangue	Mangrove	Bark	Tannin	PA	1.8
Carapa guianensis	Andiroba	Crabwood	Seed	Oil	PA	1.6
Orbignya spp.	Babaçu		Seed	Oil	PA	0.7
Copaifera spp.	Copaíba		Resin	Oil	AC, AM, PA	99.0
Dipteryx odorata	Cumaru	Tonka bean	Seed	Oil	AM, PA	289.9
Scheelea martiana	Licuri (Ouricuri)		Copra	Oil	AC	17.1
Astrocaryum murumuru; A. sciophilum	Murumuru		Seed	Oil	PA	0.5
Virola spp.	Ucuúba		Seed	Oil	PA, AP	41.1
Euterpe spp.	Açai		Fruit	Food	AC, AP, PA, RO,	593.9
Bertholetia exelsa	Castanha-do-Para	Brazil nut	Nut	Food	AC, AM, AP, RO, RR	10,982.9
Hancornia speciosa	Mangaba		Fruit	Food	PA	1.6
Euterpe spp. and other palms	Palmito	Heart of palm	Apical meristem	Food	PA, AP	854.8
Hymanaea courbaril	Jatobá (Jutaicica)	Locust	Resin	Medicine	PA	17.4
Lonchocarpus urucu	Timbó	Rotenone	Root	Poison	PA	2.8
Bixa orellana	Urucu	Annatto	Fruit	Colorant	PA	6.8
						44,213.2

*Products listed in government statistics for 1981 (IBGE 1984).
†Northern region only (AC, Acre; AM, Amazonas; AP, Amapá; PA, Pará; RO, Rondônia; RR, Roraima); does not include other parts of Amazônia Legal: Mato Grosso, Tocantins (formerly northern Goiás), and western Maranhão.
‡Converted to US$ at 96.65 cruzeiros per US dollar, the average of the official exchange rates for the first and last days of 1981.
§Value for 1981 not available; 1979 value calculated from cruzeiro total given by Balick (1985), citing IBGE (1979). Converted using 31.73 cruzeiros per US dollar as the average exchange rate.‡

increase their vested interest in the forest's survival. But forestry management projects, such as an International Tropical Timber Organization scheme proposed in Acre, have several disadvantages when compared to extractive reserves:

- Their sustainability is unproven;
- They provide less benefit for the local population;
- They provoke greater disturbance of the forest;
- Their top-down planning and administration reduce the likelihood that they will resist the constantly changing winds of official policies, thereby reducing the chances of a consistent long-term management routine;
- Their management routines are more susceptible to circumvention through corruption (e.g., a major impediment to sustained management schemes in Indonesia);
- Because of reliance on paid guards, they are less likely to resist invasion by migrants and speculators.

In contrast, extractive reserves produce salable goods on a sustainable basis, using known harvesting techniques that have proved themselves over approximately a century of continuous use in these areas and that rely on the people who live in the reserves and whose livelihoods depend directly on the forest's continued existence.

Economic value of extractive products

Production of economic goods, especially rubber, is the principal argument used by the rubber tappers in justifying their proposal to the government. The value of nonwood products extracted in Acre, Rondônia, and Amazonas totaled US$48 million in 1980, according to official statistics. But this argument may not

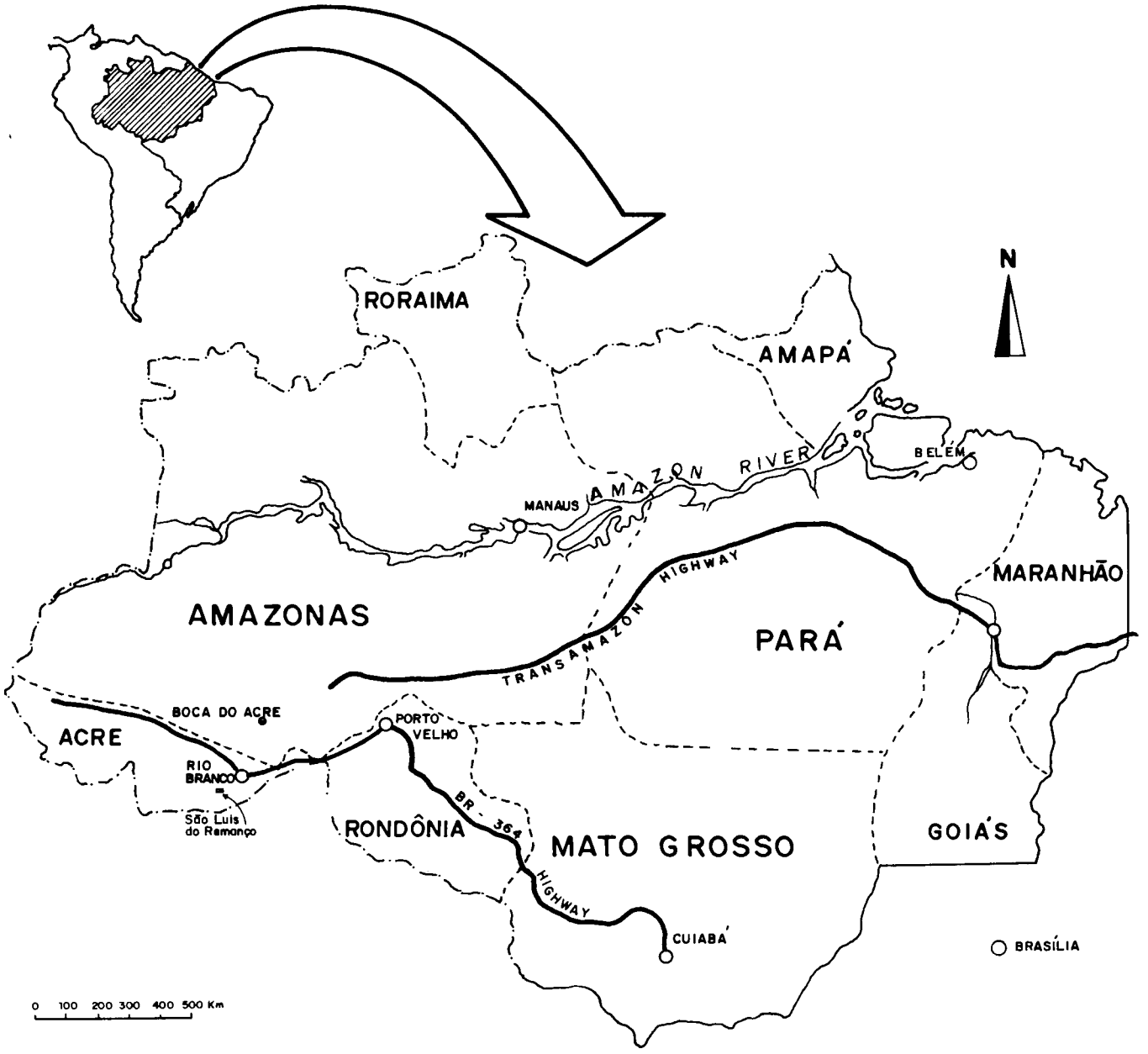

Figure 2. Brazil's legal Amazon region.

be strong enough to withstand future pressure to allocate land to other uses. This pressure is expected to mount as the price of tropical hardwood continues to rise and when the flood of migrants to Acre increases after completion of the reconstruction and paving of the BR-364 Highway from Porto Velho (Rondônia) to Rio Branco (Acre) in 1989 (and later from Rio Branco to the Pacific).

The production of nonwood economic goods is less of a justification than it may appear, because Amazonian rubber is highly subsidized. Rubber prices in Brazil are approximately three times higher than the international price (*Guia Rural Abril* 1987). Rubber is more cheaply produced on plantations in Southeast Asia than in Amazonia, because Asia does not suffer from South American leaf blight fungus (*Microcyclus ulei*, formerly *Dothidella ulei*). This fungus increases costs and lowers productivity in Amazonian plantations.

Although rubber trees in natural forests suffer only light levels of fungal attack, the long distances that must be walked between forest trees make labor requirements high per ton of rubber collected. Of the Brazilian rubber production, the proportion obtained from plantations is steadily increasing as rubber planting spreads in Brazil's non-Amazonian states.

Brazil produces less than 1% of the world's natural rubber (Goering 1982). The country imports approximately half the natural rubber it uses (*A Crítica* 1982); this fraction is down from a previous reported level of two-thirds (Moraes 1979). However, as domestic production expands, the rubber subsidy is expected to become more and more onerous to Brazilian consumers.

Brazil's precarious economy is un-

Table 2. Existing and proposed extractive reserves*

No.	State	Município	Reserve Name	Area (km²)	No. of families present	Status	Land title
1	Acre	Xapuri	Floresta	180	50	Existing	Indicated for disappropriation
2	Acre	Xapuri	Cachoeira	250	80	Existing	Disappropriated
3	Acre	Rio Branco	São Luis do Remanço	396	130	Existing	Disappropriated
4	Acre	Rio Branco	Figueira	?	20	Existing	Disappropriated
5	Acre	Brasileia	Santa Quitéria	440	150	Existing	Disappropriated
6	Acre	Sena Madureira	Macaua	1030	150†	Existing	?
7	Acre	Cruzeiro do Sul	Tejo	3000	407‡	Proposed	Discriminated
8	Amapá	Laranjal do Jari	Iratapuru	700	12	Proposed	In litigation
9	Amapá	Laranjal do Jari	Cajari-2	820	228	Proposed	In litigation
10	Amapá	Mazagão	Maracá-1	750	76	Existing	Disappropriated
11	Amapá	Mazagão	Maracá-2	225	64	Existing	Disappropriated
12	Amapá	Mazagão	Maracá-3	2260§	81	Existing	Disappropriated
13	Amapá	Laranjal do Jari	Cachoeira	390‖	74	Proposed	In litigation
14	Amapá	Laranjal do Jari	Cajari-3	1040¶	202	Proposed	In litigation
15	Amapá	Laranjal do Jari	Matauaú	680#	71	Proposed	In litigation
16	Rondônia	Guajará Mirim	Ouro Preto	1700	95	Proposed	50% federal land; 50% undefined
17	Rondônia	Guajará Mirim	Pacáas Novos	1800	100	Proposed	Disappropriated
18	Rondônia	Costa Marques	Cautário	2300	100	Proposed	50% federal land; 50% undefined
19	Rondônia	Costa Marques	Pedras Negras	1800	80	Proposed	50% federal land; 50% undefined
20	Rondônia	Porto Velho	Jaciparaná and Mutumparaná	2400	120	Proposed	Disappropriated
				>22,161	2290		

*Situation in November 1988. Source: Instituto de Estudos Amazônicas, 1988.
†Source: Francisco Mendes Filho, 1988, personal communication. Sindicato dos Trabalhadores Rurais, Xapuri, Acre.
‡Includes 282 Amerindians.
§Occupied area, 957 km².
‖Occupied area, 195 km².
¶Occupied area, 676 km².
#Occupied area, 450 km².

likely to be able to maintain the rubber subsidies. The government decided in 1988 to drastically reduce the staff and budget of the agency (SUDHEVEA) responsible for rubber marketing and promotion. The agency had provided the institutional means of limiting imports and maintaining high domestic prices. In 1989 what remained of SUDHEVEA was merged with other agencies in a newly created Department of Environment and Renewable Resources. Losing SUDHEVEA is a setback for rubber tappers and for plantation owners.

World prices for natural rubber have been low for several years, so that even some Asian plantations have become unprofitable. For an increasing number of uses, synthetic rubber, particularly polyisoprene, can substitute for natural rubber (Grilli et al. 1980). The cost of synthetics is heavily dependent on petroleum prices. Thus in the long run, oil prices can be expected to increase as global supplies dwindle, thereby improving the relative demand for natural rubber.

Extractive products for the future

The rubber tappers would be wise to make a major effort to diversify the products they extract and sell. This strategy would require collaboration with researchers (such as pharmacologists, chemists, and botanists) to develop new products, especially from medicinal plants. By limiting the products collected and the intensities of harvesting, care must be taken that only sustainable extraction is practiced.

Marketing mechanisms for new products need to be developed if extractivists are ever to enjoy a reasonable standard of living. As the misery of the rubber tappers during the rubber boom shows, when the value of the products accrues to intermediaries, extractivists remain poor, regardless of the amount of wealth they generate. Also, institutional arrangements need to be made to assure that the extractivists receive royalties from the future sale of the products, including synthetic copies and subsequent modifications of plant compounds.

Biological information is a valuable extractive resource, although the monetary value of genetic material and potential pharmaceutical compounds is difficult to assess (Myers 1984, Oldfield 1981). The forest has inspired flights of fancy since the search for the fountain of youth almost 500 years ago, but information on the potential value of the forest as a source of medicinal plants is scanty and largely anecdotal. No one pays indigenous peoples for traditional knowledge that leads to identification of new compounds from nature. Amazonia holds the world's largest store of species. Deforestation destroys both the compounds themselves and the traditional knowledge of the medicinal uses of each plant.

Most drugs now produced synthetically in laboratories were almost invariably obtained originally from living organisms (e.g., the mold that produces penicillin and the willow that produces the active ingredient in aspirin). New drugs continue to be

needed because new diseases continue to appear and drug-resistant strains of old diseases are constantly arising. Recently anticancer agents were discovered in the Madagascar periwinkle (*Catharanthus roseus*, formerly *Vinca rosea*), a tropical plant containing more than 60 useful alkaloids. Analysis of the periwinkle, whose promise was indicated by its use in folk medicine, revealed a class of compounds whose pharmacological activity could not have been guessed on the basis of existing chemical knowledge (Humphreys 1982). One drug (vincristine or leurocristine) extracted from the periwinkle has reduced mortality from lymphocytic (child) leukemia from 80% in 1960 to 20% today, and another (vinblastine or vincaleukoblastine) has raised the 10-year survival rate for Hodgkin's disease from 2% to 58% (Caufield 1985, Humphreys 1982, Myers 1983).

Statements submitted by pharmaceutical firms to a US congressional committee that assessed impacts of tropical deforestation described the value of forest compounds as models for subsequent industrial synthesis (US House of Representatives 1983). However, even in the absence of any arrangement for returning some of the profits to the extractivists, activity in exploring tropical plants is limited among large pharmaceutical firms.

The lack of substantial effort by pharmaceutical companies to screen Amazonian plants for new compounds is frequently put forward by governmental agencies as evidence that the forest's potential usefulness is low. The tepid response is better explained by the costs and risks of the search for new compounds. The long process of testing not only makes future returns weigh little when discounted for financial decision making, but it also extends product development beyond the job longevity of most corporate executives. The attraction of a faster payoff favors investments in less substantive activities, such as refining the packaging and advertising of current products. Because drug company executives are guided by their financial balance sheets, these companies are not likely to initiate a screening program with the speed and scale required.

Similarly, some firms are more interested in the Amazonian forest's potential for providing ingredients for soaps and cosmetics. Part of the attraction of cosmetics is the more rapid and inexpensive process of gaining approval for marketing, as compared with drugs, which are encumbered by requirements for extended clinical testing. These nonmedicinal uses, although providing some potential income, lack the important moral appeal that pharmaceutical compounds have in justifying the maintenance of forests.

Amazonia might prove to be less of a pharmaceutical treasure house than some have claimed. But, at the very least, the forest should not be thrown away before there is a systematic evaluation of the compounds it contains.

Beyond cost-benefit analysis

As is the case for many potential uses of the forest, cost-benefit analysis for pharmaceutical screening is inherently unreliable, because it is based on estimating the difference between large and uncertain numbers. Although monetary value is often cited as a principal reason for not destroying the Amazon forest, good reasons would exist for saving it even if the forest were not financially valuable. These reasons would remain important even if its replacement were a miraculous crop that produced sustainable yields of US dollar bills. These reasons include the forest's role in macroecological processes, such as the water cycle and the balance of atmospheric gases that affect global climate (Andreae et al. 1988, Eagleson 1986, Fearnside 1985, 1986a, 1986b, 1987, Salati and Vose 1984).

Some have argued that substantial tracts of natural ecosystems should be preserved just because there is so much about the forest that is not yet understood. Humility should motivate at least some preservation. Such explicitly noneconomic and nonutilitarian arguments for saving tropical forests as those made by Budowski (1976), Ehrenfeld (1976), Jacobs (1980), Janzen (1986), and Poore (1976) are usually dismissed in Brazil pejoratively as "poetry" or "very beautiful." But a strong case must be made for saving substantial tracts of forest on the basis of human self-interest in spheres unrelated to direct use of the forest's products.

The race to justify forest

The question of whether Brazil should allow its Amazonian forest to be destroyed is not related to direct economic costs and benefits. If financial benefit is insufficient, one should not cut down the forest but rather alter the economic equation until conservation becomes profitable.

Finding ways to make sustainable uses profitable and nonsustainable ones unprofitable is essential (Fearnside 1979b). Researchers are racing to find ways to make saving the forest economically advantageous. These efforts include identifying new products obtainable from the forest, finding sustainable economic uses for timber trees, demonstrating the feasibility of sustained forest management, and documenting both the environmental costs (including the greenhouse effect) of forest loss and how short-lived are the benefits of most land uses that replace it.

Other actions could include altering the relative prices of sustainable and nonsustainable products to favor the sustainable ones (Fearnside in press) and changing the discount rates used in evaluating forest-use options (Fearnside 1989). High discount rates provide economists with a rationale for disregarding the future costs and benefits, which may be a rational way for investors to decide how to maximize profits, but it is no way for a country to decide how to develop in the best interests of its people.

To point the government's activity in the direction of sustainable forest use will require disposing of traditional economic calculations rather than tinkering with their input parameters. The real reason for maintaining forest is not directly economic.

Forest maintenance as a constraint on development

Maintaining forest should be treated as a constraint on development options that is accepted before cost-benefit or other economic calculations are made. This constraint should have a place similar to that of national security. For example, security considerations have led the Brazilian government to force consumers to pay higher prices to help the country

to gain independence in producing such products as computers, automobiles, small aircraft, rubber, and fuel alcohol. Rather than simply selecting the cheaper option for supplying these products, the government has forced the economy to adapt itself to overriding considerations.

The same logic applies to controlling deforestation and favoring sustainable forest use. Maintaining the forest should be a given, from which economic mechanisms must follow. The proposed plan for a set of extractive reserves offers an excellent opportunity to act on this precondition in a way that is inexpensive, solves a number of social problems, and, above all, is likely to be effective.

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